

Prep Standard - Chemical Standard Summary

| Order ID : | P4103 | |
|--------------------|----------|--------------------------------------------------------|
| Test : | TCLP Me | ercury,TCLPMetals Group2 |
| | | |
| Prepbatch ID : | PB163580 | ,PB163584, |
| Sequence ID/Qc Bat | tch ID: | LB132543,LB132557,LB132557,LB132557,LB132557,LB132578, |
| | | |

Standard ID :

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MP81818,MP81819,MP81820,MP81821,MP82127,MP82393,MP82400,MP82402,MP82404,MP82409,MP82410,MP824 11,MP82412,MP82413,MP82414,MP82415,MP82416,MP82418,MP82422,MP82423,MP82424,MP82441 MP82476 MP82477 MP82478 MP82479 MP82484,MP82485,MP82486 MP82487,MP82488,MP82489, MP82492,

Chemical ID :

M4251,M4399,M4465,M4916,M5062,M5130,M5218,M5223,M5295,M5296,M5394,M5429,M5613,M5802,M5815,M5816,M5817,M5820,M5875,M5882,M5953,M5963,M5965,M5970,M5982,M6000,M6009,M6037,M6040,mp82484,W 3112,



| Recipe ID 3965 | NAME 2:1 H2SO4 : HNO3 | <u>NO.</u> MP81818 | Prep Date 08/13/2024 | Expiration Date 01/04/2025 | Prepared By Mohan Bera | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|----------------------|----------------------------------|-----------------------|-------------------------|----------------------------------|------------------------------|------------------------|--------------------------|-----------------|
| <u>FROM</u> | 1600.00000ml of M5613 + 800.0000 | Dml of M596 | i3 = Final Qua | antity: 3200.000 |) ml | | | |
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| Recipe ID 65 | NAME POTASSIUM PERMANGANATE SOLUTION 5 % | <u>NO.</u> MP81819 | <u>Prep Date</u> 08/13/2024 | Expiration Date 02/13/2025 | <u>Prepared</u> <u>By</u> Mohan Bera | <u>ScaleID</u> METALS_SCA LE_3 (M SC-3) | Sarabjit Jaswal |
|--------------------|------------------------------------------------|-----------------------|--------------------------------|----------------------------------|--------------------------------------------|-----------------------------------------------|-----------------|
| FROM | 100.00000gram of M4916 + 2000.00 | 000ml of W | 3112 = Final (| Quantity: 2000. | 000 ml | | |



| Recipe ID 66 | NAME POTASSIUM PERSULFATE SOLUTION 5 % | <u>NO.</u> MP81820 | Prep Date 08/13/2024 | Expiration Date 02/13/2025 | | <u>ScaleID</u> METALS_SCA LE_3 (M SC-3) | Sarabjit Jaswal |
|--------------------|----------------------------------------------|-----------------------|-------------------------|----------------------------------|------|-----------------------------------------------|-----------------|
| FROM | 100.00000ml of M4465 + 2000.0000 | 0ml of W311 | 2 = Final Qua | antity: 2000.000 | D ml | | |

| <u>Recipe</u> <u>ID</u> | NAME | <u>NO.</u> | Prep Date | Expiration Date | <u>Prepared</u> <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By |
|----------------------------|----------------------------------------------|-------------------------|---------------|--------------------|------------------------------|-----------------------------|------------------|-------------------------------|
| 67 | SODIUM CHLORIDE - HYDROXYL- CHLORIDE | <u>MP81821</u> | 08/13/2024 | 02/14/2025 | Mohan Bera | METALS_SCA LE_3 (M SC-3) | None | Sarabjit Jaswal 08/13/2024 |
| FROM | SOLUTION 2000.00000ml of W3112 + 240.0000 | Ogram of M ² | 1251 + 240.00 | 0000gram of M4 | 1399 = Final Qu | uantity: 2000.00 | 0 ml | |
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FROM

Metals STANDARD PREPARATION LOG

1.00000ml of M6037 + 2.50000ml of M5062 + 96.50000ml of W3112 = Final Quantity: 100.000 ml



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Metals STANDARD PREPARATION LOG

| Recipe ID 1346 FROM | NAME Hg ICV SOLUTION 2.50000ml of M5953 + 2.50000ml of | <u>NO.</u> <u>MP82400</u> M6037 + 24 | Prep Date 09/20/2024 5.00000ml of | Expiration Date 09/21/2024 W3112 = Fina | Prepared By Mohan Bera I Quantity: 250. | <u>ScaleID</u> None | PipettelD METALS_PIP ETTE_5 (HG A) | Sarabjit Jaswal 09/20/2024 |
|------------------------------------|--------------------------------------------------------------|--------------------------------------------|-----------------------------------------|--------------------------------------------------|--------------------------------------------------|------------------------|---------------------------------------------|-------------------------------|
| <u>Recipe</u> <u>ID</u> 1358 | NAME CCV (Hg 5.0 PPB SOLUTION) | <u>NO.</u> MP82402 | Prep Date 09/20/2024 | Expiration Date 09/21/2024 | Prepared By Mohan Bera | <u>ScaleID</u> None | PipettelD METALS_PIP ETTE_5 (HG | Sarabjit Jaswal |

FROM 485.00000ml of W3112 + 5.00000ml of M6037 + 10.00000ml of MP82393 = Final Quantity: 500.000 ml



| Recipe ID 1349 FROM | NAME CRA/CRI (Hg 0.2 PPB SOLUTION) 2.50000ml of M6037 + 247.30000ml | <u>NO.</u> <u>MP82404</u> of W3112 + | Prep Date 09/20/2024 0.20000ml of | Expiration Date 09/21/2024 MP82393 = F | Prepared By Mohan Bera inal Quantity: 25 | <u>ScaleID</u> None | PipettelD METALS_PIP ETTE_5 (HG A) | Sarabjit Jaswal 09/20/2024 |
|------------------------------|------------------------------------------------------------------------------|--------------------------------------------|-----------------------------------------|-------------------------------------------------|---------------------------------------------------|------------------------|---------------------------------------------|-------------------------------|
| Recipe ID 871 | NAME MERCURY INTERMEDIATE B 250PPB WORKING STD. | <u>NO.</u> MP82409 | Prep Date 09/21/2024 | Expiration Date 09/22/2024 | Prepared By Mohan Bera | <u>ScaleID</u> None | PipetteID METALS_PIP ETTE_5 (HG | Sarabjit Jaswal |

FROM 1.00000ml of M6037 + 2.50000ml of M5062 + 96.50000ml of W3112 = Final Quantity: 100.000 ml



FROM

A)

Metals STANDARD PREPARATION LOG

| Recipe ID 1340 FROM | NAME Hg 0.00 PPB STD 2.50000ml of M6037 + 247.50000ml | <u>NO.</u> <u>MP82410</u> of W3112 = | Prep Date 09/21/2024 Final Quanti | Expiration Date 09/22/2024 ty: 250.000 ml | Prepared By Mohan Bera | <u>ScaleID</u> None | PipettelD METALS_PIP ETTE_5 (HG A) | Sarabjit Jaswal 09/23/2024 |
|------------------------------------|-------------------------------------------------------------|--------------------------------------------|-----------------------------------------|----------------------------------------------------|--------------------------------------------|------------------------|---------------------------------------------|-------------------------------|
| <u>Recipe</u> <u>ID</u> 1341 | NAME Hg 0.2 PPB STD | <u>NO.</u> MP82411 | Prep Date 09/21/2024 | Expiration Date 09/22/2024 | <u>Prepared</u> <u>Ву</u> Mohan Bera | <u>ScaleID</u> None | PipettelD METALS_PIP ETTE_5 (HG | Sarabjit Jaswal |

2.50000ml of M6037 + 247.30000ml of W3112 + 0.20000ml of MP82409 = Final Quantity: 250.000 ml



| Recipe ID 1342 FROM | NAME Hg 2.5 PPB STD 2.50000ml of M6037 + 245.00000ml | <u>NO.</u> MP82412 of W3112 + | Prep Date 09/21/2024 2.50000ml of | Expiration Date 09/22/2024 MP82409 = F | Prepared By Mohan Bera inal Quantity: 25 | ScaleID None | PipetteID METALS_PIP ETTE_5 (HG A) | Supervised By Sarabjit Jaswal 09/23/2024 |
|---------------------------------------------------|------------------------------------------------------------|--------------------------------------------|-----------------------------------------|-------------------------------------------------|---------------------------------------------------|------------------------|---------------------------------------------|------------------------------------------------|
| Recipe ID 1343 FROM | NAME Hg 5.0 PPB STD 2.50000ml of M6037 + 242.50000ml | <u>NO.</u> <u>MP82413</u> of W3112 + | Prep Date 09/21/2024 5.00000ml of | Expiration Date 09/22/2024 MP82409 = F | Prepared By Mohan Bera inal Quantity: 25 | <u>ScaleID</u> None | PipetteID METALS_PIP ETTE_5 (HG A) | Sarabjit Jaswal |



| Recipe ID 1344 FROM | NAME Hg 7.5 PPB STD 2.50000ml of M6037 + 240.00000ml | <u>NO.</u> <u>MP82414</u> of W3112 + | Prep Date 09/21/2024 7.50000ml of | Expiration Date 09/22/2024 MP82409 = Fi | Prepared By Mohan Bera | | PipettelD METALS_PIP ETTE_5 (HG A) | Sarabjit Jaswal 09/23/2024 |
|------------------------------|------------------------------------------------------------|--------------------------------------------|-----------------------------------------|--------------------------------------------------|--------------------------------------------|------------------------|---------------------------------------------|-------------------------------|
| Recipe ID 1345 | NAME Hg 10.0 PPB STD | <u>NO.</u> MP82415 | Prep Date 09/21/2024 | Expiration Date 09/22/2024 | <u>Prepared</u> <u>By</u> Mohan Bera | <u>ScaleID</u> None | PipettelD METALS_PIP ETTE_5 (HG A) | Sarabjit Jaswal |



FROM

Metals STANDARD PREPARATION LOG

| Recipe ID 1346 FROM | NAME Hg ICV SOLUTION 2.50000ml of M5953 + 2.50000ml of | <u>NO.</u> <u>MP82416</u> M6037 + 24 | Prep Date 09/21/2024 5.00000ml of | Expiration Date 09/22/2024 W3112 = Fina | Prepared By Mohan Bera | <u>ScaleID</u> None | PipettelD METALS_PIP ETTE_5 (HG A) | Sarabjit Jaswal 09/23/2024 |
|------------------------------|----------------------------------------------------------------------------|--------------------------------------------|-----------------------------------------|--------------------------------------------------|------------------------------|------------------------|---------------------------------------------|-------------------------------|
| | | | | | | | | |

485.00000ml of W3112 + 5.00000ml of M6037 + 10.00000ml of MP82409 = Final Quantity: 500.000 ml



| Recipe ID 68 | NAME STANNOUS CHLORIDE SOLUTION | <u>NO.</u> MP82422 | Prep Date 09/21/2024 | Expiration Date 09/22/2024 | Prepared By Mohan Bera | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|--------------------|---------------------------------------|-----------------------|-------------------------|----------------------------------|------------------------------|------------------------|--------------------------|-----------------|
| <u>FROM</u> | 450.00000ml of W3112 + 50.00000gi | ram of M588 | 32 + 50.00000 | ml of M6040 = | Final Quantity: | 500.000 ml | | |
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| <u>Recipe</u> <u>ID</u> 104 | NAME 5% RINSING HCL | <u>NO.</u> MP82423 | Prep Date 09/21/2024 | Expiration Date 09/22/2024 | Prepared By Mohan Bera | <u>ScaleID</u> None | PipetteID None | Sarabjit Jaswal |
|-----------------------------------|----------------------------------|-----------------------|-------------------------|----------------------------------|------------------------------|------------------------|-------------------|-----------------|
| FROM | 100.00000ml of M6040 + 1900.0000 | Dml of W311 | 2 = Final Qu | antity: 2000.00 |) ml | | | |



| Recipe ID 1349 | NAME CRA/CRI (Hg 0.2 PPB SOLUTION) | <u>NO.</u> MP82424 | Prep Date 09/21/2024 | Expiration Date 09/22/2024 | Prepared By Mohan Bera | <u>ScaleID</u> None | PipettelD METALS_PIP ETTE_5 (HG | |
|----------------------|------------------------------------------|-----------------------|-------------------------|----------------------------------|------------------------------|------------------------|---------------------------------------|------------|
| <u>FROM</u> | 2.50000ml of M6037 + 247.30000ml | of W3112 + | 0.20000ml of | MP82409 = F | nal Quantity: 25 | 50.000 ml | A) | JUILUILULT |
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| | | | | Expiration | | | | |

| Recipe | | | | Expiration | Prepared | | | Supervised By |
|---------------|-----------------------------------|------------|--------------|-------------------|----------------|----------------|---------------|-----------------|
| <u>ID</u> | NAME | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | PipetteID | Sarabjit Jaswal |
| 912 | ICP AES ICV SOLN | MP82485 | 09/24/2024 | 10/23/2024 | Kareem | None | None | 2 |
| | | | | | Khairalla | | | 09/24/2024 |
| FROM | 0.02500ml of M5429 + 0.02500ml of | M5815 + 0 | 02500ml of M | 5817 + 0 02500 |)ml of M5982 + | 0 25000ml of M | 5218 + 10 000 | 000ml |
| <u></u> | of M5295 + 89.77500ml of MP82441 | | | | | | | |
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| Recipe ID 911 | NAME ICP AES CCV SOLN | <u>NO.</u> MP82488 | Prep Date 09/24/2024 | Expiration Date 10/23/2024 | <u>Prepared</u> <u>By</u> Kareem Khairalla | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|---------------------|----------------------------------|-----------------------|-------------------------|----------------------------------|-----------------------------------------------------|------------------------|--------------------------|-----------------|
| FROM | 50.00000ml of MP82441 + 50.00000 | ml of MP824 | 476 = Final Q | tuantity: 100.00 | 0 ml | | | |



