

### Prep Standard - Chemical Standard Summary

Order ID :	Q2375
Test :	Metals Group4
Prepbatch ID :	PB168583,
Sequence ID/Qc Ba	tch ID: LB136255,LB136255,LB136255,LB136273,
Standard ID : MP85156,MP85867, 96,MP85897,MP859	,MP85868,MP85869,MP85870,MP85871,MP85873,MP85874,MP85875,MP85876,MP85877,MP858 )34,
M5969,M5970,M598	71,M5658,M5697,M5747,M5748,M5798,M5799,M5800,M5801,M5811,M5814,M5820,M5942,M5962, 34,M5985,M5996,M5997,M6007,M6015,M6021,M6023,M6028,M6030,M6032,M6077,M6127,M6128 42,M6144,M6145,M6146,M6151,M6152,M6155,M6158,M6159,M6162,M6163,M6164,M6165,W311



Recipe ID 170 FROM	NAME 1:1HCL 1250.00000ml of M6151 + 1250.0000	<u>NO.</u> <u>MP85156</u> 00ml of W31	Prep Date 04/07/2025 112 = Final Q	Expiration Date 08/18/2025 uantity: 2500.00	Prepared By Kareem Khairalla	<u>ScaleID</u> None	PipettelD None	Sarabjit Jaswal 04/07/2025
Recipe ID 902 FROM	NAME ICP AES CAL BLK ( SO/ICB/CCB) 125.00000ml of M6151 + 2350.00000	<u>NO.</u> <u>MP85867</u> Oml of W311	Prep Date 06/02/2025	Expiration Date 06/25/2025 ml of M6162 =	Prepared By Janvi Patel Final Quantity:	<u>ScaleID</u> METALS_SCA LE_3 (M SC-3) 2500.000 ml		Sarabjit Jaswal 06/14/2025



Recipe ID 907	NAME ICP AES STD S ( S5 )	<u>NO.</u> MP85868	<u>Prep Date</u> 06/02/2025	Expiration Date 06/25/2025		<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	
<u>FROM</u>	5.00000ml of M5467 + 5.00000ml of of M5996 + 5.00000ml of M5997 + 5. 500.000 ml							
Pasina				Evpiration	Bronorod			Supervised By

<b>Recipe</b>				<b>Expiration</b>	<b>Prepared</b>			Supervised By
ID	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipetteID	Sarabjit Jaswal
910	ICP AES STD S4	<u>MP85869</u>	06/02/2025	06/25/2025	Janvi Patel	METALS_SCA		
						LE_3 (M SC-3)	ETTE_1 (ICP	06/14/2025
FROM	50.0000ml of MP85867 + 50.00000	ml of MP858	368 = Final Q	uantity: 100.00	0 ml		A)	



908

ICP AES S2/CRI MINERALS

ONLY STD

### Metals STANDARD PREPARATION LOG

<u>Recipe</u> <u>ID</u> 909	NAME ICP AES STD S3	<u>NO.</u> <u>MP85870</u>	<u>Prep Date</u> 06/02/2025	Expiration Date 06/25/2025	<u>Prepared</u> <u>By</u> Janvi Patel	<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	Sarabjit Jaswal
<u>FROM</u>	25.00000ml of MP85868 + 75.00000	ml of MP858	367  = Final Q	uantity: 100.00	0 ml		A)	
<u>Recipe</u> <u>ID</u>	NAME	<u>NO.</u>	Prep Date	Expiration Date	<u>Prepared</u> <u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	<u>Supervised By</u> Sarabjit Jaswal

06/25/2025

Janvi Patel

METALS\_SCA METALS\_PIP

LE\_3 (M SC-3) ETTE\_1 (ICP

06/14/2025

**FROM** 8.00000ml of MP85868 + 92.00000ml of MP85867 = Final Quantity: 100.000 ml

MP85871 06/02/2025



Recipe ID 904 FROM	NAME ICP AES ICSA SOLN 25.00000ml of M6152 + 225.00000m	<u>NO.</u> <u>MP85873</u> I of MP8586	Prep Date 06/02/2025 67 = Final Qu	Expiration Date 06/25/2025 antity: 250.000		<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)		Sarabjit Jaswal 06/14/2025
Recipe ID 3494	NAME	<u>NO.</u> MP85874	Prep Date	Expiration Date 06/25/2025	<u>Prepared</u> <u>By</u> Janvi Patel	<u>ScaleID</u> METALS_SCA	<u>PipetteID</u> METALS PIP	<u>Supervised By</u> Sarabjit Jaswal



Recipe ID 911	NAME ICP AES CCV SOLN	<u>NO.</u> MP85875	Prep Date 06/02/2025	Expiration Date 06/25/2025		<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	Sarabjit Jaswal 06/14/2025
<u>FROM</u>	50.00000ml of MP85867 + 50.00000	ml of MP858	368 <i>=</i> Final Q	uantity: 100.00	0 ml		A)	
<u>Recipe</u>				Expiration	Prepared			Supervised By

Recipe				<b>Expiration</b>	<b>Prepared</b>			Supervised By
<u>ID</u>	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipetteID	Sarabjit Jaswal
919	ICP AES INTERNAL STD	<u>MP85876</u>	06/02/2025	06/25/2025		METALS_SCA		-
						LE_3 (M SC-3)		06/14/2025
FROM	1.00000ml of M5984 + 10.00000ml o	f M5985 + 1	969.00000ml	of W3112 + 20	.00000ml of M6	6162 = Final Qu	A) antity: 2000.00	0 ml



Recipe ID 903 FROM	NAME ICP AES RINSE SOLN 200.00000ml of M6162 + 9800.00000	<u>NO.</u> <u>MP85877</u> 0ml of W311	Prep Date 06/02/2025 2 = Final Qua	Expiration Date 06/25/2025 antity: 10000.00	<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	Sarabjit Jaswal 06/14/2025
Recipe ID 2950	NAME ICP AES S1/CRI STOCK STD	<u>NO.</u> MP85896	Prep Date 06/02/2025	Expiration Date 06/25/2025	<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	Sarabjit Jaswal

FROM 0.03000ml of M5798 + 0.03000ml of M6028 + 0.05000ml of M5658 + 0.05000ml of M5811 + 0.05000ml of M6030 + 0.05000ml of M6159 + 0.06000ml of M5747 + 0.10000ml of M5471 + 0.10000ml of M5697 + 0.10000ml of M5801 + 0.10000ml of M5820 + 0.10000ml of M5962 + 0.10000ml of M5969 + 0.10000ml of M5970 + 0.10000ml of M6128 + 0.15000ml of M5800 + 0.20000ml of M5748 + 0.20000ml of M5799 + 0.20000ml of M5942 + 0.20000ml of M6021 + 0.20000ml of M6023 + 0.20000ml of M6145 + 0.25000ml of M5466 + 0.25000ml of M6146 + 0.50000ml of M5814 + 0.50000ml of M6032 + 1.00000ml of M6127 + 1.00000ml of M6142 + 1.00000ml of M6144 + 2.00000ml of M6137 + 90.03000ml of MP85867 = Final Quantity: 100.000 ml



Recipe ID 2951	NAME ICP AES S1/CRI WORK STD	<u>NO.</u> MP85897	Prep Date 06/02/2025	Expiration Date 06/25/2025	<u>Prepared</u> <u>By</u> Janvi Patel	<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	Sarabjit Jaswal
<u>FROM</u>	2.00000ml of MP85896 + 90.03000m	nl of MP8586	67  = Final Qu	antity: 100.000	ml		A) '	
Recipe				Expiration	Prepared			Supervised By

Recipe				<b>Expiration</b>	<b>Prepared</b>			Supervised By
ID	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Mohan Bera
4163	NEW ICV-060925	<u>MP85934</u>	06/10/2025	06/25/2025	Sarabjit Jaswal			
						LE_1 (M SC-1)	ETTE_3 (A)	06/16/2025
<u>FROM</u>	0.20000ml of M6163 + 0.20000ml of	M6164 + 0.:	20000ml of M	6165 + 49.400	00ml of MP8586	67 = Final Quar	ntity: 50.000 m	I



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57058 / Cerium, 1000PPM, 100ML	061322	06/13/2025	03/06/2023 / bin	03/01/2023 / bin	M5466
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57058 / Cerium, 1000PPM, 100ML	020623	02/06/2026	03/06/2023 / bin	03/01/2023 / bin	M5467
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57038 / Sr, 1000 PPM, 125 ml	082922	08/29/2025	04/14/2025 / jaswal	03/16/2023 / jaswal	M5471
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58024 / Chromium, Cr, 500 ml, 1000 PPM	060523	06/05/2026	08/28/2023 / jaswal	08/25/2023 / jaswal	M5658
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.	/ Lead (Pb) 1000PPM	100923	10/09/2026	05/20/2024 / Jaswal	12/20/2023 / jaswal	M5747



ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
/ Nickel (Ni) 1000PPM	091223	09/12/2026	01/02/2024 / bin	12/20/2023 / jaswal	M5748
ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
57004 / Be, 1000 PPM, 125 ml	102523	10/25/2026	02/09/2024 / bin	02/09/2024 / bin	M5798
-	/ Nickel (Ni) 1000PPM ItemCode / ItemName 57004 / Be, 1000 PPM,	/ Nickel (Ni) 1000PPM         091223           ItemCode / ItemName         Lot #           57004 / Be, 1000 PPM,         102523	ItemCode / ItemName         Lot #         Date           / Nickel (Ni) 1000PPM         091223         09/12/2026           ItemCode / ItemName         Lot #         Expiration Date           57004 / Be, 1000 PPM,         102523         10/25/2026	ItemCode / ItemName         Lot #         Date         Opened By           / Nickel (Ni) 1000PPM         091223         09/12/2026         01/02/2024 / bin           ItemCode / ItemName         Lot #         Expiration Date         Date Opened By           57004 / Be, 1000 PPM,         102523         10/25/2026         02/09/2024 /	ItemCode / ItemName       Lot #       Date       Opened By       Received By         / Nickel (Ni) 1000PPM       091223       09/12/2026       01/02/2024 / bin       12/20/2023 / jaswal         ItemCode / ItemName       Lot #       Expiration Date Opened By       Received Date / Received Date / Opened By         ItemCode / ItemName       Lot #       Itepiration Date Opened / Opened By       Received Date / Received Date / Opened By         57004 / Be, 1000 PPM,       102523       10/25/2026       02/09/2024 /       02/09/2024 /

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.	58126 / Fe, 10000 PPM, 500 ml	051523	05/15/2026	02/06/2025 / kareem	01/03/2024 / jaswal	M5811



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57005 / B, 1000 PPM, 125 ml	071123	07/11/2026	03/26/2024 / Sohil	01/03/2024 / jaswal	M5814
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	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	CGTI1-1 / TITANIUM 125mL 1000ug/mL	T2-TI719972	06/17/2027	06/18/2024 / Jaswal	02/22/2024 / Jaswal	M5942
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.	57016 / S, 1000 PPM, 125 ml	122923	03/31/2026	03/31/2025 / kareem	06/11/2024 / Jaswal	M5969

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	CGY10-1 / YTTRIUM 125mL 10,000ug/mL	V2-Y740548	02/20/2029	08/05/2024 / kareem	06/14/2024 / Jaswal	M5984
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CGIN10-5 / INDIUM 1 x 500 ml	U2-IN729349	02/21/2028	10/08/2024 / Jaswal	06/14/2024 / Jaswal	M5985
			Expiration	Date Opened /	Received Date /	Chemtech
Supplier	ItemCode / ItemName	Lot #	Date	Opened By	Received By	Lot #
Inorganic Ventures	CLPP-CAL-1 / CLP CAL SOLUTION #1, 125mL	T2-MEB714417	01/27/2027	05/07/2024 / JANVI	02/22/2024 / kareem	M5996

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CLPP-CAL-3 / CLP CAL SOLUTION #3, 125mL	T2-MEB727800	12/21/2027	02/03/2025 / JANVI	02/22/2024 / kareem	M5997

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	WW-LFS-1 / Laboratory Fortified Stock Solution 1, 125 ml	T2-MEB723367	05/27/2026	05/27/2025 / Janvi	05/14/2024 / Jaswal	M6007

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
U U	WW-LFS-2 / Laboratory Fortified Stock Solution 2, 125 ml	U2-MEB731108	03/17/2028	06/19/2025 / MOHAN	05/14/2024 / Jaswal	M6015



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.	57048 / Cd, 1000 PPM, 125 ml	070124	07/01/2027	08/05/2024 / kareem	08/05/2024 / Jaswal	M6028
				<u> </u>		
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57047 / Ag, 1000 PPM, 125 ml	122823	12/28/2026	08/05/2024 / kareem	08/05/2024 / Jaswal	M6030
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Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57056 / Ba, 1000 PPM, 125 ml	010924	01/09/2027	01/14/2025 / Jaswal	08/05/2024 / Jaswal	M6032

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	Z9651Q / CHEM-CLP-4/.25L	V2-MEB746762	09/06/2029	01/23/2025 / kareem	09/19/2024 / kareem	M6077



Supplier	ItemCode / ItemName	ItemCode / ItemName Lot # Expiration Date Open Date Opened B				
Absolute Standards, Inc.	58112 / Mg, 10000 PPM, 500 ml	112124	11/21/2027	01/13/2025 / kareem	01/13/2025 / kareem	M6127
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58025 / Mn, 1000 PPM, 500 ml	101124	10/11/2027	01/13/2025 / kareem	01/13/2025 / kareem	M6128
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CGSI1-1 / SILICON 125mL 1000ug/mL	V2-SI744713	07/10/2029	01/14/2025 / Jaswal	10/03/2024 / Jaswal	M6137
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58120 / Ca, 10000 PPM, 500 ml	121824	12/18/2027	04/17/2025 / Janvi	01/13/2025 / Jaswal	M6138
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58119 / K, 10000 PPM, 500 ml	103024	10/30/2027	05/06/2025 / JANVI	01/13/2025 / Jaswal	M6142
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58111 / Na, 10000 PPM,	072424	07/24/2027	01/23/2025 /	01/13/2025 /	M6144



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58030 / Zinc, Zn, 500 ml, 1000 PPM	121724	12/17/2027	02/04/2025 / jaswal	01/13/2025 / Jaswal	M6145
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	071724	07/17/2027	01/31/2025 / kareem	10/18/2024 / kareem	M6146
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Seidler Chemical	BA-9530-33 / Hydrochloric Acid, Instra-Analyzed (cs/6x2.5L)	22G2862015	08/18/2025	02/18/2025 / Sagar	01/15/2025 / Sagar	M6151
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
EPA	PART A / ICSA ( ICP ) STOCK SOLN	ICSA-1211	08/24/2025	02/24/2025 / kareem	04/20/2021 / kareem	M6152
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
EPA	PART B / ICSAB ( ICP ) STOCK SOLN	ICSB-0710	06/30/2025	02/10/2025 / kareem	02/09/2024 / kareem	M6155
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Seidler Chemical	BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L)	24D1062002	03/25/2029	03/10/2025 / Eman	02/02/2025 / Sagar	M6158



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	011325	03/18/2026	03/18/2025 / kareem	02/09/2025 / kareem	M6159
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)	24H0162012	11/27/2025	05/27/2025 / Sagar	04/27/2025 / Sagar	M6162
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	QCP-CICV-1-125ML / EPA CLP ICP Verification Standard1	V2-MEB744107	05/22/2029	06/09/2025 / jaswal	06/06/2025 / jaswal	M6163
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	QCP-CICV-2-125ML / EPA CLP ICP Verification Standard2	U2-MEB733713	06/01/2028	06/09/2025 / jaswal	06/09/2025 / jaswal	M6164
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	QCP-CICV-3-125ML / EPA CLP ICP Verification Standard3	V2-MEB749572	01/02/2030	06/09/2025 / jaswal	06/09/2025 / jaswal	M6165
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Seidler Chemical	DIW / DI Water	Daily Lab-Certified		07/03/2024 / Iwona	07/03/2024 / Iwona	W3112

m/z->	N. 5 11 0	m/≥-≫ 5.0⊑6	m/z-> 2.0回5 1.0回5	2.0 同の の	1. Barium nitrate (Ba)	Compound	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa	CERTIFIED WEIGHT REPORT: Part A Lot A Desc	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
N		110	10	[1] Spectrum No.1	IN02	RM#	Expiration Date:010927Recommended Storage:Ambient (Il Concentration (µg/mL):1000NIST Test Number:6UTBWeight shown below was diluted to (mL):	<u>PORT:</u> Part Number: Lot Number: Description:	om om
ນ ວ		120	N O		IN023 BAD022019A1 1	Lot Number	20	<u>57056</u> 010924 Barium (Ba)	
).		130	Q O	12.514 sec]:58156.D# [Count] [Linear]	1000 99.999	Nominal Purity Unc Conc. (µg/mL) (%) Pu	5E-05 00.02		R1815
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		150 160	0 0 0	t] [Linear]	3.82417 3.82441	Target Actual Weight (g) Weight (g)	40.0 Nitric Acid (mL)	46	Certified Reference Material CRM 1/2-4
I		0 170	70		1 1000.1	Actual Conc. (µg/mL)			<b>:RM</b> М6032
		180	8- 0		2.0 10022-31-8	Expanded Uncertainty (So +/- (µg/mL) CAS#	Formulated By:	Hiovanni	-
		190 Varianti	9 O		0.5 mg/m3	SDS Information (Solvent Safety Info. On Attached pg.) COSHA PEL (TWA) LD51	Giovanni Esposito		AI Al
		200	100		orl-rat 355 mg/kg	n Attached pg.) ) LD50	010924	(P)	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
					g 3104a	NIST	<u>2</u> [2]	<u> </u>	Accredited Ite Number Idards.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):

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## **Physical Characterization:**

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

In P. S.

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 # 57056 Lot # 010924

m/z->	1.067	m/z-> 2.0€7	5.014	m/z-> 1.0E5	2.5 <b>E</b> 4	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 <sup>6</sup>		[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:	<b>15, Inc.</b> om
		120		20		-	IN024 CDM092021A1	Lot Number	6UTB uted to (mL):	070127 Ambient (20 °C) <b>1000</b>	<u>57048</u> <u>070124</u> Cadmium (Cd)		
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				-			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.

