

Prep Standard - Chemical Standard Summary

Order ID : P5009

Test : Metals CLP Full

Prepbatch ID : PB165301,

Sequence ID/Qc Batch ID: LB134057,LB134069,

Standard ID :

MP83122,MP83134,MP83141,MP83147,MP83500,MP83501,MP83502,MP83503,MP83504,MP83505,MP83506,MP83507,MP83508,MP83509,MP83510,MP83511,MP83513,MP83514,MP83619,MP83726,MP83745,

Chemical ID :

M5130,M5218,M5223,M5289,M5295,M5296,M5390,M5393,M5429,M5473,M5476,M5496,M5497,M5498,M5513,M5515,M5519,M5658,M5697,M5698,M5751,M5768,M5769,M5798,M5799,M5800,M5801,M5802,M5806,M5815,M5816,M5817,M5818,M5819,M5820,M5875,M5959,M5960,M5962,M5970,M5976,M5978,M5982,M5985,M5990,M5999,M6021,M6023,M6025,M6028,M6030,M6033,M6111,M6116,M6117,M6121,M6124,M6125,M6126,W3112,



Recipe ID 169	NAME 1:1HNO3	<u>NO.</u> MP83122	Prep Date 11/07/2024	Expiration Date 12/06/2024	Prepared By Janvi Patel	<u>ScaleID</u> None	<u>PipetteID</u> None	Sarabjit Jaswal
<u>FROM</u>	1000.00000ml of M6116 + 1000.0000	00ml of W31	12 = Final Qu	uantity: 2000.00	00 ml			
<u>Recipe</u> <u>ID</u> 902	NAME ICP AES CAL BLK (SO/ICB/CCB)	<u>NO.</u> MP83134	<u>Prep Date</u> 10/30/2024	Expiration Date 12/06/2024	<u>Prepared</u> <u>By</u> Kareem Khairalla	<u>ScaleID</u> None	<u>PipetteID</u> None	Supervised By Mohan Bera 11/08/2024

FROM 125.00000ml of M6111 + 2350.00000ml of W3112 + 25.00000ml of M6117 = Final Quantity: 2500.000 ml



<u>Recipe</u> <u>ID</u> 994	NAME ICPAES ISM01.2 S1 (CONC.)	<u>NO.</u> MP83141	Prep Date 10/30/2024	Expiration Date 12/06/2024	Prepared By Kareem Khairalla	<u>ScaleID</u> None	PipetteID None	<u>Supervised By</u> Mohan Bera 11/08/2024
FROM	0.02000ml of M5815 + 0.03000ml of of M5476 + 0.20000ml of M5515 + 0. 0.20000ml of M6025 + 0.20000ml of of M6023 + 0.70000ml of M5962 + 0. 1.20000ml of M5819 + 10.00000ml o 10.00000ml of M5818 + 2.00000ml o	20000ml of M6030 + 0. 80000ml of f M5498 + 1	M5658 + 0.20 30000ml of M M5960 + 1.00 0.00000ml of	0000ml of M580 5698 + 0.40000 0000ml of M580 M5519 + 10.00	01 + 0.20000ml 0ml of M6033 + 00 + 1.00000ml 0000ml of M576	of M5817 + 0.2 0.50000ml of M of M6021 + 1.2 8 + 10.00000ml	0000ml of M59 15751 + 0.5000 0000ml of M58 1 of M5806 +	976 + 90ml 902 +
Desire				Eurojactica	Duou ouo d			Currentia e d. Du

Recipe				Expiration	Prepared			Supervised By
<u>ID</u>	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipetteID	Mohan Bera
921	ICPAES SPIKE SOL#6	<u>MP83147</u>	10/30/2024	12/06/2024	Kareem	None	None	
					Khairalla			11/08/2024
FROM	2.50000ml of M5962 + 50.00000ml o	f M5990 + 5	50.00000ml of	M5999 + 147.5	50000ml of MP8	3134 = Final C	uantity: 250.00	00 ml



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

<u>Recipe</u> <u>ID</u>	NAME	<u>NO.</u>	Prep Date	Expiration Date	<u>Prepared</u> <u>By</u>	<u>ScaleID</u>	PipettelD	Supervised By
								Sarabjit Jaswal
2480	ICP AES STD 6 ISM01.3	<u>MP83501</u>	12/06/2024	01/06/2025	Kareem	None	None	
					Khairalla			12/09/2024
<u>FROM</u>	4.00000ml of M5289 + 4.00000ml of of MP83500 = Final Quantity: 50.000		00000ml of M	5515 + 4.0000	0ml of M5768 +	4.00000ml of M	15806 + 30.000)00ml



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Recipe ID 1004	NAME ICPAES ISM01.2 (S5)	<u>NO.</u> MP83502	Prep Date 12/06/2024	Expiration Date 01/06/2025	Prepared By Kareem Khairalla	<u>ScaleID</u> None	<u>PipetteID</u> None	Sarabjit Jaswal
FROM	0.25000ml of M5798 + 0.50000ml of of M5519 + 12.50000ml of M5698 + M5496 + 14.50000ml of M5515 + 14. + 5.00000ml of M5296 + 5.00000ml of 303.50000ml of MP83500 = Final Q	12.50000ml 50000ml of of M5393 +	of M5806 + 1 M5658 + 2.00 5.00000ml of	2.50000ml of M 0000ml of M551	15819 + 13.750 13 + 22.50000m	00ml of M5697 nl of M5497 + 22	+ 14.50000ml 2.50000ml of N	of

Recipe				Expiration	Prepared	- · ·-		Supervised By
ID	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipetteID	Sarabjit Jaswal
1005	ICPAES ISM01.2(S4)	<u>MP83503</u>	12/09/2024	01/06/2025	Kareem	None	None	
					Khairalla			12/09/2024
FROM	250.00000ml of MP83500 + 250.000	00ml of MP8	33502 = Fina	Quantity: 500.	000 ml			
				-				



<u>Recipe</u> <u>ID</u> 1007	NAME ICPAES ISM01.2(S3)	<u>NO.</u> MP83504	Prep Date 12/09/2024	Expiration Date 01/06/2025	<u>Prepared</u> <u>By</u> Kareem Khairalla	<u>ScaleID</u> None	<u>PipetteID</u> None	Sarabjit Jaswal
FROM	25.00000ml of MP83502 + 75.00000	nl of MP83	500 = Final Q	uantity: 100.00	0 ml			

<u>Recipe</u> <u>ID</u> 1008	NAME ICPAES ISM01.2(S2)	<u>NO.</u> MP83505	Prep Date 12/09/2024	Expiration Date 01/06/2025	Prepared By Kareem Khairalla	<u>ScaleID</u> None	<u>PipetteID</u> None	Sarabjit Jaswal
FROM	12.50000ml of MP83502 + 87.50000	ml of MP83	500 = Final Q	uantity: 100.00	0 ml			



Recipe ID 994	NAME ICPAES ISM01.2 S1 (CONC.)	<u>NO.</u> MP83506	Prep Date 12/09/2024	Expiration Date 01/06/2025	<u>Prepared</u> <u>By</u> Kareem Khairalla	<u>ScaleID</u> None	PipetteID None	Sarabjit Jaswal
FROM	0.02000ml of M5815 + 0.03000ml of of M5473 + 0.20000ml of M5515 + 0. 0.20000ml of M6025 + 0.20000ml of of M6023 + 0.70000ml of M5962 + 0. 1.20000ml of M5819 + 10.00000ml o 10.00000ml of M5818 + 2.00000ml o	20000ml of M6030 + 0. 80000ml of f M5498 + 1	M5658 + 0.20 30000ml of M M5960 + 1.00 0.00000ml of	0000ml of M580 5698 + 0.40000 0000ml of M580 M5519 + 10.00	01 + 0.20000ml 0ml of M5496 + 00 + 1.00000ml 0000ml of M576	of M5817 + 0.2 0.50000ml of M of M6021 + 1.2 9 + 10.00000ml	0000ml of M59 5697 + 0.5000 0000ml of M58 I of M5806 +	976 + 90ml 902 +

Recipe ID 1003	NAME ICPAES ISM01.2 S1	<u>NO.</u> MP83507	Prep Date 12/09/2024	Expiration Date 01/06/2025	Prepared By Kareem Khairalla	<u>ScaleID</u> None	PipetteID None	Sarabjit Jaswal
FROM	0.50000ml of MP83506 + 99.50000m	ו of MP835(00 = Final Qu	antity: 100.000	ml			



Recipe ID 2054	NAME ICV-ICPAES	<u>NO.</u> MP83508	Prep Date 12/09/2024	Expiration Date 01/06/2025	Prepared By Kareem Khairalla	<u>ScaleID</u> None	PipetteID None	Sarabjit Jaswal
<u>FROM</u>	0.50000ml of M5218 + 0.50000ml of of M5295 + 87.50000ml of MP83500)ml of M5970 +	0.50000ml of M	5982 + 10.000	000ml
Paging				Expiration	Bronarad			Supervised By

Recipe				Expiration	Prepared			Supervised By
ID	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipetteID	Sarabjit Jaswal
904	ICP AES ICSA SOLN	<u>MP83509</u>	12/09/2024	01/06/2025	Kareem	None	METALS_PIP	
					Khairalla		ETTE_3 (A)	12/09/2024
FROM	10.00000ml of M5130 + 90.00000ml	of MP83500) = Final Qua	ntity: 250.000	ml			



FROM 10.00000ml of M5130 + 10.00000ml of M5223 + 80.00000ml of MP83500 = Final Quantity: 250.000 ml	Recipe ID 905	NAME ICP AES ICSAB SOLN	<u>NO.</u> MP83510	Prep Date 12/09/2024	Expiration Date 01/06/2025	<u>Prepared</u> <u>By</u> Kareem Khairalla	<u>ScaleID</u> None	<u>PipetteID</u> None	Sarabjit Jaswal
	FROM	10.00000ml of M5130 + 10.00000ml	of M5223 +	80.00000ml c	of MP83500 = I	Final Quantity: 2	250.000 ml		

<u>Recipe</u> <u>ID</u> 1119	NAME ICPAES ISM01.2(CCV)	<u>NO.</u> <u>MP83511</u>	<u>Prep Date</u> 12/09/2024	Expiration Date 01/06/2025	<u>Prepared</u> <u>By</u> Kareem Khairalla	<u>ScaleID</u> None	<u>PipetteID</u> None	<u>Supervised By</u> Sarabjit Jaswal 12/09/2024
<u>FROM</u>	0.75000ml of M5497 + 0.75000ml of of MP83500 + 25.00000ml of MP835)ml of M5515 +	1.25000ml of M	5806 + 19.775	i00ml



Recipe ID 919	NAME ICP AES INTERNAL STD	<u>NO.</u> <u>MP83513</u>	Prep Date 12/09/2024	Expiration Date 01/06/2025	Prepared By Kareem Khairalla	<u>ScaleID</u> None	PipetteID None	Sarabjit Jaswal
FROM	l 1.00000ml of M5959 + 10.00000ml o	I f M5985 + 1	l 1969.00000ml	of W3112 + 20		126 = Final Qu	l ıantity: 2000.00	

<u>Recipe</u>				Expiration	Prepared			<u>Supervised By</u>
<u>ID</u>	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipetteID	Sarabjit Jaswal
513	RINSE SOLN	<u>MP83514</u>	12/09/2024	01/06/2025	Kareem	None	None	-
					Khairalla			12/09/2024
FROM	200.00000ml of M6126 + 9800.0000	Oml of W311	2 = Final Qua	antity: 10000.0	00 ml			



Recipe ID 1122	NAME ICPMS CALIB BLANK(S0/ICB/CCB)	<u>NO.</u> MP83619	Prep Date 12/13/2024	Expiration Date 01/07/2025	<u>Prepared</u> <u>By</u> Sarabjit Jaswal	<u>ScaleID</u> None	<u>PipetteID</u> METALS_PIP ETTE_3 (A)	Supervised By Mohan Bera 12/17/2024
<u>FROM</u>	25.00000ml of M6121 + 4925.00000r	nl of W3112	2 + 50.00000m	nl of M6126 = I	i Final Quantity: 5	000.000 ml		
Recipe				Expiration	<u>Prepared</u>			Supervised By

Recipe				Expiration	Prepared			Supervised By
ID	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipettelD	Mohan Bera
3559	SE 100PPM	<u>MP83726</u>	12/18/2024	01/06/2025	Sarabjit Jaswal	None	None	
								12/20/2024
FROM	1.00000ml of M5962 + 9.00000ml of	MP83500 =	Final Quanti	ty: 10.000 ml				



Recipe ID 1905	NAME TL 10PPM	<u>NO.</u> MP83745	Prep Date 12/23/2024		<u>Prepared</u> <u>By</u> Sarabjit Jaswal	<u>ScaleID</u> None	<u>PipetteID</u> None	Supervised By Mohan Bera 12/23/2024
FROM	0.10000ml of M6023 + 9.90000ml of	MP83619 =	- Final Quanti	ty: 10.000 ml				



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
EPA	PART A / ICSA (ICP) STOCK SOLN	ICSA-1211	12/28/2024	05/20/2024 / jaswal	04/20/2021 / bin	M5130
Quartier	literra Carda / Iterra Norma	1 - 4 #	Expiration	Date Opened /	Received Date /	Chemtech

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Opened By	Received Date / Received By	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	12/28/2024	05/20/2024 / jaswal	04/20/2021 / bin	M5223

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58113 / Aluminum (Al) 10,000PPM	070622	07/06/2025	09/02/2022 / jaswal	07/12/2022 / jaswal	M5289

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
EPA	ICV-1 / ICV (ICP/ICPMS) STOCK SOLN	ICV-1014	02/05/2025	08/07/2024 / jaswal	04/20/2021 / bin	M5295

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
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 #
Absolute Standards, Inc.	57056 / Ba, 1000 PPM, 125 ml	072122	07/21/2025	08/07/2024 / jaswal	09/18/2022 / bin	M5390
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CLPP-CAL-3 / CLP CAL SOLUTION #3, 125mL	T2-MEB714159	01/13/2027	10/12/2022 / bin	09/19/2022 / bin	M5393
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57103 / Li, 10000 PPM, 125 ml	070622	07/06/2025	01/30/2023 / bin	01/26/2023 / bin	M5429
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57138 / Sr, 10000 PPM, 125 ml	082922	08/29/2025	03/16/2023 / jaswal	03/16/2023 / jaswal	M5473
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57138 / Sr, 10000 PPM, 125 ml	082922	08/29/2025	07/29/2024 / jaswal	03/16/2023 / jaswal	M5476
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 #
Absolute Standards, Inc.	58113 / Al, 10000 PPM, 500 ml	011623	01/16/2026	08/15/2023 / jaswal	03/17/2023 / bin	M5496



500 ml, 1000 PPM

Standards, Inc.

CHEMICAL RECEIPT LOG BOOK

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58120 / Ca, 10000 PPM, 500 ml	031523	03/15/2026	03/18/2023 / bin	03/17/2023 / bin	M5497
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58120 / Ca, 10000 PPM, 500 ml	031523	03/15/2026	08/15/2023 / jaswal	03/17/2023 / bin	M5498
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57182 / Pb, 10000 PPM, 125 ml	061522	06/15/2025	03/19/2023 / bin	03/17/2023 / bin	M5513
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58126 / Fe, 10000 PPM, 500 ml	092122	09/21/2025	08/01/2024 / Jaswal	03/17/2023 / bin	M5515
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57119 / Potassium (K) 10,000PPM	120822	12/08/2025	01/08/2024 / bin	03/17/2023 / bin	M5519
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute	58024 / Chromium, Cr,	060523	06/05/2026	08/28/2023 /	08/25/2023 /	M5658

jaswal

jaswal



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58029 / Cu, 1000 PPM, 500 ml	102523	10/25/2026	04/03/2024 / jaswal	10/27/2023 / jaswal	M5697
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58025 / Mn, 1000 PPM, 500 ml	102623	10/26/2026	04/18/2024 / jaswal	10/27/2023 / jaswal	M5698
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58029 / Cu, 1000 PPM, 500 ml	071723	07/17/2026	10/01/2024 / Jaswal	08/25/2023 / jaswal	M5751
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58112 / Mg, 10000 PPM, 500 ml	091823	09/18/2026	01/08/2024 / bin	01/03/2024 / bin	M5768
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58112 / Mg, 10000 PPM, 500 ml	091823	09/18/2026	05/24/2024 / Jaswal	01/03/2024 / bin	M5769
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57004 / Be, 1000 PPM, 125 ml	102523	10/25/2026	02/09/2024 / bin	02/09/2024 / bin	M5798



Standards, Inc.