| 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-3624-05 / Sodium Chloride, Crystal (cs/4x2.5kg) | 0000187425 | 08/16/2024 | 08/16/2019 / RICHARD | 07/08/2019 / RICHARD | M4399 |
| 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 10ug/mL | S2-HG709270 | 09/22/2026 | 05/28/2022 / mohan | 01/27/2022 / mohan | M5062 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
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| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------|------------------------------------------------------------------------------|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| Inorganic Ventures | CHEM-QC-4 / CHEM-QC-4, Second Source, 1000 ug/ml, B, Mo, Si, Sn, Ti | S2-MEB711674 | 11/02/2026 | 07/01/2022 / bin | 09/10/2021 / bin | M5218 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| EPA | PART B / ICSAB (ICP) STOCK SOLN | ICSB-0710 | 11/19/2024 | 05/20/2024 / | 04/20/2021 / bin | M5223 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| EPA | ICV-1 / ICV (ICP/ICPMS) STOCK SOLN | ICV-1014 | 02/05/2025 | 08/07/2024 / jaswal | 02/20/2020 / bin | M5295 |
| Sumplier | them Code / them Neme | L at # | Expiration | Date Opened / | Received Date / | Chemtech |

| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------|-----------------------------|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| Inorganic Ventures | Z9651Q / CHEM-CLP-4/.25L | S2-MEB711673 | 11/02/2026 | 09/19/2022 / jaswal | 08/20/2022 / jaswal | M5296 |
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| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------|--------------------------------------------|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| Inorganic Ventures | CLPP-CAL-3 / CLP CAL SOLUTION #3, 125mL | T2-MEB714159 | 01/13/2027 | 11/28/2022 / bin | 09/19/2022 / bin | M5394 |
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| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|----------------------------------|--------|--------------------|----------------------------|--------------------------------|-------------------|
| Absolute Standards, Inc. | 57103 / Li, 10000 PPM, 125 ml | 070622 | 07/06/2025 | 01/30/2023 / bin | 01/26/2023 / bin | M5429 |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|------------------------------------------------------------|------------|--------------------|----------------------------|--------------------------------|-------------------|
| Seidler Chemical | BA-9673-33 / Sulfuric Acid, Instra-Analyzed (cs/6c2.5L) | 0000265056 | 11/05/2025 | 07/13/2023 / mohan | 07/07/2023 / mohan | M5613 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 57051 / Sb, 1000 PPM, 125 ml | 120523 | 12/05/2026 | 08/07/2024 / jaswal | 01/03/2024 / jaswal | M5802 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 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 |

| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|---------------------------------|--------|--------------------|----------------------------|--------------------------------|-------------------|
| Absolute Standards, Inc. | 57116 / S, 10000 PPM, 125 ml | 071123 | 07/11/2026 | 03/01/2024 / jaswal | 02/09/2024 / jaswal | M5817 |
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| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|--------------------------------|--------|--------------------|----------------------------|--------------------------------|-------------------|
| Absolute Standards, Inc. | 57015 / P, 1000 PPM, 125 ml | 091123 | 09/11/2026 | 05/01/2024 / jaswal | 02/09/2024 / jaswal | M5820 |
| | | | | | | |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------|--------------------------------------------|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| 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 # |

| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|----------|-------------------------------|-----------|--------------------|----------------------------|--------------------------------|-------------------|
| EPA | ICV-5 / ICV (HG)STOCK SOLN | ICV5-0415 | 01/01/2025 | 07/01/2024 / mohan | 03/30/2023 / mohan | M5953 |
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| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------|----------------------------------------------------------|------------|--------------------|----------------------------|--------------------------------|-------------------|
| Seidler Chemical | BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L) | 24B1362001 | 01/04/2025 | 07/09/2024 / Al-Terek | 07/03/2024 / Al-Terek | M5963 |
| | | | | | | |

| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------|----------------------------------------------------------|------------|--------------------|----------------------------|--------------------------------|-------------------|
| Seidler Chemical | BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L) | 24B1362001 | 01/04/2025 | 07/05/2024 / Jaswal | 07/03/2024 / Al-Terek | M5965 |
| | | | | | | |

| 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 |
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CHEMICAL RECEIPT LOG BOOK

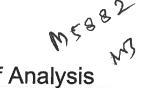
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| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|-------------------------------------------------------------------|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| Absolute Standards, Inc. | 57038 / Sr, 1000 PPM, 125 ml | 031524 | 03/15/2027 | 07/01/2024 / Jaswal | 06/11/2024 / Jaswal | M5982 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | WW-LFS-1 / Laboratory Fortified Stock Solution 1, 125 ml | T2-MEB723367 | 08/30/2026 | 08/13/2024 / Jaswal | 05/14/2024 / Jaswal | M6000 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | WW-LFS-2 / Laboratory Fortified Stock Solution 2, 125 ml | U2-MEB731108 | 03/17/2028 | 08/13/2024 / Jaswal | 05/14/2024 / Jaswal | M6009 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Seidler Chemical | BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L) | 24D1062002 | 02/02/2025 | 08/24/2024 / Janvi | 08/01/2024 / Janvi | M6037 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Seidler Chemical | BA-9530-33 / Hydrochloric Acid, Instra-Analyzed (cs/6x2.5L) | 24D1562005 | 02/08/2025 | 08/09/2024 / | 08/01/2024 / Janvi | M6040 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |

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

Certificate of Analysis Thermo Fisher SCIENTIFIC



Page 1 of 1

Certificate of Analysis 1 Reagent Lane Fair Lawn, NJ 07410 Thermo Fisher Scientific's Quality System has been found to conform to Quality Management System 201,796,7100 tel 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, DIH | YDRATE CERTIFIED ACS (Suitable for Me | ercury Determination) |
| Country of Origin | United States | Suggested Retest Date | Aug/2028 |
| Chemical Origin | Inorganic-non animal | | |
| BSE/TSE Comment | No animal products are used a processing aids, or any other | as starting raw material ingredients, or used material that might migrate to the finished p | in processing, including lubricants, roduct. |

| N/A | | | | | |
|-------------------|-----------|----------------------------|---------------------|--|--|
| 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%) | | |

ut Sabyr

Harout Sahagian - Quality Control Supervisor - Fair Lawn

Note: The data listed is valid for all package sizes of this lot of this product, expressed as an extension of this catalog number listed above. If there are any questions with this certificate, please call at (800) 227-6701.

*Based on suggested storage condition.

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







Material No.: 9673-33 Batch No.: 0000265056 Manufactured Date: 2020/05/12 Retest Date: 2025/05/11 Revision No: 1

Certificate of Analysis

| Test | Specification | Result |
|-------------------------------------------------|---------------|--------|
| ACS – Assay (H2SO4) | 95.0 - 98.0 % | 96.5 |
| Appearance | Passes Test | РТ |
| ACS – Color (APHA) | <= 10 | 5 |
| ACS - Residue after Ignition | <= 3 ppm | < 1 |
| ACS – Substances Reducing Permanganate (as SO2) | <= 2 ppm | < 2 |
| Ammonium (NH4) | <= 1 ppm | < 1 |
| Chloride (Cl) | <= 0.1 ppm | < 0.1 |
| Nitrate (NO3) | <= 0.2 ppm | < 0.1 |
| Phosphate (PO4) | <= 0.5 ppm | < 0.1 |
| Trace Impurities – Aluminum (Al) | <= 30.0 ppb | < 0.2 |
| Arsenic and Antimony (as As) | <= 4 ppb | < 2 |
| Trace Impurities – Barium (Ba) | <= 10.0 ppb | < 1.0 |
| Trace Impurities – Beryllium (Be) | <= 10.0 ppb | < 1.0 |
| Trace Impurities – Bismuth (Bi) | <= 10.0 ppb | < 1.0 |
| Trace Impurities – Boron (B) | <= 10.0 ppb | < 5.0 |
| Trace Impurities – Cadmium (Cd) | <= 2.0 ppb | < 0.3 |
| Trace Impurities – Calcium (Ca) | <= 50.0 ppb | < 1.0 |
| Trace Impurities – Chromium (Cr) | <= 6.0 ppb | < 0.4 |
| Trace Impurities - Cobalt (Co) | <= 0.5 ppb | < 0.3 |
| Trace Impurities – Copper (Cu) | <= 1.0 ppb | < 0.1 |
| Trace Impurities - Gallium (Ga) | <= 10.0 ppb | < 1.0 |
| Trace Impurities - Germanium (Ge) | <= 10.0 ppb | < 10.0 |
| Trace Impurities – Gold (Au) | <= 10.0 ppb | < 0.2 |
| Heavy Metals (as Pb) | <= 500 ppb | < 100 |

For questions on this Certificate of Analysis please contact Technical Services at 855.282.6867 or +1.610.386.1700 Avantor Performance Materials, LLC 100 Matsonford Rd, Suite 200, Radnor, PA 19087. U.S.A. Phone: 610.386.1700

Material No.: 9673-33 Batch No.: 0000265056

| Test | Specification | Result |
|------------------------------------|---------------|--------|
| Trace Impurities - Iron (Fe) | <= 50.0 ppb | 3.3 |
| Trace Impurities - Lead (Pb) | <= 0.5 ppb | < 0.5 |
| Trace Impurities – Lithium (Li) | <= 10.0 ppb | < 1.0 |
| Trace Impurities – Magnesium (Mg) | <= 7.0 ppb | < 0.2 |
| Trace Impurities – Manganese (Mn) | <= 1.0 ppb | < 0.4 |
| Trace Impurities – Mercury (Hg) | <= 0.5 ppb | < 0.1 |
| Trace Impurities - Molybdenum (Mo) | <= 10.0 ppb | < 5.0 |
| Trace Impurities – Nickel (Ni) | <= 2.0 ppb | < 0.3 |
| Trace Impurities – Niobium (Nb) | <= 10.0 ppb | < 1.0 |
| Trace Impurities – Potassium (K) | <= 500.0 ppb | < 2.0 |
| Trace Impurities – Selenium (Se) | <= 50.0 ppb | 17.8 |
| Trace Impurities – Silicon (Si) | <= 100.0 ppb | < 10.0 |
| Trace Impurities – Silver (Ag) | <= 1.0 ppb | < 0.3 |
| Trace Impurities – Sodium (Na) | <= 500.0 ppb | 1.5 |
| Trace Impurities – Strontium (Sr) | <= 5.0 ppb | < 0.2 |
| Trace Impurities – Tantalum (Ta) | <= 10.0 ppb | < 5.0 |
| Trace Impurities – Thallium (Tl) | <= 20.0 ppb | < 5.0 |
| Trace Impurities – Tin (Sn) | <= 5.0 ppb | < 0.8 |
| Trace Impurities – Titanium (Ti) | <= 10.0 ppb | < 1.0 |
| Trace Impurities – Vanadium (V) | <= 10.0 ppb | < 1.0 |
| Frace Impurities – Zinc (Zn) | <= 5.0 ppb | 0.4 |
| Frace Impurities – Zirconium (Zr) | <= 10.0 ppb | < 1.0 |

For Laboratory, Research or Manufacturing Use

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

James Techie Jamie Ethier Vice President Global Quality

For questions on this Certificate of Analysis please contact Technical Services at 855.282.6867 or +1.610.386.1700 Avantor Performance Materials, LLC 100 Matsonford Rd, Suite 200, Radnor, PA 19087. U.S.A. Phone: 610.386.1700 M5296 OP: 09/19/2022 BH



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 | n |
|---------------------|---------------------------------------------------|---------------------|
| Catalog Number: | CHEM-CLP-4 | |
| Lot Number: | S2-MEB711673 | |
| Matrix: | 3% (v/v) HNO3 3% (v/v) HF | |
| Value / Analyte(s): | 1 000 μg/mL ea: Boron, Silicon, Titanium | Molybdenum, Tin, |

3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE Boron, B | CERTIFIED VALUE 1 000 ± 6 μg/mL | ANALYTE Molybdenum, Mo | CERTIFIED VALUE 1 000 ± 6 μg/mL | |
|---------------------|------------------------------------|---------------------------|------------------------------------|----------|
| Silicon, Si | 1 000 ± 7 μg/mL | Tin, Sn | 1 000 ± 6 µg/mL | |
| Titanium, Ti | 1 000 ± 7 μg/mL | | | |
| Density: | 1.030 g/mL (meas | sured at 20 ± 4 °C) | | |
| Assay Information | n: | | | |
| ANALYTE | METHOD | NIST SRM# | | SRM LOT# |
| B | ICP Assav | 3107 | | 110830 |

| В | ICP Assay | 3107 | 110830 |
|----|-----------|-------|--------|
| Мо | ICP Assay | 3134 | 130418 |
| Si | ICP Assay | 3150 | 130912 |
| Sn | ICP Assay | 3161a | 140917 |
| Ti | ICP Assay | 3162a | 130925 |
| | | | |

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

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

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

4.0

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

November 02, 2021

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

11.2 Lot Expiration Date

- November 02, 2026

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Director, Quality Control

Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Paul R Line



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

3.0

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

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

| ANALYTE Aluminum, Al | CERTIFIED VALUE 2 000 ± 7 μg/mL | ANALYTE Barium, Ba | CERTIFIED VALUE 2 000 ± 9 μg/mL |
|-------------------------|------------------------------------|-----------------------|------------------------------------|
| Beryllium, Be | 50.00 ± 0.26 μg/mL | Calcium, Ca | 5 000 ± 22 μg/mL |
| Chromium, Cr | 200.0 ± 1.0 μg/mL | Cobalt, Co | 500.0 ± 2.4 μg/mL |
| Copper, Cu | 250.0 ± 1.0 μg/mL | Iron, Fe | 1 000 ± 4 μg/mL |
| Magnesium, Mg | 5 000 ± 20 μg/mL | Manganese, Mn | 500.0 ± 2.0 μg/mL |
| Nickel, Ni | 500.0 ± 2.2 μg/mL | Potassium, K | 5 000 ± 19 μg/mL |
| Silver, Ag | 250.0 ± 1.1 μg/mL | Sodium, Na | 5 000 ± 18 μg/mL |
| Vanadium, V | 499.7 ± 2.2 μg/mL | Zinc, Zn | 500.0 ± 2.2 μg/mL |

Density:

1.118 g/mL (measured at 20 ± 4 °C)

