

8900, Fax: 908 789 8922

Prep Standard - Chemical Standard Summary

Order ID: Q1956

Test: Mercury, Metals ICP-TAL

Prepbatch ID: PB167858,PB167866,PB167870,PB167880,

Sequence ID/Qc Batch ID: LB135662,LB135670,LB135674,LB135674,LB135699,

Standard ID:

MP84041,MP85156,MP85240,MP85241,MP85242,MP85243,MP85529,MP85530,MP85531,MP85532,MP85533,MP85534,MP85535,MP85536,MP85537,MP85538,MP85539,MP85540,MP85541,MP85543,MP85545,MP85546,MP85547,MP85548,MP85549,MP85551,MP85552,MP85553,MP85554,MP85555,MP85556,MP85557,MP85558,

Chemical ID:

 $\begin{array}{l} M4251, M4465, M4916, M5062, M5429, M5466, M5467, M5470, M5471, M5581, M5658, M5747, M5748, M5751, M5798, M5799\\ , M5800, M5801, M5811, M5814, M5815, M5816, M5817, M5820, M5875, M5882, M5884, M5942, M5959, M5962, M5970, M5985\\ , M5997, M6005, M6016, M6021, M6023, M6028, M6030, M6032, M6041, M6058, M6076, M6077, M6125, M6126, M6127, M6128\\ , M6137, M6138, M6142, M6144, M6145, M6146, M6150, M6151, M6152, M6155, M6158, M6159, M6161, W 3112, \\ \end{array}$





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Metals STANDARD PREPARATION LOG

| Recipe ID | <u>NAME</u> | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|-------------|---------|------------|--------------------|----------------|----------------|------------------|-------------------------------|
| 169 | 1:1HNO3 | MP84041 | 01/14/2025 | 07/14/2025 | Eman Mughal | None | None | • |
| | | | | | | | | 01/16/2025 |
| | | | | | | | | - |

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

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | ScaleID | PipetteID | Supervised By |
|--------------|-------------|------------|------------|--------------------|----------------|---------|-----------|-----------------|
| 170 | | | 04/07/2025 | 08/18/2025 | Kareem | None | None | Sarabjit Jaswal |
| | | | | | Khairalla | | | 04/07/2025 |

FROM 1250.00000ml of M6151 + 1250.00000ml of W3112 = Final Quantity: 2500.000 ml





Metals STANDARD PREPARATION LOG

| Recipe ID | <u>NAME</u> | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|------------------|---------|------------|--------------------|----------------|----------------|------------------|-------------------------------|
| 3965 | 2:1 H2SO4 : HNO3 | MP85240 | 04/16/2025 | 10/16/2025 | Mohan Bera | None | None | 04/00/0005 |
| | | | | | | | | 04/29/2025 |

FROM 1600.00000ml of M6041 + 800.00000ml of M6158 = Final Quantity: 3200.000 ml

| Recipe ID | <u>NAME</u> | NO. | Prep Date | Expiration Date | <u>Prepared</u> <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|--|---------|------------|--------------------|------------------------------|-----------------------------|------------------|-------------------------------|
| 65 | POTASSIUM PERMANGANATE SOLUTION 5 % | MP85241 | 04/16/2025 | 10/16/2025 | | METALS_SCA LE_3 (M SC-3) | | 04/29/2025 |

FROM 100.00000gram of M4916 + 2000.00000ml of W3112 = Final Quantity: 2000.000 ml



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Metals STANDARD PREPARATION LOG

| Recipe ID | NAME | NO. | Prep Date | Expiration Date | <u>Prepared</u> <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|--------------------------------------|---------|------------|--------------------|------------------------------|-----------------------------|------------------|-------------------------------|
| 66 | POTASSIUM PERSULFATE SOLUTION 5 % | MP85242 | 04/16/2025 | 08/06/2025 | | METALS_SCA LE_3 (M SC-3) | | 04/29/2025 |

| FROM | 100.00000ml of M4465 + 2000.00000ml of W3112 = Final Quantity: 2000.000 ml |
|-------------|--|
|-------------|--|

| Recipe ID | NAME_ | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|---|---------|------------|--------------------|----------------|-----------------------------|------------------|-------------------------------|
| 67 | SODIUM CHLORIDE - HYDROXYL- CHLORIDE | MP85243 | 04/16/2025 | 06/25/2025 | | METALS_SCA LE_3 (M SC-3) | | 04/29/2025 |

FROM 2000.0000ml of W3112 + 240.00000gram of M4251 + 240.00000gram of M5884 = 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 Janvi Patel |
|--------------|---|---------|------------|--------------------|----------------|----------------|--------------------------|---------------------------|
| 871 | MERCURY INTERMEDIATE B 250PPB WORKING STD. | MP85529 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP ETTE_5 (HG | |
| | | | | | | | A) | |

FROM 1.00000ml of M6158 + 2.50000ml of M5062 + 96.50000ml of W3112 = Final Quantity: 100.000 ml

| Recipe | | | | Expiration | <u>Prepared</u> | | | Supervised By |
|-----------|-----------------|---------|------------|-------------------|-----------------|----------------|------------------|---------------|
| <u>ID</u> | NAME | NO. | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Janvi Patel |
| 1340 | Hg 0.00 PPB STD | MP85530 | 05/05/2025 | 05/06/2025 | Mohan Bera | None | METALS_PIP | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 |

FROM 2.50000ml of M6158 + 247.50000ml of W3112 = Final Quantity: 250.000 ml





Metals STANDARD PREPARATION LOG

| Recipe | | | | Expiration | <u>Prepared</u> | | | Supervised By |
|----------------------|----------------|------------|------------|-------------------|-----------------|----------------|------------------|---------------|
| <u>ID</u> <u>V</u> | <u>NAME</u> | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Janvi Patel |
| 1341 F | Hg 0.2 PPB STD | MP85531 | 05/05/2025 | 05/06/2025 | Mohan Bera | None | METALS_PIP | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 |

FROM 2.50000ml of M6158 + 247.30000ml of W3112 + 0.20000ml of MP85529 = Final Quantity: 250.000 ml

| Recipe | | | | Expiration | Prepared | | | Supervised By |
|-----------|----------------|------------|------------|-------------|------------|----------------|------------------|---------------|
| <u>ID</u> | NAME | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Janvi Patel |
| 1342 | Hg 2.5 PPB STD | MP85532 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 |
| | | | | | | | A) | |

FROM 2.50000ml of M6158 + 245.0000ml of W3112 + 2.50000ml of MP85529 = Final Quantity: 250.000 ml





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Metals STANDARD PREPARATION LOG

| Recipe | | | | Expiration | <u>Prepared</u> | | | 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> | Janvi Patel |
| 1343 | Hg 5.0 PPB STD | MP85533 | 05/05/2025 | 05/06/2025 | Mohan Bera | None | METALS_PIP | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 |
| | 0.50000 1.5000015000015000015 | 514/0440 | | | | | A) | |

FROM 2.50000ml of M6158 + 242.50000ml of W3112 + 5.00000ml of MP85529 = Final Quantity: 250.000 ml

| Recipe | | | | Expiration | Prepared | | | Supervised By | | |
|-----------|----------------|------------|------------|-------------|------------|----------------|------------------|---------------|--|--|
| <u>ID</u> | NAME | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Janvi Patel | | |
| 1344 | Hg 7.5 PPB STD | MP85534 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP | | | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 | | |
| | A) | | | | | | | | | |

FROM 2.50000ml of M6158 + 240.00000ml of W3112 + 7.50000ml of MP85529 = Final Quantity: 250.000 ml



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Metals STANDARD PREPARATION LOG

| Recipe | | | | Expiration | Prepared | | | Supervised By | | |
|-----------|-----------------|------------|------------|-------------|------------|----------------|------------------|---------------|--|--|
| <u>ID</u> | NAME. | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Janvi Patel | | |
| 1345 | Hg 10.0 PPB STD | MP85535 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP | | | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 | | |
| | A) | | | | | | | | | |

FROM 2.50000ml of M6158 + 237.50000ml of W3112 + 10.00000ml of MP85529 = Final Quantity: 250.000 ml

| Recipe | | | | Expiration | <u>Prepared</u> | | | Supervised By |
|-----------|-----------------|---------|------------|-------------------|-----------------|----------------|------------------|---------------|
| <u>ID</u> | NAME | NO. | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Janvi Patel |
| 1346 | Hg ICV SOLUTION | MP85536 | 05/05/2025 | 05/06/2025 | Mohan Bera | None | METALS_PIP | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 |

FROM 2.50000ml of M6158 + 2.50000ml of M6161 + 245.00000ml of W3112 = Final Quantity: 250.000 ml



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Metals STANDARD PREPARATION LOG

| Recipe | | | | Expiration | <u>Prepared</u> | | | Supervised By | | |
|-----------|----------------------------|---------|------------|-------------------|-----------------|----------------|------------------|---------------|--|--|
| <u>ID</u> | NAME | NO. | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Janvi Patel | | |
| 1351 | ICB (Hg 0.00 PPB SOLUTION) | MP85537 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP | | | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 | | |
| | A) | | | | | | | | | |

FROM 2.50000ml of M6158 + 247.50000ml of W3112 = Final Quantity: 250.000 ml

| 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> | Janvi Patel |
| 1358 | CCV (Hg 5.0 PPB SOLUTION) | MP85538 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 |

FROM 485.00000ml of W3112 + 5.00000ml of M6158 + 10.00000ml of MP85529 = Final Quantity: 500.000 ml



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Metals STANDARD PREPARATION LOG

| Recipe | | | | Expiration | <u>Prepared</u> | | | 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> | Janvi Patel | | |
| 1352 | CCB (Hg 0.00 PPB SOLUTION) | MP85539 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP | | | |
| | | | | | | | ETTE_5 (HG | 05/07/2025 | | |
| | A) | | | | | | | | | |

FROM 495.00000ml of W3112 + 5.00000ml of M6158 = Final Quantity: 500.000 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> | Janvi Patel |
| 1349 | | MP85540 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP | |
| | SOLUTION) | | | | | | ETTE_5 (HG | 05/07/2025 |

FROM 2.50000ml of M6158 + 247.30000ml of W3112 + 0.20000ml of MP85529 = Final Quantity: 250.000 ml



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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 Janvi Patel |
|--------------|----------------------------------|------------|------------|--------------------|----------------|----------------|--------------------------|---------------------------|
| 1350 | CHK STD (Hg 7.0 PPB SOLUTION) | MP85541 | 05/05/2025 | 05/06/2025 | Mohan Bera | | METALS_PIP ETTE_5 (HG | |
| | | | | | | | A) | |

FROM 2.50000ml of M6158 + 240.50000ml of W3112 + 7.00000ml of MP85529 = Final Quantity: 250.000 ml

| Recipe ID | NAME | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Janvi Patel |
|--------------|-------------------------------|---------|------------|--------------------|----------------|-----------------------------|------------------|---------------------------|
| 68 | STANNOUS CHLORIDE SOLUTION | MP85543 | 05/05/2025 | 05/06/2025 | | METALS_SCA LE_3 (M SC-3) | | 05/07/2025 |

FROM 450.00000ml of W3112 + 50.00000gram of M5882 + 50.00000ml of M6151 = Final Quantity: 500.000 ml



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Metals STANDARD PREPARATION LOG

| 902 ICP AES CAL BLK (SO/ICB/CCB) MP85545 05/02/2025 06/02/2025 Janvi Patel METALS_SCA METALS_PIP LE_3 (M SC-3) ETTE_1 (ICP 05/07/2025 | <u>R</u> | ecipe ID | NAME | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipettelD</u> | Supervised By Sarabiit Jaswal |
|--|----------|-------------|-------------------------------|---------|------------|--------------------|----------------|----------------|------------------|-------------------------------|
| | | 902 | ICP AES CAL BLK (SO/ICB/CCB) | MP85545 | 05/02/2025 | 06/02/2025 | | _ | _ | , |

FROM 125.00000ml of M6151 + 2350.00000ml of W3112 + 25.00000ml of M6158 = Final Quantity: 2500.000 ml

| Recipe ID | <u>NAME</u> | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipettelD</u> | Supervised By Sarabjit Jaswal |
|--------------|----------------------|------------|------------|--------------------|----------------|-----------------------------|------------------|-------------------------------|
| 907 | ICP AES STD S (S5) | MP85546 | 05/02/2025 | 06/02/2025 | | METALS_SCA LE_3 (M SC-3) | | • |

FROM

5.00000ml of M5466 + 5.0000ml of M5471 + 5.0000ml of M5816 + 5.0000ml of M5820 + 5.0000ml of M5970 + 5.0000ml of M5997 + 5.0000ml of M6076 + 5.0000ml of M6146 + 455.0000ml of MP85545 = Final Quantity: 500.000 ml



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Metals STANDARD PREPARATION LOG

| | Recipe <u>ID</u> | <u>NAME</u> | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal | |
|---|---------------------|----------------|---------|------------|--------------------|----------------|-----------------------------|------------------|-------------------------------|--|
| | 910 | ICP AES STD S4 | MP85547 | 05/02/2025 | 06/02/2025 | | METALS_SCA LE_3 (M SC-3) | _ | | |
| I | A) | | | | | | | | | |

FROM 50.00000ml of MP85545 + 50.00000ml of MP85546 = Final Quantity: 100.000 ml

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipettelD</u> | Supervised By Sarabjit Jaswal |
|--------------|----------------|------------|------------|--------------------|----------------|-----------------------------|------------------|-------------------------------|
| 909 | ICP AES STD S3 | MP85548 | 05/02/2025 | 06/02/2025 | | METALS_SCA LE_3 (M SC-3) | _ | • |

FROM 25.00000ml of MP85546 + 75.00000ml of MP85545 = Final Quantity: 100.000 ml



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Metals STANDARD PREPARATION LOG

| 3913 ICP AES STD S2 MP85549 05/02/2025 06/02/2025 Janvi Patel METALS_SCA METALS_PIP | Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipettelD</u> | Supervised By Sarabjit Jaswal |
|---|--------------|----------------|------------|------------|--------------------|----------------|----------------|------------------|-------------------------------|
| | 3913 | ICP AES STD S2 | MP85549 | 05/02/2025 | 06/02/2025 | | _ | _ | • |

FROM 16.00000ml of MP85546 + 184.00000ml of MP85545 = Final Quantity: 200.000 ml

| Recipe ID | <u>NAME</u> | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | ScaleID | <u>PipetteID</u> | Supervised By Sarabiit Jaswal |
|--------------|--------------------------|------------|------------|--------------------|----------------|-----------------------------|------------------|-------------------------------|
| 2950 | ICP AES S1/CRI STOCK STD | MP85551 | 05/02/2025 | 06/02/2025 | | METALS_SCA LE_2 (M SC-2) | | |

FROM

 $0.03000ml\ of\ M5798+0.03000ml\ of\ M6028+0.04000ml\ of\ M6137+0.05000ml\ of\ M5658+0.05000ml\ of\ M5811+\acute{0}.05000ml\ of\ M6030+0.05000ml\ of\ M6159+0.06000ml\ of\ M5747+0.10000ml\ of\ M5471+0.10000ml\ of\ M5751+0.10000ml\ of\ M5761+0.10000ml\ of\ M5761+0.10000ml\ of\ M5761+0.10000ml\ of\ M5761+0.10000ml\ of\ M5800+0.20000ml\ of\ M5748+0.20000ml\ of\ M5748+0.20000ml\ of\ M5799+0.20000ml\ of\ M6021+0.20000ml\ of\ M6023+0.20000ml\ of\ M6145+0.25000ml\ of\ M5466+0.25000ml\ of\ M6146+0.50000ml\ of\ M5814+0.50000ml\ of\ M6032+1.00000ml\ of\ M5942+1.00000ml\ of\ M6127+1.00000ml\ of\ M6138+1.00000ml\ of\ M6142+1.00000ml\ of\ M6144+2.00000ml\ of\ M5816+89.29000ml\ of\ MP85545=Final\ Quantity:\ 100.000\ ml$



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Metals STANDARD PREPARATION LOG

| 2951 ICP AES S1/CRI WORK STD MP85552 05/02/2025 06/02/2025 Janvi Patel METALS_SCA METALS_PIP | Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipettelD</u> | Supervised By Sarabiit Jaswal |
|--|--------------|-------------------------|------------|------------|--------------------|----------------|----------------|------------------|-------------------------------|
| | 2951 | ICP AES S1/CRI WORK STD | MP85552 | 05/02/2025 | 06/02/2025 | | _ | _ | , |

FROM 2.00000ml of MP85551 + 98.00000ml of MP85545 = Final Quantity: 100.000 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> | Sarabjit Jaswal |
| 912 | ICP AES ICV SOLN | MP85553 | 05/02/2025 | 06/02/2025 | | METALS_SCA | | |
| | | | | | | LE_3 (M SC-3) | ETTE_1 (ICP | 05/07/2025 |

FROM

0.02500ml of M5429 + 0.02500ml of M5815 + 0.02500ml of M5817 + 0.10000ml of M5467 + 0.25000ml of M6150 + 89.32500ml of M6058 + 10.00000ml of M6150 + 89.32500ml of MP85545 = Final Quantity: 100.000 ml



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| Recipe ID | NAME | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabiit Jaswal |
|--------------|-------------------|---------|------------|--------------------|----------------|-----------------------------|------------------|-------------------------------|
| 904 | ICP AES ICSA SOLN | MP85554 | 05/02/2025 | 06/02/2025 | | METALS_SCA LE_3 (M SC-3) | _ | , |
| | | | | | | | A) | |