500 ml

CHEMICAL RECEIPT LOG BOOK

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57050 / Sn, 1000 PPM, 125 ml	071123	07/11/2026	02/09/2024 / bin	02/09/2024 / bin	M5799
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57027 / CO, 1000 PPM, 125 ml	091923	09/19/2026	05/31/2024 / bin	02/09/2024 / bin	M5800
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57033 / As, 1000 PPM, 125 ml	111323	11/13/2026	02/09/2024 / bin	02/09/2024 / bin	M5801
Supplier	ItemCode / ItemName	Lot #	Expiration Date	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	58111 / Na, 10000 PPM,	122223	12/22/2026	08/01/2024 /	01/03/2024 /	M5806

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57115 / P, 10000 PPM, 125 ml	041723	04/17/2026	05/21/2024 / Jaswal	02/09/2024 / jaswal	M5815

Jaswal

jaswal

M5806



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.	57014 / Si, 1000 PPM, 125 ml	122023	12/20/2026	03/06/2024 / jaswal	02/09/2024 / jaswal	M5818
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58030 / Zinc, Zn, 500 ml, 1000 PPM	111623	11/16/2026	03/20/2024 / jaswal	02/09/2024 / jaswal	M5819
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
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 #
Inorganic Ventures	CGY10-1 / YTTRIUM 125mL 10,000ug/mL	V2-Y740548	02/20/2029	07/01/2024 / Jaswal	06/14/2024 / Jaswal	M5959
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57028 / Ni, 1000 PPM, 125 ml	041124	04/11/2027	07/03/2024 / kareem	06/11/2024 / kareem	M5960
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57034 / Se, 1000 PPM, 125 ml	060624	06/06/2027	07/02/2024 / Jaswal	06/14/2024 / Jaswal	M5962
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57003 / Li, 1000 PPM, 125 ml	061224	06/21/2027	07/01/2024 / Jaswal	07/01/2024 / Jaswal	M5970
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CGMO1-1 / MOLYBDENUM 125mL 1000ug/mL	T2-MO720876	07/17/2027	08/07/2024 / jaswal	02/22/2024 / Jaswal	M5976
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Opened By	Received Date / Received By	Lot #	
Inorganic Ventures	CGTI1-1 / TITANIUM 125mL 1000ug/mL	T2-TI719972	06/17/2027	08/07/2024 / jaswal	02/22/2024 / Jaswal	M5978	



ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot # M5982	
57038 / Sr, 1000 PPM, 125 ml	031524	03/15/2027	07/01/2024 / Jaswal	06/11/2024 / Jaswal		
ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
CGIN10-5 / INDIUM 1 x 500 ml	U2-IN729349	02/21/2028	10/08/2024 / Jaswal	06/14/2024 / Jaswal	M5985	
	57038 / Sr, 1000 PPM, 125 ml ItemCode / ItemName CGIN10-5 / INDIUM 1 x	57038 / Sr, 1000 PPM, 125 ml 031524 ItemCode / ItemName Lot # CGIN10-5 / INDIUM 1 x U2-IN729349	ItemCode / ItemName Lot # Date 57038 / Sr, 1000 PPM, 125 ml 031524 03/15/2027 ItemCode / ItemName Lot # Expiration Date CGIN10-5 / INDIUM 1 x U2-IN729349 02/21/2028	ItemCode / ItemName Lot # Date Opened By 57038 / Sr, 1000 PPM, 125 ml 031524 03/15/2027 07/01/2024 / Jaswal ItemCode / ItemName Lot # Expiration Date Date Opened / Opened By CGIN10-5 / INDIUM 1 x U2-IN729349 02/21/2028 10/08/2024 /	ItemCode / ItemNameLot #DateOpened ByReceived By57038 / Sr, 1000 PPM, 125 ml03152403/15/202707/01/2024 / Jaswal06/11/2024 / Jaswal06/11/2024 / JaswalItemCode / ItemNameLot #Expiration DateDate Opened / Opened ByReceived Date / Received Date / Opened ByCGIN10-5 / INDIUM 1 xU2-IN72934902/21/202810/08/2024 /06/14/2024 /	

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CLPP-SPK-5 / CLP Spike Standard 5	V2-MEB742037	03/12/2029	10/04/2024 / Jaswal	02/22/2024 / Jaswal	M5990

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CLPP-SPK-1 / SOIL/WATER SPIKE SOLN 1, 125mL	T2-MEB721963	07/27/2027	09/04/2024 / Jaswal	02/22/2024 / kareem	M5999

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57023 / V, 1000 PPM, 125 ml	062424	06/24/2027	09/28/2024 / jaswal	08/05/2024 / Jaswal	M6021

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57081 / TI, 1000 PPM, 125 ml	0624724	06/27/2027	08/05/2024 / kareem	08/05/2024 / Jaswal	M6023



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Absolute Standards, Inc.	57082 / Pb, 1000 PPM, 125 ml	00 PPM, 061224		08/05/2024 / Jaswal	08/05/2024 / Jaswal	M6025	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Absolute Standards, Inc.	57048 / Cd, 1000 PPM, 125 ml	070124	07/01/2027	08/05/2024 / kareem	08/05/2024 / Jaswal	M6028	
Supplier	Supplier ItemCode / ItemName		# Expiration Date Date Open		Received Date / Received By	Chemtech Lot #	
Absolute Standards, Inc.	57047 / Ag, 1000 PPM, 125 ml	122823	12/28/2026	08/05/2024 / kareem	08/05/2024 / Jaswal	M6030	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Absolute Standards, Inc.	58113 / AI, 10000 PPM, 500 ml	011623	01/16/2026	08/07/2024 / Jaswal	01/03/2024 / Jaswal	M6033	
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)	22F0762009	05/09/2027	11/04/2024 / Eman	09/29/2024 / Janvi	M6111	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Seidler Chemical			_09/29/2024 /	M6116			

Janvi

Eman

Instra-Analyzed (cs/4x2.5L)



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	05/06/2025	11/06/2024 / Janvi	09/29/2024 / Eman	M6117	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Seidler Chemical BA-9530-33 / Hydrochloric Acid, Instra-Analyzed (cs/6x2.5L)		0000275677	05/13/2025	11/13/2024 / Eman	10/13/2024 / Eman	M6121	
Supplier	ItemCode / ItemName	remCode / ItemName of # '		Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Seidler Chemical BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L)		24D1062002	05/22/2025	11/22/2024 / Janvi	10/22/2024 / Janvi	M6124	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
PCI Scientific Supply, Inc.	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		05/25/2025	11/26/2024 / Eman	11/22/2024 / Eman	M6125	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Seidler Chemical	Seidler Chemical BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L)		06/03/2025	12/03/2024 / Janvi	11/12/2024 / Janvi	M6126	

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



Certificate of Analysis ME986 ME987 MEGRA R: 02 22 24

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1.0 **ACCREDITATION / REGISTRATION**

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



M5989-M5990

2.0 **PRODUCT DESCRIPTION**

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

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

3.0

Assay Information:

Page 1 of 4

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

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

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

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

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

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

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

k = coverage factor = 2

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

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

4.0 **TRACEABILITY TO NIST**

Characterization of CRM/RM by One Method Certified Value, X_{CRM/RM}, where one method of characterization is used is the mean of individual results: X_{CRM/RM} = (X_a) (u_{char a})

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

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

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

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

INTENDED USE 6.0

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

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

March 12, 2024

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

11.2 Lot Expiration Date

- March 12, 2029

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Joseph Burns **Custom VS Manager**

Paul R Laine

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

m/z->	1.067	m/z-> 2.0€7	5.014	m/z-> 1.0E5	2.5E4	5. 0 114	1. Cadmium nitrate tetrahydrate (Cd)	Compound	Weight shov	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL):		CERTIFIED WEIGHT REPORT:	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
		 0		0 ⁶		[1] Spectrum No.1		RM#	Weight shown below was dliuted to (mL):	Expiration Date: nended Storage: ntration (µg/mL):	Part Number: Lot Number: Description:	PORT:	15, Inc. om
		120		20		-	IN024 CDM092021A1	Lot Number	6UTB uted to (mL):	070127 Ambient (20 °C) 1000	<u>57048</u> <u>070124</u> Cadmium (Cd)		
		130		30		12.514 800	1000 99.	Nominal Pu Conc. (µg/mL) (1	2000.07 0.1		(Cd)		R
200		140		\$		12.514 sec]:58148.D# [Count] [Linear]	99.999 0.10 36.5	Purity Uncertainty Assay (%) Purity (%) (%)	5E-05 Balance Uncertainty 0.100 Flask Uncertainty		Solvent: 2%		Certified R
		1 () ()		ő		Count] [Line	.5 5.4797	say Target 6) Weight (g)	ţ		ent: 24002546 2% 40.0	Lot #	Certified Reference Material CRM 3 15 12 4
		160		0 O		ar]	5.4804	Actual Actual Weight (g) Conc. (µg/mL)			Nitric Acid		terial CRM
		170		70			1000.1	11	Re	5	5		M6028
		-1 2 C		BO			10022-68-1	Expanded Uncertainty (Solvent +/- (µg/mL) CAS# 0	Reviewed By: Ped	\$	Alloch & B		-
		190 200		90 100				SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD51	Pedro L. Rentas	ento	Brack		ANAB IS AR-153 https://Ab
				-			orl-rat 60.2mg/kg 3108	ned pg.) NIST LD50 SRM	070124		070194		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com

1 of 2

Part # 57048

Lot # 070124

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

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

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Physical Characterization:

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

In P. S.

Certified by:

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

- * All standard containers are meticulously cleaned prior to use.
- * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated.
- * All standards should be stored with caps tight and under appropriate laboratory conditions. * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST

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

e24

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:						
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

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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

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

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

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

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As	4 0.2	ĉ	<0.02	E	<0.02	6	<0.02	Mg	<0.01	õ	<0.02	R	<0.02	Ag	40.02	H	40.02	<	20.02
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Physical Characterization:

(T)= Target analyte

Certified by:

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

Son P. Shirt

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

- the preparation of all standards.
- * All standard containers are meticulously cleaned prior to use.
- * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated.
- * All Standards should be stored with caps tight and under appropriate laboratory conditions. * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



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

Instructions for QATS Reference Material: ICP-AES ICS

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

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

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

Contains Heavy Metals HAZARDOUS MATERIAL

Safety Data Sheets Available Upon Request

(A) SAMPLE DESCRIPTION

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

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

(B) BREAKAGE OR MISSING ITEMS

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

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

(C) ANALYSIS OF SAMPLES

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

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

Page 1 of 2

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



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



ICSA

M5126

M5127

M5128

M5129

M5130

Instructions for QATS Reference Material: ICP-AES ICS

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

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

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

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

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

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

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

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



Certificate of Analysis

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

130925

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Ti

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

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

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ICP Assay

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

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

3162a

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

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

4.0

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

November 02, 2021

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

11.2 Lot Expiration Date

- November 02, 2026

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Director, Quality Control

Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Paul R Line



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

Instructions for QATS Reference Material: ICP-AES ICS

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

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

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

Contains Heavy Metals HAZARDOUS MATERIAL

Safety Data Sheets Available Upon Request

(A) SAMPLE DESCRIPTION

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

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

(B) BREAKAGE OR MISSING ITEMS

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

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

(C) ANALYSIS OF SAMPLES

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

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

Page 1 of 2

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



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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.



1 of 2

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	Inc.
	800-368-1131



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

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

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

Physical Characterization:

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

(T)= Target analyte

Certified by:

In P. Mr.

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

the preparation of all standards.

* All standard containers are meticulously cleaned prior to use.

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

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

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



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

Instructions for QATS Reference Material: Inorganic ICV Solutions

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

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

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

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

> Safety Data Sheets Available Upon Request



(A) SAMPLE DESCRIPTION

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

(B) BREAKAGE OR MISSING ITEMS

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

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

(C) ANALYSIS OF SAMPLES

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

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

RMs ICV 1, 5, 6 SFAM.docx

Page 1 of 2

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



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

AP11MInstructions for QATS Reference Material: Inorganic ICV SolutionsICV1-1014For ICP-MS analysis, use a 50-fold dilution by pipetting 2 mL of the ICV1 concentrate
into a 100 mL volumetric flask and dilute to volume with 1% (v/v) nitric acid.ICV5-0415For the cold vapor analysis of mercury by AA, use a 100-fold dilution by pipetting
1 mL of the ICV5 concentrate into a 100 mL volumetric flask and dilute to volume
with 2% (v/v) nitric acid. The ICV5 concentrate is prepared in 0.05% (w/v) K2Cr2O7
and 5% (v/v) nitric acid.ICV6-0400For the analysis of cyanide, use a 100-fold dilution by pipetting 1 mL of the ICV6
concentrate into a 100 mL volumetric flask and dilute to volume with Type II water.
Distill this solution along with the samples before analysis. The cyanide concentrate
is prepared from K3Fe(CN)6, Type II water, and 0.1 % sodium hydroxide, and will
decompose rapidly if exposed to light.

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

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

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

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

1 023 Multed to (2 072 1 1000 1000 1000 1000 1000 1000 1000 1
Expiration Dete: 072125 2% 40.0 Nithic Add neradid Storage: Ambient (20 °C) SE-05 Baaroe Uncertainty (mL) Nithic Add ST Test Number GUTB SE-05 Baaroe Uncertainty SE-05 Baaroe Uncertainty Actual Number Actual
NIST fest Number: 6UTB SE-05 Bance Unordary Lot Nominal Purity Uncertainty Assy Taget Actual Bance Intrate (Ba) IN023 excame 1000 99.99 0.10 E23 3.82417 3.82426 1:0E8 [1] Spectrum No.1 [1] 12.514 sec):69156.0/f [Count] [Linear] 2:0E8 11.0E8 11.0E8 1 20 30 40 50 60 2:0E8 10 120 130 140 150 160 50
Compound New Number Core: (up/m.) (%) Parity (%) (%) Weight (0) Weight (0)
[1] Spectrum No.1 [12.514 sec]:58156.D# [Count] [Linear] E8 E5 E5 E6 E6 E6 E6 E6 E6 E6 E6 E6 E6 E6 E6 E6
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10 120 120 130 140 150
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m/z-> 210 220

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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 Spectrometry (ICP-MS):

					Children -									a the second sec					
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02		,ei	<0.02	Бu	<0.02	ŗ	<0.07	ŷ	1002	č	000	24	1000	5	70.02	5	20.05	2	40.02
F		2	000	3			1010	9.1	TO'O'	ŝi	70.02	2	70.02	A0	<0.02	F	<0.02	>	<u>6.02</u>
+ .	-	3	70'N2	3		늭	<0.02	MN	<0.02	Ъ	<0.02	RЪ	<0.02	Na	40.2	Ē	<0 UD	42	0007
0.0		1	<0.02	Ga	<0.02	Че	<0.2	Hg	<0.2	۵.	<0.02	Ru	<0.02	2	CO 07	ł		; >	1000
20.0>		0	<0.02	e	<0.02	La	<0.02	Mo	<0.02	å	2007			5 0			70.02	-	20.02
<0.02	1	jă,	<0.02	An	000	á	2007	PIN I		: >	20.00		70.02	0	70'02	цо	<0.U2	U 7	<0.02
	1			mL	TRA	2	20.02	DNT	ZUNZ	2	202	ŝ	<0.02	E	<0.02	i	2002	7,	2007

Physical Characterization:

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

Certified by:

ar R

- * 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).

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

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



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

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

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-	<0.02	3	<0.02	Dy	<0.02	Hf	<0.02	E	Ŧ	N	<0.02	占	<0.02	Se	₫02	e.	<0.02	M	000>
Sb	<0.02	లి	⊲0.2	Ъ	<0.02	Ho	<0.02	La L	≤0.0>	ź	≤0:0>	Re	<0.0>	3	€0.02	e H	<0.02	Þ	4002
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ė	≤0.01	ර	<0.02	පී	<0.02	£	<02	He	<02	Δ.	<0,00	Ru	89	3	200	Ę	200	2 >	70.00
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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.
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Lot # 070622 Part # 57103

ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	031523	on ttached pg.) NIST LD50 SRM ont-rat >2000mo/kg 3109a	Ő	O O N
ARA	Ped X Gio	SDS Information (Solvent Safety Info. On Attached pg.) CSHA PEL (TWA) LD5C C	-0 0	190 200
MUXCITI	Formulated By: Reviewed By:	Expanded Uncertainty +/- (µg/mL) CAS: 20.0 471-34	Q R	170
170		Actual Actual Weight (g) Conc. (ug/mL) 75.2093 10001.4	So	1900 1900 1900
Certified Reference Material CRM	Lot # Solvent: 21110221 2% 60.0 (mL) Uncertainty sentainty	Uncertainty Assay Target Purity (%) (%) Weight (g) 0.10 38.9 75.1990	0.D# [Count] [Line	140 150 240 250
NV5497	5E-05 Balance 00.41 0.058 Flask Un	Nominal Purity Uncertainty Conc. (<i>ug/m</i> L) (%) Purity (%) 10000 99.999 0.10	30 30	- 30 5 7 30 7 30 7 30
	58120 031523 031526 031526 Ambient (20 10000 6UTB 6UTB 6UTB	Lot A RM# Number Con	10 To 1 12	220
Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT: Part Number: 58120 Lot Number: 031523 Description: 031526 Expiration Date: 031526 Recommended Storage: Ambient (2 Nominal Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was diluted to (mL):	Compound 1. Calcium carbonate (Ca)	2.0E4 1.0E4 3.0E4 5.0E4 2.5E4	T.OES 1.0ES 5.0E4 m/2-> 2 m/2-> 2 Part # 58120 Lot # 031523

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

Certified Reference Material CRM



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

	<0.02	3	<0.02	ĥ	<0.02	Hf	<0.02	Ц	<0.02	z	<0.02	Ł	<0.02	ŝ	<0.2	£	<0.02	×	<0.02
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	<0.01	q	<0.02	g	40.02	Ę	402	Hg	<0.2	۵.	<0.02	Ru	<0.02	S	€0.02	Ę	<0.02	×	<0.02
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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.