Assay Information:

| ANALYTE Ag | METHOD ICP Assay | NIST SRM# 3151 | SRM LOT# 160729 |
|---------------|---------------------|-------------------|--------------------|
| Ag | Volhard | 999c | 999c |
| AI | ICP Assay | 3101a | 140903 |
| AI | EDTA | 928 | 928 |
| Ва | ICP Assay | 3104a | 140909 |
| Ва | Gravimetric | | See Sec. 4.2 |
| Ве | ICP Assay | 3105a | 090514 |
| Ве | Calculated | | See Sec. 4.2 |
| Са | ICP Assay | 3109a | 130213 |
| Са | EDTA | 928 | 928 |
| Со | ICP Assay | 3113 | 190630 |
| Со | EDTA | 928 | 928 |
| Cr | ICP Assay | 3112a | 170630 |
| Cr | Calculated | | See Sec. 4.2 |
| Cu | ICP Assay | 3114 | 121207 |
| Cu | EDTA | 928 | 928 |
| Fe | ICP Assay | 3126a | 140812 |
| Fe | EDTA | 928 | 928 |
| К | ICP Assay | 3141a | 140813 |
| К | Gravimetric | | See Sec. 4.2 |
| Mg | ICP Assay | 3131a | 140110 |
| Mg | EDTA | 928 | 928 |
| Mn | ICP Assay | 3132 | 050429 |
| Mn | EDTA | 928 | 928 |
| Na | ICP Assay | 3152a | 120715 |
| Na | Gravimetric | | See Sec. 4.2 |
| Ni | ICP Assay | 3136 | 120619 |
| Ni | EDTA | 928 | 928 |
| V | IC Assay | 3165 | 160906 |
| V | EDTA | 928 | 928 |
| Zn | ICP Assay | 3168a | 120629 |
| Zn | EDTA | 928 | 928 |
| | | | |

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

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

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

4.0

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

Note: This solution contains Silver (Ag), please refer to our Sample Preparation Guide for more information.

https://www.inorganicventures.com/sample-preparation-guide/samples-containing-silver

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 27, 2022

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

11.2 Lot Expiration Date

- January 27, 2027

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Thomas Kozikowski Manager, Quality Control

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

SD978Ci Paul R Saines



Certificate of Analysis

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

1.0 ACCREDITATION / REGISTRATION

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2.0 **PRODUCT DESCRIPTION**

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

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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

Density:

1.043 g/mL (measured at 20 \pm 4 °C)

Assay Information:

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

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

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

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

4.0

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 13, 2022

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

11.2 Lot Expiration Date

- January 13, 2027

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Thomas Kozikowski Manager, Quality Control

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

SD978Ci Paul R Saines

Certificate of Analysis

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

INORGANIC" V E N T U R E S

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-1 |
| Lot Number: | T2-MEB723367 |
| Matrix: | 5% (v/v) HNO3 |

| Value / A | Analyte(s): 1 000 µg/mL ea: Potassium, | | |
|------------|------------------------------------------------------------|-------------------------------------------------|--|
| | 600 μg/mL ea: Phosphorus, | | |
| | 300 μg/mL ea: Sodium, | Iron, | |
| | 200 µg/mL ea: Magnesium, Cerium, Thallium, | Aluminum, Selenium, | |
| | 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, Vanadium, | Boron, | |
| | 20 μg/mL ea: Zinc, Barium, Cadmium, Manganese, | Strontium, Beryllium, Cobalt, Lithium, | |
| 3.0 CERTIF | 7.5 µg/mL ea: Silver IED 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 | | |
| | | | |

Density:

1.034 g/mL (measured at 20 \pm 4 °C)

Assay Information:

| ANALYTE Ag | METHOD ICP Assay | NIST SRM# 3151 | SRM LOT# 160729 |
|---------------|--------------------------|--------------------|--------------------|
| Ag | Volhard | 999c | 999c |
| Ag | Calculated | | See Sec. 4.2 |
| A | ICP Assay | 3101a | 140903 |
| Al | EDTA | 928 | 928 |
| As | ICP Assay | 3103a | 100818 |
| В | ICP Assay | 3107 | 190605 |
| Ba | ICP Assay | 3104a | 140909 |
| Ва | Gravimetric | | See Sec. 4.2 |
| Be | ICP Assay | 3105a | 090514 |
| Са | ICP Assay | 3109a | 130213 |
| Са | 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 |
| к | ICP Assay | 3141a | 140813 |
| к | 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 | 0400 | See Sec. 4.2 |
| Ni Ni | ICP Assay | 3136 | 120619 |
| P | EDTA | 928 3139a | 928 |
| P | ICP Assay Acidimetric | | 060717 |
| F Pb | ICP Assay | 84L 3128 | 84L |
| Pb | EDTA | 928 | 101026 928 |
| Se | ICP Assay | 3149 | |
| Se | EDTA | 928 | 100901 928 |
| Sr | ICP Assay | Traceable to 3153a | 920 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 |
| | Eco 4 | | |

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 | Characterization of CRM/RM by One Method |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Certified Value, X _{CRMRM} , where two or more methods of characterization are used is the weighted mean of the results: | Certified Value, X _{CRM/RM} , where one method of characterization is used is the mean of individual results: |
| $\begin{split} & X_{CRM/RM} \equiv \Sigma(w_i) \; (X_i) \\ & X_i = \text{mean of Assay Method i with standard uncertainty } u_{char, i} \\ & w_i = \text{the weighting factors for each method calculated using the inverse square of the variance:} \\ & w_i = (1/u_{char, i})^2 / (\Sigma(1/(u_{char, i})^2)) \end{split}$ | $X_{CRM/RM} = (X_a) (u_{char a})$ $X_a = mean of Assay Method A withu_{char a} = the standard uncertainty of characterization Method A$ |
| CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k $(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{V_2}$ k = coverage factor = 2 $u_{char} = [\Sigma[(w_i)^2 (u_{char}_i)^2])^{V_2}$ where u_{char} is the errors from each characterization method u_{bb} = bottle to bottle homogeneity standard uncertainty $u_{lts} = long term stability standard uncertainty (storage) u_{te} = transport stability standard uncertainty$ | CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k ($u^2_{chara} + u^2_{bb} + u^2_{tts} + u^2_{ts}$) ^{1/k} k = coverage factor = 2 u _{chara} = the errors from characterization u _{bb} = bottle to bottle homogeneity standard uncertainty u _{Its} = long term stability standard uncertainty (storage) u _{uts} = transport stability standard uncertainty |

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

6.0 INTENDED USE

4.0

- 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

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 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

SD9781.

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Page 6 of 6

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

ÍNORGANÍ

VENTURES

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: | | | | | |
| | Titanium | | | | | |
| | | | | | | |

3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE Antimony, Sb | CERTIFIED VALUE 80.1 ± 0.6 µg/mL | ANALYTE Molybdenum, Mo | CERTIFIED VALUE 40.03 ± 0.18 µg/mL |
|-------------------------|-------------------------------------|---------------------------|---------------------------------------|
| Silica, SIO2 | 200.2 ± 1.3 μg/mL | Tin, Sn | 70.0 ± 0.4 µg/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 Assay | 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 |
| π | ICP Assay | 3162a | 130925 |
| Ті | Calculated | | See Sec. 4.2 |
| | | | |

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

Characterization of CRM/RM by Two or More Methods

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

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

 X_i = mean of Assay Method i with standard uncertainty u_{char} i w_i = the weighting factors for each method calculated using the inverse square of the variance:

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

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

k = coverage factor = 2

 $\begin{array}{l} u_{char} = [\overline{\Sigma}((w_{i})^{2} \, (u_{char})^{2})]^{2} \ \ \, \mbox{ where } u_{char} \ \, _{i} \mbox{ are the errors from each characterization method} \\ u_{bb} = bottle \ \, \mbox{ bottle homogeneity standard uncertainty} \\ u_{hs} = long \ \, \mbox{ term stability standard uncertainty (storage)} \end{array}$

uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

$$\begin{split} X_{CRM/RM} = (X_{a}) (u_{oher \ a}) \\ X_{a} = mean \ of Assay Method A with \\ u_{oher \ a} = the standard uncertainty of characterization Method A \end{split}$$

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

 $\label{eq:coverage factor = 2} \\ u_{char} a = the errors from characterization \\ u_{bb} = bottle to bottle homogeneity standard uncertainty$ $u_{its} = long term stability standard uncertainty (storage)$ $u_{its} = transport stability standard uncertainty$

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

6.0 INTENDED USE

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

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

- For more information, visit www.inorganicventures.com/TCT HF Note: This standard should not be prepared or stored in glass.

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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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.

- Sealed TCT Bag Open Date:

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

NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

Certificate Approved By:

Thomas Kozikowski Manager, Quality Control

3D978

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Hydroxylamine Hydrochloride, Crystal BAKER ANALYZED® A.C.S. Reagent Suitable for Mercury Determination (hydroxylammonium chloride)

M4251





Material No.: 2196-01 Batch No.: 0000215387 Manufactured Date: 2018/06/27 Retest Date: 2025/06/25 Revision No: 1

| Test | Specification | Result |
|-----------------------------------------------|---------------|---------|
| Assay (NH₂OH · HCl) (by KMnO₄ titrn) | >= 96.0 % | 99.1 |
| Clarity of Alcohol Solution | Passes Test | PT |
| Residue after Ignition | <= 0.050 % | 0.017 |
| Titrable Free Acid (meq/g) | <= 0.25 | 0.19 |
| Ammonium (NH4) | Passes Test | PT |
| Sulfur Compounds (as SO4) | <= 0.005 % | < 0.003 |
| Trace Impurities – ACS – Heavy Metals (as Pb) | <= 5 ppm | 4 |
| Trace Impurities – Iron (Fe) | <= 5 ppm | < 3 |
| Trace Impurities – Mercury (Hg) | <= 0.050 ppm | < 0.005 |
| | | |

Certificate of Analysis Meets ACS Reagent Chemical Requirements,

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 Techie Jamie Ethier

Vice President Global Quality

For questions on this Certificate of Analysis please contact Technical Services at 855.282.6867 or +1.610.386.1700 Avantor Performance Materials, LLC 100 Matsonford Rd, Suite 200, Radnor, PA 19087. U.S.A. Phone: 610.386.1700 Sodium Chloride, Crystal BAKER ANALYZED® A.C.S. Reagent

M4399 Supplud - 07.08.19



avantor

Material No.: 3624-05 Batch No.: 0000187425 Manufactured Date: 2017/08/03 Retest Date: 2024/08/01

Certificate of Analysis

Meets ACS Reagent Chemical Requirements,

| Test | Specification | Result |
|------------------------------|---------------|---------|
| ssay (NaCl) (by Ag titrn) | >= 99.0 % | 99.8 |
| H of 5% Solution at 25°C | 5.0 - 9.0 | 5.8 |
| CS – Insoluble Matter | <= 0.005 % | 0.003 |
| odide (I) | <= 0.002 % | < 0.002 |
| romide (Br) | <= 0.01 % | < 0.01 |
| hlorate and Nitrate (as NO3) | <= 0.003 % | < 0.003 |
| CS – Phosphate (PO4) | <= 5 ppm | < 5 |
| ulfate (SO4) | <= 0.004 % | < 0.004 |
| arium (Ba) | Passes Test | PT |
| CS – Heavy Metals (as Pb) | <= 5 ppm | < 5 |
| on (Fe) | <= 2 ppm | < 2 |
| alcium (Ca) | <= 0.002 % | < 0.002 |
| agnesium (Mg) | <= 0.001 % | < 0.001 |
| otassium (K) | <= 0.005 % | < 0.005 |

For Laboratory, Research or Manufacturing Use Meets Reagent Specifications for testing USP/NF monographs

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

PS U8.16.19



Phillipsburg, NJ 9001:2008, 14001:2004, FSSC 22000 Paris, KY 9001:2008 Mexico City, Mexico 9001:2008 Deventer, The Netherlands 9001:2008, 14001:2004, 13485:2003 Gliwice, Poland 9001:2008, 13485:2012 Selangor, Malaysia 9001:2008 Dehradun, India, 9001:2008, 14001:2004, 13485:2003 Mumbai, India, 9001:2008 Panoli, India 9001:2008

James Techie

Vice President Global Quality

For questions on this Certificate of Analysis please contact Technical Services at 855.282.6867 or +1.610.573.2600 Avantor Performance Materials, LLC.

3477 Corporate Parkway. Center Valley, PA 18034. U.S.A. Phone: 610.573.2600 . Fax: 610.573.2610

Certificate of Analysis **ThermoFisher** S C I E N T I F I C

M4913-16

Page 1 of 1

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 Buston

Julian Burton - Quality Control Manager - Fair Lawn

Note: The data listed is valid for all package sizes of this lot of this product, expressed as an extension of this catalog number listed above. If there are any questions with this certificate, please call at (800) 227-6701. *Based on suggested storage condition.