FROM 25.00000ml of M6152 + 225.00000ml of MP85545 = Final Quantity: 250.000 ml

| Recipe | | | | Expiration | <u>Prepared</u> | | | 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> | Sarabjit Jaswal |
| 3494 | ICP AES ICSAB SOLN-1 | MP85555 | 05/02/2025 | 06/02/2025 | Janvi Patel | METALS_SCA | METALS_PIP | |
| | | | | | | LE_3 (M SC-3) | ETTE_1 (ICP | 05/07/2025 |

FROM

0.01000ml of M5815 + 0.01000ml of M5817 + 0.10000ml of M5470 + 0.10000ml of M5970 + 0.10000ml of M6077 + 10.0000ml of M6152 + 10.0000ml of M6155 + 79.68000ml of MP85545 = Final Quantity: 100.000 ml



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| Recipe ID | <u>NAME</u> | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|------------------|---------|------------|--------------------|----------------|-----------------------------|------------------|-------------------------------|
| 911 | ICP AES CCV SOLN | MP85556 | 05/02/2025 | 06/02/2025 | | METALS_SCA LE_3 (M SC-3) | | |
| | | | | | | | A) | |

FROM 50.00000ml of MP85545 + 50.00000ml of MP85546 = Final Quantity: 100.000 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> | Sarabjit Jaswal |
| 919 | ICP AES INTERNAL STD | MP85557 | 05/02/2025 | 06/02/2025 | | METALS_SCA | _ | |
| | | | | | | LE_3 (M SC-3) | ETTE_1 (ICP | 05/07/2025 |

FROM 1.00000ml of M5959 + 10.00000ml of M5985 + 1969.00000ml of W3112 + 20.00000ml of M6158 = Final Quantity: 2000.000 ml



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Metals STANDARD PREPARATION LOG

| Recipe ID 903 | NAME ICP AES RINSE SOLN | NO. MP85558 | Prep Date 05/02/2025 | Expiration Date 06/02/2025 | Prepared By Janvi Patel | ScaleID METALS_SCA LE_3 (M SC-3) | ETTE_1 (ICP | Supervised By Sarabjit Jaswal 05/07/2025 |
|---------------------|-----------------------------------|----------------|-------------------------|----------------------------|-------------------------------|-----------------------------------|-------------|--|
| FROM | 200.00000ml of M6158 + 9800.00000 | Oml of W311 | 2 = Final Qu | antity: 10000.00 | 00 ml | | A) ' | |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------------------------|--|-----------------|--------------------|----------------------------|---------------------------------|-------------------|
| Seidler Chemical | BA-2196-01 / Hydroxylamine Hydrochloride, Crystal (cs/4x500g) | 0000215387 | 06/25/2025 | 12/19/2018 / mohan | 12/05/2018 / mohan | M4251 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Seidler Chemical | BA-3238-05 / Potassium Persulfate (2.5kg) | 0000234156 | 08/06/2025 | 07/23/2019 / | 07/25/2019 / manojkumar | M4465 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Seidler Chemical | BA-3227-05 / Potassium Permanganate (2.5kg) | 210800 | 03/31/2026 | 11/30/2022 / mohan | 07/28/2021 / mohan | M4916 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | MSHG-10PPM / MERCURY HCI 125mL | S2-HG709270 | 09/22/2026 | 05/28/2022 / mohan | 01/27/2022 / mohan | M5062 |
| | 10ug/mL | | | | | |
| Supplier | 10ug/mL ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | Chemtech Lot # |
| Supplier Absolute Standards, Inc. | | Lot # 070622 | I - | - | | |
| Absolute | ItemCode / ItemName 57103 / Li, 10000 PPM, | | Date | Opened By 01/30/2023 / | Received By 01/26/2023 / | Lot # |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------------------------|---|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| Absolute Standards, Inc. | 57058 / Cerium, 1000PPM, 100ML | 020623 | 02/06/2026 | 03/06/2023 / bin | 03/01/2023 / bin | M5467 |
| 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 | 04/14/2025 / jaswal | 03/16/2023 / jaswal | M5470 |
| 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 | 04/14/2025 / jaswal | 03/16/2023 / jaswal | M5471 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| PCI Scientific Supply, Inc. | 26397-103 / PTFE BOILING STONES | W126678 | 03/20/2026 | 03/20/2025 / | 06/12/2023 / jaswal | M5581 |
| | | | | | | |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | 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. | / Nickel (Ni) 1000PPM | 091223 | 09/12/2026 | 01/02/2024 / bin | 12/20/2023 / jaswal | M5748 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 58029 / Cu, 1000 PPM, 500 ml | 071723 | 07/17/2026 | 10/01/2024 / Jaswal | 08/25/2023 / jaswal | M5751 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 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 / | Chemtech Lot # |
| Absolute Standards, Inc. | 57027 / CO, 1000 PPM, 125 ml | 091923 | 09/19/2026 | 05/31/2024 / bin | 02/09/2024 / bin | M5800 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 57033 / As, 1000 PPM, 125 ml | 111323 | 11/13/2026 | 02/09/2024 / bin | 02/09/2024 / bin | M5801 |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------------------------|---|-----------------|--------------------|----------------------------|---------------------------------|-------------------|
| Absolute Standards, Inc. | 58126 / Fe, 10000 PPM, 500 ml | 051523 | 05/15/2026 | 02/06/2025 / kareem | 01/03/2024 / jaswal | M5811 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 57005 / B, 1000 PPM, 125 ml | 071123 | 07/11/2026 | 03/26/2024 / Sohil | 01/03/2024 / jaswal | M5814 |
| 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. | 57016 / S, 1000 PPM, 125 ml | 122923 | 12/29/2026 | 05/20/2024 / Jaswal | 02/09/2024 / jaswal | M5816 |
| I | | | | | | |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | Chemtech Lot # |
| Supplier Absolute Standards, Inc. | ItemCode / ItemName 57116 / S, 10000 PPM, 125 ml | Lot # 071123 | - | - | | |
| Absolute | 57116 / S, 10000 PPM, | | Date | Opened By 03/01/2024 / | Received By 02/09/2024 / | Lot # |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------|--|---------------------|--------------------|----------------------------|------------------------------------|-------------------|
| Inorganic Ventures | CLPP-CAL-1 / CLP CAL SOLUTION #1, 125mL | T2-MEB714417 | 01/27/2027 | 04/19/2024 / jaswal | 02/22/2024 / jaswal | M5875 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Seidler Chemical | BA-3980-01 / Stannous Chloride (cs/4x500g) | 232820 | 08/31/2028 | 04/30/2024 / mohan | 04/25/2024 / mohan | M5882 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Seidler Chemical | BA-3624-05 / Sodium Chloride, Crystal (cs/4x2.5kg) | 0000281938 | 07/06/2026 | 04/30/2024 / mohan | 04/25/2024 / mohan | M5884 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic | CGTI1-1 / TITANIUM | T2-TI719972 | 06/17/2027 | 06/18/2024 / | 02/22/2024 / | M5942 |
| Ventures | 125mL 1000ug/mL | | | Jaswal | Jaswal | WI0542 |
| Ventures Supplier | 125mL 1000ug/mL ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Jaswal Received Date / Received By | Chemtech Lot # |
| | | Lot # V2-Y740548 | • | Date Opened / | Received Date / | Chemtech |
| Supplier Inorganic | ItemCode / ItemName | | Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|--|--------------|--------------------|----------------------------|---|-------------------|
| Absolute Standards, Inc. | 57003 / Li, 1000 PPM, 125 ml | 061224 | 06/21/2027 | 07/01/2024 / Jaswal | 07/01/2024 / Jaswal | M5970 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | CGIN10-5 / INDIUM 1 x 500 ml | U2-IN729349 | 02/21/2028 | 10/08/2024 / Jaswal | 06/14/2024 / Jaswal | M5985 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | CLPP-CAL-3 / CLP CAL SOLUTION #3, 125mL | T2-MEB727800 | 12/21/2027 | 02/03/2025 / JANVI | 02/22/2024 / kareem | M5997 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorgania | MANALES 4 / Laboratory | T2-MEB723367 | 00/00/0000 | 04/15/2025 / | 05/14/2024 / | MOOOF |
| Inorganic Ventures | WW-LFS-1 / Laboratory Fortified Stock Solution 1, 125 ml | 12 MEB/2001 | 08/30/2026 | JANVI | Jaswal | M6005 |
| • | Fortified Stock Solution 1, | Lot # | Expiration Date | | | Chemtech |
| Ventures | Fortified Stock Solution 1, 125 ml | | Expiration | JANVI Date Opened / | Jaswal Received Date / | Chemtech |
| Supplier Inorganic | ItemCode / ItemName WW-LFS-2 / Laboratory Fortified Stock Solution 2, | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By 05/14/2024 / | Chemtech Lot # |



| 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. | 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 / | Chemtech Lot # |
| Seidler Chemical | BA-9673-33 / Sulfuric Acid, Instra-Analyzed (cs/6c2.5L) | 23D2462010 | 03/20/2028 | 08/16/2024 / mohan | 08/16/2024 / mohan | M6041 |
| 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 | V2-MEB746173 | 01/29/2026 | 01/29/2025 / JANVI | 08/22/2024 / Jaswal | M6058 |



| 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 | 01/01/2026 | 01/01/2025 / kareem | 09/19/2024 / kareem | M6076 |
| 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 # |
| PCI Scientific Supply, Inc. | 1403 / Hydrogen Peroxide, 30% 1 gal | 820803 | 05/25/2025 | 11/26/2024 / Eman | 11/22/2024 / Eman | M6125 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | Chemtech Lot # |
| Seidler Chemical | BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L) | 24D1062002 | 06/03/2025 | 12/03/2024 / Janvi | 11/12/2024 / Janvi | M6126 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | Chemtech Lot # |
| Absolute Standards, Inc. | 58112 / Mg, 10000 PPM, 500 ml | 112124 | 11/21/2027 | 01/13/2025 / kareem | 01/13/2025 / kareem | M6127 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 58025 / Mn, 1000 PPM, 500 ml | 101124 | 10/11/2027 | 01/13/2025 / kareem | 01/13/2025 / kareem | M6128 |



Fax: 908 789 8922

| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|---------------------------------------|-------------|--------------------|----------------------------|--------------------------------|-------------------|
| Inorganic Ventures | CGSI1-1 / SILICON 125mL 1000ug/mL | V2-SI744713 | 07/10/2029 | 01/14/2025 / Jaswal | 10/03/2024 / Jaswal | M6137 |
| 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 | 121824 | 12/18/2027 | 04/17/2025 / Janvi | 01/13/2025 / Jaswal | M6138 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 58119 / K, 10000 PPM, 500 ml | 103024 | 10/30/2027 | 05/06/2025 / JANVI | 01/13/2025 / Jaswal | M6142 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 58111 / Na, 10000 PPM, 500 ml | 072424 | 07/24/2027 | 01/23/2025 / kareem | 01/13/2025 / Jaswal | M6144 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 58030 / Zinc, Zn, 500 ml, 1000 PPM | 121724 | 12/17/2027 | 02/04/2025 / | 01/13/2025 / Jaswal | M6145 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | Chemtech Lot # |
| Absolute Standards, Inc. | 57051 / Sb, 1000 PPM, 125 ml | 071724 | 07/17/2027 | 01/31/2025 / kareem | 10/18/2024 / kareem | M6146 |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------|---|------------|--------------------|----------------------------|--------------------------------|-------------------|
| EPA | ICV-1 / ICV (ICP/ICPMS) STOCK SOLN | ICV1-1014 | 07/07/2025 | 02/07/2025 / JANVI | 04/20/2021 / JANVI | M6150 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Seidler Chemical | BA-9530-33 / Hydrochloric Acid, Instra-Analyzed (cs/6x2.5L) | 22G2862015 | 08/18/2025 | 02/18/2025 / Sagar | 01/15/2025 / Sagar | M6151 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| EPA | PART A / ICSA (ICP) STOCK SOLN | ICSA-1211 | 08/24/2025 | 02/24/2025 / kareem | 04/20/2021 / kareem | M6152 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | Chemtech Lot # |
| EPA | PART B / ICSAB (ICP) STOCK SOLN | ICSB-0710 | 06/20/2025 | 02/10/2025 / kareem | 02/09/2024 / kareem | M6155 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | Chemtech Lot # |
| Seidler Chemical | BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L) | 24D1062002 | 03/25/2029 | 03/10/2025 / Eman | 02/02/2025 / Sagar | M6158 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / | Chemtech Lot # |
| | | | 03/18/2026 | 03/18/2025 / | 02/09/2025 / | |

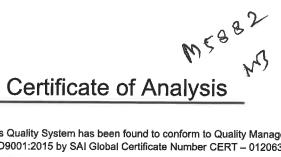


Fax: 908 789 8922

| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|----------|-------------------------------|------------|--------------------|----------------------------|--------------------------------|-------------------|
| EPA | ICV-5 / ICV (HG)STOCK SOLN | ICV 5 0415 | 07/31/2025 | 05/01/2025 / mohan | 03/30/2024 / mohan | M6161 |
| | | | | | | |

| 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 |
| | | | | | | |





1 Reagent Lane Fair Lawn, NJ 07410 201,796,7100 tel

Thermo Fisher Scientific's Quality System has been found to conform to Quality Management System

Standard ISO9001:2015 by SAI Global Certificate Number CERT - 0120633 201,796,1329 fax

This is to certify that units of the lot number below were tested and found to comply with the specifications of the grade listed. Certain data have been supplied by third parties. Thermo Fisher Scientific expressly disclaims all warranties, expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. Products are for research use or further manufacturing. Not for direct administration to humans or animals. It is the responsibility of the final formulator and end user to determine suitability based upon the intended use of the end product. Products are tested to meet the analytical requirements of the noted grade. The following information is the actual analytical results obtained.

| Catalog Number | T142 | Quality Test / Release Date | 08/17/2023 |
|-------------------|---|--|---|
| Lot Number | 232820 | | |
| Description | STANNOUS CHLORIDE, DIHYDR | ATE CERTIFIED ACS (Suitable for Me | rcury Determination) |
| Country of Origin | United States | Suggested Retest Date | Aug/2028 |
| Chemical Origin | Inorganic-non animal | | |
| BSE/TSE Comment | No animal products are used as sta processing aids, or any other mater | arting raw material ingredients, or used rial that might migrate to the finished pr | in processing, including lubricants, oduct. |

| N/A | H. M. C. S. C. | | Was I will still |
|-------------------|----------------|----------------------------|---------------------|
| Result Name | Units | Specifications | Test Value |
| APPEARANCE | | REPORT | Clear crystals |
| ASSAY | % | Inclusive Between 98 - 103 | 100.65 |
| CALCIUM | % | <= 0.005 | 0.0017 |
| IDENTIFICATION | PASS/FAIL | = PASS TEST | PASS TEST |
| IRON (Fe) | % | <= 0.003 | 0.0011 |
| LEAD (Pb) | % | <= 0.01 | 0.0006 |
| MERCURY (Hg) | ppm | <= 0.05 | <0.05 |
| POTASSIUM (K) | % | <= 0.005 | 0.0001 |
| SODIUM (Na) | % | <= 0.01 | <0.01 |
| SOLUBILITY IN HCL | PASS/FAIL | = PASS TEST | PASS TEST |
| SULFATE (SO4) | PASS/FAIL | = P.T. (ABOUT 0.003%) | P.T. (ABOUT 0.003%) |

Harout Sahagian - Quality Control Supervisor - Fair Lawn

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):

| | ſ | B | В | | ᆏ | Ва | 2 | D _c | S | 2 | 2 | Ì | ĺ | | |
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| | | A) 02 | 40.02 | 20.02 | 3 | ∆ 0.02 | 20.02 | 3 | ∆ 0.2 | 20.02 | 20.02 | | | | |
| | | AII | ନୁ | Ca | ? | 2 | E | 7 | 다 | 7 | יינ | | | | |
| | 20.00 | 3 | <0.02 | 20.02 | 3 | <u>&</u> | <0.02 | 3 | ∆ .02 | 20.02 | SO OC | STREET, STREET | | | |
| | | ş | 2 | ř | 1 ; | = | Ħ | • | 픙 | 121 | 30. | SOUTH STATES | l. | | |
| | 70.02 | 3 | ∆ .02 | 8 | 0.01 | A 02 | <0.02 | | <u>&</u> | 20.02 | 20.00 | NAME OF TAXABLE PARTY. | 200 | TSCP M | |
| (T) = Tarr | Z | 2 | Mo | H | 11444 | <u> </u> | Me | | Ę | Ē | | S JEW | | מלם | |
| | 20.02 | 3 6 | A)(2) | 802 | 20.00 | 3 | 40.01 | | A0.02 | 20.02 | | DESCRIPTION OF THE PERSON NAMED IN | 4011100 | Spriftics | |
| Target analyte | 2 | 4 ; | Þ | P | 5 | 2 | ဝွ | i | Z, | 2 | 1 | | | ÷. | |
| lyte | 8.2 | 20.02 | 3 | 0.02 | 20.02 | 3 | ♦ 0.02 | 10.04 | 3 | 40.02 | | | by ICI | - CD- | |
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| | 40.02 | 20.02 | 3 | △0.02 | 202 | | A).02 | 20.02 | 3 | <u>6</u> | MINISTRAL PROPERTY. | | | | |
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| | <0.02 | <0.02 | 0.00 | 3 | ∆ 0.02 | 10.02 | 3 | 40.02 | 0 00 | 2000 | Street Street Street Street | | | | |

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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|--------------------------------------|--------------|--------|--------------|--------------|---------------|-------|--------------|---------------|-------|---------------|--|----------|-------|--|
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| | Ð.02 | 40.02 | 40.04 | 3 | 40.2 | 20.02 | 3 | ∆ 0.02 | 7.03 | 3 | | | | |
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| | 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:

| 13. | 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: | |
|---|--|
|---|--|

- 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

M5810 M5811

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

CERTIFIED WEIGHT REPORT

Part Number: Lot Number: Description:

58126 051523 Iron (Fe)

R: 01/03/24

Solvent: 21110221 Lot # Nitric Acid

Formulated By:

J. Brans

であるから

5.0%

250.0

Nitric Acid

Giovanni Esposito

051523

Reviewed By:

Pedro L. Rentas

051523

Purity Uncertainty Assay 0.12 Flask Uncertainty Expanded SDS Information

Weight (g) Target Weight (g) Conc. (µg/mL) +/- (µg/mL) CAS#

IN346 2302010-500 10000 99.995 0.10 100.0 50.0034 50.0111 10001.5 20.0 7439-89-6

1. Iron (Fe)

Compound

RM#

Number E E

Conc. (µg/mL)

36

Purity (%)

8

Nominal

Nominal Concentration (µg/mL):

NIST Test Number:

BTUB 10000

5E-05 Balance Uncertainty

Recommended Storage:

Ambient (20 °C) 051526

Expiration Date:

Weight shown below was diluted to (mL):

5000.1

Uncertainty

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

LD50

SRM

5 mg/m3 orl-rat 7500mg/kg 3126a

70 BO 90

100

m/2->

10

20

30

40

S O

60

1.054

2.0E4

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

1.0E8

200

m/z->

110

120

130

5.0E7

1.0E8-

5.0E7

230 240

250

260

1 of 2

Lot # 051523

T/2->

210

220

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

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

| | Al Sb Ba | i i |
|----------------------|--|---------|
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| | A A A A A A A A A A A A A A A A A A A | y ICP |
| | | -MS |
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| | 40.02 40.02 40.02 40.02 40.02 | |

(I) = larger 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

* 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).