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Part # 58120 Lot # 031523

ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	031523	on ttached pg.) NIST LD50 SRM ont-rat >2000mo/kg 3109a	Ő	O O N
ARA	Ped X Gio	SDS Information (Solvent Safety Info. On Attached pg.) CSHA PEL (TWA) LD5C C	-0 0	190 200
MUXCITI	Formulated By: Reviewed By:	Expanded Uncertainty +/- (µg/mL) CAS: 20.0 471-34	Q R	170
170		Actual Actual Weight (g) Conc. (ug/mL) 75.2093 10001.4	So	1900 1900 1900
Certified Reference Material CRM	Lot # Solvent: 21110221 2% 60.0 (mL) Uncertainty sentainty	Uncertainty Assay Target Purity (%) (%) Weight (g) 0.10 38.9 75.1990	0.D# [Count] [Line	140 150 240 250
NV5497	5E-05 Balance 00.41 0.058 Flask Un	Nominal Purity Uncertainty Conc. (<i>ug/m</i> L) (%) Purity (%) 10000 99.999 0.10	30 30 30 30 30 30 30 30 30 30 30 30 30 3	- 30 5 7 30 7 30 7 30
	58120 031523 031526 031526 Ambient (20 10000 6UTB 6UTB 6UTB	Lot A RM# Number Con	10 To 1 12	220
Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT: Part Number: 58120 Lot Number: 031523 Description: 031526 Expiration Date: 031526 Recommended Storage: Ambient (2 Nominal Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was diluted to (mL):	Compound 1. Calcium carbonate (Ca)	2.0E4 1.0E4 3.0E4 5.0E4 2.5E4	T.OES 1.0ES 5.0E4 m/2-> 2 m/2-> 2 Part # 58120 Lot # 031523

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

Certified Reference Material CRM



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

	<0.02	3	<0.02	ĥ	<0.02	Hf	<0.02	Ц	<0.02	z	<0.02	Ł	<0.02	ŝ	<0.2	£	<0.02	×	<0.02
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	40 12	ථ	40.02	a	40.02	h	<0.02	Mg	±0.01	ő	20 .0>	2	<0.02	Ag	<0.02	F	<0.02	>	<0.02
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	<0.01	q	<0.02	ß	40.02	Ę	402	Hg	<0.2	۵.	<0.02	Ru	<0.02	S	€0.02	Ę	<0.02	×	<0.02
	≤0.02	გ	<u>60.02</u>	ප්	40.02	3	0.02	Mo	<0.02	æ	<0.02	Sn	<0.02	S	<0.02	Sn	<0.02	Ŋ	<0.02
	≤0.02	ð	<u>60.05</u>	Au	000	£	<0.02	PN	<u>40.02</u>	Å	40.2	ŝ	<0.02	T.	≤0.02	Ę	<0.02	2	2002

Physical Characterization:

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

Certified by:

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Part # 58120 Lot # 031523

Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com				Certified R	Certified Reference Material CRM	aterial CRI	R 103/17	H/2		AN AF https	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	Accredited ate Number ndards.com
CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description:	r: <u>57182</u> rr: <u>061522</u> n: <u>Lead (Pb</u>)	-		Solvent:	Lot # It: 20510011	Nitric Acid		Lievannie	/ nui E	apertite		
Expiration Date:061525Recommended Storage:Ambient (2)Nominal Concentration (ug/mL):10000NIST Test Number:6UTBWeight shown below was diluted to (mL):	e: 061525 e: Ambient (20 °C)): 10000 n: 6UTB rs diluted to (mL): 20	0 °C) 2000.02	5E-05 B 0.058 F	2% 5E-05 Balance Uncertainty 0.058 Flask Uncertainty	2% 40.0 mty (mL)	Nitric Acid		Formulated By:		Giovanní Esposito	061522	য় য
Compound	Lot RM# : Number	Nominal Conc. (µg/mL)	Purity (%)	Uncertainty Assay Purity (%) (%)	ay Target) Weight (g)	Actual Weight (g)	Actual Conc. (µg/mL)	Expanded Uncertainty +/- (µg/mL) C	Solvent S CAS# 0S	SDS information (Solvent Safety Info. On Attached pg.) COHA PEL (TWA)	tion Attached pg.) LD50	NIST
1. Lead(II) nitrate (Pb)	IN029 PBD122016A1	10000	99,999	0.10 62.5	5 32.0006		10001.1		φ	0.05 ma/m3	introne	
[1] Speci	[1] Spectrum No.1 [17.284 s	90]:58	85.D#	17.284 sec]:58182.D# [Count] [Linear]	(upe						11
ສ ອ ອ												
2.0E6	20	O.		40	80	Co	20	Ö Ø	0	*	100	
1.0E6												
rn/z->	110	130		140	150	160	170	180		0	002	
ы С. С. Ш. С.												
R A E	210 220	530		N 0	250	260						
Part # 57182 Lot # 061522					1 of 2				Printed: 3	Printed: 3/16/2023, 1:45:32 PM	45:32 PM	

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



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

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

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							70.00	4	10	20	20.02	13		q	8.U2	3	808

Physical Characterization:

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

In P M.

Certified by:

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

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

* All standard containers are meticulously cleaned prior to use.

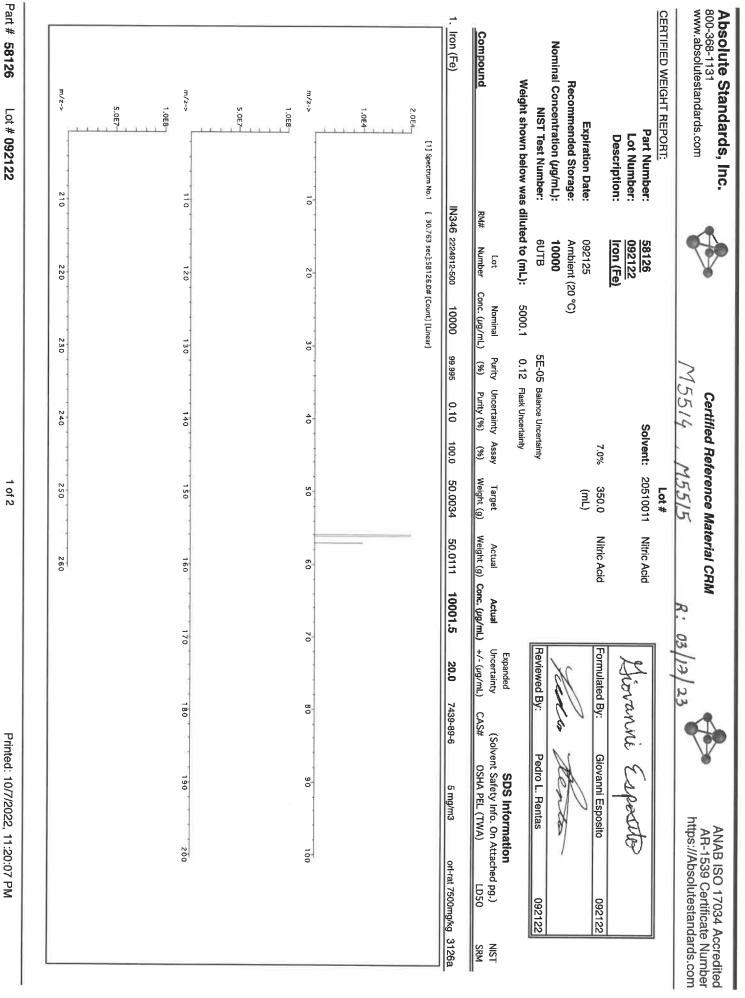
Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).

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

All Standards should be stored with caps tight and under appropriate laboratory conditions.

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

Part # 57182 Lot # 061522



Lot # 092122

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

Certified Reference Material CRM



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

E	<0.02	G	<0.02	Ŋ	<0.02	Hf	<0.02	п	<0.02	ÿ	<0.10	놊	<0.02	Se	40.2	4	<0.02	M	<0.02
_	<0.02	ථ	40.2	斑	40:02	Но	40.02	3	40.02	ĝ	<0.02	Re	<0.02	ន	<0.02	Ъ.	€0.05	D	<0.02
As	Ø2	ථ	<0.02	a	<0.02	a	<0.02	Mg	€0,01	ő	€0.02	Rh	≤0.02	Ag	40.02	F	<0.0>	>	<0.02
_	≤0.02	ඊ	40.02	3	≤0:02	н	60 102	Mn	<0.10	R	<u>60.02</u>	Rb	≤0.02	R	40.2	f	<0.02	۹۶ ۲	≤0.02
	40.01	Ċ	<0.05	3	<0.02	Ъ.	402	Hg	<02	الم	<0.02	Ru	<0.02	S.	<0.02	Ę	40.02	۲	≤0.02
_	40.02	රී	<0.10	පී	0.10	La	<0.02	Mo	<u>40.02</u>	æ	<0.02	Sm	<0.02	s	<0.02	Sn	<0.02	Z	<0.05
	<0.02	8	<0.10	Au	<0.02	£	<0.02	PN	20.02	M	402	3	40.02	f	<0.02	F	<0.02	77	<000×

Physical Characterization:

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

Certified by:

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

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Lot # 092122 Part # 58126

m/z->	5 0 0 0	m/z-> 1.0E4	1.0	m/z-> 2.065	1.000	N. O M	1. Potassium nitrate (K)	Compound	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below was	CERTIFIED WEIGHT REPORT: Part I Lot I Des	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
210 220		110 120		10 20		[1] Spectrum No.1 [IN034 KD022021A1	RM# Number	Expiration Date:120825Recommended Storage:Ambient (20 °C)Il Concentration (µg/mL):10000NIST Test Number:6UTBWeight shown below was diluted to (mL):30	<u>PORT:</u> Part Number: <u>58119</u> Lot Number: <u>120822</u> Description: <u>Potassium (K)</u>	om om
200		130		ŵ			10000 . 8	Nominal Conc. (µg/mL)	000,4	m (K)	
v. 0		140		4. 0		35.763 sec]:58119.D# [Count] [Linear]	99.999 0.10 37.6	Purity Uncertainty Assay (%) Purity (%) (%)	29 5E-05 Belance Uncertainty 0.06 Flask Uncertainty	Solvent:	Certified R
N U		1- 0		S.		čount] [Line	6 79.7990	ay Target 5) Weight (g)	2% 60.0 (mL)	Lot #	Certified Reference Material CRM
2		160		<u>e</u>		ar)		Actual Weight (g) Co	Nitric Acid	Nitric Acid	NUCO
		170		70			10001.1	Expanded Actual Uncertainty Conc. (µg/mL) +/- (µg/mL)	2 S		(B)
		180		Ø			20.0 7757-79-1	CAS	Formulated By:	Giovanni	RIANU
		190		8 0			5 mg/m3	SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD5(Giovanni Esposito	L'Especite	₹.
		200		100			orl-rat 3015 mg/kg	mation On Attached pg.) (A) LD50	120822	B	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
							lei I	NIST			4 Accredite ate Numb indards.co

Part # 58119 Lot # 120822

1 of 2

Printed: 3/16/2023, 1:45:22 PM

	Printed: 3/16/2023, 1:45:22 PM	Printed: 3						2 of 2							0822	Lot # 120822		Part # 58119	Pan
				above) of NIS	to NIST (see above). 9 Uncertainty of NIST 9.C. (1994).	le to N the Ur 1, D.C.	Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. All standards should be stored with caps tight and under appropriate laboratory conditions. Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).	weight d. ry cond i and E: fice, W	ated with ise stated laborator ivaluating rinting Of	e calibr: otherw opriate es for E ment P	Standards are prepared gravimetrically using balances that are calibrated with weights trace Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. All standards should be stored with caps tight and under appropriate laboratory conditions. Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressi Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washing	balance ed valu t and u it, C.E., 297, U.	Insignation of the standard for the stan	metrica 0.5% of d with (r, B.N. echnica	Standards are prepared gravimetrically using balances that ar Standards are certifed (+/-) 0.5% of the stated value, unless All standards should be stored with caps tight and under app Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelin Measurement Result," NIST Technical Note 1297, U.S. Govern	e prepa e certifi should leferend t Result	idards an Idards an Idards an Itandards ertainty F Isuremen	* Star * All s Mea	
			tated. sed in	rwise s Is are u	s unless otherwise stated. raw materials are used in	ents ur rity rav	The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. Purified acids, 18.2 megohim deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.	the hi	ind volum sware and	netric a A glas:	om gravir Ited Class	lated fr , calibra	ion calcu ed water	centrat deioniz ds.	The certified value is the concert Purified acids, 18.2 megohim deic the preparation of all standards. All the preparation of all standards.	value is 18.2 I ion of a	certified fied acids preparat	* The * Puri-	
	s.																		
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	in P. M.	1								ndard.	Homogeneity: No heterogeneity was observed in the preparation of this standard.	paration	d in the pr	observe	eneity was	heterog	geneity: No	Homo	
	Certified by:														ation:	acteriz	Physical Characterization:	Phys	
					. Þ		ulyte	(T) = Target analyte	(T) = Ta						æ				
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	40,02 40,020 40,000 40,000 40,000 40,0000000000	극R 및 크 딕 역 역	4000 10 10 10 10 10 10 10 10 10 10 10 10	Ta Sr Na Sr Sr	888888888	Sen Rb Rb Pr		x p p g g N	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Ndo H Mg L: L:	4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8	29년 31 부 55 표	888888888	<u> </u>	40.02 40.02 20 20 20 20 20 20 20 20 20 20 20 20 2	5 S S S S S S S	40.02 40.02 40.02 40.02 40.02 40.02	Al Sb Ba Be Bi Bi	
				[]	(µg/mL)	S	Verification by ICP-M	ation		Metals	Trace M								
							(S):	ICP-M	ometry (Spectr	Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	ed Plas	y Couple	uctive	is by Ind	Analys	umental	Instr	
ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	ANAB IS AR-1539 https://Abs	V				CRM	Certified Reference Material CRM	rence	fied Refe	Certi			V		, inc.	dards.con	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	Absolute : 800-368-1131 www.absolute	₹ 88

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m/z->	N .5 E 5	m/z-> 5.0E5	ស .0 ពា ស	m/z-≫ 1.0≣6	5000	1.004	1. Chromium(III) nitrate nonahydrate (Cr)	Compound	outs ewing A	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL):	Par De	CERTIFIED WEIGHT REPORT:	www.absolutestandards.com
N O		110		10:		[1] Spectrum No.1		Pa	Volume shown below was diluted to (mL):	Expiration Date: nended Storage: ntration (µg/mL):	Part Number: Lot Number: Description:		5
220		120		N. O		-	58124 071122	Part Lot Number Number	filuted to (mL):	060526 Ambient (20 °C) 1000	<u>58024</u> 060523 Chromium (Cr)		
230		130		ů,		31,393 80	0.1000	Dilution Factor	2000.02		1 (Cr)		MS
240		140				c]:57024.	200.0 0.084	Initial Uncertainty Vol. (mL) Pipette (mL)	0.058 Flask U				M.S.65.8
				ð.		31,393 sec]:57024.D# [Count] [Línear]	084 1000	Uncertainty Nominal Pipette (mL) Conc. (µg/mL)	Balance Uncertainty Flask Uncertainty		21110221 2.0%	Lot #) B
250		н О		С О		t] [Linear]	0 10000,1	nał Initial g/mL) Conc. (µg/mL)		(mL)	221 Nitric Acid % 40.0	# Solvent:	Certified Reference Inaterial Chin
200		180		0		¢.	0.1 1000.0	al Final rg/mL) Conc. (µg/mL)		Ļ	0 Nitric Acid	ent:	123
		170		70			0.0 2.2	Expanded al Uncertainty g/mL) +/- (µg/mL)	Lueviewed by:	X	Acid Formulated By:		
		18. 0		8- 0-			7789-02-8) CAS	a py:	al al	Heren By:		
		190		90			2-8 0.5 mg(Cr)/m3	Solvent Safety Info. On OSHA PEL (TWA)		len	Lawrence Barry		
		200		100				Attached			Barry		AH-1539 Certificate Number https://Absolutestandards.com
							ori-rat 3250 mg/kg		626000	000500	060523		AH-1539 Certificate Number ttps://Absolutestandards.com
							3112a	SRM					rds.com