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% | | | | | | | |
| CERTIFIED VALUES AND UNCERTAINTIES | | | | | | | | |

| Certified Value: | 10.001 ± 0.053 μg/mL |
|------------------|----------------------------------------|
| Density: | 1.020 g/mL (measured at 20 \pm 4 °C) |

Assay Information:

3.0

| ANALYTE | METHOD | NIST SRM# | SRM LOT# |
|---------|------------|-----------|--------------|
| Hg | ICP Assay | 3133 | 160921 |
| Hg | EDTA | 928 | 928 |
| Hg | 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 | Characterization of CRM/RM by One Method |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Certified Value, X _{CRM/RM} , where two or more methods of characterization are used is the weighted mean of the results: | Certified Value, X _{CRWRM} , where one method of characterization is used is the mean of individual results: |
| $X_{CRM/RM} = \Sigma(w_i) (X_i)$ | $X_{CRM/RM} = (X_a) (u_{char a})$ |
| X _i = mean of Assay Method i with standard uncertainty u _{char i} | X _a = mean of Assay Method A with |
| w_i = the weighting factors for each method calculated using the inverse square of the variance. $w_i = (1/u_{char} i)^2 / (\Sigma(1/(u_{char} i)^2))$ | uchar a = the standard uncertainty of characterization Method A |
| CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k (u ² _{char} + u ² _{bb} + u ² _{lts} + u ² _{ts}) ^{1/2} | CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k $(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{\frac{1}{2}}$ |
| k = coverage factor = 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 | uchar a = the errors from characterization |
| ubb = bottle to bottle homogeneity standard uncertainty | ubb = bottle to bottle homogeneity standard uncertainty |
| u _{lts} = long term stability standard uncertainty (storage) | ults = long term stability standard uncertainty (storage) |
| uts = transport stability standard uncertainty | 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.

| 0 | Ag | | 0.000011 | M | Eu | < | 0.000201 | 0 | Na | | 0.000004 | М | Se | < | 0.015915 | 0 | Zn | < | 0.001510 |
|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| 0 | AI | | 0.000001 | 0 | Fe | | 0.000001 | М | Nb | < | 0.000201 | 0 | Si | | 0.000005 | М | Zr | < | 0.000201 |
| М | As | < | 0.000402 | Μ | Ga | < | 0.000201 | Μ | Nd | < | 0.000201 | М | Sm | < | 0.000201 | | | | |
| М | Au | < | 0.003631 | М | Gd | < | 0.000201 | M | Ni | < | 0.000402 | M | Sn | < | 0.001007 | | | | |
| Μ | В | < | 0.001208 | М | Ge | < | 0.000201 | М | Os | < | 0.000605 | М | Sr | < | 0.000201 | | | | |
| Μ | Ba | < | 0.000201 | Μ | Hf | < | 0.000201 | 0 | Ρ | < | 0.032370 | M | Та | < | 0.000201 | | | | |
| Μ | Be | < | 0.000201 | s | Hg | < | | Μ | Pb | < | 0.000201 | M | Tb | < | 0.000201 | | | | |
| Μ | Bi | < | 0.000201 | М | Ho | < | 0.000201 | Μ | Pd | < | 0.000403 | М | Te | < | 0.002216 | | | | |
| 0 | Ca | | 0.000007 | Μ | In | < | 0.000201 | Μ | Pr | < | 0.000201 | М | Th | < | 0.000201 | | | | |
| M | Cd | < | 0.000201 | М | lr | < | 0.000201 | Μ | Pt | < | 0.000402 | M | Ti | < | 0.000402 | | | | |
| Μ | Ce | < | 0.000201 | 0 | Κ | | 0.000020 | М | Rb | < | 0.000201 | 0 | ΤI | < | 0.016508 | | | | |
| M | Co | < | 0.000201 | М | La | < | 0.000201 | Μ | Re | < | 0.000201 | Μ | Tm | < | 0.000201 | | | | |
| 0 | Cr | < | 0.003021 | 0 | Li | < | 0.000107 | М | Rh | < | 0.000201 | М | U | < | 0.008058 | | | | |
| М | Cs | < | 0.001208 | М | Lu | < | 0.000201 | Μ | Ru | < | 0.000201 | Μ | V | < | 0.000201 | | | | |
| М | Cu | < | 0.000402 | 0 | Mg | | 0.000001 | 0 | S | < | 0.053950 | М | W | < | 0.000604 | | | | |
| M | Dy | < | 0.000201 | M | Mn | < | 0.000604 | М | Sb | < | 0.001208 | М | Y | < | 0.000201 | | | | |
| Μ | Er | < | 0.000201 | М | Мо | | 0.000009 | М | Sc | < | 0.000201 | М | 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 $4^{\circ} - 24^{\circ}$ C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 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 guestions 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

Ulya new

Certificate Approved By:

Michael Booth Director, Quality Control

Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Paul R Laine



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

Instructions for QATS Reference Material: ICP-AES ICS

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

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

- **APPLICATION:** For use with the CLP SFAM01.0 SOW and revisions.
 - **<u>CAUTION</u>**: Read instructions carefully before opening bottle(s) and proceeding with the analyses.

Contains Heavy Metals HAZARDOUS MATERIAL

Safety Data Sheets Available Upon Request

(A) SAMPLE DESCRIPTION

Enclosed is a set of one (1) or more bottles of Aqueous Reference Material, each composed of metals at various concentrations and prepared with nitrate salts and oxy-acids of the respective elements in a 5% nitric acid matrix. For the reference material source in reporting ICSA and ICSAB mixture use "USEPA". For the reference material lot number for the ICSA use "ICSA-1211" and for the ICSAB mixture use "ICSA-1211+ICSB-0710".

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

(B) BREAKAGE OR MISSING ITEMS

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

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

(C) ANALYSIS OF SAMPLES

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

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

Page 1 of 2

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



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



ICSA

M5126

M5127

M5128

M5129

M5130

Instructions for QATS Reference Material: ICP-AES ICS

Cd, Co, Cr, Cu, Mn, Ni, Pb, Tl, Se, V, and Zn. This instruction sheet provides the nominal values for ICP-AES Part A and Part B target analytes when diluted as directed.

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

ICSA-1211, Interferents: Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 2% v/v HNO₃. Analyze this ICSA solution by ICP-AES.

ICSB-0710, Analytes, mixed with ICSA-1211, Interferents: Pipet 10 mL of the ICSA solution and 10 mL of the ICSB solution into a 100 mL volumetric flask and dilute to volume with 2% v/v HNO₃. Analyze this ICSAB solution by ICP-AES.

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

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

| Table 1. | "CERTIFIE | | | ERENCE CH | IECK SAMPL CSB-0710 | E ICP-AES IO | CSA-1211, |
|----------|-----------|------------------|------------------------|-------------------------|-----------------------------|------------------------|-------------------------|
| Element | CRQL | Part A (µg/L) | Low Limit (µg/L) | High Limit (µg/L) | Part A +Part B (µg/L) | Low Limit (µg/L) | High Limit (µg/L) |
| AI | 200 | 255000 | 216000 | 294000 | 247000 | 209000 | 285000 |
| Sb | 60 | (0.0) | -60.0 | 60.0 | 618 | 525 | 711 |
| As | 10 | (0.0) | -10.0 | 10.0 | 104 | 88.4 | 120 |
| Ва | 200 | (6.0) | -194 | 206 | (537) | 337 | 737 |
| Be | 5.0 | (0.0) | -5.0 | 5.0 | 495 | 420 | 570 |
| Cd | 5.0 | (1.0) | -4.0 | 6.0 | 972 | 826 | 1120 |
| Са | 5000 | 245000 | 208000 | 282000 | 235000 | 199000 | 271000 |
| Cr | 10 | (52.0) | 42.0 | 62.0 | 542 | 460 | 624 |
| Со | 50 | (0.0) | -50.0 | 50.0 | 476 | 404 | 548 |
| Cu | 25 | (2.0) | -23.0 | 27.0 | 511 | 434 | 588 |
| Fe | 100 | 101000 | 85600 | 116500 | 99300 | 84400 | 114500 |
| Pb | 10 | (0.0) | -10.0 | 10.0 | (49.0) | 39.0 | 59.0 |
| Mg | 5000 | 255000 | 216000 | 294000 | 248000 | 210000 | 286000 |
| Mn | 15 | (7.0) | -8.0 | 22.0 | 507 | 430 | 584 |
| Ni | 40 | (2.0) | -38.0 | 42.0 | 954 | 810 | 1100 |
| Se | 35 | (0.0) | -35.0 | 35.0 | (46.0) | 11.0 | 81.0 |
| Ag | 10 | (0.0) | -10.0 | 10.0 | 201 | 170 | 232 |
| TI | 25 | (0.0) | -25.0 | 25.0 | (108) | 83.0 | 133 |
| V | 50 | (0.0) | -50.0 | 50.0 | 491 | 417 | 565 |
| Zn | 60 | (0.0) | -60.0 | 60.0 | 952 | 809 | 1095 |

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



Certificate of Analysis

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

130925

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Ti

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

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

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ICP Assay

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

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

3162a

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

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

4.0

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

November 02, 2021

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

11.2 Lot Expiration Date

- November 02, 2026

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Director, Quality Control

Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Paul R Line



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

Instructions for QATS Reference Material: ICP-AES ICS

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

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

- **APPLICATION:** For use with the CLP SFAM01.0 SOW and revisions.
 - **<u>CAUTION</u>**: Read instructions carefully before opening bottle(s) and proceeding with the analyses.

Contains Heavy Metals HAZARDOUS MATERIAL

Safety Data Sheets Available Upon Request

(A) SAMPLE DESCRIPTION

Enclosed is a set of one (1) or more bottles of Aqueous Reference Material, each composed of metals at various concentrations and prepared with nitrate salts and oxy-acids of the respective elements in a 5% nitric acid matrix. For the reference material source in reporting ICSA and ICSAB mixture use "USEPA". For the reference material lot number for the ICSA use "ICSA-1211" and for the ICSAB mixture use "ICSA-1211+ICSB-0710".

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

(B) BREAKAGE OR MISSING ITEMS

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

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

(C) ANALYSIS OF SAMPLES

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

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

Page 1 of 2

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



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



ICSA

M5126

M5127

M5128

M5129

M5130

Instructions for QATS Reference Material: ICP-AES ICS

Cd, Co, Cr, Cu, Mn, Ni, Pb, Tl, Se, V, and Zn. This instruction sheet provides the nominal values for ICP-AES Part A and Part B target analytes when diluted as directed.

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

ICSA-1211, Interferents: Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 2% v/v HNO₃. Analyze this ICSA solution by ICP-AES.

ICSB-0710, Analytes, mixed with ICSA-1211, Interferents: Pipet 10 mL of the ICSA solution and 10 mL of the ICSB solution into a 100 mL volumetric flask and dilute to volume with 2% v/v HNO₃. Analyze this ICSAB solution by ICP-AES.

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

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

| Table 1. | "CERTIFIE | | | ERENCE CH | IECK SAMPL CSB-0710 | E ICP-AES IO | CSA-1211, |
|----------|-----------|------------------|------------------------|-------------------------|-----------------------------|------------------------|-------------------------|
| Element | CRQL | Part A (µg/L) | Low Limit (µg/L) | High Limit (µg/L) | Part A +Part B (µg/L) | Low Limit (µg/L) | High Limit (µg/L) |
| AI | 200 | 255000 | 216000 | 294000 | 247000 | 209000 | 285000 |
| Sb | 60 | (0.0) | -60.0 | 60.0 | 618 | 525 | 711 |
| As | 10 | (0.0) | -10.0 | 10.0 | 104 | 88.4 | 120 |
| Ва | 200 | (6.0) | -194 | 206 | (537) | 337 | 737 |
| Be | 5.0 | (0.0) | -5.0 | 5.0 | 495 | 420 | 570 |
| Cd | 5.0 | (1.0) | -4.0 | 6.0 | 972 | 826 | 1120 |
| Са | 5000 | 245000 | 208000 | 282000 | 235000 | 199000 | 271000 |
| Cr | 10 | (52.0) | 42.0 | 62.0 | 542 | 460 | 624 |
| Со | 50 | (0.0) | -50.0 | 50.0 | 476 | 404 | 548 |
| Cu | 25 | (2.0) | -23.0 | 27.0 | 511 | 434 | 588 |
| Fe | 100 | 101000 | 85600 | 116500 | 99300 | 84400 | 114500 |
| Pb | 10 | (0.0) | -10.0 | 10.0 | (49.0) | 39.0 | 59.0 |
| Mg | 5000 | 255000 | 216000 | 294000 | 248000 | 210000 | 286000 |
| Mn | 15 | (7.0) | -8.0 | 22.0 | 507 | 430 | 584 |
| Ni | 40 | (2.0) | -38.0 | 42.0 | 954 | 810 | 1100 |
| Se | 35 | (0.0) | -35.0 | 35.0 | (46.0) | 11.0 | 81.0 |
| Ag | 10 | (0.0) | -10.0 | 10.0 | 201 | 170 | 232 |
| TI | 25 | (0.0) | -25.0 | 25.0 | (108) | 83.0 | 133 |
| V | 50 | (0.0) | -50.0 | 50.0 | 491 | 417 | 565 |
| Zn | 60 | (0.0) | -60.0 | 60.0 | 952 | 809 | 1095 |

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



QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY "An ISO 9001:2015 Certified Program" R : 以120 2 [

Instructions for QATS Reference Material: Inorganic ICV Solutions

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

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

- APPLICATION: For use with the CLP SFAM01.0 SOW and revisions.
 - **<u>CAUTION</u>**: Read instructions carefully before opening bottle(s) and proceeding with the analyses.

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

> Safety Data Sheets Available Upon Request



(A) SAMPLE DESCRIPTION

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

(B) BREAKAGE OR MISSING ITEMS

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

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

(C) ANALYSIS OF SAMPLES

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

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

RMs ICV 1, 5, 6 SFAM.docx

Page 1 of 2

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



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

AP11MInstructions for QATS Reference Material: Inorganic ICV SolutionsICV1-1014For 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.ICV5-0415For 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.ICV6-0400For the analysis of cyanide, use a 100-fold dilution by pipetting 1 mL of the ICV6
concentrate into a 100 mL volumetric flask and dilute to volume with Type II water.
Distill this solution along with the samples before analysis. The cyanide concentrate
is prepared from K3Fe(CN)6, Type II water, and 0.1 % sodium hydroxide, and will
decompose rapidly if exposed to light.

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

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

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

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

| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | By: Lawrence Barr By: Lawrence Barr Jy: Pedro L. Renta SDS Info. (Solvent Safety Info. | 7790-69-4 | | Printed: 1/18/2023, 4:01:43 PM |
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| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Lot Number: Description: Expiration Date: Thilum (070622 Recommended Storage: Nominal Concentration (µg/mL): Nominal Concentration (µg/mL): Neight shown below was diluted to (mL): Compound RM# Number | 1. Lithium nitrate (Li) IN01 | [1] Spectrum No.1 1.0E6 5.0E5 m/z-> 10 500 500 500 10 10 10 10 10 10 10 10 10 | |

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



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

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

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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.
- * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994). All Standards should be stored with caps tight and under appropriate laboratory conditions.

