

## **Prep Standard - Chemical Standard Summary**

Order ID : Q2064

Test : Mercury, Metals ICP-TAL

Prepbatch ID : PB168036,PB168071,

Sequence ID/Qc Batch ID: LB135823,LB135823,LB135832,

## Standard ID :

MP85156,MP85545,MP85546,MP85547,MP85548,MP85549,MP85551,MP85552,MP85553,MP85554,MP85555,MP855 56,MP85557,MP85558,MP85700,MP85701,MP85702,MP85703,MP85704,MP85705,MP85706,MP85707,MP85708,MP 85709,MP85710,MP85711,MP85712,MP85714,

## **Chemical ID :**

M5062,M5429,M5466,M5467,M5470,M5471,M5658,M5747,M5748,M5751,M5798,M5799,M5800,M5801,M5811,M5814, M5815,M5816,M5817,M5820,M5875,M5882,M5942,M5959,M5962,M5970,M5985,M5997,M6005,M6016,M6021,M6023,M6028,M6030,M6032,M6058,M6076,M6077,M6127,M6128,M6137,M6138,M6142,M6144,M6145,M6146,M6150,M6151,M6152,M6155,M6158,M6159,M6161,W3112,



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	PipetteID 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>MP85545</u> Oml of W311	Prep Date 05/02/2025 12 + 25.00000	Expiration Date 06/02/2025 ml of M6158 =	Prepared By Janvi Patel Final Quantity:	ScaleID METALS_SCA LE_3 (M SC-3) 2500.000 ml		Sarabjit Jaswal 05/07/2025



<u>Recipe</u> <u>ID</u> 907	NAME ICP AES STD S ( S5 )	<u>NO.</u> <u>MP85546</u>	Prep Date 05/02/2025			<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	
FROM	5.00000ml of M5466 + 5.00000ml of of M5970 + 5.00000ml of M5997 + 5. 500.000 ml							
Desire				Enviration	Ducucaucid			Currentia ed Du

<u>Recipe</u>				Expiration	Prepared			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>MP85547</u>	05/02/2025	06/02/2025		METALS_SCA		
						LE_3 (M SC-3)	ETTE_1 (ICP	05/07/2025
FROM	50.00000ml of MP85545 + 50.00000	ml of MP85	546 = Final Q	uantity: 100.00	0 ml		<b>~</b> )	



<u>Recipe</u> <u>ID</u> 909	NAME ICP AES STD S3	<u>NO.</u> MP85548	Prep Date 05/02/2025	Expiration Date 06/02/2025		<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	
<u>FROM</u>	25.00000ml of MP85546 + 75.00000	ml of MP855	545 = Final Q	uantity: 100.00	0 ml		A)	
Desine				Evairation	Drenered			Supervised By

<b>Recipe</b>				Expiration	<b>Prepared</b>			Supervised By
<u>ID</u>	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Sarabjit Jaswal
3913	ICP AES STD S2	<u>MP85549</u>	05/02/2025	06/02/2025		METALS_SCA		
						LE_3 (M SC-3)	ETTE_1 (ICP	05/07/2025
FROM	16.00000ml of MP85546 + 184.0000	0ml of MP8	5545 = Final	Quantity: 200.0	00 ml		A)	



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Recipe ID 2950	NAME ICP AES S1/CRI STOCK STD	<u>NO.</u> MP85551	Prep Date 05/02/2025	Expiration Date 06/02/2025	<u>Prepared</u> <u>By</u> Janvi Patel	<u>ScaleID</u> METALS_SCA LE_2 (M SC-2)	ETTE_1 (ICP	Sarabjit Jaswal
FROM	0.03000ml of M5798 + 0.03000ml of of M6030 + 0.05000ml of M6159 + 0. 0.10000ml of M5820 + 0.10000ml of of M5748 + 0.20000ml of M5799 + 0. 0.25000ml of M6146 + 0.50000ml of of M6138 + 1.00000ml of M6142 + 1. 100.000 ml	.06000ml of M5962 + 0. .20000ml of M5814 + 0.	M5747 + 0.10 10000ml of M M6021 + 0.20 50000ml of M	0000ml of M547 5970 + 0.10000 0000ml of M602 6032 + 1.00000	71 + 0.10000ml 0ml of M6128 + 23 + 0.20000ml 0ml of M5942 +	of M5751 + 0.1 0.15000ml of M of M6145 + 0.2 1.00000ml of M	0000ml of M58 5800 + 0.2000 5000ml of M54 6127 + 1.0000	01 + 0ml 66 + 0ml

Recipe				Expiration	Prepared			Supervised By
<u>ID</u>	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipetteID	Sarabjit Jaswal
2951	ICP AES S1/CRI WORK STD	<u>MP85552</u>	05/02/2025	06/02/2025		METALS_SCA		
						LE_3 (M SC-3)		05/07/2025
FROM	2.00000ml of MP85551 + 98.00000m	nl of MP8554	45 = Final Qu	antity: 100.000	ml		A)	



<u>Recipe</u> <u>ID</u> 912	NAME ICP AES ICV SOLN	<u>NO.</u> MP85553	Prep Date 05/02/2025	Expiration Date 06/02/2025		<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	
FROM	0.02500ml of M5429 + 0.02500ml of of M6058 + 10.00000ml of M6150 + 8					0.25000ml of M	A) 5470 + 0.2500	00ml
Desire				Function	Durana d			Currentine d Du

<b>Recipe</b>				Expiration	<b>Prepared</b>			Supervised By
ID	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipettelD	Sarabjit Jaswal
904	ICP AES ICSA SOLN	<u>MP85554</u>	05/02/2025	06/02/2025	Janvi Patel	METALS_SCA		-
						LE_3 (M SC-3)		05/07/2025
FROM	25.00000ml of M6152 + 225.00000m	l of MP8554	5 = Final Qu	antity: 250.000	ml		A)	



Recipe ID 3494	NAME ICP AES ICSAB SOLN-1	<u>NO.</u> <u>MP85555</u>	Prep Date 05/02/2025	Expiration Date 06/02/2025	<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	
FROM	0.01000ml of M5815 + 0.01000ml of of M6152 + 10.00000ml of M6155 + 7				0.10000ml of M	A) 6077 + 10.000	100ml

<b>Recipe</b>				<b>Expiration</b>	Prepared			Supervised By
ID	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipetteID	Sarabjit Jaswal
911	ICP AES CCV SOLN	<u>MP85556</u>	05/02/2025	06/02/2025		METALS_SCA		
						LE_3 (M SC-3)	ETTE_1 (ICP A)	05/07/2025
FROM	50.00000ml of MP85545 + 50.00000	ml of MP85	546 = Final Q	uantity: 100.00	0 ml		A)	



<u>Recipe</u> <u>ID</u> 919	NAME ICP AES INTERNAL STD	<u>NO.</u> MP85557	Prep Date 05/02/2025	Expiration Date 06/02/2025		<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)	ETTE_1 (ICP	
<u>FROM</u>	1.00000ml of M5959 + 10.00000ml o	f M5985 + 1	969.00000ml	of W3112 + 20	.00000ml of M6	i158  = Final Qu	A) antity: 2000.00	
Recipe				Expiration	<u>Prepared</u>			Supervised By

<b>Recipe</b>				Expiration	<u>Prepared</u>			<u>Supervised By</u>
<u>ID</u>	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Sarabjit Jaswal
903	ICP AES RINSE SOLN	<u>MP85558</u>	05/02/2025	06/02/2025		METALS_SCA		-
						LE_3 (M SC-3)	• •	05/07/2025
FROM	200.00000ml of M6158 + 9800.0000	0ml of W311	2 = Final Qua	antity: 10000.00	00 ml		A)	



Recipe ID 871	NAME MERCURY INTERMEDIATE B 250PPB WORKING STD.	<u>NO.</u> MP85700	Prep Date 05/19/2025	Expiration Date 05/20/2025	Prepared By Mohan Bera	<u>ScaleID</u> None	PipettelD METALS_PIP ETTE_5 (HG	
<u>FROM</u>	1.00000ml of M6158 + 2.50000ml of	M5062 + 96	5.50000ml of V	V3112 = Final	Quantity: 100.00	00 ml	A)	

Recipe	 			Expiration	Prepared			Supervised By
ID	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	PipettelD	Sarabjit Jaswal
1340	Hg 0.00 PPB STD	<u>MP85701</u>	05/19/2025	05/20/2025	Mohan Bera	None	METALS_PIP	
							ETTE_5 (HG	05/22/2025
FROM	2.50000ml of M6158 + 247.50000ml	of W3112 =	Final Quantit	ty: 250.000 ml			A)	
				-				



Recipe ID 1341 FROM	NAME Hg 0.2 PPB STD 2.50000ml of M6158 + 247.30000ml	<u>NO.</u> <u>MP85702</u> of W3112 +	Prep Date 05/19/2025 0.20000ml of	<u>Expiration</u> <u>Date</u> 05/20/2025 MP85700 = F	Prepared By Mohan Bera inal Quantity: 25	<u>ScaleID</u> None	PipetteID METALS_PIP ETTE_5 (HG A)	Sarabjit Jaswal 05/22/2025
Recipe ID 1342 FROM	NAME Hg 2.5 PPB STD 2.50000ml of M6158 + 245.00000ml	<u>NO.</u> <u>MP85703</u> of W3112 +	Prep Date 05/19/2025 2.50000ml of	Expiration Date 05/20/2025 MP85700 = F	Prepared By Mohan Bera inal Quantity: 25	<u>ScaleID</u> None 50.000 ml	PipettelD METALS_PIP ETTE_5 (HG A)	Sarabjit Jaswal 05/22/2025



Recipe ID 1343 FROM	NAME Hg 5.0 PPB STD 2.50000ml of M6158 + 242.50000ml	<u>NO.</u> MP85704 of W3112 +	Prep Date 05/19/2025 5.00000ml of	<u>Expiration</u> <u>Date</u> 05/20/2025 MP85700 = F	Prepared By Mohan Bera inal Quantity: 25	ScaleID None	PipetteID METALS_PIP ETTE_5 (HG A)	Supervised By Sarabjit Jaswal 05/22/2025
Recipe ID 1344 FROM	NAME Hg 7.5 PPB STD 2.50000ml of M6158 + 245.00000ml	<u>NO.</u> <u>MP85705</u> of W3112 +	Prep Date 05/19/2025 2.50000ml of	Expiration Date 05/20/2025 MP85700 = F	Prepared By Mohan Bera inal Quantity: 25	<u>ScaleID</u> None 60.000 ml	PipettelD METALS_PIP ETTE_5 (HG A)	Sarabjit Jaswal



<u>Recipe</u> <u>ID</u> 1345	NAME Hg 10.0 PPB STD	<u>NO.</u> MP85706	Prep Date 05/19/2025	Expiration Date 05/20/2025	Prepared By Mohan Bera	<u>ScaleID</u> None	PipettelD METALS_PIP ETTE_5 (HG	Sarabjit Jaswal
FROM	2.50000ml of M6158 + 237.50000ml	of W3112 +	10.00000ml c	of MP85700 =	Final Quantity: 2	250.000 ml	· <u>A</u> )	
Recipe ID		<u>NO.</u>	Prep Date	Expiration Date	<u>Prepared</u> <u>By</u>	ScaleID	PipettelD	Sarabjit Jaswal

1346	Hg ICV SOLUTION	<u>MP85707</u>	05/19/2025	05/20/2025	Mohan Bera	None	METALS_PIP	
							ETTE_5 (HG	05/22/2025
FROM	2.50000ml of M6158 + 2.50000ml of	M6161 + 24	5.00000ml of	W3112 = Fina	I Quantity: 250.	000 ml	A)	