M6000,M6001,M6002,M6003,M6004,M6005,M6006,M6007,M6008



Certificate of Analysis

Refine your results. Redefine your industry. RD:05/14/2024

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

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2.0 PRODUCT DESCRIPTION

Product Code:

Multi Analyte Custom Grade Solution

Catalog Number:

WW-LFS-1

Lot Number:

T2-MEB723367

Matrix:

5% (v/v) HNO3

Value / Analyte(s):

1 000 μg/mL ea: Potassium, 600 μg/mL ea: Phosphorus, 300 μg/mL ea:

Iron,

200 μg/mL ea:

Sodium,

Magnesium, Aluminum, Cerium, Selenium,

Thallium,

100 μg/mL ea:

Lead, Calcium,

80 µg/mL ea: Arsenic, 70 µg/mL ea: Mercury, 50 µg/mL ea: Nickel,

40 μg/mL ea: Chromium,

30 μg/mL ea:

Copper, Boron,

Vanadium,

20 μg/mL ea:

Zinc, Strontium,
Barium, Beryllium,
Cadmium, Cobalt,
Manganese, Lithium,

7.5 µg/mL ea: Silver

3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE Aluminum, Al | CERTIFIED VALUE 200.0 ± 0.7 µg/mL | ANALYTE Arsenic, As | CERTIFIED VALUE 80.0 ± 0.7 µg/mL |
|-------------------------|--------------------------------------|------------------------|-------------------------------------|
| Barium, Ba | 20.00 ± 0.09 μg/mL | Beryllium, Be | 20.00 ± 0.13 μg/mL |
| Boron, B | 30.00 ± 0.18 μg/mL | Cadmlum, Cd | 20.00 ± 0.09 μg/mL |
| Calcium, Ca | 100.0 ± 0.4 μg/mL | Cerium, Ce | 200.0 ± 0.8 µg/mL |
| Chromium, Cr | 40.00 ± 0.30 μg/mL | Cobalt, Co | 20.00 ± 0.10 μg/mL |
| Copper, Cu | 30.00 ± 0.13 μg/mL | Iron, Fe | 300.0 ± 1.3 μg/mL |
| Lead, Pb | 100.0 ± 0.4 μg/mL | Lithium, Li | 20.00 ± 0.08 µg/mL |
| Magneslum, Mg | 200.0 ± 0.8 μg/mL | Manganese, Mn | 20.00 ± 0.08 µg/mL |
| Mercury, Hg | 70.0 ± 0.3 µg/mL | Nickel, Ni | 50.00 ± 0.22 μg/mL |
| Phosphorus, P | 600.0 ± 2.7 μg/mL | Potassium, K | 1 000 ± 4 µg/mL |
| Selenium, Se | 200.0 ± 1.3 μg/mL | Silver, Ag | 7.50 ± 0.03 µg/mL |
| Sodium, Na | 300.0 ± 1.4 μg/mL | Strontium, Sr | 20.01 ± 0.08 μg/mL |
| Thailium, Ti | 200.0 ± 1.4 μg/mL | Vanadium, V | 30.00 ± 0.13 μg/mL |
| Zinc, Zn | 20.00 ± 0.09 μg/mL | | |

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

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 |
| As | ICP Assay | 3103a | 100818 |
| В | ICP Assay | 3107 | 190605 |
| Ва | ICP Assay | 3104a | 140909 |
| Ва | Gravimetric | | See Sec. 4.2 |
| Ве | ICP Assay | 3105a | 090514 |
| Ca | ICP Assay | 3109a | 130213 |
| Ca | EDTA | 928 | 928 |
| Cd | ICP Assay | 3108 | 130116 |
| Cd | EDTA | 928 | 928 |
| Се | ICP Assay | 3110 | 090504 |
| Ce | EDTA | 928 | 928 |
| Co | ICP Assay | 3113 | 190630 |
| Со | 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 |
| Hg | ICP Assay | 3133 | 160921 |
| Hg | EDTA | 928 | 928 |
| K | ICP Assay | 3141a | 140813 |
| K | Gravimetric | | See Sec. 4.2 |
| Li | ICP Assay | 3129a | 100714 |
| Li | Gravimetric | | See Sec. 4.2 |
| Mg | ICP Assay | 3131a | 140110 |
| Mg | EDTA | 928 | 928 |
| Mn | ICP Assay | 3132 | 050429 |
| Mn | EDTA | 928 | 928 |
| Na | ICP Assay | Traceable to 3152A | S2-NA700842 |
| Na | Gravimetric | | See Sec. 4.2 |
| Ni | ICP Assay | 3136 | 120619 |
| Ni | EDTA | 928 | 928 |
| P | ICP Assay | 3139a | 060717 |
| P | Acidimetric | 84L | 84L |
| Pb | ICP Assay | 3128 | 101026 |
| Pb | EDTA | 928 | 928 |
| Se | ICP Assay | 3149 | 100901 |
| Sr | EDTA | 928 | 928 |
| Sr | ICP Assay | Traceable to 3153a | K2-SR650985 |
| TI | ICP Assay | 3158 | 151215 |
| V | IC Assay | 3165 | 160906 |
| V | EDTA | 928 | 928 |
| Zn | ICP Assay | 3168a | 120629 |
| Zn | EDTA | 928 | 928 |

Page 4 of 6

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:

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

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

 $u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{1/2}$ where u_{char} is 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_{CRMRM}, where one method of characterization is used is the mean of individual results:

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

X_g = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

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

k = coverage factor = 2

uchar a = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

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

N/A

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

August 30, 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

- August 30, 2026
- The date after which this CRM/RM should not be used.
- The lot expiration date reflects the period of time that the stability of a CRMRM can be supported by long term stability studies conducted on properly stored and handled CRMRMs. 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

DD978hi.



Certificate of Analysis

Refine your results. Redefine your industry. RD:05/14/2024

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:

WW-LFS-2

Lot Number:

U2-MEB731108

Matrix:

5% (v/v) HNO3

tr. HF

Value / Analyte(s):

200 µg/mL ea:

Silica,

80 µg/mL ea: Antimony, 70 µg/mL ea:

Tin,

40 µg/mL ea: Molybdenum, 20 µg/mL ea:

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ANALYTE Antimony, Sb **CERTIFIED VALUE** 80.1 ± 0.6 µg/mL

Titanium

ANALYTE Molybdenum, Mo **CERTIFIED VALUE** 40.03 ± 0.18 µg/mL

Silica, SIQ2

200.2 ± 1.3 μg/mL

Tin, Sn

 $70.0 \pm 0.4 \, \mu g/mL$

Titanium, Ti

20.01 ± 0.13 µg/mL

Density:

1.025 g/mL (measured at 20 ± 4 °C)

Assay Information:

| ANALYTE Mo | METHOD ICP Assav | NIST SRM# 3134 | SRM LOT# 130418 |
|---------------|---------------------|-------------------|--------------------|
| Мо | Calculated | | See Sec. 4.2 |
| Sb | ICP Assay | 3102a | 140911 |
| SiO2 | ICP Assay | 3150 | 130912 |
| Sn | ICP Assay | 3161a | 140917 |
| П | ICP Assay | 3162a | 130925 |
| Ti | 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:

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

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

 $\mathbf{w_j}$ = the weighting factors for each method calculated using the inverse square of the variance:

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

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

k = coverage factor = 2

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

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = 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:

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

X_a = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

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

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)

N/Δ

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 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

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11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

March 17, 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 17, 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 3D978hi.

Certifying Officer:

Paul Gaines
Chairman / Senior Technical I

Chairman / Senior Technical Director

Hydroxylamine Hydrochloride, Crystal BAKER ANALYZED® A.C.S. Reagent

Suitable for Mercury Determination (hydroxylammonium chloride)

MY251





Material No.: 2196-01 Batch No.: 0000215387

Manufactured Date: 2018/06/27

Retest Date: 2025/06/25 Revision No: 1

Certificate of Analysis

Meets ACS Reagent Chemical Requirements,

| Specification | Result |
|---------------|---|
| >= 96.0 % | 99.1 |
| Passes Test | PT |
| <= 0.050 % | 0.017 |
| <= 0.25 | 0.19 |
| Passes Test | PT |
| <= 0.005 % | < 0.003 |
| <= 5 ppm | 4 |
| <= 5 ppm | < 3 |
| <= 0.050 ppm | < 0.005 |
| | >= 96.0 % Passes Test <= 0.050 % <= 0.25 Passes Test <= 0.005 % <= 5 ppm <= 5 ppm |

For Laboratory, Research or Manufacturing Use

Country of Origin:

CN

Packaging Site:

Paris Mfg Ctr & DC



Phillipsburg, NJ 9001:2015, FSSC22000
Paris, KY 9001:2008
Mexico City, Mexico 9001:2008
Gliwice, Poland 9001:2015, 13485:2012
Selangor, Malaysia 9001:2008
Dehradun, India, 9001:2008, 14001:2004, 13485:2003
Mumbai, India, 9001:2015, 17025:2005
Panoli, India 9001:2015

James Tethier
Vice President Global Quality

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

Avantor Performance Materials, LLC

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



M4913- 16



Certificate of Analysis

1 Reagent Lane Fair Lawn, NJ 07410 201.796.7100 tel 201.796.1329 fax

Thermo Fisher Scientific's Quality System has been found to conform to Quality Management System Standard ISO9001:2015 by SAI Global Certificate Number CERT – 0120632

This is to certify that units of the lot number below were tested and found to comply with the specifications of the grade listed. Certain data have been supplied by third parties. Thermo Fisher Scientific expressly disclaims all warranties, expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. Products are for research use or further manufacturing. Not for direct administration to humans or animals. It is the responsibility of the final formulator and end user to determine suitability based upon the intended use of the end product. Products are tested to meet the analytical requirements of the noted grade. The following information is the actual analytical results obtained.

| Catalog Number | P279 | Quality Test / Release Date | 01/12/2021 |
|-------------------|--------------------------------|-----------------------------|------------|
| Lot Number | 210306 | | |
| Description | POTASSIUM PERMANGANATE, A.C.S. | | |
| Country of Origin | United States | Suggested Retest Date | Jan/2026 |

| N/A | | | |
|---------------------|-----------|----------------|--------------------------------------|
| Result Name | Units | Specifications | Test Value |
| APPEARANCE | | REPORT | Dark purple to purple green crystals |
| ASSAY | % | >= 99 | 99.3 |
| CHLORIDE & CHLORATE | % | <= 0.005 | <0.005 |
| IDENTIFICATION | PASS/FAIL | = PASS TEST | pass test |
| INSOLUBLE MATTER | % | <= 0.2 | <0.2 |
| MERCURY (Hg) | ppm | <= 0.05 | <0.004 |
| SULFATE (SO4) | % | <= 0.02 | <0.02 |

Julian Burton

Julian Burton - Quality Control Manager - Fair Lawn



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com M5062 M5063

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 Mass Spec Solution

Catalog Number:

MSHG-10PPM

Lot Number:

S2-HG709270

Matrix:

10% (v/v) HCI

Value / Analyte(s):

10 μg/mL ea:

Mercury

Starting Material:

Hg metal

Starting Material Lot#:

1959

Starting Material Purity:

99.9994%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value:

 $10.001 \pm 0.053 \,\mu g/mL$

Density:

1.020 g/mL (measured at 20 ± 4 °C)

Assay Information:

| ANALYTE | METHOD | NIST SRM# | SRM LOT# |
|---------|------------|-----------|--------------|
| Hg | ICP Assay | 3133 | 160921 |
| Hg | EDTA | 928 | 928 |
| Ha | 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:

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

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

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

the variance.

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

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

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

u_{bb} = 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 (u²char a + u²bb + u²lts + u²ts) 1/2

k = coverage factor = 2

u_{char a} = the errors from characterization

ubb = bottle to bottle homogeneity standard uncertainty

u_{lts} = 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.

```
O Ag
          0.000011 M Eu <
                            0.000201 O Na
                                              0.000004 M Se <
                                                               0.015915 O Zn <
                                                                                 0.001510
0
   Al
          0.000001 O Fe
                            0.000001 M Nb <
                                              0.000201 O Si
                                                                0.000005 M Zr <
                                                                                 0.000201
M
   As <
          0.000402 M Ga <
                            0.000201 M Nd <
                                              0.000201 M Sm <
                                                               0.000201
M
   Au <
          0.003631 M Gd <
                            0.000201 M Ni <
                                              0.000402 M
                                                        Sn <
                                                               0.001007
M
   B <
          0.001208 M
                    Ge <
                            0.000201 M Os <
                                              0.000605 M
                                                        Sr <
                                                               0.000201
M Ba <
          0.000201 M Hf <
                            0.000201 O P <
                                              0.032370 M
                                                        Ta <
                                                               0.000201
M
  Be <
          0.000201 s
                                   M Pb <
                    Hq <
                                              0.000201 M Tb <
                                                               0.000201
M Bi <
          0.000201 M
                    Ho <
                            0.000201 M Pd <
                                              0.000403 M
                                                        Te <
                                                               0.002216
0
  Ca
          0.000007 M In <
                            0.000201 M Pr <
                                              0.000201 M Th <
                                                               0.000201
M
  Cd <
          0.000201 M Ir
                            0.000201 M
                                      Pt <
                                              0.000402 M Ti <
                                                               0.000402
                                              0.000201 O TI <
M
  Ce <
          0.000201 O K
                            0.000020 M
                                      Rb <
                                                               0.016508
  Co <
M
          0.000201 M La <
                            0.000201 M
                                      Re <
                                              0.000201 M Tm <
                                                               0.000201
  Cr <
0
          0.003021 O Li <
                            0.000107 M
                                      Rh <
                                              0.000201 M U <
                                                               0.008058
M
  Cs <
          0.001208 M Lu <
                            0.000201 M Ru <
                                              0.000201 M V <
                                                               0.000201
M
  Cu <
          0.000402 O
                    Mg
                            0.000001 O
                                      S <
                                             0.053950 M W <
                                                               0.000604
M Dy <
          0.000201 M Mn <
                            0.000604 M Sb <
                                             0.001208 M Y <
                                                               0.000201
M Er <
          0.000201 M Mo
                           0.000009 M Sc <
                                             0.000201 M Yb <
                                                               0.000201
```

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 - 200.59 +2 4 Hg(OH)(aq) 1+ **Chemical Compatibility -** Stable in HNO3. Avoid basic media forming insoluble carbonate. The sulfide, basic carbonate, oxalate, phosphate, arsenite, arsenate and iodide are insoluble in water.

Stability - 2-100 ppb levels not stable in 1% HNO3 / LDPE container, stable in 10% HNO3 packaged in borosilicate glass. 1-100 ppm levels stable in 7% HNO3 packaged in borosilicate glass. 1000-10,000 ppm solutions are chemically stable for years in 5-10% HNO3 / LDPE container.

Hg Containing Samples (Preparation and Solution) - Metal (soluble in HNO3); Oxide (Soluble in HNO3); Ores and Organic based (The literature has more references to the preparation of Hg containing samples than any other element. Please consult the literature for your specific sample type, since such preparations are prone to error. Or e-mail our technical staff and we will contact you to discuss your particular sample preparation questions in further detail.).