Lot # 070622 Part # 57103

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| Part # | 57115 | | Lot # 041723 | 1723 | | | | | | | 2 of 2 | of 2 | | | | | Print | Printed: 2/8/2024, 5:01:22 PM | 24, 5:0 |)1:22 PM | |

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| m/z-> | N. 01 00 | 5. O M 8 | m/z-> | 5.0E7 | 1.0E8 | m/z-> | N. 00 00 | 5.0E5 | Ammonium sulfate (S) | Compound | NIST Test Number: 6UTB Weight shown below was diluted to (mL): | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): | Part Number: Lot Number: Description: | 800-368-1131 www.absolutestandards.com |
|---------|----------------|-------------------|----------|-------|-------|-------------------------------------------|------------------------------------------------------|---------------------------------------|------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| 210 | | | 110 | | | 10 | | [1] Spectrum No.1 | IN117 | RM# | umber: low was dilute | n Date: lorage: lg/mL): | <u>Part Number:</u> Lot Number: Description: | |
| 220 | | | 120 | | | NO | | - | IN117 SLBR7225V | Lot Number C | GUTB d to (mL): | 122926 Ambient (20 °C) 1000 | <u>57016</u> 122923 Sulfur (S) | |
| 230 | | | 130 | | 9 | 30 | | 33.603 80 | 1000 | Nominal F Conc. (µg/mL) | 4000.0 5 | ĉ | | <i>b</i> |
| N 40 | | | 140 | | | b | den gegen og gener første kommen och som en forse og | 33.603 sec]:57016.D# [Count] [Linear] | 99.9 0.10 24.3 | Purity Uncertainty Assay (%) Purity (%) (%) | 5E-05 Balance Uncertainty 0.06 Flask Uncertainty | | Solvent: | Certified Re |
| N 80 | | | 100 | | | 50 | | Count] [Lin | .3 16.4979 | say Target 6) Weight (g) | Y | | Lot # 122923 | fere 12 |
| N80 | | | 0 | | | 8 | | 9 9 7 | 16.4980 | Actual Weight (g) | | | ASTM Type 1 Water | aterial CRM |
| | | | 170 | | | 70 | | | 1000.0 | Actual (Conc. (µg/mL) | 5 | | 1 | rm 167816- |
| | | | 180 | | | 80 | | | 2.0 77 | Expanded Uncertainty +/- (µg/mL) | Reviewed By: | M | Formulated By: | |
| | | | | | | Complete and complete | | | 7783-20-2 | (Solvent : CAS# 05 | Pedr | \$ | a and a second sec | |
| | | | 190 | | | 0 | | | NA | SDS Information It Safety Info. On Attac OSHA PEL (TWA) | Pedro L. Rentas | e la | Benson Chan | http |
| | | | 2000 | | | 100 | | | ort-rat 4250mg/kg 3181 | SDS Information (Solvent Safety Info. On Attached pg.) * OSHA PEL (TWA) LD50 | 122923 | 7 | 100002 | AR-1539 Certificate Number https://Absolutestandards.com |

1 of 2

| Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994). | * All standard containers are meticulously cleaned prior to use. * All standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). * Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated. * All standards should be stored with caps tight and under appropriate laboratory conditions. * 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 | 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 measurement of all standards | | Homogeneity: No heterogeneity was observed in the preparation of this standard. | Physical Characterization: | (T) = Target analyte | AI A002 Cd A002 Pr A002 Pr | Trace Metals Verification by ICP-MS (µg/mL) | Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
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| 30) | | | 5 2 | I She | Certified by: | | MI MI MI 40.02 | | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |

2 of 2

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| | - | 260 | 250 | 240 | 230 | | 220 | 210 | m/z-> |
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| | | | | | | | | | 2.0厘5 |
| 180 190 200 | 170 | 160 | 150 | 140 | 130 | р. 9 | 120 | 110 | m/z-> |
| | | | | | | | | | 2,5E |
| | | | | | | | | | 5.0E5 |
| 80 80 100 | 70 | eo | 50 | 40 | 8 | magan Raji Anana ya Anany | N | 10 | m/z-> |
| | | | | | | | | | 1000 |
| | | ear) | ount] [Lin | 24.004 sec];58116,D# [Count] [Linear] | ¢ sec];58 | [24.00 | | [1] Spectrum No.1 | 2000 |
| 20.0 7763-20-2 NA orf-rat 4250mg/kg 3181 | 10000.1 | 82,4682 | 82.4675 | 0.10 24.3 | 99,9 | 10000 | IN117 SLBR7225V | IN11 | 1. Ammonium sulfate (S) |
| Expanded SDS Information Uncertainty (Solvent Safety Info. On Attached pg.) NIST +/- (ug/mL) CAS# OSHA PEL (TWA) LDSO SRM | (g) Conc. (µg/mL) | Actual Weight (g) | Target Weight (g) | Uncertainty Assay Purity (%) (%) | Purity (%) | Nominal Conc. (µg/mL) | Lot. Number | RM# | Compound |
| i By: Ped | [F | | | Balance Uncertainty Flask Uncertainty | 0.058 | 1999.48 | led to (mL): | Weight shown below was diluted to (mL): | Weight show |
| Lawrence barry | 1 1 | | | | | 20 °C) | 071126 Ambient (20 °C) 10000 Sum | Expiration Date: nended Storage: htration (µg/mL): %T Test Number: | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Teet Number |
| around Bring | Type 1 Water | ASTM Ty | Lot# 071123 | Solvent: | | E) | 57116 071123 Sulfur (S) | <u>PORT:</u> Part Number: Lot Number: Description: | CERTIFIED WEIGHT REPORT: Part N Lot N Desc |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | CRM | | ference M | Certified Reference Material | R a | | | om | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
| | | | | | | | | And in case of the local division of the loc | |

| 800-368-1131 www.absolutestandards.com | | 0 | Certified Reference Material CRM | nce Material C | RM | | | • | ANAB ISO 1: AR-1539 Ce https://Absolut | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-----------|------------|----------------------------------------------|------------------------------------------------------------------------------------------|
| Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | ictively Coupled | Plasma Mass Sp | ectrometry (IC | P-MS): | | | | | | |
| | | Trace Metals | | Verification by ICP-MS | IS (µg/mL) | | | | | |
| AI <0.02 Cd <0.02 | Dv 40.02 | A M | -12 | | | a dista div. | ALL MERCY | | A STREET STREET STREET | |
| 40.02 Ca | | 40.02 | 40.02 40.02 | Ni <0.02 Nb <0.02 | Pr <0.02 Re <0.02 | Si Se | | | | A 6.3 |
| 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | Gd <0.02 | In <0.02 N | Mg <0.01 C | | | | | | < 0 | <0.02 |
| 40.02 | Ga 40.02 | Fe <0.2 Hg | A A 3 12 | 8 8 | | | 12 1 | | 40.02 Y 40.02 | |
| B (UUZ CI 40,02 | Au <0.02 | <0.02 | <0.02 | | Sc <0.02 | Ta o | <0.02 | | 40.02 21 21 40 | 40.02 |
| Physical Characterization: | | | (T)= Target analyte | alyte | | | | ۲ ۲ | Certified by: | |
| Homogeneity: No heterogeneity was observed in the preparation of this standard. | oserved in the prepa | ation of this standard | | | | | | | | 1 |
| | | | | | | | (| the second | P.S. | |
| * The certified value is the concentration calculated from gravimetric and volumetric measurements * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity in the preparation of all standards. * All standard containers are meticulously cleaned prior to use the preparation of the preparation of all standards. | ntration calculate ionized water, ca | d from gravimetri librated Class A g | c and volumetric lassware and the | c measurement highest purity | s unless otherwise stated. raw materials are used in | ise state are used i | 5.6 | | | |
| * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. | trically using bala % of the stated | value, unless othe | brated with weighwise stated. | phts traceable : | to NIST (see ab | ove). | | | | |
| * Uncertainty Reference: Taylor, Measurement Result," NIST Tec | vith caps tight ar B.N. and Kuyat, (hnical Note 1297 | id under appropria 2.E., "Guidelines fc , U.S. Governmen | ite laboratory co r Evaluating and t Printing Office, | I Expressing the Washington, D | ⁹ Uncertainty of NIST).C. (1994). | F NIST | | | | |
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| * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. * All standards should be stored with caps tight and under appropriate laboratory conditions. * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D. | itrically using bails bails of the stated with caps tight ar B.N. and Kuyat, C hnical Note 1297 | prior to use. ances that are cali value, unless othe d under appropria 2.E., "Guidelines fo , U.S. Governmen | brated with weig rwise stated. re laboratory co or Evaluating and t Printing Office, t Printing Office, | ghts traceable . onditions. I Expressing the Washington, D | to NiST (see ab 3 Uncertainty o).C. (1994). | ove). F NIST | | | | |

2 of 2

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| Image: | TT/Z-> | 2500 | 5000 | m/z-> | 500 | 1000 | N.00 M.4 | 5.0E4 | 1. Ammonium dihydrogen phosphate (P) IN008 PvœzoisAi | Compound | Weight shown below was diluted to (mL): | NIST Test Number: | Recommended Storage: Nominal Concentration (ug/mL): | Expiration Date: | Lot Number: Description: | CERTIFIED WEIGHT REPORT: Part Number: | www.absolutestandards.com |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------|-------|-----|----------|-------------|-------|------------------------------------------------------|------------------------------------------------|-----------------------------------------|---------------------------|--------------------------------------------------------|------------------|-----------------------------|------------------------------------------|---------------------------|
| ric Acid Fic Acid Formulated By: Formulated | | | | 120 | | 20 | | | | Lot Number | | | | | | | R |
| ric Acid Fic Acid Formulated By: Formulated | 240 | | | 140 | | 40 | | | 89.899 0.10 27.5 7.275 | Purity Uncertainty Assay (%) Purity (%) (%) | 0.058 Flask Uncertainty | 5E-05 Balance Uncertainty | | | | | 00 |
| Prieved By: Programity Procertainty Procentainty Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory Processory P | | | | | | | | | .2730 | Actual Actual Weight (g) Conc. (µg/mL) | | | | Nitric Acid | | | M5820 |
| | | | | 180 | | | | | 7722-76-1 |) CAS | | | Here ten | Lawrence | forme (| | ٩ |

| | 01:19 PM | 024, 5:C | Printed: 2/8/2024, 5:01:19 PM | Print | | | | | | 2 of 2 | | | | | | | 123 | Lot # 091123 | Lot | 57015 | Part # |
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| | | | | | e). IST | rials are e abov ity of N | ity raw materials are us le to NIST (see above). the Uncertainty of NIST , D.C. (1994). | able to g the l on, D.(| highest p ts trace; ditions. Xpressin Vashingt | id the f id. yry con y and E ffice, V | sware ar ated with ise state laborate ivaluation rinting O | A glas calibr otherw opriate is for E ment P | ed Class to use. that are , unless (der appro Guideline Governr | calibrat ad prior alances d value and un , C.E., " 97, U.S | d water, sly clean y using b y using b the state the state hps tight nd Kuyat Note 12 | eionize Is. ticulou: ticulou: 5% of 1 S% of 1 B.N. a chnical | Purmed 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). | 8.2 me of all s repared ertifed ertifed prence: esult," | acids, 1 aration s are pi s are ci ards sh nent Refe | Purmed acids, 18.2 meg the preparation of all si All standard containers Standards are prepared Standards are certifed (All Standards should be Uncertainty Reference: Measurement Result," Measurement Result, " Measurement Result," | * * * * * * |
| · | A. | 1º | in the second se | (| stated | henwise | inless of | nents | neasurer | netric n | nd volur | letric a | m gravim | ted fro | n calcula | intratio | The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated | ue is th | fied val | he certi | + + 7 |
| | y: | Certified by: | Ca | | | | | | | | | wland | of this stan | paration | in the pre | observed | r nysical Unaracterization: Homogeneity: No heterogeneity was observed in the preparation of this standard | Sterrizal eterogen | y: No he | r nysical Characterization: Homogeneity: No heterogeneity | Ho |
| | | | | | | | | | alyte | (T) = Target analyte | () = () | | | | | | | | | | Į |
| | 4 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 | 22 × 2 × C × | 4 4 4 4 4 4 4 4 5 5 5 5 5 5 5 5 5 5 5 5 | ෘ망칰랔극 乌 역 | 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | Ta Sr Nage Sc | 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | Sc Sm | 40.22 | * * * * \$ Q N N | 400 400 400 400 400 400 400 400 400 400 | LL Mg Mg Nd | 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | ****** | 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 | A C C C E F | 4 4 8 8 4 4 8 8 4 4 8 8 8 8 8 8 8 8 8 8 | 5 S S S S S S S | | | B B B B A S A |
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| | | | | | | | | | MS): | (ICP-) | rometry | Spect | na Mass | d Plası | Couple | ıctively | Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | nalysis | ntal Ar | strume | = |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | VAB ISO 17(R-1539 Certi s://Absolutes | http: A | | | | | 2 | ial CRM | e Mater | ferenc | Certified Reference Material | Cert | | | V | | Inc. | ards, Is.com | standard | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | Absolute 800-368-1131 www.absolute |
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QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY "An ISO 9001:2015 Certified Program"

Instructions for QATS Reference Material: Inorganic ICV Solutions

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

These instructions are for advisory purposes only. If any apparent conflict exists between these NOTE: 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 $\frac{1}{2}$ M5528 - 3 M5528 - 3 M553 - 3130 123 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

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

RMs ICV 1, 5, 6 SFAM (1)

Page 1 of 2

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



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



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

| APTIM | Instructions for a reason |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ICV1-1014 | Instructions for QATS Reference Material: Inorganic ICV Solutions |
| | For ICP-MS analysis, use a 50-fold dilution by pipetting 2 mL of the ICV1 concentrate into a 100 mL volumetric flask and dilute to volume with 1% (v/v) nitric acid. |
| ICV5-0415 | For the cold vapor analysis of mercury by AA, use a 100-fold dilution by pipetting 1 mL of the ICV5 concentrate into a 100 mL volumetric flask and dilute to volume with 2% (v/v) nitric acid. The ICV5 concentrate is prepared in 0.05% (w/v) K ₂ Cr ₂ O ₇ and 5% (v/v) nitric acid. |
| | For the analysis of cyanide, use a 100-fold dilution by pipetting 1 mL of the ICV6 concentrate into a 100 mL volumetric flask and dilute to volume with Type II water. Distill this solution along with the samples before analysis. The cyanide concentrate is prepared from $K_3Fe(CN)_6$, Type II water, and 0.1 % sodium hydroxide, and will decompose rapidly if exposed to light. |
| | |

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

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

| | ICV1-1014 | |
|---------|--------------------------------------------------|--------------------------|
| Element | Concentration (µg/L) (after 10-fold dilution) | Concentration (µg/L) |
| AI | 2500 | (after 50-fold dilution) |
| Sb | 1000 | 500 |
| As | 1000 | 200 |
| Ba | 520 | 200 |
| Be | 510 | 100 |
| Cd | 510 | 100 |
| Ca | 10000 | 100 |
| Cr | 520 | 2000 |
| Co | 520 | 100 |
| Cu | 510 | 100 |
| Fe | 10000 | 100 |
| Pb | 1000 | 2000 |
| Mg | 6000 | 200 |
| Mn | 520 | 1200 |
| Ni | 530 | 100 |
| K | 9900 | 110 |
| Se | 1000 | 2000 |
| Ag | 250 | 200 |
| Na | 10000 | 50 |
| TI | 1000 | 2000 |
| V | 500 | 210 |
| 2n | 1000 | 100 |
| | 1000 | 200 |

