

Prep Standard - Chemical Standard Summary

Order ID: 03572

Test: Metals Group3

Prepbatch ID: PB154548,

Sequence ID/Qc Batch ID: LB126984,

Standard ID:

MP75962,MP76408,MP76426,MP76427,MP76428,MP76429,MP76440,MP76765,MP76766,MP76767,MP76768,MP76769,MP76770,MP76771,MP76772,MP76773,MP76774,MP76775,MP76776,MP76777,MP76778,MP76779,MP76780,MP76781,

Chemical ID:

 $M4657,M4707,M4825,M4874,M4875,M4876,M4877,M4878,M4880,M4881,M4882,M4883,M4884,M4885,M4886,M4887,\\M4888,M4889,M4890,M4891,M4892,M5019,M5020,M5184,M5192,M5193,M5200,M5218,M5224,M5227,M5228,M5229,\\M5230,M5231,M5244,M5245,M5286,M5288,M5289,M5293,M5298,M5301,M5387,M5448,M5468,M5473,M5494,M5496,\\M5498,M5513,M5518,M5521,M5545,M5587,M5612,M5614,M5616,M5620,M5626,W2606,$

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Metals STANDARD PREPARATION LOG

Recipe ID 169	NAME 1:1HNO3	NO. MP75962	Prep Date 06/23/2023		Prepared By Al-Terek Isaac	<u>ScaleID</u> None	PipetteID None	Supervised By Sarabjit Jaswal 06/23/2023
FROM	1250.00000ml of M5587 + 1250.0000	00ml of W26	606 = Final Q	uantity: 2500.0	00 ml			

Recipe ID	NAME	<u>NO.</u>	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipetteID</u>	Supervised By Bin He
1122	ICPMS CALIB BLANK(S0/ICB/CCB)	MP76408	07/24/2023	08/14/2023	Sarabjit Jaswal	None	METALS_PIP ETTE_3 (A)	-

FROM 25.00000ml of M5614 + 4925.00000ml of W2606 + 50.00000ml of M5612 = Final Quantity: 5000.000 ml

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Metals STANDARD PREPARATION LOG

ID NAME NO. Prep Date By Sca		
	PipettelD	Bin He
3881 M&B SPIKE-2 MP76426 07/24/2023 08/14/2023 Sarabjit Jaswal N		
	ETTE_3 (A)	07/24/2023

FROM

 $10.00000ml\ of\ M4888+10.00000ml\ of\ M5192+12.50000ml\ of\ M5288+12.50000ml\ of\ M5298+12.50000ml\ of\ M5289+2.50000ml\ of\ M4875+2.50000ml\ of\ M4884+2.50000ml\ of\ M4886+5.00000ml\ of\ M5289+30.00000ml\ of\ MP76408\ =\ Final\ Quantity:\ 100.000\ ml$

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	<u>NAME</u>	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
3882	M&B SPIKE-3	MP76427	07/24/2023	08/14/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	07/24/2023

FROM

0.62500ml of M5513 + 12.50000ml of M4891 + 12.50000ml of M5184 + 12.50000ml of M5521 + 11.87500ml of MP76408 = Final Quantity: 50.000 ml

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Metals STANDARD PREPARATION LOG

Recipe ID	NAME	<u>NO.</u>	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipetteID</u>	Supervised By Bin He
3900	M&B SPIKE-4	MP76428	07/24/2023	08/14/2023	Sarabjit Jaswal	None	METALS_PIP ETTE_3 (A)	_
FROM	6.25000ml of M5193 + 6.25000ml of	M5200 + 6.2	25000ml of M	5468 + 6.2500	0ml of MP76408	= Final Quant	ity: 25.000 ml	

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	NAME.	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
4025	M&B SPIKE-5	MP76429	07/24/2023	08/14/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	07/24/2023

FROM 15.00000ml of M4888 + 15.00000ml of M5192 + 20.00000ml of MP76408 = Final Quantity: 50.000 ml

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Metals STANDARD PREPARATION LOG

Recipe	NAME	NO	D D.4.	Expiration	<u>Prepared</u>	0 - D	Discoutt a ID	Supervised By
	NAME M&B SPIKE-1	NO.	Prep Date 07/24/2023	<u>Date</u> 08/14/2023	<u>By</u> Sarabjit Jaswal	<u>ScaleID</u> None	PipetteID METALS PIP	Bin He
3660	WIXE SPINE-1	<u>IVIF 7 0440</u>	0112412023	06/14/2023	Sarabjit Jaswai	None	ETTE_3 (A)	07/25/2023

FROM 5.00000ml of M4657 + 5.00000ml of M4707 + 5.00000ml of M4825 + 5.00000ml of M4874 + 5.00000ml of M4876 + 5.00000ml of M4877 + 5.00000ml of M4883 + 5.00000ml of M4885 + 5.00000ml of M4889 + 5.00000ml of M5224 + 5.00000ml of M5228 + 5.00000ml of M5229 + 5.00000ml of M5230 + 5.00000ml of M5494 + 30.00000ml of MP76408 = Final Quantity: 100.000 ml

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
1122		MP76765	08/15/2023	08/31/2023	Sarabjit Jaswal	None	None	
	BLANK(S0/ICB/CCB)							08/15/2023

FROM 25.00000ml of M5616 + 4925.00000ml of W2606 + 50.00000ml of M5626 = Final Quantity: 5000.000 ml

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Metals STANDARD PREPARATION LOG

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	<u>NAME</u>	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
2902	S8 ICPMS	MP76766	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	08/15/2023

FROM

1.00000ml of M5496 + 2.50000ml of M5288 + 2.50000ml of M5298 + 5.00000ml of M5200 + 5.00000ml of M5498 + 5.00000ml of M5518 + 79.00000ml of MP76765 = Final Quantity: 100.000 ml

Recipe				Expiration	Prepared			Supervised By
<u>ID</u>	<u>NAME</u>	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
3947	S7(SFAM,6020,200.8)	MP76767	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	08/15/2023

FROM

 $1.00000ml\ of\ M4875+1.00000ml\ of\ M4884+1.00000ml\ of\ M4886+1.00000ml\ of\ M5229+1.00000ml\ of\ M5230+1.90000ml\ of\ M5496+10.00000ml\ of\ M5496+10.00000ml\ of\ M5496+10.00000ml\ of\ M5020+2.50000ml\ of\ M5473+4.00000ml\ of\ M4881+4.00000ml\ of\ M5387+4.90000ml\ of\ M5288+4.90000ml\ of\ M5288+4.90000ml\ of\ M5298+5.00000ml\ of\ M5616+50.00000ml\ of\ M5301+827.10000ml\ of\ W2606+9.00000ml\ of\ M4891+9.00000ml\ of\ M5184+9.00000ml\ of\ M5521+9.90000ml\ of\ M5200+9.90000ml\ of\ M5498+9.90000ml\ of\ M5518=Final\ Quantity:\ 1000.000\ ml$

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Metals STANDARD PREPARATION LOG

Recipe ID	NAME	NO.	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipetteID</u>	Supervised By Bin He
3948	S6(SFAM,6020,200.8)	MP76768	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP ETTE_3 (A)	08/15/2023
FROM	0.50000ml of M5616 + 1.00000ml of	M5626 + 48	3.50000ml of V	W2606 + 50.00	000ml of MP767	767 = Final Qu	antity: 100.000	ml

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	NAME	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
3949	S5(SFAM,6020,200.8)	MP76769	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	08/15/2023

FROM 0.50000ml of M5616 + 1.00000ml of M5626 + 73.50000ml of W2606 + 25.00000ml of MP76767 = Final Quantity: 100.000 ml

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Metals STANDARD PREPARATION LOG

Recipe ID	NAME	NO.	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipettelD</u>	Supervised By Bin He	
3954	S4(SFAM,6020,200.8)	<u>MP76770</u>	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP ETTE_3 (A)	08/15/2023	
FROM 0.50000ml of M5616 + 1.00000ml of M5626 + 86.00000ml of W2606 + 12.50000ml of MP76767 = Final Quantity: 100.000 ml									

Recipe ID	NAME	<u>NO.</u>	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipettelD</u>	Supervised By Bin He
3951	S3(SFAM, 6020,200.8)	MP76771	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP ETTE 3 (A)	

FROM 0.50000ml of M5616 + 1.00000ml of M5626 + 88.50000ml of W2606 + 10.00000ml of MP76768 = Final Quantity: 100.000 ml

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Metals STANDARD PREPARATION LOG

Recipe ID	NAME	<u>NO.</u>	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipetteID</u>	Supervised By Bin He
3955	S2CONC(SFAM,6020,200.8)	<u>MP76772</u>	08/15/2023	08/26/2023	Sarabjit Jaswal	None	None	08/15/2023

FROM

 $0.05000ml\ of\ M4825 + 0.05000ml\ of\ M4874 + 0.05000ml\ of\ M4876 + 0.05000ml\ of\ M4877 + 0.05000ml\ of\ M4881 + 0.05000ml\ of\ M4885 + 0.05000ml\ of\ M4889 + 0.05000ml\ of\ M5184 + 0.05000ml\ of\ M5228 + 0.05000ml\ of\ M5229 + 0.05000ml\ of\ M5230 + 0.05000ml\ of\ M5494 + 0.10000ml\ of\ M4657 + 0.10000ml\ of\ M4891 + 0.10000ml\ of\ M5224 + 0.10000ml\ of\ M5496 + 0.10000ml\ of\ M5521 + 0.25000ml\ of\ M4883 + 0.25000ml\ of\ M4886 + 0.25000ml\ of\ M4888 + 0.25000ml\ of\ M5192 + 0.25000ml\ of\ M5192 + 0.25000ml\ of\ M5192 + 0.25000ml\ of\ M5298 + 0.50000ml\ of\ M4884 + 0.50000ml\ of\ M5387 + 1.25000ml\ of\ M4875 + 1.25000ml\ of\ M4880 + 1.25000ml\ of\ M4880 + 1.25000ml\ of\ M5518 + 2.50000ml\ of\ M5616 + 225.15000ml\ of\ W2606 + 5.00000ml\ of\ M5626 = Final\ Quantity:\ 250.000\ ml$

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	<u>NAME</u>	NO.	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
3956	S2(SFAM,6020,200.8)	MP76773	08/15/2023	08/26/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	08/15/2023

FROM 0.50000ml of M5616 + 1.00000ml of M5626 + 98.00000ml of W2606 + 0.50000ml of MP76772 = Final Quantity: 100.000 ml

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Metals STANDARD PREPARATION LOG

Recipe				Expiration	<u>Prepared</u>			Supervised By		
<u>ID</u>	<u>NAME</u>	NO.	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He		
3957	S1(SFAM,6020,200.8)	MP76774	08/15/2023	08/26/2023	Sarabjit Jaswal	None	METALS_PIP			
							ETTE_3 (A)	08/15/2023		
FDOM	EDOM 0.50000ml of M5616 ± 1.00000ml of M5626 ± 99.50000ml of W2606 ± 10.00000ml of MD76773 = Final Quantity: 100.000 ml									

FROM 0.50000ml of M5616 + 1.00000ml of M5626 + 88.50000ml of W2606 + 10.00000ml of MP76773 = Final Q	uantity: 100.000 ml
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Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	<u>NAME</u>	NO.	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
3959	ICV(6020,200.8)	MP76775	08/15/2023	08/31/2023	Sarabjit Jaswal	None	None	
								08/15/2023

FROM 0.05000ml of M4887 + 0.05000ml of M4890 + 0.05000ml of M4892 + 0.05000ml of M5218 + 0.45000ml of M4878 + 0.45000ml of M5545 + 2.00000ml of M5293 + 96.90000ml of MP76765 = Final Quantity: 100.000 ml

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Metals STANDARD PREPARATION LOG

Recipe ID	NAME.	NO.	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipettelD</u>	Supervised By Bin He
3961	ccv	<u>MP76776</u>	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP ETTE_3 (A)	08/15/2023

FROM

 $0.50000 \text{ml of M4875} + 0.50000 \text{ml of M4884} + 0.50000 \text{ml of M4886} + 0.50000 \text{ml of M5229} + 0.50000 \text{ml of M5230} + 1.00000 \text{ml} \\ \text{of M5019} + 1.00000 \text{ml of M5020} + 1.25000 \text{ml of M5473} + 10.00000 \text{ml of M5626} + 12.45000 \text{ml of M5288} + 12.45000 \text{ml of M5288} + 12.45000 \text{ml of M5298} + 2.00000 \text{ml of M4881} + 24.95000 \text{ml of M5200} + 24.95000 \text{ml of M5468} + 24.95000 \text{ml of M5498} + 25.00000 \text{ml of M5498} + 25.00000 \text{ml of M5498} + 25.00000 \text{ml of M5498} + 5.00000 \text{ml of M5499} + 5.00000 \text{ml of M5496} + 5.00000 \text{ml} \text{of M5490} + 5.00000 \text{ml} \text{of M5490} + 5.00000 \text{ml} \text{of M5490} + 324.05000 \text{ml} \text{of M2600} + 324.050000 \text{ml} \text{of M2600} + 324.05000 \text{ml} \text{of M2600} + 324.05000 \text{ml} \text{of M2600} + 324.05000$

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	<u>NAME</u>	NO.	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
1142	ICSA ICPMS	MP76777	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	08/15/2023

FROM 10.00000ml of M5244 + 90.00000ml of MP76765 = Final Quantity: 100.000 ml

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Metals STANDARD PREPARATION LOG

Reci		<u>NAME</u>	NO.	Prep Date	Expiration Date	Prepared By	<u>ScaleID</u>	<u>PipetteID</u>	Supervised By Bin He
114	3	ICSAB ICPMS	MP76778	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP ETTE_3 (A)	
FROM 0.00500ml of M4886 + 0.00500ml of M5228 + 0.00500ml of M5229 + 0.00500ml of M5230 + 10.00000ml of M5244 + 10.00000ml of M5245 + 79.98000ml of MP76765 = Final Quantity: 100.000 ml									

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	<u>NAME</u>	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
3962	MG 10PPM FOR TUNE	MP76779	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	08/15/2023

FROM 0.01000ml of M5468 + 9.99000ml of MP76765 = Final Quantity: 100.000 ml

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Metals STANDARD PREPARATION LOG

Recipe ID 3894	NAME TUNE 200PPB	NO. MP76780	Prep Date 08/15/2023		<u>Prepared</u> <u>By</u> Sarabjit Jaswal	ScaleID None	PipetteID METALS_PIP	Supervised By Bin He
3094	TONE 200FFB	IVIF 7 0 7 6 0	00/13/2023	00/31/2023	Sarabjit Jaswai	None	ETTE_3 (A)	08/15/2023
FROM	2.00000ml of M5231 + 2.00000ml of	MP76779 +	96.00000ml	of MP76765 =	Final Quantity:	100.000 ml		

Recipe				Expiration	<u>Prepared</u>			Supervised By
<u>ID</u>	NAME.	<u>NO.</u>	Prep Date	<u>Date</u>	<u>By</u>	<u>ScaleID</u>	<u>PipetteID</u>	Bin He
3903	ISS 3PPM	MP76781	08/15/2023	08/31/2023	Sarabjit Jaswal	None	METALS_PIP	
							ETTE_3 (A)	08/15/2023

FROM 5.00000ml of M5626 + 75.00000ml of M5448 + 170.00000ml of MP76765 = Final Quantity: 250.000 ml



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	082620	08/26/2023	11/11/2020 / bin	10/28/2020 / bin	M4657
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CGV1-1 / VANADIUM 125mL 1000ug/mL	P2-V685591	12/05/2023	11/21/2020 / bin	08/21/2020 / bin	M4707
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	020821	02/08/2024	05/23/2021 / jaswal	05/18/2021 / jaswal	M4825
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	/ Arsenic (As)	012521	01/25/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4874
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	/ Boron (B)	031921	03/19/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4875
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Absolute Standards, Inc.	57004 / Be, 1000 PPM, 125 ml	030221	03/02/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4876



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	072821	07/28/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4877
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57042 / Mo, 1000 PPM, 125 ml	072821	07/28/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4878
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	051121	05/11/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4880
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57082 / Pb, 1000 PPM, 125 ml	062221	06/22/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4881
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	051721	05/17/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4882
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Absolute	57034 / Se, 1000 PPM,	070221	07/02/2024	08/06/2021 /	08/05/2021 /	M4883



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57014 / Si, 1000 PPM, 125 ml	030921	03/09/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4884
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	072921	07/29/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4885
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	021121	02/11/2024	08/05/2021 / jaswal	08/05/2021 / jaswal	M4886
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	062221	06/22/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4887
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57022 / Ti, 1000 PPM, 125 ml	070721	07/07/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4888
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
	57081 / TI, 1000 PPM, 125	073021	07/30/2024	08/06/2021 /	08/05/2021 /	



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57092 / U, 1000 PPM, 125 ml	041521	04/15/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4890
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	031921	03/19/2024	08/25/2021 / bin	08/05/2021 / jaswal	M4891
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57040 / Zr, 1000 PPM, 125 ml	073021	07/30/2024	08/06/2021 / jaswal	08/05/2021 / jaswal	M4892
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	011421	01/14/2024	12/13/2021 / bin	12/09/2021 / bin	M5019
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Absolute Standards, Inc.	57115 / P, 10000 PPM, 125 ml	032921	03/29/2024	12/13/2021 / bin	12/09/2021 / bin	M5020
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Absolute Standards, Inc.	58025 / Mn, 1000 PPM, 500 ml	060122	06/01/2025	07/01/2022 / bin	06/02/2022 / jaswal	M5184



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57042 / Mo, 1000 PPM, 125 ml	051722	05/17/2025	07/01/2022 / bin	06/17/2022 / jaswal	M5192
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	082021	08/20/2024	06/23/2022 / bin	09/25/2021 / bin	M5193
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	092121	09/21/2024	06/23/2022 / bin	10/05/2021 / bin	M5200
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	CHEM-QC-4 / CHEM-QC-4, Second Source, 1000 ug/ml, B, Mo, Si, Sn, Ti	S2-MEB711674	07/01/2024	07/01/2022 / bin	09/10/2021 / bin	M5218
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Absolute Standards, Inc.	57051 / Sb, 1000 PPM, 125 ml	101521	10/15/2024	06/29/2022 / bin	10/18/2021 / bin	M5224
Cumulian	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Supplier						