<u>Recipe</u> <u>ID</u> 1351	NAME ICB (Hg 0.00 PPB SOLUTION)	<u>NO.</u> MP85708	Prep Date 05/19/2025	Expiration Date 05/20/2025	Prepared By Mohan Bera	<u>ScaleID</u> None	PipettelD METALS_PIP ETTE_5 (HG	
FROM	2.50000ml of M6158 + 247.50000ml	of W3112 =	Final Quantit	y: 250.000 ml			A)	
Recipe	NAME	NO	Prop Data	Expiration	Prepared By	ScalolD	PinottolD	<u>Supervised By</u>

<b>Recipe</b>				Expiration	Prepared			Supervised By
ID	NAME	<u>NO.</u>	Prep Date	Date	<u>By</u>	<u>ScaleID</u>	PipetteID	Sarabjit Jaswal
1358	CCV (Hg 5.0 PPB SOLUTION)	<u>MP85709</u>	05/19/2025	05/20/2025	Mohan Bera	None	METALS_PIP	
							ETTE_5 (HG	05/22/2025
<u>FROM</u>	485.00000ml of W3112 + 5.00000ml	of M6158 +	10.00000ml c	of MP85700 =	Final Quantity: 5	500.000 ml	A)	



<u>Recipe</u> <u>ID</u> 1352	NAME CCB (Hg 0.00 PPB SOLUTION)	<u>NO.</u> MP85710	<u>Prep Date</u> 05/19/2025	Expiration Date 05/20/2025	Prepared By Mohan Bera	<u>ScaleID</u> None	PipettelD METALS_PIP ETTE_5 (HG	Sarabjit Jaswal
FROM	495.00000ml of W3112 + 5.00000ml	of M6158 =	Final Quantit	y: 500.000 ml			A)	
Recipe ID	NAME	<u>NO.</u>	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipettelD</u>	<u>Supervised By</u> Sarabjit Jaswal

		<u>NO.</u>	Prep Date	Date	<u>by</u>	ScaleID	PipelleiD	Sarabjit Jaswal
1349	CRA/CRI (Hg 0.2 PPB SOLUTION)	<u>MP85711</u>	05/19/2025	05/20/2025	Mohan Bera	None	METALS_PIP ETTE_5 (HG	05/22/2025
FROM	2.50000ml of M6158 + 247.30000ml	I of W3112 +	I 0.20000ml of	MP85700 = F	I I I I I I I I I I I I I I I I I I I	50.000 ml	<u> </u>	



Recipe ID 1350	NAME CHK STD (Hg 7.0 PPB SOLUTION) 2.50000ml of M6158 + 240.50000ml	<u>NO.</u> <u>MP85712</u> of W3112 +	Prep Date 05/19/2025 7.00000ml of	Expiration Date 05/20/2025 MP85700 = F	Prepared By Mohan Bera inal Quantity: 25	<u>ScaleID</u> None 50.000 ml	PipetteID METALS_PIP ETTE_5 (HG A)	Sarabjit Jaswal 05/22/2025
Recipe ID 68	NAME STANNOUS CHLORIDE SOLUTION	<u>NO.</u> <u>MP85714</u>	Prep Date 05/20/2025	Expiration Date 05/21/2025	Prepared By Mohan Bera	<u>ScaleID</u> METALS_SCA LE_3 (M SC-3)		Sarabjit Jaswal

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



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	MSHG-10PPM / MERCURY HCI 125mL 10ug/mL	S2-HG709270	09/22/2026	05/28/2022 / mohan	01/27/2022 / mohan	M5062
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57103 / Li, 10000 PPM, 125 ml	070622	07/06/2025	01/30/2023 / bin	01/26/2023 / bin	M5429
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	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	M5470
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57038 / Sr, 1000 PPM, 125 ml	082922	08/29/2025	04/14/2025 / jaswal	03/16/2023 / jaswal	M5471



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
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.	/ Lead (Pb) 1000PPM	100923	10/09/2026	05/20/2024 / Jaswal	12/20/2023 / jaswal	M5747
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	/ Nickel (Ni) 1000PPM	091223	09/12/2026	01/02/2024 / bin	12/20/2023 / jaswal	M5748
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58029 / Cu, 1000 PPM, 500 ml	071723	07/17/2026	10/01/2024 / Jaswal	08/25/2023 / jaswal	M5751

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57004 / Be, 1000 PPM, 125 ml	102523	10/25/2026	02/09/2024 / bin	02/09/2024 / bin	M5798

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57050 / Sn, 1000 PPM, 125 ml	071123	07/11/2026	02/09/2024 / bin	02/09/2024 / bin	M5799



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## CHEMICAL RECEIPT LOG BOOK

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Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57027 / CO, 1000 PPM, 125 ml	091923	09/19/2026	05/31/2024 / bin	02/09/2024 / bin	M5800
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57033 / As, 1000 PPM, 125 ml	111323	11/13/2026	02/09/2024 / bin	02/09/2024 / bin	M5801
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58126 / Fe, 10000 PPM, 500 ml	051523	05/15/2026	02/06/2025 / kareem	01/03/2024 / jaswal	M5811
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57005 / B, 1000 PPM, 125 ml	071123	07/11/2026	03/26/2024 / Sohil	01/03/2024 / jaswal	M5814
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57115 / P, 10000 PPM, 125 ml	041723	04/17/2026	05/21/2024 / Jaswal	02/09/2024 / jaswal	M5815
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57016 / S, 1000 PPM, 125 ml	122923	12/29/2026	05/20/2024 / Jaswal	02/09/2024 / jaswal	M5816



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57116 / S, 10000 PPM, 125 ml	071123	07/11/2026	03/01/2024 / jaswal	02/09/2024 / jaswal	M5817
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Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57015 / P, 1000 PPM, 125 ml	091123	09/11/2026	05/01/2024 / jaswal	02/09/2024 / jaswal	M5820
Supplier	ItemCode / ItemName	Lot #	Expiration	Date Opened /	Received Date /	Chemtech
Inorganic Ventures	CLPP-CAL-1 / CLP CAL SOLUTION #1, 125mL	T2-MEB714417	Date 01/27/2027	Opened By 04/19/2024 / jaswal	Received By 02/22/2024 / jaswal	Lot # M5875
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Seidler Chemical	BA-3980-01 / Stannous Chloride (cs/4x500g)	232820	08/31/2028	04/30/2024 / mohan	04/25/2024 / mohan	M5882
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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 #
Inorganic Ventures	CGY10-1 / YTTRIUM 125mL 10,000ug/mL	V2-Y740548	02/20/2029	07/01/2024 / Jaswal	06/14/2024 / Jaswal	M5959



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57034 / Se, 1000 PPM, 125 ml	060624	06/06/2027	07/02/2024 / Jaswal	06/14/2024 / Jaswal	M5962
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57003 / Li, 1000 PPM, 125 ml	061224	06/21/2027	07/01/2024 / Jaswal	07/01/2024 / Jaswal	M5970
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CGIN10-5 / INDIUM 1 x 500 ml	U2-IN729349	02/21/2028	10/08/2024 / Jaswal	06/14/2024 / Jaswal	M5985

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

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	WW-LFS-1 / Laboratory Fortified Stock Solution 1, 125 ml	T2-MEB723367	08/30/2026	04/15/2025 / JANVI	05/14/2024 / Jaswal	M6005

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	WW-LFS-2 / Laboratory Fortified Stock Solution 2, 125 ml	U2-MEB731108	10/30/2025	04/30/2025 / mohan	05/14/2024 / Jaswal	M6016



Standards, Inc.

125 ml

## CHEMICAL RECEIPT LOG BOOK

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot # M6021	
Absolute Standards, Inc.	57023 / V, 1000 PPM, 125 ml	062424	06/24/2027	09/28/2024 / jaswal	08/05/2024 / Jaswal		
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Absolute Standards, Inc.	57081 / TI, 1000 PPM, 125 ml	0624724	06/27/2027	08/05/2024 / kareem	08/05/2024 / Jaswal	M6023	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Absolute Standards, Inc.	57048 / Cd, 1000 PPM, 125 ml	070124	07/01/2027	08/05/2024 / kareem	08/05/2024 / Jaswal	M6028	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Absolute Standards, Inc.	57047 / Ag, 1000 PPM, 125 ml	122823	12/28/2026	08/05/2024 / kareem	08/05/2024 / Jaswal	M6030	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Absolute	57056 / Ba, 1000 PPM,	010924	01/09/2027	01/14/2025 /	08/05/2024 /	M6032	

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CHEM-QC-4 / CHEM-QC-4, Second Source, 1000 ug/ml, B, Mo, Si, Sn, Ti	V2-MEB746173	01/29/2026	01/29/2025 / JANVI	08/22/2024 / Jaswal	M6058

Jaswal

Jaswal



Supplier	Supplier ItemCode / ItemName Lot # Expirati		Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
Inorganic Ventures	Z9651Q / CHEM-CLP-4/.25L	V2-MEB746762	01/01/2026	01/01/2025 / kareem	09/19/2024 / kareem	M6076	
Supplier	ItemCode / ItemName	Lot #	Expiration Date Opened / R Date Opened By		Received Date / Received By	Chemtech Lot #	
Inorganic Ventures	Z9651Q / CHEM-CLP-4/.25L			01/23/2025 / kareem	09/19/2024 / kareem	M6077	
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #	
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			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 Opened /	Received Date /	Chemtech	

Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58120 / Ca, 10000 PPM, 500 ml	121824	12/18/2027	04/17/2025 / Janvi	01/13/2025 / Jaswal	M6138



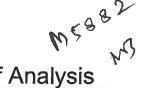
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58119 / K, 10000 PPM, 500 ml	103024	10/30/2027	05/06/2025 / JANVI	01/13/2025 / Jaswal	M6142
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58111 / Na, 10000 PPM, 500 ml			01/23/2025 / kareem	01/13/2025 / Jaswal	M6144
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58030 / Zinc, Zn, 500 ml, 1000 PPM	121724 12/17/2027 02/04/2025 jaswal		02/04/2025 / jaswal	01/13/2025 / Jaswal M614	
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 #
Supplier EPA	ItemCode / ItemName	Lot # ICV1-1014	-			
	ICV-1 / ICV (ICP/ICPMS)		Date	Opened By 02/07/2025 /	Received By 04/20/2021 /	Lot #



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	/ ICSAB ( ICP ) ICSB-0710 06/20/2025 02/10/2025 /		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 / Al, 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 #	
EPA	ICV-5 / ICV (HG)STOCK SOLN	ICV 5 0415	07/31/2025	05/01/2025 / mohan	03/30/2024 / mohan	M6161	
Supplier	ItemCode / ItemName	Lot #	Expiration	Date Opened /	Received Date /	Chemtech	

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

## Certificate of Analysis Thermo Fisher SCIENTIFIC



Page 1 of 1

## Certificate of Analysis 1 Reagent Lane Fair Lawn, NJ 07410 Thermo Fisher Scientific's Quality System has been found to conform to Quality Management System 201,796,7100 tel Standard ISO9001:2015 by SAI Global Certificate Number CERT - 0120633 201.796.1329 fax

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

Catalog Number	T142	Quality Test / Release Date	08/17/2023
Lot Number	232820		
Description	STANNOUS CHLORIDE, DIH	YDRATE CERTIFIED ACS (Suitable for Me	ercury Determination)
Country of Origin	United States	Suggested Retest Date	Aug/2028
Chemical Origin	Inorganic-non animal		
BSE/TSE Comment	No animal products are used a processing aids, or any other	as starting raw material ingredients, or used material that might migrate to the finished p	in processing, including lubricants, roduct.

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

ut Sabyr

Harout Sahagian - Quality Control Supervisor - Fair Lawn

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

\*Based on suggested storage condition.