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

Nitric Acid 69% CMOS





M5963 M5964 M5965 M5966 M5967 M5968

Material No.: 9606-03 Batch No.: 24B1362001 Manufactured Date: 2024-01-25 Retest Date: 2029-01-23 Revision No.: 0

Certificate of Analysis

| Assay (HNO2) $69.0 - 70.0 \%$ 69.6% AppearancePasses TestPasses TestColor (APHA) ≤ 10 5Residue after Ignition $\leq 2 ppm$ <1 ppmChioride (C1) $\leq 0.08 ppm$ <0.03 ppmPhosphate (PO4) $\leq 0.2 ppm$ <0.2 ppmSulfate (SO4) $\leq 0.2 ppm$ <0.2 ppmTrace Impurities - Aluminum (AI) $\leq 40.0 ppb$ <1.0 ppbArsenic and Antimony (as As) $\leq 5.0 ppb$ <2.0 ppbTrace Impurities - Barium (Ba) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Barium (Bi) $\leq 20.0 ppb$ <1.0 0pbTrace Impurities - Barium (Cd) $\leq 50 ppb$ <1.0 0pbTrace Impurities - Cadmium (Cd) $\leq 50 ppb$ <1.0 0pbTrace Impurities - Cadmium (Cd) $\leq 50 ppb$ <1.0 ppbTrace Impurities - Cadmium (Ca) $\leq 50.0 ppb$ <1.0 ppbTrace Impurities - Calium (Ca) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Cobatt (Co) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Coper (Cu) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colatt (Co) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colat (Ca) $\leq 20 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 20 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 20 ppb$ <1.0 ppbTrace Impurities - | Test | Specification | Result |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------|-----------|
| AppearancePasses TestPasses TestColor (APHA) ≤ 10 5Residue after Ignition ≤ 2 ppm <1 ppmChloride (C) ≤ 0.08 ppm <0.03 ppmPhosphate (PO4) ≤ 0.10 ppm <0.03 ppmSulfate (SO4) ≤ 0.2 ppm <0.2 ppmTrace Impurities - Aluminum (A) ≤ 40.0 ppb <1.0 ppbArsenic and Antimony (as As) ≤ 5.0 ppb <2.0 ppbTrace Impurities - Barium (Ba) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Beryllium (Be) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Barium (Ca) ≤ 50.0 ppb <5.0 ppbTrace Impurities - Cadinum (Ca) ≤ 50.0 ppb <1.0 ppbTrace Impurities - Cadinum (Ca) ≤ 50.0 ppb <1.0 ppbTrace Impurities - Cadinum (Ca) ≤ 30.0 ppb <1.0 ppbTrace Impurities - Cadinum (Ca) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Cadinum (Ca) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Cobalt (Co) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Collium (Ga) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Gold (Au) ≤ 20 ppb <1.0 ppbTrace Impurities - Gold (Au) ≤ 20.0 ppb <1.0 ppbTrace Impurities - Gold (Au) ≤ 20.0 ppb <1.0 ppbTrace Impurities - Gold (Au) ≤ 20.0 ppb <1.0 ppbTrace Impurities - Icadinum (Ge) ≤ 20.0 ppb <1.0 ppbTrace Impurities - Collou (Ce) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Collou (Ce) <td>Assay (HNO3)</td> <td>69.0 - 70.0 %</td> <td></td> | Assay (HNO3) | 69.0 - 70.0 % | |
| Color (APHA)≤ 105Residue after ignition≤ 2 ppm< 1 ppm | Appearance | Passes Test | |
| Residue after Ignition≤ 2 ppm< 1 ppmChloride (Cl)≤ 0.08 ppm< 0.03 ppm | Color (APHA) | | |
| Chloride (Cl)≤ 0.08 ppm< 0.03 ppmPhosphate (PO4)≤ 0.10 ppm< 0.03 ppm | Residue after Ignition | ≤ 2 ppm | |
| Phosphate (PO4)≤ 0.10 ppm< 0.03 ppmSulfate (SO4)≤ 0.2 ppm< 0.2 ppm | Chloride (Cl) | | |
| Sulfate (SO4)≤ 0.2 ppm< 0.2 ppmTrace Impurities - Aluminum (Al)≤ 40.0 ppb< 1.0 ppb | Phosphate (PO4) | | |
| Trace Impurities - Aluminum (AI)≤ 40.0 ppb< 1.0 ppbArsenic and Antimony (as As)≤ 5.0 ppb< 2.0 ppb | Sulfate (SO4) | ≤ 0.2 ppm | |
| Arsenic and Antimony (as As) \leq 5.0 ppb $<$ 2.0 ppbTrace Impurities - Barium (Ba) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Beryllium (Be) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Bismuth (Bi) \leq 20.0 ppb $<$ 10.0 ppbTrace Impurities - Boron (B) \leq 10.0 ppb $<$ 5.0 ppbTrace Impurities - Cadmium (Cd) \leq 50 ppb $<$ 1 ppbTrace Impurities - Calcium (Ca) \leq 50.0 ppb $<$ 1.0 ppbTrace Impurities - Cobalt (Co) \leq 30.0 ppb $<$ 1.0 ppbTrace Impurities - Coper (Cu) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Coper (Cu) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Gallium (Ga) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Gold (Au) \leq 20 ppb $<$ 10 ppbTrace Impurities - Gold (Au) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Iron (Fe) \leq 40.0 ppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impu | Trace Impurities – Aluminum (Al) | | |
| Trace Impurities - Barium (Ba) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Beryllium (Be) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Bismuth (Bi) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Boron (B) $\leq 10.0 \text{ ppb}$ $< S.0 \text{ ppb}$ Trace Impurities - Cadmium (Cd) $\leq 50 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Calcium (Ca) $\leq 50.0 \text{ ppb}$ $< 0.2 \text{ ppb}$ Trace Impurities - Chomium (Cr) $\leq 30.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Cobalt (Co) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Coper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Linkium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Arsenic and Antimony (as As) | ≤ 5.0 ppb | |
| Trace Impurities - Beryllium (Be)≤ 10.0 ppb< 1.0 ppbTrace Impurities - Bismuth (Bi)≤ 20.0 ppb< 10.0 ppb | Trace Impurities – Barium (Ba) | ≤ 10.0 ppb | |
| Trace Impurities - Bismuth (Bi) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Boron (B) $\leq 10.0 \text{ ppb}$ $< 5.0 \text{ ppb}$ Trace Impurities - Cadmium (Cd) $\leq 50 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Calcium (Ca) $\leq 50.0 \text{ ppb}$ $< 0.2 \text{ ppb}$ Trace Impurities - Chromium (Cr) $\leq 30.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Cobalt (Co) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Coper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 50 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Beryllium (Be) | ≤ 10.0 ppb | |
| Trace Impurities - Boron (B)≤ 10.0 ppb< 5.0 ppbTrace Impurities - Cadmium (Cd)≤ 50 ppb< 1 ppb | Trace Impurities – Bismuth (Bi) | ≤ 20.0 ppb | |
| Trace Impurities - Cadmium (Cd) \leq 50 ppb< 1 ppbTrace Impurities - Calcium (Ca) \leq 50.0 ppb< 0.2 ppb | Trace Impurities – Boron (B) | ≤ 10.0 ppb | |
| Trace Impurities - Calcium (Ca) \leq 50.0 ppb $<$ 0.2 ppbTrace Impurities - Chromium (Cr) \leq 30.0 ppb $<$ 1.0 ppbTrace Impurities - Cobalt (Co) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Copper (Cu) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Gallium (Ga) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Germanium (Ge) \leq 20 ppb $<$ 10 ppbTrace Impurities - Gold (Au) \leq 20 ppb $<$ 5 ppbHeavy Metals (as Pb) \leq 100 ppb $<$ 50 ppbTrace Impurities - Iron (Fe) \leq 40.0 ppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20.0 ppb $<$ 1.0 ppbTrace Impurities - Lithium (Li) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Magnesium (Mg) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 20 ppb $<$ 2.0 ppb <td>Trace Impurities – Cadmium (Cd)</td> <td>≤ 50 ppb</td> <td></td> | Trace Impurities – Cadmium (Cd) | ≤ 50 ppb | |
| Trace Impurities - Chromium (Cr) $\leq 30.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Cobalt (Co) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Copper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Germanium (Ge) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 50 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Mickel (Ali) $< 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Calcium (Ca) | ≤ 50.0 ppb | |
| Trace Impurities - Cobalt (Co)≤ 10.0 ppb< 1.0 ppbTrace Impurities - Copper (Cu)≤ 10.0 ppb< 1.0 ppb | Trace Impurities - Chromium (Cr) | ≤ 30.0 ppb | |
| Trace Impurities - Copper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Germanium (Ge) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 5 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Cobalt (Co) | ≤ 10.0 ppb | |
| Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Germanium (Ge) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 5 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Copper (Cu) | ≤ 10.0 ppb | |
| Trace Impurities - Germanium (Ge)≤ 20 ppb< 10 ppbTrace Impurities - Gold (Au)≤ 20 ppb< 5 ppb | Trace Impurities – Gallium (Ga) | ≤ 10.0 ppb | |
| Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 5 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities – Germanium (Ge) | ≤ 20 ppb | |
| Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Gold (Au) | ≤ 20 ppb | |
| Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Maganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Maganese (Mn) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Heavy Metals (as Pb) | ≤ 100 ppb | |
| Trace Impurities – Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities – Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities – Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities – Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities – Minganese (Mn) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities – Iron (Fe) | ≤ 40.0 ppb | |
| Trace Impurities – Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities – Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities – Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities – Nickel (Ni) $\geq 0.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Lead (Pb) | ≤ 20.0 ppb | |
| Trace Impurities - Magnesium (Mg)≤ 20 ppb< 1 ppbTrace Impurities - Manganese (Mn)≤ 10.0 ppb< 1.0 ppb | Trace Impurities – Lithium (Li) | ≤ 10.0 ppb | |
| Trace Impurities - Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Nickel (Ni) | Trace Impurities – Magnesium (Mg) | ≤ 20 ppb | |
| Trace Impurities - Nickel (Ni) | Trace Impurities – Manganese (Mn) | ≤ 10.0 ppb | |
| | Trace Impurities - Nickel (Ni) | | < 5.0 ppb |

>>> Continued on page 2 >>>

For questions on this Certificate of Analysis please contact Technical Services at 855 282 6867 or +1 610 386 1700





Material No.: 9606-03 Batch No.: 24B1362001

| Test | Specification | Result |
|-------------------------------------|---------------|------------|
| Trace Impurities – Niobium (Nb) | ≤ 50.0 ppb | < 1.0 ppb |
| Trace Impurities – Potassium (K) | ≤ 50 ppb | < 10 ppb |
| Trace Impurities – Silicon (Si) | ≤ 50 ppb | < 10 ppb |
| Trace Impurities – Silver (Ag) | ≤ 20.0 ppb | < 1.0 ppb |
| Trace Impurities – Sodium (Na) | ≤ 150.0 ppb | < 5.0 ppb |
| Trace Impurities – Strontium (Sr) | ≤ 30.0 ppb | < 1.0 ppb |
| Trace Impurities – Tantalum (Ta) | ≤ 10.0 ppb | < 5.0 ppb |
| Trace Impurities – Thallium (TI) | ≤ 10.0 ppb | < 5.0 ppb |
| Trace Impurities – Tin (Sn) | ≤ 20.0 ppb | < 10.0 ppb |
| Trace Impurities – Titanium (Ti) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities – Vanadium (V) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities - Zinc (Zn) | ≤ 20.0 ppb | < 1.0 ppb |
| Trace Impurities - Zirconium (Zr) | ≤ 10.0 ppb | < 1.0 ppb |
| Particle Count - 0.5 µm and greater | ≤ 60 par/ml | 3 par/ml |
| Particle Count - 1.0 µm and greater | ≤ 10 par/ml | 1 par/ml |

Nitric Acid 69% CMOS





Material No.: 9606-03 Batch No.: 24B1362001

| Test | | | _ |
|------|---------------|--------|---|
| Test | Specification | Decult | |
| | Specification | Result | |
| | | | |

For Microelectronic Use

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

Kennet, leel

Ken Koehnlein Sr. Manager, Quality Assurance

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M5963 M5964 M5965 M5966 M5967 M5968

Material No.: 9606-03 Batch No.: 24B1362001 Manufactured Date: 2024-01-25 Retest Date: 2029-01-23 Revision No.: 0