Part # 58024 Lot # 060523

1 of 2

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Absolute 800-368-1131 www.absolute	Absolute Standards, Inc. Certified Reference 800-368-1131 www.absolutestandards.com www.absolutestandards.com instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	י, Inc.	ctively	V Coupled	Plasm	na Mass S	Ce Ce	rtified Ru	eferer CP-Mi	Certified Reference Material Ci	rial C	RM						https	AB ISO 170 1-1539 Cert ://Absolute	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
						Trace N	Metals	Verification		by ICP-MS		/g/mL)								
A	-0.02 Cd	40.02	Dy	40.02	Hf	40.02		A).02	Ŋ	40.02		A).02	- Se	ð		7	A 33	W	000	
		40.02	E Dy	<0.02	Ho	4).02 (0).02	달드	4 4 22	Ş 3	40.02	R P	40.02 40.02	Si Se	4 A A	-	ч Ч	A 0.02	C W	<0.02	
		40.02) 달	-40.02	5	<0.02	Mg	<0.01	, õ	40.02	Rh	<0.02	Ag	<0.02			40.02	v (<0.02	
R Ba		-T T	ନ୍ଦୁ ହ	A 0.02	1) H	4. 6. B	F. M	A. 0.02	P Pd	3 8	R RB	A 0.02	e Na	202		1 2	8 8 8	; \$	A0.02	
		40.02	ନ ଜୁ	40.02	8 L :	a a 3	Nd S	8 8 8 8 8	× 7 ·	A A A	Sm	40.02	Tas	40.02				22-		
								(T)=1	(T)= Target analyte	nalyte										
Physical	Physical Characterization:	tion:															Certified by:	led by:		a
Homogen	Homogeneity: No heterogeneity was observed in the preparation of this standard.	neity was o	bserved	l in the prepa	ration c	of this stands	ard.										LA .	J.		K
* The ce * Purifiec * All star * Standa * Standa * All star Measu	The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards. All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated. All standards should be stored with caps tight and under appropriate laboratory conditions. Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).	the conce standard rs are me rs are me ed gravim d (+/-) 0. d (+/-) 0. ce stored ce stored se stored " NIST Te	eionize s. s. etriculou etrical with c with c chnica	on calculat ed water, c usly cleaned ly using ba the stated aps tight <i>a</i> and Kuyat, and Kuyat,	ed fro alibrat d prior lances 1 value C.E., 1 C.E., 1 C.E., 1	ed Class <i>A</i> ed Class <i>A</i> to use. that are i that are i that approp Guidelines Governm	A glass A glass calibra therwia s for En hent Pr	ware and ware and ware and ware and with ware stated. Se stated aboratory valuating a valuating official section of the sectio	tric me the hig veights ce, Wa	easuremer yhest purit s traceable tions. pressing t ashington,	y raw to NII D.C. (ess otherwise stated. materials are used in ST (see above). ST (see NIST 2994).	vise st are us bove). of NIST	ated. ed in						

Part # 58024 Lot # 060523

Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT:		Ex	Recommended Storage: Nominal Concentration (um/mL):	NIST	Volume s	Compound	1. Copper(II) nitrate trihydrate (Cu)	1.0E8	5.OE5	m/z->	5.0E7	2.5E7	m/z-≻ 2.0€7	1.0€7	m/z->
om as, Inc.		Part Number: Lot Number: Description:	Expiration Date:	Recommended Storage: Concentration (un/mL):	NIST Test Number:	Volume shown below was diluted to (mL):	z				10			110		2
-		58029 102523 Copper (Cu)	102526	Ambient (20 °C) 1000	6UTB	diluted to (mL)	Part Lot Number Number	58129 100223			N			120		
		(Cu)		20 °C)		2000.02	Dilution Factor	0.1000			30			130		
Certif					5E-05 Balance	0.058 Flask U	Initial Uncertainty Vol. (mL) Pipette (mL)	200.0 0.084			40			140		
ified Referen M569子	Lot #	24002546	2.0%		Balance Uncertainty	Flask Uncertainty	Initial Uncertainty Nominal Vol. (mL) Pipette (mL) Conc. (ug/mL)	84 1000			50			150		
Certified Reference Material CRM M 56 G子 R いり0 12	Solve	46 Nitric Acid	40.0 (mL)				nL) Conc. (µg/mL)	10000.1			80			160		
1 CRM 10 27 23		L	Nitric Acid				Final L) Conc. (µq/mL)	1000.0	894	ng tha tha an	provincian de dessen			0 170		
			Formulated By:	M.	Reviewed By:		Expanded Uncertainty +/- (ug/mL)	2.2			70					
-		and and		to the	-70		(Solven CAS# C	10031-43-3			8 Ô			180		
AN AF			Benson Chan	and a	Pedro L. Rentas		Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD50	1 mg/m3			90			1.00		
ANAB ISO 17034 Accreditec AR-1539 Certificate Number https://Absolutestandards.com			102523	,	102523		Attached pg.)	ori-rat 794 mg/kg			100			N 0		
Accredite Ite Numbe Idards.com	4				<u></u>	Į	NIST	3114								

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



Certified Reference Material CRM



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

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

Γ							Trace M	etals	; Verifica	ition	by ICP-N	r) SI	g/mL)						
	3	2	22	7	2		2	and the second		Sale Con			South States of the	Mag	Contraction of the other			Distant.	The second second
A	40.02	8	20,02	Dy	<0.02	Hf	<0.02	5	<0.02	N	<0.02	Pr	<0.02	se	<0.2	4	<0.02	W	<0.02
SB	40.02	ß	<0.2	Ę	<0.02	Но	<0.02	Ŀ	<0.02	Ŗ	<0.02	Re	<0.02	ŝ	<0.02	Te	<0.02	c	<0.02
As	40.2	ů	<0.02	F	<0.02	F	<0.02	Mg	<0.01	õ	-0.02	Rb	<0.02	Ag	40.02	3	40.02	<	4002
Ba	<0.02	S	<0.02	ନ୍ଥ	<0.02	F	40.02	Mb	<0.02	Pd	-0.02	Rb	<0.02	Na	40 i2	đ	<0.02	\$	40.02
Be	<0.01	ዮ	<0.02	Ga	<0.02	Fe	<0.2	Hg	<0.2	'n	<0.02	Ru	<0.02	Sr	40.02	F	40.02	ĸ	40.02
Bi	<0.02	S	<0.02	ĉ	<0.02	L	40.02	Mo	<0.02	¥	40.02	Sm	<0.02	s	<0.02	Sn	<0.02	2	40.02
œ	<0,02	ß	-1	Au	<0.02	3	<0.02	Nd	<0.02	ĸ	<0.2	S.	<0.02	Ta	<0.02	H	<0.02	2	40.02

(T) = Target analyte

Physical Characterization:

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

in politic

Certified by:

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

the preparation of all standards.

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

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

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

urt # 58029 Lot # 102523

800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT:		ņ	Recomme	Nominal Concentration (µg/mL):	NIST	Volume		Compound	1. Manganese(II) nitrate tetrahydrate (Mn)	Сл. О ПП Ф	N.5 6		1.088	0. 0 M7	1.0E8	5.0篇7	m/z->
om	Ð	Part Number: Lot Number: Description:	Expiration Date:	Recommended Storage	ration (µg/mL):	NIST Test Number:	Volume shown below was diluted to (mL):		Nu		[1] Speatrum No.1					110)
		<u>58025</u> 102623 Manganese (Mn)	100808	Amhient (20 °C)	1000	6UTB	diluted to (mL):	Part Lot	N N	58125 071123	-					120		
		(Mn)		Ċ,	ç	5E-05	3000.41 0.058	Dilution Initial		0.1000 300.0	34.243 sec]:57025.D# [Count] [Linear]		2			130		
Certified Rei M.5-6 4 8						05 Balance Uncertainty	58 Flask Uncertainty	lal Uncertainty	Pipette (mL)	0.084	7025,D# [C		5			140		
ference A	Lot #	24002546	2.0%			ainty	ų	Nominal	Ĉ	1000	ount] [Lines					150		
Material CRM	Solvent:	Nitric Acid	60.0 Nitr					Initial	m	10000.1 10	ŗ					160		
			Nitric Acid Formulated By:	\$	X	Reviewed By:		Expanded Final Lincertainty	mL)	1000.0 2.1						170		
			ited By:		erthe 1	ed By:) CAS	20694-39-7						180		
http		-	Benson Chan	A	Vento	Pedro L. Rentas		(Solvent Safety Info. On Attached no.)	OSHA PEL (TWA)	7 5 mg/m3						160		
AR-1539 Certificate Number https://Absolutestandards.com		,	102623		/	102623		nation On Attached not)	A) LD50	ort-rat >300mg/kg						200		
e Numbe	l							NIST	SRM	3132								

Part # 58025 Lot # 102623

1 of 2

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vww.absolutestandards.com 300-368-1131 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):

23	r,	40.02	3	40.02	Ta	<0.02	s	<0.2	ĸ	<0.02	Nd	<0.02	Рв	40.02	Au	<0.02	ß	40.02	₿
A0.02	Zn	<0.02	S	40.02	ŝ	<0.02	Sm	40 ,02	7	<0.02	Mo	<0.02	5	<0.02	ĉ	<0.02	S	<0.02	Bi
<0.02	Y	<0.02	Tm	<0.02	ş	<0.02	Ru	<0.02	q	<0.2	ВĦ	40.2	Fe	<0.02	G	<0.02	Ω	<0.01	Be
40.02	٩,	<0.02	11	40.2	Na	<0.02	RЬ	<0.02	Pd	Ч	Mn	<0.02	. H	<0.02	ନ୍ଥ	<0.02	S	40.02	Ba
A0.02	<	40.02	H	<0.02	Ag	<0.02	R }	<0.02	8	<0.01	Mg	40.02	la	<0.02	臣	<0.02	ĉ	40.2	As
40.02	٩	40.02	Те	<0.02	Si	<0.02	Re	<0.02	ß	40.02	Ľ	A0.02	Ho	<0.02	Ę	<0.2	ß	40.02	SP
40.02	W	<0.02	1	<0.2	8	<0.02	P	<0.02	N	<0.02	E	<0.02	Hf	<0.02	Dy	<0.02	ß	A0.02	A
					Section of the sectio	State of the state	MASSON IN	ALCOND. DOD TOTAL		Statistic States	All the second		Concession of the local division of the loca		-				100
								DY ICP-N		Verifica	letais	I race M							

(T) = Target analyte

Physical Characterization:

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

In 1. Sli

Certified by:

* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the balances that are calibrated with weights traceable to NIST (see above). * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.

* 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).

art # 58025 Lot # 102623

2 of 2

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Part #											R	
58029	m/z-v	1.027	m/z-> 2.0€7	2.567	m/z->- 5.0巨7	а. О П	1.0 E	Copper(II) nitrate trihydrate (Cu)	Volume sh Compound	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number:	<u>CERTIFIED WEIGHT REPORT</u> Par Lo De	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
Lot # 071723	ານ 100		110		10		[1] Spectrum No.		Volume shown below was diluted to (mL): Part Lot Number Number	Expiration Date: Recommended Storage: I Concentration (µg/mL): NIST Test Number:	<u>Part Number:</u> Lot Number: Description:	Is, Inc.
			0		4		, J	58129	Part Number	-		
	220		1 N		N 0		-	022723	d to (mL): Lot Number	071726 Ambient (20 °C) 1000 6UTB	58029 071723 Copper (Cu)	
	230		130		ය 0		13,422 8	0.1000	2000.02 Dilution Factor	ර	<u>u</u>	
			0				əc]:58	200.0	0.058 Initial Vol. (mL)	5E-05		
	240		1 4 0		ð		33.422 sec]:58029.D# [Count] [Linear]	0.084	Flask Uncertainty Uncertainty Pipette (mL) C	Balance Uncertainty		Certified R
1 of 2	າ ທີ່ 0		1 0 0		D.		Count] [L	1000	Flask Uncertainty Uncertainty Nominal Pipette (mL) Conc. (µg/mL)	2.0% ainty	Lot # 21110221	Reference M
	NO		160		<u>e</u>		[near]	10000.5	Initial Conc. (µg/mL)	40.0 (mL)	<u> </u>	laterial
	0						_	1000.0	Final	NITIC ACID		CRM M5751
			071		70			2.2		Pormulated By:		
Prin			1 80 0		80			10031-43-3	CAS			
Printed: 8/24/2023, 4:18:28 PM			100		0			3 1 mg/m3	SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD50	Pedro L. Rentas		e
023, 4:1			N		<u>_</u>			m 3	SDS Information Safety Info. On Attac HA PEL (TWA)	nan		ANAI AR-1 https://
8:28 PM			N O O		100			orf-rat 794 mg/kg	on :tached pg.) LDS0	071723		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
								g 3114	NIST	23		Accredited ate Number ndards.com

Printed: 8/24/2023, 4:18:28 PM	Printed: 8/24/20						2 of 2							1723	Lot # 071723	58029		Part #
			used in)). ST	rials are see above inty of NI 4).	nless oth w materia NIST (see Incertaint	t purity ra t purity ra ceable to sing the U gton, D.C	highesi highesi ndition: Expres Washin	and the and the with weigi ated. ated. g Office, g Office,	and ve assware vrated v wise st te labo r Evalua Printin	om gravimetric and volumetric measurements unless otherwise stated Class A glassware and the highest purity raw materials are use or to use. It are calibrated with weights traceable to NIST (see above). the, unless otherwise stated. Inder appropriate laboratory conditions. "Guidelines for Evaluating and Expressing the Uncertainty of NIST S. Government Printing Office, Washington, D.C. (1994).	l from g brated rrior to alue, u alue, u d under E., "Gu U.S. G	 * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards. * All standard containers are meticulously cleaned prior to use. * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). * Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated. * All Standards should be stored with caps tight and under appropriate laboratory conditions. * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994). 	onization culoush trically % of th 8.N. an hnical N	he concer sgohm dei standards, are meti s are meti d gravime (+/-) 0.5 (+/-) 0.5 (+/-) 0.5 Taylor, I NIST Tecl NIST Tecl	value is t 18.2 m 70 n f all m ontainen prepare certifed should b eference Result,"	The certified value is the concen Purified acids, 18.2 megohm deio the preparation of all standards. All standard containers are metic Standards are prepared gravimet Standards are certifed (+/-) 0.5 Standards should be stored w Uncertainty Reference: Taylor, E Measurement Result," NIST Tech	* * * * * * * * * * * * * * * * * * *	
d by:	Certified by:									is standard.	ion of th	Physical Characterization: Homogeneity: No heterogeneity was observed in the preparation of this standard.	served in	ion: eity was obs	acterizat heterogen	Physical Characterization: Homogeneity: No heterogeneity v	Phys i Homo	
						yte	get anal	(T) = Target analyte										
40.02 W <0.02 40.02 U <0.02	다. 같 답 답 답 답 답 답	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Ta S S Na A S S			40.02 40.02 40.02 40.02 40.02 40.02	K P P 2 S N N	40.02 40.02 40.02 40.02 40.02 40.02 40.02	Hg Nd	40.02 Li 40.02 Ni 40.02 Lu 40.02 Ni 40.02 Lu 40.02 Ni 40.02 Mg 40.02 No 40.02 Mg 40.01 Os 40.02 Mg 40.02 Pi 40.02 Hg 40.02 Pi 40.02 Hg 40.02 Pi 40.02 Nd 40.02 Pi 40.02 Nd 40.02 Pi 40.02 Nd 40.02 Pi	952F5	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	A C C C F F P	40.02 - 40.	5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Al Al Ba Be Bi	
						5	· .	ry (ICP-)	tromet	Mass Spec	asma l	Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	lively (by Induct	nalysis	umental A	Instr	
ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com					CRM	Certified Reference Material CRM	ence	ed Refer	Certifi					Inc.	Standards, Inc.	Absolute Standards, 800-368-1131 www.absolutestandards.com	Absolute : 800-368-1131 www.absolute	

Lot # 071723

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Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	M	M5768 [M5769 (64) Certified Reference Material	ce Material CRM	42/s	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description:	<u>58112</u> 091823 Magneslum (Mg)	Solvent: 24	Lot # 24002546 Nitric Acid	Advenue	Or -
Expiration Date: 091826 Recommended Storage: Ambient (Nominal Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was diluted to (mL):	20 °C)		(mL) (mL) (BF) $R - \frac{1}{3}/2\phi$	Formulated By: Heviewed By:	Lawrence Barry 091823 Pedro L. Rentas 091823
Compound	Lot Nominal I RM# Number Conc. (µg/mL)	Purity Uncertainty Assay T (%) Purity (%) (%) We	Target Actual Actual Weight (g) Weight (g) Conc. (vg/mL)	Expanded Uncertainty +/- (µg/mL) CAS	SDS Information (Solvent Safety Info. On Attached pg.) NIST # OSHA PEL (TWA) LDSO SRM
1. Magnesium nitrate hexahydrate (Mg) IN030 маюзаал	10000	99.999 0.10 8.51 23		20.0 13446-1	ng/kg 3
[1] Spectrum No.1 1.0E6		[19.923 sec]:58112.D# [Count] [Linear]	[Linear]		
5. O M B R					
m/z-> 10	20	8	ø	70 80	90 100
1000 -		·		4	
₩/z->	120 130	140	150 160	170 180 1	190
1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0					
Part # 58112 Lot # 091823		-	1 of 2	Drintod	Drintod- 10/00/0000 0.56-15 DM

3

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		Inc



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

Γ							Trace Mo	etals	Verifica	tion	by ICP-N	IS (µ	g/mL)						
									1100 100 100 100					100	The second second				
A	<0.02	8	<0.02	Dy	<0.02	Hf	<0.02	5	<0.02	N	<0.02	Ŗ	<0.02	Se	40.2	qI.	<0.02	W	<0.02
SP	<0.02	G	<0.2	E.	<0.02	Но	<0.02	Lu	<0.02	Nb	<0.02	Re	<0.02	ŝ	<0.02	Te	<0.02	d	<0.02
As	<0.2	ĉ	<0.02	E	<0.02	In	<0.02	Mg]	SO	<0.02	Rh	<0.02	Ag	<0.02	H	<0.02	V	40.02
Ba	<0.02	S	<0.02	ନୁ	<0.02	F	<0.02	Mn	<0.02	Pd	<0.02	Rb	<0.02	Na	<0.2	Ъ	<0.02	Υð	<0.02
Ве	<0.01	Ŷ	<0.02	Ga	<0.02	Fe	40.2	Hg	<0.2	٩	<0.02	Ru	<0.02	Sr	<0.02	Tm	<0.02	ĸ	<0.02
B	<0.02	S	<0.02	Ģ	<0.02	La	<0.02	Mo	<0.02	Ŗ	<0.02	Sm	<0.02	cn	<0.02	Sn	<0.02	6	<0.02
5	40.02	ç	40.02	Au	<0.02	P	<0.02	Nd	<0.02	ĸ	<0.2	S.	<0.02	Ta	<0.02	Ti	<0.02	Zr	<0.02

(T) = Target analyte

Physical Characterization:

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

Certified by:

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

the preparation of all standards.