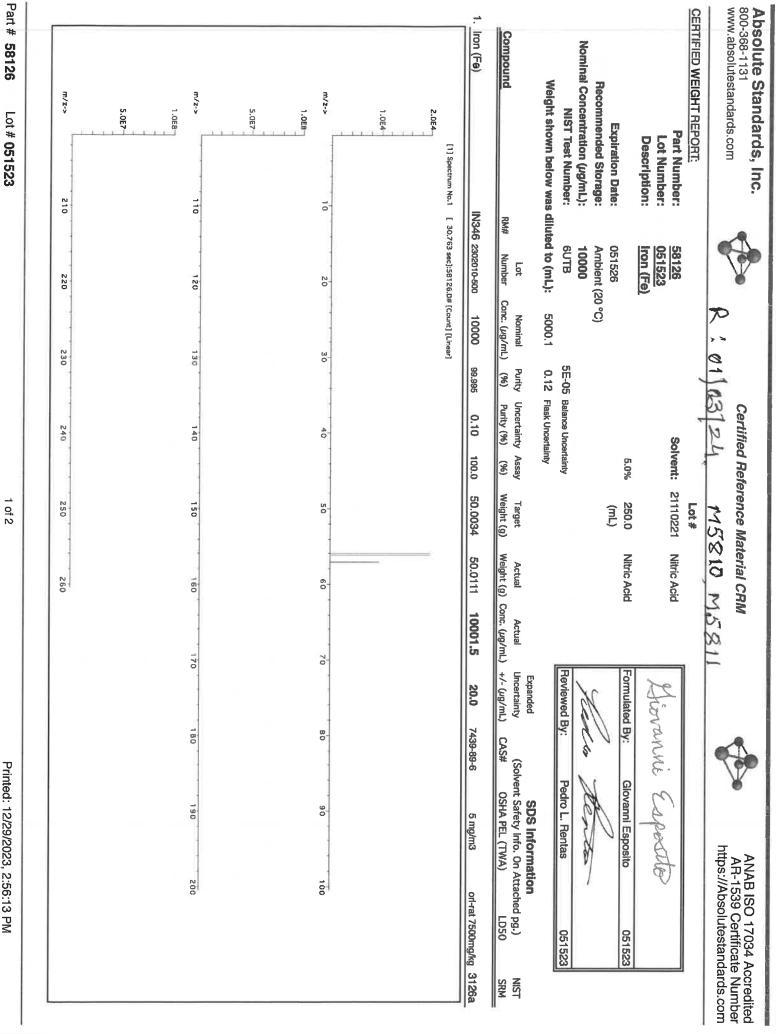
Certified by:

\* 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).

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11. 2015 BT 70000 an	4002       C:       4002       Fe       4		Trace Metals Verification by ICP-MS (µg/mL)	Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	Description       Descring <thdescring< th="">       Descring       <thd< th=""><th></th></thd<></thdescring<>	
	(T) = Target analyte	(T) = Target analyte	(T) = Target analyte	Is Verification by ICP-MS (µg/mL)         4002       Ni       40.0       Pi       Mi       Mi       Mi       Mi	etrometry (ICP-MS): Is Verification by ICP-MS ( $\mu$ g/mL) $\begin{array}{c ccccccccccccccccccccccccccccccccccc$	trified Reference Material CRMCtrometry (ICP-MS):Is Verification by ICP-MS (µg/mL) $4002$ Ni $402$ Ni $402$ $4002$ Ni $402$ Re $402$ $32$ $4002$ Re $402$ $32$ $32$ $402$ $402$ Re $402$ $32$ $32$ $402$ $402$ Re $402$ $32$ $32$ $402$ $402$ Re $402$ $32$ $32$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $33$ $402$ $1$ $302$ $33$ $302$ $33$ $1$ $402$ $32$

2 of 2

## Certificate of Analysis

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

**INORGANIC**" V E N T U R E S

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

### 1.0 ACCREDITATION / REGISTRATION

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



### 2.0 PRODUCT DESCRIPTION

Product Code:	Multi Analyte Custom Grade Solution
Catalog Number:	WW-LFS-1
Lot Number:	T2-MEB723367
Matrix:	5% (v/v) HNO3

Value / A	Analyte(s): 1 000 µg/mL ea: Potassium,		
	600 μg/mL ea: Phosphorus,		
	300 μg/mL ea: Sodium,	Iron,	
	200 µg/mL ea: Magnesium, Cerium, Thallium,	Aluminum, Selenium,	
	100 µg/mL ea: Lead,	Calcium,	
	80 μg/mL ea: Arsenic,		
	70 μg/mL ea: Mercury,		
	50 μg/mL ea: Nickel,		
	40 μg/mL ea: Chromium,		
	30 µg/mL ea: Copper, Vanadium,	Boron,	
	20 μg/mL ea: Zinc, Barium, Cadmium, Manganese,	Strontium, Beryllium, Cobalt, Lithium,	
3.0 CERTIF	7.5 µg/mL ea: Silver IED VALUES AND UNCERTAINTIES		

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

Density:

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

Assay Information:

ANALYTE Ag	METHOD ICP Assay	NIST SRM# 3151	SRM LOT# 160729
Ag	Volhard	999c	999c
Ag	Calculated		See Sec. 4.2
A	ICP Assay	3101a	140903
Al	EDTA	928	928
As	ICP Assay	3103a	100818
В	ICP Assay	3107	190605
Ba	ICP Assay	3104a	140909
Ва	Gravimetric		See Sec. 4.2
Be	ICP Assay	3105a	090514
Са	ICP Assay	3109a	130213
Са	EDTA	928	928
Cd	ICP Assay	3108	130116
Cd	EDTA	928	928
Се	ICP Assay	3110	090504
Ce	EDTA	928	928
Co	ICP Assay	3113	190630
Со	EDTA	928	928
Cr	ICP Assay	3112a	170630
Cu	ICP Assay	3114	121207
Cu	EDTA	928	928
Fe	ICP Assay	3126a	140812
Fe	EDTA	928	928
Hg	ICP Assay	3133	160921
Hg	EDTA	928	928
к	ICP Assay	3141a	140813
к	Gravimetric		See Sec. 4.2
Li	ICP Assay	3129a	100714
Li	Gravimetric		See Sec. 4.2
Mg	ICP Assay	3131a	140110
Mg	EDTA	928	928
Mn	ICP Assay	3132	050429
Mn	EDTA	928	928
Na	ICP Assay	Traceable to 3152A	S2-NA700842
Na	Gravimetric	0400	See Sec. 4.2
Ni Ni	ICP Assay	3136	120619
P	EDTA	928 3139a	928
P	ICP Assay Acidimetric		060717
F Pb	ICP Assay	84L 3128	84L
Pb	EDTA	928	101026 928
Se	ICP Assay	3149	920 100901
Sr	EDTA	928	928
Sr	ICP Assay	Traceable to 3153a	920 K2-SR650985
TI	ICP Assay	3158	151215
V	IC Assay	3165	160906
v	EDTA	928	928
Zn	ICP Assay	3168a	120629
Zn	EDTA	928	928
	Eco 4		

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

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

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

### 4.1 Thermometer Calibration

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

### 6.0 INTENDED USE

4.0

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

### 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

### 7.1 Storage and Handling Recommendations

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

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

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between  $4^{\circ}$  -  $24^{\circ}$  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

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

### 8.0 **HAZARDOUS INFORMATION**

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

### 9.0 HOMOGENEITY

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

### 10.0 **QUALITY STANDARD DOCUMENTATION**

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

### **11.1 Certification Issue Date**

August 30, 2022

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

### 11.2 Lot Expiration Date

### - August 30, 2026

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

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

### **11.3 Period of Validity**

Sealed TCT Bag Open Date:

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

### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

### **Certificate Approved By:**

Thomas Kozikowski Manager, Quality Control

SD9781.

Certifying Officer:

**Paul Gaines** Chairman / Senior Technical Director

Page 6 of 6

## **Certificate of Analysis**

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

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

### 1.0 ACCREDITATION / REGISTRATION

ÍNORGANÍ

VENTURES

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



### 2.0 PRODUCT DESCRIPTION

Product Code:	Multi Analyte Custom Grade Solution
Catalog Number:	WW-LFS-2
Lot Number:	U2-MEB731108
Matrix:	5% (v/v) HNO3 tr. HF
Value / Analyte(s):	200 μg/mL ea: Silica,
	80 μg/mL ea: Antimony,
	70 μg/mL ea: Tīn,
	40 μg/mL ea: Molybdenum,
	20 μg/mL ea:
	Titanium

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE Antimony, Sb	CERTIFIED VALUE 80.1 ± 0.6 µg/mL	ANALYTE Molybdenum, Mo	CERTIFIED VALUE 40.03 ± 0.18 µg/mL
Silica, SIO2	200.2 ± 1.3 μg/mL	Tin, Sn	70.0 ± 0.4 µg/mL
Titanium, Ti	20.01 ± 0.13 μg/mL		

Density:

1.025 g/mL (measured at 20 ± 4 °C)

### **Assay Information:**

ANALYTE Mo	METHOD ICP Assay	NIST SRM# 3134	SRM LOT# 130418
Мо	Calculated		See Sec. 4.2
Sb	ICP Assay	3102a	140911
SiO2	ICP Assay	3150	130912
Sn	ICP Assay	3161a	140917
π	ICP Assay	3162a	130925
ті	Calculated		See Sec. 4.2

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

### Characterization of CRM/RM by Two or More Methods

Certified Value, X<sub>CRWRM</sub>, 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<sub>char</sub> i w<sub>i</sub> = the weighting factors for each method calculated using the inverse square of the variance:

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

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

k = coverage factor = 2

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

uts = transport stability standard uncertainty

### 4.0 TRACEABILITY TO NIST

Characterization of CRM/RM by One Method Certified Value, X<sub>CRM/RM</sub>, where one method of characterization is used is the mean of individual results:

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

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

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

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

### 4.1 Thermometer Calibration

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

N/A

### 6.0 INTENDED USE

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

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

### 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

### 7.1 Storage and Handling Recommendations

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

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

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between  $4^{\circ}$  -  $24^{\circ}$  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**

March 17, 2023

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

### 11.2 Lot Expiration Date

### - March 17, 2028

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

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

- Sealed TCT Bag Open Date:

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

### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

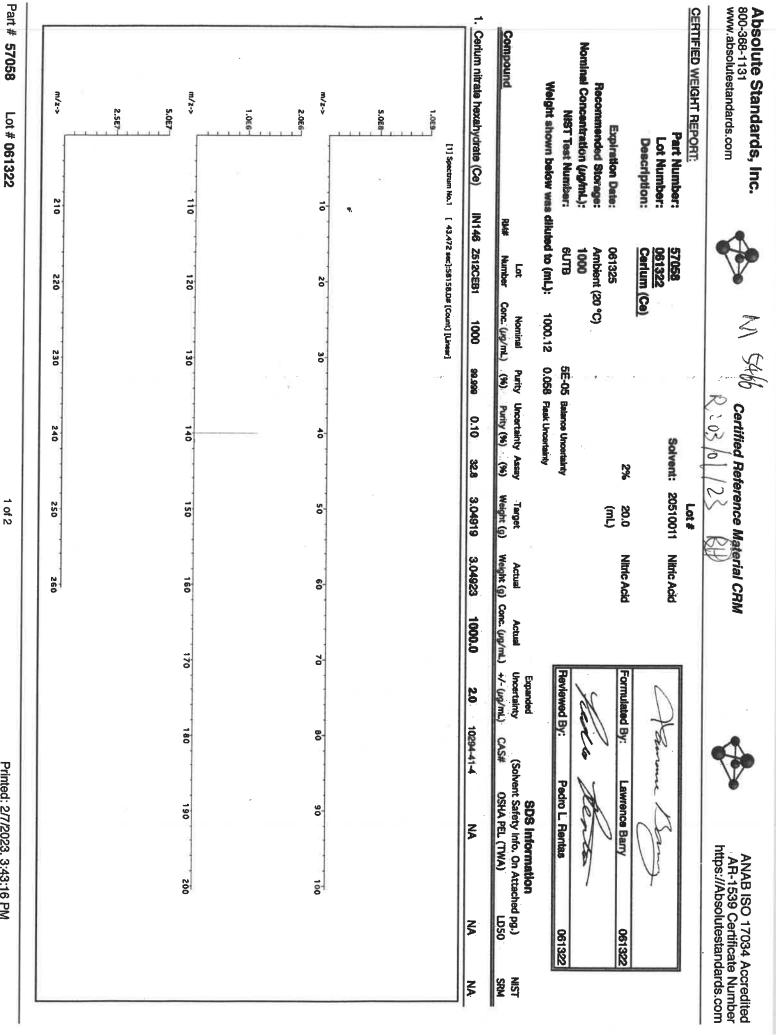
**Certificate Approved By:** 

Thomas Kozikowski Manager, Quality Control

3D9784. Paul R Laine

**Certifying Officer:** 

**Paul Gaines** Chairman / Senior Technical Director

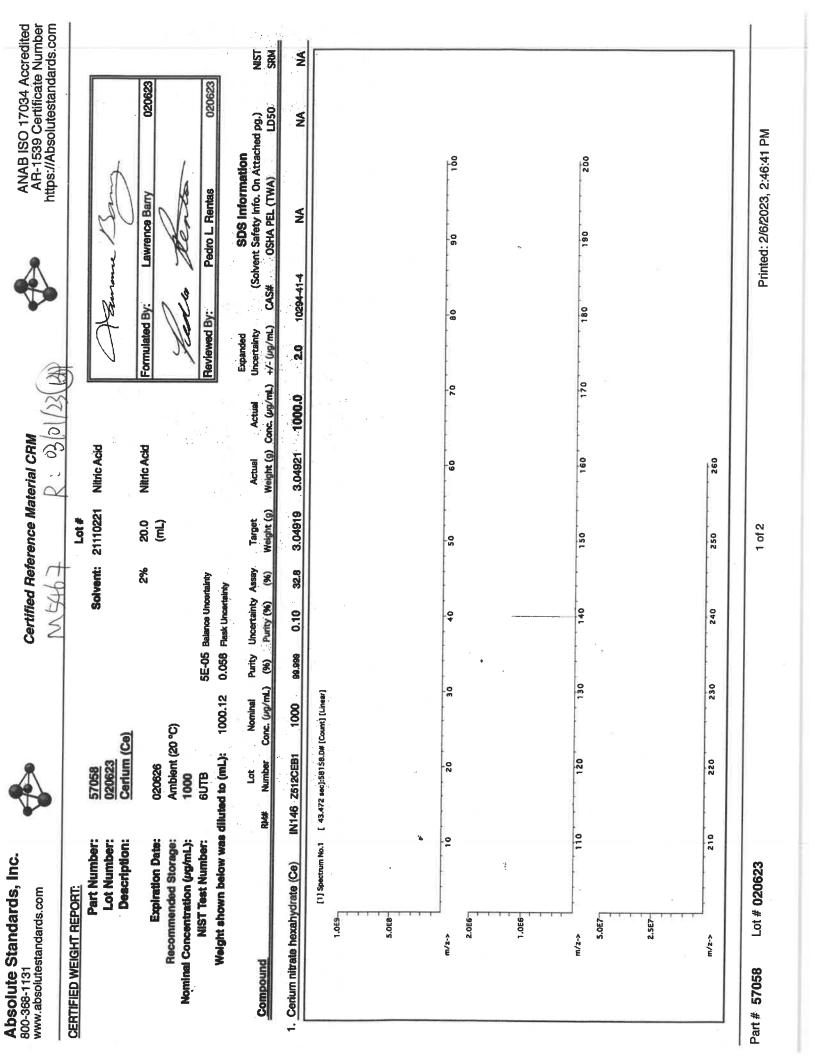


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Inductively Coupled Plasma Mass Spectroscopy (ICP-MS):         Trace Metals Verification by ICP-MS (lg/mL) $\frac{1}{100}$ $\frac{1}{1000}$ \frac{1}{1000}       \frac{1}{1000}
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2 of 2

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



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

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(T)= Target analyte

## Physical Characterization:

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

Certified by:

Ser P

\* 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).

m/z->	N.5 6	m/z-≯ 5.0E5	ភ. ០ ពេស	m/z-> 1.0≣6	5000	1.0트4	1. Chromium(III) nitrate nonahydrate (Cr)	Compound	Volume sho	Expiration Date: Recommended Storage: Nominal Concentration (Jug/mL):	Par De	CERTIFIED WEIGHT REPORT:	www.absolutestandards.com
N 10		110		<b>1</b>		[1] Spectrum No.1		Pa	Volume shown below was diluted to (mL):	Expiration Date: nended Storage: ntration (µg/mL):	Part Number: Lot Number: Description:	0	3
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				ð.		31,393 sec]:57024.D# [Count] [Línear]	084 1000	Uncertainty Nominal Pipetta (mL) Conc. (µg/mL)	Flask Uncertainty		21110221 2.0%	Lot #	) A
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		20- 00-		100			0.5 mg(Cr)/m3 ort-	SDS Information nt Safety Info. On Attac OSHA PEL (TWA)		Ø	nce Barry		AH-15: https://Ab
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Part # 58024 Lot # 060523

1 of 2

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Absolute Standards, Inc.       Certified Reference         800-368-1131       Image: Certified Reference         www.absolutestandards.com       Image: Certified Reference         Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	andards.cor	s by Indu	ictive	y Coupled	Plasn	na Mass S	Spectr C	Certified Reference Material Ci	ICP-M	IS):	ateria	I CRM					¥	크	ANAB AR-11 ttps:///	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	034 Acc lificate N standar	lumbe ds.corr
the stype of the style						Trace N	Metals	s Verification	ation	হ	ICP-MS		/g/mL)									
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Homogeneity: No heterogeneity was observed in the preparation of this standard.	No heteroge	meity was o	observe	d in the preps	aration (	of this stand	lard.										1	14	1		ľ	
<ul> <li>* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.</li> <li>* 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.</li> <li>* All standard containers are meticulously cleaned prior to use.</li> <li>* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).</li> <li>* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.</li> <li>* All standards should be stored with caps tight and under appropriate laboratory conditions.</li> <li>* 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).</li> </ul>	ad value is ds, 18.2 n ation of all are prepar are prepar are certife ds should ds should ent Result.	he conc megohm d Ill standarc are me ars are me are are are me ars are me ars are me ars are me ars are me ars are me are are are me are are are me are	entrat leioniz ls. sticulou etrica .5% of .5% of .5	ed water, c ed water, c usly cleane ully using ba f the state f the state f the state and Kuyat, a Note 122	ted fro calibrat d prior alanced d value and un and un 97, U.S	red Class, ted Class, that are that are that are der appro Guideline Guideline	A glass A glass calibra priate s for E nent P	nd volume sware and ited with ites stated laborator, ivaluating vinting Off	the hi weight cond y cond fice, W	ighest p ighest p is trace itions. xpressir /ashingt	ments ourity able tr able the ton, D.	unless raw m raw m NIST 0 NIST 0. C. (19	materials are used in Materials are used in ST (see above). ertainty of NIST 1994).	se stat re usec vve). NIST	n .							