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 202 amu | 9 ppt | n/a | 186W16O |
| ICP-OES 184.950 nm | 0.03 / 0.005 μg/mL | 1 | |
| ICP-OES 194.227 nm | 0.03 / 0.005 µg/mL | 1 | V |
| ICP-OES 253.652 nm | 0.1 / 0.03 µg/mL | 1 | Ta, Co, Th, Rh, Fe, |
| | | | U |

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 22, 2021

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

11.2 Lot Expiration Date

- September 22, 2026
- The date after which this CRM/RM should not be used.
- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

| Sealed TCT | Bag | Open Date | : | | |
|------------|-----|-----------|---|--|--|
| | | | | | |

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS Certificate Prepared By:

Uyen Truong
Supervisor, Product Documentation

Mya Truong

Certificate Approved By:

Michael Booth Director, Quality Control Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director Paul R Laines

Certified Deference Metaric Com

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

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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 | | | | | 1000 | | | | | | | | |
| 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 og.) | (Solvent Safety Info. On Attached pg.) | (Solv | Uncertainty | Actual | Actual | Target | Assay | Nominal Punty Uncertainty Assay. Target | Funty | Nominal | 707 | | | Commonwood |
| | ition | SDS Information | | Expanded | | | | | | | | - | | | |

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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/) | | | | | | |
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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 [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

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

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

| I. | 1 50 | B | | > | 50 | > | | ı | |
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(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

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



Certified Reference Material CRM

R: 03/01/23(12)



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

| Solvent: 2110221 Nitric Acid Permulated By: Lawrence Barry D20623 Cerlum (Ce) 2% 20.0 Nitric Acid Formulated By: Lawrence Barry D20623 Cerlum (Co) 1000 Current (20 °C) 1000 | Ce) Solvent: 2110221 Nitric Acid Formulated By: Lawrence Barry O20623 (mL) (mL) |
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| 57058 Solvent: 21110221 Nitric Acid Cerlum (Ce) 2% 20.0 Nitric Acid Formulated By: Lawrence Barry Ambient (20 °C) (mL) ************************************ | Lot # Lot # Lot # Solvent: 21110221 Nitric Acid Certum (Ce) 2% 20.0 Nitric Acid Formulated By: Lawrence Barry (mL) Ambient (20 °C) 1000 |
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| 57058 Solvent: 21110221 Nitric Acid Cerlum (Ce) 2% 20.0 Nitric Acid Formulated By: Lawrence Barry Ambient (20 °C) (mL) (mL) Mandient (20 °C) (mL) | Lot # Lot # Lot # Solvent: 21110221 Nitric Acid Cerlum (Ce) 2% 20.0 Nitric Acid Formulated By: Lawrence Barry (mL) Ambient (20 °C) Minus (mL) |
| Solvent: 2110221 Nitric Acid Solvent: 21110221 Nitric Acid Certum (Ce) 2% 20.0 Nitric Acid Formulated By: Lawrence Barry (mL) Ambient (20 °C) (mL) Formulated By: Lawrence Barry (mL) Formulated By: Lawrence By: Lawren | Lot # Lot # |
| 57058 Solvent: 2110221 Nitric Acid 020623 2% 20.0 Nitric Acid Ambient (20 °C) (mL) Formulated By: Lawrence Barry | 57058 Solvent: 21110221 Nitric Acid Cerlum (Ce) 2% 20.0 Nitric Acid Formulated By: Lawrence Barry Ambient (20 °C) (mL) Ambient (20 °C) Ambient (20 °C) Control of the contro |
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| Compound | RM# | Lot | Nominal Conc. (vg/mL) | Purity (%) | Purity Uncertainty Assay (%) Purity (%) (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Actual Uncertainty Weight (g) Conc. (µg/mL) +/- (µg/mL) | Uncertainty +/- (ug/mL) | SS | (Solvent Safety Info. On Attached pg.) CAS# OSHA PEL (TWA) LD50 | ched pg.) LD50 | NIST |
|---------------------------------|---------------|------------------|---|------------|--|--------------|----------------------|----------------------|--|----------------------------|-------|---|-------------------|---------------|
| Cerium nitrate hexahydrate (Ce) | IN146 | IN146 Z512CEB1 | 1000 | 88.98 | 0.10 | 32.8 | 3.04919 | 3.04921 1000.0 | 1000.0 | 20 | II == | ¥. | 4 2 | ĄN |
| [1] Spectrum N | lo.1 [43.472 | \$ sec]:58158.D# | [1] Spectrum No.1 [43.472 sec]:58158.D# [Count] [Linear] | | | | | | | | | | | $\ \cdot \ $ |
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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):

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| by ICP-MS | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.05 | <0.7 |
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Physical Characterization:

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

(T)= Target analyte

My J. M.

Certified by:

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

^{*} Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.

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.

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).



MATERIAL CERTIFICATE OF COMPLIANCE

DATE: JUNE 12, 2023

CUSTOMER:

PCI SCIENTIFIC SUPPLY, INC

PURCHASE ORDER NO.

6054931

CATALOG NO.

BOI5021-450L

PRODUCT DESCRIPTION:

BOILING STONES, TFE, 454GMS

QUANTITY:

10 EACH

LOT NO.

W126678

SPECIFICATION (S):

Made from Virgin PTFE Resin

We certify that we have complied with the terms and conditions of the above Purchase Order and the Part Specifications in the manufacturing of the above product.

Laura Valencia

Quality Assurance Inspector

F:U:J:CF:PCISCI:GOC-55118-BQI5021-061223

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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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 MSTHT

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

CERTIFIED WEIGHT REPORT: Part Number: R: 12/20/23 Lot #

Nitric Acid

Solvent: 24002546

2%

Nitric Acid

Formulated By:

Lawrence Barry

100923

60.0

Lot Number: Description: 57082 100923 Lead (Pb)

Expiration Date: 100926

Recommended Storage: **NIST Test Number:** BIN9 1000 Ambient (20 °C)

Nominal Concentration (µg/mL): Weight shown below was diluted to (mL): 3000.41 0.06 Flask Uncertainty 5E-05 Balance Uncertainty Reviewed By:

Cot

Nominal

Purity

Uncertainty Assay

| | | | 1000.0 2.0 10099-74-8 0.05 mg/m3 | 0 2.0 10 | | 0.10 62.5 4.80071 4.80077 | 62.5 | 0.10 | 99.999 | 1000 | N029 PBD122016A1 | Lead(II) nitrate (Pb) |
|--|--|--|----------------------------------|----------|--|---------------------------|------|------|--------|------|------------------|-----------------------|
|--|--|--|----------------------------------|----------|--|---------------------------|------|------|--------|------|------------------|-----------------------|

Target Weight (a) Con Actual Actual Uncertainty +/- (ua/mL) Expanded #SAC SDS Information
(Solvent Safety Info. On Attached pg.)
(SONA PEL (TWA) TSIN

Pedro L. Rentas

100923

| m/2-> | 1.0E6 | m/z-> | 5.OE4 | m/z-> | 5.0 M4 | 1.0E6 |
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Part # 57082



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| 20,02 | 2002 | 20.02 | 20.02 | 500 | 3 | 40.02 | 40.02 | (SIPPLY) (SPECIAL) | | |
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| l-i | 20.02 | A) 12 | 40,02 | 20.02 | | A 63 | <0.02 | | race Me | |
| Z | Mo | H9 | M | M M | : [| 7 | Ц | | tals | - |
| 40.02 | 40.02 | 402 | △0.02 | 10.0 | 200 | 3 | <0.02 | | Verifica | |
| K | 7 | 7 | P | Ç | 2 | Ş | Z. | TOTAL PROPERTY. | tion | ١ |
| 402 | <0.02 | 40.02 | 40.02 | 40.02 | 20.02 | 3 | <0.02 | | by ICP-I | |
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| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 20.02 | 3 | 40.02 | | ug/mL) | |
| Ta | S | Ş | Z | Ag | 21 | 2 | Se | MUSEUM | | ı |
| 40.02 | 40.02 | 20.02 | 402 | 40.02 | 20.02 | 3 8 | 40 2 | DESCRIPTION OF THE PROPERTY OF | | |
| Ti | Sh | Tm | Ħ | Ħ | e | 7 | ŧ | | | |
| 40.02 | 40.02 | △0.02 | ₫.02 | 40.02 | 40.02 | 20.02 | AMA | COLOR STREET | | |
| Zr | Zn | × | 44 | < | C | 1 | W | | | |
| ₫,02 | 40.02 | ₫.02 | △0.02 | 40.02 | 40.02 | 20.02 | 200 | | | |

Physical Characterization:

(1)= 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
- * All standard containers are meticulously cleaned prior to use.

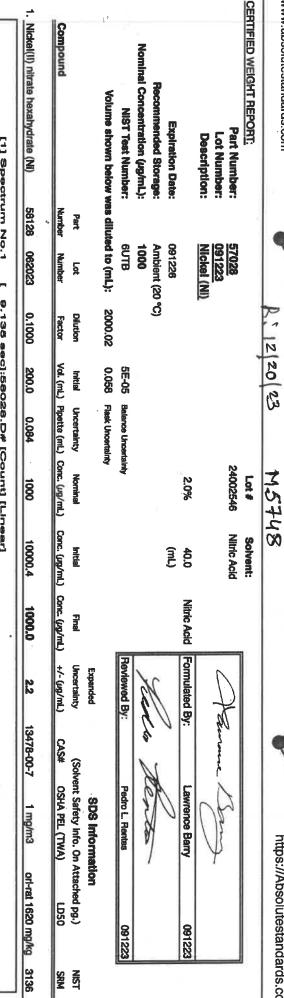
the preparation of all standards.

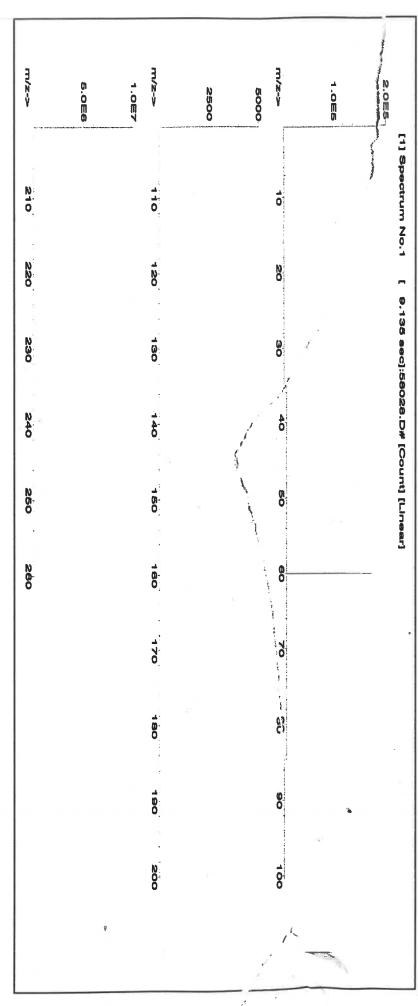
- * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
 * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated.
- * All Standards should be stored with caps tight and under appropriate laboratory conditions.
- * 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).

Certified Reference Material CRM



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800-368-1131

Absolute Standards, Inc.

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

| | 1 | - | | - | - | | - | - | | - | - | T | 9 | | = |
|----------|-------|---------------|--------------|---------------|-------------|---------------|---------------------|--------------|-----------------------|-------|------------|--------------|----------|----------|---|
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| 3 | | \$ | 88 | 2.0 | 200 | A | <u>0.01</u> | | A)(2) | 20.02 | 200 | | ACTILICA | | |
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| | <0.02 | 20.02 | 600 | 3 | 6002 | 20:02 | 3 | ∆ .02 | 200 | 2000 | | | | | |

Physical Characterization:

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

Certified by:

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

the preparation of all standards.

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www.absolutestandards.com

CERTIFIED WEIGHT REPORT



Certified Reference Material CRM

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

R:8/25) Lot # Solvent:

21110221

Nitric Acid

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

Recommended Storage: **Expiration Date:** Ambient (20 °C) 071726 2.0%

(mL)

40.0

Nitric Acid

Formulated By:

Benson Chan

071723

Nominal Concentration (µg/mL): Volume shown below was diluted to (mL): **NIST Test Number:** 1000 **BTU9** 2000.02 0.058 5E-05 Flask Uncertainty Balance Uncertainty Reviewed By: Pedro L. Rentas

Part

Lot

Dilution

Initia

Uncertainty

Nominal

Initial

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

Number Number Factor Val. (mL) Pipette (mL) Conc. (µg/mL) Conc. (µg/mL) Conc. (µg/mL) +/- (µg/mL) CAS# OSHA PEL (TWA) LDSO 3114 SRM

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

071723

5.0E5 1.0E6 [1] Spectrum No.1 [33.422 sec]:58029.D# [Count] [Linear]

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

| | [| , <u>p</u> | . E | <u> </u> | Ą | 35 | A | | Ī | |
|----------------------|-------------|-------------------------|-------|----------------|--------------|------------|-------|--|----------|---|
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| | 198 | : <u>F</u> | क्र | 17 | 5 | Ήο | Ж | DESTRUCTION OF THE PERSON NAMED IN | | |
| (T) - Target analyto | 40.02 | 40.02 | 40,2 | 40.02 | 40.02 | 40.02 | <0.02 | ALTERNATION OF THE PERSON NAMED IN | Irace M | 1 |
| | Z | Mo | ВН | Ma | Mg | ٤ | Ľ. | Nestera | etais | |
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| | × | 29 | ש | 25 | ွှ | ¥ | Z | | tion | |
| | ∆0.2 | 40.02 | 40.02 | 40.02 | 40.02 | <0.02 | 40.02 | | by ICP-N | |
| | Sc | Sm | Ŗ. | Rb | Rh | Re | P | | S (Hi | , |
| | 40.02 | 40.02 | <0.02 | ∆ 0.02 | 40.02 | 40,02 | <0.02 | | g/mL) | |
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| | 40,02 | 40,02 | 40.02 | ∆ 0.2 | 40.02 | <0.02 | <0.2 | | | |
| | 11 | Sn | Im | Ħ | ∄ | 7 | 4. | | | |
| | 40.02 | 40,02 | 40,02 | 40.02 | <0.02 | 40.02 | <0.02 | | | |
| | Zr | Z | Υ | ۲ ۵ | < | 4 | W | STANDARD STANDARD | | |
| | <0.02 | 40.02 | <0.02 | <0.02 | 40.02 | <0.02 | <0.02 | | | |

(I) = larget analyte

Physical Characterization:

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

Certified by:

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.

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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%

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.)

Pipette (mL) Conc. (µg/mL)

Conc. (µg/mL)

Part

Dilution Factor

hitia

Uncertainty

Nominal

Final

58104

091423

0.1000

200.0

0.084

98

10001.5

1000.0

22

13597-99-4

0.2ug/m3

intryns-rat 3.16mg/kg

₹

Recommended Storage:

Ambient (20 °C) 102526

Expiration Date:

Lot Number: Description:

Beryllium (Be)

40.0

Nitric Acid

Benson Chan

102523

Formulated By:

Reviewed By:

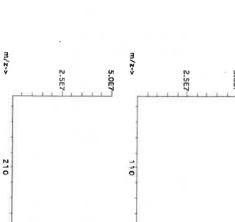
Pedro L. Rentas

102523

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

1. Beryllium nitrate (Be)

m/z-> 5.0E7 1.0E4 2.0€4 [1] Spectrum No.1 [Z9.233 sec]:58004R.D# [Count] [Linear] 70 20 30 40 50 60 70 80 90 100



120

130

140

051

160

170

180

190

200

Lot # 102523

220

230

240

250

260

Part # 57004

1 of 2

Printed: 2/8/2024, 5:01:11 PM



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) S | ua/mL) | | | | | | |
|----|---------------|----|----------------|---------------------|--------------|-------------|--------------|-------------|----------------|---------------|---------------|--|--------------|----|-------|----|-------|---|--------------|
| | TATES AND AND | | District Color | STATE OF THE PERSON | | Section and | | SOMETHINGS. | NAME OF STREET | SAMOOGE STATE | SECOND SPINSO | No. of Concession, Name of Street, or other Persons and Street, or other P | . 18 | | | | | | |
| F | <0.02 | 3 | <0.02 | Ďλ | <0.02 | HL | <0.02 | Li | <0.02 | z | <0.02 | Ā | <0.02 | Se | <0.2 | T. | <0.02 | M | <0.02 |
| Sp | <0.02 | ථ | 40.2 | 占 | ₹0.02 | He | <0.02 | 3 | <0.02 | £ | <0.02 | Re | <0.02 | Š | <0.02 | ę | ₹0.02 | Þ | <0.02 |
| As | <0.7 | ඊ | <0.02 | 립 | ₩ | ដ | ₹0.02 | Mg | 10.0> | ő | <0.02 | Rh | <0.02 | Ag | <0.02 | F | <0.02 | > | 40.02 |
| Ba | <0.02 | ర | <0.02 | 3 | <0.02 | ㅂ | <0.02 | Mn | <0.02 | 2 | <0.02 | 8 | <0.02 | ž | 40.2 | Ħ | <0.02 | 2 | <0.02 |
| æ | Т | Ç | 40.02 | ő | 40.02 | £ | <0.7 | Hg | <02 | Δ, | <0.02 | Ru | <0.02 | š | <0.02 | Tm | ₹0.02 | × | 40.02 |
| 洒 | <0.02 | රි | <0.02 | ප | <0.02 | ឌ | 40.02 | Mo | <0.02 | 武 | 40.02 | Sm | <0.02 | S | <0.02 | S | <0.02 | 2 | <0.02 |
| æ | <0.02 | ರೆ | <0.02 | Au | <0.02 | £ | ₹0.02 | 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

