

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			
				:				

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	



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

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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		

<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
				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							



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 #



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

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

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

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

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

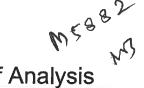
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Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57038 / Sr, 1000 PPM, 125 ml	031524	03/15/2027	07/01/2024 / Jaswal	06/11/2024 / Jaswal	M5982
Supplier	ItemCode / 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%)		

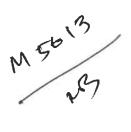
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Harout Sahagian - Quality Control Supervisor - Fair Lawn

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

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



2.0 **PRODUCT DESCRIPTION**

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

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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

Density:

1.043 g/mL (measured at 20 \pm 4 °C)

Assay Information:

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

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

Characterization of CRM/RM by Two or More Methods Certified Value, X _{CRM/RM} , where two or more methods of characterization are	Characterization of CRM/RM by One Method Certified Value, X _{CRM/RM} , where one method of characterization
used is the weighted mean of the results:	is used is the mean of individual results:
$X_{CRM/RM} = \Sigma(w_i) (X_i)$	X _{CRM/RM} = (X _a) (u _{char a})
X _i = mean of Assay Method i with standard uncertainty u _{char i}	X _a = mean of Assay Method A with
w_i = the weighting factors for each method calculated using the inverse square of the variance: $w_i = (1/u_{chari})^2 / (\Sigma(1/(u_{chari})^2)$	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

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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		

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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

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

March 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

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



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



ICSA

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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



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"

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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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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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
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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	
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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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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								
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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
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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
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										1000 400									
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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# *:

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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 >>>



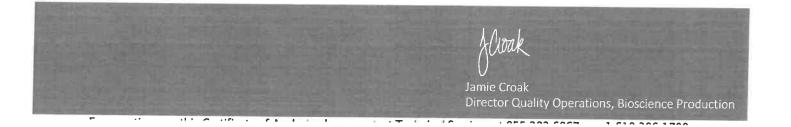


Material No.: 9606-03 Batch No.: 24D1062002

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



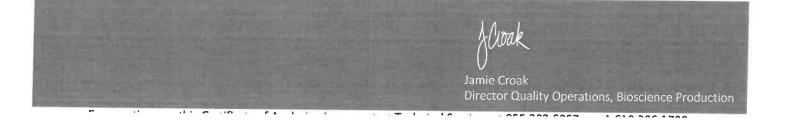


Material No.: 9530-33 Batch No.: 24D1562005

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
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						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)						
A	B	2	202	2	200	1	With the second s	Mediation	State of the state			No. of Lot, No.			Contraction of the local division of the loc	Non-	AL TRANSFORMED		
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(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