Part # 58024 Lot # 060523

Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT:		Ex	Recommended Storage: Nominal Concentration (µg/mL):	NIST	Volume s	Compound	1. Copper(II) nitrate trihydrate (Cu)	1.0E8	5.0E5	m/z->	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 (µg/mL):	<b>NIST Test Number:</b>	Volume shown below was diluted to (mL):	z				10		110		2
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ified Referen M569子	Lot #	24002546	2.0%		Balance Uncertainty	Flask Uncertainty	Initial Uncertainty Nominal Vol. (mL) Pipette (mL) Conc. (µg/mL)	84 1000			50		150		
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-		and and a second		to the	-70		(Solven CAS# C	10031-43-3			8 0		180		
http:			Benson Chan	and a	Pedro L. Rentas		(Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD50	1 mg/m3			90		190		
ANAB ISO 17034 Accreditec AR-1539 Certificate Number https://Absolutestandards.com			102523	,	102523		Attached pg.)	ori-rat 794 mg/kg			100		N 0		
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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)						
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œ	<0,02	ß	-1	Au	<0.02	3	<0.02	Nd	<0.02	ĸ	<0.2	8	<0.02	Ta	<0.02	Н	<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).

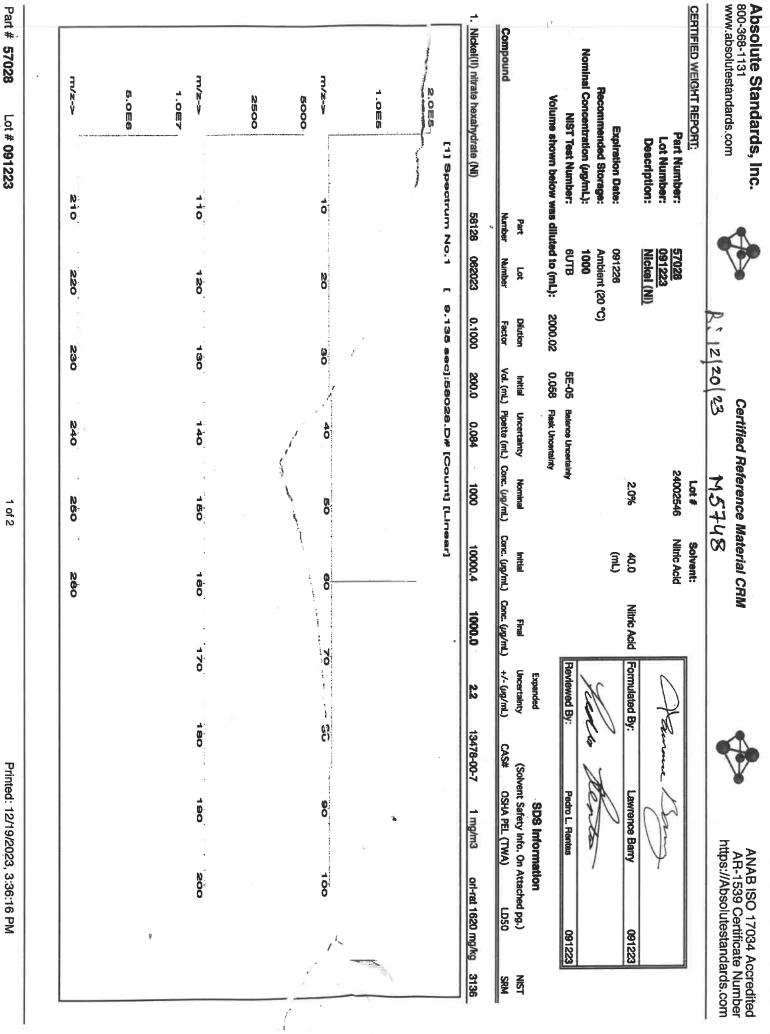
\* Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated.

\* 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

m/z->		2.0E6	m/z->	0.0 П 14	A ) ]	1.0E5	m/z->	0, 0 11 12 12 12 12 12 12 12 12 12 12 12 12	1.005	1. Lead(II) nitrate (Pb)	Compound	Weight sho	NIST 1	Recommended Storage: Nominal Concentration (µg/mL):	Exc		CERTIFIED WEIGHT REPORT:	ADSOIUTE Standards, Inc. 800-368-1131 www.absolutestandards.com
21 0 220 0			110 120				10 20		[1] Spectrum No.1 [ 14	IN029 PBD122016A1	Lot M RM# Number Conc	s diluted to (mL):	NIST Test Number: 6UTB		Expiration Date: 100926	Lot Number: 100923 Description: Lead (Pb)		om
230			130 140				30 40		14.144 sec]:58082.D# [Count] [Linear]	1000 93.999 0.10 62.5	Nominal Purity Uncertainty Assay Conc. (µg/mL) (%) Purity (%) (%) V	3000.41 0.06 Flask Uncertainty	5E-05 Balance Uncertainty		2%			Certified Referenc
250 260			150 160 170				50 60 70		tj [Linear]	4.80071 4.80077 1000.0	Target Actual Actual Weight (g) Weight (g) Conc. (µg/mL)			(111)	60.0 Nitric Acid	46 NITHC ACID		Certified Reference Material CRM こして、20123 Mらそれチ
			0 180 190				80 00			2.0 10099-74-8 0.05 mg/m3	Expanded SDS Informa Uncertainty (Solvent Safety Info. On +/- (µg/mL) CAS# OSHA PEL (TWA)		Reviewed By: Pedro L. Rentas	Kerten Hen	Formulated By: Lawrence Barry	Admine By		*
			2000				100			m3 intrvns-rat 83 mg/kg 3128	SDS Information (Solvent Safety Info. On Attached pg.) NIST # OSHA PEL (TWA) LD50 SRM		tas 100923	Ø	ny 100923	\¥		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com

	DELL-10205000					2 of 2							00923	Lot # 100923		Part # 57082
		are used in ove). 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 preparation of all standards. 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. 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).	ity raw the to Ni the Unc. (	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 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 t 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 Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D	netric d the d. g and I g ffice, V	and volur assware ar vrated with wise state te laborate Printing C Printing C	s A gli re califi ropria nes foi nment	or to use. S. Gover S. Gover	ated f calibr valance t and c t, C.E. 297, U	tion calcu ed water usly clear ally using f the stat and Kuya al Note 1; al Note 1;	sentrat deioniz deioniz deioniz deioniz echnic c, B.N. h S.% o c, B.N. h i. S.% o c, B.N.h h i. S.% o c, B.N.h h h i. S.% o c, B.N.h h h h h h h h h h h h h h h h h h h	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	value i ion of a contain e prepa e certif keferen t Result t Result	certified preparat landard a dards ar dards ar tandards tandards suremen suremen	* The * Purifi * Stan * Stan Mea
P. S.	for the second s							ındard.	1 of this sta	paratio	xd in the pre	observe	Homogeneity: No heterogeneity was observed in the preparation of this standard.	o heterog	encity: N	Homog
Certified by:	S				Vte	get anal	(T)= Target analyte						zation:	racteri	Physical Characterization:	Physi
W         40.02           V         40.02           Yb         40.02           Yb         40.02           Zn         40.02           Zn         40.02           Zn         40.02           Zn         40.02	Ть         Алл           11         Алл	e 40.2 g 40.02 g 40.02 a 40.02 a 40.02 a 40.02 a 40.02 a 40.02 a 40.02	40.02         Se           40.02         Si           40.02         Ag           40.02         Ag           40.02         Na           40.02         Na           40.02         Si	Rb Sm Sm	40.02 40.02 40.02 40.02 40.02	P P R P	40.02 40.02 40.02 40.02 40.02	Hg Mg	- 40.02 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7	요 한 않 날 막 発 표	40.02 40.020	~ Co Co Co 또 편 것	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	5	40.02 40.02 40.02 40.02 40.02	Al Sb Ba Bi Bi
			(µg/mL)		by ICP-MS		Verification	Metals	Trace M							
					MS):	(ICP-	trometry	s Spe	sma Mas	ed Pla	ly Couple	uctive	Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	Analy	umental	Instru
ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com				CRM	Certified Reference Material C	erenc	tified Re	Ce					s, Inc.	ards.co	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	w.absol



Part # 57028 Lot # 091223 2 of 2		<ul> <li>* 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.</li> <li>* All standard containers are meticulously cleaned prior to use.</li> <li>* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).</li> <li>* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.</li> <li>* All Standards should be stored with caps tight and under appropriate laboratory conditions.</li> <li>* 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).</li> </ul>	Homogeneity: No heterogeneity was observed in the preparation of this standard.	(T) = Target aria/vie	AI         A02         Cd         A02         Dy         A02         H         A02         N         T         Pr         A02         S         A02         C4         A02         E         A02         H         A02         Li         A02         N         T         Pr         A02         S         A02         C4         A02         E         A02         C4         A02         E         A02         H         A02         Li         A02         N         T         Pr         A02         S         A02         G         A02         H         A02         Li         A02         N         A02         R         A02         S         A02         S         A02         I         A02         N         A02         N <t< th=""><th>Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS): Trace Metals Verification by ICP-MS (µg/mL)</th><th>www.absolutestandards.com</th></t<>	Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS): Trace Metals Verification by ICP-MS (µg/mL)	www.absolutestandards.com
			et .	2	Tb         40.02           Te         40.02           TI         40.02           Th         40.02           Sn         40.02           Ti         40.02		
	5 		P. S.	Certified by:	W         -0.02           U         -0.02           V         -0.02           Yb         -0.02           Yb         -0.02           Yb         -0.02           Zn         -0.02           Zr         -0.02           Zr         -0.02		AR-1539 Certificate Number https://Absolutestandards.com

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Certified Reference Material CRM



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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	à	<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	Ę	<b>40.02</b>	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	<b>40</b> 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,	<b>40.02</b>	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.
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- Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
  - Standards are certifed ( $\frac{1}{4}$ ) 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 #	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:	Certifi
	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	<b>SDS Information</b> (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				<b>V</b>	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	
					÷	
<ul> <li>* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.</li> <li>* 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.</li> <li>* All standard containers are meticulously cleaned prior to use.</li> <li>* Standards are prepared gravimetrically using balances that are politoriated with using balances.</li> </ul>	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.
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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 # 57050 Lot # 071123

2 of 2

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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 # 24002546 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 02 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 Cobait (C 091926 Recommended Storage: Nominal Concentration (µg/mL): Nominal Concentration (µg/mL): Nominal Concentration (µg/mL): COTB NIST Test Number: COTB CODAIT (C) Part (C) CODAIT (C) C) CODAIT (C) C) C) C) C) C) C) C) C) C)	1. Cobatt(II) nitrate hexahydrate (Co) 58		<pre>Part # 57027 Lot # 091923</pre>

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

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	20.05	5	20.02	Ħ	40.02	3	<0.02	ż	40.02	£	40.02	8	40.2	f	₫.02	M	<b>40.02</b>
_	40.02	లి	<b>4</b> 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	<b>40.02</b>	Mg	10 <sup>0</sup> ⊳	ő	≤0.02	붭	<0.02	Ag	<b>40.02</b>	F	<0.02	Ż	<0.02
_	40.02	చి	≤0.02	ઝ	<b>600</b>	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	<b>20.0</b> 2	ङ	402	Hg	40.2	۵.	€0:02	Ru	<0.02	ي.	≪0.02	Ta	≤0.02	Y	€0.02
_	<0.02	ථ	£-	ö	40.02	Ľ	<b>0</b> 02	Mo	<u>60.02</u>	æ,	<0.02	Sm	<0.02	S	<0.02	Sn	<0.02	Z	<b>6</b> .02
_	40.02	ට්	<0.02	Au	<b>40.02</b>	£	40.02	PN	40.02	м	<b>4</b> 02	8	<b>40.02</b>	£	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
		G O O
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 sec]: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 <b>SDS Information</b> 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 <b>#</b> 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:** 

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

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

Part # 57033 Lot # 111323

N O N O O		
	220 230 240 21	m/z-> 210
		א. 50 ס
		5.068
150 160 170 180 190 200	120 130 140 18	m/z-> 110
		N 07 00
		5. OE6
50 70 80 100	Ю О О	m/z->
		1.0臣4
[Linear]	4o.1 [ 12.275 sec]:58105.D# [Count] [Linear]	[1] Spectrum No.1 2.0E4
11.55772 11.56201 1000.4 2.0 10043-35-3 2 mg/m3 orl-rat 2660 mg/kg	IN018 BV082016A1 1000 99.9988 0.10 17.3 11.5	1. Boric acid (B) IN018 E
Expanded       SDS Information         Target       Actual       Uncertainty       (Solvent Safety Info. On Attached pg.)         Weight (g)       Weight (g)       Conc. (µg/mL)       +/- (µg/mL)       CAS#       OSHA PEL (TWA)       LD50	Nominal Purity Uncertainty Assay Conc. (µg/mL) (%) Purity (%) (%)	Compound RM#
	1000 4R	
Reviewed By: Pedro L. Rentas 071123	6UTB 5E-05 Balance Uncertainty	Nominal Concentration (µg/mL): 1 NIST Test Number: 6
40.0 Ammonium hydroxide Formulated By: Benson Chan 071123	( <b>B</b> ) 2.0%	
Solvent: MKBC8597V Ammonium hydroxide	57005 Lo 071123	CERTIFIED WEIGHT REPORT: Part Number: 5
ce Material CRM       ANAB ISO 17034 Accredited         M 5종14       주가 5종14	Certified Reference Material CRM	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com



**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):

							Trace Me	tals	S Verifica	tion	by ICP-	Ś	(µg/mL)						
S S A	40.02	0 2 2 2 2 2	40.02	Er Dy	<0.02	Ho	4).02	臣	40.02 002	A N	40.02 20.02	R 7	A A 8 8	s: %	A ()	3 3	2 A 3 R	: ¥	40.02
	_	n (1		2 8	A	- 5		Mg	<0.01	õ	<0.02	Rh	<0.02	Ag	40.02	3	6 8 8	< 0	40.02
		다. 	A 0.02	ត្ន ខ្ល	40.02	<b>न</b> ह			20.02	3 R	40.02	R	<0.02	Na	40.2	Ţ	40.02	₽¥	<0.02
_	_	6	<0.02	ନ୍ନ	<0.02	5			3 6	7	20.02	, Ku	40.02	Sr	<0.02	Тв	<0.02	×	<0.02
		¥	<0.02	Au	<0.02	3		N a	32	4 3	<0.02	2	40.02	1 60	40.02	S	-0.02	Za	<0.02
						I		ļ			101	ą	2000	La	20.02	11	20.02	N	40.02

(T) = Target analyte

**Physical Characterization:** 

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

In P. Str

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 #: 57005 Lot # 071123

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
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# **Certificate of Analysis**

R: 02/22/24 M.5942

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

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

# 1.0 ACCREDITATION / REGISTRATION

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



### 2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGTI1
Lot Number:	T2-TI719972
Matrix:	2% (v/v) HNO3 tr. HF
Value / Analyte(s):	1 000 μg/mL ea: Titanium
Starting Material:	Ti Metal
Starting Material Lot#:	2094
Starting Material Purity:	99.9975%
CERTIFIED VALUES	AND UNCERTAINTIES

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

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**Assay Information:** 

3.0

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

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

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

Characterization of CRM/RM by Two or More Methods	Characterization of CRM/RM by One Method
Certified Value, $X_{\mbox{CRM/RM}}$ , where two or more methods of characterization are used is the weighted mean of the results:	Certified Value, X <sub>CRMRM</sub> , where one method of characterization is used is the mean of individual results:
$\begin{split} & \textbf{X}_{CRM/RM} = \Sigma(w_i) \; (\textbf{X}_i) \\ & \textbf{X}_i = \text{mean of Assay Method } i \; \text{with standard uncertainty } \textbf{u}_{char \; i} \\ & \textbf{w}_i = \text{the weighting factors for each method calculated using the inverse square of the variance:} \\ & \textbf{w}_i = (1/u_{char \; i})^2 / (\Sigma(1/(u_{char \; i})^2)) \end{split}$	$X_{CRM/RM} = (X_a) (u_{char a})$ $X_a = mean of Assay Method A withu_{char a} = the standard uncertainty of characterization Method A$
CRM/RM Expanded Uncertainty (±) = U <sub>CRM/RM</sub> = k ( $u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts}$ ) <sup>Y<sub>2</sub></sup> k = coverage factor = 2 $u_{char} = [\Sigma((w_i)^2 (u_{char}_i)^2)]^{Y_2}$ where $u_{char}$ is the errors from each characterization method $u_{bb}$ = bottle to bottle homogeneity standard uncertainty $u_{tts}$ = long term stability standard uncertainty (storage) $u_{tts}$ = transport slability standard uncertainty	CRMRM Expanded Uncertainty (±) = U <sub>CRMRM</sub> = k ( $u^2_{char  e} + u^2_{bb} + u^2_{lts} + u^2_{ts}$ ) <sup>1/2</sup> k = coverage factor = 2 uchar e = the errors from characterization u <sub>bb</sub> = bottle to bottle homogeneity standard uncertainty u <sub>lts</sub> = long term stability standard uncertainty (storage) u <sub>ts</sub> = 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.