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
240		140	<b>4</b> 0	56. D# [Cour	0.10 52.3 3	Uncertainty Assay Purity (%) (%) W	2% Balance Uncertainty Flask Uncertainty		ertified Refere १२-५
		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
1		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 Variante	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	2.5E4	5. 0 114	1. Cadmium nitrate tetrahydrate (Cd)	Compound	Weight shov	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL):		CERTIFIED WEIGHT REPORT:	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
		 		0 0		[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)		
		130		30		12.514 800	1000 99.	Nominal Pu Conc. (µg/mL) (1	2000.07 0.1		(Cd)		R
200		140		\$		12.514 sec]:58148.D# [Count] [Linear]	99.999 0.10 36.5	Purity Uncertainty Assay (%) Purity (%) (%)	5E-05 Balance Uncertainty 0.100 Flask Uncertainty		Solvent: 2%		Certified R
		1 () ()		ő		Count] [Line	.5 5.4797	say Target 6) Weight (g)	ţ		ent: 24002546 2% 40.0	Lot #	Certified Reference Material CRM 3 15 12 4
		160		0 O		ar]	5.4804	Actual Actual Weight (g) Conc. (µg/mL)			Nitric Acid		terial CRM
		170		70			1000.1	11	Re	53 80	5		M6028
		-1 2 C		BO			10022-68-1	Expanded Uncertainty (Solvent +/- (µg/mL) CAS# 0	Reviewed By: Ped	\$	Alloch & B		-
		190 200		90 100				SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD51	Pedro L. Rentas	ento	Brack		ANAB IS AR-153 https://Ab
				-			orl-rat 60.2mg/kg 3108	hed 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).

**e**24



## **Certificate of Analysis**

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

3.0

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

## 1.0 ACCREDITATION / REGISTRATION

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



## 2.0 PRODUCT DESCRIPTION

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

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

Density:

1.118 g/mL (measured at 20 ± 4 °C)

## **Assay Information:**

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

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

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

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

## 4.1 Thermometer Calibration

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

## 4.2 Balance Calibration

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

## 4.3 Glassware Calibration

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

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

N/A

4.0

## 6.0 INTENDED USE

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

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

## 7.1 Storage and Handling Recommendations

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

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

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

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

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

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

## 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

## 10.0 QUALITY STANDARD DOCUMENTATION

## 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

## 11.1 Certification Issue Date

January 27, 2022

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

## 11.2 Lot Expiration Date

## - January 27, 2027

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

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

## 11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

## 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

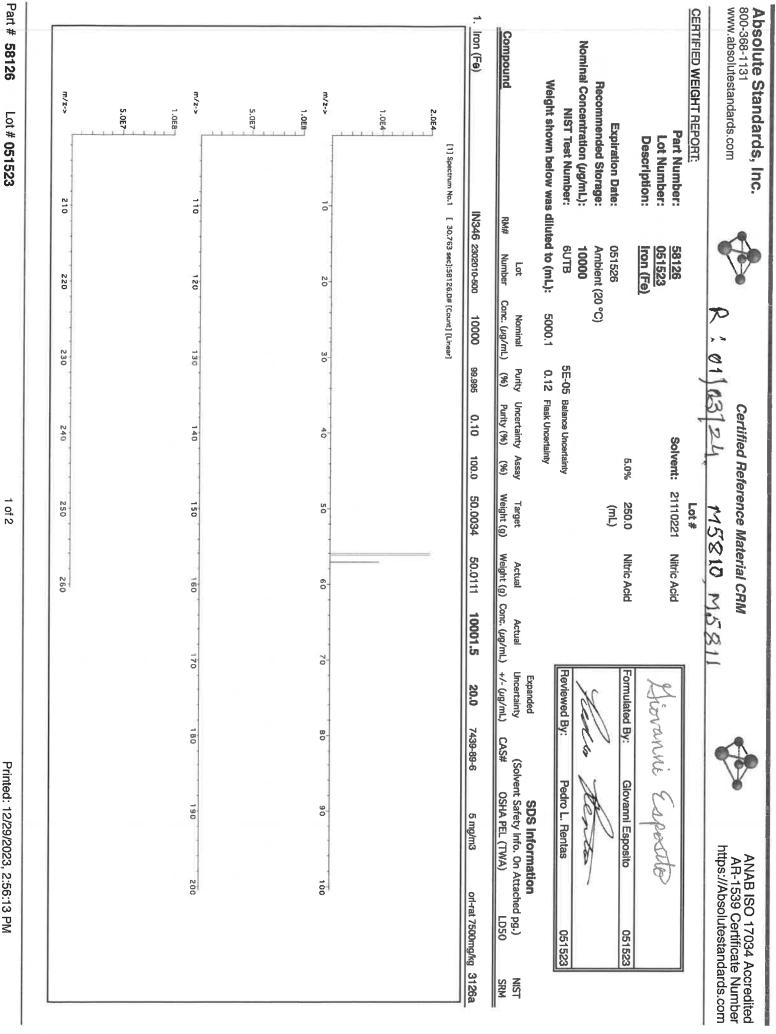
**Certificate Approved By:** 

Thomas Kozikowski Manager, Quality Control

**Certifying Officer:** 

Paul Gaines Chairman / Senior Technical Director

SD978Ci Paul R Saines



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Printed: 12/29/2023, 2:56:13 PM

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       <	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 $402$ $32$ $32$ $402$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ $402$ $32$ $32$ $32$ $32$ $1$ $402$ $32$ $32$ $33$ $402$ $1$ <t< th=""></t<>

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## 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 / Analyte(s):	1 000 µg/mL ea: Potassium,		
		600 μg/mL ea: Phosphorus,		
		300 µg/mL ea: Sodium,	Iron,	
		200 µg/mŁ 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	CERTIFIED VALUES	7.5 µg/mL ea: Silver AND UNCERTAINTI	ES	

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	Cadmium, 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: Tin,					
	40 μg/mL ea: Molybdenum,					
	20 μg/mL ea:					
	Titanium					

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

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

Density:

1.025 g/mL (measured at 20 ± 4 °C)

### **Assay Information:**

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

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

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

Certified Value, X<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

3D978 ..........

**Certifying Officer:** 

**Paul Gaines** Chairman / Senior Technical Director



# Certificate of Analysis

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

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

### 1.0 ACCREDITATION / REGISTRATION

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



### 2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Mass Spec Solution								
Catalog Number:	MSHG-10PPM								
Lot Number:	S2-HG709270								
Matrix:	10% (v/v) HCI								
Value / Analyte(s):	10 µg/mL ea: Mercury								
Starting Material:	Hg metal								
Starting Material Lot#:	1959								
Starting Material Purity:	99.9994%								
CERTIFIED VALUES	CERTIFIED VALUES AND UNCERTAINTIES								

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

### Assay Information:

3.0

ANALYTE	METHOD	NIST SRM#	SRM LOT#
Hg	ICP Assay	3133	160921
Hg	EDTA	928	928
Hg	Calculated		See Sec. 4.2

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

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

### 4.0 TRACEABILITY TO NIST

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

### 4.1 Thermometer Calibration

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

### 4.2 Balance Calibration

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

### 4.3 Glassware Calibration

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

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

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

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

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

### 6.0 INTENDED USE

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

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

7.1 Storage and Handling Recommendations

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

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

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

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 200.59 +2 4 Hg(OH)(aq) 1+ Chemical Compatibility - Stable in HNO3. Avoid basic media forming insoluble carbonate. The sulfide, basic carbonate, oxalate, phosphate, arsenite, arsenate and iodide are insoluble in water.

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

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

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

Technique/Line	Estimated D.L.	Order	Interferences (underlined indicates severe
ICP-MS 202 amu	9 ppt	n/a	186W16O
ICP-OES 184.950 nm	0.03 / 0.005 µg/mL	1	
ICP-OES 194.227 nm	0.03 / 0.005 µg/mL	1	V
ICP-OES 253.652 nm	0.1 / 0.03 µg/mL	1	Ta, Co, Th ,Rh , Fe,
			U

### 8.0 HAZARDOUS INFORMATION

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

### 9.0 HOMOGENEITY

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

### 10.0 QUALITY STANDARD DOCUMENTATION

### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

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

### **11.1 Certification Issue Date**

### September 22, 2021

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

### **11.2 Lot Expiration Date**

### - September 22, 2026

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

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

### 11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

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

Uyen Truong Supervisor, Product Documentation

Ulya new

### **Certificate Approved By:**

Michael Booth Director, Quality Control

Michael 2 Booth

### **Certifying Officer:**

Paul Gaines Chairman / Senior Technical Director

Paul R Laine

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

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



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

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

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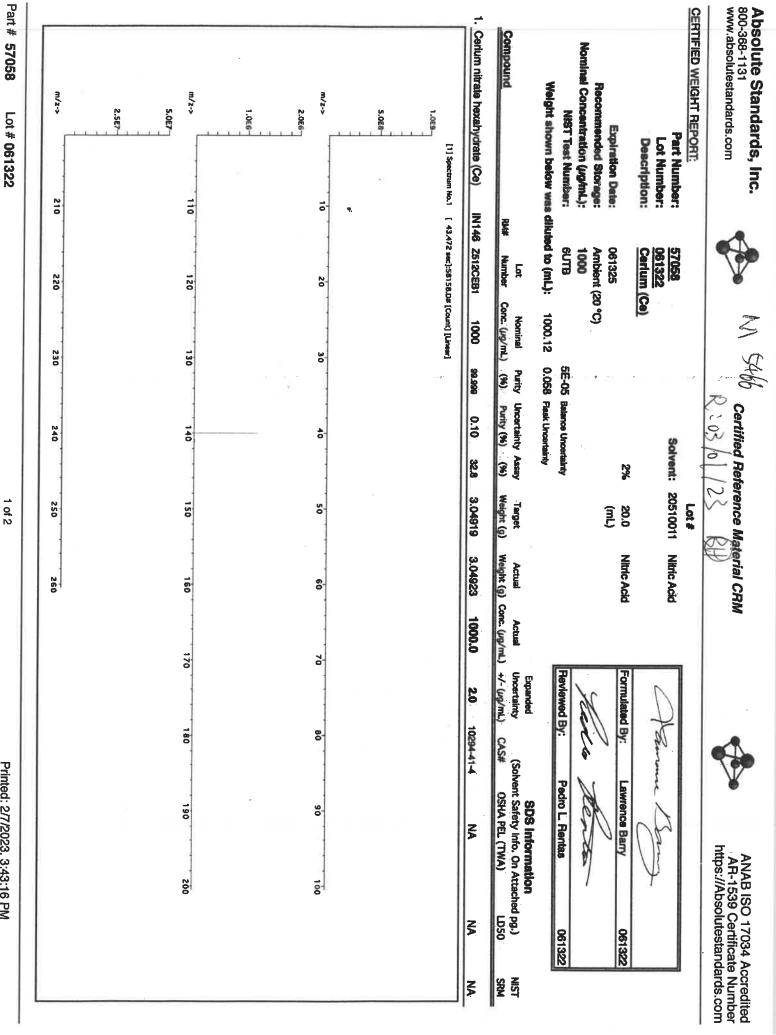
**Physical Characterization:** 

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

Certified by:

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

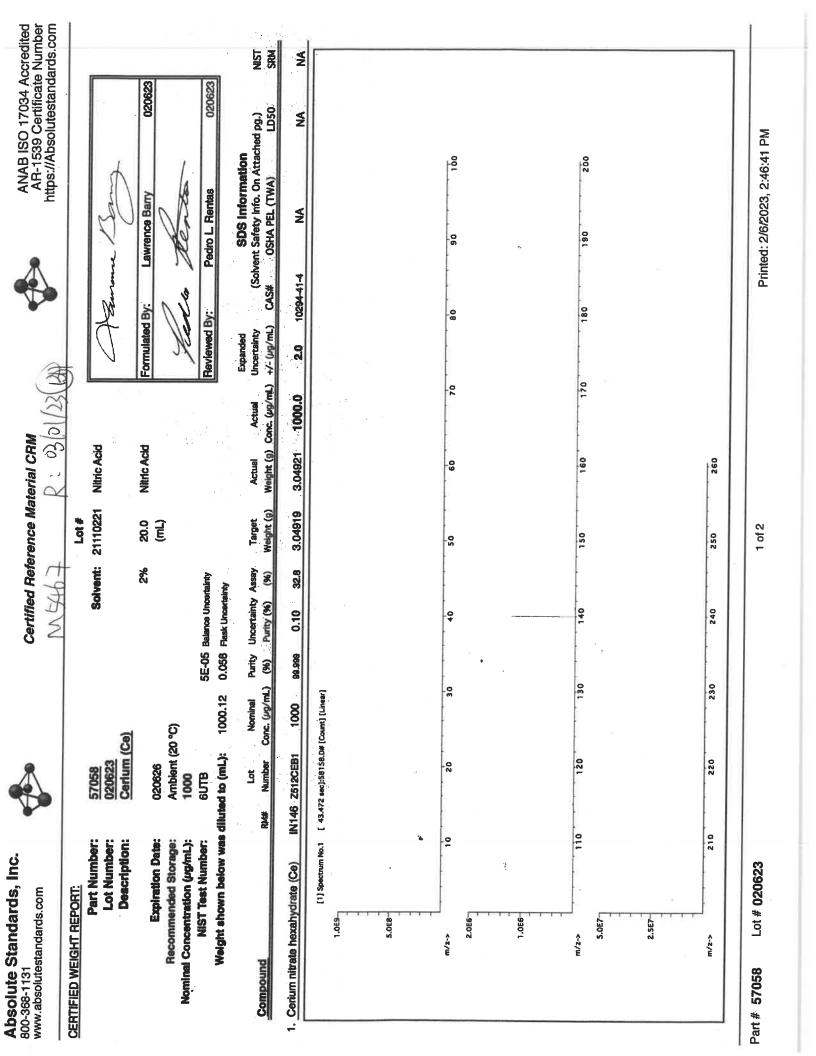
Lot # 070622 Part # 57103



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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).