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	073021	07/30/2024	11/27/2022 / jaswal	07/05/2022 / bin	M5228
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57092 / U, 1000 PPM, 125 ml	073021	07/30/2024	11/27/2022 / jaswal	07/05/2022 / bin	M5229
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57040 / Zr, 1000 PPM, 125 ml	073021	07/30/2024	05/08/2023 / jaswal	07/05/2022 / bin	M5230
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	IV-STOCK-12 / TUNE-A,	R2-MEB695520	11/26/2023	11/27/2022 / jaswal	07/06/2022 / jaswal	M5231
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Supplier EPA	PART A / ICSA (ICPMS) STOCK SOLN	Lot #	Date			
	PARTA / ICSA (ICPMS)		Date	Opened By 08/02/2022 /	Received By 02/20/2020 /	Lot #



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
PCI Scientific Supply, Inc.	1403 / Hydrogen Peroxide, 30% 1 gal	820803	08/30/2024	1	09/07/2022 / bin	M5286
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	071122	07/11/2025	09/01/2022 / jaswal	07/21/2022 / jaswal	M5288
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58113 / Aluminum (AI) 10,000PPM	070622	07/06/2025	09/02/2022 / jaswal	07/12/2022 / jaswal	M5289
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
EPA	ICV-1 / ICV (ICP/ICPMS) STOCK SOLN	ICV-1014	12/12/2023	06/12/2023 / jaswal	02/20/2020 / bin	M5293
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Absolute Standards, Inc.	58126 / Fe, 10000 PPM, 500 ml	020422	02/04/2025	05/02/2023 / jaswal	06/15/2022 / jaswal	M5298
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
	6020CAL-1 / Calibration	S2-MEB711244	10/20/2026	05/01/2022 /	04/01/2022 /	M5301



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57056 / Ba, 1000 PPM, 125 ml	072122	07/21/2025	11/01/2022 / jaswal	09/18/2022 / jaswal	M5387
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Inorganic Ventures	6020ISS / 6020ISS, 10 ug/ml, Bi, Ho, In, 6Li, Rh, Sc, TB, Y	S2-MEB709511	03/06/2024	03/07/2023 / jaswal	04/01/2022 / jaswal	M5448
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	120922	12/09/2025	03/14/2023 / jaswal	03/14/2023 / jaswal	M5468
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57138 / Sr, 10000 PPM, 125 ml	082922	08/29/2025	03/16/2023 / jaswal	03/16/2023 / jaswal	M5473
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Absolute Standards, Inc.	57028 / Ni, 1000 PPM, 125 ml	011223	01/12/2026	01/20/2023 / bin	01/19/2023 / bin	M5494
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date /	Chemtech Lot #
Absolute Standards, Inc.	58113 / AI, 10000 PPM, 500 ml	011623	01/16/2026	08/15/2023 / jaswal	03/17/2023 / bin	M5496



Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58120 / Ca, 10000 PPM, 500 ml	031523	03/15/2026	08/15/2023 / jaswal	03/17/2023 / bin	M5498
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57182 / Pb, 10000 PPM, 125 ml	061522	06/15/2025	03/19/2023 / bin	03/17/2023 / bin	M5513
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	58112 / Mg, 10000 PPM, 500 ml	031523	03/15/2026	08/15/2023 / jaswal	03/17/2023 / bin	M5518
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	102622	10/26/2025	11/21/2022 / bin	11/20/2022 / bin	M5521
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Absolute Standards, Inc.	57022 / Titanium (Ti) 1000PPM	050223	05/02/2026	05/08/2023 / jaswal	05/08/2023 / jaswal	M5545
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
					1	



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)	23B0262006	01/11/2024	07/17/2023 / jaswal	01/13/2023 / Al-Terek	M5612
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Seidler Chemical	BA-9530-33 / Hydrochloric Acid, Instra-Analyzed (cs/6x2.5L)	22E1662006	01/18/2024	07/17/2023 / Al-Terek	04/11/2022 / Al-Terek	M5614
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Seidler Chemical	BA-9530-33 / Hydrochloric Acid, Instra-Analyzed (cs/6x2.5L)	22E1662006	01/18/2024	07/26/2023 / mohan	04/11/2022 / Al-Terek	M5616
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)	23B0262006	01/25/2024	07/24/2023 / Al-Terek	01/13/2023 / Al-Terek	M5620
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)	23B0262006	02/03/2024	08/08/2023 / Al-Terek	01/13/2023 / Al-Terek	M5626
Supplier	ItemCode / ItemName	Lot #	Expiration Date	Date Opened / Opened By	Received Date / Received By	Chemtech Lot #
Seidler Chemical	DIW / DI Water	Daily Lab-Certified	10/24/2024	10/24/2019 / apatel	10/24/2019 / apatel	W2606



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

Instructions for QATS Reference Material: ICP-MS ICS

QATS LABORATORY INORGANIC REFERENCE MATERIAL INTERFERENCE CHECK SAMPLE SET FOR ICP-MS (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

(A) SAMPLE DESCRIPTION

Enclosed is a set of one (1) or more bottles of an 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-0803" and for the ICSAB mixture use "ICSA-0803+ICSB-0803".

<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.

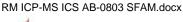
QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY
APTIM Federal Services, LLC
2700 Chandler Avenue - Building C
Las Vegas, NV 89120

(C) ANALYSIS OF SAMPLES

This interference check sample set is to be used to verify elemental isobaric correction factors of inductively coupled plasma-mass spectrometers (ICP-MS). This reference material set consists of two (2) concentrated solutions. The ICSA solution contains several interferent elements and species; for a complete listing refer to the CLP SOW. The ICSB solution contains the analytes: Ag, As, Sb, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, Tl, Se, V, and Zn. This instruction sheet provides the nominal values for the ICP-MS ICS 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:









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

Instructions for QATS Reference Material: ICP-MS ICS

ICSB:

M5245

ICSA-0803, Inferferents: Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 1% v/v HNO₃. Analyze this solution by ICP-MS.

ICSB-0803, Analytes, mixed with ICSA-0803, 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 1% v/v HNO₃. Analyze this ICSAB solution by ICP-MS.

(D) "CERTIFIED VALUE" CONCENTRATIONS OF QATS ICP-MS 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.

ICSA: M5244

	Table 1. "CERTIFIED VALUES" FOR INTERFERENCE CHECK SAMPLE ICP-MS ICSA-0803, AND ICSA-0803 MIXED WITH ICSB-0803													
Element	CRQL	Part A (µg/L)	Lower Limit (µg/L)	Upper Limit (µg/L)	Part A +Part B (µg/L)	Lower Limit (µg/L)	Upper Limit (µg/L)							
Al	20	[100000]			[100000]									
Sb	2.0	(1.5)	-2.5	5.5	(22.0)	18.0	26.0							
As	1.0	(0.10)	-1.9	2.1	19.0	16.2	21.9							
Ва	10	(1.2)	-18.8	21.2	(22.0)	2.0	42.0							
Be	1.0	(0.0)	-2.0	2.0	19.0	16.2	21.9							
Cd	1.0	(0.70)	-1.3	2.7	20.0	17.0	23.0							
Ca	500	[100000]			[100000]									
С		[200000]			[200000]									
CI		[1000000]			[1000000]									
Cr	2.0	(21.0)	17.0	25.0	40.0	34.0	46.0							
Co	1.0	(1.0)	-1.0	3.0	20.0	17.0	23.0							
Cu	2.0	(8.0)	4.0	12.0	(25.0)	21.0	29.0							
Fe	200	[100000]			[100000]									
Pb	1.0	(4.0)	2.0	6.0	25.0	21.3	28.8							
Mg	500	[100000]			[100000]									
Mn	1.0	(7.0)	5.0	9.0	27.0	23.0	31.1							
Мо		[2000]			[2000]									
Ni	1.0	(6.0)	4.0	8.0	24.0	20.4	27.6							
Р		[100000]			[100000]									
K	500	[100000]			[100000]									
Se	5.0	(0.30)	-9.7	10.0	(19.0)	9.0	29.0							
Ag	1.0	(0.0)	-2.0	2.0	18.0	15.3	20.7							
Na	500	[100000]			[100000]									
S		[100000]			[100000]									
TI	1.0	(0.0)	-2.0	2.0	21.0	17.9	24.2							
Ti		[2000]			[2000]									
V	5.0	(0.50)	-9.5	10.5	(19.0)	9.0	29.0							
Zn	5.0	(11.0)	1.0	21.0	(29.0)	19.0	39.0							

[] Indicates analytes that do not require ICP-MS determination in the ICS.

The acceptance ranges for all analytes in parentheses in the above table were determined using the listed certified value \pm 2 times the associated CLP SOW CRQL. The acceptance ranges for all other analytes were determined using the certified value \pm 15 percent of the listed certified value.



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

Instructions for QATS Reference Material: ICP-MS ICS

QATS LABORATORY INORGANIC REFERENCE MATERIAL INTERFERENCE CHECK SAMPLE SET FOR ICP-MS (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

(A) SAMPLE DESCRIPTION

Enclosed is a set of one (1) or more bottles of an 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-0803" and for the ICSAB mixture use "ICSA-0803+ICSB-0803".

<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.

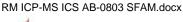
QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY
APTIM Federal Services, LLC
2700 Chandler Avenue - Building C
Las Vegas, NV 89120

(C) ANALYSIS OF SAMPLES

This interference check sample set is to be used to verify elemental isobaric correction factors of inductively coupled plasma-mass spectrometers (ICP-MS). This reference material set consists of two (2) concentrated solutions. The ICSA solution contains several interferent elements and species; for a complete listing refer to the CLP SOW. The ICSB solution contains the analytes: Ag, As, Sb, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, Tl, Se, V, and Zn. This instruction sheet provides the nominal values for the ICP-MS ICS 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:









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

Instructions for QATS Reference Material: ICP-MS ICS

ICSB:

M5245

ICSA-0803, Inferferents: Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 1% v/v HNO₃. Analyze this solution by ICP-MS.

ICSB-0803, Analytes, mixed with ICSA-0803, 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 1% v/v HNO₃. Analyze this ICSAB solution by ICP-MS.

(D) "CERTIFIED VALUE" CONCENTRATIONS OF QATS ICP-MS 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.

ICSA: M5244

	Table 1. "CERTIFIED VALUES" FOR INTERFERENCE CHECK SAMPLE ICP-MS ICSA-0803, AND ICSA-0803 MIXED WITH ICSB-0803													
Element	CRQL	Part A (µg/L)	Lower Limit (µg/L)	Upper Limit (µg/L)	Part A +Part B (µg/L)	Lower Limit (µg/L)	Upper Limit (µg/L)							
Al	20	[100000]			[100000]									
Sb	2.0	(1.5)	-2.5	5.5	(22.0)	18.0	26.0							
As	1.0	(0.10)	-1.9	2.1	19.0	16.2	21.9							
Ва	10	(1.2)	-18.8	21.2	(22.0)	2.0	42.0							
Be	1.0	(0.0)	-2.0	2.0	19.0	16.2	21.9							
Cd	1.0	(0.70)	-1.3	2.7	20.0	17.0	23.0							
Ca	500	[100000]			[100000]									
С		[200000]			[200000]									
CI		[1000000]			[1000000]									
Cr	2.0	(21.0)	17.0	25.0	40.0	34.0	46.0							
Co	1.0	(1.0)	-1.0	3.0	20.0	17.0	23.0							
Cu	2.0	(8.0)	4.0	12.0	(25.0)	21.0	29.0							
Fe	200	[100000]			[100000]									
Pb	1.0	(4.0)	2.0	6.0	25.0	21.3	28.8							
Mg	500	[100000]			[100000]									
Mn	1.0	(7.0)	5.0	9.0	27.0	23.0	31.1							
Мо		[2000]			[2000]									
Ni	1.0	(6.0)	4.0	8.0	24.0	20.4	27.6							
Р		[100000]			[100000]									
K	500	[100000]			[100000]									
Se	5.0	(0.30)	-9.7	10.0	(19.0)	9.0	29.0							
Ag	1.0	(0.0)	-2.0	2.0	18.0	15.3	20.7							
Na	500	[100000]			[100000]									
S		[100000]			[100000]									
TI	1.0	(0.0)	-2.0	2.0	21.0	17.9	24.2							
Ti		[2000]			[2000]									
V	5.0	(0.50)	-9.5	10.5	(19.0)	9.0	29.0							
Zn	5.0	(11.0)	1.0	21.0	(29.0)	19.0	39.0							

[] Indicates analytes that do not require ICP-MS determination in the ICS.

The acceptance ranges for all analytes in parentheses in the above table were determined using the listed certified value \pm 2 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.

Absolute Standards, Inc.

800-368-1131 www.absolutestandards.com



Certified Reference Material CRM

19410105

Nitric Acid

Initial

Nitric Acid

Final

Expanded

Uncertainty



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

NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent:

Part Number: <u>58024</u>
Lot Number: 082620

Description: Chromium (Cr)

2.0% 40.0 082623 (mL)

Uncertainty

Initial

Recommended Storage: Ambient (20 °C)

Part

Nominal Concentration (µg/mL): 1000

Expiration Date:

NIST Test Number: 23060 5E-05 Balance Uncertainty

Dilution

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Lot

Formulated By: Lawrence Barry 082620

Lawrence Barry 082620

Reviewed By: Pedro L. Rentas 082620

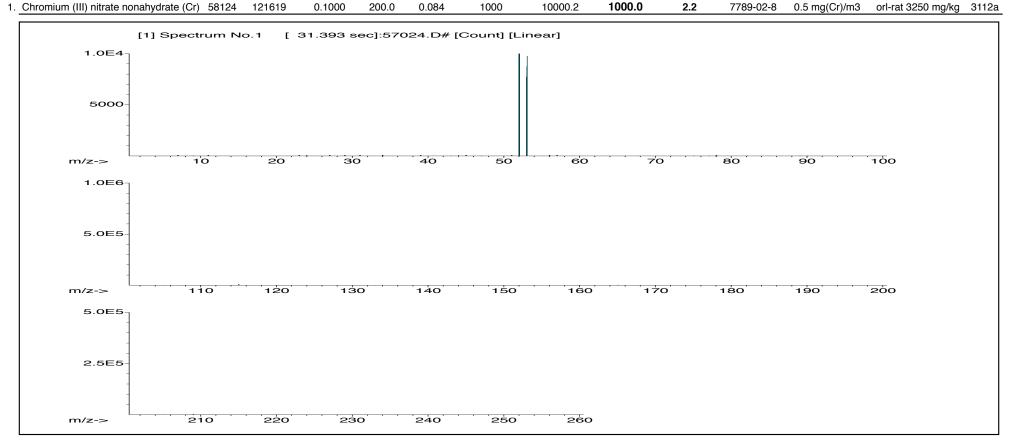
SDS Information

(Solvent Safety Info. On Attached pg.)

Compound

Number Number Factor Vol. (mL) Pipette Conc. (µg/mL) Conc. (µg/mL) Conc. (µg/mL) +/- (µg/mL) CAS# OSHA PEL (TWA) LD50 SRM

Nominal



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):

	Trace Metals Verification by ICP-MS (μ g/mL)																		
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb I	<0.02	l w	<0.02
Sb	<0.02	Ca	<0.02	Er	< 0.02	Ho	<0.02	Lu	<0.02	Nb	<0.02	Re	<0.02	Si	<0.02	Te	< 0.02	U "	<0.02
As	<0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	<0.2	Th	< 0.02	Yb	< 0.02
Be	<0.01	Cr	T	Ga	< 0.02	Fe	< 0.2	Hg	<0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization:

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

- * 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:

Bu f. All

M4707 R:08/21/2020 BH



inorganicventures.com

Christiansburg, VA 24073 · USA

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030 fax: 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: CGV1

Lot Number: P2-V685591

Matrix: 2% (v/v) HNO3

Value / Analyte(s): 1 000 μg/mL ea:

Vanadium

Starting Material: V2O5

Starting Material Lot#: 1782

Starting Material Purity: 99.9939%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: $1002 \pm 4 \mu g/mL$

Density: 1.016 g/mL (measured at 20 \pm 4 °C)

Assay Information:

Assay Method #1 $1004 \pm 5 \mu g/mL$

ICP Assay NIST SRM 3165 Lot Number: 160906

Assay Method #2 1002 ± 3 µg/mL

EDTA NIST SRM 928 Lot Number: 928

Assay Method #3 $1000 \pm 3 \mu g/mL$

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 Characterization of CRM/RM by One Method Certified Value, X_{CRM/RM}, where two or more methods of characterization are Certified Value, X_{CRM/RM}, where one method of characterization used is the weighted mean of the results: is used is the mean of individual results: $X_{CRM/RM} = \Sigma(w_i) (X_i)$ $X_{CRM/RM} = (X_a) (u_{char} a)$ X_i = mean of Assay Method i with standard uncertainty uchar i Xa = mean of Assay Method A with **w**_i = the weighting factors for each method calculated using the inverse square of u_{char a} = the standard uncertainty of characterization Method A $\mathbf{w_i} = (1/u_{\text{char i}})^2 / (\Sigma (1/(u_{\text{char i}})^2)$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 a + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ k = coverage factor = 2 k = coverage factor = 2 $\mathbf{u_{char}} = [\Sigma((\mathbf{w_i})^2 (\mathbf{u_{char}}_i)^2)]^{1/2}$ where $\mathbf{u_{char}}_i$ are the errors from each characterization method u_{char a} = the errors from characterization = bottle to bottle homogeneity standard uncertainty u_{bb} = bottle to bottle homogeneity standard uncertainty u_{lts} = long term stability standard uncertainty (storage) u_{lts} = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty u_{ts} = 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.

```
М
  Ag <
          0.000273 M Eu <
                            0.000118 O Na
                                               0.010915 M Se <
                                                                 0.001167 M Zn <
                                                                                    0.006080
М
  ΑI
          0.006218 M Fe
                            0.023106 M Nb <
                                               0.001479 O
                                                          Si
                                                                 0.036363 M Zr <
                                                                                    0.003181
М
  As <
          0.000540 M Ga <
                            0.009451 M Nd <
                                               0.000118 M Sm <
                                                                 0.000118
М
  Au <
          0.000191 M Gd <
                            0.000118 M Ni <
                                               0.003169 M Sn <
                                                                 0.000733
М
  B <
          0.002950 M
                     Ge <
                            0.000434 M Os <
                                               0.000150 M Sr
                                                                 0.000060
М
  Ba <
          0.001024 M
                     Hf <
                            0.000118 O P <
                                               0.056000 M
                                                          Ta <
                                                                 0.000118
М
   Be <
          0.000118 M
                     Ha <
                            0.000170 M Pb
                                               0.000241 M
                                                          Tb <
                                                                 0.000118
M
  Bi <
          0.000363 M
                     Ho <
                            0.000118 M Pd <
                                               0.000140 M
                                                          Te <
                                                                 0.002236
0
   Ca
          0.011869 M In <
                            0.000118 M Pr <
                                               0.000118 M
                                                          Th <
                                                                 0.000118
M
   Cd <
          0.000145 M Ir
                            0.000118 M Pt <
                                               0.000118 M
                                                          Τi
                                                                 0.001386
                                                          TI <
M
   Ce <
          0.000245 M K
                            0.002082 M Rb <
                                               0.000118 M
                                                                 0.000118
M
   Co <
          0.000119 M La <
                            0.000118 M Re <
                                               0.000118 M
                                                          Tm <
                                                                 0.000118
0
   Cr
          0.017206 M
                     li <
                            0.000501 M Rh <
                                               0.000118 M
                                                          U <
                                                                 0.000395
M
   Cs
          0.000477 M
                     Lu <
                            0.000118 M Ru <
                                               0.000118 s
                                                          V
M
   Cu <
          0.002021 M
                     Mg
                            0.000612 n
                                       S <
                                                       M
                                                         W
                                                                 0.000174
   Dy <
М
          0.000118 M
                     Mn
                            0.000649 M
                                       Sb
                                               0.008706 M Y
                                                                 0.000118
  Er <
          0.000118 O
                            0.007182 M Sc <
                                               0.000118 M Yb <
                                                                 0.000118
                     Mο
```

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

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.
- For more information, visit www.inorganicventures.com/TCT

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 50.94 +5 6 H2V10O284-Chemical Compatibility -Soluble in HCl, HNO3, H2SO4, HF, H3PO4 and strong basic media. Stable with most metals and inorganic anions in acidic media.