* All standard containers are meticulously cleaned prior to use.

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

* All Standards should be stored with caps tight and under appropriate laboratory conditions.

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

Part # 58112 Lot # 091823

Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	M	M5768 [M5769 (64) Certified Reference Material	ce Material CRM	42/s	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description:	<u>58112</u> 091823 Magneslum (Mg)	Solvent: 24	Lot # 24002546 Nitric Acid	Advenue	Or -
Expiration Date: 091826 Recommended Storage: Ambient (Nominal Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was diluted to (mL):	20 °C)		(mL) (mL) (BF) $R - \frac{1}{3}/2\phi$	Formulated By: Heviewed By:	Lawrence Barry 091823 Pedro L. Rentas 091823
Compound	Lot Nominal I RM# Number Conc. (µg/mL)	Purity Uncertainty Assay T (%) Purity (%) (%) We	Target Actual Actual Weight (g) Weight (g) Conc. (vg/mL)	Expanded Uncertainty +/- (µg/mL) CAS	SDS Information (Solvent Safety Info. On Attached pg.) NIST # OSHA PEL (TWA) LDSO SRM
1. Magnesium nitrate hexahydrate (Mg) IN030 маюзаал	10000	99.999 0.10 8.51 23		20.0 13446-1	ng/kg 3
[1] Spectrum No.1 1.0E6		[19.923 sec]:58112.D# [Count] [Linear]	[Linear]		
5. O M B R					
m/z-> 10	20	8	ø	70 80	90 100
1000 -		·		4	
₩/z->	120 130	140	150 160	170 180 1	190
1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0					
Part # 58112 Lot # 091823		-	1 of 2	Drintod	Drintod- 10/00/0000 0.56-15 DM

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		Inc



Certified Reference Material CRM



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

Γ							Trace Mo	etals	Verifica	tion	by ICP-N	IS (µ	g/mL)						
									1100 100 100 100					100	The second second				
A	<0.02	8	<0.02	Dy	<0.02	Hf	<0.02	5	<0.02	N	<0.02	Ŗ	<0.02	Se	40.2	qI.	<0.02	W	<0.02
SP	<0.02	G	<0.2	E.	<0.02	Ho	<0.02	Lu	<0.02	Nb	<0.02	Re	<0.02	ŝ	<0.02	Te	<0.02	d	<0.02
As	<0.2	ĉ	<0.02	E	<0.02	In	<0.02	Mg]	SO	<0.02	Rh	<0.02	Ag	<0.02	H	<0.02	V	40.02
Ba	<0.02	S	<0.02	ନୁ	<0.02	h	<0.02	Mn	<0.02	Pd	<0.02	Rb	<0.02	Na	<0.2	Ъ	<0.02	Υb	<0.02
Ве	<0.01	Ŷ	<0.02	Ga	<0.02	Fe	40.2	Hg	<0.2	٩	<0.02	Ru	<0.02	Sr	<0.02	Tm	<0.02	ĸ	<0.02
B	<0.02	S	<0.02	Ģ	<0.02	La	<0.02	Mo	<0.02	Ŗ	<0.02	Sm	<0.02	cn	<0.02	Sn	<0.02	6	<0.02
5	40.02	ç	40.02	Au	<0.02	P	<0.02	Nd	<0.02	ĸ	<0.2	S.	<0.02	Ta	<0.02	Ti	<0.02	Zr	<0.02

(T) = Target analyte

Physical Characterization:

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

Certified by:

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

the preparation of all standards.

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

* All Standards should be stored with caps tight and under appropriate laboratory conditions.

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

Part # 58112 Lot # 091823



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

Physical Characterization:

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

Certified by:

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

- * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
 - All standard containers are meticulously cleaned prior to use.
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- All Standards should be stored with caps tight and under appropriate laboratory conditions. Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

Part # 57050 Lot #	m/z->	N.01 M.4	m/2->-	1.0E5	177/2-> 2.0E5	N G M G	8. 0 11 15	1. Ammonium hexatluorostannate(IV) (Sn)	Compound	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below w	<u>CERTIFIED WEIGHT REPORT</u> Part N Lot N Desc	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
Lot # 071123	210		110 120		0 No		[1] Spectrum No.1	(W) (Sn) INO10 SND042023A1	Lot RM# Number	Expiration Date: 071126 Pecommended Storage: Ambient (20 °C) Concentration (µg/mL): 1000 NIST Test Number: 6UTB Weight shown below was diluted to (mL):	<u>PORT:</u> Part Number: <u>57050</u> Lot Number: <u>071123</u> Description: <u>Tin (Sn)</u>	s.com
	230		130		e e		[15.034 sec]:	1000	Nominal Conc. (µg/mL)	0 °C) 499.93	2	V
	20		140		ð		15.034 sec]:58150.D# [Count] [Linear]	99.999 0.10 44.2	Purity Uncertainty Assay (%) Purity (%) (%)	5E-05 Balance Uncertainty 0.058 Flask Uncertainty	Solvents:	Certific
	N30 260		150 160		8		unt) [Linear]	1.13107	r Target Actual Weight (g) Weight (g)	(mL)	Lot # 21110221 22D0562008	Certified Reference Material
			170		70			1001.6	Actual Conc. (µg/mL)	ric acid	ric acid	CRM
			180		80			16919-	Expanded Uncertainty (Solv +/- (µg/mL) CAS#	Formulated By:		PPGP M
			190 200		90 100			7 mg/m3	SDS Information (Solvent Safety Info. On Attached pg.))# OSHA PEL (TWA) LD50	Benson Chan		R
			0		ŏ			ω	on tached pg.) NIST LD50 SRM	071123 - 071123		ANAB ISC AR-1539 (https://Abso
												ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com

Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	•	Cei	Certified Reference Material CRM	ial CRM		ANAB ISO 17034 Accredited
www.absolutestandards.com	5				V	AR-1539 Certificate Number https://Absolutestandards.com
Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	ductively Coupled	Plasma Mass Spec	trometry (ICP-MS):			
		Trace Metals	Is Verification by ICP-MS	P-MS (µg/mL)		
AI <0.02 Cd <0.02	Dy <0.02	4003				
A)2 C C		2 2 2 2 2 2 2	40.02 Ni		Se <0.2 Tb Si <0.02 Te	40.02 W 40.02
2 2 2 2 2 2 2 2			<0.01 Os <0.02 Pd	Rb Rb		\$ < c
	Ge 40.02	Fe 40.2 Hg	40.2 P 40.02 Pt	Ru Sm		_
			(T) = Target	4	ZITAS	<0.02 Zr <0.02
Physical Characterization:						Certified by:
Homogeneity: No heterogeneity was observed in the preparation of this standard.	observed in the prepa	ration of this standard.				//
ŝ	9					mr P All
		9 4			20	
					÷	
 * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards. * All standard containers are meticulously cleaned prior to use. * Standards are prepared gravimetrically using balances that are politoriated with using balances. 	centration calculat deionized water, ca ds. eticulously cleaned	d from gravimetric librated Class A gla prior to use.	and volumetric measurer ssware and the highest p	nents unless otherwise stated. writy raw materials are used in	ie stated. 'e used in	

Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
 Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated.
 All standards should be stored with caps tight and under appropriate laboratory conditions.
 Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

Part # 57050 Lot # 071123

2 of 2

Printed: 2/8/2024, 5:01:38 PM

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

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Certified Reference Material CRM



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

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

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

Physical Characterization:

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

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Certified by:

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

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Certified Reference Material CRM



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

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

(T) = Target analyte

Physical Characterization:

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

Low P. S.

Certified by:

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

Part # 57033 Lot # 111323

$\begin{array}{c c c c c c c c c c c c c c c c c c c $	m/z->	2500	m/z->	500	m/z->-	2.5 114	5.OE4	1. Ammonium dihydrogen phosphate (P)	Compound	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa	CERTIFIED WEIGHT REPORT: Par Lo De	www.absolutestandards.com
R I D 2 M 4 C 1 M 52 15 Interview Lat* Solvent: 2111021 Nitric Acid Provide (P) 2% 40.0 Nitric Acid 2000/2 0.058 Failure inventienty Environmenty 2000/2 0.058 Failure inventienty Environmenty Environmenty Nominia Party Uncertainty Assay Target Actual Actual Commutated By: Perford L Ren 10000 ease 0.10 27.5 72.7287 72.7287 72.7284 10000.0 30.0 772.78-1 5mg/r 12.074 aeoc)15891 16. D/r County (Lineau) Factor Lange Store 5mg/r 30 40 sio eo 70 sio sio sio 30 40 sio read read read read 30 40 sio read read read read read read 30 40 sio read read read	N O		110		10		[1] Spectrum			Expiration Date: Recommended Storage: I Concentration (µg/mL): NIST Test Number: Weight shown below was d	DRT: Part Number: Lot Number: Description:	om
RICZINGLA MITELS Bolvent: 21110221 Nitric Acid IDP 2% 40.0 Nitric Acid SEC5 Balance locentary (mL) Nitric Acid Formulated Br. Formulated Br. SEC5 Balance locentary (mL) Nitric Acid Formulated Br. Lawrence Balance (mL) Formulated Br. Lawrence Balance (mL) Formulated Br. Lawrence Balance (mL) Source It Mitels Acid Formulated Br. Lawrence Balance (ML) Source It Mitels Acid Formulated Br. Lawrence Balance (ML) Source It Mitels Acid Formulated Br. Formulated Br	2220		120		N. O				Lot Number	041726 Ambient (20 10000 6UTB 6UTB	57115 041723 Phosphore	5
Hric Acid Iric Acid Iric Acid Iric Acid Iric Acid Actual Actual Actual Expanded Expanded Expanded SDS Inf Expanded SDS Inf Solvent Safety Inf eight (g) Conc. (ug/mL) · (AS# OSHA PEL) 2.7289 10000.0 20.0 7722-76-1 5 mg/m 2.7289 10000.0 20.0 7722-76-1 5 mg/m 150 170 180 190 190 190	230		130		ຜ. ວ		2.074 sec]:58			00.02	us (P)	R
Hric Acid Frite Acid Formulated By: Lawrence Ba Formulated By: Pedro L. Ren Expanded Actual Uncertainty (Solvent Safety Inf eight (g) Conc. (ug/mL) - 4/- (ug/mL) CAS# OSHA PEL 2.7289 10000.0 20.0 7722-76-1 5 mg/m 2.7289 10000.0 1722-76-1 5 mg/m 160 170 180 190 190	240		140		4		3115.D# [Cot		Uncertainty Assay Purity (%) (%)	2% Balance Uncertainty Flask Uncertainty	Solvent:	22/09/12
Formulated By: Lawrence Ba Formulated By: Lawrence Ba Reviewed By: Pedro L. Ren Conc. (ug/m), -/- (ug/m), CAS# OSHA PEL 10000.0 20.0 7722-76-1 5 mg/m 10000.0 20.0 7722-76-1 5 mg/m 10000.0 eio eio	250		150		S O		ınt] [Linear]					
Formulated By: Lawrence Ba Formulated By: Pedro L. Ren Expanded SDS Inf Uncertainty (Solvent Safety Inf +/- (ug/mL) CAS# OSHA PEL (20.0 7722-76-1 5 mg/m 20.0 7722-76-1 5 mg/m 20.0 190 90	260							2.7289 10000.	Actual Actual sight (g) Conc. (µg/1	rric Acid	tric Acid	15815
22-76-1 5 mg/m					1			20.0		Formulated B	Q	
o 200			4						SC (Solvent Saf CAS# OSH/	Ped	Gerence /	
.hed pg.) LbS0 LbS0									DS Information fety Info. On Attac A PEL (TWA)	L. Rentas	Jan	https://At
g 3186 SRM			9		J				0	041723 041723		tps://Absolutestandards.com

Abs	Absolute (800-368-1131 www.absolute	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	lards , ds.com	Inc.	-				ĉ	rtified Re	eren	Certified Reference Material CRM	ial CR	M					https AF	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	4 Accredited cate Number andards.com
-	nstrum	iental A	nalysi	s by Indi	uctive	ły Coupl	ed Pla	Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS);	s Spec	troscopy	(ICP	-MS):									
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m/z->	N. 01 00	5. O M 8	m/z->	5.0E7	1.0E8	m/z->	N. 00 00	5.0E5	Ammonium sulfate (S)	Compound	NIST Test Number: 6UTB Weight shown below was diluted to (mL):	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL):	Part Number: Lot Number: Description:	800-368-1131 www.absolutestandards.com
210			110			10		[1] Spectrum No.1	IN117	RM#	umber: low was dilute	n Date: lorage: lg/mL):	<u>Part Number:</u> Lot Number: Description:	
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			180			80			2.0 77	Expanded Uncertainty +/- (µg/mL)	Reviewed By:	M	Formulated By:	
						 Complete and complete 			7783-20-2	(Solvent : CAS# 05	Pedr	\$	a and a second sec	
			190			0			NA	SDS Information It Safety Info. On Attac OSHA PEL (TWA)	Pedro L. Rentas	e la	Benson Chan	http
			2000			100			ort-rat 4250mg/kg 3181	SDS Information (Solvent Safety Info. On Attached pg.) * OSHA PEL (TWA) LD50	122923	7	100002	AR-1539 Certificate Number https://Absolutestandards.com

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
30			5 2	I She	Certified by:		MI MI<			ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com

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Expanded SDS Information Uncertainty (Solvent Safety Info. On Attached pg.) NIST +/- (ug/mL) CAS# OSHA PEL (TWA) LDSO SRM	(g) Conc. (µg/mL)	Actual Weight (g)	Target Weight (g)	Uncertainty Assay Purity (%) (%)	Purity (%)	Nominal Conc. (µg/mL)	Lot. Number	RM#	Compound
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Lawrence barry	1 1					20 °C)	071126 Ambient (20 °C) 10000 Sum	Expiration Date: nended Storage: htration (µg/mL): %T Test Number:	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Teet Number
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ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	CRM		ference M	Certified Reference Material	R a			om	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
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800-368-1131 www.absolutestandards.com		0	Certified Reference Material CRM	nce Material C	RM			•	ANAB ISO 1: AR-1539 Ce https://Absolut	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	ictively Coupled	Plasma Mass Sp	ectrometry (IC	P-MS):						
		Trace Metals		Verification by ICP-MS	IS (µg/mL)					
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Physical Characterization:			(T)= Target analyte	alyte				۲ ۲	Certified by:	
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 * The certified value is the concentration calculated from gravimetric and volumetric measurements * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity in the preparation of all standards. * All standard containers are meticulously cleaned prior to use the preparation of the preparation of all standards. 	ntration calculate ionized water, ca	d from gravimetri librated Class A g	c and volumetric lassware and the	c measurement highest purity	s unless otherwise stated. raw materials are used in	ise state are used i	5.6			
* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated.	trically using bala % of the stated	value, unless othe	brated with weighwise stated.	phts traceable :	to NIST (see ab	ove).				
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* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. * All standards should be stored with caps tight and under appropriate laboratory conditions. * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.	itrically using bail trically using bail is of the stated with caps tight ar B.N. and Kuyat, (hnical Note 1297	prior to use. ances that are cali value, unless othe d under appropria 2.E., "Guidelines fo , U.S. Governmen	brated with weig rwise stated. re laboratory co or Evaluating and t Printing Office, t Printing Office,	ghts traceable . onditions. I Expressing the Washington, D	to NiST (see ab 3 Uncertainty o).C. (1994).	ove). F NIST				