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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. Ammortium 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

Part # 57050

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

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|-------------------|---|-----------|
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| | 40.02 40.02 40.02 40.02 40.02 | |
| | \$ > > \$ × £ 5 | |
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(I) = larget analyte

Physical Characterization:

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

Certified by:

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

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.) | ttached 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 | 9.0 | 10008.000 | 000 | 700 | - 5 |
| | | | | | | | 20000 | | 7:5 | 100c0-22-9 | O.UZ ING/ITIS | 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 WO | [1] Spectrum No.1 F at year, near, n | | | | | | | |

| 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 STATES | | 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 |
| ౙ | 40.02 | రే | 40 7 | 占 | <0.02 | H9 | <0.02 | .3 | ₹005 | Ź | ₹0.02 | 2 | <0.02 | Š | 40.02 | T _e | 40.05 | ם | 40.02 |
| 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 |
| 2 | ¥0.01 | ඊ | 20.02 | త్ర | 40.02 | હ | 40.2 | 쁀 | \$ 20 | تم | ₹0.02 | 콥 | 40.02 | Şt | 40.02 | Tm | Ø.02 | 7 | Ø.02 |
| 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 |
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(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

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

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

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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
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- * 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 # 57033

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Certified Reference Material CRM

Solvent: MKBQ8597V Ammonium hydroxide

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CERTIFIED WEIGHT REPORT: R - 02 00 124 M.5814

Part Number: Lot Number: 57005 071123

Description: Boron (B)

Nominal Concentration (µg/mL): Recommended Storage: 1000 Ambient (20 °C)

Expiration Date:

071126

2.0%

Ammonium hydroxide

Formulated By:

Benson Chan

071123

tento

40.0

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

RM#

Number

Purity (%)

3

NIST Test Number: Ĕ Nominal Purity 5E-05 Balance Uncertainty Uncertainty Assay Target Actual Reviewed By: Expanded Pedro L. Rentas **SDS Information**

071123

1. Boric acid (B) IN018 BV092016A1 Conc. (µg/mL) 9 8 0.10 17.3 11.55772 Weight (g) 11.56201 1000.4 120 10043-35-3 2 mg/m3 orl-rat 2660 mg/kg 3107

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

NIST SRM

Weight (g) Conc. (µg/mL)

[1] Spectrum No.1 [12.275 sec]:58105.D# [Count] [Linear]

17/Z-V <-Z/111 m/z-> 2.5EG 5.0E6 2.5E6 S.OE6 1.0E4 2.0≡4 110 1210 0 120 220 Ŋ 130 230 30 140 240 40 150 250 (I) O 200 160 60 170 70

180

190

200

80

90

100

Part # 57005

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

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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.
- 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

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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(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.

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*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 # 57115

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R1 02/09/124 Certified Reference Material CRM

M5816

CERTIFIED WEIGHT REPORT

Part Number:

Lot Number: Description:

57016 122923

Solvent:

122923

ASTM Type 1 Water

Lot #

Expiration Date: 122926 Sulfur (S)

Nominal Concentration (µg/mL): NIST Test Number: 1000

Recommended Storage:

Ambient (20 °C)

Weight shown below was diluted to (mL): 4000.0 5E-05 Balance Uncertainty 0.06 Flask Uncertainty

Nominal

Purity

Uncertainty Assay

Target

Actual

Uncertainty

Expanded

Reviewed By:

Pedro L. Rentas

122923

tento

Formulated By:

Benson Chan

122923

 Ammonium sulfate (S) IN117 SLBR7225V Number Conc. (µg/mL) 1000 99.9 38 Purity (%) 0.10 24.3 38 Weight (g) 16.4979 Weight (g) Conc. (µg/mL) 16.4980 1000.0 +/- (µg/mL) 20 7783-20-2 CAS# SDS Information
(Solvent Safety Info. On Attached pg.)
LD50 ¥ orl-rat 4250mg/kg 3181 SRM

1/Z-V m/z-> m/z-> N.SES S.OEB 5.OE7 1.0**E**8 N. SES 5.0E5 [1] Spectrum No. 1 210 110 0 120 ななり 0 [33.603 sec]:57016.D# [Count] [Linear] 130 230 30 140 240 40 250 150 000 160 200 00 170 0 180 80 190 00 200 100

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

Part # 57016

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

(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.

* 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

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 |
|-------------|-------|----------------|-------|------------|------|------|
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| N N O | | 120 | | 20 | | |
| 230 | | 130 | | 3 0 | | |
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| 260 | | 190 | | 8 | | |
| | | 170 | | 70 | | |
| | | 180 | | 8. | | |
| | | 190 | | 90 | | |
| | | 200 | | 100 | | |

Part # 57116

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

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Physical Characterization:

(1)= larger analyte

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

Certified by:

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Part # 57116

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Certified Reference Material CRM

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

CERTIFIED WEIGHT REPORT: Lot #

Part Number: Lot Number: Description: 57015 091123 Phosphorous (P) Solvent: 24002546 2% 40.0 Nitric Acid Nitric Acid

Formulated By:

Lawrence Barry

091123

Pedro L. Rentas

091123

SDS information

rento

Nominal Concentration (µg/mL): Recommended Storage: **Expiration Date:** 1000 091126 Ambient (20 °C) (JE)

Weight shown below was diluted to (mL): **NIST Test Number:** BITUB Lot 2000.02 Nominal 0.058 Flask Uncertainty 5E-05 Balance Uncertainty Purity Uncertainty Assay Target Actual Uncertainty Reviewed By: Expanded

 Ammonium dihydrogen phosphate (P) IN008 Pvos2018A1 [1] Spectrum No.1 RM# Number [12.074 sec]:58115.D# [Count] [Linear] Conc. (µg/mL) 1000 99.999 3 Purity (%) 0.10 27.5 3 Weight (g) 7.2729 Weight (g) Conc. (µg/mL) 7.2730 1000.0 +/- (µg/mL) 2.0 7722-76-1 CAS# (Solvent Safety Info. On Attached pg.)
OSHA PEL (TWA) LD50 5 mg/m3 rl-rat >2000mg/ki 3186 SRM

Part # 57015

--z/m

210

220

230

240

250

260



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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:

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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).

Sodium Chloride, Crystal BAKER ANALYZED® A.C.S. Reagent







Material No.: 3624-01

Batch No.: 0000281938

Manufactured Date: 2021-06-07

Retest Date: 2026-06-07

Revision No.: 1

Certificate of Analysis

| Test | Specification | Result |
|--|---------------|-------------|
| Assay (NaCl) (by Ag titrn) | ≥ 99.0 % | 100.0 % |
| pH of 5% Solution at 25°C | 5.0 - 9.0 | 6.3 |
| Insoluble Matter | ≤ 0.005 % | 0.003 % |
| lodide (I) | ≤ 0.002 % | < 0.002 % |
| Bromide (Br) | ≤ 0.01 % | < 0.01 % |
| Chlorate and Nitrate (as NO ₃) | ≤ 0.003 % | < 0.001 % |
| ACS - Phosphate (PO ₄) | ≤ 5 ppm | < 5 ppm |
| Sulfate (SO ₄) | ≤ 0.004 % | < 0.004 % |
| Barium (Ba) | Passes Test | Passes Test |
| ACS - Heavy Metals (as Pb) | ≤ 5 ppm | < 5 ppm |
| ron (Fe) | ≤ 2 ppm | < 1 ppm |
| Calcium (Ca) | ≤ 0.002 % | < 0.001 % |
| Magnesium (Mg) | ≤ 0.001 % | < 0.001 % |
| Potassium (K) | ≤ 0.005 % | 0.001 % |

For Laboratory, Research, or Manufacturing Use Meets Reagent Specifications for testing USP/NF monographs Country of Origin: USA

Packaging Site: Paris Mfg Ctr & DC





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 | М | 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 \pm 4 °C)

Assay Information:

Assay Method #1

10011 ± 25 µg/mL

EDTA NIST SRM 928 Lot Number: 928

Assay Method #2

9997 ± 50 µg/mL

ICP Assay NIST SRM 3167a Lot Number: 190730

Assay Method #3

9984 ± 31 µg/mL

Calculated NIST SRM Lot Number: See Sec. 4.2

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

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

Characterization of CRM/RM by Two or More Methods

Certified Value, X_{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 | M | 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

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-> | | i, | m/z-> | | 10 c | ÷ is | 1. Selenium (Se) | Compound | | < | | Nominal Co | Re | | | CERTIFIED WEIGHT REPORT | מדודודה שובום |
|-------|-------|-------|-------|-------|---------|---------------------------------------|--------------------|--------------------------------------|--|---|---------------------|--------------------------------|----------------------|----------------|-----------------------------|-------------------------|---------------|
| 210 | 1.008 | 2.008 | 110 | 1.008 | /z-> 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 | | Ū | Z | 58134 | Number | Part | as dilute | | | | | lie ie ii | _ | |
| 220 | | | 120 | | N 0 | r. | 071223 | Number | Lot | d to (mL): | 6UTB | 1000 | Ambient (20 °C) | | 060624 Selenium (Se) | 57034 | |
| Ŋ | | | 4 | | ω | 3.702 | 0.1000 | Factor | Dilution | 2000.07 | | | <u>೦</u> | | Se) | | |
| 230 | | | 130 | | 90 | sec]:58 | 200.0 | Val. (mL | Initial | 0.100 | 5E-05 | | | | | | |
| 240 | | | 140 | | 40 | 33.702 sec]:58034.D# [Count] [Linear] | 0.084 | Vol. (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 2 | 10002.5 | Conc. (µg/mL | Initial | | | | (mL) | 40.0 | Zin Zin | Solvent: | |
| 0 | | | | | | | 1000.0 | Conc. (µg/mL) Conc. (µg/mL) | Final | | | | | Nitric Acid | | | (1) |
| | | | 170 | | 70 | | 2.2 | .) +/- (µg/mL) | Uncertainty | Expanded | Reviewed By: | K | N | Formulated By: | M | | 10 |
| | | | 180 | | 80 | | 7782-49-2 | C | (So | | y: | 200 | 11 | Ву: | | | |
| | | | 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 | | |
| | | | 200 | | 100 | | | NA) |). On Atta | rmation | ntas | , | / | 5 | | | |
| | | | - | | J | | orl-rat 6700 mg/kg | LDS0 | ched pg.) | | 060624 | | | 060624 | | | |
| | | | | | | | 3149 | SRM | NIST | | 4 | | | 4-1 | | _ | |

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

| | | | | | | | I race M | 1etals | Verifica | lion | oy ICP-M | S (1) | g/mL) | | | | | | |
|----|-------|-----|-------|----|-------|----|----------|--------|----------|------|----------|-------|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | 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 | н | <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 | Ħ | <0.02 | Mg | <0.01 | ° | <0.02 | Rh | 40.02 | Ag | <0.02 | ∄ | 40.02 | ۷ | <0.02 |
| Ва | <0.02 | င္တ | <0.02 | æ | <0.02 | ŀ | <0.02 | Mn | <0.02 | Pd | 40.02 | ₽. | <0.02 | Na | <0.2 | Ħ | <0.02 | ታ | <0.02 |
| Ве | 40.01 | ť | 40.02 | Ga | <0.02 | F | <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 | Рь | <0.02 | M | <0.02 | × | 40.2 | Sc | <0.02 | Ta | <0.02 | Ħ | <0.02 | Z | <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).

CERTIFIED WEIGHT REPORT:
Part Number:
Lot Number: Lithium nitrate (Li) Nominal Concentration (µg/mL): m/z-> Recommended Storage: Volume shown below was diluted to (mL): NIST Test Number: **Expiration Date** [1] Spectrum No.1 [32.093 sec]:58003.D# [Count] [Linear] Description: 210 10 Part Lot Number Number 58103 070622 0.1000 57003 062124 Lithium (Li) 6UTB 062127 Ambient (20 °C) 1000 220 120 20 250.11 230 25.0 0.004 Initial Uncertainty Nominal Initial Final

Vol. (mL) Pipette (ml.) Conc. (µg/mL) Conc. (µg/mL) Conc. (µg/mL) 0.016 Flask Uncertainty 5E-05 Balance Uncertainty HEBSON OF PSON 240 40 1000 24002546 Lot# 2.0% 250 150 50 Nitric Acid Solvent: 10000.4 (mL) 260 1000.0 Nitric Acid 7/01/24 Formulated By: Reviewed By: +/- (µg/mL) Uncertainty Giovannie Capacito 2.0 7790-69-4 5 mg/m3 orl-rat 1426 mg/kg NA SDS Information
(Solvent Safety Info. On Attached pg.)
CAS# OSHA PEL (TWA) LD50 Pedro L. Rentas Giovanni Esposito 9 0 062124 062124 SRM

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

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Certified Reference Material CRM

20

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

Part # 57003 Lot # 062124

1 of 2

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



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):

| 40.02 40.01 | 40.2 40.02 | 40.02 | 40.2 | | <0.02 | 40.02 | | | | |
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| 20.02 | 3 | <0.02 | <0.02 | <0.02 | <0.2 | 20.02 | 9 | | | |
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| 3 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 20.02 | A0 003 | ١ | | |
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| <0.02 | <0.02 | <0.2 | <0.02 | <0.02 | 40.02 | 0.00 | 2000 | | Trace N | |
| N | Мо | Hg | Мп | Mg | LI | 1 | | ı | letals | l |
| <0.02 | <0.02 | <0.2 | <0.02 | <0.01 | 20.02 | 6 | 7 | | Verifica: | |
| × | 77 | Ъ | Pd | Os | NO | ř | Z. | ۱ | tion k | ١ |
| <0.2 | <0.02 | <0.02 | <0.02 | 20.02 | 20.02 | 3 | <0.02 | 1 | y ICP-M | ١ |
| Sc | Sm | Ru | Kb | 2 3 | 1 2 | D., | Pr | | en) s | ۱ |
| <0.02 | <0.02 | <0.02 | <0.02 | 0.02 | 0.00 | 9 | <0.02 | | | ١ |
| Ta | 00 | , g | Na | Ng. | | 2 | Sc | ١ | | ١ |
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| 20.02 | \$0.0Z | 40.02 | 6.05 | 0.02 | 200 | <0.02 | <0.02 | | | |
| E | 2 1 | 7 - | < ? | ∳ . | < | d | W | | | |
| 20,02 | 20.02 | 40.02 | 20.00 | 3 8 | 20.02 | <0.02 | <0.02 | | | |

(T) = Target analyte

Physical Characterization:

Al Sh As Ba Ba Bi

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

Certified by:

| | Puri | 굺 |
|---|--|----------|
| | Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in | certifi |
| | ids, | ed v |
| • | 18.2 | alue i |
| = | 3 | st |
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the preparation of all standards.

* All standard containers are meticulously cleaned prior to use.

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

* Standards are prepared gravimetrically using balances that are calibrated.

* 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

* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST

* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST

Part # 57003 Lot # 062124

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2 of 2



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.

| M | Ag | < | 0.000760 | М | Eu | < | 0.000760 | 0 | Na | | 0.012771 | M | Se | < | 0.023000 | М | Zn | < | 0.006100 |
|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| М | ΑI | | 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 | M | Gd | < | 0.000760 | 0 | Ni | < | 0.005100 | М | Sn | < | 0.000760 | | | | |
| 0 | В | | 0.003692 | M | 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 | S | 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 | | | | |
| M | Ce | < | 0.000760 | 0 | K | | 0.007078 | М | Rb | < | 0.000760 | М | TI | < | 0.000760 | | | | |
| M | Co | < | 0.000760 | М | La | < | 0.000760 | М | Re | < | 0.000760 | М | Tm | < | 0.000760 | | | | |
| 0 | Cr | < | 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

| One led TOT Day C | San Dates | |
|--------------------|------------|--|
| - Sealed TCT Bag C | 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



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com R:2/22/24 M5-997

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

1.0 ACCREDITATION / REGISTRATION

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2.0 PRODUCT DESCRIPTION

Product Code: Multi Analyte Custom Grade Solution

Catalog Number: CLPP-CAL-3

Lot Number: T2-MEB727800

Matrix: 7% (v/v) HNO3

Value / Analyte(s): 1 000 μg/mL ea:

Arsenic, Lead,

Selenium, Thallium,

500 µg/mL ea: Cadmium

3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE | CERTIFIED VALUE | ANALYTE | CERTIFIED VALUE |
|-------------|-----------------|--------------|-------------------|
| Arsenic, As | 1 000 ± 7 μg/mL | Cadmium, Cd | 500.0 ± 2.2 μg/mL |
| Lead, Pb | 1 000 ± 4 μg/mL | Selenium, Se | 1 000 ± 6 μg/mL |

Thallium, ΤΙ 1 000 ± 7 μg/mL

Density: 1.042 g/mL (measured at 20 ± 4 °C)

Assay Information:

| ANALYTE As | METHOD ICP Assay | NIST SRM# 3103a | SRM LOT# 100818 |
|----------------------|---------------------|---------------------------|--------------------|
| As | Calculated | | See Sec. 4.2 |
| 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

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;

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

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} 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_{CRIMRM}, where one method of characterization is used is the mean of individual results:

XCRM/RM = (Xa) (uchar a)

X_a = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

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

k = coverage factor = 2

uchar a = the errors from characterization

u_{bb} = 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.