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

V Containing Samples (Preparation and Solution) -Metal (Fusion with NaOH or KOH in Ni0 or Na2CO3 / KNO3); Oxides (V2O3 - use HCl, V2O4 - use HCl or HNO3, V2O5 - use concentrated acids); Ores (Na2CO3 / KNO3 in Pt0 caution - nitrates attack Pto followed by water extraction of fuseate); Organic Matrices (Ash at 450 EC followed by dissolving according to V2O5 above).

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 51 amu	4 ppt	N/A	34S16O1H,
			35Cl16O, 38Ar13C,
			36Ar15N,
			36Ar14N1H,
			37Cl14N,36S15N,
			33S18O, 34S17O,
			102Ru+2,02Pd+2
ICP-OES 290.882 nm	0.008 / 0.0008 µg/mL	1	Hf, Nb
ICP-OES 292.402 nm	0.006 / 0.001 µg/mL	1	Th
ICP-OES 309.311 nm	0.005 / 0.001 µg/mL	1	Mg, U, Th

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

December 05, 2019

- 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 05, 2023
- 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.

Michael 2 Booth

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Manager, Quality Control

Certifying Officer:

Paul Gaines CEO, Senior Technical Director

Absolute Standards, Inc.

800-368-1131 www.absolutestandards.com



Certified Reference Material CRM

19410105

2.0%

Nitric Acid

40.0

(mL)

Initial

Nitric Acid

Final

Expanded

Uncertainty



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

NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent:

Part Number: <u>57027</u>
Lot Number: 020821

Description: Cobalt (Co)

Part

Expiration Date: 020824

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

NIST Test Number: 23060 5E-05 Balance Uncertainty

Dilution

Initial

Uncertainty

Volume shown below was diluted to (mL): 1999.78 0.265 Flask Uncertainty

Lot

Formulated By: Lawrence Barry 020821

Serviewed By: Pedro L. Rentas 020821

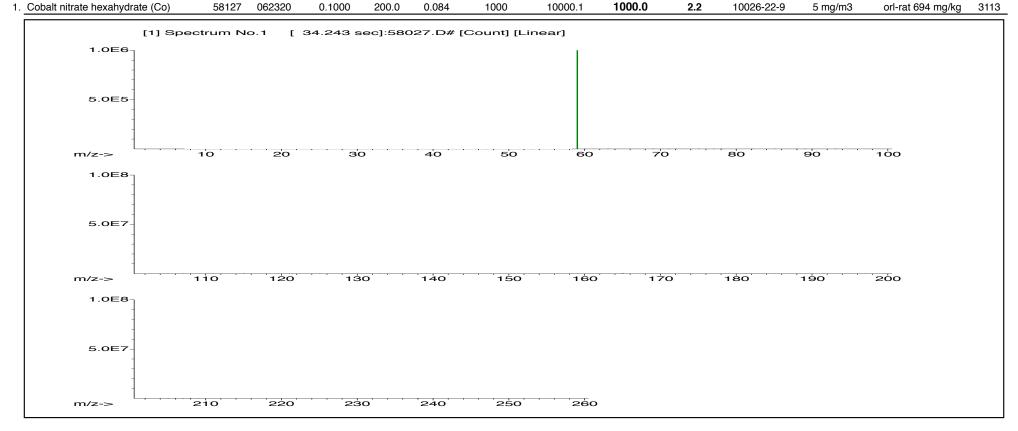
SDS Information

(Solvent Safety Info. On Attached pg.)

Compound

Number Number Factor Vol. (mL) Pipette (mL) Conc. (µg/mL) Conc. (µg/mL) +/- (µg/mL) CAS# OSHA PEL (TWA) LD50 SRM

Nominal



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):

	Trace Metals Verification by ICP-MS (μg/mL)																		
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	<0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	<0.01	Cr	< 0.02	Ga	< 0.02	Fe	<0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	T	Ge	< 0.02	La	< 0.02	Мо	< 0.02	Pt	< 0.02	Sm	<0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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).

Bu P. Sha

Absolute Standards, Inc.

800-368-1131 www.absolutestandards.com



Certified Reference Material CRM

19410105

2.0%

Nitric Acid

40.0

(mL)

Initial

Nitric Acid

Final

Expanded

Uncertainty



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

NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent:

> Part Number: 57033 012521 Lot Number:

Description: Arsenic (As)

Part

Expiration Date: 012524

Recommended Storage: Ambient (20 °C)

1000 Nominal Concentration (µg/mL):

> **NIST Test Number:** 23060 5E-05 Balance Uncertainty

> > Dilution

Initial

Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Lot

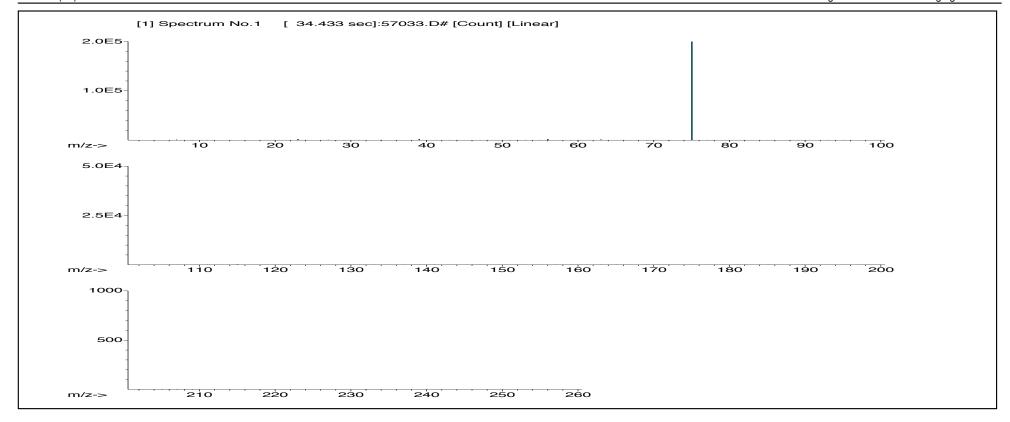
Formulated By: Lawrence Barry 012521 Reviewed By 012521 Pedro L. Rentas

SDS Information

(Solvent Safety Info. On Attached pg.)

OSHA PEL (TWA) SRM Compound Number Factor Vol. (mL) Pipette (mL) Conc. (μ g/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (μg/mL) CAS# LD50 Number 1000.0 1. Arsenic (As) 58133 092220 0.1000 200.0 0.084 1000 10001.0 2.2 7440-38-2 0.2 mg/m3 orl-rat 763 mg/kg 3103a

Nominal





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

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	T	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	<0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	<0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization:

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

- * 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:

Bur P. Sha

Part # 57033 Lot # 012521 2 of 2 Printed: 2/8/2021, 11:15:08 PM

Absolute Standards, Inc. 800-368-1131

www.absolutestandards.com



Certified Reference Material CRM

SESP W

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

CERTIFIED WEIGHT REPORT: Nominal Concentration (µg/mL): Recommended Storage: Volume shown below was diluted to (mL): NIST Test Number: **Expiration Date:** Part Number: Lot Number: Description: 57005 031921 Boron (B) 1000 6UTB Ambient (20 °C) 031924 2000.02 5E-05 0.058 Flask Uncertainty Balance Uncertainty MKBQ8597V Ammonium hydroxide Lot # 2.0% Solvent: (III) 40.0 Ammonium hydroxide Formulated By: Reviewed By: Diracra Giovanni Esposito Pedro L. Rentas Specific

Compound

Part Number

Lot

Dilution

Initial

Uncertainty

Nominal

Initial

Final

Vol. (mL) Pipette (mL) Conc. (µg/mL)

Conc. (µg/mL) Conc. (µg/mL)

Expanded
Uncertainty
+/- (µg/mL)

CAS#

OSHA PEL (TWA)

LD50

SRM

(Solvent Safety Info. On Attached pg.)

SDS Information

031921

031921

2.5E7	m/z-> 5.0E7	5.0E7	m/z->	1.0E5	2.0E5	1. Boric acid (B)
					ds E.	
	110		ō	ante afun pet i con unand region fol Propri dan	bectrum	58105
	7		Ŋ			5 063020
	ŏ				34.5	0 0.1000
	130		ω 0		83 sec]	
	_		N		:56005	200.0 0.
	0		ö		.D# [Co	0.084
	150		U)		ount] [L	1000
					inear]	10000.0
	160		0			
	170		70			1000.0
	Ü					2.2
	180		80			10043-35-3
	190		90			2 mg/m3
	200		100			orl-rat 2660 mg/kg
	2.5E7	110 120 130 140 150 160 170 180 190 E7	110 120 130 140 150 160 170 180 190	10 20 30 40 50 60 70 80 90 17 110 120 130 140 150 160 170 180 190 17	10 20 30 40 50 60 70 80 90 18 19 110 120 130 140 150 160 170 180 190	[1] Spectrum No.1 [34.583 sec]:56005.D# [Count] [Linear] 10 20 30 40 50 60 70 80 90 10 120 130 140 150 160 170 180 190

Printed: 8/4/2021, 11:29:12 AM

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

В	Bi:	Be	Ва	As	Sb	Αl			
Т	<0.02	10.0	<0.02	<0.2	<0.02	<0.02			
δ	8	Ω.	Cs	င္ပ	Ca	Ω			
<0.02	<0.02	<0.02	<0.02	<0.02	<0.2	<0.02			
Au	Ge	Ga	Gd	Eu	판	Dy			
<0.02	<0.02	< 0.02	<0.02	<0.02	<0.02	<0.02			
Рb	La	Fe	4	ď	Но	Hf			
<0.02	<0.02	40.2	<0.02	<0.02	<0.02	<0.02		Trace M	
Nd	Мо	Hg	Mn	Mg	L	Ľ		Jetals	
<0.02	<0.02	<0.2	<0.02	<0.01	<0.02	<0.02		Verifica	
~	Pt	P	Pd	°S	Ş	Z.		tion I	
40.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		oy ICP-M	
Sc	Sm	Ru	Rb	Rh	Re	Pr		S (µc	
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		/mL)	
Ta	s	Sr	Na	Ag	Si	Se			
<0.02	<0.02	<0.02	40.2	<0.02	<0.02	<0.2			
Ti	Sn	Tm	긁	Ħ	Te	41			
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			
72	Zn	~	4,4	<	_	¥	SCHOOL STATE		
<0.02	40.02	<0.02	<0.02	<0.02	<0.02	<0.02			

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

* 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 # 031921

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Certified Reference Material CRM

19410105

2.0%

Nitric Acid

40.0

(mL)

Initial

Nitric Acid

Final

Expanded

Uncertainty



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

NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent:

Part Number: <u>57004</u>

Lot Number: 030221

Description: Beryllium (Be)

Part

Expiration Date: 030224

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

NIST Test Number: 23060 5E-05 Balance Uncertainty

Dilution

Initial

Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Lot

Formulated By: Lawrence Barry 030221

Lawrence Barry 030221

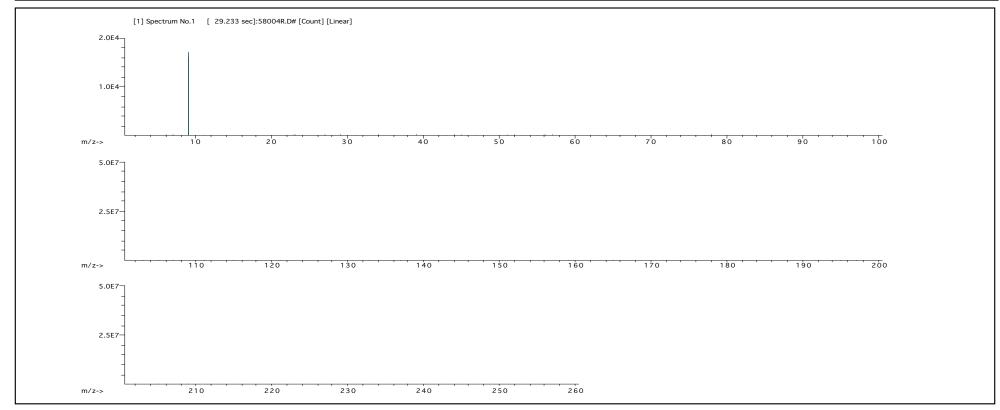
Reviewed By: Pedro L. Rentas 030221

SDS Information

(Solvent Safety Info. On Attached pg.)

Compound	Number	Number	Factor	Vol. (mL)	Pipette	Conc. (µg/mL)	Conc. (µg/mL)	Conc. (µg/mL)	+/- (μg/mL)	CAS#	OSHA PEL (TWA)	LD50	SRM
Beryllium acetate basic (Be)	58104	063020	0.1000	200.0	0.084	1000	10000.1	1000.0	2.2	19049-40-2	0.002 mg/m3	orl-rat 28 mg/kg	3105a

Nominal





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Bu P. Sha

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	< 0.02	Cd	<0.02	Dy	< 0.02	Hf	< 0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	< 0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	<0.02																		
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	T	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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).

Part # 57004 Lot # 030221 2 of 2 Printed: 3/3/2021, 11:15:33 PM

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Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Initial

Nitric Acid

Final

Expanded

20370011

2.0%



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NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent:

> Part Number: 57048 072821 Lot Number:

Description: Cadmium (Cd)

Part

Expiration Date: 072824

Recommended Storage: Ambient (20 °C)

1000 Nominal Concentration (µg/mL):

> **NIST Test Number:** 6UTB 5E-05 Balance Uncertainty

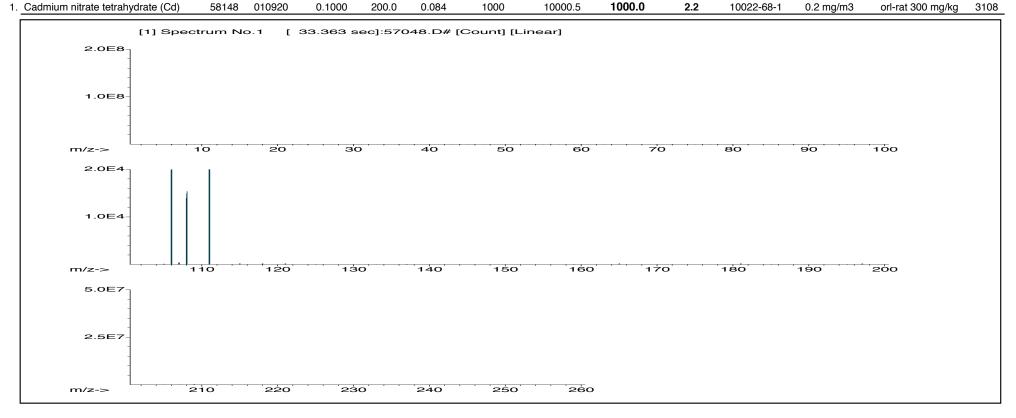
Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Liovanni Esposito Formulated By: Giovanni Esposito 072821 Reviewed By 072821 Pedro L. Rentas

SDS Information

Dilution Initial Uncertainty (Solvent Safety Info. On Attached pg.) Lot Uncertainty Compound SRM Number Number Factor Vol. (mL) Pipette (mL) Conc. (μ g/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (μg/mL) CAS# OSHA PEL (TWA) LD50

Nominal





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

Bu P. All

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	<0.02	Cd	T	Dy	< 0.02	Hf	< 0.02	Li	< 0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	<0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	< 0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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.