М	Ag	<	0.000536	Μ	Eu	<	0.000268	0	Na	<	0.032670	Μ	Se		0.001204	0	Zn	<	0.003267	
0	AI		0.000872	0	Fe		0.003225	0	Nb	<	0.043560	0	Si		0.004735	0	Zr	<	0.043560	ŧ
М	As	<	0.008586	М	Ga	<	0.000268	Μ	Nd	<	0.000268	Μ	Sm	<	0.000268					
Μ	Au	<	0.004577	Μ	Gd	<	0.000268	0	Ni	<	0.010890	М	Sn		0.000096					
0	В	<	0.008929	М	Ge	<	0.002146	M	Os	<	0.000269	0	Sr		0.000096					
М	Ba	<	0.002683	Μ	Hf		0.002161	0	P	<	0.054450	М	Та		0.010560					
M	Be	<	0.005366	Μ	Hg	<	0.003231	Μ	Pb	<	0.001073	Μ	Тb	<	0.000268					
М	Bi	<	0.001609	М	Но	<	0.000268	М	Pd	<	0.000268	Μ	Те	<	0.001341					
0	Ca		0.000676	Μ	In	<	0.002683	Μ	Pr	<	0.000268	M	Th	<	0.053663					
М	Cd	<	0.000268	Μ	lr –	<	0.000269	М	Pt	<	0.000536	S	Tī	<						
М	Се	<	0.000268	Μ	κ		0.001172	М	Rb	<	0.000268	Μ	TI	<	0.000268					
М	Co	<	0.004293	Μ	La	<	0.000268	М	Re	<	0.000268	Μ	Tm	<	0.000268					
М	Cr		0.000752	0	Li	<	0.027225	M	Rh	<	0.000268	M	U	<	0.000268					
М	Cs	<	0.000268	М	Lu	<	0.000268	Μ	Ru	<	0.000269	M	V	<	0.019855					
0	Cu	<	0.010890	0	Mg	<	0.005445	i	S	<		Μ	W		0.000473					
M	Dy	<	0.000268	0	Mn	<	0.003267	M	Sb	<	0.006976	Μ	Y	<	0.002146					
Μ	Er	<	0.000268	Μ	Мо		0.000774	0	Sc	<	0.004900	Μ	Yb	<	0.000536					

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

### 6.0 INTENDED USE

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

## 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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

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

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

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 47.87 +4 6 Ti(F)6-2 Chemical Compatibility - Soluble in concentrated HCl, HF, H3PO4 H2SO4 and HNO3. Avoid neutral to basic media. Unstable at ppm levels with metals that would pull F- away (i.e. Do not mix with Alkaline or Rare Earths or high levels of transition elements unless they are fluorinated). Stable with most inorganic anions with a tendency to hydrolyze forming the hydrated oxide in all dilute acids except HF.

**Stability** - 2-100 ppb levels stable (Alone or mixed with all other metals) as the Ti(F)6-2 for months in 1% HNO3 / LDPE container. 1-10,000 ppm single element solutions as the Ti(F)6-2 chemically stable for years in 2-5% HNO3 / trace HF in an LDPE container.

**Ti Containing Samples (Preparation and Solution) -** Metal (Soluble in H2O / HF caution -powder reacts violently); Oxide - low temperature history anatase or rutile (Dissolved by heating in 1:1:1 H2O / HF / H2SO4); Oxide - high temperature history (~800EC) brookite (fuse in Pt0 with K2S2O7); Ores ( fuse in Pt0 with KF + K2S2O7 - no KF if silica not present); Organic Matrices (Dry ash at 450EC in Pt0 and dissolve by heating with 1:1:1 H2O / HF / H2SO4 or fuse ash with pyrosulfate if oxide is as plastic pigment and likely in brookite crystalline form).

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

Technique/Line	Estimated D.L.	Order	Interferences (underlined indicates severe)
ICP-MS 48 amu	14 ppt	N/A	32S16O, 32S14N,
			14N16O18O,
			14N17N2, 36Ar12C,
			48Ca, [96X=2
			(where X = Zr, Mo,
			Ru)]
ICP-OES 323.452 nm	0.0054 / 0.00092 µg/mL	1	Ce, Ar, Ni
ICP-OES 334.941 nm	0.0038 / 0.000028 µg/mL	1	Nb, Ta, Cr, U
ICP-OES 336.121 nm	0.0053 / 0.000034 µg/mL	1	W, Mo, Co

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

# 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

### 10.0 QUALITY STANDARD DOCUMENTATION

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

### **11.1 Certification Issue Date**

June 17, 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

- June 17, 2027
- The date after which this CRM/RM should not be used.

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

### 11.3 Period of Validity

- Sealed TCT Bag Open Date: \_

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

### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Approved By:** 

Thomas Kozikowski Manager, Quality Control

DD978ti

### **Certifying Officer:**

**Paul Gaines** Chairman / Senior Technical Director

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	0			o		J		um No	58134	Part Number	6 as diluted			л	
220				120		12 0		-	071223	Lot Number	ed to (mL):	060627 Ambient (20 °C) 1000	<u>060624</u> Selenium (Se)	7024	V
	N			4		ω		33.702	0.1000	Dilution Factor	2000.07	ĉ	(Se)		
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				190		90			0.2 mg/m3	SDS Information nt Safety Info. On Att: OSHA PEL (TWA)	Pedro L. Rentas		Benson Chan		ਤ
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Printed: 6/7/2024 3:58:44 PM			0 0		100			NA orl-rat 4250mg/kg 3181	Solvent Safety Information (Solvent Safety Info. On Attached pg.) NIST # OSHA PEL (TWA) LD50 SRM	Pentas 122923		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com



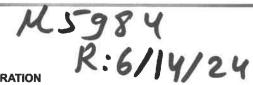
Part# 57003 Lot # 062124	<ul> <li>* The certified value is the concentration calculated from gravimetric and volumer * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and 1 the preparation of all standards.</li> <li>* All standard containers are meticulously cleaned prior to use.</li> <li>* Standards are prepared gravinetrically using balances that are calibrated with w * Standards are certified (+/) 0.5% of the stated value, unless otherwise stated.</li> <li>* 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</li> </ul>	Homogeneity: No heterogeneity was observed in the preparation of this standard.	Physical Characterization:	Al         40.02         Cit         40.02         Dr         40.02         Hd           Sb         40.02         Cit         40.02         Ein         40.02         Hd           As         40.2         Cit         40.02         Ein         40.02         In           Ba         40.02         Cit         40.02         Gd         40.02         In           Ba         40.02         Cit         40.02         Ge         40.02         In           Ba         40.02         Cit         40.02         Ge         40.02         La		Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	Absolute Standards, Inc. 800-368-1131 www.absolutiestandards.com
2 01 2	<ul> <li>* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.</li> <li>* 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.</li> <li>* All standard containers are meticulously cleaned prior to use.</li> <li>* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).</li> <li>* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).</li> <li>* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.</li> <li>* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.</li> <li>* All Standards broud by stoud with cases tight and under appropriate laboratory conditions.</li> <li>* All Standards are prepared with cases tight and under appropriate laboratory conditions.</li> <li>* 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).</li> </ul>	this standard.		40/02         Li         T         Nh         40/02         Hr         40/02         And           40/02         Li         An	-MS (µg/mL)	Mass Spectrometry (ICP-MS):	Certified Reference Material CRM
Printed: 6/24/2024, 11:20:08 PM	Ъ.	Sur P. S.	Certified by:	Site         Gall         Tite         Gall         U         Gall         Site         Gall         Tite         Gall         Site         Gall         Si			ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com



# **Certificate of Analysis**

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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).

# 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	

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

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

Assay Information:

Assay Method #1	<b>10011 ± 25 μg/mL</b> EDTA NIST SRM 928 Lot Number: 928
Assay Method #2	<b>9997 ± 50 μg/mL</b> ICP Assay NIST SRM 3167a Lot Number: 190730
Assay Method #3	9984 ± 31 µg/mL

- 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.

Calculated NIST SRM Lot Number: 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<sub>CRWRM</sub>, where two or more methods of characterization are used is the weighted mean of the results:

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

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

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

- k = coverage factor = 2
- $u_{char} = [\Sigma((w_i)^2 (u_{char} i)^2)]^{1/2}$  where  $u_{char} i$  are the errors from each characterization method
- $u_{bb}$  = bottle to bottle homogeneity standard uncertainty  $u_{its}$  = long term stability standard uncertainty (storage)
- uts = transport stability standard uncertainty (stor
- als assister subsity surraise atternal

### 4.0 TRACEABILITY TO NIST

### **Characterization of CRM/RM by One Method**

Certified Value, X<sub>CRM/RM</sub>, where one method of characterization is used is the mean of individual results:

 $X_{CRM/RM} = (X_a) (u_{char a})$   $X_a = mean of Assay Method A with$  $<math>u_{char a} = the standard uncertainty of characterization Method A$ 

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k ( $u^2_{char a} + u^2_{bb} + u^2_{lts} + u^2_{ts}$ )<sup>1/2</sup> 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\_{lts} = 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	<	0.004600	М	Eu		0.009037	М	Na		0.086360	М	Se	<	0.005200	М	Zn		0.030125
М	A		0.014862	0	Fe		0.002410	М	Nb	<	0.000570	ο	Si		0.024100	0	Zr	<	0.002600
М	As	<	0.003500	м	Ga	<	0.000570	м	Nd		0.000923	М	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	Р	<		М	Та	<	0.000570				
0	Be	<	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	Ca		0.009841	Μ	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	Со	<	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	М	Lu		0.000582	М	Ru	<	0.000570	М	V		0.001265				
М	Cu		0.002610	0	Mg		0.001486	n	S	<		М	W	<	0.002300				
М	Dy		0.003815	М	Mn		0.000582	М	Sb		0.005422	s	Y	<					
М	Er		0.003615	М	Мо	<	0.005700	М	Sc	<	0.001200	м	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 Weight; Valence; Coordination Number; Chemical Form in Solution - 88.91 +3 6 Y(OH)(H2O)x+2 Chemical Compatibility -Soluble in HCl, H2SO4 and HNO3. Avoid HF, H3PO4 and neutral to basic media. Stable with most metals and inorganic anions forming an insoluble carbonate, oxide, oxalate, and fluoride. Avoid mixing with elements / solutions containing moderate amounts of fluoride.

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

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

### 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

### **11.1 Certification Issue Date**

February 20, 2024

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

### **11.2 Lot Expiration Date**

- February 20, 2029
- The date after which this CRM/RM should not be used.

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

### **11.3 Period of Validity**

- Sealed TCT Bag Open Date:

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

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

Uyen Truong **Custom Processing Supervisor** 

### **Certificate Approved By:**

Muzzammil Khan Stock Laboratory Supervisor

Mayn menny Mayyni Kh Paul R Laina

### **Certifying Officer:**

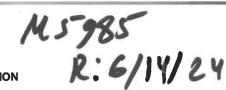
Paul Gaines Chairman / Senior Technical Director



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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). 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	CERTIFIED VALUES AND 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	<b>10021 ± 56 μg/mL</b> ICP Assay NIST SRM 3124a Lot Number: 110516
Assay Method #2	<b>10035 ± 25 µg/mL</b> 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<sub>CRM/RM</sub>, 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<sub>CRM/RM</sub> = 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<sub>CRM/RM</sub>, 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<sub>CRM/RM</sub> = k (u<sup>2</sup><sub>cher</sub> a + u<sup>2</sup><sub>bb</sub> + u<sup>2</sup><sub>Hs</sub> + u<sup>2</sup><sub>ts</sub>)<sup>½</sup> k = coverage factor = 2 u<sub>char</sub> a = the errors from characterization u<sub>bb</sub> = bottle to bottle homogeneity standard uncertainty u<sub>fts</sub> = long term stability standard uncertainty (storage) u<sub>tt</sub> = 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	ТΙ	<	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	Μ	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<sup>™</sup>) see the Limited License to Use PCRM<sup>™</sup> 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<sup>™</sup> 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 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

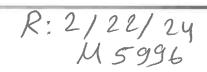


# **Certificate of Analysis**

300 Technology Drive Christiansburg, VA 24073 USA

inorganicventures.com

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:	lion	
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,	
CERTIFIED VALUES	50 μg/mL ea: Beryllium AND UNCERTAINTIES	

ANALYTE Aluminum, Al	CERTIFIED VALUE 2 000 ± 7 µg/mL	ANALYTE Barlum, Ba	CERTIFIED VALUE 2 000 ± 9 µg/mL
Beryllium, Be	50.00 ± 0.26 μg/mL	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

### 1.118 g/mL (measured at 20 ± 4 °C)

Assav	Information:

**Density:** 

METHOD NIST SRM# SRM LOT# ANALYTE 3151 160729 Ag **ICP Assay** 999c 999c Ag Volhard ICP Assay 3101a 140903 AI EDTA 928 928 AI **ICP** Assay 3104a 140909 Ва Gravimetric See Sec. 4.2 Ba Ве **ICP** Assay 3105a 090514 Calculated See Sec. 4.2 Be 130213 Ca **ICP** Assay 3109a 928 EDTA 928 Са Co **ICP Assay** 3113 190630 928 EDTA 928 Со 170630 **ICP** Assay 3112a Cr See Sec. 4.2 Cr Calculated **ICP** Assay 3114 121207 Cu EDTA 928 928 Cu **ICP Assay** 3126a 140812 Fe Fe EDTA 928 928 ICP Assay 3141a 140813 κ κ Gravimetric See Sec. 4.2 3131a 140110 **ICP** Assay Mg Mg EDTA 928 928 050429 **ICP** Assay 3132 Mn 928 928 EDTA Mn 3152a 120715 **ICP** Assay Na Gravimetric See Sec. 4.2 Na Ni **ICP Assay** 3136 120619 EDTA 928 928 Ni ٧ IC Assay 3165 160906 V EDTA 928 928 Zn **ICP Assay** 3168a 120629 928 EDTA 928 Zn

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.

Page 2 of 4

### Characterization of CRM/RM by Two or More Methods

Certified Value, X<sub>CRMRM</sub>, where two or more methods of characterization are used is the weighted mean of the results:

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

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

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

u<sub>bb</sub> = bottle to bottle homogeneity standard uncertainty u<sub>its</sub> = long term slability standard uncertainty (storage) u<sub>ts</sub> = transport stability standard uncertainty Characterization of CRM/RM by One Method

Certified Value, X<sub>CRWRM</sub>, where one method of characterization is used is the mean of individual results:

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

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k ( $u^2_{cher a} + u^2_{bb} + u^2_{Hs} + u^2_{ts}$ )<sup>%</sup> k = coverage factor = 2 u<sub>char a</sub> = the errors from characterization u<sub>bb</sub> = bottle to bottle homogeneity standard uncertainty u<sub>lta</sub> = long term stability standard uncertainty (storage) u<sub>lta</sub> = tong term stability standard uncertainty

### 4.0 TRACEABILITY TO NIST

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

### **4.1 Thermometer Calibration**

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

N/A

### 6.0 INTENDED USE

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

### 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

### 7.1 Storage and Handling Recommendations

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

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

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between  $4^{\circ} - 24^{\circ}$  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

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 CRWRM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

### 11.2 Lot Expiration Date

### - 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

SD978ti

### **Certifying Officer:**

Paul Gaines Chairman / Senior Technical Director



# **Certificate of Analysis**

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

## R:2/22/24 MS-997

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

### 1.0 ACCREDITATION / REGISTRATION

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



### 2.0 PRODUCT DESCRIPTION

Product Code:	Multi Analyte Custom Grade Solution	
Catalog Number:	CLPP-CAL-3	
Lot Number:	T2-MEB727800	
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 ± 7 µg/mL	ANALYTE Cadmium, Cd	CERTIFIED VALUE 500.0 ± 2.2 µg/mL
Lead, Pb	1 000 ± 4 µg/mL	Selenium, Se	1 000 ± 6 µg/mL
Thallium, Tl	1 000 ± 7 µg/mL		

**Density:** 

1.042 g/mL (measured at 20 ± 4 °C)

### **Assay Information:**

1330 1	normation.			
ANA	LYTE	METHOD	NIST SRM#	SRM LOT#
As		ICP Assay	3103a	100818
As		Calculated		See Sec. 4.2
Cd		ICP Assay	3108	130116
Cd		EDTA	928	928
Pb		ICP Assay	3128	101026
Pb		EDTA	928	928
Se		ICP Assay	3149	100901
TI		ICP Assay	3158	151215

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

### Characterization of CRM/RM by Two or More Methods

Certified Value, X<sub>CRWRM</sub>, where two or more methods of characterization are used is the weighted mean of the results:

### $X_{CRM/RM} = \Sigma(w_j) (X_j)$

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

CRM/RM Expanded Uncertainty (1) = U<sub>CRM/RM</sub> = k  $(u^2_{char} + u^2_{bb} + u^2_{ts} + u^2_{ts})^{\frac{1}{2}}$ k = coverage factor = 2

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

### Characterization of CRM/RM by One Method

Certified Value, X<sub>CRN/RM</sub>, where one method of characterization is used is the mean of individual results:

 $X_{CRM/RM} = (X_{e}) (u_{char.e})$   $X_{a}$  = mean of Assay Method A with  $u_{char.e}$  = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k {u<sup>2</sup><sub>char a</sub> + u<sup>2</sup><sub>bb</sub> + u<sup>2</sup><sub>its</sub> + u<sup>2</sup><sub>ts</sub>}<sup>1/2</sup> k = coverage factor = 2 u<sub>char a</sub> = the errors from characterization u<sub>bb</sub> = bottle to bottle homogeneity standard uncertainty u<sub>its</sub> = long term stability standard uncertainty (storage) u<sub>ts</sub> = transport stability standard uncertainty

### 4.0 TRACEABILITY TO NIST

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

### 4.1 Thermometer Calibration

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

### N/A

### 6.0 INTENDED USE

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

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

### 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**

December 21, 2022

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

### 11.2 Lot Expiration Date

### - December 21, 2027

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

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

### **11.3 Period of Validity**

- Sealed TCT Bag Open Date: \_

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

### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Approved By:** 

Thomas Kozikowski Manager, Quality Control

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**Certifying Officer:** 

Paul Gaines Chairman / Senior Technical Director



## **Certificate of Analysis** MGO 7Y

M6075 M6076

M6077

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:	Multi Analyte Custom Grade Solution	
Catalog Number:	CHEM-CLP-4	
Lot Number:	V2-MEB746762	
Matrix:	3% (v/v) HNO3 3% (v/v) HF	
Value / Analyte(s):	1 000 µg/mL ea:	Molubdopum
	Boron,	Molybdenum,
	Silicon,	Tin,
	Titanium	

### 3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ANALYTE Boron, B	CERTIFIED VALUE 1 000 ± 5 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	1 000 ± 6 µg/mL		
Density:	1.033 g/mL (measur	ed at 20 ± 4 °C)	
Assay Information:			

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

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

### Characterization of CRM/RM by Two or More Methods

Certified Value, X<sub>CRW/RM</sub>, 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  $u_{char i}$ 
  - $w_j$  = the weighting factors for each method calculated using the inverse square of the variance:
    - $w_i = (1/u_{char i})^2 / (\Sigma(1/(u_{char i})^2))$

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k  $(u^2_{cher} + u^2_{bb} + u^2_{ts} + u^2_{ts})^{1/2}$ k = coverage factor = 2

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

### 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:

 $\begin{array}{l} X_{CRM/RM}=(X_{a}) \left(u_{char\,a}\right) \\ X_{a}= mean of Assay Method A with \\ u_{char\,a}= the standard uncertainty of characterization Method A \end{array}$ 

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k ( $u^2_{chere} + u^2_{bb} + u^2_{ts} + u^2_{ts}$ )<sup>1/2</sup> k = coverage factor = 2  $u_{chara} = the errors from characterization$  $<math>u_{bb} =$  bottle to bottle homogeneity standard uncertainty  $u_{ts} = long term stability standard uncertainty (storage)$ 

u<sub>ts</sub> = transport stability standard uncertainty

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

### 4.1 Thermometer Calibration

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

N/A

### 6.0 INTENDED USE

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

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

### 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

### 7.1 Storage and Handling Recommendations

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

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

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between  $4^{\circ}$  -  $24^{\circ}$  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"