Certificate of Analysis

| Assay (HNO2) $69.0 - 70.0 \%$ 69.6% AppearancePasses TestPasses TestColor (APHA) ≤ 10 5Residue after Ignition $\leq 2 ppm$ <1 ppmChioride (C1) $\leq 0.08 ppm$ <0.03 ppmPhosphate (PO4) $\leq 0.2 ppm$ <0.2 ppmSulfate (SO4) $\leq 0.2 ppm$ <0.2 ppmTrace Impurities - Aluminum (AI) $\leq 40.0 ppb$ <1.0 ppbArsenic and Antimony (as As) $\leq 5.0 ppb$ <2.0 ppbTrace Impurities - Barium (Ba) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Barium (Bi) $\leq 20.0 ppb$ <1.0 0pbTrace Impurities - Barium (Cd) $\leq 50 ppb$ <1.0 0pbTrace Impurities - Cadmium (Cd) $\leq 50 ppb$ <1.0 0pbTrace Impurities - Cadmium (Cd) $\leq 50 ppb$ <1.0 ppbTrace Impurities - Cadmium (Ca) $\leq 50.0 ppb$ <1.0 ppbTrace Impurities - Calium (Ca) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Cobatt (Co) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Coper (Cu) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colatt (Co) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colat (Ca) $\leq 20 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 20 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 10.0 ppb$ <1.0 ppbTrace Impurities - Colatt (Ca) $\leq 20 ppb$ <1.0 ppbTrace Impurities - | Test | Specification | Result |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------|-----------|
| AppearancePasses TestPasses TestColor (APHA) ≤ 10 5Residue after Ignition ≤ 2 ppm <1 ppmChloride (C) ≤ 0.08 ppm <0.03 ppmPhosphate (PO4) ≤ 0.10 ppm <0.03 ppmSulfate (SO4) ≤ 0.2 ppm <0.2 ppmTrace Impurities - Aluminum (A) ≤ 40.0 ppb <1.0 ppbArsenic and Antimony (as As) ≤ 5.0 ppb <2.0 ppbTrace Impurities - Barium (Ba) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Beryllium (Be) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Barium (Ca) ≤ 50.0 ppb <5.0 ppbTrace Impurities - Cadinum (Ca) ≤ 50.0 ppb <1.0 ppbTrace Impurities - Cadinum (Ca) ≤ 50.0 ppb <1.0 ppbTrace Impurities - Cadinum (Ca) ≤ 30.0 ppb <1.0 ppbTrace Impurities - Cadinum (Ca) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Cadinum (Ca) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Cobalt (Co) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Collium (Ga) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Gold (Au) ≤ 20 ppb <1.0 ppbTrace Impurities - Gold (Au) ≤ 20.0 ppb <1.0 ppbTrace Impurities - Gold (Au) ≤ 20.0 ppb <1.0 ppbTrace Impurities - Gold (Au) ≤ 20.0 ppb <1.0 ppbTrace Impurities - Icadinum (Ge) ≤ 20.0 ppb <1.0 ppbTrace Impurities - Collou (Ce) ≤ 10.0 ppb <1.0 ppbTrace Impurities - Collou (Ce) <td>Assay (HNO3)</td> <td>69.0 - 70.0 %</td> <td></td> | Assay (HNO3) | 69.0 - 70.0 % | |
| Color (APHA)≤ 105Residue after ignition≤ 2 ppm< 1 ppm | Appearance | Passes Test | |
| Residue after Ignition≤ 2 ppm< 1 ppmChloride (Cl)≤ 0.08 ppm< 0.03 ppm | Color (APHA) | | |
| Chloride (Cl)≤ 0.08 ppm< 0.03 ppmPhosphate (PO4)≤ 0.10 ppm< 0.03 ppm | Residue after Ignition | ≤ 2 ppm | |
| Phosphate (PO4)≤ 0.10 ppm< 0.03 ppmSulfate (SO4)≤ 0.2 ppm< 0.2 ppm | Chloride (Cl) | | |
| Sulfate (SO4)≤ 0.2 ppm< 0.2 ppmTrace Impurities - Aluminum (Al)≤ 40.0 ppb< 1.0 ppb | Phosphate (PO4) | | |
| Trace Impurities - Aluminum (AI)≤ 40.0 ppb< 1.0 ppbArsenic and Antimony (as As)≤ 5.0 ppb< 2.0 ppb | Sulfate (SO4) | ≤ 0.2 ppm | |
| Arsenic and Antimony (as As) \leq 5.0 ppb $<$ 2.0 ppbTrace Impurities - Barium (Ba) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Beryllium (Be) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Bismuth (Bi) \leq 20.0 ppb $<$ 10.0 ppbTrace Impurities - Boron (B) \leq 10.0 ppb $<$ 5.0 ppbTrace Impurities - Cadmium (Cd) \leq 50 ppb $<$ 1 ppbTrace Impurities - Calcium (Ca) \leq 50.0 ppb $<$ 1.0 ppbTrace Impurities - Cobalt (Co) \leq 30.0 ppb $<$ 1.0 ppbTrace Impurities - Coper (Cu) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Coper (Cu) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Gallium (Ga) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Gold (Au) \leq 20 ppb $<$ 10 ppbTrace Impurities - Gold (Au) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Iron (Fe) \leq 40.0 ppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 20 oppb $<$ 1.0 ppbTrace Impu | Trace Impurities – Aluminum (Al) | | |
| Trace Impurities - Barium (Ba) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Beryllium (Be) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Bismuth (Bi) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Boron (B) $\leq 10.0 \text{ ppb}$ $< S.0 \text{ ppb}$ Trace Impurities - Cadmium (Cd) $\leq 50 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Calcium (Ca) $\leq 50.0 \text{ ppb}$ $< 0.2 \text{ ppb}$ Trace Impurities - Chomium (Cr) $\leq 30.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Cobalt (Co) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Coper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Linkium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Arsenic and Antimony (as As) | ≤ 5.0 ppb | |
| Trace Impurities - Beryllium (Be)≤ 10.0 ppb< 1.0 ppbTrace Impurities - Bismuth (Bi)≤ 20.0 ppb< 10.0 ppb | Trace Impurities – Barium (Ba) | ≤ 10.0 ppb | |
| Trace Impurities - Bismuth (Bi) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Boron (B) $\leq 10.0 \text{ ppb}$ $< 5.0 \text{ ppb}$ Trace Impurities - Cadmium (Cd) $\leq 50 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Calcium (Ca) $\leq 50.0 \text{ ppb}$ $< 0.2 \text{ ppb}$ Trace Impurities - Chromium (Cr) $\leq 30.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Cobalt (Co) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Coper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 50 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Beryllium (Be) | ≤ 10.0 ppb | |
| Trace Impurities - Boron (B)≤ 10.0 ppb< 5.0 ppbTrace Impurities - Cadmium (Cd)≤ 50 ppb< 1 ppb | Trace Impurities – Bismuth (Bi) | ≤ 20.0 ppb | |
| Trace Impurities - Cadmium (Cd) \leq 50 ppb< 1 ppbTrace Impurities - Calcium (Ca) \leq 50.0 ppb< 0.2 ppb | Trace Impurities – Boron (B) | ≤ 10.0 ppb | |
| Trace Impurities - Calcium (Ca) \leq 50.0 ppb $<$ 0.2 ppbTrace Impurities - Chromium (Cr) \leq 30.0 ppb $<$ 1.0 ppbTrace Impurities - Cobalt (Co) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Copper (Cu) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Gallium (Ga) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Germanium (Ge) \leq 20 ppb $<$ 10 ppbTrace Impurities - Gold (Au) \leq 20 ppb $<$ 5 ppbHeavy Metals (as Pb) \leq 100 ppb $<$ 50 ppbTrace Impurities - Iron (Fe) \leq 40.0 ppb $<$ 1.0 ppbTrace Impurities - Lead (Pb) \leq 20.0 ppb $<$ 1.0 ppbTrace Impurities - Lithium (Li) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Magnesium (Mg) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Magnese (Mn) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 10.0 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Manganese (Mn) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 20 ppb $<$ 1.0 ppbTrace Impurities - Mickel (Vii) \leq 20 ppb $<$ 1.0 ppb <td>Trace Impurities – Cadmium (Cd)</td> <td>≤ 50 ppb</td> <td></td> | Trace Impurities – Cadmium (Cd) | ≤ 50 ppb | |
| Trace Impurities - Chromium (Cr) $\leq 30.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Cobalt (Co) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Copper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Germanium (Ge) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 50 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Mickel (Ali) $< 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Calcium (Ca) | ≤ 50.0 ppb | |
| Trace Impurities - Cobalt (Co)≤ 10.0 ppb< 1.0 ppbTrace Impurities - Copper (Cu)≤ 10.0 ppb< 1.0 ppb | Trace Impurities - Chromium (Cr) | ≤ 30.0 ppb | |
| Trace Impurities - Copper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Germanium (Ge) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 5 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Cobalt (Co) | ≤ 10.0 ppb | |
| Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Germanium (Ge) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 5 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Copper (Cu) | ≤ 10.0 ppb | |
| Trace Impurities - Germanium (Ge)≤ 20 ppb< 10 ppbTrace Impurities - Gold (Au)≤ 20 ppb< 5 ppb | Trace Impurities – Gallium (Ga) | ≤ 10.0 ppb | |
| Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 5 \text{ ppb}$ Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities – Germanium (Ge) | ≤ 20 ppb | |
| Heavy Metals (as Pb) $\leq 100 \text{ ppb}$ $< 50 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Gold (Au) | ≤ 20 ppb | |
| Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Maganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Maganese (Mn) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Heavy Metals (as Pb) | ≤ 100 ppb | |
| Trace Impurities – Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities – Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities – Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities – Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities – Minganese (Mn) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities – Iron (Fe) | ≤ 40.0 ppb | |
| Trace Impurities – Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities – Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities – Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities – Nickel (Ni) $\geq 0.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ | Trace Impurities - Lead (Pb) | ≤ 20.0 ppb | |
| Trace Impurities - Magnesium (Mg)≤ 20 ppb< 1 ppbTrace Impurities - Manganese (Mn)≤ 10.0 ppb< 1.0 ppb | Trace Impurities – Lithium (Li) | ≤ 10.0 ppb | |
| Trace Impurities - Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Nickel (Ni) | Trace Impurities – Magnesium (Mg) | ≤ 20 ppb | |
| Trace Impurities - Nickel (Ni) | Trace Impurities – Manganese (Mn) | ≤ 10.0 ppb | |
| | Trace Impurities - Nickel (Ni) | | < 5.0 ppb |

>>> Continued on page 2 >>>

For questions on this Certificate of Analysis please contact Technical Services at 855 282 6867 or +1 610 386 1700





Material No.: 9606-03 Batch No.: 24B1362001

| Test | Specification | Result |
|-------------------------------------|---------------|------------|
| Trace Impurities – Niobium (Nb) | ≤ 50.0 ppb | < 1.0 ppb |
| Trace Impurities – Potassium (K) | ≤ 50 ppb | < 10 ppb |
| Trace Impurities – Silicon (Si) | ≤ 50 ppb | < 10 ppb |
| Trace Impurities – Silver (Ag) | ≤ 20.0 ppb | < 1.0 ppb |
| Trace Impurities – Sodium (Na) | ≤ 150.0 ppb | < 5.0 ppb |
| Trace Impurities – Strontium (Sr) | ≤ 30.0 ppb | < 1.0 ppb |
| Trace Impurities – Tantalum (Ta) | ≤ 10.0 ppb | < 5.0 ppb |
| Trace Impurities – Thallium (TI) | ≤ 10.0 ppb | < 5.0 ppb |
| Trace Impurities – Tin (Sn) | ≤ 20.0 ppb | < 10.0 ppb |
| Trace Impurities – Titanium (Ti) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities – Vanadium (V) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities - Zinc (Zn) | ≤ 20.0 ppb | < 1.0 ppb |
| Trace Impurities - Zirconium (Zr) | ≤ 10.0 ppb | < 1.0 ppb |
| Particle Count - 0.5 µm and greater | ≤ 60 par/ml | 3 par/ml |
| Particle Count - 1.0 µm and greater | ≤ 10 par/ml | 1 par/ml |





Material No.: 9606-03 Batch No.: 24B1362001

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

For Microelectronic Use

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

Kennet, leel

Ken Koehnlein Sr. Manager, Quality Assurance

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1 2 4 4

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| Part# 57003 Lot # 062124 | * The certified value is the concentration calculated from gravimetric and volumer * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and 1 the preparation of all standards. * All standard containers are meticulously cleaned prior to use. * Standards are prepared gravinetrically using balances that are calibrated with w * Standards are certified (+/) 0.5% of the stated value, unless otherwise stated. * All Standards should be stored with caps tight and under appropriate iaboratory * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating of Measurement Result," NIST Technical Note 1297, U.S. Government Printing Off | Homogeneity: No heterogeneity was observed in the preparation of this standard. | Physical Characterization: | Al 40.02 Cid 40.02 Dr 40.02 Hd 3b 40.02 Cic 40.02 Ein 40.02 Hd As 40.2 Cic 40.02 Ein 40.02 In Ba 40.02 Cic 40.02 Gid 40.02 In Ba 40.02 Cic 40.02 Gid 40.02 In Bi 40.02 Cic 40.02 Gid 40.02 Ia | | Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | Absolute Standards, Inc. 800-368-1131 www.absolutiestandards.com |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 2 01 2 | * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standard. * All standard containers are meticulously cleaned prior to use. * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). * Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated. * Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated. * All Standards broud by stoud with cases tight and under appropriate laboratory conditions. * All Standards are prepared with cases tight and under appropriate laboratory conditions. * Mucertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994). | this standard. | | 40/02 Li T Nh 40/02 Hr 40/02 And 40/02 Li An | -MS (µg/mL) | Mass Spectrometry (ICP-MS): | Certified Reference Material CRM |
| Printed: 6/24/2024, 11:20:08 PM | Ъ. | Sur P. S. | Certified by: | Site Gall Tite Gall U Gall Site Gall Tite Gall Site Gall Si | | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |

| ADSOIUTE STANDARDS, INC. 800-368-1131 www.absolutestandards.com | | | U | ertified I | Referen | ce Mate | Certified Reference Material CRM | C | 1117 | | • | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | ANAB ISO 17034 Accredited AR-1539 Certificate Number ttps://Absolutestandards.com | ccredited Number ards.com |
|------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------|------------------------|---------------------------------------------------------------------------|-----------|------------------------|----------------------------------|-------------------------|----------------------------------------|------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------|
| הבמדובובה אובותווד מרמסמד. | | | | | | | 4 | | 20 | 2 | | | | |
| CENTIFIED WEIGHT NET ON | <u>57038</u> 031524 | | | Solvent: | | 24002546 | Nitric Acid | | | | 1 | | | |
| Description: | Strontium (Sr) | (Sr) | | | 700 | | Nitrio Acid | | Comulated Bur | N Dr. | Boncon Chan | to manual state | 031504 | |
| Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): | 031527 Ambient (20 °C) 1000 | ŝ | | | | | Nume Acid | | | apy. | Denson crian | La | 120100 | |
| NIST Test Number: | 6UTB | | 5E-05 B | 5E-05 Balance Uncertainty | uinty | | | | Reviewed By: | By: | Pedro L. Rentas | as | 031524 | |
| Weight shown below was diluted to (mL): Lot <u>Compound</u> RM# Number | Is diluted to (mL): Lot RM# Number | 2000.07 Nominal Conc. (µg/mL) | 0.100 Purity (%) | 0.100 Flask Uncertainty Purity Uncertainty Assay (%) Purity (%) (%) | say () | Target Weight (g) V | Actual Weight (g) C | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS | SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LDS | SDS Information Safety Info. On Attachee SHA PEL (TWA) | d pg.) LDSO | NIST SRM |
| 1. Strontium nitrate (Sr) | IN017 SRZ022018A1 | 1000 | 68.997 | 0.10 | 41.2 4.8 | 4.85470 | 4.85502 | 1000.1 | 2.0 | 10042-76-9 | NA | orl-ra | ori-rat >2000mg/kg 3153a | 3153a |
| 5.0E6 | - | 14.495 sec]:58138.D# [Count] [Linear] | ec]:581 | 38.D#[| Count | [Linear | | | | | | | | |
| | | | | | | | | | | | | | | |
| 9 9 9 9 | | | | | | | | | | | 1997 mar Rossenar van sonar kar kar kar ka | | | |
| m/z->- | 10 20 | 0 | | 40 | 20 | 0 | 80 | 20 | | 80 | - O 0 | 100 | | |
| 6.0局 | | | | | | | | | | | | | | |
| | | 5. | 1 | | | | | | | | ÷ | | | |
| 5.0E6 | 110 120 | 130 | 0 | 40 | 150 | Q | 160 | 170 | | 180 | 180 | 000 | | |
| | | | | | | | | | | | | | | |
| 2.02 2.02 | | | | | | | | | | | | | | |
| m/z->- 21 | 210 220 | 230 | 0 | 240 | 550 | 0 | 260 | | | | | | | |
| | | | | | | | | | | | | | | |
| oart # 57038 Lot # 031524 | | | | | Ť | 1 of 2 | | | | Pri | Printed: 6/7/2024, 3:58:42 PM | 4, 3:58:42 F | Wo | |