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Part # 58024 Lot # 060523

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<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 Uncer	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

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 R ÷ 12/20[を3
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 ACIO		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 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:	ې ک				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.absolut



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         H         A02         Li         A02         N         T         Pr         A02         S         A02         C4         A02         E         A02         H         A02         Li         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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Part #											LEF	
58029	m/z->	1.057	m/≥-> 2.0E7	2.567	m/z->- 5.0巨7	01 .0 .0 .0 .0 .0	1.0E6	Copper(II) nitrate trihydrate (Cu)	Volume sh	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number:	<u>CERTIFIED WEIGHT REPORT</u> Par Lo De	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
Lot # 071723	0 0		110		10		[1] Spectrum No.		Volume shown below was diluted to (mL): Part Lot Number Number	Expiration Date: Recommended Storage: I Concentration (µg/mL): NIST Test Number:	<u>Part Number:</u> Lot Number: Description:	om
			0				, J	58129	Part Number			
	NNO		120		20		-	022723	d to (mL): Lot Number	071726 Ambient (20 °C) <b>1000</b> 6UTB	58029 071723 Copper (Cu)	100
	230		130		а О		53.422 B	0.1000	2000.02 Dilution Factor	°,	(T	
			0		-		ac]:58	200.0	0.058 Initial Vol. (mL)	5E-05		
	840 840		<b>4</b> 0		6		33.422 sec]:58029.D# [Count] [Linear]	0.084	Flask Uncertainty Uncertainty Pipette (mL) C	Balance Uncertainty		Certified R
1 of 2	N 5		1 0		n O		Count] [L	1000	Flask Uncertainty Uncertainty Nominal Pipette (mL) Conc. (µg/mL)	L.C. Z	Lot # 21110221	Reference M
	N 00		1.00		Ø		lnear]	10000.5	Initial Conc. (µg/mL)	(mL)	<u> </u>	laterial
	0						_	1000.0	Final ) Conc. (µg/mL)			CRM M5751
			0		70			2.2	Expanded Uncertainty ) +/- (µg/mL)	Reviewed By:		
Prin			0		8 8			10031-43-3	CAS			
Printed: 8/24/2023, 4:18:28 PM			190		0			3 1 mg/m3	SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LDSO	Pedro L. Rentas		
023, 4:1			N		4			m3	<b>SDS Information</b> Safety Info. On Attac HA PEL (TWA)	Rentas		ANAI AR-1 https://
8:28 PM			200		100			orf-rat 794 mg/kg	<b>on</b> ttached pg.) LDS0	071723	00743	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
								(g 3114	NIST	22	5	Accredited ate Number ndards.com

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

Lot # 071723

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Certified Reference Material CRM



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							Trace M	letals	Verification	Ition	by ICP-MS		(ng/mL)						
		and a second sec	State of the state				State State State State	All and a state	Total a losse	The second s	AND STREET	Nonese and			and a state of the second				and the second second
R	<0.02	3	<0.02	δ	<0.02	Hf	<0.02	Ц	<0.02	N	<0.02	Ł	<0.02	Se	<0.2	176	<0.02	M	<0.02
Sb	<0.02	J	40.2	卤	40.02	Ho	₹0.02	3	<0.02	£	<0.02	Re	<0.02	ŝ	≤0.02	Je T	€0.02	þ	<0.02
As	<02	ථ	<0.02	nE	¢0.02	ч	Ø.02	Mg	10.0>	ő	<0.02	Rh	<0.02	Ag	<0.02	F	≤0.02	>	<0.02
Ba	<0.02	ő	<0.02	3	40.02	Ч	Q.02	Ma	<0.02	R	<b>40.02</b>	ВЪ	\$0.02	Na Na	40.2	f	\$0.02	Å	<0.02
Be	F	5	40.02	ç	<0.02	£	<02	Hg	<02	۵.	<0.02	Ru	≤0.02	š	<0.02	Tm	€0.02	×	<0.02
Bi	40.02	රී	<0.02	පී	<0.02	4	<0.02	Mo	<0.02	۶,	<b>40.02</b>	Sm	≤0.02	s	<0.02	r.S	<0.02	Zu	<0.02
æ	<0.02	ð	<0.02	Au	<0.02	£	40.02	PN	<0.02	Ж	<0.2	Sc	<b>40.02</b>	Ta	<0.02	F	40.02	N	<0.02
									(T) = Tarr	pet analy	yte								A second s

Physical Characterization:

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

**Certified by:** 

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

- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
  - All standard containers are meticulously cleaned prior to use.
- Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
  - Standards are certifed ( $\frac{1}{4}$ ) 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 55 M 4	m/2->	1.0E5	m/≥-> 2.0E5	N G M G	。 0 而 5	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 # 071122	210		110 120		10 No		[1] Spectrum No.1	(W) (Sn) INO10 SND042023A1	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	
	240		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
	N 80 260		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		e			16919-	Expanded Uncertainty (Solv +/- (µg/mL) CAS#	Formulated By:		PPFP 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
			ō		ŏ			NA 3161a		071123 071123		ANAB ISO 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.absoiutestandards.com	5				<b>V</b>	AR-1539 Certificate Number https://Absolutestandards.com
Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	iductively Coupled	Plasma Mass Spec	trometry (ICP-MS):			
		Trace Metals	Verification	by ICP-MS (µg/mL)		
AI <0.02 Cd <0.02	areas a	4003				
		0 0 0 0 0 0 0 0 0	<0.02 Ni 0.02 Nb		Se 40.2 Tb Si 40.02 Te	
2 2 6			<0.01 Os <0.02 Pd	Rb Rb		\$ < c
	Ga 40.02		40.2 P	Sm Sm		
			(T) = Tamet		Ta <0.02 Ti	<0.02 Zr <0.02
Physical Characterization:						
Homogeneity: No heterogeneity was observed in the preparation of this standard.	s observed in the prepa	ation of this standard.				//
ž	₹,					in P fler
		4			2.	
					٠	
<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 politored with using balances.</li> </ul>	icentration calculate deionized water, ca rds. neticulously cleaned	d from gravimetric librated Class A gla prior to use.	and volumetric measurer ssware and the highest p	ments unless otherwise stated. Jurity raw materials are used in	e stated. e used in	

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

Part # 57050 Lot # 071123

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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'VI 58001	Nitric Acid	1000.0		
Certified Reference Material CRM $02109124$	Solvent: Nttric Acid 40.0 (mL) httal bittal Conc. (ug/mL)	10000.0		
artified Reference   0 Z   0 9 1 2 4	Lot # C 24002546 2.0% 2.0% Nominat Nominat Conc. (rg/mL)	1000	34.243 eec]:58027.D# [Count] [Linear] 30 40 50 130 140 150 230 240 250	1 of 2
Certified F		0.084	240 240 240	
Å	5E-05 0.058 on Initial or Vol. (mL)	00 200.0	3 eec]:55 230 30 23 130	
	57027 091923 Cobait (Co) 091926 Ambient (20 °C) 1000 6UTB 6UTB 6UTB d to (mL): 2000.02 Lot Dilution Lot Dilution	23 0.1000		
	57027 091923 Cobalt ( Cobalt ( Ambient Ambient 1000 6UTB ss diluted to (mL Part Lot	58127 050923		
Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description: Cobait (C Cobait (C Cobait (C 091926 Recommended Storage: Nominal Concentration (µg/mL): Nominal Concentration (µg/mL): Nominal Concentration (µg/mL): NIST Test Number: COTB NIST Test Number: COTB CODAIT (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			www.	4	2000		400			-	000	4					and the second se		
_	20.02	3	20.05	5	20.02	Ħ	<0.02	Ξ	40.0Z	ź	40.02	£	40.02	8	40.2	ß	₫0.02	M	<b>60.02</b>
_	40.02	రో	<b>4</b> 02	山	<0.02	Ho	<0.02	5	<0.02	Ż	€0:02	Re	<0.02	3	≤0.02	Ъе	<0.02	Ð	<0.02
_	<b>6</b> <b>6</b>	ඊ	€0.05	圕	<0.02	Ч	<0.02	Mg	<0.01	ő	≤0.02	Rh	≤0.02	Ag	<b>40.02</b>	F	<0.02	Þ	<0:02
_	€0.02	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	ዳ	<0.02
	<0.01	გ	≤0.02	g	<b>20.0</b> 2	ङ	<b>4</b> 02	Hg	40.2	۵.	40.02	Ru	<0.02	ي.	≪0.02	Ta	<0.02	Υ	€0.02
	<0.02	ර	£-	ö	40.02	Ľ	40 10 10	Mo	<u>60.02</u>	æ,	<0.02	Sm	<0.02	S	<0.02	Sn	<0.02	2	<u>6.02</u>
	<0.02	õ	<0.02	Au	<b>40.02</b>	£	<b>40.02</b>	PN	40.02	м	40.2	8	<b>40.02</b>	Ľ	40.02	F	40.02	72	2002

Physical Characterization:

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

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

the preparation of all standards.