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$\begin{array}{c c c c c c c c c c c c c c c c c c c $	m/z>	ζι Ο Μ Ο	m/z-> 1.0E6	₩/z-> 2.0E6	5000 2500	Compound 1. Ammonium hexafluorosilicate (Si)	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa	<u>CERTIFIED WEIGHT REPORT:</u> Part Nu Lot Nu Descri	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
Certified Reference Material CRM A: 12: p 4: 2.4 Ph/SI R Solvent: 24002546 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 40.0 2% 1140 1140 12.865 111 12.865 111 12.865 111 12.865 111 12.865 111 12.865 111 12.865 111 12.865 111 12.865 111 12.865 111 12.865 111 12.9 111 12.9 111 12.9 111 13.865 111 14.0 111 14.0 111 14.0 111 11.9 <th></th> <th></th> <th></th> <th></th> <th></th> <th>Lot RM# Number IN009 SID082022A1</th> <th>s dilute</th> <th>mber: mber: ption:</th> <th>, Inc.</th>						Lot RM# Number IN009 SID082022A1	s dilute	mber: mber: ption:	, Inc.
Instant Image: Constraint of the con	≥40		140	4	1.393 sec]:58014.D# [Count]	Purity Uncertainty Assay (%) Purity (%) (%) 99.999 0.10 14.4	2% 5E-05 Balance Uncertainty 99.48 0.058 Flask Uncertainty		Certified Reference
v: Aleah O'Brady V: Aleah O'Brady CAS# OSHA PEL (TM 919-19-0 2.5 mg/m: 919-19-0 150	N		160	0- 	Linear]	Actual Actual Weight (g) Conc. (Jy/mL) 13.8855 1000.0	Nitric Acid	Nitric A	182
			(*)			(Solvent S CAS# () 18919-19-0	Ped Ped	ha	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com

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Certified Reference Material CRM



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

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(T) = Target analyte

Physical Characterization:

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

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Certified by:

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

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Part # 57014 Lot # 122023



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Certified Reference Material CRM



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

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

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(T) = Target analyte

Physical Characterization:

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

Certified by:

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

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

Part # 58030 Lot # 111623

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

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					e). IST	rials are e abov ity of N	ity raw materials are us le to NIST (see above). the Uncertainty of NIST , D.C. (1994).	able to g the l on, D.(highest p ts trace; ditions. Xpressin Vashingt	id the f id. yry con y and E ffice, V	sware ar ated with ise state laborate ivaluation rinting O	A glas calibr otherw opriate is for E ment P	ed Class to use. that are , unless (der appro Guideline Governr	calibrat ad prior alances d value and un , C.E., " 97, U.S	d water, sly clean y using b y using b the state the state hps tight nd Kuyat Note 12	eionize Is. ticulou: ticulou: 5% of 1 S% of 1 B.N. a chnical	 Purmed acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards. All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. All Standards should be stored with caps tight and under appropriate laboratory conditions. Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994). 	8.2 me of all s repared ertifed ertifed prence: esult,"	acids, 1 aration s are pi s are ci ards sh nent Refe	 Purmed acids, 18.2 meg the preparation of all si All standard containers Standards are prepared Standards are certifed (All Standards should be Uncertainty Reference: Measurement Result," Measurement Result, " Measurement Result," 	* * * * * *
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Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

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

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

Assay Information:

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

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

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

Characterization of CRM/RM by Two or More Methods

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

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

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

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

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

4.0 TRACEABILITY TO NIST

Characterization of CRM/RM by One Method

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

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

CRM/RM Expanded Uncertainty (\pm) = U_{CRM/RM} = k ($u^2_{char a} + u^2_{bb} + u^2_{tts} + u^2_{bs}$)^{1/2} k = coverage factor = 2 $u_{char a}$ = the errors from characterization u_{bb} = bottle to bottle homogeneity standard uncertainty

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

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

4.1 Thermometer Callbration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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

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

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

6.0 INTENDED USE

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

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

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

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

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

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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

February 20, 2024

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

11.2 Lot Expiration Date

- February 20, 2029

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

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

Uyen Truong **Custom Processing Supervisor**

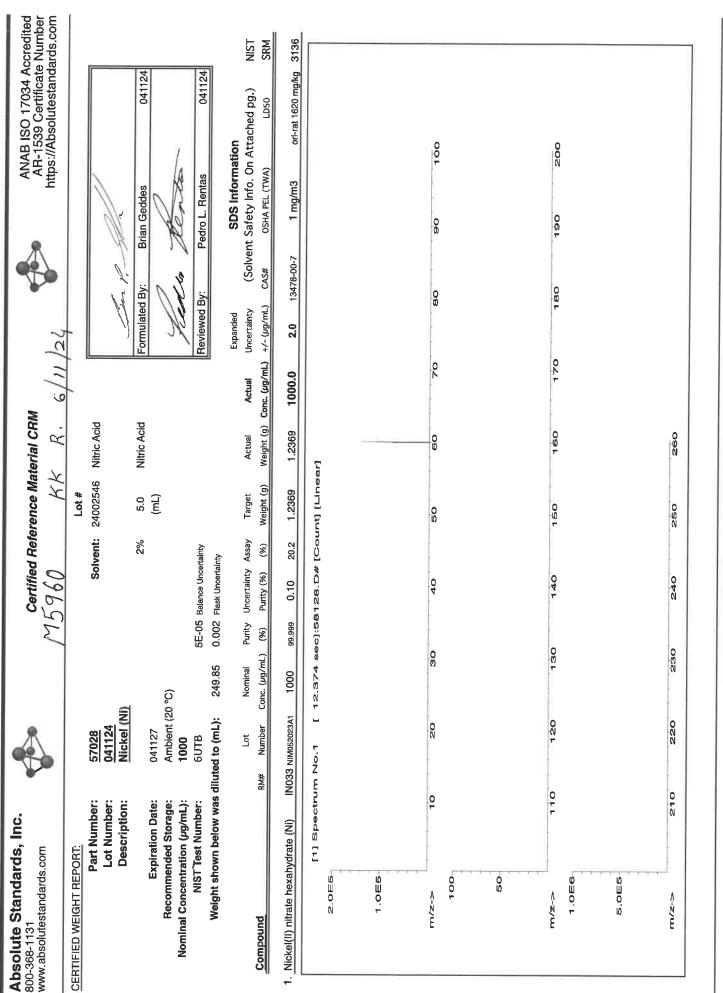
Certificate Approved By:

Muzzammil Khan Stock Laboratory Supervisor

Mayn Mung Mayni Kh Paul R Laina

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director



Part # 57028 Lot # 041124

1 of 2

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





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

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

							I race Me	Metals	Verification	ation	by ICP-MS	MS ((JmL)						
A	_	B	<0.02	Dy	<0.02	Ηf	<0.02	Li.	<0.02	Ni	T	Pr	<0.02	Se	<0.2	Th	<0.02		000
Sb	<0.02	G	<0.2	ם	<0.02	Но	<0.02	Lu	<0.02	Νb	<0.02	Re	<0.02	5	<0.05	e E	20.02	= =	20.02
As		C	<0.02	Eu	<0.02	In	<0.02	Mg	<0.01	ő	<0.02	Rh	<0.02	Ασ	000	2 F	20.07		20.02
Ba		C	<0.02	Gd	<0.02	Ir	<0.02	Mn	<0.02	Рd	<0.02	Rh	2002	en.	20:07	Ĩ		- 5	20.02
Be	•	ų	<0.02	Ga	<0.02	ы Ц	C 0>	μœ	C07	4	000		2010	10	10.00	1	<0.02		<0.02
Bi		ĉ	<0.02	Ge	<0.02	e I	~0.0>	o Mo	CU U2	- Å	20.02	n ^w S	20.02	50	20.02		<0.02	7 1	<0.02
8	_	Cn	<0.02	Au	<0.02	P	<0.02	PN	<0.02	×	<0.02	5	20.02	٩¢	20.02	i i	20.02	5	<0.02
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									l										

(T) = Target analyte

Physical Characterization:

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

Certified by:

an P S

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

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220				120		12 0		-	071223	Lot Number	ed to (mL):	060627 Ambient (20 °C) 1000	<u>060624</u> Selenium (Se)	7024	V
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	230			130		80		90C]:58	200.0	Initial Vol. (mL)	5E-05 0.100				
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	260			160		60		inear]	10002.5	Initial Conc. (µg/mL)		(mL)	40.0	Solvent:	Certified Reference Material CRM からすチェート・アンの
				170		70			1000.0	Final Conc. (ug/mL)	11		Nitric Acid		114
				ŏ		0			2.2	Expanded Uncertainty +/- (µg/mL)	Reviewed By:	<i>M</i>	Formulated By:		24
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				200		100			3 orl-rat 6700 mg/kg	SDS Information (Solvent Safety Info. On Attached pg.) AS# OSHA PEL (TWA) LDS0	1tas 060624	,	n 060624		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
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	The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards. All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. All standards should be stored with caps tight and under appropriate laboratory conditions. Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).	The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise st. Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are us the preparation of all standards. All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. All standards should be stored with caps tight and under appropriate laboratory conditions. Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).	rements t purity r ceable to s. s. sing the l ngton, D.0	highes highes tra ndition: Expres Washir	volumetric re and the i with weij stated. stated. oratory cc uating and ing Office.	ric and glasswa glasswa alibratec nerwise riate lab for Evalu nt Print	 * The certified value is the concentration calculated from gravimetric and volumetric measurements unlee * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw n the preparation of all standards. * All standard containers are meticulously cleaned prior to use. * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIS * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. * All standards should be stored with caps tight and under appropriate laboratory conditions. * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Unce Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1 	ed fron alibrate alibrates lances l value, l value, C.E., "Q C.E., "Q C.E., "Q	The certified value is the concentration calculated from gravi Purified acids, 18.2 megohm deionized water, calibrated Class the preparation of all standards. All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that ar Standards are certifed (+/-) 0.5% of the stated value, unless All standards should be stored with caps tight and under app Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelin Measurement Result," NIST Technical Note 1297, U.S. Gover	ntratio sionized s. etrically etrically 5% of t 5% of t B.N. a B.N. a	he conce egohm de standardd s are met d gravim (+/-) 0. e stored : Taylor, NIST Tev	alue is t 1 8.2 me n of all : ntainer: orepare certifed bould bu ference ference Result,"	The certified value is the concen Purified acids, 18.2 megohm dei the preparation of all standards. All standard containers are meti Standards are prepared gravime Standards are certifed (+/-) 0.5 All standards should be stored w Uncertainty Reference: Taylor, E Measurement Result," NIST Tech	* The c * Purifie the purifie * All stand * Stand * All stand Measu	
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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 4002 Cd 4002 Dy 4002 Hf Sb 4002 Ca 402 Dy 402 H As 402 Ca 402 Eu 4022 In Ba 4002 Ca 4002 Gd 4022 In Ba 4002 Ca 4002 Gd 4022 In Ba 4002 Ca 4002 Gd 4022 In Bi 4002 Ca 4002 Gd 4022 In Bi 4002 Ca 4002 Ge 4002 In Bi 4002 Ca 4002 Ge 4002 In Bi 4002 Ca 4002 An 4002 In B 4002 Ca 4002 An 4002 Ib		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.		40/2 Li T Nb 40/2 Fr 40/2 And 40/2 Li 40/2 Nb 40/2 Rc 40/2 Rc	1/Br/) SW-	Mass Spectrometry (ICP-MS):	Certified Reference Material CRM
Printed: 6/24/2024, 11:20:08 PM	Ъ.	Sur P. S.	Certified by:	Si 40.2 Th 40.02 U 40.02 Na 40.2 Th 40.02 U 40.02 Na 40.02 Th 40.02 V 40.02 Si 40.02 Th 40.02 V 40.02 Si 40.02 Th 40.02 V 40.02 Si 40.02 Th 40.02 Y 40.02 Ta 40.02 Th 40.02 Y 40.02 Ta 40.02 Th 40.02 Y 40.02 Ta 40.02 Th 40.02 Zn 40.02			ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com



300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

Certificate of Analysis M5936, M5933 R: 02/22/24 P: 800-669-6799/540-585-3030 F: 540-585-3012 info@inorganicventures.com

1.0 **ACCREDITATION / REGISTRATION**

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



2.0 **PRODUCT DESCRIPTION**

Product Code:	Single Analyte Custom Grade Solution				
Catalog Number:	CGMO1				
Lot Number:	T2-M0720876				
Matrix:	H2O				
	tr. NH4OH				
Value / Analyte(s):	1 000 μg/mL ea:				
	Molybdenum				
Starting Material:	Ammonium Molybdate				
Starting Material Lot#:	2361				
Starting Material Purity:	99.9893%				
CERTIFIED VALUES AND UNCERTAINTIES					

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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

Assav Information:

Assay Method #1	998 ± 4 μg/mL
	ICP Assay NIST SRM 3134 Lot Number: 130418

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

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

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

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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

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

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

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 95.94 +6 6,7,8,9 [MoO4]-2(chemical form as received)

Chemical Compatibility -Mo is received in a NH4OH matrix giving the operator the option of using HCI or HF to stabilize acidic solutions. The [MoO4]-2 is soluble in concentrated HCI [MoOCI5]-2, dilute HF / HNO3 [MoOF5]-2 and basic media [MoO4]-2. Stable at ppm levels with some metals provided it is fluorinated. Do not mix with Alkaline or Rare Earths when HF is present. Stable with most inorganic anions provided it is in the [MoO4]-2 chemical form.

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the [MoOF5]-2 for months in 1% HNO3 / LDPE container. 1-10,000 ppm single element solutions as the [MoO4]-2 chemically stable for years in 1% NH4OH in a LDPE container.

Mo Containing Samples (Preparation and Solution) -Metal (Soluble in HF / HNO3 or hot dilute HCI); Oxide (soluble in HF or NH4OH); Organic Matrices (Dry ash at 450EC in Pt0 and dissolve oxide with HF or HCI). Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	Estimated D.L.	Order	Interferences (underlined indicates severe)
ICP-MS 95 amu	3 ppt	n/a	40Ar39K16O,79Br1
			60,1900s2+,190Pt
			2+
ICP-OES 202.030 nm	0.008 / 0.0002 µg/mL	1	Os, Hf
ICP-OES 203.844 nm	0.012 / 0.002 μg/mL	1	
ICP-OES 204.598 nm	0.012 / 0.001 µg/mL	1	Ir, Ta

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

July 17, 2022

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

11.2 Lot Expiration Date

- July 17, 2027

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

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

Uyen Truong Supervisor, Product Documentation

Michael 2 Booth

Certificate Approved By:

Michael Booth **Director**, Technical

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Paul R Laine

Page 1 of 4

ក⁰⁸ = ក្រុងអាស់ ដែល ភ្លេង ភ្ល

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

nienesty standard uncertain ucherts mort arone enti = a fanta lisnegomort ettod,ot ettod = dd^u adnere vitidats mot gnot = _{ad}t $\label{eq:spinor} \min \left\{ x \right\} = U_{CRM/RM} = k \left\{ u^2_{char} * u^2_{bb} + u^2_{bb} + u^2_{bb} + u^2_{bb} \right\}^{4}$

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

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

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

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

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

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

Pssay Method #1

BCIOL = 3

un pepuedra w

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

:noiternotnl ysseA

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

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

CERTIFIED VALUES AND UNCERTAINTIES 3.0

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

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

Single Analyte Custom Grade Solution

PRODUCT DESCRIPTION 0.S

Number QSR-1034).

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



ACCREDITATION / REGISTRATION 0.r

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

R:2/22/24

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

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

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

.my €.0 a2 M 0732£0.0 > ⊨N O 832000.0 > ⊔∃ M 8€2000.0 > ⊵A M ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to CRMRMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS, were analyzed in an up of the method for each element of the property effection of the method for the met

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

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

- QSR Certificate Number QSR-1034

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0.01

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

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

NOITAMAORNI SUOGAASAH 0.8

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SET Interferences (underlined indicates severe) 32S160, 32S14N,	Orde A/N	14 pt	ICP-MS 48 amu

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

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

HINGS / LDPE compared from and solutions as the TI(F)6-2 chemically stable for years in the solution and the solutions as the TI(F)6-2 chemically stable for years in the solution from and solutions. 1-10,000 ppm aingle element solutions as the TI(F)6-2 chemically stable for years in the solution from and solutions are the transformer and solutions. with a fendency to hydrolyze forming the hydrafied oxide in all dilute acids except HF. **Stability -** 2-100 ppb levels stable (Alone or mixed with all other metals) as the Ti(F)6-2 for months in 1% HNO3 / LDPE container. 1-10.000 point and element solutions as the Ti(F)6-2 chemically stable for year media. Unstable at ppm levels with metals that would pull F- away (i.e. Do not mix with Alkaline or Rare Earths or high levels of thansition elements unless they are fluorinated). Stable with more inorganic anions with a tendency to hydrolyze forming the hydrafed oxide in all dilute acids except HF. Chemical Compatibility - Soluble in concentrated HCI, HF, H3PO4 H2SO4 and HVO3. Avoid neutral to basic S-8(T)T 6 4+ 78.74 - noiluite in Solution (Chemical Form in Solution - 47.74 6 T(F)6-5-- For more information, visit www.inorganicventures.com/TCT Afomic Weinher Valence: Coordination Winnher: Chemical Equa

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

Page some more served to the served to the served to the ordent of the ordent increase in the analyte concentration (s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being the rescaled to the test to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss. - While stored in the sealed TCT bag, transpiration of this CRAWRM is negligible. After opening the sealed TCT had transmission of the CDMMAN will occur recutification increase in the source concentration of the is

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

Page 4 of 4

Certifying Officer:

Chairman / Senior Technical Director

NOS Paulo 182

Paul Gaines

-

Thomas Kozikowski Manager, Quality Control

Certificate Approved By:

0.2r

NAMES AND SIGNATURES OF CERTIFYING OFFICERS

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7,1.