Part # **57048** Lot # **072821** Printed: 8/19/2021, 11:15:05 PM

^{*} 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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Certified Reference Material CRM

SESTIM



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CERTIFIED WEIGHT REPORT: Nominal Concentration (µg/mL): Recommended Storage: Volume shown below was diluted to (mL): **NIST Test Number: Expiration Date:** Part Number: Description: Lot Number: 57042 072821 **BTU9** 1000 072824 Ambient (20 °C) Molybdenum (Mo) 2000.02 0.058 5E-05 Balance Uncertainty Flask Uncertainty MKBQ8597V Ammonium hydroxide Lot # 0.5% Solvent: (ME) 10.0 Ammonium hydroxide Formulated By: Reviewed By: Dievanie LASSEL Giovanni Esposito Pedro L. Rentas 072821 072821

Compound

Number Part

Number Lot

Vol. (ml.) Pipette (ml.) Conc. (µg/ml.)

Conc. (µg/mL)

Conc. (µg/mL)

Dilution Factor

Initial

Uncertainty

Nominal

Initial

Final

Uncertainty +/- (µg/mL)

(Solvent Safety Info. On Attached pg.)

SDS Information

CAS#

OSHA PEL (TWA)

LD50

TSIN SRM

Expanded

1.0E6	2.0€6	m/z->	1000	2000	m/z-y	1.0E5	N.OE5	
							[1] Sp	
		110			0		[1] Spectrum No.1	
							Z 0.1	
		120			20		. 8	
		130			30		.594 s	
		ŏ			0		ec]:570	
		140			40		8.594 sec]:57042.D# [Count] [Linear]	
							(Cour	
		150			50		it] [Line	
		_			0		ear]	
		160			60			
		170			70			
		180			80			
		190			90			
		20			10			
		200			100			

Part # 57042

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

		_	Ве					Carlo And Property		Name and Address of the Owner, where the Owner, which is the Owner, where the Owner, which is the Owner, where the Owner, which is the Owner, which
	40.02	40.02	40.01	<0.02	<0.2	40.02	<0.02			The state of the s
	Cr	င္ပ	ζ.	S	င့	Ca	CO			NAME AND ADDRESS OF TAXABLE PARTY.
	<0.02	<0.02	<0.02	<0.02	<0.02	<0.2	<0.02			Committee of the Committee of the Committee of
	Au	ဂ္ဂ	Ga	ପ୍ର	Eu	ဌ	Dy			
The second name of the least of	<0.02	<0.02	40.02	<0.02	40.02	<0.02	<0.02			
	Pb	La	Fe	Ιτ	'n	Но	ЭH			
CONTROL SALES AND ADDRESS OF THE PERSON NAMED IN COLUMN NAMED	<0.02	<0.02	<0.2	<0.02	<0.02	<0.02	<0.02		Trace M	
	Nd	Mo	Hg	Mn	Mg	Lu	Ľ		/letals	-
THE REAL PROPERTY AND ADDRESS OF THE PERSON NAMED IN COLUMN 1	<0.02	Н	<0.2	<0.02	40.01	<0.02	<0.02		Verifica	
	×	7	P	Pd	o _s	Š	ĭ		tion	
	<0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		oy ICP-M	
	Sc	Sm	Ru	Rb	Rh	Re	Pr		S (µg	
	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		J/mL)	
	Ta	s	Sr	Na	Ag	Si	Se			
	<0.02	<0.02	<0.02	40.2	<0.02	<0.02	40.2			
	71	Sn	Tm	긁	=======================================	Te	т			
	<0.02	40.02	40.02	40.02	40.02	40.02	<0.02			The second secon
	Zr	Zn	×	4,4	<	C	W			
	<0.02	40.02	<0.02	40.02	40.02	<0.02	<0.02			

(1)= larger arrange

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.
- * 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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Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Initial

Nitric Acid

Final

Expanded

Uncertainty

20370011

2.0%



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NIST

<u>CERTIFIED WEIGHT REPORT:</u>

Lot # Solvent:

Part Number: <u>57015</u> Lot Number: 051121

Description: Phosphorous (P)

Expiration Date: 051124

Part

Recommended Storage: Ambient (20 °C)

Nominal Concentration (μg/mL): 1000

NIST Test Number: 6UTB 5E-05 Balance Uncertainty

Dilution

Initial

Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Lot

Formulated By: Lawrence Barry 051121

Lawrence Barry 051121

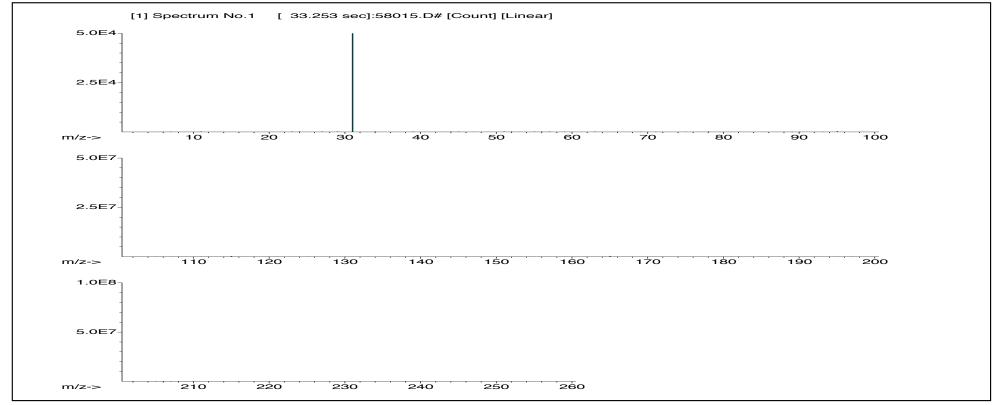
Reviewed By: Pedro L. Rentas 051121

SDS Information

(Solvent Safety Info. On Attached pg.)

Compound Number OSHA PEL (TWA) SRM Factor Vol. (mL) Pipette (mL) Conc. (μ g/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (μg/mL) CAS# LD50 Number 1000.0 1. Ammonium dihydrogen phosphate (P) 58115 121020 0.1000 200.0 0.084 1000 10000.3 2.2 7722-76-1 5 mg/m3 NA 3186

Nominal





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

In P. All

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	<0.02 Ca <0.2 Er <0.02 Ho <0.02 Lu <0.02 Nb <0.02 Re <0.02 Si <0.02 Te <0.02 U <0.02																		
As	<0.02 Ca <0.2 Er <0.02 Ho <0.02 Lu <0.02 Nb <0.02 Re <0.02 Si <0.02 Ie <0.02 U <0.02 <0.2 Ce <0.02 Eu <0.02 Mg <0.01 Os <0.02 Rh <0.02 Ag <0.02 Tl <0.02 V <0.02																		
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	<0.02	Rb	< 0.02	Na	<0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	<0.2	P	T	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Со	< 0.02	Ge	< 0.02	La	< 0.02	Мо	< 0.02	Pt	<0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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.
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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 # **57015** Lot # **051121** 2 of 2 Printed: 5/17/2021, 11:15:11 PM

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Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Nitric Acid

20370011

2.0%



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CERTIFIED WEIGHT REPORT: Lot # Solvent:

 Part Number:
 57082

 Lot Number:
 062221

Description: Lead (Pb)

Expiration Date: 062224

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

NIST Test Number: 6UTB 5E-05 Balance Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Formulated By: Lawrence Barry 062221

Lawrence Barry 062221

Reviewed By: Pedro L. Rentas 062221

SDS Information Expanded Part Lot Dilution Initial Uncertainty Nominal Initial Final Uncertainty (Solvent Safety Info. On Attached pg.) NIST Compound OSHA PEL (TWA) SRM Number Number Factor Vol. (mL) Pipette (mL) Conc. (μ g/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (μg/mL) CAS# LD50

1000.0 2.2 1. Lead (II) Nitrate (Pb) 58182 032321 0.1000 200.0 0.084 1000 10000.1 10099-74-8 0.05 mg/m3 intrvns-rat 93 mg/kg 3128 [1] Spectrum No.1 [14.144 sec]:58082.D# [Count] [Linear] 1.0E5 5.0E4 m/z->10 20 зо 40 50 60 70 80 90 100 1.0E5 5.0E4 m/z->110 120 130 140 150 160 170 180 190 200 2.0E6 1.0E6 220 230 240 250 260 m/z->210



Certified by:

Bur P. All

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

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	<0.2	Th	< 0.02	Yb	< 0.02
Be	<0.01	Cr	< 0.02	Ga	< 0.02	Fe	<0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	T	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization:

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

- * 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 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).

5.0E8

2.5E8

m/z->

210

220

230

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Certified Reference Material CRM

ASTM Type 1 Water

051721



Expanded

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CERTIFIED WEIGHT REPORT: Lot # Solvent:

> Part Number: 57016 Lot Number:

051721 **Description:** Sulfur (S)

Expiration Date: 051724

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

> **NIST Test Number:** 6UTB 5E-05 Balance Uncertainty

Volume shown below was diluted to (mL): 1999.48 0.058 Flask Uncertainty Formulated By: Lawrence Barry 051721 Reviewed By Pedro L. Rentas 051721

SDS Information

		Part	Lot	Dilution Initia	Uncertainty	Nominal	Initial	Final	Uncertainty	(Solv	vent Safety Info. On	Attached pg.)	NIST
	Compound	Number	Number	Factor Vol. (n	L) Pipette (mL)	Conc. (µg/mL)	Conc. (µg/mL)	Conc. (µg/mL)	+/- (μg/mL)	CAS#	OSHA PEL (TWA)	LD50	SRM
1.	Ammonium sulfate (S)	58116	011421	0.1000 199.	0.084	1000	10000.2	1000.0	2.2	7783-20-2	NA	NA	3181
	5.0E5	[1] Spectrum No	9.1 [33.603 sec]:5	7016.D#	[Count] [Li	inear]						
	2.5E5-												
	m/z->	10	20	30	40		60	70		ദ ്ഠ	90	100	
	5.0E7												
	m/z->	110	120	130	140	150	160	17	0	180	190	200	

250

260

240



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

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	< 0.02	Cd	<0.02	Dy	< 0.02	Hf	<0.02	Li	< 0.02	Ni	<0.02	Pr	< 0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	<0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	T	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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).

Bu f. All

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Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Nitric Acid

Expanded

20370011

2.0%



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CERTIFIED WEIGHT REPORT: Lot # Solvent:

 Part Number:
 57034

 Lot Number:
 070221

Description: Selenium (Se)

Expiration Date: 070224

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

NIST Test Number: 6UTB 5E-05 Balance Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

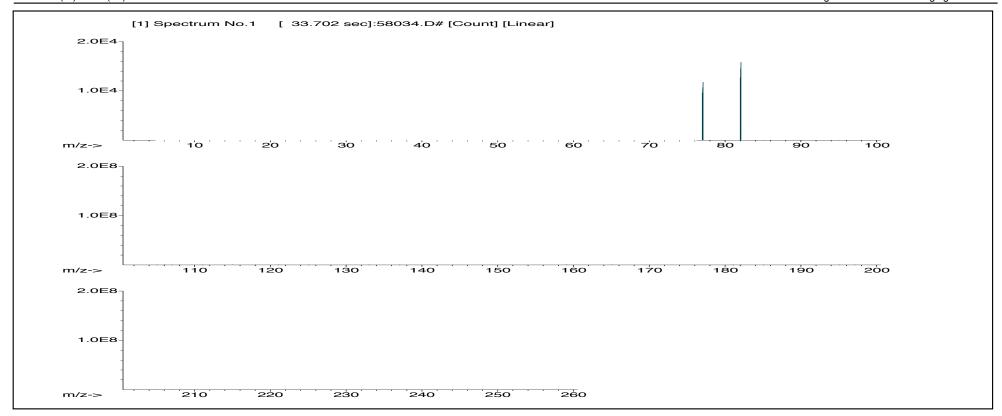
Formulated By: Giovanni Esposito 070221

Lector Denta 070221

Reviewed By: Pedro L. Rentas 070221

SDS Information

	Part	Lot	Dilution	Initial	Uncertainty	Nominal	Initial	Final	Uncertainty	(Solv	ent Safety Info. On A	Attached pg.)	NIST
Compound	Number	Number	Factor	Vol. (mL)	Pipette (mL)	Conc. (µg/mL)	Conc. (µg/mL)	Conc. (µg/mL)	+/- (μg/mL)	CAS#	OSHA PEL (TWA)	LD50	SRM
 Selenium(IV) oxide (Se) 	58134	021621	0.1000	200.0	0.084	1000	10000.2	1000.0	2.2	7446-08-4	0.2 mg/m3	orl-rat 68 mg/kg	3149





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

Sn P. Shi

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	< 0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	T	Tb	< 0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	< 0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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

Part # 57034 Lot # 070221 Printed: 8/19/2021, 11:15:02 PM

^{*} 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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Certified Reference Material CRM

19410105

2.0%

Nitric Acid

Nitric Acid



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

CERTIFIED WEIGHT REPORT: Lot # Solvent:

> Part Number: 57014 030921 Lot Number:

Description: Silicon (Si)

60.0 **Expiration Date:** 030924 (mL)

Recommended Storage: Ambient (20 °C)

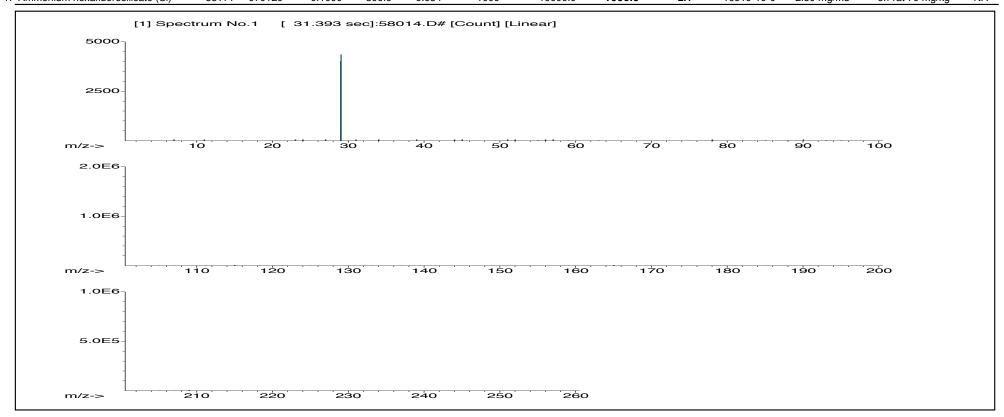
Nominal Concentration (µg/mL): 1000

> **NIST Test Number: 6UTB** 5E-05 Balance Uncertainty

Volume shown below was diluted to (mL): 3000.41 0.058 Flask Uncertainty

Formulated By: Lawrence Barry 030921 Reviewed By: Pedro L. Rentas 030921

									Expanded		SDS Informat	ion	
	Part	Lot	Dilution	Initial	Uncertainty	Nominal	Initial	Final	Uncertainty	(Solve	ent Safety Info. On A	Attached pg.)	NIST
Compound	Number	Number	Factor	Vol. (mL)	Pipette (mL)	Conc. (µg/mL)	Conc. (µg/mL)	Conc. (µg/mL)	+/- (μg/mL)	CAS#	OSHA PEL (TWA)	LD50	SRM
Ammonium hexafluorosilicate (Si)	58114	070120	0 1000	300.0	0 084	1000	10000 0	1000.0	2.1	16919-19-0	2 50 mg/m3	orl-rat 70 mg/kg	NA





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

Bu K. Spla

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	< 0.02	Cd	<0.02	Dy	< 0.02	Hf	< 0.02	Li	< 0.02	Ni	<0.02	Pr	< 0.02	Se	<0.2	Tb	< 0.02	W	< 0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	T	Te	< 0.02	U	< 0.02
As	<0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	T1	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	<0.2	Th	< 0.02	Yb	< 0.02
Be	<0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	<0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	< 0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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).

Part # **57014** Lot # **030921** 2 of 2 Printed: 3/16/2021, 11:15:07 PM

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Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Nitric Acid

Expanded

20370011

2.0%



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CERTIFIED WEIGHT REPORT: Lot # Solvent:

> Part Number: 57047 Lot Number: 072921

Description: Silver (Ag)

Expiration Date: 072924

Recommended Storage: Ambient (20 °C)

1000 Nominal Concentration (µg/mL):

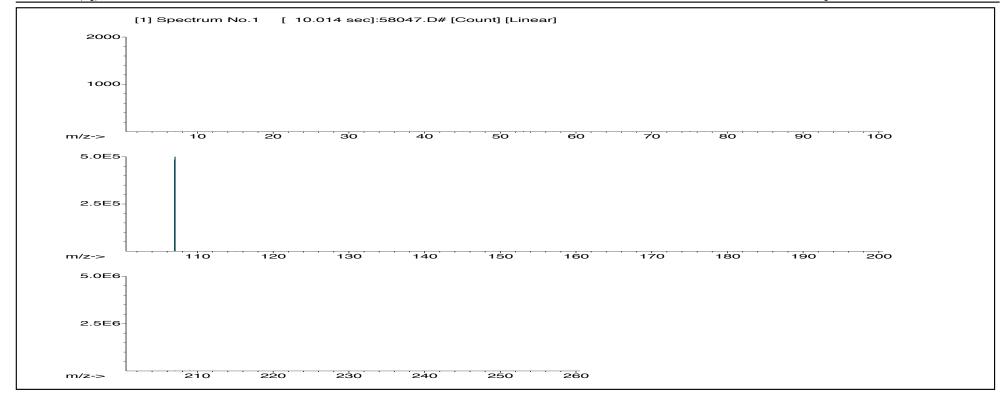
> **NIST Test Number:** 6UTB 5E-05 Balance Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Liovanni Esporto Formulated By: Giovanni Esposito 072921 Reviewed By 072921 Pedro L. Rentas

SDS Information

	Part	Lot	Dilution	Initial	Uncertainty	Nominal	Initial	Final	Uncertainty	(Solv	vent Safety Info. On At	tached pg.)	NIST
Compound	Number	Number	Factor	Vol. (mL)	Pipette (mL)	Conc. (µg/mL)	Conc. (µg/mL)	Conc. (µg/mL)	+/- (μg/mL)	CAS#	OSHA PEL (TWA)	LD50	SRM
1. Silver nitrate (Ag)	58147	010820	0.1000	200.0	0.084	1000	10000.4	1000.0	2.2	7761-88-8	10 ug/m3	N/A	3151





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

But All

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

							Trace M	etals	Verifica	tion	by ICP-M	S (μ	g/mL)						
Al	< 0.02	Cd	< 0.02	Dy	< 0.02	Hf	< 0.02	Li	< 0.02	Ni	< 0.02	Pr	< 0.02	Se	<0.2	Tb	< 0.02	W	< 0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	T	T1	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Мо	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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

Part # 57047 Lot # 072921 2 of 2 Printed: 8/19/2021, 11:15:10 PM

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

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

^{*} All standard containers are meticulously cleaned prior to use.