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

December 21, 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

- December 21, 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 DD9784.

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director Sulfuric Acid
BAKER INSTRA-ANALYZED® Reagent
For Trace Metal Analysis
Low Selenium





Material No.: 9673-33

Batch No.: 23D2462010 Manufactured Date: 2023-03-22

Retest Date: 2028-03-20

Revision No.: 0

Certificate of Analysis

| Test | Specification | Result |
|---|---------------|-------------|
| ACS - Assay (H2SO4) | 95.0 - 98.0 % | 96,1 % |
| Appearance | Passes Test | Passes Test |
| ACS - Color (APHA) | ≤ 10 | 5 |
| ACS – Residue after Ignition | ≤ 3 ppm | < 1 ppm |
| ACS - Substances Reducing Permanganate (as SO2) | ≤ 2 ppm | < 2 ppm |
| Ammonium (NH ₄) | ≤ 1 ppm | 1 ppm |
| Chloride (CI) | ≤ 0.1 ppm | < 0.1 ppm |
| Nitrate (NO ₃) | ≤ 0.2 ppm | < 0.1 ppm |
| Phosphate (PO ₄) | ≤ 0.5 ppm | < 0.1 ppm |
| Trace Impurities – Aluminum (AI) | ≤ 30.0 ppb | < 5.0 ppb |
| Arsenic and Antimony (as As) | ≤ 4.0 ppb | < 2.0 ppb |
| Trace Impurities - Boron (B) | ≤ 10.0 ppb | 8.5 ppb |
| Trace Impurities – Cadmium (Cd) | ≤ 2.0 ppb | < 0.3 ppb |
| Trace Impurities - Chromium (Cr) | ≤ 6.0 ppb | < 0.4 ppb |
| Trace Impurities - Cobalt (Co) | ≤ 0.5 ppb | < 0.3 ppb |
| Trace Impurities - Copper (Cu) | ≤ 1.0 ppb | < 0.1 ppb |
| Trace Impurities - Gold (Au) | ≤ 10.0 ppb | 0.5 ppb |
| Heavy Metals (as Pb) | ≤ 500.0 ppb | < 100.0 ppb |
| Trace Impurities - Iron (Fe) | ≤ 50.0 ppb | 1.3 ppb |
| Trace Impurities - Lead (Pb) | ≤ 0.5 ppb | < 0.5 ppb |
| Trace Impurities - Magnesium (Mg) | ≤ 7.0 ppb | 0.8 ppb |
| Trace Impurities – Manganese (Mn) | ≤ 1.0 ppb | < 0.4 ppb |
| Trace Impurities – Mercury (Hg) | ≤ 0.5 ppb | < 0.1 ppb |
| Trace Impurities - Nickel (Ni) | ≤ 2.0 ppb | 0.3 ppb |
| Trace Impurities – Potassium (K) | ≤ 500.0 ppb | < 2.0 ppb |
| Trace Impurities – Selenium (Se) | ≤ 50.0 ppb | < 0.1 ppb |
| Trace Impurities – Silicon (Si) | ≤ 100.0 ppb | 31.5 ppb |
| Trace Impurities – Silver (Ag) | ≤ 1.0 ppb | < 0.3 ppb |

>>> Continued on page 2 >>>

Sulfuric Acid
BAKER INSTRA-ANALYZED® Reagent
For Trace Metal Analysis
Low Selenium





Material No.: 9673-33 Batch No.: 23D2462010

| Test | Specification | Result | |
|-----------------------------------|---------------|-----------|--|
| Trace Impurities - Sodium (Na) | ≤ 500.0 ppb | 5.4 ppb | |
| Trace Impurities – Strontium (Sr) | ≤ 5.0 ppb | < 0.2 ppb | |
| Trace Impurities – Tin (Sn) | ≤ 5.0 ppb | < 0.8 ppb | |
| Trace Impurities – Zinc (Zn) | ≤ 5.0 ppb | 0.4 ppb | |

For Laboratory, Research, or Manufacturing Use

Country of Origin: USA

Packaging Site: Phillipsburg Mfg Ctr & DC





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:

Multi Analyte Custom Grade Solution

Catalog Number:

CHEM-CLP-4

Lot Number:

V2-MEB746172

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 1 000 ± 7 µg/mL

Tin. Sn

1 000 ± 5 µg/ml.

Titanium, Ti

1 000 ± 6 μg/mL

Density:

1.032 g/mL (measured at 20 ± 4 °C)

Assav 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-S1702546 |
| 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_{CRWRM}, where two or more methods of characterization are used is the weighted mean of the results:

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

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

 \mathbf{w}_{i} = the weighting factors for each method calculated using the inverse square of the variance:

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

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

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

utts = long term stability standard uncertainty (storage)

uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

 $X_a = mean$ of Assay Method A with $u_{char} = the$ standard uncertainty of characterization Method A $CRM/RM = the standard uncertainty ($^{\pm}$) = U_{CRM/RM} = k \left(u^2_{char} + u^2_{bb} + u^2_{tts} + u^2_{ts}\right)^{\frac{1}{2}} \\ k = coverage factor = 2 \\ u_{char} = the errors from characterization \\ u_{bb} = bottle to bottle homogeneity standard uncertainty \\ u_{lts} = long term stability standard uncertainty (storage) \\ u_{tg} = transport stability standard uncertainty$

Characterization of CRM/RM by One Method

is used is the mean of individual results:

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

Certified Value, X_{CRM/RM}, where one method of characterization

- 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.lnorganicventures.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@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

August 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

- August 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 Ba | ad 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



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



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 <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 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

M6125 Receive -> 11/22/24

CORCO CHEMICAL CORPORATION

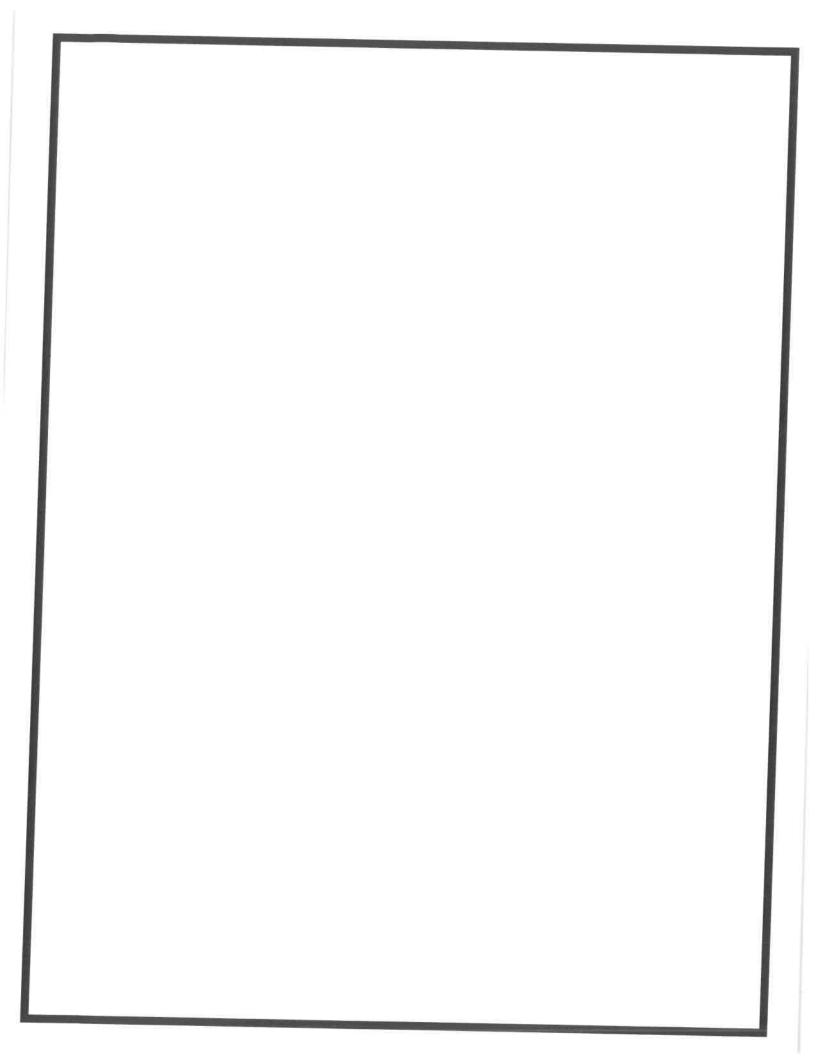
Manufacturers of ACS Reagents and Semiconductor Grade Chemicals

Office and Plant 299 Cedar Lane Fairless Hills, PA 19030

Phone: 215-295-5006 Fax: 215-295-0781

Hydrogen Peroxide 30%, ACS Reagent Grade

| SPECIFICATION | MAXIMUM LIMITS |
|-----------------------------|--|
| Appearance | Colorless and free from suspended matter or sediment |
| Assay | 29-32% |
| Color (APHA) | 10 |
| Residue after Evaporation | 0.002% |
| Titratable Acid | 0.0006 meq/g |
| Chloride (CI) | 3 ppm |
| Nitrate (NO ₃) | 2 ppm |
| Phosphate | 2 ppm |
| Sulfate (SO ₄) | 5 ppm |
| Ammonium (NH ₄) | 5 ppm |
| Heavy Metals (as Pb) | 1 ppm |
| Iron (Fe) | 0.5 ppm |







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 MGDO | 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 |
| | 180 | | 8 . | | 10-8 | 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 | Đ. | : } | ಕ | Ва | Às | Sb | 2 | | | | - |
|-------|-------|----------------|--------|-------|-------|------------|-------|--------------|---|----------|-----|
| <0.02 | <0.02 | 0.04 | A | <0.02 | 40.2 | <0.02 | 20.02 | 3 | | | |
| Cu | S | 9 | 2 | రొ | ర్ట | ಧಿ | 5 | G. | | | |
| <0.02 | <0.02 | | 40.02 | <0.02 | <0.02 | 0.2 | 70.02 | 3 | | | |
| Au | ç | 9 | ු ව | 2 | 띨 | 탁 | Ş | | | | |
| <0.02 | 70.02 | | 40.02 | <0.02 | <0.02 | <0.02 | 20.02 | 200 | | | |
| Pb | 2 | 1 | 73 | ŀ | Ĭn | Но | 1 | F . | | | |
| 40.02 | 20.02 | 3 | A)2 | 40.02 | <0.02 | 40.02 | 70.02 | 2000 | | Irace Mo | |
| Nd | MO | 5 , | Ηg | Mn | Mg | Ē | , E | | | etais | |
| <0.02 | 20.02 | 200 | 40.2 | <0.02 | Н | <0.02 | 0.02 | 2000 | | Verifica | 101 |
| 7 | : 2 | Ş | ъ | Pd | ô | 8 | 1 | Z. | I | TION I | |
| 70 | 20.02 | 3 | 40.02 | <0.02 | <0.02 | 20.02 | 5 6 | A) ()2 | | oy ICP-N | |
| oc. | 2111 | S S | R | Rb | Rh | Ke | | Pr | | 10 (11 | , |
| 70.02 | 3 6 6 | 3 | 40.02 | <0.02 | 40.02 | 20.02 | 3 | 40.02 | | g/mL) | 1 |
| 165 | 3 6 | 0 | St | 2 | Ag | - <u>2</u> | 2 | Ş | | | |
| 20.02 | 200 | AD 02 | <0.02 | 40.2 | 20.02 | 20.02 | 3 | ∆ 0.2 | | | |
| E | 4 | 3 | Tm | 10 | = | ; [| 7 | 4 | | | |
| 10:02 | 3 | 40.02 | 40.02 | 20.02 | 20.02 | 6 6 | 3 | 40.02 | | | |
| 452 | 7, | Z ₀ | ~ | YO | 4 < | 4 0 | ≓ | W | | | |
| 10:00 | 3 | ∆ 0.02 | 40.02 | 20.02 | 20.0 | 3 6 | <0.02 | <0.02 | | | |

(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 | 5.067 | m/z-> | in M | 5. O E 6 |
|-------------|-------|-------|-------|----------|---------|---|
| | | | | | | [1] 8 |
| 0 | | 110 | | 0 | | [1] Spectrum No.1 |
| | | , | | | | NO.1 |
| N N O | | 120 | | N O | | Ę Q |
| 230 | | 130 | | Q | | 243 |
| ō | | Ō | | | | ec]:57(|
| N 40 | | 140 | | 4 | | [34.243 sec]:57025.D# [Count] [Linear] |
| , | | | | | | Coun |
| N D | | 150 | | G. | | t] [Line |
| N O | | 100 | | 8. | | 2 |
| U | | | | | | |
| | | 170 | | 70 | | |
| | | | | m | | |
| | | 80 | | 80 | | |
| | | 190 | | 0 | | |
| | | | | | | |
| | | N 00 | | 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 | × | ∠0.02 |
| dS | <0.02 | ರೌ | 40.2 | 뎍 | <0.02 | Н | <0.02 | Ę | 40.02 | Z | 40.02 | Re | <0.02 | ž. | 40.02 | Te | <0.02 | c | ♦ 0.02 |
| 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 T. 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).



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

M6137

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:

CGSI1

Lot Number:

V2-SI744713

Matrix:

tr. HNO3

tr. HF

Value / Analyte(s):

1 000 µg/mL ea:

Silicon

Starting Material:

Silica

Starting Material Lot#:

1771

Starting Material Purity:

99.9981%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value:

999 ± 6 µg/mL

Density:

1.003 g/mL (measured at 20 ± 4 °C)

Assay Information:

Assay Method #1

999 ± 5 µg/mL

ICP Assay NIST SRM Traceable to 3150 Lot Number: S2-Si702546

Assay Method #2

1000 ± 7 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:

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

 $\mathbf{X_i}$ = mean of Assay Method \mathbf{i} with standard uncertainty \mathbf{u}_{char} \mathbf{i} \mathbf{w}_{i} = the weighting factors for each method calculated using the inverse square of the variance:

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

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

k = coverage factor = 2

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

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, = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

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

k = coverage factor = 2

uchar a = the errors from characterization

u_{bb} = 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.

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

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 | < | 0.000310 | M | Eu | < | 0.000310 | 0 | Na | | 0.001656 | M | Se | < | 0.022000 | М | Zn | < | 0.002500 |
|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| M | Al | | 0.010787 | M | Fe | < | 0.027000 | M | Nb | < | 0.001300 | s | Si | < | | 0 | Zr | < | 0.001900 |
| М | As | < | 0.001900 | М | Ga | < | 0.001300 | M | Nd | < | 0.000310 | М | Sm | < | 0.000310 | | | | |
| М | Au | < | 0.000910 | М | Gd | < | 0.000310 | M | Ni | < | 0.005500 | М | Sn | | 0.000096 | | | | |
| M | В | | 0.016180 | M | Ge | < | 0.001900 | M | Os | < | 0.000610 | 0 | Sr | | 0.000092 | | | | |
| М | Ba | | 0.000096 | M | Hf | | 0.000423 | i | Р | < | | M | Ta | | 0.002542 | | | | |
| 0 | Be | < | 0.000570 | M | Hg | < | 0.000610 | M | Pb | < | 0.000310 | М | Tb | < | 0.000310 | | | | |
| M | Bi | < | 0.000310 | М | Но | < | 0.000610 | M | Pd | < | 0.000610 | M | Te | < | 0.000910 | | | | |
| 0 | Ca | | 0.011557 | M | ln | < | 0.000310 | M | Pr | < | 0.000310 | M | Th | < | 0.001900 | | | | |
| M | Cd | < | 0.000310 | M | lr | < | 0.000310 | M | Pt | < | 0.000310 | М | Ti | | 0.001078 | | | | |
| M | Ce | < | 0.000610 | 0 | K | | 0.000577 | M | Rb | < | 0.009100 | М | TI | < | 0.000310 | | | | |
| M | Co | < | 0.001600 | M | La | < | 0.000310 | M | Re | < | 0.000310 | М | Tm | < | 0.000310 | | | | |
| М | Cr | < | 0.010000 | 0 | Li | < | 0.000460 | М | Rh | < | 0.000310 | М | U | < | 0.000310 | | | | |
| М | Cs | < | 0.000310 | M | Lu | < | 0.000310 | M | Ru | < | 0.000310 | 0 | V | < | 0.001300 | | | | |
| М | Cu | < | 0.002500 | 0 | Mg | | 0.001348 | 0 | S | < | 0.570000 | М | W | < | 0.001900 | | | | |
| М | Dу | < | 0.000310 | М | Mn | < | 0.002500 | M | Sb | < | 0.000310 | M | Υ | < | 0.000310 | | | | |
| M | Er | < | 0.000310 | M | Мо | < | 0.000310 | 0 | Sc | < | 0.000590 | M | Yb | < | 0.000310 | | | | |
| | | | | | | | | | | | | | | | | | | | |

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

Atomic Welght; Valence; Coordination Number; Chemical Form in Solution - 28.09 +4 6 Si(OH)x(F)y2-Chemical Compatibility -Soluble in HCl, HF, H3PO4 H2SO4 and HNO3 as the Si(OH)x(F)y2-. 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 silicic acid (silicic acid is soluble up to ∼100 ppm in water) in all dilute acids

Stability - 2-100 ppb levels - stability unknown - (alone or mixed with all other metals) as the Si(OH)x(F)y2-. 1-10,000 ppm single element solutions as the Si(OH)x(F)y2- chemically stable for years in 2-5 % HNO3 / trace HF in a LDPE container.