- Sealed TCT Bag Open Date:

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

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

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

- June 17, 2027

11.2 Lot Expiration Date

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

June 17, 2022

11.1 Certification Issue Date

CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY 0.11

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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			
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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
1. Strontium nitrate (Sr)	IN017 SRZ022018A1	1000	68.997	0.10	41.2 4.8	4.85470	4.85502	1000.1	2.0	10042-76-9	NA	orl-ra	ori-rat >2000mg/kg 3153a	3153a
5.0E6	-	14.495 sec]:58138.D# [Count] [Linear]	ec]:581	38.D#[Count	[Linear								
9 9 9 9											1997 mar Rossenar van sonar kar kar kar ka			
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		5. 	1								÷			
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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)						
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Physical Characterization:

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

Certified by:

Sur ?

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

the preparation of all standards.

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

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

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

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-3



Certificate of Analysis

Refine your results. Redefine your industry.

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com



1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034). P: 800-669-6799/540-585-3030 F: 540-585-3012 info@inorganicventures.com



2.0 PRODUCT DESCRIPTION

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

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

Assay Information:

3.0

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

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

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

Characterization of CRM/RM by Two or More Methods

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

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

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

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

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

4.0 TRACEABILITY TO NIST

Characterization of CRM/RM by One Method

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

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

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

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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

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

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

6.0 INTENDED USE

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

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

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

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

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

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

Technique/Line	Estimated D.L.	Order	Interferences (underlined indicates severe)
ICP-MS 115 amu	1 ppt	n/a	115Sn, 99Ru16O
ICP-OES 158.583 nm	0.05 / 0.002 µg/mL	1	
ICP-OES 230.606 nm	0.1 / 0.03 µg/mL	1	Ni, Os
ICP-OES 325.609 nm	0.2 / 0.05 µg/mL	1	Mn, Mo, Th

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

February 21, 2023

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

11.2 Lot Expiration Date

- February 21, 2028

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Thomas Kozikowski Manager, Quality Control

DJ 78

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com R: 2/22/2024 M5999

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	on
Catalog Number:	CLPP-SPK-1	
Lot Number:	T2-MEB721963	
Matrix:	7% (v/v) HNO3	
Value / Analyte(s):	2 000 µg/mL ea: Aluminum,	Barium,
	1 000 µg/mL ea: Iron,	
	500 μg/mL ea: Manganese, Vanadium, Cobalt,	Nickel, Zinc,
	250 µg/mL ea: Copper,	
	200 μg/mL ea: Chromium,	
	50 µg/mL ea: Beryllium,	Silver

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE Aluminum, Al	CERTIFIED VALUE 2 000 ± 7 µg/mL	ANALYTE Barium, Ba	CERTIFIED VALUE 2 000 ± 9 µg/mL
Beryllium, Be	50.00 ± 0.26 µg/mL	Chromium, Cr	200.0 ± 1.1 µg/mL
Cobalt, Co	500.0 ± 2.4 μg/mL	Copper, Cu	250.0 ± 1.0 µg/mL
Iron, Fe	1 000 ± 4 µg/mL	Manganese, Mn	500.0 ± 2.0 µg/mL
Nickel, Ni	500.0 ± 2.2 μg/mL	Silver, Ag	50.00 ± 0.22 µg/mL
Vanadium, V	500.0 ± 2.2 μg/mL	Zinc, Zn	500.0 ± 2.2 μg/mL

1.070 g/mL (measured at 20 ± 4 °C)

Assay Information:

Density:

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

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

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

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

X _i = mean of Ass	ay Method i with standard uncertainty u _{char i}
	g factors for each method calculated using the inverse square of
the variance	

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

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k \left(u^2_{char} + u^2_{bb} + u^2_{15} + u^2_{15} \right)^{\gamma_2}$ k = coverage factor = 2

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

uts = transport stability standard uncertainty

4.0 **TRACEABILITY TO NIST**

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

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

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

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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Page 3 of 4

11.0 **CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY**

11.1 Certification Issue Date

July 27, 2022

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

11.2 Lot Expiration Date

- July 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

SD9781.

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

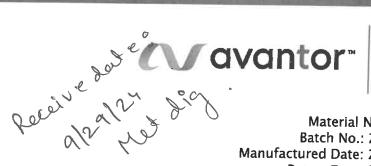


1 of 1



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







Material No.: 9530-33 Batch No.: 22F0762009 Manufactured Date: 2022-05-10 Retest Date: 2027-05-09 Revision No.: 0

Certificate of Analysis

Test	Specification	Result
ACS – Assay (as HCI) (by acid-base titrn)	36.5 - 38.0 %	37.6 %
ACS – Color (APHA)	≤ 10	5
ACS – Residue after Ignition	≤ 3 ppm	< 1 ppm
ACS - Specific Gravity at 60°/60°F	1.185 - 1.192	1.190
ACS – Bromide (Br)	≤ 0.005 %	< 0.005 %
ACS – Extractable Organic Substances	≤ 5 ppm	< 1 ppm
ACS – Free Chlorine (as Cl2)	≤ 0.5 ppm	< 0.5 ppm
Phosphate (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	0.8 ppb
Arsenic and Antimony (as As)	≤ 5.0 ppb	< 3.0 ppb
Trace Impurities – Barium (Ba)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Beryllium (Be)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Bismuth (Bi)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Boron (B)	≤ 20.0 ppb	< 5.0 ppb
Trace Impurities – Cadmium (Cd)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities ~ Calcium (Ca)	≤ 50.0 ppb	14.9 ppb
Trace Impurities – Chromium (Cr)	≤ 1.0 ppb	< 0.4 ppb
Trace Impurities - Cobalt (Co)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities - Copper (Cu)	≤ 1.0 ppb	< 0.1 ppb
Trace Impurities – Gallium (Ga)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Germanium (Ge)	≤ 3.0 ppb	< 2.0 ppb
Trace Impurities - Gold (Au)	≤ 4.0 ppb	0.2 ppb
Heavy Metals (as Pb)	≤ 100 ppb	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 15 ppb	6 ppb

>>> Continued on page 2 >>>

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





Material No.: 9530-33 Batch No.: 22F0762009

Test	Specification	Result
Trace Impurities – Lead (Pb)	≤ 1.0 ppb	< 0.5 ppb
Trace Impurities – Lithium (Li)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Magnesium (Mg)	≤ 10.0 ppb	0.8 ppb
Trace Impurities – Manganese (Mn)	≤ 1.0 ppb	< 0.4 ppb
Trace Impurities – Mercury (Hg)	≤ 0.5 ppb	0.1 ppb
Trace Impurities – Molybdenum (Mo)	≤ 10.0 ppb	< 3.0 ppb
Trace Impurities - Nickel (Ni)	\leq 4.0 ppb	< 0.3 ppb
Trace Impurities – Niobium (Nb)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Potassium (K)	≤ 9.0 ppb	< 2.0 ppb
Trace Impurities – Selenium (Se), For Information Only		< 1.0 ppb
Trace Impurities – Silicon (Si)	≤ 100.0 ppb	1.0 ppb
Trace Impurities – Silver (Ag)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities – Sodium (Na)	≤ 100.0 ppb	0.7 ppb
Trace Impurities – Strontium (Sr)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Tantalum (Ta)	≤ 1.0 ppb	< 0.9 ppb
Trace Impurities – Thallium (TI)	≤ 5.0 ppb	< 2.0 ppb
Trace Impurities – Tin (Sn)	≤ 5.0 ppb	< 0.8 ppb
Trace Impurities – Titanium (Ti)	≤ 1.0 ppb	0.2 ppb
Trace Impurities - Vanadium (V)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Zinc (Zn)	≤ 5.0 ppb	0.8 ppb
Trace Impurities – Zirconium (Zr)	≤ 1.0 ppb	< 0.1 ppb

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

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





Material No.: 9530-33 Batch No.: 22F0762009

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

James Techier

Jamie Ethier Vice President Global Quality

Nitric Acid 69% CMOS



Receive: a/2a/21 net dig



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

Certificate of Analysis

Test	Specification	Result
Assay (HNO3)	69.0 ~ 70.0 %	69.6 %
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	< 0.2 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	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 40.0 ppb	< 1.0 ppb
Trace Impurities – Lead (Pb)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Lithium (Li)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Magnesium (Mg)	≤ 20 ppb	< 1 ppb
Trace Impurities – Manganese (Mn)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Nickel (Ni)	≤ 20.0 ppb	< 5.0 ppb

>>> Continued on page 2 >>>





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	l par/ml

Nitric Acid 69% CMOS





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

Test	Specification	Result	

For Microelectronic Use

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



Sr. Manager, Quality Assurance

Nitric Acid 69% CMOS



Receive: a/2a/21 net dig



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

Certificate of Analysis

Test	Specification	Result
Assay (HNO3)	69.0 ~ 70.0 %	69.6 %
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	< 0.2 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	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 40.0 ppb	< 1.0 ppb
Trace Impurities – Lead (Pb)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Lithium (Li)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Magnesium (Mg)	≤ 20 ppb	< 1 ppb
Trace Impurities – Manganese (Mn)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Nickel (Ni)	≤ 20.0 ppb	< 5.0 ppb

>>> Continued on page 2 >>>





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	l par/ml

Nitric Acid 69% CMOS





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

Test	Specification	Result	

For Microelectronic Use

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



Sr. Manager, Quality Assurance

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

For Trace Metal Analysis





R->10/13/24

Met dig

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

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Certificate of Analysis

Test	Specification	Result
ACS - Assay (as HCl) (by acid-base titrn)	36.5 - 38.0 %	37.6
ACS – Color (APHA)	<= 10	5
ACS - Residue after Ignition	<= 3 ppm	1
ACS - Specific Gravity at 60°/60°F	1.185 - 1.192	1.190
ACS – Bromide (Br)	<= 0.005 %	< 0.005
ACS – Extractable Organic Substances	<= 5 ppm	1
ACS - Free Chlorine (as Cl2)	<= 0.5 ppm	< 0.5
Phosphate (PO4)	<= 0.05 ppm	< 0.03
Sulfate (SO4)	<= 0.5 ppm	< 0.3
Sulfite (SO ₃)	<= 0.8 ppm	0.3
Ammonium (NH4)	<= 3 ppm	< 1
Trace Impurities - Arsenic (As)	<= 0.010 ppm	< 0.003
Trace Impurities - Aluminum (Al)	<= 10.0 ppb	< 0.2
Arsenic and Antimony (as As)	<= 5 ppb	< 3
Trace Impurities – Barium (Ba)	<= 1.0 ppb	< 0.2
Trace Impurities – Beryllium (Be)	<= 1.0 ppb	< 0.2
Trace Impurities – Bismuth (Bi)	<= 10.0 ppb	< 1.0
Trace Impurities – Boron (B)	<= 20.0 ppb	< 5.0
Trace Impurities - Cadmium (Cd)	<= 1.0 ppb	< 0.3
Trace Impurities – Calcium (Ca)	<= 50.0 ppb	29.7
Trace Impurities – Chromium (Cr)	<= 1.0 ppb	< 0.4
Trace Impurities – Cobalt (Co)	<= 1.0 ppb	< 0.3
Trace Impurities – Copper (Cu)	<= 1.0 ppb	< 0.1
Trace Impurities – Gallium (Ga)	<= 1.0 ppb	< 0.2

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

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

Test	Specification	Result
Trace Impurities – Germanium (Ge)	<= 3.0 ppb	< 2.0
Trace Impurities - Gold (Au)	<= 4.0 ppb	< 0.2
Heavy Metals (as Pb)	<= 100 ppb	< 50
Trace Impurities – Iron (Fe)	<= 15.0 ppb	<]
Trace Impurities – Lead (Pb)	<pre>>> dqq 0.1 =></pre>	< 0.5
Trace Impurities – Lithium (Li)	<= 1.0 ppb	0.2
Frace Impurities – Magnesium (Mg)	<= 10.0 ppb	0.2
Frace Impurities – Manganese (Mn)	<= 1.0 ppb	< 0.4
race Impurities – Mercury (Hg)	<= 0.5 ppb	0.1
race Impurities – Molybdenum (Mo)	<= 10.0 ppb	< 5.0
race Impurities – Nickel (Ni)	<= 4.0 ppb	< 0.3
race Impurities – Niobium (Nb)	<= 1.0 ppb	< 0.2
race Impurities – Potassium (K)	<= 9.0 ppb	< 2.0
race Impurities - Selenium (Se), For Information Only	ppb	1.0
race Impurities - Silicon (Si)	<= 100.0 ppb	< 10.0
race Impurities – Silver (Ag)	<= 1.0 ppb	< 0.3
race Impurities – Sodium (Na)	<= 100.0 ppb	< 5.0
race Impurities – Strontium (Sr)	<= 1.0 ppb	< 0.2
race Impurities – Tantalum (Ta)	<= 1.0 ppb	< 0.2
ace Impurities - Thallium (TI)	<= 5.0 ppb	< 2.0
ace Impurities – Tin (Sn)	<= 5.0 ppb	
ace Impurities - Titanium (Ti)	<= 1.0 ppb	< 0.8
ace Impurities – Vanadium (V)	<= 1.0 ppb	0.2
ace Impurities – Zinc (Zn)	<= 5.0 ppb	< 0.2
ace Impurities – Zirconium (Zr)	<= 1.0 ppb	0.3 < 0.1

For Laboratory, Research or Manufacturing Use Product Information (not specifications): Appearance (clear, fuming liquid) Meets ACS Specifications

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

James Techie Jamie Ethier Vice President Global Quality

For questions on this Certificate of Analysis please contact Technical Services at 855.282.6867 or +1.610.386.1700 Avantor Performance Materials, LLC 100 Matsonford Rd, Suite 200, Radnor, PA 19087. U.S.A. Phone: 610.386.1700 Nitric Acid 69% CMOS





M6124

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

Certificate of Analysis

Test	Specification	Result
Assay (HNO3)	69.0 - 70.0 %	69.7 %
Appearance	Passes Test	Passes Test
Color (APHA)	≤ 10	5
Residue after Ignition	≤ 2 ppm	l ppm
Chioride (CI)	≤ 0.08 ppm	< 0.03 ppm
Phosphate (PO4)	≤ 0.10 ppm	< 0.03 ppm
Sulfate (SO4)	≤ 0.2 ppm	< 0.2 ppm
Trace Impurities – Aluminum (AI)	≤ 40.0 ppb	< 1.0 ppb
Arsenic and Antimony (as As)	≤ 5.0 ppb	< 2.0 ppb
Trace Impurities – Barium (Ba)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Beryllium (Be)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Bismuth (Bi)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities - Boron (B)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities – Cadmium (Cd)	≤ 50 ppb	< 1 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	2.3 ppb
Trace Impurities - Chromium (Cr)	≤ 30.0 ppb	< 1.0 ppb
Trace Impurities - Cobalt (Co)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Copper (Cu)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Gallium (Ga)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Germanium (Ge)	≤ 20 ppb	< 10 ppb
Trace Impurities - Gold (Au)	≤ 20 ppb	< 5 ppb
Heavy Metals (as Pb)	≤ 100 ppb	100 ppb
Trace Impurities – Iron (Fe)	≤ 40.0 ppb	< 1.0 ppb
Trace Impurities - Lead (Pb)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Lithium (Li)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Magnesium (Mg)	≤ 20 ppb	< 1 ppb
Trace Impurities – Manganese (Mn)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Nickel (Ni)	≤ 20.0 ppb	< 5.0 ppb
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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