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^{*} 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

Certified Reference Material CRM



Expanded

SDS Information

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NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent: Part Number: 57050 19410105 Nitric Acid 021121 Lot Number: 240241 Hydrochloric acid

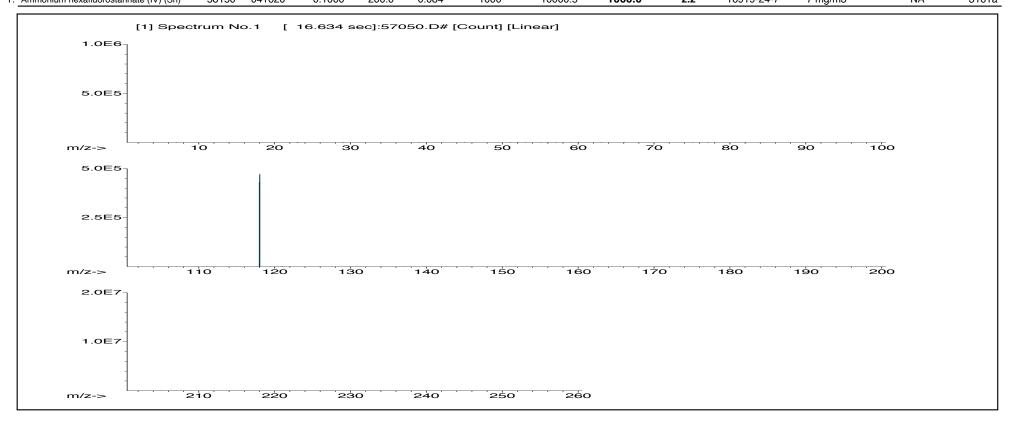
Description: Tin (Sn) 2.0% 40.0 Nitric Acid Formulated By: Lawrence Barry 021121 **Expiration Date:** 021124 6.0% 120.0 Hydrochloric acid **Recommended Storage:** Ambient (20 °C) (mL) 1000 Nominal Concentration (µg/mL): **NIST Test Number:** 23060 5E-05 Balance Uncertainty Reviewed By 021121 Pedro L. Rentas Volume shown below was diluted to (mL): 1999.78 0.265 Flask Uncertainty

Dilution Initial (Solvent Safety Info. On Attached pg.) Lot Uncertainty Uncertainty Compound OSHA PEL (TWA) SRM Number Number Factor Vol. (mL) Pipette (mL) Conc. (μ g/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (μg/mL) CAS# LD50 1000.0 1. Ammonium hexafluorostannate (IV) (Sn) 58150 041620 0.1000 200.0 0.084 1000 10000.5 2.2 16919-24-7 7 mg/m3 NA 3161a

Initial

Final

Nominal





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

Bu f. All

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	< 0.02	Ca	<0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	<0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	<0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	T	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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.
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- * 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 # 021121 2 of 2 Printed: 2/23/2021, 11:15:13 PM

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Certified Reference Material CRM

Nitric Acid

20.0

(mL)

Nitric Acid

Expanded

20370011

2.0%



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

Solvent: **CERTIFIED WEIGHT REPORT:** Lot#

> Part Number: 57038 062221 Lot Number:

Description: Strontium (Sr)

Expiration Date: 062224

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

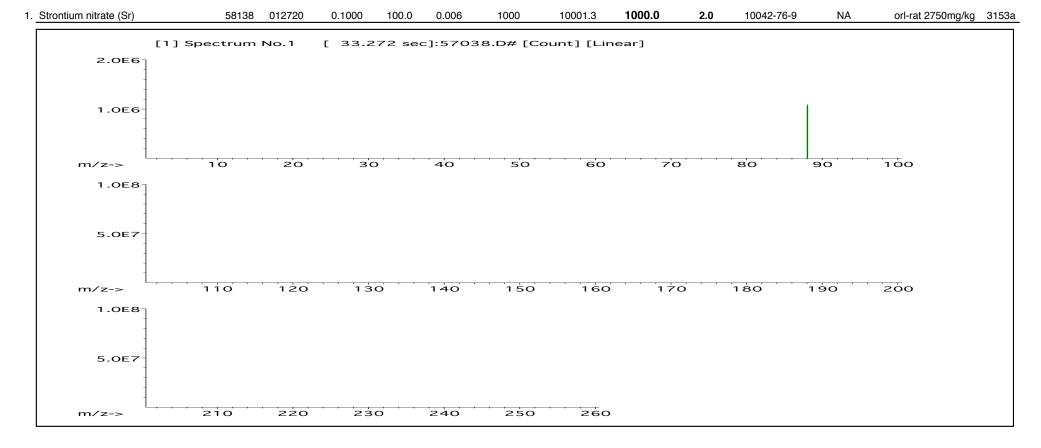
> **NIST Test Number: 6UTB** 5E-05 Balance Uncertainty

Volume shown below was diluted to (mL): 1000.12 0.058 Flask Uncertainty

Formulated By: Lawrence Barry 062221 Reviewed By: Pedro L. Rentas 062221

SDS Information

	Part	Lot	Dilution	Initial	Uncertainty	Nominal	Initial	Final	Uncertainty	(Sol	lvent Safety Info. On At	tached pg.)	NIST
Compound	Number	Number	Factor	Vol. (mL)	Pipette	Conc. (µg/mL)	Conc. (µg/mL)	Conc. (µg/mL)	+/- (μg/mL)	CAS#	OSHA PEL (TWA)	LD50	SRM





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

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	<0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	<0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	<0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	T	Tm	< 0.02	Y	< 0.02
Bi	<0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization:

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

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

Certified by:

Bu P. All

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Certified Reference Material CRM

20370011



Formulated By:

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

070721

CERTIFIED WEIGHT REPORT: Lot # Solvent:

> Part Number: 57022 070721 Lot Number:

Description: Titanium (Ti)

2.0% 40.0 Nitric Acid

Nitric Acid

(mL)

Expiration Date: 070724

Nominal Concentration (µg/mL): 1000

Recommended Storage:

NIST Test Number: 6UTB 5E-05 Balance Uncertainty Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

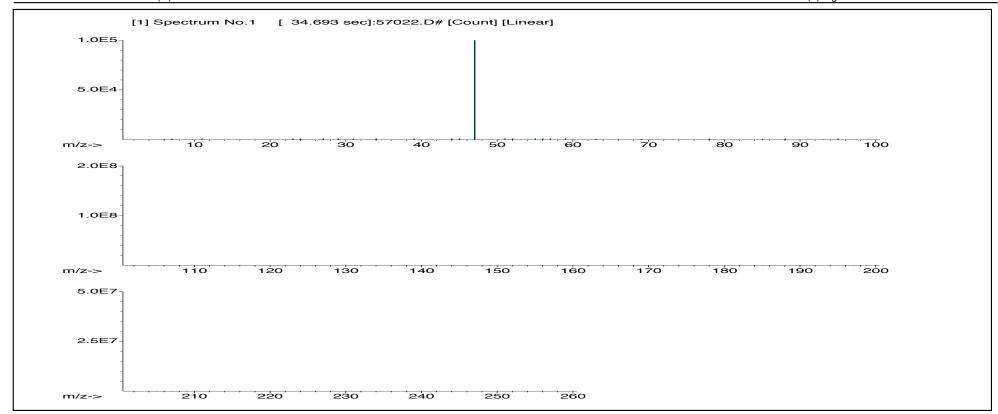
Ambient (20 °C)

Reviewed By: 070721 Pedro L. Rentas

Lawrence Barry

SDS Information Expanded Dilution Initial Final (Solvent Safety Info. On Attached pg.) NIST Lot Uncertainty Nominal Part Initial Uncertainty Compound CAS# OSHA PEL (TWA) LD50 SRM Number Number Factor Vol. (mL) Pipette Conc. (µg/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (µg/mL)

1000.0 16962-40-6 1. Ammonium hexafluorotitanate (Ti) 58122 070120 0.1000 200.0 0.084 1000 10000.1 2.2 2.5 (F) mg/m3 NA 3162a





Certified by:

Bu f. All

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

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	< 0.02	Cd	< 0.02	Dy	< 0.02	Hf	< 0.02	Li	< 0.02	Ni	< 0.02	Pr	< 0.02	Se	<0.2	Tb	< 0.02	W	< 0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	<0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	<0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	T	Zr	< 0.02

(T)= Target analyte

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).

- * 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).

* 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.

800-368-1131 www.absolutestandards.com



Certified Reference Material CRM

20370011

Nitric Acid

40.0

(mL)

Nitric Acid



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

CERTIFIED WEIGHT REPORT: Lot # Solvent:

 Part Number:
 57081

 Lot Number:
 073021

Description: Thallium (TI)

2.0% **Expiration Date:** 073024

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

NIST Test Number: 6UTB 5E-05 Balance Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Formulated By: Giovanni Esposito 073021

Reviewed By: Pedro L. Rentas 073021

SDS Information Expanded Dilution Initial Final (Solvent Safety Info. On Attached pg.) NIST Lot Initial Uncertainty Nominal Part Uncertainty Compound CAS# OSHA PEL (TWA) LD50 SRM Number Number Factor Vol. (mL) Pipette (mL) Conc. (µg/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (µg/mL)

1000.0 1. Thallium (TI) 58181 060920 0.1000 200.0 0.084 1000 10001.0 2.2 7440-28-0 0.1 mg/m3 orl-rat 6700 mg/kg 3158 [1] Spectrum No.1 [14.044 sec]:57081.D# [Count] [Linear] 2.0E6 1.0E6 10 20 30 40 60 70 80 90 100 m/z->50 1.0E4 5000 110 120 130 140 150 160 170 180 190 200 m/z->1.0E6 5.0E5 m/z-> 210 220 230 240 250 260



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

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al																< 0.02			
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	T1	T	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	< 0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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

Part # **57081** Lot # **073021** Printed: 8/20/2021, 11:15:04 PM

^{*} 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).

 $^{^{\}star}$ 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).

800-368-1131 www.absolutestandards.com



Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Initial

Nitric Acid

Final

Expanded

Uncertainty

20370011

2.0%



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

NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent:

> Part Number: 57092 041521 Lot Number:

> > Part

Description: Uranium (U)

Expiration Date: 041524

Recommended Storage: Ambient (20 °C)

1000 Nominal Concentration (µg/mL):

> **NIST Test Number:** 6UTB 5E-05 Balance Uncertainty Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

> > Lot

Dilution

Uncertainty

Initial

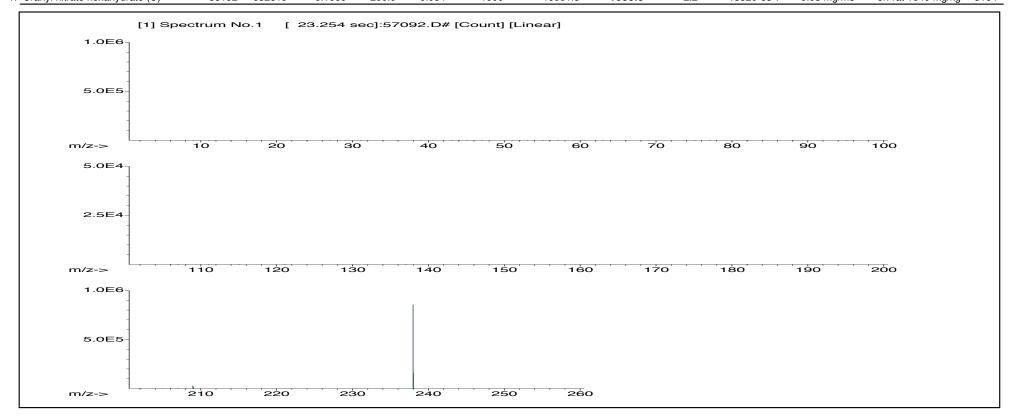
Formulated By: Lawrence Barry 041521 Reviewed By 041521 Pedro L. Rentas

SDS Information

(Solvent Safety Info. On Attached pg.)

Compound OSHA PEL (TWA) SRM Number Number Factor Vol. (mL) Pipette (mL) Conc. (μ g/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (μg/mL) CAS# LD50 1000.0 1. Uranyl nitrate hexahydrate (U) 58192 082819 0.1000 200.0 0.084 1000 10001.5 2.2 13520-83-7 0.05 mg/m3 orl-rat 1040 mg/kg

Nominal





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

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

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	<0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	T
As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	T1	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	<0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	<0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Мо	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization:

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

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- * All standard containers are meticulously cleaned prior to use.
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- * 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:

Bu f. All

Part # 57092 Lot # 041521 2 of 2 Printed: 4/29/2021, 11:15:12 PM

^{*} 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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Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Initial

Nitric Acid

Final

Expanded

Uncertainty

20370011

2.0%



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

NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent:

 Part Number:
 58030

 Lot Number:
 031921

Description: Zinc (Zn)

Part

Expiration Date: 031924

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

NIST Test Number: 6UTB 5E-05 Balance Uncertainty

Dilution

Initial

Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

Lot

Formulated By: Giovanni Esposito 031921

Licks Kenta

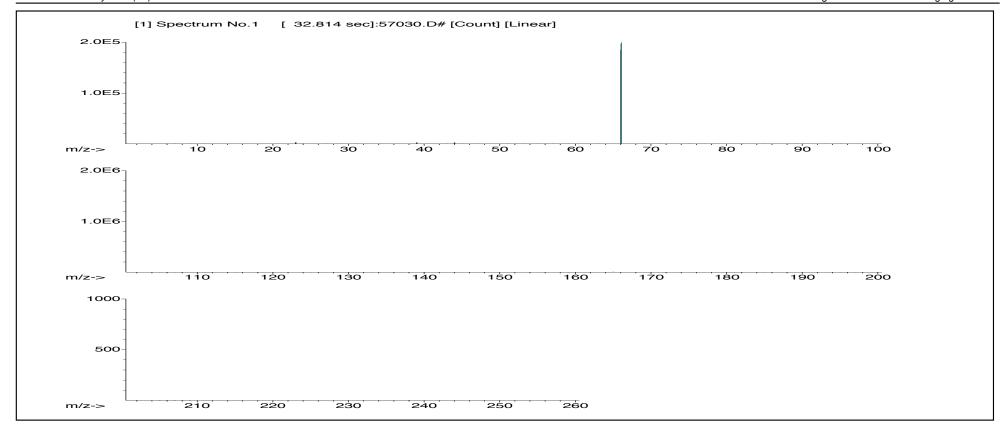
Reviewed By: Pedro L. Rentas 031921

SDS Information

(Solvent Safety Info. On Attached pg.)

Compound OSHA PEL (TWA) SRM Number Number Factor Vol. (mL) Pipette (mL) Conc. (μ g/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (μg/mL) CAS# LD50 1000.0 1. Zinc nitrate hexahydrate (Zn) 58130 082020 0.1000 200.0 0.084 1000 10000.3 2.2 10196-18-6 1 mg/m3 orl-rat 1190mg/kg 3168

Nominal





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

Bn f. Spla

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

							Trace M	etals	Verifica	tion	by ICP-M	S (μ	g/mL)						
Al	< 0.02	Cd	<0.02	Dy	< 0.02	Hf	< 0.02	Li	<0.02	Ni	< 0.02	Pr	< 0.02	Se	<0.2	Tb	<0.02	W	< 0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	T
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	< 0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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

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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).