Si Containing Samples (Preparation and Solution) -Metal (Soluble in 1:1:1 H2O / HF / HNO3); Oxide - SiO2, amorphic (dissolve by heating in 1:1:1 H2O / HF / HNO3); Oxide - quartz (fuse in Pt0 with Na2CO3); Geological Samples(fuse in Pt0with Na2CO3 followed by HCI solution of the fuseate); Organic Matrices containing silicates and non volatile silicon compounds (dry ash at 4500C in Pt0 and dissolve by gently warming with 1:1:1 H2O / HF / H2SO4 or fuse / ash with Na2CO3 and dissolve fuseate with HCI / H2O); Silicone Oils - dimethyl silicones depolymerize to form volatile monomer units when heated (Measure directly in alcoholic KOH / xylene mixture where sample is treated first with the KOH at 60-1000C to "unzip" the Si- O-Si polymeric structure or digest with conc. H2SO4 / H2O2 followed by cooling and dissolution of the dehydrated silica with HF.) Note that the direct analysis of silicone oils in an organic solvent will result in false high results due to high vapor pressure of volatile monomer units like hexamethylcyclotrisiloxane. The KOH forms the K2+Si(CH3)2O= salt which is not volatile at room temperature.

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 28 amu | 4000 - 8000 ppt | N/A | N2, 12C16O |
| ICP-OES 212.412 nm | 0.02/0.01 µg/mL | 1 | Hf, Os, Mo, Ta |
| ICP-OES 251.611 nm | 0.012/0.003 µg/mL | 1 | Ta, U, Zn, Th |
| ICP-OES 288.158 nm | 0.03/0.004 µg/mL | 1 | Ta, Ce, Cr, Cd. Th |

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.

QUALITY STANDARD DOCUMENTATION 10.0

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 10, 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

- July 10, 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

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

NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0 Certificate 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 6138





orl-rat >2000mg/kg 3109a NIST SRM 121824 121824 (Solvent Safety Info. On Attached pg.) 200 100 SDS Information Giovanni Esposito OSHA PEL (TWA) Pedro L. Rentas 5 mg/m3 190 00 Diovarine 471-34-1 CAS# 180 80 Formulated By: Reviewed By: +/- (ng/mL) Uncertainty Expanded 20.0 470 0 Conc. (µg/mL) 10001.4 Actual Nitric Acid Nitric Acid 100.2677 160 9 Weight (g) Actual [12.514 sec]:58120.D# [Count] [Linear] Solvent: 24012496 100.2537 Weight (g) 80.0 (III) Target 150 250 50 39.9 5% Assay 5E-05 Balance Uncertainty 8 0.15 Flask Uncertainty 140 240 0 Uncertainty Purity (%) 0.10 R>1/13/25 Purity 99.999 (%) 130 230 30 Conc. (µg/mL) 10000 4000.1 Nominal Ambient (20 °C) Calcium (Ca) 120 220 S IN014 CAD032023B3 Weight shown below was diluted to (mL): 121824 121827 10000 58120 Number **6UTB** ē [1] Spectrum No.1 RN# 110 210 0 Recommended Storage: NIST Test Number: Part Number: Lot Number: Description: **Expiration Date:** Nominal Concentration (µg/mL): CERTIFIED WEIGHT REPORT: 1. Calcium carbonate (Ca) 1,0日4 2.5E4 4.0ES 5.0E4 **5.0E4** 2.0E4 Y-2/E V-Z/E ~-Z/W Compound

Lot # 121824

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Certified Reference Material CRM



Absolute Standards, Inc.

www.absolutestandards.com

800-368-1131



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

| | | | | | | | Trace Me | tals | Verificat | ion | by ICP-M. | S | g/mL) | | | | | | |
|-------------|------------|----|-------|----|-------|----|-------------------|------|-----------|---------|--|----|-------|----|-------|----------|-------|----|-------|
| 1 | The second | | | i | | | ALL NO - STATE OF | | | TION IN | The state of the s | | | | | 0 | | | |
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| _ | €0.05 | రే | L | 西 | _ | Но | <0.02 | 3 | <0.02 | g | <0.02 | \$ | <0.02 | Şi | <0.02 | <u>e</u> | <0.02 | ב | <0.02 |
| As | <0.2 | ටී | <0.02 | En | _ | 되 | <0.02 | M | <0.01 | ő | <0.02 | Rh | <0.02 | Ag | <0.02 | F | <0.02 | > | <0.02 |
| _ | <0.02 | ű | <0.02 | E | _ | I | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2 | Ę | <0.02 | χp | <0.02 |
| Be | <0.0> | Ö | <0.02 | Ğ | <0.02 | Fe | 30 | Hg | <0.2 | Д | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | ¥ | <0.02 |
| | <0.02 | ථ | 40.02 | Ö | _ | Ľ. | <0.02 | Mo | <0.02 | £ | <0.02 | Sm | <0.02 | S | <0.02 | Sn | <0.02 | Zn | <0.02 |
| Е | <0.02 | đ | <0.02 | Au | Ĭ | £ | <0.02 | PN | <0.02 | ¥ | <0.2 | Sc | <0.02 | Ta | <0.02 | F | <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.

^{*} 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.

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

^{&#}x27;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

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

CERTIFIED WEIGHT REPORT: 1. Potassium nitrate (K) Nominal Concentration (µg/ml.): アンメート m/z-> Weight shown below was diluted to (mL): Recommended Storage: 1.0≡4 1.0E5 2.0 € 5 1.0⊑8 2.0E6 5000 **NIST Test Number: Expiration Date:** Part Number: Lot Number: Description: [1] Spectrum No.1 110 0 IN034 KD062022A1 BTU9 57119 103024 Potassium (K) M6141 10000 103027 Ambient (20 °C) Number 5 120 NO [35.763 sec]:58119.D# [Count] [Linear] Conc. (µg/mL) 4000.1 10000 76142 Nominal R->1/13/25 130 90 99.999 0.15 Flask Uncertainty 5E-05 Balance Uncertainty Purity 8 Uncertainty Assay Purity (%) 0.10 40 40 Solvent: 24002546 37.7 æ 2% 150 106.1040 0 Weight (g) Target 80.0 Lot # Nitric Acid Nitric Acid ###### Weight (g) Conc. (µg/mL) Actual 160 00 10001.1 Actual 170 0 Reviewed By: Formulated By: +/- (µg/mL) Uncertainty Expanded 20.0 Dievanne 180 80 7757-79-1 CAS# (Solvent Safety Info. On Attached pg.) Pedro L. Rentas Giovanni Esposito からからかん OSHA PEL (TWA) 190 90 **SDS Information** 5 mg/m3 100 200 orl-rat 3750 mg/kg 3141a LD50 103024 103024 SRM NIST

m/z->

210

220

230

240

250

200

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

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

| 1 | L | H | ы | क | 7 | S | , | | | 1 |
|---------------------|-------|-------|-------|----------------|----------------|-------|-------|---|----------|---|
| | В | 34. | ĕ | 32 | As | ď | | 1 | | I |
| | <0.02 | 40.02 | <0.01 | 40.02 | 0.2 | 40.02 | <0.02 | | | |
| | Cu | ဝ | ΰ | င္တ | င္ပ | Ç | S | i | | |
| | <0.02 | <0.02 | <0.02 | <0.02 | 40.02 | 40.2 | 40.02 | | | |
| | Αu | ත | Ga | වු | 댐 | 田 | Ņ | I | | |
| | <0.02 | 40.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | |
| | 138 | 7 | Fe | Ч | 'n | Но | Ħ | İ | | |
| | <0.02 | <0.02 | 402 | <0.02 | <0.02 | <0.02 | <0.02 | | Trace M | |
| | M | Mo | Hg | Mn | Mg | Ľ | Ε. | İ | Metals | |
| (T) - Tamet analyte | <0.02 | <0.02 | 02 | <0.02 | <0.01 | <0.02 | <0.02 | | Verifica | |
| not an | × | 7 | P | Pd | S _O | 7 | Z | I | tion | |
| ahrio | T | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | by ICP- | |
| | Sc | Sm | Ru | Rb | 字 | Re | 꾸 | ı | NS (| |
| | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | (μg/mL) | |
| | Ta | S | Sr | N _B | Ag | Si | Se | I | | I |
| | <0.02 | <0.02 | <0.02 | 40.2 | <0.02 | <0.02 | <0.2 | | | |
| | 7. | Sn | Tm | H | = | Te | Тb | l | | I |
| | <0.02 | 40.02 | △0.02 | €0.02 | ₫.02 | 40.02 | <0.02 | | | |
| | Zr | Zn | ¥ | 4 | < | c | W | I | | |
| | 40.02 | 0.02 | 40.02 | <0.02 | 40.02 | 40.02 | <0.02 | | | |

(i) = larger analyre

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 # 57119

www.absolutestandards.com



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.

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1 of 2

www.absolutestandards.com



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

| В | <u>58</u> | Be | Ba | As | Sb | ≥ | | ٦ |
|-------|-----------|-------|----------|----------|-------------|-------|-----|----------|
| <0.02 | <0.02 | <0.01 | <0.02 | 40.2 | <0.02 | <0.02 | | |
| 5 | င္ပ | Ω | င္တ | දි | C2 | S | | |
| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | ∆0.2 | <0.02 | | |
| Au | ဂ္ဂ | ଦ୍ଧ | <u>ਨ</u> | Eu | E) | Дy | | ١ |
| 40.02 | <0.02 | <0.02 | △0.02 | <0.02 | △0.02 | <0.02 | | |
| Pb | L | Fe | F | In | Но | Hf | | ١ |
| <0.02 | <0.02 | 40.2 | <0.02 | <0.02 | <0.02 | <0.02 | | Trace M |
| Z. | Mo | Hg | Mn | Mg | L | Е | | etals |
| 40.02 | <0.02 | 40.2 | <0.02 | <0.01 | <0.02 | <0.02 | | Verifica |
| × | ₽ | ٩ | Pd | °C Os | ğ | Z | | |
| 40.2 | <0.02 | 0.02 | A.02 | 40,02 | 40.02 | <0.02 | | by ICP-N |
| Se | Sm | Ru | Rb | Rh | Re | Pr | | S (II |
| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 40.02 | <0.02 | 9,, | a/mL) |
| Ta | Ç0 | Sr | Z | Ag | S: | જ | | |
| 40,02 | 40.02 | △0.02 | -7 | <0.02 | <0.02 | 40.2 | | |
| | Sn | Tm | H | ⊒ | Te | 13 | | |
| 40,02 | 40.02 | <0.02 | <0.02 | 40.02 | <0.02 | <0.02 | | |
| 12 | Zn | ۲ | 44 | < | C | ₩ | | |
| 20.02 | A0.02 | 40.02 | <0.02 | <0.02 | <0.02 | <0.02 | | |

(T) = Target analyte

Physical Characterization:

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

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.

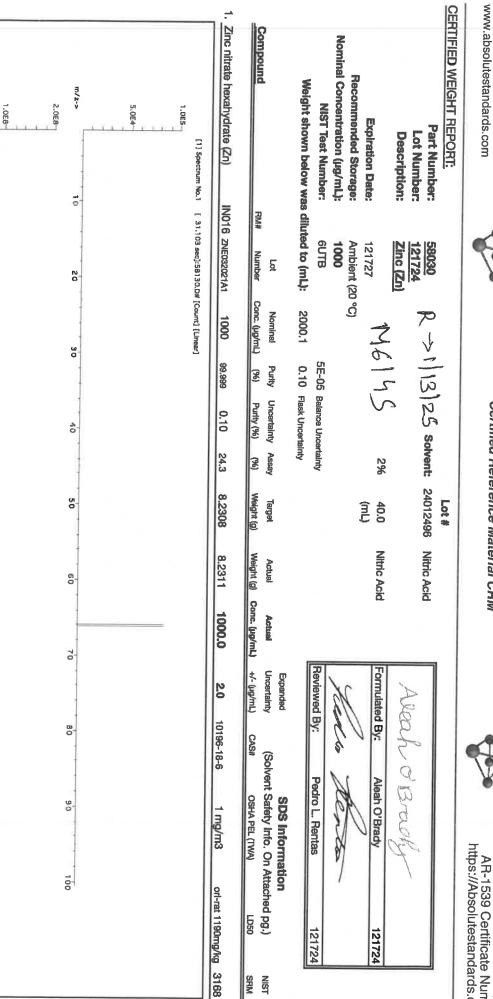
Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

Part # 58111

Certified Reference Material CRM



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



NIST SRM

m/z->

210

220

230

240

250

260

m/z->

110

120

130

140

50

160

170

180

190

200

1.0E8

5.0E7



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

| | | | | | | | | | | | | | | | | | | - | |
|--------------|---|-------|-----|-------|-----|--------------|----|--------------|--------|----------|-------|-----------|------|-------|----------|---------------|-----|-------|-----|
| ľ | | l | - | 20.02 | T d | 20.02 | 30 | 702 | 7 | 40.02 | Z | 40.02 | P | ₹0.02 | Au | ∆ 0.02 | 5 | 40.02 | 00 |
| 7 | | | | 3 | 3 | 3 | 2 | 3 | : : | 6 6 | 200 | 20.02 | La | 70.02 | Ca | 20.02 | S | 20.02 | 191 |
| 1 | | | N. | 20.02 | v | <u>A</u> .02 | Sm | <u>A</u> .83 | P | A 23 | 5 | 3 | 3 | 3 | 9 | 3 | 3 | 3 | 2 |
| ĭ | | | - | 000 | , | | 1 | 40.00 | 1 | 10.6 | 27.7 | 10% | 70 | 20.02 | Ca | 20.02 | ŭ | 10.0 | Be |
| jed | | _ | n. | 20.02 | S | A).(72 | Z: | 3 | 0 | 3 | E | 3 | | 3 | | | 2 | | |
| 9 8 | | 20.00 | 1 : | 6 | ING | 20.03 | Z | 20.02 | Pd | 20.02 | Mn | <0.02 | H | 40.02 | 8 | 40.02 | င္တ | | B |
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| _ | | | 11 | 20.02 | Ag | 40.02 | 25 | <u>A</u> ,23 | ွှ | A) () | × o | 3 | 3 | 3 | ri Fi | 3 | 3 | 3 | |
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| | | | | | | | | | | | | | | | | | | | |

(T) = Target analyte

Physical Characterization:

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

Certified by:

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

Part # 58030



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

R: 4/20/21

Instructions for QATS Reference Material: Inorganic ICV Solutions

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

* M6150

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

APPLICATION:

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

CAUTION:

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

the analyses.