Nitric Acid 69% CMOS





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

Task			
Test	Specification	Result	

For Microelectronic Use

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



M612 S Receive -> 11/22/24 CORCO CHEMICAL CORPORATION

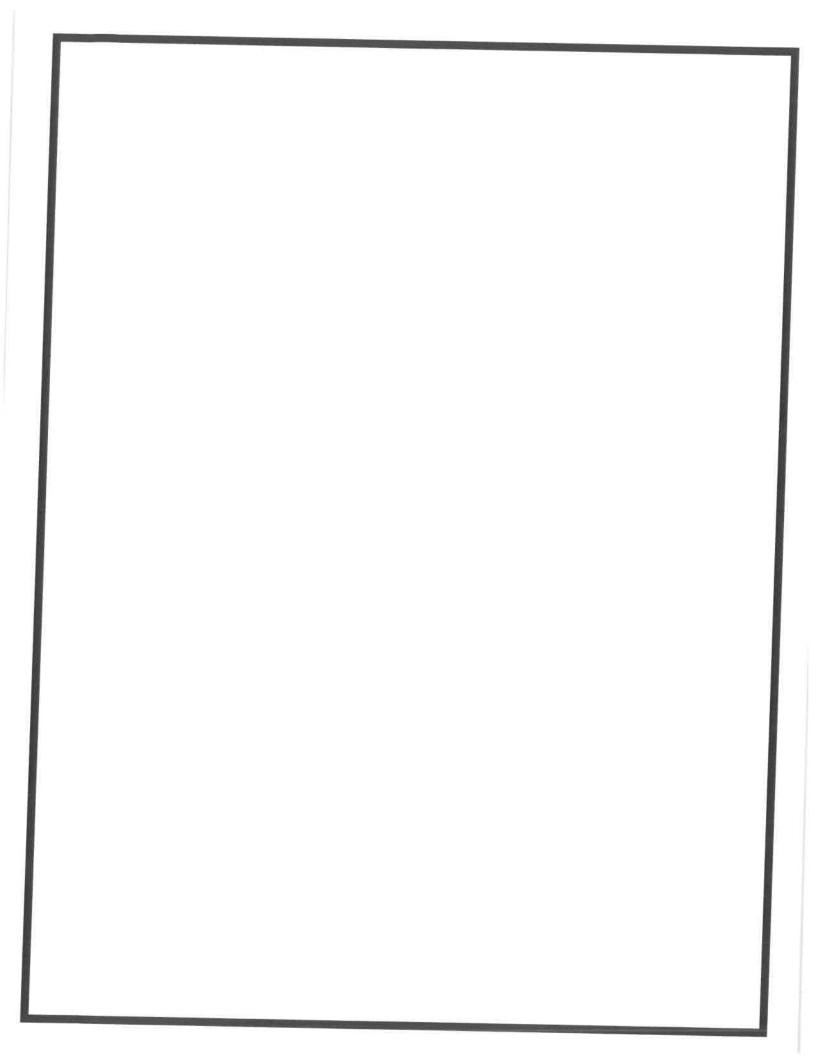
Manufacturers of ACS Reagents and Semiconductor Grade Chemicals

Office and Plant 299 Cedar Lane Fairless Hills, PA 19030

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

Hydrogen Peroxide 30%, ACS Reagent Grade

SPECIFICATION	MAXIMUM LIMITS
Appearance	Colorless and free from suspended matter or sediment
Assay	29-32%
Color (APHA)	10
Residue after Evaporation	0.002%
Titratable Acid	0.0006 meq/g
Chloride (Cl)	3 ppm
Nitrate (NO ₃)	2 ppm
Phosphate	2 ppm
Sulfate (SO ₄)	5 ppm
Ammonium (NH₄)	5 ppm
Heavy Metals (as Pb)	1 ppm
Iron (Fe)	0.5 ppm







R-> 11/12/24 TH6126

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

Certificate of Analysis

Test	Specification	Result
Assay (HNO₃)	69.0 – 70.0 %	69.7 %
Appearance	Passes Test	Passes Test
Color (APHA)	≤ 10	5
Residue after Ignition	≤ 2 ppm	1 ppm
Chloride (CI)	≤ 0.08 ppm	< 0.03 ppm
Phosphate (PO4)	≤ 0.10 ppm	< 0.03 ppm
Sulfate (SO4)	≤ 0.2 ppm	< 0.2 ppm
Trace Impurities – Aluminum (Al)	≤ 40.0 ppb	< 1.0 ppb
Arsenic and Antimony (as As)	≤ 5.0 ppb	< 2.0 ppb
Trace Impurities – Barium (Ba)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities - Beryllium (Be)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Bismuth (Bi)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities - Boron (B)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities – Cadmium (Cd)	≤ 50 ppb	< 1 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	2.3 ppb
Trace Impurities - Chromium (Cr)	≤ 30.0 ppb	< 1.0 ppb
Trace Impurities – Cobalt (Co)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Copper (Cu)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Gallium (Ga)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Germanium (Ge)	≤ 20 ppb	< 10 ppb
Trace Impurities – Gold (Au)	≤ 20 ppb	< 5 ppb
Heavy Metals (as Pb)	≤ 100 ppb	100 ppb
Trace Impurities – Iron (Fe)	≤ 40.0 ppb	< 1.0 ppb
Trace Impurities - Lead (Pb)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Lithium (Li)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Magnesium (Mg)	≤ 20 ppb	< 1 ppb
Trace Impurities – Manganese (Mn)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Nickel (Ni)	≤ 20.0 ppb	< 5.0 ppb

>>> Continued on page 2 >>>

Nitric Acid 69% CMOS





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

Test	Specification	Result	

For Microelectronic Use

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



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

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

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

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



Certified Reference Material CRM



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

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

							I race M	etals	Verifica	tion	by ICP-N	IS (II)	g/mL)						
A	B	2	202	2	-	1	MILLION CONTRACTOR	Manual	AND IN THE OWNER.						Contraction of the local division of the loc	CONTRACTO	AL INCOME IN		
2	20.02	5	20.02	Dy	40.02	Hf	40.02	E	<0.02	Ni	40.02	7	20.02	Se	<0.2	7	400	W	200
S		ۍ	4	ដ	2003	Ľ,	ŝ	4	2	1		1			1012		10.02	**	20.02
	5,			1	20.00	CR1	70.02	L	20.02	NP	40.02	Re	40.02	2	40.02	P	20102	9	4000
au.	202	ß	20.02	ñ	40.02	5	A ,92	M	40,01	õ	4002	R.	23	A.	2003	3	3	4	
B	2020	ç	33	5	5	ľ	3	5,		!		-	mot on	9	TNNE		20.02	~	20.02
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De	1000	ç	40,02	ନ୍ଥ	40,02	4	402	He	A 12	Ð	300	2	33	n'	3	1	3	: :	
<u>H</u>	43	3	2	P	3	4						111	700.00	ġ	20.02	101	<u.u2< td=""><td>1</td><td>20.02</td></u.u2<>	1	20.02
		1	20.02	G	20.05	5	20.02	Mo	20.02	7	0 02	S	40.02	6	AN 03	3	33	7	3
G	SUUS	ç	A .02	Au		y	A B	K	200	4	5	2	5	3,			10.00	1	70.02
				I					NAL ON	ļ	44	Ŕ	20.02	12	20.02	11	40.02	2	20.02

(T) = Target analyte

Physical Characterization:

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

Certified by:

In P. S.

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Part # 57051 Lot # 120523

N 55 10 0	m/z-> 110 5.0E6	រា .0 ៣ ភា	m/≥-> 10	ហ .0 ៣ ៥	[1] Spectrum No.1 1.0E7	1. Silver nitrate (Ag)	Compound	Part Number: 57047 Lot Number: 122823 Description: Silver (A Description: Silver (A Expiration Date: 122826 Recommended Storage: Ambient (; Nominal Concentration (µg/mL): 1000 NIST Test Number: 6UTB Weight shown below was diluted to (mL):	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com CERTIFIED WEIGHT REPORT:
	120		N.		-	5 J0612AGA1	Lot Nor RM# Number Conc. (57047 122823 Silver (Ag) 122826 Ambient (20 Ambient (20 1000 6UTB 6UTB	-
	130 140		90 40		14.044 sec]:58147.D# [Count] [Linear]	88.8988 0.10	Nominal Purity Uncertainty Assay Conc. (Jug/mL) (96) Purity (96) (96)	*C) 5E-05 Balance Uncertainty	Certified I R 1 8 5 2 4
	1 ភូ- O		50		[Count] [Linear]	6.27992	Target Weight (g)	n t: 24002546 2% 80.0 (mL)	Certified Reference Material
	160 170		60 70			1000.0	Actual Actual U Weight (g) Conc. (µg/mL) +	Nitric Acid	rial CRM M6030
	180		80			2.0 7761-88-8	Expanded Uncertainty (Solv +/- (µg/mL) CAS#	ad By:)30
	190 200		90 100			10 ug/m3	SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD51	Benson Chan Pedro L. Rentas	http
	ŏ		ŏ				n ached pg.) NIST LD50 SRM	122823	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com

Part # 57047 Lot # 122823

1 of 2

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

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			The shares	A COLUMN	THE WAY DOWN	State of	12.12.2.2016	18 - ¹ 19		100	The state of the state		1.40 . 10 . 10 . 10 E	No.		No.			
A	<0.02	8	<0.02	Dy	<0.02	Hf	<0.02	5	<0.02	N	<0.02	7	<0.02	Se	<0.2	ТЪ	<0.02	W	<0.02
Sb	<0.02	ß	<0.2	막	40.02	Но	<0.02	Lu	<0.02	ĥ	<0.02	Re	<0.02	<u>8</u>	<0.02	Te	40.02	q	<0.02
As	4 0.2	ĉ	<0.02	땹	<0.02	h	<0.02	Mg	<0.01	õ	<0.02	Rh	<0.02	Ag	T	1	<0.02	<	<0.02
Ba	<0.02	S	<0.02	ନ୍ଥ	<0.02	Ħ	<0.02	Mn	<0.02	Pd	<0.02	Rb	<0.02	Na	<0.2	Ţ	<0.02	YЪ	<0.02
Be	<0.01	Ω	<0.02	ଦ୍ଧ	<0.02	Fe	<0.2	Hg	40.2	p	<0.02	Ru	<0.02	ş	<0.02	Tm	<0.02	×	<0.02
B	<0.02	S	<0.02	ନ୍ନ	<0.02	L	<0.02	Mo	<0.02	Ŗ	<0.02	Sm	<0.02	Ś	<0.02	Sh	<0.02	2	<0.02
μ.	<0.02	ß	<0.02	Au	<0.02	Pb	<0.02	Nd	<0.02	K	40 2	Ş	<0.02	Ta	<0.02	Ð	<0.02	2	<0.02

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

Physical Characterization:

(T)= Target analyte

Certified by:

In & She

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

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		Inc



Certified Reference Material CRM



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

							race Me	tais	Verifica	TION	by ICP-	MC (hd/mr)						
					10-31										10 T		101000		No. of Concession, No. of Conces
AI	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Ε.	<0.02	<u>N</u>	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
SР	<0.02	Ca	<0.2	막	<0.02	Но	<0.02	Lu	<0.02	ß	<0.02	Re	<0.02	ŝ	<0.02	Te	A0.02	ď	<0.02
As	<0.2	ĉ	<0.02	F	<0.02	ľ	<0.02	Mg	<0.01	õ	<0.02	Rh	<0.02	Ag	<0.02	Ц	<0.02	<	<0.02
Ba	<0.02	ß	<0.02	ନ୍ଦ	<0.02	F	<0.02	M'n	< 0.02	Pd	<0.02	RЬ	<0.02	Na	<0.2	Ţ	<0.02	ΥЪ	<0.02
Be	<0.01	Ω	<0.02	Ga	<0.02	F	<0.2	Hg	<0.2	P	<0.02	Ru	<0.02	Sr	Ţ	Tm	<0.02	Y	<0.02
Bi	<0.02	ĉ	<0.02	Ge	<0.02	La	<0.02	Mo	<0.02	Ŗ	<0.02	Sm	<0.02	s	<0.02	Sn	<0.02	Zn	<0.02
в	<0.02	Cu	<0.02	Au	<0.02	Pb	<0.02	Nd	<0.02	ĸ	<0.2	Sc	<0.02	Ta	<0.02	H	<0.02	Zr	<0.02

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

(T)= Target analyte

Physical Characterization:

Certified by:

Sur & Sur

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Part # 56138 Lot # 082922

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

vww.absolutestandards.com	300-368-1131	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 Spectroscopy (ICP-MS):

							race Me	tais	Verifica	TION	by ICP-	MC (hd/mr)						
					10-31										10 T		101000		No. of Concession, No. of Conces
AI	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Ε.	<0.02	Ä	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
SР	<0.02	Ca	<0.2	막	<0.02	Но	<0.02	Lu	<0.02	Nb	<0.02	Re	<0.02	ŝ	<0.02	Te	A0.02	d	<0.02
As	<0.2	ĉ	<0.02	E	<0.02	ľ	<0.02	Mg	<0.01	õ	<0.02	Rh	<0.02	Ag	<0.02	Ц	<0.02	<	<0.02
Ba	<0.02	ß	<0.02	ନ୍ଦ	<0.02	F	<0.02	M'n	<0.02	Pd	<0.02	RЬ	<0.02	Na	<0.2	Ţ	<0.02	ΥЪ	<0.02
Be	<0.01	Ω	<0.02	Ga	<0.02	F	<0.2	Hg	<0.2	P	<0.02	Ru	<0.02	Sr	Ţ	Tm	<0.02	Y	<0.02
Bi	<0.02	ĉ	<0.02	Ge	<0.02	La	<0.02	Mo	<0.02	Þ	<0.02	Sm	<0.02	s	<0.02	Sn	<0.02	Zn	<0.02
в	<0.02	Cu	<0.02	Au	<0.02	Pb	<0.02	Nd	<0.02	ĸ	<0.2	Sc	<0.02	Ta	<0.02	H	<0.02	Z	<0.02

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

(T)= Target analyte

Physical Characterization:

Certified by:

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Part # 56138 Lot # 082922

Absolute standards, Inc. 800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT: Part N Lot N Desc	Expiration Date: Recommended Storage:	NIST Te	Weight showr	Compound		2.0 円の	1.0巨6	TVZ->	1.0巨4	50 00 00	m/z->	1.006	5.0 E5	mvz->
	<u>PORT:</u> Part Number: Lot Number: Description:	Expiration Date: nended Storage:	NIST Test Number:	Weight shown below was diluted to (mL):	RM#				ö			110			210
	<u>57081</u> 062724 Thalllum (TI)	062727 Ambient (20 °C)	6UTB	ed to (mL): Lot	Number C	INDU/ DUUF4088			N			120			220
		°C)		2000.1 0 Nominal Pi	Conc. (µg/mL) (88			ක්			130			230
Certified Refi R ! 8]5]24	ğ			0.10 Flask Uncertainty Purity Uncertainty Assay	(%) Purity (%)	89,889 U.1U			4			140			240
Certified Reference Material CRM とという		2% 40 (m	sertainty	ainty v Assay Target	(%) Weight (g)	0.11			8			150			250
e Material	Lot # 24002546 Nitric Acid	40.0 Nitric Acid (mL)		get Actual		116C'7 CJR									
СRМ М6023	Acid	Acid		Actual	Weight (g) Conc. (µg/mL)	1000.1			80			160			260
23	Ala	Formulated By:	Reviewed By:	Expanded Uncertainty		2.0			70			170			
	20	\$		(Solvent	CAS#	10102-45-1			80			180			
http	Gion El o	Aleah O'Brady	Pedro L. Rentas	SDS Information Safety Info. On Atta	OSHA PEL (TWA)	u.i mg/ma			90			190			
ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com		062724	062724	SDS Information (Solvent Safety Info. On Attached pg.)	s) LD50	gy/gmct snut-no			100			200			
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Part # 57081 Lot # 062724

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





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

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

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(I) = Target analyte

Physical Characterization:

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

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Certified by:

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

* All standard containers are meticulously cleaned prior to use.

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

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

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Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT:	Part Number: 57023 Lot Number: 062424 Description: Vanadium (V)	Expiration Date: 062427			Volume shown below was diluted to (mL): 2000.3	Part Lot Dilution	Compound Number Number Factor	1. Ammonium metavanadate (V) 58123 021224 0.1000	[1] Spectrum No.1 [34.243 2.0E6		m/z->- 10 20	2.067	1.067	m/z 110 120 1	2.588	
8:81 Ce					5E-05	0.06	Initial		200.0	sec]:58		30			190		200
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eference l	Lot #	24002546	2,0%		inty		Nominal	Conc. (µg/mL)	1000	žount) [Lin		5 0			- 50		2000
Naterial Cl	Solvent:	Nitric Acid	40.0 (mL)				Initial	Conc. (µg/mL)	10000.3	1⊖ar]		60			160		260
MF M6021			Nitric Acid				Final	Con	1000.0						- 		•
21		Alla	Formulated By:	M	Reviewed By:		Expanded		2.2			70			170		
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ht		Garan	Aleah O'Brady	ento	Pedro L. Rentas		SDS Information It Safety Info. On Atta	OSHA PEL (TWA)	0.05 mg/m3			90			190		
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Part # 57023 Lot # 062424





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

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Physical Characterization:

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

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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.

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