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

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

### **11.1 Certification Issue Date**

September 06, 2024

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

### 11.2 Lot Expiration Date

### - September 06, 2029

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

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

- Sealed TCT Bag Open Date: \_\_\_\_

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

### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

**Certificate Approved By:** 

Joseph Burns **Custom VS Manager** 

Paul R Saines

**Certifying Officer:** 

Paul Gaines Chairman / Senior Technical Director

Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description: Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number:	Setting     Certified Reference Material CRM       Setting     National       112124     N.S. I/I/3/250/vent:     24012496       Magnesium (Mg)     N.S. I/I/3/250/vent:     24012496     Nitric Acid       112127     N.G. V.Y.     2%     40.0     Nitric Acid       112127     M.G.V.Y.     2%     40.0     Nitric Acid       112127     M.G.V.Y.     2%     40.0     Nitric Acid       110000     M.S. Steros Uncertainty     SE-05     Balance Uncertainty	Formulated By:
Weight shown below was diluted to (mL):	2000.07 0.100 Fask Uncertainty 2000.07 0.100 Fask Uncertainty Nominal Purthy Uncertainty Assay Target Actual Conc. (ug/mL) (%) Purthy (%) (%) Weight (g)	Expanded     SDS Information       Actual     Uncertainty       Uncertainty     (Solvent Safety Info. On Attached pg.)       Conc. (ug/mL)     +/- (ug/mL)       CAS#     OSHA PEL (TWA)
1. Magnesium nitrate hexahydrate (Mg) IN030 Mgposzoza41	10000 98.999 0.10 8.51 234.9183 234.9459	20.0 13446-18-9 NA orf-rat
[1] Spectrum No.1 1.0E6	[ 19.923 sec];58112.D# [Count] [Linear]	
g. Oeg		
m/≈-> 10 2000	20 30 40 50 <b>6</b> 0	70 80 90 100
1000		
m/z-> 110 2.0厘4	120 130 140 150 160	170 180 190 200
m/z-≫ 210	220 230 240 250 260	

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



**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):

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40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02         Se         40.2         Th         40.02         W           40.02         Ca         40.2         Er         40.02         Hf         40.02         Li         40.02         Pr         40.02         Se         40.2         Th         40.02         W           40.02         Ca         40.2         Er         40.02         Ha         40.02         Nb         40.02         Re         40.02         Si         40.02         T         40.02         V         40.02         V	40.02       Cd       40.02       Dy       40.02       Hf       40.02       Li       40.02       Ni       40.02       Pr       40.02       Se       40.2       Tb       40.02       W         40.02       Ca       40.2       Er       40.02       Hf       40.02       Li       40.02       N       40.02       Se       40.2       Tb       40.02       U         40.02       Ca       40.02       Hr       40.02       Li       40.02       Nb       40.02       Se       40.2       Tb       40.02       U         40.02       Ca       40.02       Hr       40.02       Mg       T       0s       40.02       Rb       40.02       Tb       40.02       U         40.02       Ca       40.02       In       40.02       Mg       T       0s       40.02       Rb       40.02       Tb       40.02       V         40.02       Ca       40.02       In       40.02       Mg       T       0s       40.02       Rb       40.02       Tb       40.02       V         40.02       Fin       40.02       Mg       T       0s       40.02       Rb       40.02	. 6	IO	20.02	10	40.2	Næ	<0.02	Rb	<0.02	Pd	<0.02	Mn	<0.02	ŀ	<0.02	R	<0.02	S	<0.02	Ba
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		3	;	3	3 3	5	a g	10.02	1	0.02	1	<0.02	F	20.02	HI	20.02	Ŋ	<0.02	2	<0.02	A
		4	W	40.02	7	c (b)	S	300	Dr	3		2003	1	200							

(I) = larget analyte

# Physical Characterization:

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

Son P. A.

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.

\* All standard containers are meticulously cleaned prior to use. the preparation of all standards.

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

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

\* All standards should be stored with caps tight and under appropriate laboratory conditions. \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST

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

Part # 58112 Lot # 112124

Dat # 60036 101 #	m/z->-	5.067	m/z-> 1.0⋿8	5.067	m/≥-> 1.0E8	N.5 8	5.006	1. Manganese(II) nitrate hydrate (Mn)	Weight sh Compound	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number:	CERTIFIED WEIGHT REPORT: Part I Lot Des	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
Lot # 101124	Ņ		110		10		[1] Spectrum No.1		Weight shown below was diluted to (mL): Lot RM# Number	Expiration Date: Recommended Storage: Il Concentration (µg/mL): NIST Test Number:	<u>Part Number:</u> Lot Number: Description:	<b>s, Inc.</b>
	N N O		120		0 0			A1		õ	58025 101124 Manganese (Mn)	
	N. 0		100		۵ Ö		[ 34.243 sec]:57025.D# [Count] [Linear]	1000 99.999	4000.2 0.10 Fit Nominal Purity U Cone. (ug/mL) (%) F	Ś	R-71/13/2& Solvent:	Се
_	N 4 0		140		4 0		25.D# [Count]	0.10 20.8	0.10 Flask Uncertainty Purity Uncertainty Assay (%) Purity (%) (%)	SE-05 Balance Uncertainty		rtified Referen
1 of 2	260 260		150 160		0. 0.		[Linear]		Target Actual Weight (g) Weight (g)	(mL) Nitric Acid	46	Certified Reference Material CRM
			170		70				Actual Conc. (ug/mL)	(		M
Prin			180		8			<b>2.0</b> 15710-66-4	Expanded Uncertainty (SolVe +/- (µg/mL) CAS#	Pormulated by:	Giovannie	
Printed: 1/10/2025, 4:51:16 PM			190		80			5 mg/m3	SDS Information (Solvent Safety Info. On Attached pg.) S# OSHA PEL (TWA) LD50	Pedro L. Rentas	Especite	ANA AR- https:
:51:16 PM			N 0 0		100			orl-rat >300mg/kg	ttion Attached pg.) LD50	101124		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
								g 3132	NIST	<u>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 </u>		Accredited e Number Jards.com

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





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

Г							Trace Mo	etals	Verifica	ition	by ICP-	Ś	(µg/mL)						
	3	2	2000		5		200												
Al	<0.02	8	<0.02	Ðy	<0.02	Hf	<0.02	5	<0.02	N	<0.02	Ŗ	<0.02	Se	40.2	ТЪ	<0.02	W	<0.02
Sb	<0.02	Q	<0.2	Ę	<0.02	Ho	<0.02	Ę	<0.02	N	<0.02	Re	<0.02	S	<0.02	Te	<0.02	C	<0.02
As	<0.2	ଚ	<0.02	Eu	<0.02	In	<0.02	Mg	<0.01	°s	<0.02	RJ.	<0.02	Ag	<0.02	Ξ	<0.02	<	<0.02
Ba	<0.02	Ç	<0.02	ଜୁ	<0.02	F,	<0.02	Mn	Н	Pd	<0.02	Rb	<0.02	Na	<0.2	П	<0.02	Υ <sub>b</sub>	<0.02
Be	<0.01	ភ្	<0.02	ဌ	<0.02	Fe	<0.2	Hg	<0.2	Ψ	<0.02	Ru	<0.02	Sr	<0.02	Tm	<0.02	×	<0.02
Bi	<0.02	S	<0.02	ନ୍ଚ	<0.02	La	<0.02	Mo	<0.02	P	<0.02	Sm	<0.02	s	<0.02	Sn	<0.02	Z'n	<0.02
в	<0.02	Q	<0.02	Au	<0.02	РЬ	<0.02	Nd	<0.02	ĸ	<0.2	Sc	<0.02	Ta	<0.02	E	<0.02	Zr	<0.02

(T) = Target analyte

# **Physical Characterization:**

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

for P. S.

**Certified by:** 

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

\* Purified acids, 18.2 megohm delonized water, calibrated Class A glassware and the highest purity raw materials are used in

the preparation of all standards.

\* All standard containers are meticulously cleaned prior to use.

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

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

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

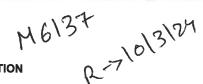
\* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

Part # 58025 Lot # 101124



# **Certificate of Analysis**

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com



### **ACCREDITATION / REGISTRATION** 1.0

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

### 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:	CGSI1
Lot Number:	V2-SI744713
Matrix:	tr. HNO3 tr. HF
Value / Analyte(s):	1 000 μg/mL ea: Silicon
Starting Material:	Silica
Starting Material Lot#:	1771
Starting Material Purity:	99.9981%
CERTIFIED VALUES AN	D UNCERTAINTIES
Certified Value:	999 ± 6 µg/mL
Density:	1.003 g/mL (measured at 20 $\pm$ 4 °C)

**Assay Information:** 

3.0

Assay Method #1	<b>999 ± 5 μg/mL</b> ICP Assay NIST SRM Traceable to 3150 Lot Number: S2-SI702546
Assay Method #2	1000 ± 7 μg/mL

1000 ± 7 µg/mL Calculated NIST SRM Lot Number: See Sec. 4.2

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

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

### Characterization of CRM/RM by Two or More Methods

Certified Value, X<sub>CRWRM</sub>, where two or more methods of characterization are used is the weighted mean of the results:

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

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

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

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k (u<sup>2</sup><sub>char</sub> + u<sup>2</sup><sub>bb</sub> + u<sup>2</sup><sub>15</sub> + u<sup>2</sup><sub>15</sub>)<sup>1/2</sup> k = coverage factor = 2 u<sub>char</sub> = [2((w<sub>i</sub>)<sup>2</sup> (u<sub>char</sub>)<sup>2</sup>)]<sup>1/2</sup> where u<sub>char</sub> is the errors from each characterization method u<sub>bb</sub> = bottle to bottle homogeneity standard uncertainty

u<sub>lts</sub> = long term stability standard uncertainty (storage) u<sub>ts</sub> = transport stability standard uncertainty

### Characterization of CRM/RM by One Method Certified Value, X<sub>CRMRM</sub>, where one method of characterization

erimed value, X<sub>CRM/RM</sub>, where one method of characterization is used is the mean of individual results:

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

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k  $(u^2_{chara} + u^2_{bb} + u^2_{its} + u^2_{ts})^{Y_b}$ k = coverage factor = 2  $u_{chara} =$ <sup>th</sup>e errors from characterization  $u_{bb} =$  bottle to bottle homogeneity standard uncertainty  $u_{its} =$  long term stability standard uncertainty (storage)  $u_{its} =$  tansport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

### 4.1 Thermometer Calibration

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

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

M	Ag	<	0.000310	М	Eu	<	0.000310	0	Na		0.001656	М	Se	<	0.022000	М	Zn	<	0.002500
М	Al		0.010787	М	Fe	<	0.027000	М	Nb	<	0.001300	s	Si	<		0	Zr	<	0.001900
М	As	<	0.001900	М	Ga	<	0.001300	М	Nd	<	0.000310	м	Sm	<	0.000310				
M	Au	<	0.000910	М	Gd	<	0.000310	Μ	Ni	<	0.005500	м	Sn		0.000096				
M	в		0.016180	М	Ge	<	0.001900	М	Os	<	0.000610	0	Sr		0.000092				
Μ	Ba		0.000096	М	Hf		0.000423	i	Р	<		M	Та		0.002542				
0	Be	<	0.000570	М	Hg	<	0.000610	М	Pb	<	0.000310			<	0.000310				
М	Bi	<	0.000310	М	Но	<	0.000610	м	Pd	<	0.000610		_	<	0.000910				
0	Са		0.011557	М	in	<	0.000310	М	Pr	<	0.000310			<	0.001900				
М	Cď	<	0.000310	M	lr	<	0.000310	м		<	0.000310		П	-	0.001078				
М	Се	<	0.000610	0	ĸ		0.000577		Rb		0.009100			<	0.000310				
М	Co	<	0.001600	M	La	<	0.000310		Re		0.000310		Tm						
М	Cr	<	0.010000		Li	<	0.000460		Rh						0.000310				
				-							0.000310	IVI	U	<	0.000310				
M	Cs	<	0.000310	M	Lu	<	0.000310	M	Ru	<	0.000310	0	V	<	0.001300				
М	Cu	<	0.002500	0	Mg		0.001348	0	S	<	0.570000	М	W	<	0.001900				
М	Dy	<	0.000310	М	Mn	<	0.002500	М	Sb	<	0.000310	М	Y	<	0.000310				
М	Er	<	0.000310	М	Мо	<	0.000310	0	Sc	<	0.000590	M	Yb	<	0.000310				

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

### 6.0 INTENDED USE

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

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

Atomic Welght; Valence; Coordination Number; Chemical Form in Solution - 28.09 +4 6 Si(OH)x(F)y2-Chemical Compatibility -Soluble in HCl, HF, H3PO4 H2SO4 and HNO3 as the Si(OH)x(F)y2-. Avoid neutral to basic media. Unstable at ppm levels with metals that would pull F- away (i.e. Do not mix with Alkaline or Rare Earths, or high levels of transition elements unless they are fluorinated. Stable with most inorganic anions with a tendency to hydrolyze forming silicic acid (silicic acid is soluble up to ∼100 ppm in water) in all dilute acids except HF.

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

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

Technique/Line	Estimated D.L.	Order	Interferences (underlined indicates severe)
ICP-MS 28 amu	4000 - 8000 ppt	N/A	N2, 12C16O
ICP-OES 212.412 nm	0.02/0.01 µg/mL	1	Hf, Os, Mo, Ta
ICP-OES 251.611 nm	0.012/0.003 µg/mL	1	Ta, U, Zn, Th
ICP-OES 288.158 nm	0.03/0.004 µg/mL	1	Ta, Ce, Cr, Cd, Th

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

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

### 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

### **QUALITY STANDARD DOCUMENTATION** 10.0

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

### **11.1 Certification Issue Date**

July 10, 2024

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

### **11.2 Lot Expiration Date**

### - July 10, 2029

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

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

### 11.3 Period of Validity

Sealed TCT Bag Open Date:

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

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

Uyen Truong Custom Processing Supervisor

Mayn Mung Mayni Kh Paul R Laine

### **Certificate Approved By:**

Muzzammil Khan Stock Laboratory Supervisor

### **Certifying Officer:**

**Paul Gaines** Chairman / Senior Technical Director

Page 4 of 4

sredited Number ds.com		NIST SRM 3109a		
ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	121824 121824	by/du		
AN/ AR https:	Giovanni Esposito Giovanni Esposito Pedro L. Rentas SDS Information	(Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD50 # -1 5 mg/m3 ort-rat >2000		
		CAS 471-3	S O C	
	Formulated B Reviewed By:	Actual Uncertainty Conc. (pg/mL) +/- (ug/mL) 10001.4 20.0	2 2 2 2 2 2	
terial CRM	Nitric Acid Nitric Acid	Actual A Weight (g) Conc 100.2677 10	asr] 260 260	
ference Ma	Lot # 24012496 80.0 (mL)	Target Weight (g) 100.2537	0 50 40 50 150 1012	
Certified Reference Material CRM	11312-5 Solvent: Solvent: 2% 2% 5% 5% 0.15 Flask Uncertainty 0.15 Flask Uncertainty	Uncertainty Assay Purity (%) (%) 0.10 39.9		
N6138	A	Nominal Purity Conc. (ug/mL) (%) 10000 88.899	12.514 sec].58120 130 230 2	
	20 °C)	Lot Number 4 CAD032023B3	2 30 15 20 20 10 10 10 10 10 10 10 10 10 10 10 10 10	
<b>Jards, Inc.</b> ds.com	(EIGHT REPORT:       58120         Part Number:       58120         Lot Number:       121824         Description:       121827         Expiration Date:       121827         Recommended Storage:       Ambient (3         I Concentration (µg/mL):       10000         NIST Test Number:       6UTB         Weight shown below was diluted to (mL):		E4 [1] Spectrum No.1 E4 10 10 110 E5 210 210 Lot #121824	
Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description: Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa:	Compound 1. Calcium carbonate (Ca)	2.0E4 2.0E4 1.0E4 m/2-> 2.5E4 2.5E4 1.0E5 1.0E5 1.0E5 1.0E5 2.0E4 2.0E4 2.0E4 1.0E5 1.	