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

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

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

Certified by:

Printed: 2/8/2024, 5:01:04 PM	1 of 2	323	Part # 57033 Lot # 111323
NBO	230 240 250	210	rπ/≥->
			а 0 0
160 170 180 190 200	130 140 150	110 120 1	m/≥->
			N.55 64
80 70 80 100	30 40 50	10 NO	m/≥-> 5.0⊑4
			1.005
	34.433 sec]:57033.D# [Count] [Linear]	[1] Spectrum No.1 [ 34.433	2.065
1000.0 2.0 7440-38-2 0.5 mg/m3 orl-rat		58133 020522 0.1000	1. Arsenic (As)
Expanded SDS Information Initial Final Uncertainty (Solvent Safety Info. On Attached pg.) Conc. (ug/mL) Conc. (ug/mL) +/- (ug/mL) CAS# OSHA PEL (TWA) LD50	Uncertainty Nominal ) Pipette (mL) Conc. (µg/mL)	Part Lot Dilution Number Number Factor	Compound
Reviewed By: Pedro L. Rentas 111323	5E-05 Balance Uncertainty 0.06 Flask Uncertainty	Volume shown below was diluted to (mL): 4000.0	Volume shown below y
Head in Hearter			Expiration Date: Recommended Storage: Nominal Concentration (µg/mL):
80.0 Nitric Acid Formulated By: Lawronce Borne 411000	24002546 2.0%	Part Number: 57033 Lot Number: 111323 Description: <u>Arsenic (As)</u>	Part Dea
Solvent:	Lot #		CERTIFIED WEIGHT REPORT:
ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	Certified Reference Material CRM ? のス/のペ (ヱ-Ӌ しいくろ	Inc.	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):

Cd         A002         Dy         A002         Hf         A002         Li         A002           Ca         A02         Er         A02         Hf         A002         Li         A002           Ca         A02         Er         A02         Hf         A002         Li         A002           Ca         A02         Er         A02         Hf         A002         Li         A002           Ca         A02         Gd         A002         In         A002         Mg         A001           Ca         A02         Ge         A002         Fe         A02         Mg         A002           Ca         A02         Ge         A022         Ha         A022         Mg         A022           Ca         A02         Ge         A02         He         A02         Mg         A02           Ca         A02         Ge         A02         He         A02         Mg         A02           Ca         A02         He         A02         Mg         A02         A02         Mg         A02           Ca         A02         Au         A02         He         A02         Mg         A02	4002       Cl       4002       Cl       4002       Cl       4002       Cl       4002       Fr       4002         T       Ca       402       Er       4002       Hr       4002       Li       4002       Fr       4002         T       Ca       402       Er       4002       Hr       4002       Li       4002       Fr       4002         4002       Ca       402       Er       4002       Hr       4002       Nh       4002       Fr       4002         4002       Ca       4002       Fr       4002       Mr       4002       Nh       4002       Re       4002         4002       Ca       4002       Fr       4002       Mr       4002       Rh       4002         4002       Ca       4002       Fr       402       Hr       4002       Rh       4002         4002       Ca       4002       Fr       402       Hr       4002       Rh       4002         4002       Ca       4002       Fr       4002       Rh       4002       Sh       4002         4002       An       4002       Fr       4002       Rh       400	ADM2       CA       ADM2       Dy       ADM2       Hf       ADM2       Li       ADM2       Ni       ADM2       Pr         T       Ca       AD2       Er       ADM2       Hf       ADM2       Li       ADM2       Ni       ADM2       Pr       ADM2         T       Ca       AD2       Er       ADM2       Hf       ADM2       Li       ADM2       Ni       ADM2       Pr       ADM2         ADM2       Ca       ADM2       Er       ADM2       Hf       ADM2       Li       ADM2       Ni       ADM2       Pr       ADM2         ADM2       Ca       ADM2       Er       ADM2       Ir       ADM2       Ni       ADM2       Pr       ADM2         ADM2       Ca       ADM2       Fr       ADM2       Mr       ADM2       Rit       ADM2         ADM2       Ca       ADM2       Fr       ADM2       Mr       ADM2       Rit       ADM2         ADM2       Ca       ADM2       Fr       ADM2       Rit       ADM2       Rit       ADM2         ADM2       Ca       ADM2       Rit       ADM2       Rit       ADM2       Rit       ADM2	ADV2         CA         ADV2         Dy         ADV2         Hf         ADV2         LI         ADV2         N         ADV2         Pr         ADV2         Pr         ADV2         Fr         ADV2         Hf         ADV2         LI         ADV2         Nh         ADV2         Pr         ADV2         Nh         ADV2         Nh         ADV2         Pr         ADV2         Nh         ADV2 <th>-</th> <th>1</th> <th>Ľ.,</th> <th>20.05</th> <th>18</th> <th>70.02</th> <th>ę</th> <th>No.4</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>l</th> <th></th> <th></th> <th></th> <th></th>	-	1	Ľ.,	20.05	18	70.02	ę	No.4							l				
4002       Cd       4002       Dy       4002       Hf       4002       Li       4002       Pr         4002       Ca       402       Er       4002       Hf       4002       Li       4002       Re         7       Ca       402       Er       4002       Ho       4002       Li       4002       Re         4001       Cr       4002       Eu       4002       In       4002       Nh       4002       Re         4001       Cr       4002       Gd       4002       Ir       4002       Mg       4001       08       4002       Rh         4001       Cr       4002       Gd       4002       Fr       4002       Mg       4002       Rh         4002       Ge*       4002       Fe       402       Hg       402       P       4002       Rh         4002       Ge*       4002       Li       4002       P       4002       Rh	4002         Cd         4002         Dy         4002         Hr         4002         Li         4002         Pr           4002         Ca         402         Dy         4002         Hr         4002         Ni         4002         Pr           4002         Ca         402         Er         4002         Hr         4002         Ni         4002         Pr           4002         Ca         4002         Er         4002         Hr         4002         Ni         4002         Pr         4002           4001         Ca         4002         Er         4002         Ir         4002         Ni         4002         Re         4002           4001         Ca         4002         Fr         4002         Mi         4002         Re         4002           4002         Ca         4002         Fr         402         Mg         402         Re         4002           4002         Ca         4002         Fr         402         Mg         4002         Ru         4002           4002         Ca         4002         Fr         402         Mg         4002         Sm         4002         Sm         400	A002         CA         A002         Dy         A002         Hf         A002         Li         A002         N         A002         Pr         A002           T         Ca         A02         Er         A002         Hf         A002         Li         A002         Pr         A002         Pr         A002         N         A002         Pr         A002         Pr         A002         Pr         A002         N         A002         Pr         A002         Nn         A002	Ann         Ann <td>3</td> <td>3</td> <td></td> <td></td> <td>4</td> <td>3</td> <td>s</td> <td>3</td> <td>~</td> <td>40.02</td> <td>N</td> <td><b>40.02</b></td> <td>3</td> <td>40.02</td> <td>Au</td> <td>&lt;0.02</td> <td>ß</td> <td>20.02</td> <td>æ</td>	3	3			4	3	s	3	~	40.02	N	<b>40.02</b>	3	40.02	Au	<0.02	ß	20.02	æ
4002       Cd       4002       Dy       4002       Hf       4002       Li       4002       Ni       4002       Pr         4002       Ca       402       Er       4002       Ho       4002       Li       4002       Ni       4002       Pr         4002       Ca       402       Er       4002       Ho       4002       Li       4002       Ni       4002       Re         4001       Cr       4002       Gd       4002       Ir       4002       Mg       4001       Os       4002       Rh         4001       Cr       4002       Gd       4002       Ir       4002       Mg       4001       Os       4002       Rh         4001       Cr       4002       Gd       4002       Ir       4002       Mg       4002       Rh         4001       Cr       4002       Fe       402       Hg       402       Pi       4002       Rh         4002       Cr       4002       Fe       402       Hg       402       Rh         4002       Rh       4002       Fe       402       Hg       402       P       4002       Rh   <	ADD2         Cd         ADD2         Dy         ADD2         Hf         ADD2         L1         ADD2         N         ADD2         Pr         ADD2           T         C4         AD2         Er         AD2         Hf         AD2         L1         AD2         N         AD2         Pr         AD2         AD2         N	Aug       A	If ace metals verification by ICP-MS ( $\mu$ g/mL) $40n^2$ $6n^2$ $6n^2$ $6n^2$ $11^2$ $40n^2$ $11^2$ $1$	<0.02 Sn	40.02			-	40.02	Sin	<0.02	P	A0.02	Mo	20.02	5		ģ	20.02	2	10.04	1 <u>5</u>
4002         Cd         4002         Dy         4002         Hf         4002         Li         4002         Ni         4002         Pr           4002         Ca         402         Er         4002         Hf         4002         Li         4002         Pr           4002         Ca         4002         Er         4002         Ho         4002         Li         4002         Re           4001         Cr         4002         Gd         4002         Ir         4002         Mg         4001         Os         4002         Re           4001         Cr         4002         Gd         4002         Ir         4002         Mg         4001         Os         4002         Rh           4001         Cr         4002         Gd         4002         Ir         4002         Mg         4002         Rh           4001         Cr         4002         Gd         4002         Ir         4002         Rh         4002         Rh           4001         Cr         4002         Rt         4002         Rh         4002         Rh         4002         Rh	ADD2         Cd         ADD2         Dy         ADD2         Hf         ADD2         Li         ADD2         Ni         ADD2         Pr         ADD2           T         Cc         ADD2         Er         ADD2         Hf         ADD2         Li         ADD2         Ni         ADD2         Pr         ADD2         Re         ADD2	Aug         Aug <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td>&lt;0.02 Tm</td> <td>40,02</td> <td></td> <td>_</td> <td>s</td> <td>40.02</td> <td>Ru</td> <td>&lt;0.02</td> <td>•</td> <td><b>CU</b>.2</td> <td>8u</td> <td>202</td> <td>. 4</td> <td>0.02</td> <td>) ¢</td> <td>3</td> <td>3 1</td> <td>3</td> <td>R !</td>	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	<0.02 Tm	40,02		_	s	40.02	Ru	<0.02	•	<b>CU</b> .2	8u	202	. 4	0.02	) ¢	3	3 1	3	R !
4002         Cd         4002         Dy         4002         Hf         4002         Li         4002         Ni         4002         Pr           4002         Ca         402         Er         4002         Hf         4002         Li         4002         Ni         4002         Pr           4002         Ca         4002         Er         4002         Ho         4002         Li         4002         Ni         4002         Re           4002         Ca         4002         Eu         4002         In         4002         Mg         4001         Os         4002         Re           4002         Ca         4002         Eu         4002         In         4002         Mg         4001         Os         4002         Re	ADD2         Cd         ADD2         Dy         ADD2         Hf         ADD2         Li         ADD2         Ni         ADD2         Pr         ADD2           T         Ce         ADD2         Er         ADD2         Hf         ADD2         Li         ADD2         Ni         ADD2         Pr         ADD2           T         Ce         ADD2         Er         ADD2         Hn         ADD2         Li         ADD2         Ni         ADD2         Re         ADD2           ADD2         Cs         ADD2         En         ADD2         In         ADD2         Ni         ADD2         Re         ADD2           ADD2         Cs         ADD2         En         ADD2         In         ADD2         Ni         ADD2         Re         ADD2           ADD2         Cs         ADD2         En         ADD2         In         ADD2         Ni         ADD2         Re         ADD2           ADD2         Cs         ADD2         Fr         ADD2         Ni         ADD2         Rh         ADD2	AD02       Cd       AD02       Dy       AD02       Hf       AD02       Li       AD02       Ni       AD02       Pr       AD02         T       Ca       AD2       Et       AD02       Hf       AD02       Li       AD02       Ni       AD02       Pr       AD02         T       Ca       AD02       Et       AD02       Hf       AD02       Li       AD02       Ni       AD02       Re       AD02         AD02       Ca       AD02       Et       AD02       In       AD02       Ni       AD02       Re       AD02         AD02       Ca       AD02       Et       AD02       In       AD02       Ni       AD02       Re       AD02         AD02       Ca       AD02       In       AD02       Mg       AD01       Os       AD02       Rh       AD02	ADD2         C4         ADD2         Dy         ADD2         Hf         ADD2         L1         ADD2         Ni         ADD2         Pr         ADD2           T         Ca         AD2         Er         ADD2         Hf         ADD2         L1         ADD2         Nb         ADD2         Pr         ADD2           ADD2         Ca         ADD2         Er         ADD2         L1         ADD2         Nb         ADD2         Re         ADD2           ADD2         Ca         ADD2         Er         ADD2         L1         ADD2         Nb         ADD2         Re         ADD2           ADD2         Ca         ADD2         Er         ADD2         L1         ADD2         Nb         ADD2         Re         ADD2           ADD2         Ca         ADD2         Er         ADD2         Nc         ADD2         Re         ADD2	1 40.2 Th 40.02	40.2	-	-	Z	<0.02	KO	20.02	2	20.02		10.02	<b>1</b>	3	ۍ ا	3	ç	A001	e e
40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr           40.02         Ca         40.2         Er         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr           T         Ce         40.02         Eu         40.02         In         40.02         Ma         40.02         Re           T         Ce         40.02         Eu         40.02         In         40.02         Ma         40.02         Re	40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02           T         Ce         40.02         Er         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02           T         Ce         40.02         Er         40.02         In         40.02         Ni         40.02         Re         40.02	40.02         Cd         40.02         Dy         40.02         Hr         40.02         Li         40.02         Ni         40.02         Pr         40.02           T         Ca         40.2         Er         40.02         Hr         40.02         Li         40.02         Ni         40.02         Pr         40.02           T         Ca         40.2         Er         40.02         In         40.02         Ni         40.02         Re         40.02           T         Ca         40.02         En         40.02         In         40.02         Ni         40.02         Re         40.02	I race metals verification by ICP-MS (µg/mL)         4002       C4       4002       Dy       4002       Hf       4002       Li       4002       Ni       4002       Pr       4002         T       Ce       4002       Ei       4002       Hf       4002       Li       4002       Ni       4002       Pr       4002         T       Ce       4002       Ei       4002       In       4002       Ni       4002       Re       4002         T       Ce       4002       Ei       4002       In       4002       Ni       4002       Re       4002	11 70'05	20.02	_	-	2	20.02	2 2	0.00	2 9	3		3	4	4102	£	40.02	S	A0.02	Ba
Cla         Cla <td>40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02           40.02         Ca         40.2         Er         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02</td> <td>40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02           40.02         Ca         40.2         Er         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02           40.02         Ca         40.2         Er         40.02         H6         40.02         Li         40.02         Ni         40.02         Re         40.02&lt;</td> <td>40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Fr         40.02         Re         40</td> <td></td> <td></td> <td></td> <td>5</td> <td>_</td> <td>3</td> <td>T T</td> <td>4000</td> <td>ç Ç</td> <td>4001</td> <td>Me</td> <td>40.02</td> <td>2</td> <td>40.02</td> <td>臣</td> <td><b>40.02</b></td> <td>ନ</td> <td>T</td> <td>As</td>	40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02           40.02         Ca         40.2         Er         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02	40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02           40.02         Ca         40.2         Er         40.02         Hf         40.02         Li         40.02         Ni         40.02         Pr         40.02           40.02         Ca         40.2         Er         40.02         H6         40.02         Li         40.02         Ni         40.02         Re         40.02<	40.02         Cd         40.02         Dy         40.02         Hf         40.02         Li         40.02         Ni         40.02         Fr         40.02         Re         40				5	_	3	T T	4000	ç Ç	4001	Me	40.02	2	40.02	臣	<b>40.02</b>	ନ	T	As
40.02 Cd 40.02 Dy 40.02 Hr 40.02 Li 40.02 Ni 40.02 Pr	40.02 Cd 40.02 Dy 40.02 Hr 40.02 Li 40.02 Ni 40.02 Pr 40.02		ADD     CA     ADD     Dy     ADD     Hf     ADD     Li     ADD     Ni     ADD     Pr     ADD	40.02 Te	40.02	_	23		40.02	R	<b>4</b> .02	<b>Ş</b>	40.02	E	<0.02	Ho	20.02	5	202	ç	AU/UZ	2
			I and the and	A0.2 Tb	40.2		8		20.02	7	20.02	INI	70.02	¢.	10.02	; ;	0.00	1	\$	5	3	<u>a</u>
			I race Metals Verification by ICP-MS (µg/mL)	l	l	l				,	-		2000		COLP	JH	20.02	Þ	40.02	2	40.02	A