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



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

| | | | | | | | Trace M | letals | Verification | ation | by ICP-MS | | (ng/mL) | | | | | | |
|----|-------|----|--------|----------|-------------------|---------------|-------------------|--------|--------------------|----------|--------------|--------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|
| | | | 四本派出出建 | ALCON ST | The second second | A COLUMN TO A | and states in the | | Man Landson Martin | | A DAMAGE AND | MARCE | A NUMBER OF STREET, ST | Contraction of the local division of the loc | United in the second | Self-pice | Compare and the second s | | States and the |
| N | ≪0.02 | 3 | <0.02 | Â | <0.02 | Hf | <0.02 | Ľ | <0.02 | ī | <0.02 | £ | <0.02 | Se | ⊲0.2 | P. | 40.02 | M | 2002 |
| Sb | <0.02 | ű | <0.2 | 田 | €0.02 | Ho | <0.02 | Ľ | <0.02 | q | <0.02 | Re | <0.02 | Si | <0.02 | Je | <0.02 | = | 200 |
| As | <0.2 | ථ | <0.02 | Ē | <0.02 | ä | <0.02 | Mg | ±0.0 | ő | <0.02 | Rh | <0.02 | Ag | <0.02 | F | <0 0> | > | 89 |
| Ba | <0.02 | ű | <0.02 | 3 | €0.02 | ч | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | ž | <0.2 | É | 2007 | - 5 | |
| Be | <0.01 | ບັ | <0.02 | පී | <0.02 | Ъе | 40.2 | Не | <0.2 | Þ | 20.02 | Ř | 20.02 | 5 | ļ F | ļ | 10.02 | 2 > | |
| Bi | <0.02 | රී | <0.02 | ථ | €0.02 | La | <0.02 | Mo | 40.02 | ġ. | 2000 | | | 5 0 | | | | - 6 | 20.02 |
| æ | <0.02 | õ | <0.02 | Au | 40.02 | å | <0.02 | PZ | <0.02 | ž | 202 | 3 | 10.02 | ¢ ا | | 5 F | | 5 | 20.05 |
| | | | | | | | | | | | | | 1000 | - | 70.02 | Ŧ | 70.02 | 5 | 20.02 |
| | | | | | | | | | | 1000 400 | | | | | | | | | |
| | | | | | | | | | (1) = 1 and $e(1)$ | get ana. | iyre | | | | | | | | |

Physical Characterization:

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

Certified by:

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

the preparation of all standards.

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

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

* All Standards should be stored with caps tight and under appropriate laboratory conditions. * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

- E. 5 * 2962 246 146 **4**• . 12 M 8: 2 r¹a€¹# *:

-3

Nitric Acid 69%

CMOS DECN, 1. - OSIO14025 DECN, 1. - OSIO14025 DECN, 1. - OSIO14025 M6034, M6034 M6034, M6034 M6035, M6038, M6036, 1. - Certificate of Analysis





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

| 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 (Cl) | ≤ 0.08 ppm | < 0.03 ppm |
| Phosphate (PO4) | ≤ 0.10 ppm | < 0.03 ppm |
| Sulfate (SO4) | ≤ 0.2 ppm | < 0.2 ppm |
| Trace Impurities – Aluminum (Al) | ≤ 40.0 ppb | < 1.0 ppb |
| Arsenic and Antimony (as As) | ≤ 5.0 ppb | < 2.0 ppb |
| Trace Impurities – Barium (Ba) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities ~ Beryllium (Be) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities – Bismuth (Bi) | ≤ 20.0 ppb | < 10.0 ppb |
| Trace Impurities – Boron (B) | ≤ 10.0 ppb | < 5.0 ppb |
| Trace Impurities - Cadmium (Cd) | ≤ 50 ppb | < 1 ppb |
| Trace Impurities - Calcium (Ca) | ≤ 50.0 ppb | 2.3 ppb |
| Trace Impurities - Chromium (Cr) | ≤ 30.0 ppb | < 1.0 ppb |
| Trace Impurities - Cobalt (Co) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities – Copper (Cu) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities - Gallium (Ga) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities - Germanium (Ge) | ≤ 20 ppb | < 10 ppb |
| Trace Impurities - Gold (Au) | ≤ 20 ppb | < 5 ppb |
| Heavy Metals (as Pb) | ≤ 100 ppb | 100 ppb |
| Trace Impurities - Iron (Fe) | ≤ 40.0 ppb | < 1.0 ppb |
| Trace Impurities – Lead (Pb) | ≤ 20.0 ppb | < 10.0 ppb |
| Trace Impurities – Lithium (Li) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities – Magnesium (Mg) | ≤ 20 ppb | < 1 ppb |
| Гrace Impurities – Manganese (Мп) | ≤ 10.0 ppb | < 1.0 ppb |
| Frace Impurities – Nickel (Ni) | ≤ 20.0 ppb | < 5.0 ppb |





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

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

>>> Continued on page 3 >>>



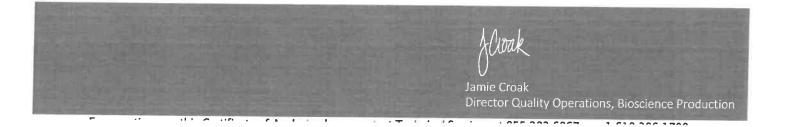


Material No.: 9606-03 Batch No.: 24D1062002

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

For Microelectronic Use

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



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





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

Merenvez - 08/01/2024 Pater m 6039 m 6039 Certificate of Analysis

| Test | Specification | Result |
|-------------------------------------------|---------------|-------------|
| ACS – Assay (as HCI) (by acid-base titrn) | 36.5 - 38.0 % | 37.6 % |
| ACS – Color (APHA) | ≤ 1 0 | 5 |
| ACS - Residue after Ignition | ≤ 3 ppm | < 1 mgg 1 > |
| ACS - Specific Gravity at 60°/60°F | 1.185 - 1.192 | 1.192 |
| ACS – Bromide (Br) | ≤ 0.005 % | < 0.005 % |
| ACS – Extractable Organic Substances | ≤ 5 ppm | < 1 ppm |
| ACS Free Chlorine (as Cl2) | ≤ 0.5 ppm | < 0.5 ppm |
| Phosphate (PO4) | ≤ 0.05 ppm | 0.03 ppm |
| Sulfate (SO4) | ≤ 0.5 ppm | < 0.3 ppm |
| Sulfite (SO3) | ≤ 0.8 ppm | 0.3 ppm |
| Ammonium (NH4) | ≤ 3 ppm | < 1 ppm |
| Trace Impurities ~ Arsenic (As) | ≤ 0.010 ppm | < 0.003 ppm |
| Trace Impurities – Aluminum (Al) | ≤ 10.0 ppb | < 5.0 ppb |
| Arsenic and Antimony (as As) | ≤ 5.0 ppb | < 3.0 ppb |
| Trace Impurities ~ Barium (Ba) | ≤ 1.0 ppb | < 1.0 ppb |
| Trace Impurities – Beryllium (Be) | ≤ 1.0 ppb | < 1.0 ppb |
| Trace Impurities – Bismuth (Bi) | ≤ 10.0 ppb | < 10.0 ppb |
| Trace Impurities ~ Boron (B) | ≤ 20.0 ppb | 2.2 ppb |
| Trace Impurities – Cadmium (Cd) | ≤ 1.0 ppb | < 1.0 ppb |
| Trace Impurities - Calcium (Ca) | ≤ 50.0 ppb | 31.0 ppb |
| Trace Impurities - Chromium (Cr) | ≤ 1.0 ppb | 0.5 ppb |
| Trace Impurities - Cobalt (Co) | ≤ 1.0 ppb | 0.2 ppb |
| Trace Impurities – Copper (Cu) | ≤ 1.0 ppb | < 0.1 ppb |
| Trace Impurities – Gallium (Ga) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities – Germanium (Ge) | ≤ 3.0 ppb | < 2.0 ppb |
| Trace Impurities – Gold (Au) | ≤ 4.0 ppb | < 0.2 ppb |
| Heavy Metals (as Pb) | ≤ 100 ppb | < 50 ppb |
| Trace Impurities - Iron (Fe) | ≤ 15 ppb | 3 ppb |
| | | |

>>> Continued on page 2 >>>

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





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

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

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



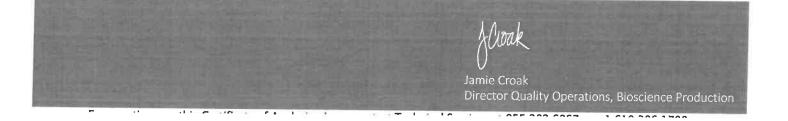


Material No.: 9530-33 Batch No.: 24D1562005

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

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

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



| m/z->+ | 1.057 | 2.0世7 | m/z-> | אַ ס ס | 5. 0 M 5 | | N 0 11 0 | 5.0E5 | 1. Antimony (Sb) | Compound | Volume shown below was diluted to (mL): | NIST Test Number: | Recommended Storage: Nominal Concentration (up/mL): | Expiration Date: | Part Number: Lot Number: Description: | CERTIFIED WEIGHT REPORT: | 800-368-1131 www.absolutestandards.com |
|--------|-------|-------|-------------|--------------|-------------------|-------------------------|-------------------|---------------------------------------|--------------------|------------------------------------------------------------------------------------|-----------------------------------------|---------------------|--------------------------------------------------------|-------------------|---------------------------------------------|--------------------------|------------------------------------------------------------------------------------------|
| NIO | | | 110 | | | 10 | | [1] Spectrum No.1 | 58151 | Part Number | lip sam mo | | nL); | ate: | oer: | | |
| | | | 1 0 | | | NO | | 40.1 | 1 100923 | Lot r Number | uted to (mL) | 6UTB | Ambient (20 °C) 1000 | 120526 | 57051 120523 Antimony (Sb) | | |
| | | | | | | a nanarana a | | | 0.1000 | Dilution Factor | : 3000.41 | | 20 °C) | | v (Sb) | | RI |
| | | | 130 | | | 30 | | sac]:58 | 300.0 | Initial Vol. (mL) | | 5E-05 | | | | • | Certifi (0 1) 03 (2 4 |
| | | | 140 | | | 4 0 | | 051.D# | 0.084 | Uncertainty) Pipette (mL) | Flask Uncertainty | Balance Uncertainty | | | | ł | Certified |
| | | | 180 | | | 50 | | 17.964 sec]:58051.D# [Count] [Línear] | 1000 | Nominal | linty | rteintv | | 2.0% | 24002546 | Lot # | Certified Reference Material CRM 【ヱ‐Ӌ |
| | | | | | | 00 | | Jnear] | 10001.4 | Initial) Conc. (µg/ml | | | | (mL) | Nitric Acid | Solvent: | nce Material |
| | | | 100 | | | 0 | | | 1000.0 | Final IL) Conc. (µg/mL) | | | | Nitric Acid | | | CRM 14.5803 |
| | | | 170 | | | 70 | | | 2.1 | Expanded Uncertainty mL) +/- (µg/mL) | Linearen oli | Reviewe | K | id Formulated By: | | | 03 |
| | | | 180 | | | 80 | | | 7440-36-0 | ed nty (S 'mL) CAS# | a 0); | | 20 | led By: | Farmen | | |
| | | | 190 | | | 0 | | | | SD (Solvent Saf \$# OSHA | | Pedro | they want | Lawre | 2 | | |
| | | | | | | A. and A. and A. and A. | | | 0.5 mg/m3 | SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD50 | | I Rentas | S) | Lawrence Barry | V. | | AN/ AR- https: |
| | | | N O O | | | 100 | | | ort-rat 7000 mg/kg | ion Attached pg.) LD50 | | | | | | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
| | | | | | | | | | mg/kg 3102a | NIST | 120020 | 120522 | | 120523 | | | 034 Acc lificate N standar |

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



Certified Reference Material CRM



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

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

| | | | | | | | I FACE M | etais | Verifica | tion | by ICP-M | IS (U) | g/mL) | | | | | | |
|----|-------|--------------|-------|-----|-------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------|-----------------|---------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------|----|-------|
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| Ba | | Š | ANS | 2 | 5 | 1 | 3 | 5 | | 2 | | | and the | | - CONTRACTOR | | 10.02 | • | 20.02 |
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| Ħ. | 38 | 2 | 200 | ç | 3 | 4 | | | | | | Nu | 70.02 | ġ | 70.02 | 100 | CU.U2 | X | 20.02 |
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| | | | | | | Ī | | | | ŀ | 102 | Ę | 70.02 | 12 | 20.02 | 11 | 40.02 | 2 | 40.02 |

(T) = Target analyte

Physical Characterization:

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

In P. S.

Certified by:

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

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

* All standard containers are meticulously cleaned prior to use. * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). * Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.

* All Standards should be stored with caps tight and under appropriate laboratory conditions. * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

Part # 57051 Lot # 120523