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):

-6.02         Cd         -6.02         Dy         -6.02         Hf         -6.02         Li         -6.02         Ni         -6.02         Pr         -6.02           -6.02         Ca         T         Er         -6.02         Ho         -0.02         Lu         -6.02         Pr         -6.02           -6.02         Ca         T         Er         -6.02         Lu         -6.02         Nb         -6.02         Rr         -6.02           -6.02         Ce         -0.02         Eu         -6.02         In         -6.02         Re         -6.02           -6.02         Cs         -6.02         In         -6.02         Na         -6.02         Re         -6.02           -6.02         Ga         -6.02         Nn         -6.02         Re         -6.02           -6.02         Ga         -6.02         Nn         -6.02         Re         -6.02           -6.02         Ga         -6.02         Re         -6.02         Re         -6.02           -6.02         Ga         -6.02         Re         -6.02         Re         -6.02         Re         -6.02           -6.02         Ga         -6.02		Contraction of the local distribution of the		and the second s		the state of the s		ALC: NOT AND ADDRESS		ALL ALL ALL	10	State of the other and	100				TO THE	a la la la la la		
<0.02												1		0.000			1.11		1 127	0007
-0.02       Ca       T       Er       -0.02       Ho       -0.02       Lu       -0.02       Nb       -0.02       Si         -0.12       Ce       -0.02       Eu       -0.02       In       -0.02       Re       -0.02       Si         -0.12       Ce       -0.02       Eu       -0.02       In       -0.02       Re       -0.02       Si         -0.02       Ca       -0.02       Fr       -0.02       Mn       -0.02       Rh       -0.02       Na         -0.01       Cr       -0.02       Fr       -0.02       Mn       -0.02       Ru       -0.02       Na         -0.01       Cr       -0.02       Fr       -0.02       Nn       -0.02       Ru       -0.02       Na         -0.01       Cr       -0.02       Fr       -0.02       Ru       -0.02       Ru       -0.02       Na         -0.01       Cr       -0.02       Fr       -0.02       Ru       -0.02       Sr       -0.02       Na         -0.01       Cr       -0.02       Fr       -0.02       Ru       -0.02       Sr       -0.02       Na         -0.02       Fr       -0.02		<0.02	G	<0.02	Dy	<0.02	Hf	<0.02	-	<0.02	ī	<0.02	Ł	<0.02	Se	202	1	70702	*	70.02
<0.2         Ce         <0.02         Eu         <0.02         In         <0.01         Os         <0.02         Rh         <0.02         Ag           <0.01	م	<0.02	Ç	L	ц	<0.02	Ю	<0.02	Ľ	<0.02	qN	<0.02	Re	<0.02	Si	<0.02	le e	<0.02	Þ	<0.02
<ul> <li>&lt;<p>&lt; &lt;0.02</p>         Cs         &lt; &lt;0.02         Gd         &lt; &lt;0.02         Ir         &lt; &lt;0.02         Mn         &lt; &lt;0.02         Pd         &lt; &lt;0.02         Rb         &lt; &lt;0.02         Rb         &lt; &lt;0.02         Rb         &lt; &lt;0.02         Rb         &lt; &lt;0.02         Ru         &lt; &lt;0.02         Sr          &lt;</li></ul>	5	<0.2	ő	<0.02	Eu	<0.02	П	<0.02	Mg	<0.01	ő	<0.02	Rh	<0.02	Ag	<0.02	F	<0.02	>	<0.02
<0.01 Cr <0.02 Ga <0.02 Fe 30 Hg <0.2 P <0.02 Ru <0.02 Sr	R	<0.02	ඊ	<0.02	3	<0.02	П	<0.02	Mn	<0.02	Ρđ	<0.02	Rb	<0.02	Na	<0.2	f	<0.02	Å	<0.02
	: 0	<0.01	ບ້	<0.02	Ga	<0.02	Fe	30	Hg	<0.2	д,	<0.02	Ru	<0.02	Sr	<0.02	Tm	<0.02	¥	<0.02
<0.02   Co   <0.02   Ge   <0.02   Je   <0.02   Je   ×0.02   Ja   <0.02   So   <0		<0.02	ථ	<0.02	ő	≤0.02	La	<0.02	Mo	<0.02	武	<0.02	Sm	<0.02	s	<0.02	Sn	<0.02	Zn	<0.02
Cu <0.02 Au <0.02 Pb <0.02 Nd <0.02 K <0.2 Sc <0.02 Ta -		<0.02	ð	<0.02	Au	<0.02	PP P	<0.02	PN	<0.02	м	<0.2	Sc	<0.02	Ta	<0.02	Ħ	<0.02	Zr	<0.02

# Physical Characterization:

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

in P.

**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 (+ $\bar{I}$ -) 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).

m/z->	\$ 000	m/z-≻ 1.0E4	-1 .0 M 03	m/z-> 2.0E5	1.0E8	2.000	1. Potassium nitrate (K)	Compound	NIST Te Weight show	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL):	<u>CERTIFIED WEIGHT REPORT:</u> Part Lot De	800-368-1131 www.absolutestandards.com
N 0		110		<b>1</b> 0		[1] Spectrum No.1	IN034	RM#	NIST Test Number: 6UTB Weight shown below was diluted to (mL):	Expiration Date: nended Storage: ntration (µg/mL):	ORT: Part Number: Lot Number: Description:	3 3
		120		20		-	IN034 KD062022A1	Lat		103027 Ambient (20 °C) <b>10000</b>	<u>57119</u> <u>103024</u> Potassium (†	
		1 0 0		a		35.763 sec]:58119.D# [Count] [Linear]	10000 99.999	Nominal Purity Conc. (µg/mL) (%)	5E-05 4000.1 0.15	M6143	$\frac{57119}{103024} R \rightarrow 1/13/2.5$ $\frac{103024}{1043} M 61/11$	
		1. 0		40		8119.D# [C	0.10 37.7	Uncertainty Assay Purity (%) (%)	5E-05 Balance Uncertainty 0.15 Flask Uncertainty		Solvent:	Certified Re
		150		07. O		ount] [Lines	106.1040	y Target Weight (g)			Lot # t: 24002546	Certified Reference Material CRM
		10- 0		0		'n	##### 100	Actual Act Weight (g) Conc.			Nitric Acid	erial CRM
		170		0			10001.1 20.0	Expanded Actual Uncertainty Conc. (µg/mL) +/- (µg/mL)	Reviewed By:	X	Hierat	
		180		80			7757-79-1	CAS#		\$	Vie.	
		061		80			5 mg/m3	SDS Information (Solvent Safety Info. On Attached pg.) OSHA PEL (TWA)	Pedro L. Rentas	tento	Capestite Giovanni Esposito	http
		200		100			orl-rat 3750 mg/kg 3141a	n Attached pg.) A) LD50	103024		103024	AIVAD ISO 17034 Accreated AR-1539 Certificate Number https://Absolutestandards.com
							vkg 3141a	NIST	124		24	4 Accredit ate Numb ndards.cc

Part # 57119 Lot # 103024

1 of 2

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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):

							Trace Me	etals	Verifica	ition	by ICP-	MS (	(Jug/mL)						
A	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	5	<0.02	Ni	<0.02	7	<0.02	Se	A0.2	Тb	40.02	W	40.02
SP	<0.02	ß	A0 2	말.	<0.02	Но	<0.02	L	<0.02	ß	<0.02	Re	<0.02	ŝ	<0.02	Te	<0.02	e	<0.02
As	<0.2	ĉ	<0.02	臣	<0.02	ľ	<0.02	Mg	<0.01	õ	<0.02	Rß	<0.02	Ag	<0.02	Ξ	<0.02	<	<0.02
Ba	<0.02	ŝ	<0.02	ଜ	<0.02	ŀ	<0.02	Mn	<0.02	Pd	<0.02	Rb	<0.02	Na	40.2	ТЪ	<0.02	Υ <sub>b</sub>	<0.02
Be	<0.01	ç	<0.02	ဌာ	<0.02	Fe	<02	Hg	<0.2	P	<0.02	Ru	<0.02	ST	<0.02	Im	<0.02	Y	<0.02
Bi	<0.02	S	<0.02	ନ୍ଚ	<0.02	5	<0.02	Mo	<0.02	Ŗ	<0.02	Sm	<0.02	s	<0.02	Sn	<0.02	Zn	<0.02
B	<0.02	0°	<0.02	Au	<0.02	РЪ	<0.02	Nd	<0.02	K	Т	Sc	<0.02	Ta	<0.02	Ti	<0.02	Zr	<0.02
									3										

(I) = Target analyte

# Physical Characterization:

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

In & All

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.

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Part # 57119 Lot # 103024

Part # 58111 Lot # 072424	m/z->	N. Un M	m/z->	א. ה ס	5.0E6	N 51 11 63	5.0E5	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 Number: Lot Number:	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
424	210 220		110 120		น ง ง		[1] Spectrum No.1	IN036 NAV01201511 1	RM# Lot N	Sodium (Na 072427 Ambient (20 ° 10000 6UTB s diluted to (mL):	a a ·	Inc.
	230 240		130 140		ల ర		8.935 sec]:58111.D# [Count] [Linear]	10000 99.999 0.10 26.9	Nominal Purity Uncertainty Assay Conc. (ug/mL) (%) Purity (%) (%)	レ WM ら 1 4 4 2% C) SE-05 Balance Uncertainty 4000.2 0.10 Flask Uncertainty	R-> 1/13/2_Solvent:	Certified Re
1 of 2	250 260		150 160 1		50 60		unt] [Linear]	148.7096 ###### 10000.0	Target Actual Actual Weight (g) Weight (g) Conc. (µg/mL)	80.0 Nitric Acid (mL)	Lot # 24002546 Nitric Acid	Certified Reference Material CRM
Printed: 1/10/2025, 4:48:22 PM			170 180 190 200		70 80 90 100			20.0 7631-99-4 5 mg/m3 or	Expanded SDS Information Uncertainty (Solvent Safety Info. On Attached pg.) .) +/- (µg/mL) CAS# OSHA PEL (TWA) LD50	Formulated By: Benson Chan	M	ANAB I AR-15: https://Ak
22 PM								orl-rat 3430 mg/kg 3152a	IChed pg.) NIST LD50 SRM	072424 072424		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com

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):

	<0.02 Cu <0.02	<0.02 Co <0.02	Be <0.01 Cr <0.02 Ga	<0.02 Cs <0.02	<0.2 Cc <0.02	<0.02 Ca <0.2	<0.02 Cd <0.02	ARREST AL STATISTICS OF STREET, STATISTICS O		
	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	O. N. M. N. LAN.		
	Pb	La	Fe	ŀ	In	Ho	Hf			
	<0.02	<0.02	40.2	<0.02	<0.02	<0.02	<0.02	Notific II.A.	Irace Mo	
	Nd	Mo	Hg	Mn	Mg	Lu	E		ietais	
Ì	40.02	<0.02	<0.2	<0.02	<0.01	<0.02	<0.02		Verifica	
	×	Ŗ	٩	Pd	<sup>S</sup>	Nb	Ni		cion i	
	<0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		OY ICP-N	57
	Sc	Sm	Ru	Rb	Rh	Re	Pr	Presenter of	10 F	10 /
	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		g/mL)	
	Ta	ŝ	Sr	Na	Ag	<u>s</u>	Se	1001		
	<0.02	<0.02	<0.02	Т	<0.02	<0.02	<0.2	and the set		
	13	Sn	Tm	Th	T	Te	7			
	40.02	40.02	<0.02	<0.02	<0.02	<0.02	<0.02	The second s		
	Zr	Zn	Y	Yb	<	U	W			
	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			

**Physical Characterization:** 

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

In P. St.

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.

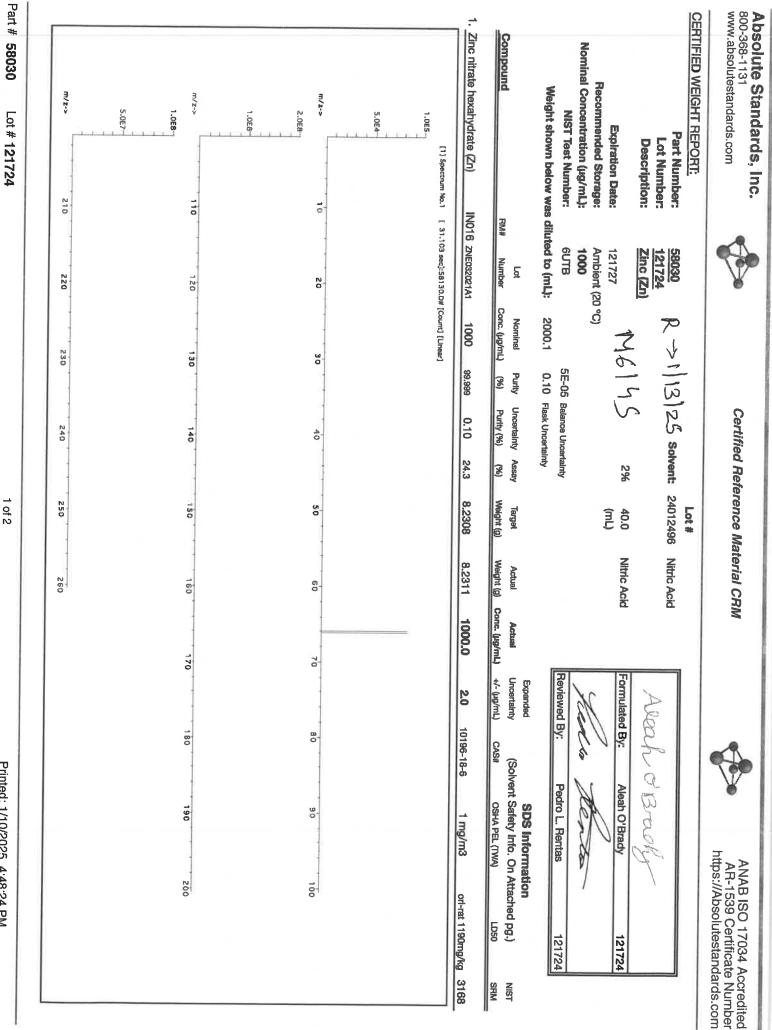
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1 of 2

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





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

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

						-	I race M	etais	Verifica		by icr-	UNIC	/9/111L/	L					
															2	77	50.02	W	SUG
A1	cu u-	1 64 1	20.02	Dv	<0.02	Hf	<0.02	Li	40.02	Z	40.02	P	<0.02	Se	202	10	20.02	W	20.02
2	10.01	1		1	5	ŧ.	3	;	2	Ş	2002	R P	<0.02	2	<0.02	Fe	<0.02	C	<0.02
S	20.02	C <sub>2</sub>	2.2	CT.	20.02	DIU.	10.02	5	1024		10.01	1			2	1	50.00	4	33
Å	< 0 >	ç	<0.02	Fu	<0.02	h	<0.02	Mg	A0.01	õ	<0.02	Kh	20.02	Ag	20.02	11	70.02		-0.01
1			5	2	5	7	333	Š	50.02	Р	40.02	Rb	A0.02	Na	4012	Th	<0.02	ХP	20.02
Ba	20.05	Ç	20.02	00	10.04	**						,	5	?	500	1	33	<	30
Re	-001	R	<0.02	ନ୍ମ	<0.02	Fe	<0.2	Hg	40.2	7	<0.02	KU	<0.02	2	20.02	L III	10.01	3,	
2	2	2	3	2	2000	5	300	K	<0.02	Ş	A.02	Sm	A.02	S	<0.02	Sn	<0.02	20	I
10	20.02	ξ	10.02	00	10.00	-					5	2	5	7	33	1	<0 03	77	<0.02
80	<0.02	Q	<0.02	Au	<0.02	Pb	<0.02	Nd	<0.02	К	202	30	20.02	1a	20.02		10.04		

(T) = Target analyte

**Physical Characterization:** 

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

Ser R. She

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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Part # 58030 Lot # 121724

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





M6151

R-> 1/15/25

Material No.: 9530-33 Batch No.: 22G2862015 Manufactured Date: 2022-06-15 Retest Date: 2027-06-14 Revision No.: 0

## **Certificate of Analysis**

Test	Specification	D. L.
ACS - Assay (as HCI) (by acid-base titrn)		Result
ACS - Color (APHA)	36.5 - 38.0 %	37.9 %
ACS - Residue after Ignition	≤ 10	5
ACS - Specific Gravity at 60°/60°F	≤ 3 ppm	< 1 ppm
ACS – Bromide (Br)	1.185 - 1.192	1.191
ACS - Extractable Organic Substances	≤ 0.005 %	< 0.005 %
ACS – Free Chlorine (as Cl <sub>2</sub> )	≤ 5 ppm	< 1 ppm
Phosphate (PO4)	≤ 0.5 ppm	< 0.5 ppm
Sulfate (SO4)	≤ 0.05 ppm	< 0.03 ppm
Sulfite (SO3)	≤ 0.5 ppm	< 0.3 ppm
Ammonium (NH4)	≤ 0.8 ppm	0.3 ppm
Trace Impurities - Arsenic (As)	≤ 3 ppm	< 1 ppm
Trace Impurities - Aluminum (Al)	≤ 0.010 ppm	< 0.003 ppm
Arsenic and Antimony (as As)	≤ 10.0 ppb	1.3 ppb
Trace Impurities – Barium (Ba)	≤ 5.0 ppb	< 3.0 ppb
	≤ 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	163.0 ppb
Trace Impurities – Chromium (Cr)	≤ 1.0 ppb	0.7 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	0.6 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.: 22G2862015