(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.

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

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

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

Part # 57033 Lot # 111323

	N G O			
		230	220	m/z-≻ 210
				א. מ מ
				5.0E8
170 180 190 200	150 180	180 140	120 10	m/z-> 110
				N 07 00
				5.0E0
70 80 90 100	50	40	N. O SO	m/z->
				1.0臣4
	nt) [Línear]	12.275 sec]:58105.D# [Count] [Linear]		[1] Spectrum No.1 2.0E4
1000.4 2.0 10043-35-3 2 mg/m3 orl-rat 2660 mg/kg	11.55772 11.56201	99.9999 0.10 17.3 11	IN018 BV082016A1 1000	1. Boric acid (B) IN018
Expanded SDS Information Actual Uncertainty (Solvent Safety Info. On Attached pg.) Conc. (µg/mL) +/- (µg/mL) CAS# OSHA PEL (TWA) LD50	Target Actual Weight (g) Weight (g) (	ssay 96)	Nominal Conc. (µg/mL)	Compound RM#
		O DSR Elset I tanatsintu	1000 4R	Weight shown halow was diluted to (mi ):
Reviewed By: Pedro L. Rentas 071123	(IIII)	5E-05 Batance Uncertainty	t (20 °C)	Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number:
Formulated By: Benson Chan	40.0 Ammonium hydroxide	2.0%	Boron (B)	Description:
hydroxide	Lot # Solvent: MKBQ8597V Ammonium hydroxide	Solvent: MK	57005 071123	CERTIFIED WEIGHT REPORT: Part Number: Lot Number:
-	Certified Reference Material CRM 2.   ののインム M SS 1 4	Certified Refere	*	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
ANAB ISO 17 AR-1539 Cei https://Absolut	ince Material CRI 아이지 지원 나 Lot # BO8597V Ammonium 40.0 Ammonium (mL)	Certified Refere		* Standards, Inc. 31 testandards.com <u>WEIGHT REPORT:</u> Part Number: Lot Number: Description: Expiration Date: Recommended Storage: al Concentration (ug/mL):



**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> ⊧			20.02	3 R	40.02	R	<0.02	Na	40.2	Ţ	40.02	₽¥	<0.02
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(T) = Target analyte

**Physical Characterization:** 

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

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Certified by:

\* 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

$\begin{array}{c c c c c c c c c c c c c c c c c c c $	m/z->	2500	m/z->	500	m/z->-	2.5 114	5.OE4	1. Ammonium dihydrogen phosphate (P)	Compound	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa	CERTIFIED WEIGHT REPORT: Par Lo De	www.absolutestandards.com
R I D 2 M 4 C 1         M 52 15           Interview         Lat*           Solvent:         2111021         Nitric Acid           Provide (P)         2%         40.0         Nitric Acid           2000/2         0.058         Failure inventienty         Environmenty           2000/2         0.058         Failure inventienty         Environmenty         Environmenty           Nominia         Party Uncertainty Assay         Target         Actual         Actual         Commutated By:         Perford L Ren           10000         ease         0.10         27.5         72.7287         72.7287         72.7284         10000.0         30.0         772.78-1         5mg/r           12.074         aeoc)15891 16. D/r         County (Lineau)         Factor Lange         Store         5mg/r           30         40         sio         eo         70         sio         sio         sio           30         40         sio         read         read         read         read           30         40         sio         read         read         read         read         read         read           30         40         sio         read         read         read	N O		110		10		[1] Spectrum		-	Expiration Date: Recommended Storage: I Concentration (µg/mL): NIST Test Number: Weight shown below was d	DRT: Part Number: Lot Number: Description:	om
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g 3186 SRM			9		J				0	041723 041723		tps://Absolutestandards.com

<b>Abs</b>	Absolute ( 800-368-1131 www.absolute	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com	<b>lards</b> , ds.com	Inc.	-				ĉ	rtified Re	eren	Certified Reference Material CRM	ial CR	M					https AF	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	4 Accredited cate Number andards.com
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Part #	57115		Lot # 041723	1723							2 of 2	of 2					Print	Printed: 2/8/2024, 5:01:22 PM	24, 5:0	)1:22 PM	

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

1 of 2

Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).	<ul> <li>* All standard containers are meticulously cleaned prior to use.</li> <li>* All 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>* 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</li> </ul>	<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 measurement of all standards</li> </ul>		Homogeneity: No heterogeneity was observed in the preparation of this standard.	Physical Characterization:	(T) = Target analyte	AI         A002         Cd         A002         Pr         A002         Pr	Trace Metals Verification by ICP-MS (µg/mL)	Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
30			5 2	I She	Certified by:		MI         MI           MI         40.02			ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com

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Expanded SDS Information Uncertainty (Solvent Safety Info. On Attached pg.) NIST +/- (ug/mL) CAS# OSHA PEL (TWA) LDSO SRM	(g) Conc. (µg/mL)	Actual Weight (g)	Target Weight (g)	Uncertainty Assay Purity (%) (%)	Purity (%)	Nominal Conc. (µg/mL)	Lot. Number	RM#	Compound
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Lawrence barry	1 1					20 °C)	071126 Ambient (20 °C) <b>10000</b> Sum	Expiration Date: nended Storage: htration (µg/mL): %T Test Number:	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Teet Number
around Bring	Type 1 Water	ASTM Ty	Lot# 071123	Solvent:		E)	57116 071123 Sulfur (S)	<u>PORT:</u> Part Number: Lot Number: Description:	CERTIFIED WEIGHT REPORT: Part N Lot N Desc
ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	CRM		ference M	Certified Reference Material	R a			om	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
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800-368-1131 www.absolutestandards.com		0	Certified Reference Material CRM	nce Material C	RM			•	ANAB ISO 1: AR-1539 Ce https://Absolut	ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
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Image:	TT/Z->	2500	5000	m/z->	500	 1000	N.00 M.4	5.0E4	1. Ammonium dihydrogen phosphate (P) IN008 PvœzoisAi	Compound	Weight shown below was diluted to (mL):	NIST Test Number:	Recommended Storage: Nominal Concentration (ug/mL):	Expiration Date:	Lot Number: Description:	CERTIFIED WEIGHT REPORT: Part Number:	www.absolutestandards.com
ric Acid Fic Acid Formulated By: Formulated				120		20				Lot Number							R
ric Acid Fic Acid Formulated By: Formulated	240			140		40			89.899 0.10 27.5 7.275	Purity Uncertainty Assay (%) Purity (%) (%)	0.058 Flask Uncertainty	5E-05 Balance Uncertainty					00
Prieved By: Programity Procertainty Procentainty Processory P									.2730	Actual Actual Weight (g) Conc. (µg/mL)				Nitric Acid			M5820
				180					7722-76-1	) CAS			Here ten	Lawrence	forme (		٩

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					e). IST	rials are e abov ity of N	ity raw materials are us le to NIST (see above). the Uncertainty of NIST , D.C. (1994).	able to g the l on, D.(	highest p ts trace; ditions. Xpressin Vashingt	id the f id. yry con y and E ffice, V	sware ar ated with ise state laborate ivaluation rinting O	A glas calibr otherw opriate is for E ment P	ed Class to use. that are , unless ( der appro Guideline Governr	calibrat ad prior alances d value and un , C.E., " 97, U.S	d water, sly clean y using b y using b the state the state hps tight nd Kuyat Note 12	eionize Is. ticuloux ticuloux S96 of 1 B.N. au chnical	<ul> <li>Purmed acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.</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 certifed (+/-) 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>	8.2 me of all s repared ertifed ertifed prence: esult,"	acids, 1 aration s are pi s are ci ards sh nent Refe	<ul> <li>Purmed acids, 18.2 meg the preparation of all si</li> <li>All standard containers</li> <li>Standards are prepared</li> <li>Standards are certifed (</li> <li>All Standards should be</li> <li>Uncertainty Reference: Measurement Result," Measurement Result, " Measurement Result,"</li> </ul>	* * * * * *
·	A.	1º	in the second se	(	stated	henwise	inless of	nents	neasurer	netric n	nd volur	letric a	m gravim	ted fro	n calcula	intratio	The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated	ue is th	fied val	he certi	+ + 7
	y:	Certified by:	Ca									wland	of this stan	paration	in the pre	observed	r nysical Unaracterization: Homogeneity: No heterogeneity was observed in the preparation of this standard	<b>Sterrizal</b> eterogen	y: No he	r nysical Characterization: Homogeneity: No heterogeneity	Ho
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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

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### 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	М	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



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

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

Assay Information:

Assay Method #1	<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 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 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  $(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{\frac{1}{2}}$ k = coverage factor = 2

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

#### 4.0 TRACEABILITY TO NIST

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

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

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

CRM/RM Expanded Uncertainty ( $\pm$ ) = U<sub>CRM/RM</sub> = k ( $u^2_{char a} + u^2_{bb} + u^2_{tts} + u^2_{bs}$ )<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)  $u_{ts}$  = transport stability standard uncertainty