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

> Safety Data Sheets Available Upon Request

(A) SAMPLE DESCRIPTION

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

(B) BREAKAGE OR MISSING ITEMS

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

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

(C) ANALYSIS OF SAMPLES

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

ICV1-1014

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

Page 1 of 2











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)₈, 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 | (after 50-fold dilution) 500 200 200 100 100 100 2000 | | | | | |
|---------|---|---|--|--|--|--|--|
| Element | Concentration (µg/L) (after 10-fold dilution) | Concentration (µg/L) (after 50-fold dilution) | | | | | |
| Al | 2500 | | | | | | |
| Sb | 1000 | | | | | | |
| As | 1000 | 200 | | | | | |
| Ba | 520 | 100 | | | | | |
| Be | 510 | | | | | | |
| Cd | 510 | | | | | | |
| 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 | SPILE/ | ICV6-0400 |
|---------|--|---------|--|
| Element | Concentration (µg/L) (after 100-fold dilution) | Analyte | Concentration (µg/L) (after 100-fold dilution) |
| Hg | 4.0 | CN- | 99 |

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





M6151

R-> 1/15/25

Material No.: 9530-33

Batch No.: 22G2862015 Manufactured Date: 2022-06-15

Retest Date: 2027-06-14

Revision No.: 0

Certificate of Analysis

| Test | Specification | Result |
|---|-----------------------|-------------|
| ACS - Assay (as HCI) (by acid-base titrn) | 36.5 - 38.0 % | |
| ACS - Color (APHA) | 50.5 - 38.0 % ≤ 10 | 37.9 % |
| ACS - Residue after Ignition | ≤ 3 ppm | 5 |
| ACS - Specific Gravity at 60°/60°F | | < 1 ppm |
| ACS – Bromide (Br) | 1.185 - 1.192 | 1.191 |
| ACS - Extractable Organic Substances | ≤ 0.005 % | < 0.005 % |
| ACS - Free Chlorine (as Cl2) | ≤ 5 ppm | < 1 ppm |
| Phosphate (PO ₄) | ≤ 0.5 ppm | < 0.5 ppm |
| Sulfate (SO ₄) | ≤ 0.05 ppm | < 0.03 ppm |
| Sulfite (SO₃) | ≤ 0.5 ppm | < 0.3 ppm |
| Ammonium (NH ₄) | ≤ 0.8 ppm | 0.3 ppm |
| Trace Impurities - Arsenic (As) | ≤ 3 ppm | < 1 ppm |
| Trace Impurities – Aluminum (AI) | ≤ 0.010 ppm | < 0.003 ppm |
| Arsenic and Antimony (as As) | ≤ 10.0 ppb | 1.3 ppb |
| Trace Impurities - Barium (Ba) | ≤ 5.0 ppb | < 3.0 ppb |
| Trace Impurities - Beryllium (Be) | ≤ 1.0 ppb | 0.2 ppb |
| Trace Impurities - Bismuth (Bi) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities – Boron (B) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities - Cadmium (Cd) | ≤ 20.0 ppb | < 5.0 ppb |
| Trace Impurities - Calcium (Ca) | ≤ 1.0 ppb | < 0.3 ppb |
| Trace Impurities - Calcium (Ca) Trace Impurities - Chromium (Cr) | ≤ 50.0 ppb | 163.0 ppb |
| Trace Impurities - Cobalt (Co) | ≤ 1.0 ppb | 0.7 ppb |
| | ≤ 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 |
| Frace Impurities – Germanium (Ge) | ≤ 3.0 ppb | < 2.0 ppb |
| Frace Impurities – Gold (Au) | ≤ 4.0 ppb | 0.6 ppb |
| Heavy Metals (as Pb) | ≤ 100 ppb | < 50 ppb |
| Frace Impurities – Iron (Fe) | ≤ 15 ppb | 6 ppb |

>>> Continued on page 2 >>>

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





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

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

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





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

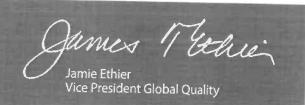
Test

Specification

Result

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

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







R-02/02/2025

M-6158

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

Manufactured Date: 2024-03-26

Retest Date: 2029-03-25 Revision No.: 0

Certificate of Analysis

| Test | Specification | Result |
|---|---------------|-------------|
| Assay (HNO3) | 69.0 - 70.0 % | |
| Appearance | Passes Test | 69.7 % |
| Color (APHA) | ≤ 10 | Passes Test |
| Residue after Ignition | | 5 |
| Chloride (CI) | ≤ 2 ppm | 1 ppm |
| Phosphate (PO ₄) | ≤ 0.08 ppm | < 0.03 ppm |
| Sulfate (SO ₄) | ≤ 0.10 ppm | < 0.03 ppm |
| Trace Impurities - Aluminum (AI) | ≤ 0.2 ppm | < 0.2 ppm |
| Arsenic and Antimony (as As) | ≤ 40.0 ppb | < 1.0 ppb |
| Trace Impurities - Barium (Ba) | ≤ 5.0 ppb | < 2.0 ppb |
| Trace Impurities – Beryllium (Be) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities – Bismuth (Bi) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities - Boron (B) | ≤ 20.0 ppb | < 10.0 ppb |
| Trace Impurities - Cadmium (Cd) | ≤ 10.0 ppb | < 5.0 ppb |
| Trace Impurities - Calcium (Ca) | ≤ 50 ppb | < 1 ppb |
| Trace Impurities - Chromium (Cr) | ≤ 50.0 ppb | 2.3 ppb |
| Trace Impurities – Cobalt (Co) | ≤ 30.0 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) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities – Gold (Au) | ≤ 20 ppb | < 10 ppb |
| Heavy Metals (as Pb) | ≤ 20 ppb | < 5 ppb |
| Trace Impurities - Iron (Fe) | ≤ 100 ppb | 100 ppb |
| Trace Impurities - Lead (Pb) | ≤ 40.0 ppb | < 1.0 ppb |
| Trace Impurities – Lead (PD) Trace Impurities – Lithium (Li) | ≤ 20.0 ppb | < 10.0 ppb |
| | ≤ 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 >>>





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

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

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

Jamie Croak Director Quality Operations, Bioscience Production

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



Certified Reference Material CRM

M6030

ANAB ISO 17034 Accredited

CERTIFIED WEIGHT REPORT: Part Number: Lot Number: 57047 122823 R = 8 | 5 | 24 Solvent: 24002546 Lot # Nitric Acid

Nominal Concentration (µg/mL): NIST Test Number: Recommended Storage: **Expiration Date:** 1000 **6UTB** Ambient (20 °C) 122826 5E-05 Balance Uncertainty 2%

> <u>E</u> 80.0

> > Nitric Acid

Formulated By:

Benson Chan

122823

Description:

Silver (Ag)

Weight shown below was diluted to (mL): 4000.30 0.058 Flask Uncertainty

 Silver nitrate (Ag) Compound IN035 J0612AGA1 RM# Number 헏 Conc. (µg/mL) 1000.0 Nominal Purity Uncertainty Assay 8 Purity (%) 0.10 63.7 38 Weight (g) 6.27992 Target Weight (g) Conc. (µg/mL) 6.27998 Actual 1000.0 Actual +/- (µg/mL) Uncertainty Expanded 2.0 7761-88-B CAS# (Solvent Safety Info. On Attached pg.) SDS Information 10 ug/m3 Z 3151

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

NIST SRM

Reviewed By: Pedro L. Rentas 122823

www.absolutestandards.com



| | | | | | | | race Me | letals | Verificat | tion | by ICP-I | S | ug/mL) | | | | | | |
|----|--|-----|-------|----|-------|-----|------------------|--------|-----------|------|----------|---------|---------------|-----|-------|---|---------------|----|--------|
| | The state of the s | | | | | | The Park of | , J | | | | | | | | | | | |
| A | <0.02 | Ω | <0.02 | Dy | <0.02 | 出 | <0.02 | Ľ | <0.02 | Z | <0.02 | 7 | <0.02 | Se | <0.2 | 4 | 40.02 | W | <0.02 |
| 4S | 40.02 | ဂ္ဂ | 40.2 | 덬 | 40.02 | Ж | 40.02 | Li | <0.02 | 3 | 40.02 | ₽ Re | 40.02 | S: | 40.02 | ď | A 0.02 | a | \$0.02 |
| As | 40.2 | Ç | <0.02 | 땹 | <0.02 | In | <0.02 | Mg | <0.01 | တ္တ | 40.02 | 짜 | <0.02 | Agr | 7 | ∄ | <0.02 | < | 40.02 |
| Ва | <0.02 | రి | 40,02 | 8 | <0.02 | 듁 | 40.02 | Mn | <0.02 | Pd | <0.02 | R. | 40.02 | N | 40.2 | ∄ | <u>\$</u> | 상 | <0.02 |
| Ве | 40.01 | Ω | <0.02 | හු | <0.02 | ਲੋਂ | 40.2 | Hg | 40.2 | Þ | 40.02 | R | A0.02 | Ž, | 40,02 | ď | ♦ 0.02 | < | 40.02 |
| 쯨 | <0.02 | င္ပ | 40.02 | ନ | 40,02 | 5 | < 0.02 | Mo | <0.02 | 77 | 40.02 | Sin | △ 0.02 | c/a | 40.02 | S | A) (2) | 7, | 40.07 |
| 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:

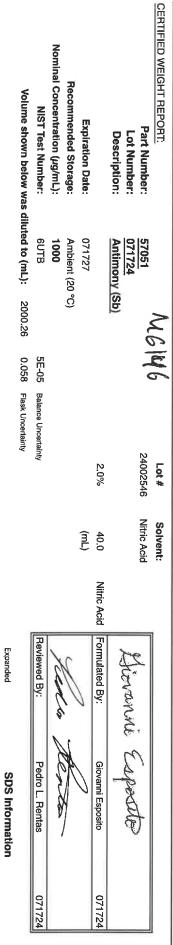
- * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- * All standard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



R:10/18/24 Certified Reference Material CRM

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



Compound

Number Part

Number Ę

Vol. (mL) Pipette (mL) Conc. (µg/mL)

Conc. (µg/mL) Conc. (µg/mL)

+/- (µg/mL) Uncertainty

CAS#

OSHA PEL (TWA)

LD50

NIST SRM

(Solvent Safety Info. On Attached pg.)

Dilution Factor

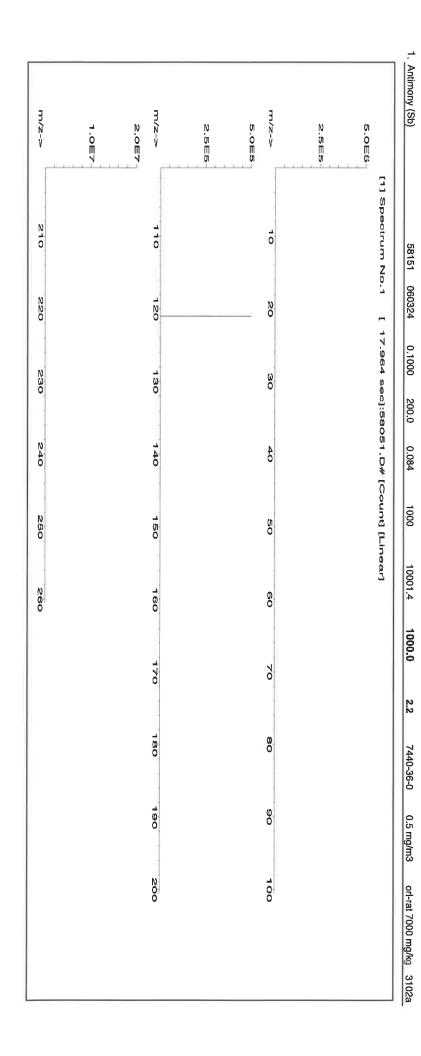
Initial

Uncertainty

Nominal

Initial

Final



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

| | l | | П | | Н | | | Trace M | etals | Verifica | | by ICP-M | S (µg | /mL) | | | | | | |
|---|---------------|-------|-----|-------|-----|-------|----|---------|-------|----------------------|----------|----------|-------|-------|----|-------|----|-------|----|-------|
| | | | 2 | | | | | | | | | | | | | | | | | |
| _ | <u>A</u> | <0.02 | δ | <0.02 | Dy | <0.02 | Hf | <0.02 | Ľ | <0.02 | Z | <0.02 | Pr | <0.02 | Se | <0.2 | Тъ | <0.02 | W | <0.02 |
| - | ď | Т | Ca | <0.2 | 턴 | <0.02 | Но | <0.02 | Ľ | < 0.02 | ¥ | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | q | <0.02 |
| _ | As | <0.2 | ဂ္ဂ | <0.02 | En | <0.02 | ln | <0.02 | Mg | <0.01 | ွ | <0.02 | Rh | <0.02 | A9 | <0.02 | ⊒ | <0.02 | < | <0.02 |
| _ | Ва — | <0.02 | ß | <0.02 | 8 | <0.02 | lr | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2 | Ŧ | <0.02 | ΥЪ | <0.02 |
| _ | _{ве} | <0.01 | 다 | <0.02 | G | <0.02 | Fe | <0.2 | Hg | <0.2 | P | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | × | <0.02 |
| | В | <0.02 | Ç | <0.02 | င္စ | <0.02 | La | <0.02 | Мо | <0.02 | Pt | <0.02 | Sm | <0.02 | s | <0.02 | Sn | <0.02 | Zn | <0.02 |
| | В | <0.02 | δ | <0.02 | Au | <0.02 | Pb | <0.02 | M | <0.02 | × | <0.2 | Sc | <0.02 | Ta | <0.02 | 11 | <0.02 | Zr | <0.02 |
| | | | | | | | | | | (T) – Target analyte | et analy | do. | | | | | | | | |

(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).

QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY "Ap 1,50,9001:20,450,5004; Gedified Program"

"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.

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

analyses.

N6152

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 and ICSAB mixture use "ICSA-1211+ICSB-0710".

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

(B) BREAKAGE OR MISSING ITEMS

Check the contents of the shipment carefully for any broken, leaking, or missing items. Check that the seal is intact on each bottle. Refer to the enclosed chain of custody record. Report any problems to 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,

Page 1 of 2

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

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

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



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



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 HNO $_3$. 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.

| "CERTIFIED VALUES" FOR INTERFERENCE CHECK SAMPLE ICP-AES ICSA-1211, AND ICSA-1211 MIXED WITH ICSB-0710 | Table 1. |
|--|----------|
| | |

| HgiH timid (J\bu) | wod Limit (J\gy) | A haq 4 haq+ (J\by) | High Himid (A\g4) | Low Limit (µg/L) | A hsq (J\gy) | свог | Flement |
|-------------------------|------------------------|---------------------------|-------------------------|------------------------|--------------|------|---------|
| 285000 | 509000 | 247000 | 294000 | 216000 | S22000 | 200 | IA |
| 117 | 979 | 818 | 0.09 | 0.09- | (0.0) | 09 | 9S |
| 120 | 4.88 | 104 | 0.01 | 0.01- | (0.0) | 01 | sA |
| 757 | 337 | (537) | 506 | ⊅6 ŀ- | (0.9) | 200 | Ba |
| 078 | 420 | 967 | 0.3 | 0.8- | (0.0) | 0.8 | Be |
| 1120 | 928 | 279 | 0.8 | 0.4- | (0.1) | 0.8 | Cd |
| 271000 | 188000 | 532000 | 282000 | 208000 | 242000 | 2000 | БЭ |
| 429 | 097 | 242 | 0.28 | 42.0 | (0.23) | 01 | Cr |
| 848 | t0t | 974 | 0.03 | 0.03- | (0.0) | 09 | 0) |
| 883 | 434 | 119 | 0.72 | 0.62- | (0.2) | 52 | nე |
| 114500 | 84400 | 99300 | 116500 | 00998 | 101000 | 100 | Еe |
| 0.63 | 39.0 | (0.64) | 0.01 | 0.01- | (0.0) | 01 | dЯ |
| 286000 | 210000 | 248000 | 294000 | 216000 | S22000 | 2000 | ВМ |
| 78 9 | 430 | 703 | 22.0 | 0.8- | (0.7) | 91 | uΜ |
| 1100 | 018 | 1 26 | 42.0 | 0.86- | (0.2) | 07 | !N |
| 0.18 | 0.11 | (0.94) | 35.0 | 0.36- | (0.0) | 35 | əs |
| 232 | 021 | 201 | 0.01 | 0.01- | (0.0) | 01 | ₽A |
| 133 | 0.88 | (801) | 0.82 | 0.82- | (0.0) | 52 | ΙL |
| 999 | 714 | 167 | 0.03 | 0.08- | (0.0) | 90 | Λ |
| 960L | 608 | 796 | 0.09 | 0.09- | (0.0) | 09 | uZ |

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.



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 M6153

(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.

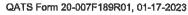
QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY
APTIM Federal Services, LLC
2700 Chandler Avenue - Building C
Las Vegas, NV 89120

(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,

Page 1 of 2











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

APTIM

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 |
| Ва | 200 | (6.0) | -194 | 206 | (537) | 337 | 737 |
| Be | 5.0 | (0.0) | -5.0 | 5.0 | 495 | 420 | 570 |
| Cd | 5.0 | (1.0) | -4.0 | 6.0 | 972 | 826 | 1120 |
| Ca | 5000 | 245000 | 208000 | 282000 | 235000 | 199000 | 271000 |
| Cr | 10 | (52.0) | 42.0 | 62.0 | 542 | 460 | 624 |
| Co | 50 | (0.0) | -50.0 | 50.0 | 476 | 404 | 548 |
| Cu | 25 | (2.0) | -23.0 | 27.0 | 511 | 434 | 588 |
| Fe | 100 | 101000 | 85600 | 116500 | 99300 | 84400 | 114500 |
| Pb | 10 | (0.0) | -10.0 | 10.0 | (49.0) | 39.0 | 59.0 |
| Mg | 5000 | 255000 | 216000 | 294000 | 248000 | 210000 | 286000 |
| Mn | 15 | (7.0) | -8.0 | 22.0 | 507 | 430 | 584 |
| Ni | 40 | (2.0) | -38.0 | 42.0 | 954 | 810 | 1100 |
| Se | 35 | (0.0) | -35.0 | 35.0 | (46.0) | 11.0 | 81.0 |
| Ag | 10 | (0.0) | -10.0 | 10.0 | 201 | 170 | 232 |
| TI | 25 | (0.0) | -25.0 | 25.0 | (108) | 83.0 | 133 |
| V | 50 | (0.0) | -50.0 | 50.0 | 491 | 417 | 565 |
| Zn | 60 | (0.0) | -60.0 | 60.0 | 952 | 809 | 1095 |

The acceptance ranges for all analytes in parentheses in the above table were determined using the listed certified value \pm 1 times the associated CLP SOW CRQL. The acceptance ranges for all other analytes were determined using the certified value \pm 15 percent of the listed certified value.

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|-----|--|--|--|
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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 | | | | |
| М | 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



Certificate of Analysis

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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

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 SE | > | |
| (Solvent Safety Info. On Attached pg.) | SDS Information | | Pedro L. Rentas | " human | A A | | Aleah O'Brady | 0 | Sar 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/m | 5.0E5 | 1.0E6 | m/z-> | 5000 | 1.0€4 | 1.0E6 | 2.0E6 | |
|------|-------|-------|----------|------|----------|-------|---|--|
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| | | | 4 | | 70 | | | |
| | | | 170 | | 0 | | | |
| | | | 180 | | 80 | | | 1000 |
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| | | | 190 | | 90 | | | or any |
| | | | 200 | | 100 | | | |
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Part # 57081



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

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

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Physical Characterization:

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

* 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).

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% (III) 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

| V-4 K | 2.588 | m/z->- 5.0E8 | 1.0E7 | m/z-> | 1.006 | 2.006 |
|----------|-------|-----------------|-------|-------|-------|-------|
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Part # 57023

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).