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

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



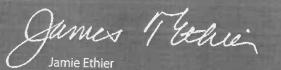


Material No.: 9530-33 Batch No.: 22G2862015

Test	Specification	Result

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

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



Vice President Global Quality

Nitric Acid 69% CMOS





R-0210212025

M-6158

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

## Certificate of Analysis

Assay (HNOs) $69.0 - 70.0 \%$ $69.7 \%$ AppearancePasses TestPasses TestColor (APHA) $\leq 10$ $5$ Residue after Ignition $\leq 2 ppm$ 1 ppmChloride (Cl) $\leq 0.08 ppm$ $< 0.03 ppm$ Phosphate (POs) $\leq 0.10 ppm$ $< 0.03 ppm$ Suifate (SOs) $\leq 0.2 ppm$ $< 0.3 ppm$ Trace Impurities - Aluminum (Al) $\leq 40.0 ppb$ $< 1.0 ppb$ Arsenic and Antimony (as As) $\leq 5.0 ppb$ $< 2.0 ppb$ Trace Impurities - Barium (Ba) $< 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Beryllium (Be) $\leq 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Boron (B) $< 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Cohalt (Cd) $\leq 50 ppb$ $< 1.0 ppb$ Trace Impurities - Cohalt (Cd) $< 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Copper (Cu) $< 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Copper (Cu) $< 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Copper (Cu) $< 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Coplat (Co) $< 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Copper (Cu) $< 10.0 ppb$ $< 1.0 ppb$ Trace Impurities - Gord (Au) $< 20 ppb$ $< 5 ppb$ Trace Impurities - Gord (Au) $< 20 ppb$ $< 1.0 ppb$ Trace Impurities - Gord (Au) $< 20 ppb$ $< 1.0 ppb$ Trace Impurities - Gord (Au) $< 20 ppb$ $< 1.0 ppb$ Trace Impurities - Gord (Au) $< 20 ppb$ $< 1.0 ppb$ Trace Impurities - Gord (Au) $< 20 ppb$ <	Test	Specification	Result
AppearancePasses TestPasses TestPasses TestColor (APHA) $\leq 10$ $\varsigma$ Residue after Ignition $\leq 2$ ppm1 ppmChloride (Cl) $\leq 0.08$ ppm $< 0.03$ ppmPhosphate (POA) $\leq 0.02$ ppm $< 0.2$ ppmSulfate (SOA) $\leq 0.2$ ppm $< 0.2$ ppmTrace Impurities - Aluminum (AI) $\leq 40.0$ ppb $< 1.0$ ppbArsenic and Antimony (as As) $\leq 5.0$ ppb $< 2.0$ ppbTrace Impurities - Beryllium (Be) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Beryllium (Be) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Beryllium (Cd) $\leq 50$ ppb $< 1.0$ ppbTrace Impurities - Cadmium (Cd) $\leq 50$ ppb $< 1.0$ ppbTrace Impurities - Cadmium (Ca) $\leq 50.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Cu) $\leq 20$ ppb $< 1.0$ ppb <td>Assay (HNO3)</td> <td></td> <td></td>	Assay (HNO3)		
Color (APHA) $\leq 10$ $\leq 10$ Residue after Ignition $\leq 2$ ppm1 ppmChioride (CI) $\leq 0.08$ ppm $< 0.03$ ppmPhosphate (PO <sub>4</sub> ) $\leq 0.10$ ppm $< 0.03$ ppmSulfate (SO <sub>4</sub> ) $\leq 0.2$ ppm $< 0.2$ ppmTrace Impurities - Aluminum (AI) $\leq 0.2$ ppm $< 2.0$ ppbArsenic and Antimony (as As) $\leq 5.0$ ppb $< 2.0$ ppbTrace Impurities - Barium (Ba) $< 10.0$ ppb $< 1.0$ ppbTrace Impurities - Beryllium (Be) $< 10.0$ ppb $< 1.0$ ppbTrace Impurities - Beryllium (Ca) $\leq 20.0$ ppb $< 1.0$ ppbTrace Impurities - Cadmium (Cd) $\leq 50$ ppb $< 1.0$ ppbTrace Impurities - Cadmium (Cd) $\leq 50.0$ ppb $< 1.0$ ppbTrace Impurities - Calcium (Ca) $\leq 50.0$ ppb $< 1.0$ ppbTrace Impurities - Calcium (Ca) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Calcium (Ca) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Calcium (Ca) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Calcium (Ca) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Calcium (Ca) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Codel (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Codel (Co) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Codel (Mu) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Calcium (Ca) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Codel (Mu) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Codel (Mu) $\leq 20$ ppb $< 1.0$ ppb </td <td>Appearance</td> <td></td> <td>69.7 %</td>	Appearance		69.7 %
Residue after ignition         ≤ 2 ppm         1 ppm           Chloride (Cl)         ≤ 0.08 ppm         < 0.03 ppm	Color (APHA)		Passes Test
Chloride (Cl) $\leq 0.08$ ppm $< 0.03$ ppmPhosphate (PO <sub>4</sub> ) $\leq 0.10$ ppm $< 0.03$ ppmSulfate (SO <sub>4</sub> ) $\leq 0.2$ ppm $< 0.2$ ppmTrace Impurities - Aluminum (Al) $\leq 40.0$ ppb $< 1.0$ ppbArsenic and Antimony (as As) $\leq 5.0$ ppb $< 2.0$ ppbTrace Impurities - Barium (Ba) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Beryllium (Be) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Beryllium (Be) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Beryllium (Cd) $\leq 20.0$ ppb $< 10.0$ ppbTrace Impurities - Cadmium (Cd) $\leq 50$ ppb $< 1.0$ ppbTrace Impurities - Cadmium (Cd) $\leq 50.0$ ppb $< 1.0$ ppbTrace Impurities - Cobalt (Co) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Coper (Cu) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Gold (Lo) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Gold (Au) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Gold (Au) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Gold (Au) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Gold (Au) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Lead (Pb) $\leq 10.0$ ppb $< 1.0$ ppbTrace Impurities - Lead (Pb) $\leq 20$ ppb $< 1.0$ ppbTrace Impurities - Lead (Pb) $\leq 20.0$ ppb $< 1.0$ ppbTrace Impurities - Lead (Pb) $\leq 20.0$ ppb $< 1.0$ ppbTrace Impurities - Lead (Pb) $\leq 20.0$ ppb $< 1.0$ ppbTrace Impurities - Lead (Pb) $\leq 20.0$ pp	Residue after Ignition		5
Phosphate (PO <sub>4</sub> )         < 0.08 ppm	-		) ppm
Sulfate (SO4)< 0.03 ppm< 0.03 ppmTrace Impurities - Aluminum (AI)< 0.2 ppm	Phosphate (PO4)		< 0.03 ppm
Trace Impurities - Aluminum (Al)< 40.0 ppb< 1.0 ppbArsenic and Antimony (as As)< 5.0 ppb			< 0.03 ppm
Arsenic and Antimony (as As)< 1.0 ppb	Trace Impurities - Aluminum (AI)		< 0.2 ppm
Trace Impurities - Barium (Ba) $\leq 3.0 \text{ ppb}$ $< 2.0 \text{ ppb}$ Trace Impurities - Beryllium (Be) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Bismuth (Bi) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Boron (B) $\leq 10.0 \text{ ppb}$ $< 5.0 \text{ ppb}$ Trace Impurities - Cadmium (Cd) $\leq 50 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Calcium (Ca) $\leq 50.0 \text{ ppb}$ $2.3 \text{ ppb}$ Trace Impurities - Cobalt (Co) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Cobalt (Co) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Copper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Copper (Cu) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 10 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Nickel (Ni) $< 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$			< 1.0 ppb
Trace Impurities - Beryllium (Be)< 1.0 ppb< 1.0 ppbTrace Impurities - Bismuth (Bi)< 20.0 ppb			< 2.0 ppb
Trace Impurities - Bismuth (Bi)< 1.0 ppb< 1.0 ppbTrace Impurities - Boron (B)< 20.0 ppb			< 1.0 ppb
Trace Impurities - Boron (B)< 10.0 ppb< 10.0 ppbTrace Impurities - Cadmium (Cd)< 50 ppb			< 1.0 ppb
Trace Impurities - Cadmium (Cd)< 50 ppb< 5.0 ppbTrace Impurities - Calcium (Ca)< 500 ppb			< 10.0 ppb
Trace Impurities - Calcium (Ca)< 10 ppbTrace Impurities - Chromium (Cr)< 30.0 ppb			< 5.0 ppb
Trace Impurities - Chromium (Cr)2.3 ppbTrace Impurities - Cobalt (Co)≤ 30.0 ppb< 1.0 ppb		≤ 50 ppb	< 1 ppb
Trace Impurities - Cobalt (Co)< 1.0 ppb		≤ 50.0 ppb	2.3 ppb
Trace Impurities - Copper (Cu)≤ 10.0 ppb< 1.0 ppb		≤ 30.0 ppb	< 1.0 ppb
Trace Impurities - Gallium (Ga)< 1.0 ppb		≤ 10.0 ppb	< 1.0 ppb
Trace Impurities - Germanium (Ge)< 20 ppb		≤ 10.0 ppb	< 1.0 ppb
Trace Impurities - Germanium (Ge)< 20 ppb< 10 ppbTrace Impurities - Gold (Au)< 20 ppb		≤ 10.0 ppb	< 1.0 ppb
Hack Impurities - Gold (Au)       < 20 ppb		≤ 20 ppb	- •
Intervery Metal's (as Pb) $\leq 100 \text{ ppb}$ $100 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 10.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1 \text{ ppb}$ Trace Impurities - Manganese (Mn) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Nickel (Ni) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$		≤ 20 ppb	
Trace Impurities – Iron (Fe)       ≤ 40.0 ppb       < 1.0 ppb		≤ 100 ppb	
Inace Impurities – Lead (Pb)       ≤ 20.0 ppb       < 10.0 ppb		≤ 40.0 ppb	
Inface Impurities – Lithium (Li)       ≤ 10.0 ppb       < 1.0 ppb		≤ 20.0 ppb	
race Impurities - Magnesium (Mg)     \$\$\le 20 ppb\$     \$<1 ppb\$		≤ 10.0 ppb	
Trace Impurities - Manganese (Mn)     ≤ 10.0 ppb     < 1.0 ppb		≤ 20 ppb	
race impurities - Nickel (Ni)		≤ 10.0 ppb	
	race Impurities - Nickel (Ni)	≤ 20.0 ppb	< 5.0 ppb

>>> Continued on page 2 >>>

**Wavantor**<sup>\*\*</sup>



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

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

Nitric Acid 69% CMOS





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

Test			
	Specification	Result	

For Microelectronic Use

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

Junie Croak Director Quality Operations, Bioscience Production

Nitric Acid 69% CMOS





M-5162 R. Date à- 0412712025

Material No.: 9606-03 Batch No.: 24H0162012 Manufactured Date: 2024-06-28 Retest Date: 2029-06-27 **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	< 1.0 ppb
Trace Impurities - Boron (B)	≤ 10.0 ppb	0.1 ppb
Trace impurities - Cadmium (Cd)	≤ 50 ppb	< 1 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	0.3 ppb
Trace Impurities - Chromium (Cr)	≤ 30.0 ppb	0.1 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	< 1 ppb
Trace Impurities – Gold (Au)	≤ 20 ppb	< 1 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	< 1.0 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	< 1.0 ppb

>>> Continued on page 2 >>>





### Material No.: 9606-03 Batch No.: 24H0162012

Test	Specification	Result
Trace Impurities - Niobium (Nb)	≤ 50.0 ppb	< 1.0 ppb
Trace Impurities – Potassium (K)	≤ 50 ppb	< 1 ppb
Trace Impurities – Silicon (Si)	≤ 50 ppb	1 ppb
Trace Impurities – Silver (Ag)	≤ 20.0 ppb	< 1.0 ppb
Trace Impurities – Sodium (Na)	≤ 150.0 ppb	< 1.0 ppb
Trace Impurities – Strontium (Sr)	≤ 30.0 ppb	< 1.0 ppb
Trace Impurities – Tantalum (Ta)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Thallium (TI)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Tin (Sn)	≤ 20.0 ppb	< 1.0 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	13 par/ml
Particle Count - 1.0 µm and greater	≤ 10 par/mł	5 par/ml

>>> Continued on page 3 >>>

Nitric Acid 69% CMOS





### Material No.: 9606-03 Batch No.: 24H0162012

Test	Specification	Result	
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For Microelectronic Use

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





# **Certificate of Analysis**

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

### 1.0 ACCREDITATION / REGISTRATION

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



### 2.0 PRODUCT DESCRIPTION

Product Code:	Multi Analyte Custom Grade Solution	
Catalog Number:	QCP-CICV-1	
Lot Number:	V2-MEB744107	
Matrix:	7% (v/v) HNO3	
Value / Analyte(s):	2 500 μg/mL ea: Calcium, Magnesium,	Potassium, Sodium,
	1 000 μg/mL ea: Aluminum,	Barium,
	500 μg/mL ea: Iron,	
	250 μg/mL ea: Nickel, Zinc, Manganese,	Vanadium, Cobalt,
	125 μg/mL ea: Silver,	Copper,
	100 μg/mL ea: Chromium,	
	25 μg/mL ea: Beryllium	
Second Source: Whenever	possible this solution was manufactured	d from a second set of o

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

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE Aluminum, Al	CERTIFIED VALUE 1 000 ± 4 µg/mL	ANALYTE Barium, Ba	CERTIFIED VALUE 1 000 ± 6 μg/mL
Beryllium, Be	24.98 ± 0.12 μg/mL	Calcium, Ca	2 500 ± 8 µg/mL
Chromium, Cr	99.9 ± 0.6 μg/mL	Cobalt, Co	250.2 ± 1.2 μg/mL
Copper, Cu	125.0 ± 0.5 μg/mL	Iron, Fe	500.0 ± 2.2 μg/mL
Magnesium, Mg	2 500 ± 11 µg/mL	Manganese, Mn	249.9 ± 1.1 μg/mL
Nickel, Ni	250.0 ± 1.2 μg/mL	Potassium, K	2 500 ± 11 μg/mL
Silver, Ag	125.0 ± 0.6 μg/mL	Sodium, Na	2 500 ± 11 μg/mL
Vanadium, V	250.0 ± 1.1 μg/mL	Zinc, Zn	249.9 ± 1.1 μg/mL

Density:

1.081 g/mL (measured at 20 ± 4 °C)

### **Assay Information:**

	ANALYTE	METHOD	NIST SRM#	SRM LOT#
	Ag	ICP Assay	3151	160729
	Ag	Volhard	999c	999c
	AI	ICP Assay	3101a	140903
	AI	EDTA	928	928
E	Ва	ICP Assay	3104a	140909
E	Ba	Gravimetric		See Sec. 4.2
E	Be	ICP Assay	3105a	090514
E	Be	Calculated		See Sec. 4.2
(	Са	ICP Assay	3109a	130213
(	Са	EDTA	928	928
(	Co	ICP Assay	3113	190630
(	Co	EDTA	928	928
(	Cr	ICP Assay	3112a	170630
(	Cu	ICP Assay	3114	120618
(	Cu	EDTA	928	928
ł	Fe	ICP Assay	3126a	140812
ł	Fe	EDTA	928	928
ł	К	ICP Assay	3141a	140813
ł	К	Gravimetric		See Sec. 4.2
I	Mg	ICP Assay	3131a	140110
I	Mg	EDTA	928	928
I	Mn	ICP Assay	3132	050429
I	Mn	EDTA	928	928
I	Na	ICP Assay	3152a	200413
I	Na	Gravimetric		See Sec. 4.2
I	Ni	ICP Assay	3136	120619
I	Ni	EDTA	928	928
١	V	ICP Assay	3165	160906
١	V	EDTA	928	928
2	Zn	ICP Assay	3168a	120629
2	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 <sub>CRM/RM</sub> , where two or more methods of characterization are used is the weighted mean of the results:	Characterization of CRM/RM by One Method Certified Value, X <sub>CRM/RM</sub> , where one method of characterization is used is the mean of individual results:
$X_{CRM/RM} = \Sigma(w_i) (X_i)$	X <sub>CRM/RM</sub> = (X <sub>a</sub> ) (u <sub>char a</sub> )
<b>X</b> <sub>i</sub> = mean of Assay Method i with standard uncertainty u <sub>char i</sub>	X <sub>a</sub> = mean of Assay Method A with
$\mathbf{w}_{i}$ = the weighting factors for each method calculated using the inverse square of the variance: $\mathbf{w}_{i} = (1/u_{char} i)^{2} / (\Sigma(1/(u_{char} i)^{2}))$	u <sub>char a</sub> = the standard uncertainty of characterization Method A
CRM/RM Expanded Uncertainty (±) = U <sub>CRM/RM</sub> = k (u <sup>2</sup> <sub>char</sub> + u <sup>2</sup> <sub>bb</sub> + u <sup>2</sup> <sub>lts</sub> + u <sup>2</sup> <sub>ts</sub> ) <sup>½</sup>	CRM/RM Expanded Uncertainty (±) = U <sub>CRM/RM</sub> = k ( $u^{2}$ <sub>char a</sub> + $u^{2}$ <sub>bb</sub> + $u^{2}$ <sub>lts</sub> + $u^{2}$ <sub>ts</sub> ) <sup>1/2</sup>
k = coverage factor = 2	k = coverage factor = 2
$u_{char} = [\Sigma((w_i)^2 (u_{char}_i)^2)]^{\frac{1}{2}}$ where $u_{char}$ i are the errors from each characterization method $u_{bb}$ = bottle to bottle homogeneity standard uncertainty	u <sub>char a</sub> = the errors from characterization u <sub>bb</sub> = bottle to bottle homogeneity standard uncertainty

$$\begin{split} & \textbf{u}_{char} = [\Sigma](w_j)^2 (u_{char,i})^2)^{1/2} \text{ where } u_{char,i} \text{ are the errors from each characterization} \\ & \textbf{u}_{bb} = \text{bottle to bottle homogeneity standard uncertainty} \\ & \textbf{u}_{lts} = \text{long term stability standard uncertainty (storage)} \\ & \textbf{u}_{ts} = \text{transport stability standard uncertainty} \end{split}$$

### 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.

ults = long term stability standard uncertainty (storage)

uts = transport stability standard uncertainty

### 4.1 Thermometer Calibration

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

### N/A

### 6.0 INTENDED USE

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

6.2 For products attaining traceability through Inorganic Ventures' Primary Certified Reference Materials (PCRM<sup>™</sup>) see the Limited License to Use PCRM<sup>™</sup> 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<sup>™</sup> 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

**Note**: This solution contains Silver (Ag), please refer to our Sample Preparation Guide for more information (https://www.inorganicventures.com/sample-preparation-guide/samples-containing-silver)

### 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

### 10.0 QUALITY STANDARD DOCUMENTATION

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

### 11.1 Certification Issue Date

### May 22, 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

### - May 22, 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.

- Sealed TCT Bag Open Date:

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

### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

Certificate Prepared By:

Justin Dirico Stock Processing Supervisor

Just Dilig Just Will And Will Paul R Laines

### **Certificate Approved By:**

Jodie Wall Stock VSM Coordinator

**Certifying Officer:** 

Paul Gaines Chairman / Senior Technical Director



# **Certificate of Analysis**

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

### 1.0 ACCREDITATION / REGISTRATION

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



### 2.0 **PRODUCT DESCRIPTION**

Product Code:	Multi Analyte Custom Grade Solution
Catalog Number:	QCP-CICV-2
Lot Number:	U2-MEB733713
Matrix:	3% (w/v) Tartaric acid
	1% (v/v) HNO3
Value / Analyte(s):	500 μg/mL ea:
	Antimony

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

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE Antimony, Sb	CERTIFIED VALUE 500.0 ± 2.8 µg/mL	ANALYTE	CERTIFIED VALUE	
Density:	1.017 g/mL (measure	ed at 20 ± 4 °C)		
Assay Information:				
ANALYTE	METHOD	NIST SRM#		SRM LOT#
Sb	ICP Assay	3102a		140911

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 <sub>CRM/RM</sub> , where two or more methods of characterization are used is the weighted mean of the results:	Characterization of CRM/RM by One Method Certified Value, X <sub>CRM/RM</sub> , where one method of characterization is used is the mean of individual results:
$\begin{split} \textbf{X}_{CRM/RM} &= \Sigma(\textbf{w}_i) \left(\textbf{X}_i\right) \\ \textbf{X}_i &= \text{mean of Assay Method i with standard uncertainty } \textbf{u}_{char  i} \\ \textbf{w}_i &= \text{the weighting factors for each method calculated using the inverse square of the variance:} \\ \textbf{w}_i &= (1/u_{char  i})^2 / (\Sigma(1/(u_{char  i})^2)) \end{split}$	$X_{CRM/RM} = (X_a) (u_{char a})$ $X_a =$ mean of Assay Method A with $u_{char a} =$ the standard uncertainty of characterization Method A
CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{\frac{1}{2}}$ k = coverage factor = 2 $u_{char} = [\Sigma[(w_i)^2 (u_{char} i)^2)]^{\frac{1}{2}}$ where $u_{char}$ i are the errors from each characterization method $u_{bb} =$ bottle to bottle homogeneity standard uncertainty $u_{lts} = long term stability standard uncertainty (storage)$ $u_{ts} = transport stability standard uncertainty$	$\begin{split} & CRM/RM \text{ Expanded Uncertainty } (\texttt{t}) = U_{CRM/RM} = k \left( u^2_{\ char \ a} + u^2_{\ bb} + u^2_{\ its} + u^2_{\ ts} \right)^{t_2} \\ & k = coverage factor = 2 \\ & u_{char \ a} = the errors from characterization \\ & u_{bb} = bottle to bottle homogeneity standard uncertainty \\ & u_{tb} = bottle to bottle homogeneity standard uncertainty \\ & u_{tb} = long term stability standard uncertainty \\ & u_{tb} = transport stability standard uncertainty \end{split}$