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

#### 4.1 Thermometer Callbration

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

#### **4.2 Balance Calibration**

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

#### 4.3 Glassware Calibration

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

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

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

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

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

#### 6.0 INTENDED USE

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

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

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

#### 7.1 Storage and Handling Recommendations

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

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

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

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

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

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

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

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

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

#### 8.0 HAZARDOUS INFORMATION

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

#### 9.0 HOMOGENEITY

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

#### 10.0 QUALITY STANDARD DOCUMENTATION

#### 10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

#### **11.1 Certification Issue Date**

February 20, 2024

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

#### 11.2 Lot Expiration Date

#### - February 20, 2029

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

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

#### **11.3 Period of Validity**

- Sealed TCT Bag Open Date:

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

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

Uyen Truong **Custom Processing Supervisor** 

#### **Certificate Approved By:**

Muzzammil Khan Stock Laboratory Supervisor

Mayn Mung Mayni Kh Paul R Laina

**Certifying Officer:** 

Paul Gaines Chairman / Senior Technical Director

	m/z-> 210	1.0E8	N. O E B	m/z-≻ 110	-1 -0 	m/z-> 10 2.0E8	1.0 [[]	[1] Spectrum No.1 2.0E4	1. Selenium (Se)	Compound	Volume shown below was diluted to (mL):	Expiration Date: Recommended Storage: Nominal Concentration (µg/mL):	Lot Number: Description:	CERTIFIED WEIGHT REPORT:	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
	0			0		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)		
	230			130		80		90C]:58	200.0	Initial Vol. (mL)	5E-05 0.100				
	240			140		4 0		034.D#	0.084	Initial Uncertainty Vol. (mL) Pipette (mL)	Balance Uncertainty Flask Uncertainty				Sertified Referen
	250			150		. (л О		33.702 sec]:58034.D# [Count] [Linear]	1000	Nominal Conc. (µg/mL)	rtainty nty		2.0%	Lot #	Reference 162.
	260			160		60		inear]	10002.5	Initial Conc. (µg/mL)		(mL)	40.0	Solvent:	Certified Reference Material CRM からすチェート・アンの
				170		70			1000.0	Final Conc. (ug/mL)	11		Nitric Acid		114
				ŏ		0			2.2	Expanded Uncertainty +/- (µg/mL)	Reviewed By:	<i>M</i>	Formulated By:		24
				180		80			7782-49-2	0	×	20	BY		
				190		90			0.2 mg/m3	SDS Information nt Safety Info. On Att: OSHA PEL (TWA)	Pedro L. Rentas		Benson Chan		ਤ
				200		100			3 orl-rat 6700 mg/kg	SDS Information (Solvent Safety Info. On Attached pg.) AS# OSHA PEL (TWA) LDS0	1tas 060624	,	n 060624		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com
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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         Gd         40.02         In           Ba         40.02         Cit         40.02         Gd         40.02         In           Bi         40.02         Cit         40.02         Ge         40.02         In           Bi         40.02         Cit         40.02         Ge         40.02         In           Bi         40.02         Cit         40.02         Ain         40.02         Ia		Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):	Absolute Standards, Inc. 800-368-1131 www.absolutiestandards.com
2 01 2	<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**

Refine your results. Redefine your industry.

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com



#### 1.0 ACCREDITATION / REGISTRATION

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



# 2.0 PRODUCT DESCRIPTION

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

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

Assay Information:

3.0

Assay Method #1	<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>CRMRM</sub>, where two or more methods of characterization are used is the weighted mean of the results:

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

- $X_{i}$  = 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				
М	Cd	<	0.000760	М	lr –	<	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

# 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:**

soay morma			
ANALYTE	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
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>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



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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:	CHEM-CLP-4			
Lot Number:	V2-MEB746172			
Matrix:	3% (v/v) HNO3 3% (v/v) HF			
Value / Analyte(s):	1 000 μg/mL ea:			
	Boron,	Molybdenum,		
	Silicon,	Tin,		
	Titanium			

#### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

CERTIFIED VALUE 1 000 ± 5 µg/mL	ANALYTE Molybdenum, Mo	CERTIFIED VALUE 1 000 ± 5 µg/mL	
1 000 ± 7 µg/mL	Tin, Sn	1 000 ± 5 µg/mL	
1 000 ± 6 µg/mL			
1.032 g/mL (measure	ed at 20 ± 4 °C)		
METHOD	NIST SRM#		SRM LOT#
ICP Assay	3107		190605
Calculated			See Sec. 4.2
ICP Assay	traceable to 3134		U2-MO739068
ICP Assay	Traceable to 3150		S2-SI702546
ICP Assay	3161a		140917
ICP Assay	traceable to 3162a	1	T2-T1725816
	1 000 ± 5 μg/mL 1 000 ± 7 μg/mL 1 000 ± 6 μg/mL 1.032 g/mL (measure METHOD ICP Assay Calculated ICP Assay ICP Assay ICP Assay	Molybdenum, Mo       1 000 ± 5 μg/mL     Tin, Sn       1 000 ± 7 μg/mL     Tin, Sn       1 000 ± 6 μg/mL     1.032 g/mL (measured at 20 ± 4 °C)       METHOD     NIST SRM#       ICP Assay     3107       Calculated     ICP Assay       ICP Assay     Traceable to 3134       ICP Assay     Traceable to 3150       ICP Assay     3161a	Molybdenum, Mo         1 000 ± 5 μg/mL           1 000 ± 7 μg/mL         TIn, Sn         1 000 ± 5 μg/mL           1 000 ± 6 μg/mL         TIn, Sn         1 000 ± 5 μg/mL           1 000 ± 6 μg/mL         1 000 ± 6 μg/mL         1 000 ± 5 μg/mL           1 000 ± 6 μg/mL         NIST SRM#         I CP Assay           ICP Assay         3107         Calculated           ICP Assay         traceable to 3134           ICP Assay         Traceable to 3150           ICP Assay         3161a

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<sub>i</sub> = mean of Assay Method i with standard uncertainty uchar i
- $\mathbf{w}_{l}$  = 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  $\{u^2_{cher} + u^2_{bb} + u^2_{its} + u^2_{ts}\}^{1/2}$ 

- k = coverage factor = 2
- $u_{cher} = \left[\Sigma((w_j)^2 (u_{char,j})^2)\right]^{\frac{1}{2}}$  where  $u_{char,j}$  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<sub>CRM/RM</sub>, where one method of characterization is used is the mean of individual results:

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

CRM/RM Expanded Uncertainty (±) = U<sub>CRM/RM</sub> = k ( $u^2_{chara} + u^2_{bb} + u^2_{its} + u^2_{ts}$ )<sup>½</sup> k = coverage factor = 2 uchara = the errors from characterization u<sub>bb</sub> = bottle to bottle homogeneity standard uncertainty u<sub>its</sub> = long term stability standard uncertainty u<sub>its</sub> = long term stability standard uncertainty (storage)

uts = transport stability standard uncertainty (storage)

- 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

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

#### **11.1 Certification Issue Date**

August 12, 2024

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

#### 11.2 Lot Expiration Date

#### - August 12, 2029

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

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

- Sealed TCT Bag Open Date:

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

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Approved By:** 

Joseph Burns **Custom VS Manager** 

Paul R Saines

**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

- $u_{char} = \left[ \sum ((w_i)^2 (u_{char})^2) \right]^{\frac{1}{2}}$  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"

- 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**

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



## **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

- $u_{char} = \left[ \sum ((w_i)^2 (u_{char})^2) \right]^{\frac{1}{2}}$  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  $u_{bb} =$  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"

- 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**

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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$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	λ.	21	2002	9 8	0.02	3 6	10.02	311	20.02	2	<0.02	MO	20.02	5	Z0102	ନ୍ନ	<0.02	S	<0.02	<u>B</u> .
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$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	Y	<0.02	Tm	<0.02	S	<0.02	Ru	<0.02	ŋ	40,2	Hø	40.2	21	40.02	<u>.</u>	AD 03	2	100	5
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
Cd           CD         Li  <	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       Nb       40.02       Se       40.2       Tb       40.02       U         40.02       Ca       40.02       Ho       40.02       Lu       40.02       Nb       40.02       Si       40.02       Tc       40.02       U	56	ģ <	20.02		20.02	Ag	<0.02	Rb	<0.02	0s	Ţ	Mg	<0.02	In	<0.02	臣	<0.02	ŝ	<0.2	As
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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	Zn	<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.

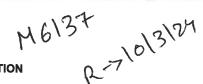
\* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

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

Aleya Mung Monggini Kh Paul R Laina

## **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 7 0	
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 40 150 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         Re         -6.02           -6.02         Ga         -6.02         Nn         -6.02         Re         -6.02         Re         -6.02           -6.02         Ga         -6.02         Fe         -6.02         Re         -6.02         Re         -6.02           -6.02         Ga         -6.02         Fe         -6.02         Re         -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	No. of Concession, name	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         <0.02         Mg         <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   La   <0.02   La   <0.02   Mo   <0.02   F1   <0.02   300   <0.02   3		<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	1.068	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	$\frac{57119}{103024} R \rightarrow 1/13/2.5$ $\frac{103024}{103024} M (K) M (14) M (14)$	
		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.

\* 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.

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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 # 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	ADDRESS IN STATISTICS OF THE S		
	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	O. N. M. N. LAN.		
	Pb	La	Fe	Ir	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		
	74	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.

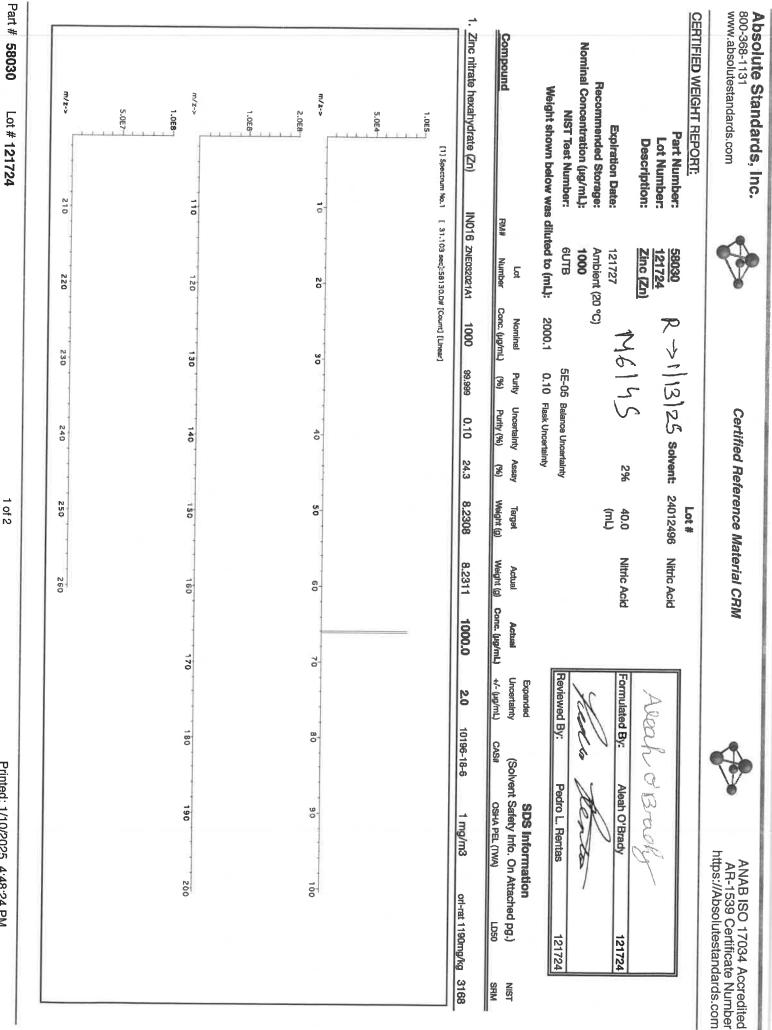
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All standard containers are meticulously cleaned prior to use.