Certified Reference Material CRM

MU8042 P. 1 8 5 2



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

3/N-V		5.OE7	1.0E8	m/z->		5.0E7	CO		On On On	1.066	Zirconyl chloride octahydrate (Zr) 58140 07 [1] Spectrum No.1	Compound		Volume shown below was diluted to (mL):	NIST Test Number:	Nominal Concentration (µg/mL):	Expiration Date:		Lot Number: Description:	Part Number:	CERTIFIED WEIGHT REPORT:
210				110				10			58140	Number	Part	was dilute							
220				120				N O			0621	Number	Lot	d to (mL):	6UTB	1000 Ambient (20 °C)	073024		073021 Zirconium (Zr)	57040	
20				4				30			0.1000	Factor	Dilution	3000.41		Ċ			(Zr)		
230	40			130				0		5	300.0	Vol. (mL)	Initial	0.058	5E-05						
240				140				40			0.084	Pipette (mL)	Uncertainty	Flask Uncertainty	Balance Uncertainty						
250				160				80		,	0.1000 300.0 0.084 1000 10000.	Vol. (mL) Pipette (mL) Conc. (µg/mL)	Nominal	nty	tainty			2.0%		20370011	Lot #
260				160				60		9	10000.3	Conc. (µg/mL)	Initial				(mL)	60.0		Nitric Acid	Solvent:
0										i	1000.0	Conc. (µg/mL) Conc. (µg/mL)	Final					Nitric Acid			, ,
				170				70			2.1	+/- (µg/mL)	Uncertainty	Expanded	Reviewed By:	M	\	Formulated By:	などで		,
				180				80			13520-92-8) CAS#	(S		y:	d'a	1	Ву:	Jieranne		
				190				90			-8 NA	OSHA PEL (TWA)	(Solvent Safety Info. On Attached pg.)	SDS Inf	Pedro L. Rentas	tento	0	Giovanni Esposito	Expert	,	
				200				100				TWA)	o. On Attac	SDS Information	ntas	/		osito	A SEP		
				J				J			NA	LD50	hed pg.)		073021			073021			
					***************************************		***************************************					SRM	NIST								

www.absolutestandards.com

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

									analyte	(T)= Target analyte									
н	Zr	<0.02	II	<0.02	Ta	<0.02	Sc	€0.2	×	<0.02	Nd	<0.02	Pb	<0.02	Au	<0.02	Cu	<0.02	a
<0.02	Zn	<0.02	Sn	<0.02	s	<0.02	Sm	<0.02	Ρt	<0.02	Mo	< 0.02	La	<0.02	Ge	<0.02	8	<0.02	, В
<0.02	к	<0.02	Tm	<0.02	Sr	<0.02	Ru	<0.02	P	<0.2	Hg	<0.2	Fe	<0.02	Ga	<0.02	IJ	<0.01	Ве
<0.02	УЪ	<0.02	Th	602	Na	<0.02	Rb	<0.02	Pd	<0.02	Mn	<0.02	Ь	<0.02	G.	<0.02	S	<0.02	Ba
<0.02	<	<0.02	11	<0.02	Ag	<0.02	Rh	<0.02	ŝ	<0.01	Mg	<0.02	In	<0.02	Eu	<0.02	င့	40.2	As
<0.02	C	<0.02	Te	<0.02	Si	<0.02	Re	<0.02	S,	<0.02	Lu	< 0.02	Но	<0.02	먁	402	Ca	<0.02	Sb
<0.02	W	<0.02	4T	A012	Se	<0.02	7	<0.02	Z	<0.02	Li	<0.02	Hf	<0.02	Dy	<0.02	5	<0.02	A
			ののでは、		MANAGEMENT STATE														
						ML)	(µg/	Y ICP-MS	on b	venticat	etais	I race M							
									•		-	+							

(I)= larget analyte

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.
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CERTIFIED WEIGHT REPORT:



Certified Reference Material CRM

RA



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

011421 57116 Lot Number: Part Number:

Sulfur (S) Description:

Ambient (20 °C) 011424 **Expiration Date:** Recommended Storage:

10000 23060 Nominal Concentration (µg/mL): NIST Test Number: 1999.53

5E-05 Balance Uncertainty

ASTM Type 1 Water

011421

Solvent:

Fot #

Lawrence Barry Or Formulated By:

011421

011421 Pedro L. Rentas Reviewed By:

> 0.100 Flask Uncertainty Weight shown below was diluted to (mL):

Nominal

to Co

SDS Information (Solvent Safety Info. On Attached pg.) Uncertainty Expanded Actual Actual Target Purity Uncertainty Assay

NIST SRM OSHA PEL (TWA) CAS# +/- (ng/mL) Weight (g) Conc. (µg/mL) Weight (g) Z Purity (%) (%) Conc. (µg/mL) Number RM# Compound

3181 Ž ¥ 7783-20-2 20.2 10000.2 83.2206 83.2191 24.3 0.10 99.0 100001 IN117 SLBF9912V Ammonium sulfate (S)

Lot # 011421 Part # 57116

260

250

240

230

220

210

m/z->

1.0E5

Certified Reference Material CRM



Absolute Standards, Inc.

www.absolutestandards.com

800-368-1131



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

The state of							I lace me	vetais	Verillication	5	יט עט	OM-	/nii/b/						
Al	<0.02	ਤ	<0.02	Dy	<0.02	Ħ	<0.02	Ľ	<0.02	Z	<0.02	뀨	<0.02	Se	<0.2	Tb	<0.02	*	<0.02
Sp	<0.02	రౌ	40.2	占	<0.02	Ho	• <0.02	٦	<0.02	£	<0.02	8	<0.02	S.	<0.02	Te	<0.02	n	<0.02
As	402	ප	<0.02	岀	<0.02	되	<0.02	Mg	<0.01	ő	<0.02	찐	<0.02	Ag	<0.02	F	<0.02	>	<0.02
Ba	<0.02	ొ	<0.02	B	<0.02	긔	<0.02	M	<0.02	R	<0.02	Rb	<0.02	Na	<0.2	Th	<0.02	χp	<0.02
Be	40.01	ర	<0.02	g _a	<0.02	Fe	40.2	Hg	<0.2	Д,	<0.02	Ru	<0.02	Sr	<0.02	Tm	<0.02	Y	<0.02
Bi	<0.02	ප	<0.02	g	<0.02	Ľ	<0.02	Mo	<0.02	표	<0.02	Sm	<0.02	S	Н	Sn	<0.02	Zn	<0.02
В	<0.02	♂	<0.02	Au	<0.02	Pb	< 0.02	PN	<0.02	×	<0.2	Sc	<0.02	Ta	<0.02	Ή	<0.02	Z	<0.02

Physical Characterization:

(T)= Target analyte

Certified by:

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).



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

CERTIFIED WEIGHT REPORT:

Part Number: Lot Number: 57115 032921

Solvent: 20370011

Nitric Acid

Lot #

2%

Nitric Acid

Formulated By:

Lawrence Barry

032921

Laronce

(mL) 60.0

Description: Phosphorous (P)

Recommended Storage: **Expiration Date:** Ambient (20 °C) 032924

NIST Test Number: BTU9

Nominal Concentration (µg/mL): Weight shown below was 10000 5E-05 Balance Uncertainty

	s diluted to (mL):	0
	3000.41	•
	3000.41 0.058 Flask Uncertainty	CE-US Balance Uncertainty
Expanded		Reviewed By:
SDS Information		Pedro L. Rentas
-	00000	032921

NIST SRM 3186

	 Ammonium dihydrogen phosphate (P) 			Compound		
	IN008 PV052018A1		MAIN	BM#		
	V052018A1		1	Nimber	בטנ	2
	10000		Conc. (July 1111)	Cons (male)	Monningi	Nominal
	99.999		(9%)		Furity	0
	0.10		Punty (%)		Uncertainty Assay	
	27.3		(%)		ASSAY	•
	109.9063		Weight (g)		larget	•
The state of the last of the l	109.9093		Weight (g)		Actua	
	10000.3) Conc. (ug/mL) +/- (ug/ml) CAS#		Actual	
	20.0		+/- (ua/ml	Contraction of	Incertainty	expanded
	20.0 7722-76-1	0, 1011	CAS#	(50)	(5)	
	5 ma/m3	(1417)	OSHA DEI (TWA)	(Solvent Salety Hilo, Oll Attached bg.)	ant Cafatu lafo On Att	and information
CAL	NA	רויסט	1050	acried pg.)	nahad and	Í

m/z->	, 2500	m/z->	500	m/z->	2.564	5.0€4
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Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS):

40.02 Ni 40.02 Pr 40.02 Nb 40.02 Re 40.01 Os 40.02 Rb 40.02 Pd 40.02 Rb 40.02 Pr 40.02 Sm 40.02 Pr 40.02 Sc	A002 Cd A002 Dy A002 Hf A002 Li A002 Ni A002 Pr A002 Si A002 A002 Ce A002 Gd A002 Fr A002 Fr A002 Mg A002 Pr A002 Ni A002 Rr A002 Ni A002 Rr A002 Ni A002 Ni		1						lyte	Target analyte	(T)= Tan									
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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).

2 of 2

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Certified Reference Material CRM

R: 6/2/22

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

CERTIFIED WEIGHT REPORT: Manganese(II) nitrate tetrahydrate (Mn) Compound Nominal Concentration (µg/mL): m/z-> m/z-> m/z-> 5.0E7 1.0E8 5.0E7 1.0E8 2.5E6 5.0E6 Recommended Storage: Volume shown below was diluted to (mL): **NIST Test Number: Expiration Date:** Part Number: [1] Spectrum No.1 Lot Number: Description: 210 110 10 58125 Number Part **BTU9** 1000 58025 060122 Ambient (20 °C) 060125 Manganese (Mn) 021022 Number 120 220 20 Lot [34.243 sec]:57025.D# [Count] [Linear] 3000.41 0.1000 Dilution Factor 230 130 30 M5184 Vol. (mL) Pipette (mL) Conc. (µg/mL) 300.0 0.058 Flask Uncertainty 5E-05 Initial Balance Uncertainty 140 Uncertainty 240 40 0.084 20510011 Nominal Lot # 2.0% 1000 150 250 50 Conc. (µg/mL) Nitric Acid Solvent: 10000.5 Initial (mL) 60.0 260 160 60 Conc. (µg/mL) Nitric Acid 1000.0 Final 170 70 Formulated By: Reviewed By: Uncertainty +/- (µg/mL) Expanded 2.1 180 Ferne 80 20694-39-7 CAS# (Solvent Safety Info. On Attached pg.) OSHA PEL (TWA) 190 Pedro L. Rentas Lawrence Barry 90 SDS Information 5 mg/m3 100 200 orl-rat >300mg/kg 060122 060122 3132 TSIN SRM

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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:



- * 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 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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Certified Reference Material CRM

M.5192 R: 06/17/2

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

CERTIFIED WEIGHT REPORT: Ammonium molybdate (Mo) Compound Nominal Concentration (µg/mL): m/z-> M/z-> Recommended Storage: m/z-> Volume shown below was diluted to (mL): 2.0E6 1.0E6 1.0E5 2.0E5 2000 1000 **NIST Test Number: Expiration Date:** Part Number: Lot Number: Description: [1] Spectrum No.1 110 210 0 58142 Number Part **BTU9** 1000 57042 Ambient (20 °C) 051722 051725 Molybdenum (Mo) 022222 Fot 120 220 20 [8.594 sec]:57042.D# [Count] [Linear] 3000.41 0.1000 Factor Dilution 130 230 30 5E-05 300.0 Vol. (mL) 0.058 Initial Flask Uncertainty Balance Uncertainty Pipette (mL) Conc. (µg/mL) Uncertainty 0.084 240 140 40 MKBQ8597V Ammonium hydroxide Nominal Lot # 0.5% 1000 250 150 50 Conc. (µg/mL) 10001.0 Initial (III) 15.0 160 260 60 Conc. (µg/mL) Ammonium hydroxide 1000.0 Final 170 70 Formulated By: Reviewed By: Uncertainty +/- (µg/mL) Expanded 2.1 180 80 13106-76-8 (Solvent Safety Info. On Attached pg.) Lawrence Barry OSHA PEL (TWA) Pedro L. Rentas 5 mg(Mo)/m3 190 90 SDS Information 200 100 orl-rat 333 mg/kg 051722 051722 3134 SRM TSIN

Printed: 6/16/2022, 1:36:08 PM

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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.
- * 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 # 57042

2 of 2

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CERTIFIED WEIGHT REPORT: Part Number:

58120 082021 Solvent: 20370011 Lot # Nitric Acid

Lot Number: Description: Calcium (Ca)

Recommended Storage: **Expiration Date:** 082024

2%

60.0 (<u>1</u>)

Nitric Acid

Formulated By:

Giovanni Esposito

082021

Pedro L. Rentas

082021

SDS Information

Horana

Laborate

Ambient (20 °C)

Nominal Concentration (µg/mL): NIST Test Number: **BTU3** 10000

Weight shown below was diluted to (mL): 3000.4 0.058 Flask Uncertainty 5E-05 Balance Uncertainty Reviewed By: Expanded

Uncertainty) +/- (µg/mL)	(Solven	nt Safe OSHA
	+/- (μg/mL)	t/- (µg/mL) CAS#
Lot Nominal Purity Uncertainty Assay Target Actual Actual Uncertainty (Solvent Safety Info. On At Number Conc. (µg/mL) (%) Purity (%) (%) Weight (g) Weight (g) Conc. (µg/mL) +/- (µg/mL) CAS# OSHA PEL (TWA)	t Safety Info. On At OSHA PEL (TWA)	
(Solvent Safety Info. On Attached pg.) CAS# OSHA PEL (TWA) LD50 SRM	4	tached pg.)

m/z->	5.0M4	m/z->	2.5 🗆 4	m/z->	1.0E4	2.0∈4
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		150		50		[12.514 sec]:58120.D# [Count] [Linear]
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		170		70		
		180		80		
		190		90		
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Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS):

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Physical Characterization:

(T)= Target analyte

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



Certified by:

Lot # 082021

2 of 2

^{*} Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest punty 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.

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CERTIFIED WEIGHT REPORT:

Part Number: Lot Number:

Lot #

Solvent: 20370011 Nitric Acid

2%

60.0 (IE)

Nitric Acid

Formulated By:

Giovanni Esposito

092121

Pedro L. Rentas

092121

SDS Information

Giranie

rapider

Description: Sodium (Na)

092121 58111

Recommended Storage: **Expiration Date:** 092124

Ambient (20 °C)

Nominal Concentration (µg/mL): 10000

Weight shown below was diluted to (mL): **NIST Test Number: 6UTB** Lot 3000.41 Nominal 0.058 Flask Uncertainty 5E-05 Balance Uncertainty Purity Uncertainty Assay Target Actual Actual Uncertainty Reviewed By: Expanded

g 3152a	orl-rat 3236 mg/kg 3152a	5 mg/m3	7631-99-4	20.0	10001.4	111.1274 111.1433	111.1274	27.0	0.10	99.999	10000 99.999	IN036 NAV01201511	IN036	1. Sodium nitrate (Na)
SRM	LD50	OSHA PEL (TWA)	CAS#	+/- (µg/mL)) Conc. (µg/mL) +/- (µg/mL) CAS#	Weight (g)		(%)	Purity (%)	(%)	Conc. (µg/mL)	Number	RM#	Compound
NIST	tached pg.)	(Solvent Safety Info. On Attached pg.)	(So	Uncertainty	Actual	Actual	Target	Assay	Purity Uncertainty Assay		Nominal	Lot	!	

							-
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		ŏ		ŏ			orl-rat 3236 mg/kg 3152
							153



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

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Physical Characterization:

(1)= Target analyte

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 NIŞT (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).



Certificate of Analysis

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Product Code: Multi Analyte Custom Grade Solution

Catalog Number: CHEM-QC-4

Lot Number: S2-MEB711674

Matrix: 3% (v/v) HNO3
 3% (v/v) HF

3 /0 (V/V) I II

Value / Analyte(s): 1 000 μg/mL ea:

Boron, Molybdenum,

Silicon, Tin,

Titanium

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

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE CERTIFIED VALUE ANALYTE CERTIFIED VALUE Boron, B $1\,000\pm7\,\mu\text{g/mL}$ Molybdenum, Mo $1\,000\pm5\,\mu\text{g/mL}$ Silicon, Si $1\,000\pm7\,\mu\text{g/mL}$ Tin, Sn $1\,000\pm5\,\mu\text{g/mL}$

Titanium, Ti $1 001 \pm 6 \mu g/mL$

Density: 1.032 g/mL (measured at 20 \pm 4 °C)

Assay Information:

ANALYTE	METHOD	NIST SRM#	SRM LOT#
В	ICP Assay	3107	110830
Мо	ICP Assay	3134	130418
Si	ICP Assay	3150	130912
Sn	ICP Assay	3161a	140917
Ti	ICP Assay	3162a	130925

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

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

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.
- For more information, visit www.inorganicventures.com/TCT **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; inorganic ventures.com; info@inorganic ventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

November 02, 2021

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

11.2 Lot Expiration Date

- November 02, 2026

- Sealed TCT Rag Open Date:

- 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

Could To F Bug opon Buto		=	
This CDM/DM should not be us	and langer than one year (or give	months in the case	of a 20 m

- Inis 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.

Michael 2 Booth

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Director, Quality Control

Certifying Officer:

Paul Gaines

Chairman / Senior Technical Director

Paul R Saines

Absolute Standards, Inc.

800-368-1131 www.absolutestandards.com



Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Initial

Nitric Acid

Final

Expanded

Uncertainty

20370011

2.0%



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NIST

CERTIFIED WEIGHT REPORT: Lot # Solvent:

> Part Number: 57051 101521 Lot Number:

Description: Antimony (Sb)

Part

Expiration Date: 101524

Recommended Storage: Ambient (20 °C)

1000 Nominal Concentration (µg/mL):

> **NIST Test Number:** 6UTB 5E-05 Balance Uncertainty

> > Dilution

Initial

Uncertainty

Volume shown below was diluted to (mL): 2000.25 0.116 Flask Uncertainty

Lot

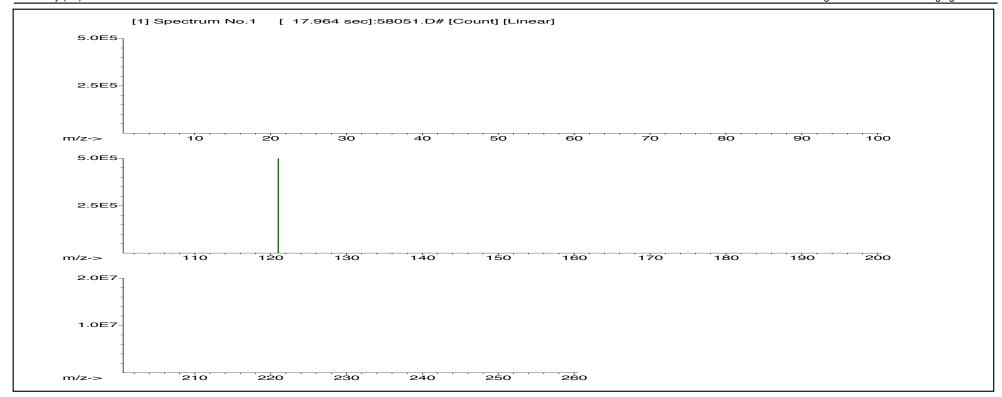
Giovanni Esposito Giovanni Esposito Formulated By: 101521 Reviewed By Pedro L. Rentas 101521

SDS Information

(Solvent Safety Info. On Attached pg.)

Compound	Number	Number	Factor	Vol. (mL)	Pipette (mL)	Conc. (µg/mL)	Conc. (µg/mL)	Conc. (µg/mL)	+/- (μg/mL)	CAS#	OSHA PEL (TWA)	LD50	SRM
 Antimony (Sb) 	58151	081820	0.1000	200.0	0.084	1000	10001.5	1000.0	2.2	7440-36-0	0.5 mg/m3	orl-rat 7000 mg/kg	3102a

Nominal



Certified Reference Material CRM



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

Bu f. Spa

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

							Trace M	etals	Verifica	tion	by ICP-M	S (μ	g/mL)						
Al	<0.02	Cd	< 0.02	Dy	< 0.02	Hf	< 0.02	Li	< 0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Tb	< 0.02	W	<0.02
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As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	T1	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	< 0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	< 0.02	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	< 0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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.