### 4.0 TRACEABILITY TO NIST

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

### 4.1 Thermometer Calibration

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

N/A

### 6.0 INTENDED USE

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

6.2 For products attaining traceability through Inorganic Ventures' Primary Certified Reference Materials (PCRM<sup>™</sup>) see the Limited License to Use PCRM<sup>™</sup> 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<sup>™</sup> 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°  $\pm$  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

### 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

### QUALITY STANDARD DOCUMENTATION 10.0

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

### **11.1 Certification Issue Date**

June 01, 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

### - June 01, 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

SD9784

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director



# **Certificate of Analysis**

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

### 1.0 ACCREDITATION / REGISTRATION

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

### 2.0 PRODUCT DESCRIPTION

Product Code:	Multi Analyte Custom Grade Solution	
Catalog Number:	QCP-CICV-3	
Lot Number:	V2-MEB749572	
Matrix:	7% (v/v) HNO3	
Value / Analyte(s):	500 μg/mL ea: Arsenic, Selenium,	Lead, Thallium,
	250 μg/mL ea: Cadmium	

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

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE Arsenic, As	CERTIFIED VALUE 500.0 ± 3.1 µg/mL	ANALYTE Cadmium, Cd	CERTIFIED VALUE 250.1 ± 1.1 µg/mL
Lead, Pb	500.0 ± 2.3 μg/mL	Selenium, Se	500.0 ± 3.2 μg/mL
Thallium, Tl	500.0 ± 3.0 μg/mL		

Density:

1.040 g/mL (measured at 20 ± 4 °C)

### Assay Information:

ANALYTE	METHOD	NIST SRM#	SRM LOT#
As	ICP Assay	3103a	100818
Cd	ICP Assay	3108	130116
Cd	EDTA	928	928
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 <sub>CRM/RM</sub> , where two or more methods of characterization are used is the weighted mean of the results:	Characterization of CRM/RM by One Method Certified Value, X <sub>CRM/RM</sub> , where one method of characterization is used is the mean of individual results:
$x_{CRM/RM} = \Sigma(w_i) (X_i)$	X <sub>CRM/RM</sub> = (X <sub>a</sub> ) (u <sub>char a</sub> )
$\mathbf{X}_{\mathbf{i}}$ = mean of Assay Method i with standard uncertainty u <sub>char i</sub>	$X_a$ = mean of Assay Method A with
$\mathbf{w_i}$ = the weighting factors for each method calculated using the inverse square of	u <sub>char a</sub> = the standard uncertainty of characterization Method A
the variance:	
$\mathbf{w_i} = (1/u_{\text{char i}})^2 / (\Sigma(1/(u_{\text{char i}})^2))$	
CRM/RM Expanded Uncertainty (±) = U <sub>CRM/RM</sub> = k (u <sup>2</sup> <sub>char</sub> + u <sup>2</sup> <sub>bb</sub> + u <sup>2</sup> <sub>lts</sub> + u <sup>2</sup> <sub>ts</sub> ) <sup>1/2</sup>	CRM/RM Expanded Uncertainty (±) = U <sub>CRM/RM</sub> = k (u <sup>2</sup> <sub>char a</sub> + u <sup>2</sup> <sub>bb</sub> + u <sup>2</sup> <sub>Its</sub> + u <sup>2</sup> <sub>ts</sub> ) <sup>1/2</sup>
k = coverage factor = 2	k = coverage factor = 2
$u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{\frac{1}{2}}$ where $u_{char}$ are the errors from each characterization method	u <sub>char a</sub> = the errors from characterization
ubb = bottle to bottle homogeneity standard uncertainty	ubb = bottle to bottle homogeneity standard uncertainty

4.0 TRACEABILITY TO NIST

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

ults = long term stability standard uncertainty (storage)

uts = transport stability standard uncertainty

### 4.1 Thermometer Calibration

ults = long term stability standard uncertainty (storage)

uts = transport stability standard uncertainty

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

### N/A

### 6.0 INTENDED USE

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

**6.2** For products attaining traceability through Inorganic Ventures' Primary Certified Reference Materials (PCRM<sup>™</sup>) see the Limited License to Use PCRM<sup>™</sup> 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<sup>™</sup> 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

### 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

### 10.0 QUALITY STANDARD DOCUMENTATION

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

### 11.1 Certification Issue Date

January 02, 2025

- 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 02, 2030

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

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

- Sealed TCT Bag Open Date:

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

### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

Certificate Prepared By:

Justin Dirico Stock Processing Supervisor

Just Dilig Just Well Paul R Laines

### **Certificate Approved By:**

Jodie Wall Stock VSM Coordinator

**Certifying Officer:** 

Paul Gaines Chairman / Senior Technical Director

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 <b>t:</b> 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			<b>2.0</b> 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 of	A COLUMN	Contraction of the	State of	UNIX 2 COL	18 - <sup>1</sup> 14		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	<b>40.02</b>	q	<0.02
As	<b>4</b> 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	<b>40</b> 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

\* 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.

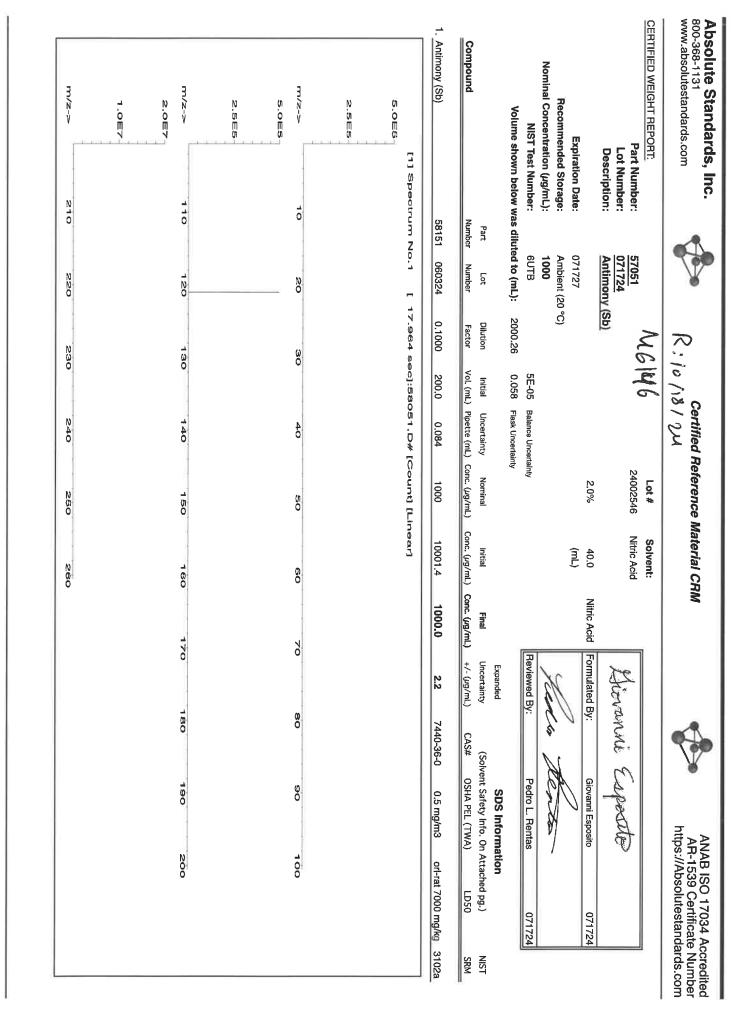
the preparation of all standards.

\* 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).



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



**Certified Reference Material CRM** 



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

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

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<0.02	<0.02	<0.02	<0.02	<0.02	<0.2	<0.02		
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Pb	La	Fe	ŀ	μ	Ho	Hf		
<0.02	<0.02	<0.2	<0.02	<0.02	<0.02	<0.02	Irace M	
Nd	Mo	Hg	Mn	Mg	Lu	Ľ	letais	
<0.02	<0.02	<0.2	<0.02	< 0.01	<0.02	<0.02	Verifica	
K	Pt	P	Pd	°s	ĥ	Ni	tion	
<0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	by ICP-N	
Sc	Sm	Ru	Rb	Rh	Re	P	in) SI	
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	g/mL)	
Ta	s	Sr	Na	Ag	Si	Se		
<0.02	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2		
T	Sn	Tm	Τħ	T	Te	Τb		
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
Zr	Zn	Y	Υь	V	Ч	W		
<0.02	<0.02	<0.02	<0.02	<0,02	<0.02	<0.02		

(T) = Target analyte

Physical Characterization:

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

Son P. Mar

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).

M6152



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.



### (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.



### Instructions for QATS Reference Material: ICP-AES ICS

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

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

**ICSA-1211, Interferents:** Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 2% v/v HNO<sub>3</sub>. 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 HNO<sub>3</sub>. Analyze this ICSAB solution by ICP-AES.

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

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

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

							ALC: NOT THE OWNER OF THE OWNER OWNER OF THE OWNER OWNE OWNER OWNE
Element	CRQL	Part A (µg/L)	Low Limit (µg/L)	High Limit (µg/L)	Part A +Part B (µg/L)	Low Limit (µg/L)	High Limit (µg/L)
Al	200	255000	216000	294000	247000	209000	285000
Sb	60	(0.0)	-60.0	60.0	618	525	711
As	10	(0.0)	-10.0	10.0	104	88.4	120
Ва	200	(6.0)	-194	206	(537)	337	737
Be	5.0	(0.0)	-5.0	5.0	495	420	570
Cd	5.0	(1.0)	-4.0	6.0	972	826	1120
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.



Instructions for QATS Reference Material: ICP-AES ICS

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

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

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

**Contains Heavy Metals** HAZARDOUS MATERIAL Safety Data Sheets

Available Upon Request

M6155

### (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".

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

### (B) BREAKAGE OR MISSING ITEMS

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

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

### (C) ANALYSIS OF SAMPLES

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

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RMICP-AES ICSA-1211 B-0710 SFAM.docx

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



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



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

### Instructions for QATS Reference Material: ICP-AES ICS

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

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

**ICSA-1211, Interferents:** Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 2% v/v HNO<sub>3</sub>. 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 HNO<sub>3</sub>. 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.

Element	CRQL	Part A (µg/L)	Low Limit (µg/L)	High Limit (µg/L)	Part A +Part B (µg/L)	Low Limit (µg/L)	High Limit (µg/L)
Al	200	255000	216000	294000	247000	209000	285000
Sb	60	(0.0)	-60.0	60.0	618	525	711
As	10	(0,0)	-10,0	10.0	104	88.4	120
Ba	200	(6.0)	-194	206	(537)	337	737
Be	5.0	(0.0)	-5.0	5.0	495	420	570
Cd	5.0	(1.0)	-4.0	6.0	972	826	1120
Ca	5000	245000	208000	282000	235000	199000	271000
Cr	10	(52.0)	42.0	62.0	542	460	624
Co	50	(0.0)	-50.0	50.0	476	404	548
Cu	25	(2.0)	-23.0	27.0	511	434	588
Fe	100	101000	85600	116500	99300	84400	114500
Pb	10	(0.0)	-10.0	10.0	(49.0)	39.0	59.0
Mg	5000	255000	216000	294000	248000	210000	286000
Mn	15	(7.0)	-8.0	22.0	507	430	584
Ni	40	(2.0)	-38.0	42.0	954	810	1100
Se	35	(0.0)	-35.0	35.0	(46.0)	11.0	81.0
Ag	10	(0.0)	-10.0	10.0	201	170	232
TI	25	(0.0)	-25.0	25.0	(108)	83.0	133
V	50	(0.0)	-50.0	50.0	491	417	565
Zn	60	(0.0)	-60.0	60.0	952	809	1095

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



## **Certificate of Analysis**

R: 8/5/24 M6019

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

### 1.0 ACCREDITATION / REGISTRATION

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



### 2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGSR1
Lot Number:	U2-SR730227
Matrix:	0.1% (v/v) HNO3
Value / Analyte(s):	1 000 μg/mL ea: Strontium
Starting Material:	SrCO3
Starting Material Lot#:	M2-2192
Starting Material Purity:	99.9993%
CERTIFIED VALUES AN	ID UNCERTAINTIES

Certified Value:	1001 ± 3 µg/mL
Density:	1.000 g/mL (measured at 20 $\pm$ 4 °C)

Assay Information:

3.0

Assay Method #1	<b>998 ± 4 μg/mL</b> ICP Assay NIST SRM Traceable to 3153a Lot Number: K2-SR650985
Assay Method #2	<b>1001 ± 3 μg/mL</b> EDTA NIST SRM 928 Lot Number: 928
Assay Method #3	<b>1001 ± 2 µg/mL</b> 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<sub>CRM/RM</sub>, 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<sub>i</sub> ≃ mean of Assay Method i with standard uncertainty u<sub>char</sub> i w<sub>i</sub> = 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<sub>CRM/RM</sub> = k ( $u^2_{cher} + u^2_{bb} + u^2_{lts} + u^2_{ts}$ )<sup>1/2</sup> k = coverage factor = 2  $u_{cher} = [Z(w_i)^2 (u_{char} i)^2]$ <sup>1/2</sup> where  $u_{char}$  i are the errors from each characterization method  $u_{bb}$  = bottle to bottle homogeneity standard uncertainty

bb - boute to outer homogeneity sandard uncertainty utrs = 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,  $X_{CRMRM},$  where one method of characterization is used is the mean of individual results:

 $X_{CRM/RM} = (X_n) (u_{char e})$   $X_n = mean of Assay Method A with$  $<math>u_{char a} =$ the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k ( $u^2_{char a} + u^2_{bb} + u^2_{tts} + u^2_{ts}$ )<sup>1/2</sup> k = coverage factor = 2 uchar a = the errors from characterization u<sub>bb</sub> = bottle to bottle homogeneity standard uncertainty u<sub>its</sub> = long term stability standard uncertainty (storage) u<sub>its</sub> = 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	<	0.001980	М	Eu	<	0.000495	0	Na		0.000200	М	Se	<	0.013862	0	Zn		0.000143
0	A		0.000370	0	Fe		0.000410	М	Nb	<	0.000495	i	Si	<		М	Zr	<	0.000495
М	As	<	0.000495	М	Ga	<	0.000495	М	Nd	<	0.000495	М	Sm	<	0.000495				
М	Au	<	0.000989	М	Gd	<	0.000495	0	Ni	<	0.007631	М	Sn	<	0.000990				
М	в	<	0.039606	М	Ge	<	0.000495	М	Os	<	0.000494	s	Sr	<					
М	Ba		0.006486	М	Hf	<	0.000495	i –	Р	<		М	Та	<	0.000495				
М	Be	<	0.000990	M	Hg	<	0.000989	М	Pb	<	0.002970	М	Tb	<	0.000495				
М	Bi	<	0.000495	М	Но	<	0.000495	М	Pd	<	0.003957	М	Те	<	0.027724				
0	Ca		0.004255	М	In	<	0.000495	М	Pr	<	0.000495	M	Th	<	0.000990				
М	Cd		0.001339	М	lr	<	0.000494	М	Pt	<	0.002970	М	Ti	<	0.005940				
М	Ce	<	0.004950	0	к	<	0.008184	М	Rb	<	0.002970	М	TI	<	0.000495				
М	Со	<	0.000495	М	La	<	0.000495	М	Re	<	0.000495	М	Tm	<	0.000495				
0	Cr	<	0.003207	0	Li	<	0.000884	0	Rh	<	0.012829	М	U	<	0.001485				
М	Cs	<	0.000990	М	Lu	<	0.002970	М	Ru	<	0.000989	М	V	<	0.001980				
М	Cu		0.000099	0	Mg		0.000064	i	s	<		М	W	<	0.003960				
М	Dy	<	0.000495	0	Mn		0.000066	М	Sb	<	0.014852	0	Y	<	0.000995				
М	Er	<	0.000495	М	Мо	<	0.001980	М	Sc	<	0.001980	М	Yb	<	0.000495				

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

### 6.0 INTENDED USE

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

6.2 For products attaining traceability through Inorganic Ventures' Primary Certified Reference Materials (PCRM™) see the Limited License to Use PCRM™ in the Inorganic Ventures Terms and Conditions of Sale. <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 Weight; Valence; Coordination Number; Chemical Form in Solution - 87.62 +2 6 Sr(H2O)6+2 Chemical Compatibility - Soluble in HCI, and HNO3. Avoid H2SO4, HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate and tungstate in neutral aqueous media.

**Stability -** 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1 - 3.5% HNO3 / LDPE container.

Sr Containing Samples (Preparation and Solution) -Metal (Best dissolved in diluted HNO3); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (Dry ash and dissolution in dilute HCl).

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

Technique/Line	Estimated D.L.	Order	Interferences (underlined indicates severe)
ICP-MS 88 amu	1200 ppt	N/A	72Ge16O, 176Yb+2,
			176Lu+2 , 176Hf+2
ICP-OES 407.771 nm	0.0004 / 0.00006 µg/mL	1	U, Ce
ICP-OES 421.552 nm	0.0008 / 0.00004 µg/mL	1	Rb
ICP-OES 460.733 nm	0.07 / 0.003 µg/mL	1	Ce

### 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

### 10.0 QUALITY STANDARD DOCUMENTATION

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

### 11.1 Certification Issue Date

March 03, 2023

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

### **11.2 Lot Expiration Date**

### - March 03, 2028

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

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

### **11.3 Period of Validity**

- Sealed TCT Bag Open Date:

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

### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

**Certificate Approved By:** 

Thomas Kozikowski Manager, Quality Control

BD9784.

**Certifying Officer:** 

**Paul Gaines** Chairman / Senior Technical Director

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		<b>2.0</b> 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	110007 BCCF4088			N			120			220
	3	°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									
<b>СRМ</b> 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	<b>SDS Information</b> (Solvent Safety Info. On Attached pg.)	s) LD50	gy/gmct sum-no			100			200			
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Part # 57081 Lot # 062724

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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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(I) = Target analyte

# Physical Characterization:

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

Ser P. S.

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).

\*^

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
Certified Reference Material CRM 冬」 シート					Balance Uncertainty	Flask Uncertainty	Uncertainty		0.084	34.243 sec]:58023.D# [Count] [Linear]		4			140		240
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
<b>MF</b> M6021			Nitric Acid				Final	Con	1000.0						j.		•
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		
ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com			062424	/	s 062424		<b>SDS Information</b> (Solvent Safety Info. On Attached pg.)	(A) LD50	3 ort-rat 58.1mg/kg			100			200		
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Lot # 062424

Part # 57023





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

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# Physical Characterization:

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