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

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

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1 of 2

Printed: 1/10/2025, 4:48:24 PM

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	;	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	0 M	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	Ş	10.02	00	10.00						5	2	2	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



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

16150

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

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

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

Safety Data Sheets Available Upon Request

## (A) SAMPLE DESCRIPTION

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

## (B) BREAKAGE OR MISSING ITEMS

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

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

## (C) ANALYSIS OF SAMPLES

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

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

RMs ICV 1, 5, 6 SFAM.docx

Page 1 of 2

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



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



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

APTIM	Instructions for QATS Reference Material: Inorganic ICV Solutions
ICV1-1014	For ICP-MS analysis, use a 50-fold dilution by pipetting 2 mL of the ICV1 concentrate into a 100 mL volumetric flask and dilute to volume with 1% (v/v) nitric acid.
ICV5-0415	For the cold vapor analysis of mercury by AA, use a 100-fold dilution by pipetting 1 mL of the ICV5 concentrate into a 100 mL volumetric flask and dilute to volume with 2% (v/v) nitric acid. The ICV5 concentrate is prepared in 0.05% (w/v) K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> and 5% (v/v) nitric acid.
ICV6-0400	For the analysis of cyanide, use a 100-fold dilution by pipetting 1 mL of the ICV6 concentrate into a 100 mL volumetric flask and dilute to volume with Type II water. Distill this solution along with the samples before analysis. The cyanide concentrate is prepared from $K_3Fe(CN)_6$ , Type II water, and 0.1 % sodium hydroxide, and will decompose rapidly if exposed to light.

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

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

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

	ICV5-0415	and a street	ICV6-0400
Element	Concentration (µg/L) (after 100-fold dilution)	Analyte	Concentration (µg/L) (after 100-fold dilution)
Hg	4.0	CN-	99

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





M6151

R-> 1/15/25

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

## **Certificate of Analysis**

Test	Specification	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 <b>.0</b> 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



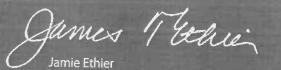


Material No.: 9530-33 Batch No.: 22G2862015

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 - Gallium (Ga) $\leq 10.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Gold (Au) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Iron (Fe) $\leq 40.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lead (Pb) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ Trace Impurities - Lithium (Li) $\leq 20.0 \text{ ppb}$ $< 1.0 \text{ ppb}$ 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 - Magnesium (Mg) $\leq 20 \text{ ppb}$ $< 1.0 \text{ ppb}$ 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/ml	3 par/ml

Nitric Acid 69% CMOS





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

Test			
	Specification	Result	

For Microelectronic Use

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

Junie Croak Director Quality Operations, Bioscience Production

 N.5 M	m/z-> 110 5.0⊑6	ហ ៣ ហ	m/z-> 10	ប ០ ព ព	[1] Spectrum No.1 1.0E7	1. Silver nitrate (Ag)	Compound	CERTIFIED WEIGHT REPORT:         Part Number:         Part Number:         Lot Number:         Lot Number:         Description:         Silver (A         Description:         Description:         Silver (A         Description:         Optimize:         Ambient (22826         Recommended Storage:         Ambient (200         Nominal Concentration (µg/mL):         NUST Test Number:         BUTB         Weight shown below was diluted to (mL):	Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com
	0 120		N		-	IN035 J0612AGA1 100	Lot Nominal RM# Number Conc. (µg/mL)	57047 122823 Silver (Ag) 122826 Ambient (20) 1000 6UTB 6UTB 6UTB	
	190 140		80 40		14.044 sec]:58147.D# [Count] [Linear]	88.8888 0.10	Nominal Purity Uncertainty Assay nc. (µg/mL) (%) Purity (%) (%)	PC) 5E-05 Balance Uncertainty	Certified I
	150		5 O		[Count] [Linear]		Target Weight (g)	Lot # 29% 80.0 (mL)	Certified Reference Material lろ ヱӋ
	160 170		60 70			1000.0	E Actual Actual Ur Weight (g) Conc. (µg/mL) +/	Nitric Acid	rial CRM M6030
	180		80			<b>2.0</b> 7761-88-8	Expanded Uncertainty (Solver +/- (µg/mL) CAS#		30
	190 200		90 100			10 ug/m3	SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD5	Benson Chan Pedro L. Rentas	AN
	0		Ŭ			NA 3151	ched 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):

							1 900 100	-lecais	VCITICA		by ICFT	SIC 1	hailer						
			The station		Salar She hade		12 2 2 2 20	14 - 14 14 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		<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	<0.02	d	<0.02
As	<b>4</b> 0.2	ĉ	<0.02	臣	<0.02	In	<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	ନ୍ମ	<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	5	<0.02	Mo	<0.02	Ŗ	<0.02	Sm	<0.02	Ś	<0.02	Sh	<0.02	7	<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.

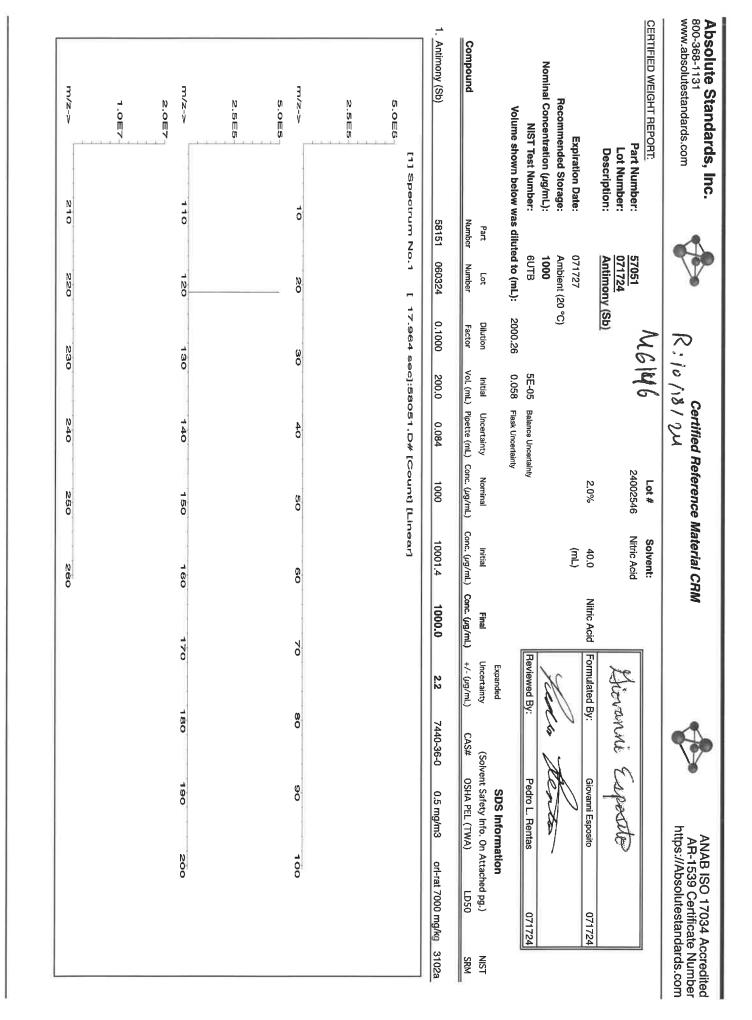
the preparation of all standards.

\* 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):

	_	Be <0							
		<0.01							
5	S	ç	ŝ	ç	ဂ္ခ	8			
<0.02	<0.02	<0.02	<0.02	<0.02	<0.2	<0.02			
Au	ନ୍ଚ	Ga	Gd	Eu	면	Dy			
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	A CONTRACTOR		
Рђ	La	Fe	Ir	ln	Ho	Hf			
<0.02	<0.02	<0.2	<0.02	<0.02	<0.02	<0.02		Irace M	
Nd	Mo	Hg	Mn	Mg	Lu	Li		letals	-
<0.02	<0.02	<0.2	<0.02	<0.01	<0.02	<0.02		Ventica	
K	Pt	P	Pd	ő	Å	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	Pr		31) 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			
Ti	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

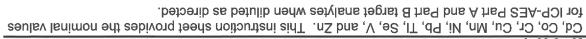
QATS Form 20-007F189R01, 01-17-2023



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

## "msrgor9 beiitithe0 &t02:1000 OSI nA" **Ουλιτή Assurance technical support laboratory**





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

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

.23A-93 vd noitulos 8A231 sidt 92vlsnA .50VH and 10 mL of the ICSB solution into a 100 mL volumetric flask and dilute to volume with 2% v/v ICSB-0710, Analytes, mixed with ICSA-1211, Interferents: Pipet 10 mL of the ICSA solution

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

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

		0120-85	XED WITH IC	IM FIST-AS			
HgiH timi1 high	woJ Low Low	Part A +Part B (µg/L)	(hgiH) timit (L)(L)	woJ Low Low	Part A (µg/L)	כצסר	tnemel
282000	509000	247000	594000	216000	522000	200	IA
111	929	819	0.03	0.08-	(0.0)	09	qs
120	68.4	104	0.01	0.01-	(0.0)	01	sA
737	285	(283)	506	±61-	(0.8)	500	Ba
029	450	462	0.8	0.8-	(0.0)	0.8	Be
1150	826	776	0.9	0.1-	(0.1)	0.8	Cq
271000	166000	532000	282000	208000	542000	2000	вЭ
624	400	242	62.0	45.0	(0.23)	01	Cr
248	404	924	20.0	-20.0	(0.0)	90	၀၂
588	434	211	27.0	-53.0	(0.2)	52	ng
114200	84400	00266	116500	00958	101000	100	Fe
0.68	39.0	(0.94)	0.01	0.01-	(0.0)	10	ЪР
286000	210000	548000	594000	216000	565000	2000	бM
<b>5</b> 84	430	209	22.0	0.8-	(0.7)	91	uM
0011	810	964	45.0	-38.0	(0.2)	40	!N
0.18	0.11	(0.94)	36.0	-32'0	(0.0)	32	əS
532	021	201	0.01	0.01-	(0.0)	10	бĄ
133	83.0	(801)	55.0	-25.0	(0.0)	52	L IL
295	417	461	20.0	-20'0	(0.0)	90	Λ
9001	608	652	0.08	0.08-	(00)	09	l uZ

## Table 1. "CERTIFIED VALUES" FOR INTERFERENCE CHECK SAMPLE ICP-AES ICSA-1211,

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

0.08-

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Page 2 of 2

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0.00

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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,

Page 1 of 2

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)	
AJ	200	255000	216000	294000	247000	209000	285000	
Sb	60	(0.0)	-60.0	60.0	618	525	711	
As	10	(0.0)         -10.0           (6.0)         -194           (0.0)         -5.0           (1.0)         -4.0           245000         208000           (52.0)         42.0		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<sup>™</sup>) see the Limited License to Use PCRM<sup>™</sup> 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<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 - 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



## **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	Μ	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				
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М	Cs	<	0.000990	М	Lu	<	0.002970	М	Ru	<	0.000989	М	V	<	0.001980				
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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<sup>™</sup>) see the Limited License to Use PCRM<sup>™</sup> 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<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 - 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		Par Loi De	Expiration Date: Recommended Storage:	NIST Tex	Weight showr		Compound		N. O	1.000	m/z->	1.0E4	5 0 0	m/z->-	1.0世8	5. 0 8	ITVZ->
	CERTIFIED WEIGHT REPORT:	Part Number: Lot Number: Description:	Expiration Date: nended Storage:	NIST Test Number:	Weight shown below was diluted to (mL):		VIMH.	[1] Spectrum No.1			10			110			012
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ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com			062724	062724		SDS Information (Solvent Safety Info. On Attached pg.)	DSG1				100			200			
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Part # 57081 Lot # 062724

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

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Certified by:

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

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

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

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

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Part # 57081 Lot # 062724

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	
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Part # 57023 Lot # 062424





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

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## Physical Characterization:

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

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Certified by:

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

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

\* 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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