Part # 57051 Lot # 101521 2 of 2 Printed: 11/22/2021, 11:15:06 PM

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

^{*} All standard containers are meticulously cleaned prior to use.

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^{*} 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.

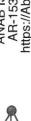
^{*} Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

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Certified Reference Material CRM

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		200	Giovanni Esposito	C Pa	Pedro L. Rentas		SDS Information	OSHA PEL (TWA)	1.0 mg/m3				0			00			
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Certified Reference Material CRM



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:

the preparation of all standards.

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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).

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



Certified Reference Material CRM 20/65



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

CERTIFIED WEIGHT REPORT: Nominal Concentration (µg/mL): Recommended Storage: Volume shown below was diluted to (mL): **NIST Test Number: Expiration Date:** Part Number: Lot Number: Description: 57038 073021 Strontium (Sr) **BTU9** 1000 Ambient (20 °C) 073024 3000.41 5E-05 0.058 Flask Uncertainty Balance Uncertainty 20370011 Lot # 2.0% Nitric Acid Solvent: 60.0 Nitric Acid Formulated By: Reviewed By: Expanded Gievannie areas 2 Giovanni Esposito Pedro L. Rentas **SDS Information** 073021 073021

	orl-rat 2750mg/kg 3153a	NA	10042-76-9	2.1	1000.0	10000.1	1000	0.084	300.0	0.1000	062321	58138	Strontium nitrate (Sr)
	LD50	OSHA PEL (TWA)	CAS#	+/- (µg/mL)	Conc. (µg/mL) +/- (µg/mL)	Conc. (µg/mL)	Vol. (mL) Pipette (mL) Conc. (µg/mL)	Pipette (mL)	Vol. (mL)	Factor	Number	Number	Compound
NIST	ttached pg.)	(Solvent Safety Info. On Attached pg.	(Solv	Uncertainty	Final	Initial	Nominal	Uncertainty	Initial	Dilution		Part	

	S.OE7	m/z-> 1 1.0E8	5.0E7	1.0E8	1.0E6	2.0E6
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))		160		6)		t] [Linear]
		170		70		
		180		80		
		190		90		
		200		100		



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

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

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(I)= larget analyte

Physical Characterization:

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

Certified by:

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^{*} Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. * 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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Certified Reference Material CRM



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CERTIFIED WEIGHT REPORT: Triuranium octoxide (U) Compound Nominal Concentration (µg/mL): m/z-> m/z-> m/z-> Recommended Storage: 5.0E4 5.0E5 1.0E6 5.0E5 1.0E6 2.5E4 Volume shown below was diluted to (mL): NIST Test Number: **Expiration Date:** Part Number: Lot Number: Description: [1] Spectrum No.1 110 210 10 58192 Number Part 57092 073021 6UTB 1000 Ambient (20 °C) 073024 Uranium (U) 122120 Number Lot 120 220 20 [23.254 sec]:57092.D# [Count] [Linear] 3000.41 0.1000 Dilution Factor 130 230 30 Vol. (mL) Pipette (mL) Conc. (µg/mL) 0.058 5E-05 300.0 Initial Flask Uncertainty **Balance Uncertainty** Uncertainty 140 0.084 240 40 20370011 Nominal 2.0% Lot # 1000 150 250 50 Conc. (µg/mL) Conc. (µg/mL) Nitric Acid Solvent: 10001.1 initial (<u>m</u>L) 60.0 160 260 60 Nitric Acid 1000.0 Final 170 70 Formulated By: Reviewed By: +/- (µg/mL) Uncertainty Expanded Giovannie 21 180 80 1344-59-8 CAS# (Solvent Safety Info. On Attached pg.) rapader Giovanni Esposito OSHA PEL (TWA) Pedro L. Rentas 190 90 0.05 mg/m3 SDS Information 100 200 orl-rat 100 mg/kg LD50 073021 073021 3164 TSIN SRM

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

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.

* 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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CERTIFIED WEIGHT REPORT:

Part Number:

Certified Reference Material CRM



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

20370011 Lot # Solvent:

Nitric Acid

Givanie

Jasa Jar

Giovanni Esposito

073021

60.0 Nitric Acid Formulated By:

2.0%

(mL)

Reviewed By:

Pedro L. Rentas 073021

Conc. (µg/mL) Conc. (µg/mL) Final +/- (µg/mL Uncertainty Expanded CAS# (Solvent Safety Info. On Attached pg.) OSHA PEL (TWA) SDS Information SRM NIST

Zirconyl chloride octahydrate (Zr)

Compound

Nominal Concentration (µg/mL): Recommended Storage:

Expiration Date:

073024

Description: Lot Number:

57040 073021 Zirconium (Zr)

NIST Test Number:

6UTB

1000

Ambient (20 °C)

Volume shown below was diluted to (mL):

3000.41

0.058 Flask Uncertainty

5E-05

Balance Uncertainty

Part

Dilution Factor

Initial

Uncertainty

Nominal

Number Lot

Vol. (mL) Pipette (mL) Conc. (µg/mL)

m/z->	5.0E7	m/z->	5.0E7	m/z->	Ø. O M O	1.0Ee
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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.
- * 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 # 57040

2 of 2



CERTIFICATE OF ANALYSIS

Christiansburg, VA 24073 · USA Inorganicventures.com

R: 7/6/22 M5231

tel: 800.669.6799 - 540.585.3030 fax: 540.585.3012 info@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).



2.0 PRODUCT DESCRIPTION

Product Code:

Multi Analyte Custom Grade Solution

Catalog Number:

IV-STOCK-12

Lot Number:

R2-MEB695520

Matrix

5% (v/v) HNO3

Value / Analyte(s):

10 µg/mL ea:

Barium,

Beryllium,

Bismuth,

Cerium,

Cobalt,

Indium,

Lithium,

Nickel,

Lead,

Uranium

CERTIFIED VALUES AND UNCERTAINTIES 3.0

ANALYTE Barium, Ba	CERTIFIED VALUE 10.00 ± 0.05 µg/mL	ANALYTE Beryllium, Be	CERTIFIED VALUE 10.00 ± 0.05 µg/mL
Bismuth, Bi	10.00 ± 0.05 μg/mL	Cerium, Ce	10.00 ± 0.04 μg/mL
Cobalt, Co	10.00 ± 0.05 μg/mL	Indium, In	10.00 ± 0.04 μg/mL
Lead, Pb	10.00 ± 0.04 μg/mL	Lithium, Li	10.00 ± 0.04 µg/mL
Nickel, Ni	10.00 ± 0.04 μg/mL	Uranium, U	10.00 ± 0.05 μg/mL

Density:

1.023 g/mL (measured at 20 ± 4 °C)

Assay Information:

ANALYTE	METHOD	NIST SRM#	SRM LOT#
Ва	ICP Assay	3104a	140909
Ва	Gravimetric		See Sec. 4.2
Be	ICPAssay	3105a	090514
Be	Calculated		See Sec. 4.2
Bi	ICPAssay	3106	991212
Bi	Calculated		See Sec. 4.2
Ce	ICPAssay	3110	090504
Ce	EDTA	928	928
Co	ICPAssay	3113	190630
Co	EDTA	928	928
Co	Calculated		See Sec. 4.2
In	ICPAssay	3124a	110516
In	EDTA	928	928
In	Calculated		See Sec. 4.2
Li	ICP Assay	3129a	100714
Li	Calculated		See Sec. 4.2
Li	Gravimetric		See Sec. 4.2
Ni	ICPAssay	3136	120619
Ni	EDTA	928	928
Ni	Calculated		See Sec. 4.2
Pb	ICPAssay	3128	101026
Pb	EDTA	928	928
Pb	Calculated		See Sec. 4.2
U	ICPAssay	3164	080521
U	Calculated		See Sec. 4.2
102 No. 1		AREA W. 1911 SERVED CONTROL MANAGEMENT	

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 One Method

Xa = mean of Assay Method A with

 $u_{
m lts}$ = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty

X_{CRM/RM} = (X_a) (u_{char a})

k = coverage factor = 2

uchar a = the errors from characterization u_{bb} = bottle to bottle homogeneity standard uncertainty

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

uchar a = the standard uncertainty of characterization Method A

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

Characterization of CRM/RM by Two o	More Methods
-------------------------------------	--------------

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

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

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

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

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

k = coverage factor = 2

 $u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{\frac{1}{2}}$ where u_{char} are the errors from each characterization method

ubb = bottle to bottle homogeneity standard uncertainty

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

Certified Abundance:

IV's Certified Abundance

Isotope	Atom %
Uranium 238U	99.8 ± 0.1
Uranium 235U	0.19 ± 0.05

TRACEABILITY TO NIST 4.0

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRWRM 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 Aglassware 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)

ΝΙ/Δ

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 CRWRM is negligible. After opening the sealed TCT bag transpiration of the CRWRM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.
- For more information, visit www.inorganicventures.com/TCT

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION, PERIOD OF VALIDITY AND REVISION HISTORY

11.1 Certification Issue Date

August 04, 2020

- The certification is valid within the measurement uncertainty specified provided the CRMRM 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 CRMRM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- August 04, 2024
- 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 CRWRM can be supported by long term stability studies conducted on properly stored and handled CRWRMs. 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 CRWRM 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 CRWRM being stored and handled in accordance with the instructions given in Sec. 7.1.

11.4 Revision Status

- Revision 1 - Revised on Wednesday, Oct 14, 2020 by utruong. Revision was made for the following reason: Added missing isotopic abundance for Uranium..

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Director, Quality Control Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

3

Certified Reference Material CRM

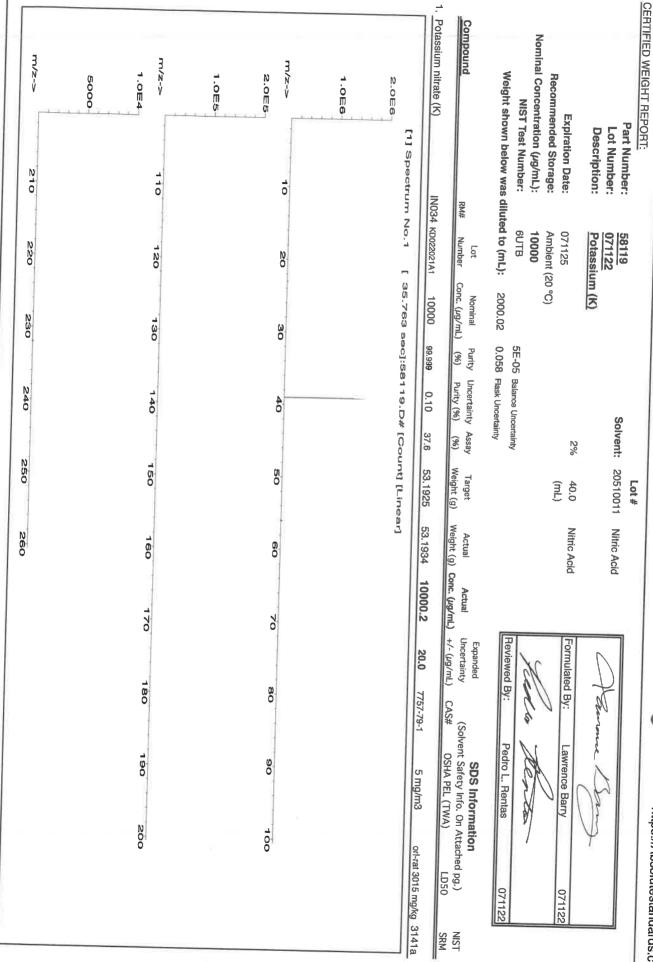
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Absolute Standards, Inc.



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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):

Physical Characterization:	Al <0.02 Cd <0.02 Dy Sb <0.02 Ca <0.2 Er As <0.2 Ce <0.02 En Ba <0.02 Cs <0.02 Gd Be <0.01 Cr <0.02 Ga Bi <0.02 Cu <0.02 Ga Bi <0.02 Cu <0.02 Ga	
11 1002 41	<0.002 Hf <0.002 Li <0.002 Ni <0.002 Pr <0.002 Se <0.02 Tb <0.002 W <0.002 <0.002	Trace Metals Verification by ICP-MS (ug/ml)

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

Certified by:

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

* 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).

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

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





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

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\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	To Te Tim Son

Physical Characterization:

(I)= larger analyte

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

Certified by:

- * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
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 * Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

2 of 2



QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY "An ISO 9001:2015 Certified Program" R: 4120/21

Instructions for QATS Reference Material: Inorganic ICV Solutions

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

These instructions are for advisory purposes only. If any apparent conflict exists between these 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 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 µg/L (ppb) for the resulting solution(s) after the dilution of the concentrate(s) according to the following instructions. Use Class 'A' glassware to prepare the solution(s).

ICV1-1014

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

Page 1 of 2



RMs ICV 1, 5, 6 SFAM.docx



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

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) K₂Cr₂O₇ 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 K₃Fe(CN)₆, Type II water, and 0.1 % sodium hydroxide, and will decompose rapidly if exposed to light.

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

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

	ICV1-1014	
Element	Concentration (µg/L) (after 10-fold dilution)	Concentration (µg/L) (after 50-fold dilution)
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

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

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



Certified Reference Material CRM

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

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	The state of the s	Giovanni Esposito	SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LDSG	5 mg/m3		
	W	Giovar	SI olvent Sal OSH,		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	iovannie	ž () ::	(So CAS#	7782-61-8	08	
	Lien	Formulated By:	Expanded Uncertainty +/- (µg/mL)	20.0		
	`			15	170	
	_	_	Actual Conc. (ug/1	10001.5		
	Nitric Acid	Nitric Acid	Actual Actual Weight (g) Conc. (ug/mL)	30.0090	160	260
	Lot # 20370011	(mL)	Target Weight (g)	30.0044	150	250
	Solvent:	5.0% srtainty uinty	Assay (%)	100.0		
	Ø.	5.0% Balance Uncertainty Flask Uncertainty	Uncertainty Assay Purity (%) (%)	0.10	04 641	240
	86	5E-05 B	Purity L	99.999		
	M5298	3000.41	Nominal Conc. (µg/mL)	10000	[1] Spectrum No.1 [30.763 sec]:58126.D# [Count] [Linear] 10 20 30 110 120 130	230
	<u>152</u> (Fe)	020425 Ambient (20 °C) 10000 6UTB ed to (mL): 3	Lot Number C	221035107	20 20 120	660
	58126 020422 Iron (Fe)	020425 Ambient 10000 6UTB illuted to (m			30.763 sec	
	Ser: Ser:	ate: age: nL): ber: w was d	RM#) IN346	10 10 110 110 110 110 110 110 110 110 1	;
Tac.	Part Number: Lot Number: Description:	Expiration Date: 020425 Recommended Storage: Ambient (20 Nominal Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was diluted to (mL):		1. Iron(III) nitrate nonahydrate (Fe)	[1] Spectra	
CEBTIFIED WEIGHT BEDORT	2 0	Explormenc ncentrat		nonahy	2.0E4 1.0E4 1.0E8 1.0E8 1.0E8 1.0E8 1.0E8	
D WEIG		Rec	Compound	III) nitratı	. c :	
FRTIFIE		Non	Com	1. Iron(_	
C	1					

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Certified Reference Material CRM



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

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

- 1							Trace M	Metals	Verificat	9 uo	v ICP-MS		(Jm/							
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(T)= Target analyte

Physical Characterization:

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



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^{*} 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).



Certificate of Analysis

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Product Code: Multi Analyte Custom Grade Solution

Catalog Number: 6020CAL-1

Lot Number: S2-MEB711244

Matrix: 5% (v/v) HNO3

tr. HF

Value / Analyte(s): 20 µg/mL ea:

Silver, Aluminum, Arsenic, Barium, Beryllium, Calcium, Cadmium, Cobalt, Chromium, Copper, Potassium, Iron, Magnesium, Manganese, Sodium, Nickel, Lead, Antimony, Selenium, Thallium, Zinc Vanadium,

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE Aluminum, Al	CERTIFIED VALUE 20.01 ± 0.08 μg/mL	ANALYTE Antimony, Sb	CERTIFIED VALUE 20.01 ± 0.12 μg/mL
Arsenic, As	20.01 ± 0.18 μg/mL	Barium, Ba	20.01 ± 0.11 μg/mL
Beryllium, Be	20.01 ± 0.14 μg/mL	Cadmium, Cd	20.01 ± 0.11 μg/mL
Calcium, Ca	20.01 ± 0.10 μg/mL	Chromium, Cr	20.01 ± 0.16 μg/mL
Cobalt, Co	20.01 ± 0.11 μg/mL	Copper, Cu	20.01 ± 0.10 μg/mL
Iron, Fe	20.01 ± 0.09 μg/mL	Lead, Pb	20.01 ± 0.11 μg/mL
Magnesium, Mg	19.99 ± 0.10 μg/mL	Manganese, Mn	20.01 ± 0.10 μg/mL
Nickel, Ni	20.01 ± 0.11 μg/mL	Potassium, K	20.01 ± 0.10 μg/mL
Selenium, Se	20.02 ± 0.14 μg/mL	Silver, Ag	20.02 ± 0.09 μg/mL
Sodium, Na	20.01 ± 0.10 μg/mL	Thallium, Tl	20.01 ± 0.13 μg/mL
Vanadium, V	20.01 ± 0.11 μg/mL	Zinc, Zn	20.01 ± 0.11 μg/mL

Assay Information:

58	say information:			
	ANALYTE	METHOD	NIST SRM#	SRM LOT#
	Ag	ICP Assay	3151 999c	160729
	Ag	Volhard		999c
	Al	ICP Assay	3101a	140903
	Al	EDTA	928	928
	As	ICP Assay	3103a	100818
	Ba	ICP Assay	3104a	140909
	Ba	Gravimetric	2405-	See Sec. 4.2
	Be	ICP Assay	3105a	090514
	Ca	ICP Assay	3109a	130213
	Ca	EDTA	928	928
	Cd	ICP Assay	3108	130116
	Cd	EDTA	928	928
	Co	ICP Assay	3113	190630
	Co	EDTA	928	928
	Cr	ICP Assay	3112a	170630
	Cu	ICP Assay	3114	121207
	Cu	EDTA	928	928
	Fe	ICP Assay	3126a	140812
	Fe	EDTA	928	928
	Fe	Calculated		See Sec. 4.2
	K	ICP Assay	3141a	140813
	K	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
	Pb	ICP Assay	3128	101026
	Pb	EDTA	928	928
	Se	ICP Assay	3149	100901
	Se	Calculated		See Sec. 4.2
	TI	ICP Assay	3158	151215
	TI	Calculated		See Sec. 4.2
	V	ICP 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 Characterization of CRM/RM by One Method Certified Value, X_{CRM/RM}, where two or more methods of characterization are Certified Value, X_{CRM/RM}, where one method of characterization used is the weighted mean of the results: is used is the mean of individual results: $X_{CRM/RM} = \Sigma(w_i) (X_i)$ $X_{CRM/RM} = (X_a) (u_{char} a)$ X_i = mean of Assay Method i with standard uncertainty u_{char i} Xa = mean of Assay Method A with $\mathbf{w_i}$ = the weighting factors for each method calculated using the inverse square of u_{char a} = the standard uncertainty of characterization Method A $\mathbf{w_i} = (1/u_{\text{char i}})^2 / (\Sigma (1/(u_{\text{char i}})^2)$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 a + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ k = coverage factor = 2 k = coverage factor = 2 $\mathbf{u_{char}} = \left[\sum ((\mathbf{w_i})^2 (\mathbf{u_{char}}_i)^2)\right]^{1/2}$ where $\mathbf{u_{char}}_i$ are the errors from each characterization method u_{char a} = the errors from characterization ubb = bottle to bottle homogeneity standard uncertainty $\mathbf{u_{bb}}$ = bottle to bottle homogeneity standard uncertainty ults = long term stability standard uncertainty (storage) u_{lts} = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty u_{ts} = 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)

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.
- For more information, visit www.inorganicventures.com/TCT

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

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; inorganic ventures.com; info@inorganic ventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

October 20, 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

- October 20, 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: 	
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- 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.

Michael 2 Booth

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Director, Quality Control

Certifying Officer:

Paul Gaines

Chairman / Senior Technical Director

Paul R Saines

www.absolutestandards.com

CERTIFIED WEIGHT REPORT:

Part Number:

57056

Solvent:

20510011

Nitric Acid

200

40.0

Nitric Acid

Description: Lot Number:

072122 Barium (Ba)

Certified Reference Material CRM

Riograph 33

Lot #

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

Formulated By: Liovannie Giovanni Esposito appeal 2

072122

Reviewed By: Pedro L. Rentas 072122

IN023 BAD022019A1 RM# Number 5 Conc. (µg/mL) Nominal 1000 99.999 Purity 8 Uncertainty Assay Purity (%) 0.10 52.3 <u>8</u> Weight (g) 3.82417 Target Weight (g) Conc. (µg/mL) 3.82426 Actual 1000.0 Actual +/- (µg/mL) Uncertainty Expanded 2.0 10022-31-8 CAS# (Solvent Safety Info. On Attached pg.) OSHA PEL (TWA) SDS Information 0.5 mg/m3 orl-rat 355 mg/kg 3104a SRM TSIN

1. Barium nitrate (Ba)

Nominal Concentration (µg/mL):

1000

Ambient (20 °C) 072125

NIST Test Number:

Recommended Storage:

Expiration Date:

Weight shown below was diluted to (mL):

2000.02

0.058 Flask Uncertainty

5E-05 Balance Uncertainty

m/z-> **1/2-**2 17/2-Y 2.5E6 5.0E6 2.0E5 1.0ES 2.0E6 1.OE6 [1] Spectrum No.1 210 110 0 220 120 N O [12.514 sec]:58156.D# [Count] [Linear] 130 230 30 140 240 4 250 150 Ö. 160 260 00 170 8 180 80 190 90 200 100

Certified Reference Material CRM



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

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

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1			2010		7000	7 0	70.05	DAT	Z0:0>	4	787	S	<0.02	2	202	Ë	200	,	5000

Physical Characterization:

(T)= Target analyte

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



Certified by:

2 of 2

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

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

^{*} All Standards should be stored with caps tight and under appropriate laboratory conditions. 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).



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com M5448

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

R: 04/01/22

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:

6020ISS

Lot Number:

S2-MEB709511

Matrix:

7% (v/v) HNO3

Value / Analyte(s):

10 µg/mL ea:

Bismuth,

Holmium,

Indium,

6-Lithium,

Rhodium,

Scandium,

Terbium.

Yttrium

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE 6-Lithium, Li6 CERTIFIED VALUE 10.00 ± 0.03 µg/mL

ANALYTE

CERTIFIED VALUE

 $10.00 \pm 0.05 \,\mu \text{g/mL}$

Holmium, Ho

10.00 ± 0.05 μg/mL

Bismuth, Bi Indium, In

10.00 ± 0.04 µg/mL

Rhodium, Rh

10.00 ± 0.07 μg/mL

Scandium, Sc

10.00 ± 0.04 µg/mL

Terbium, Tb

10.00 ± 0.04 µg/mL

Yttrium, Y

10.00 ± 0.04 µg/mL

Density:

1.035 g/mL (measured at 20 ± 4 °C)

Assay Information:

ANALYTE	METHOD	NIST SRM#	SRM LOT#
Bi	ICP Assay	3106	180815
Bi	Calculated		See Sec. 4.2
Но	ICP Assay	3123a	090408
Но	EDTA	928	928
In	ICP Assay	3124a	110516
In	EDTA	928	928
In	Calculated		See Sec. 4.2
Li6	Gravimetric		See Sec. 4.2
Rh	ICP Assay	3144	070619
Sc	ICP Assay	3148a	100701
Sc	EDTA	928	928
Tb	ICP Assay	3157a	100518
Tb	EDTA	928	928
Tb	Calculated		See Sec. 4.2
Υ	ICP Assay	3167a	120314
Υ	EDTA	928	928
Υ	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_{CRM/RM}, where two or more methods of characterization are used is the weighted mean of the results:

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

 \mathbf{X}_i = mean of Assay Method i with standard uncertainty \mathbf{u}_{char} i

w_i = the weighting factors for each method calculated using the inverse square of the variance;

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

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

k = coverage factor = 2

 $u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{3/2}$ where u_{char} i are the errors from each characterization method

ubb = bottle to bottle homogeneity standard uncertainty

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

uts = transport stability standard uncertainty

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_a) (u_{char a})

X_a = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

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

k = coverage factor = 2

u_{char a} = the errors from characterization

 u_{bb} = bottle to bottle homogeneity standard uncertainty u_{lts} = long term stability standard uncertainty (storage)

uts = transport stability standard uncertainty

Certified Abundance:

IV's Certified Abundance

<u>lsotope</u>	Atom %
Lithium Li6	95.6 ± 0.3
Lithium Li7	4.4 ± 0.1

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.
- For more information, visit www.inorganicventures.com/TCT

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

QSR Certificate Number QSR-1034

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

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

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

Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

September 03, 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 03, 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:	
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- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Director, Quality Control Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director Paul R Lains

Absolute Standards, Inc.

800-368-1131 www.absolutestandards.com



Certified Reference Material CRM

Solvent: 20510011 Nitric Acid

60.0 (mL) M5468 8



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

CERTIFIED WEIGHT REPORT:

Part Number: Lot Number: 58112

120922

Description: Magnesium (Mg)

Nitric Acid

120925 **Expiration Date:** Ambient (20 °C) **Recommended Storage:**

Nominal Concentration (µg/mL):

10000

NIST Test Number: 6UTB 5E-05 Balance Uncertainty

3000.41 Weight shown below was diluted to (mL):

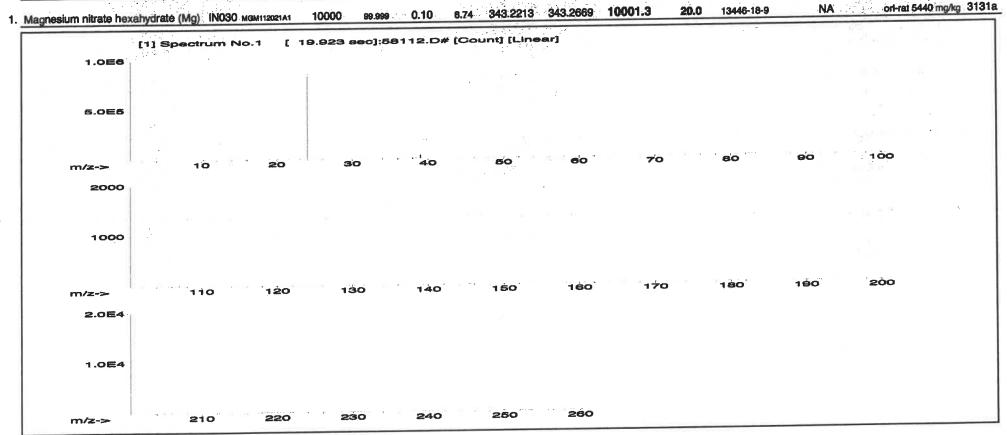
0.058 Flask Uncertainty

Giovanni Esposito Giovanni Esposito 120922 Formulated By: 120922 Pedro L. Rentas Reviewed By:

SDS Information Expanded (Solvent Safety Info. On Attached pg.)

SRM

NIST Uncertainty Actual Actual Target **Uncertainty Assay** Nominal Lot OSHA PEL (TWA) Weight (g) Conc. (µg/mL) +/- (µg/mL) CAS# Weight (g) (96) Purity (96) . (96) Conc. (µg/mL) Number Compound



Lot # 120922

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

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

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Trace Metals Verification by ICP-MS (µg/mL)

OT = Target analyte

Physical Characterization:

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

The first

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 WIST Measurement Result," MIST Technical Mote 1297, U.S. Government Printing Office, Washington, D.C. (1994).

CERTIFIED WEIGHT REPORT:

M5494 Certified Reference Material CRM



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

m/z->	1.0E7 5.0E6	m/z-> 1	8	m/2->	1.0E5	[1] Spec	Nickel(II) nitrate hexahydrate (Ni)	Compound	Volume shown below was diluted to (mL):	NIST Test Number:	Recommended Storage: Nominal Concentration (µg/mL):	Expiration Date:	Lot Number: Description:	Part Number:	CERTIFIED WEIGHT REPORT:
0		110	i			[1] Spectrum No.1	58128 (Part Number	was diluted	60			100		
220		120	8	8		Г	033122	Lot Number	to (mL):	60ТВ	Ambient (20 °C)	011226	011223 Nickel (Ni)	57028	
230		130	Q	3		.135 se	0.1000	Dilution	2000.02		Ö				
						c]:5802	200.0	Initial Vol. (mL)	0.058 F	5E-05 E					
240		140	5			8.D# [C	0.084	Uncertainty Pipette (mL)	Flask Uncertainty	Balance Uncertainty					
250		150	5 O			9.135 sec]:58028.D# [Count] [Linear]	1000	Initial Uncertainty Nominal Vol. (mL) Pipette (mL) Conc. (µg/mL)	Q	ainty		2.0%		20510011	Lot #
200		160	0 0			ear]	10000.9	Initial Conc. (µg/mL)				40.0		Nitric Acid	Solvent:
		170	70				1000.0	Initial Final Conc. (µg/mL) Conc. (µg/mL)				Nitric Acid			
		ò	0				2.2	Expanded Uncertainty +/- (µg/mL)		Reviewed By:	W	Formulated By:	\$.		7
		180	80				13478-00-7	CAS		< (10	Ву:	Diovannie		
		190	90				1	SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD50	. one of morning	Padro I Ran		Giovanni Esposito	Capacito	1	
		200	100					SDS Information Safety Info. On Attacl SHA PEL (TWA)		200	/	osito	B		
			·				orl-rat 1620 mg/kg 3136	hed pg.) NIST	011220	011223		011223			

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

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

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	<0.02	40.02	<0.02	<0.02	<0.02	<0.02	<0.02			

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.

- * 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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ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com 031523 031523 Giovanni Esposito Pedro L. Rentas Liovanni Formulated By: Reviewed By: Certified Reference Material CRM Nitric Acid Nitric Acid Solvent: 21110221 Lot # 60.0 (mL) % 5E-05 Balance Uncertainty 0.058 Flask Uncertainty 3000.41 Ambient (20 °C) Calcium (Ca) Weight shown below was diluted to (mL): 031523 031526 10000 **6UTB** Recommended Storage: Nominal Concentration (µg/mL): Part Number: Lot Number: Description: **Expiration Date:** NIST Test Number: CERTIFIED WEIGHT REPORT:

Compound	RM#	Lot Number	Nominal Purity Conc. (µg/mL) (%)	Punty (%)	Purity Uncertainty Assay (%) Purity (%) (%)		Target Weight (g)	Actual Weight (g)	Expanded Actual Actual Uncertainty (Sc Weight (g) Conc. (µg/mL) +/- (µg/mL) CAS#	Expanded Uncertainty +/- (ug/mL)	(Solv	SDS Information (Solvent Safety Info. On Attached pg.) NS# OSHA PEL (TWA) LD50	Attached pg.) LD50	NIST
1. Calcium carbonate (Ca)	IN014	INO14 caboragezat	10000 99.999	666.66	0.10	38.9	75.1990	75.2093	10001.4	20.0	471-34-1	5 mg/m3	ort-rat	3109a
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m/z->	0	.0		000	.0	400400	0	0	2		0		001	
2. 4 4														
m/z->	0	120		90	140		150	160	071	0	180	190		
6.0E4														
m/z->	019	220		230	240		250	260						

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

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

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707	ਰੋ	<0.02	Αū	<0.02	2	<0.02	PN	<0.02	×	40.2	S	<0.02	Ta	<0.02	Ξ	<0.02	Z	40.02
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(T) = Target analyte

Physical Characterization:

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



Certified by:

Printed: 3/16/2023, 1:45:15 PM

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

All standard containers are meticulously cleaned prior to use. 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.

^{*} 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.

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



800-368-1131 www.absolutestandards.com	100	Å		•	Sertified .	Refere	Since Mai	Certified Reference Material CRM	1/203 (~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com	ANAB ISO 17034 Accredited AR-1539 Certificate Number ttps://Absolutestandards.com	credited Number rds.com
CERTIFIED WEIGHT REPORT:						1	Lot#			る				
Fart Number: Lot Number: Description:		57182 061522 Lead (Pb)			Solvent:		20510011	Nitric Acid		Hieram	ranvie Ed	peate		
Expiration Date:		081525				%	40.0	Nitric Acid		Formulated By:	Giovann	Giovanní Esposito	061522	
Recommended Storage: Nominal Concentration (µg/mL):		Ambient (20 °C) 10000	Ő				(TE)			Sh	May 1	C/S		
NIST Test Number: 6UTB Weight shown below was diluted to (mL):	r: 6U as diluted		2000.02	5E-05 B 0.058 FI	5E-05 Balance Uncertainty 0.058 Flask Uncertainty	inty f				Reviewed By:	Pedro L	Pedro L. Rentas	061522	
Compound	RM#	Lot Number C	Lot Nominal Purity Uncertaint Number Conc. (µg/ml.) (%) Purity (%)	Purity (×	- 1	Target Weight (g)	Expanded Actual Actual Uncertainty Weight (g) Conc. (µg/mL) +/- (µg/mL)	Actual	Expanded Uncertainty (4+-(µg/mL) CAS#	SD: (Solvent Safe S# OSHA	SDS information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LDSC	l pg.) LD50	NIST

SRM

1. Lead(II) nitrate (Pb)	INO29 PBD122016A1	10000	88.888	0.10	62.5	32.0006	32.0041 10001.1		20.0	10099-74-8	0.05 mg/m3	intryne-rat 83 mo/kg 3128	3128
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m/z->>	0 P	O		.0		0.00	9	02		08	0	100	
1.0E6													
m/z->	1100	190		04	r P	150	160	170	Ī	180	0.00	000	
5.0ES													
Å	220	230		240		250	260						

Lot # 061522

Certified Reference Material CRM



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

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

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Ba	<0.02	రో	<0.02	3	<0.02	4	<0.02	M	<0.02	Pd	2002	40	8	0 2	6	į	70:00	- E	70'05
Be	<0.01	Ö	<0.02	S	<0.02	Ę,	402	H	5	. 0	600		7000	2 0	707	= 6	20.02	Q.	40.02
ž	2000	S	200	2	8	-	9 6	9	700	- é	20.02	1	70'05	ă	40.002	Ħ	40.02	×	<0.02
i	200	3 6	70.00	5 .	20.02	3	70:05	WIO	<0.02	Σ,	<0.02	SH	<0.02	S	<0.02	Sn	₹0.02	Z	40.02
	70.05	3	70'0>	Au	<0.02	£	T	ž	40.02	×	\$ \$	S	<0.02	Ę	CD 02	Ę	29	2	8

Physical Characterization:

(T)= Target analyte

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



Certified by:

Lot # 061522

^{*} 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.

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

All Standards should be stored with caps tight and under appropriate laboratory conditions. Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated.

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

Certified Reference Material CRM R203/17/2018



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

Part Number: CERTIFIED WEIGHT REPORT:

Magnesium (Mg) 031523 Lot Number: Description:

Ambient (20 °C) 031526 **Expiration Date:** Recommended Storage:

10000 Nominal Concentration (µg/mL):

6UTB NIST Test Number:

Nitric Acid 20510011 Solvent:

Lot #

Nitric Acid 40.0 Œ

2%

September 1 Giovanni Esposito Micrania Formulated By:

031523

Pedro L. Rentas Reviewed By:

031523 (Solvent Safety Info. On Attached pg.) SDS Information CAS# Uncertainty Expanded Weight (g) Conc. (µg/mL) Actual Actual Weight (g) Target Purity Uncertainty Assay (%) 5E-05 Balance Uncertainty 0.058 Flask Uncertainty Purity (%) Z Conc. (ug/mL) 2000.02 Nominal Weight shown below was diluted to (mL): Number ಶ **8**#

NIST **LDS0** OSHA PEL (TWA) +/- (mg/mL) Compound

orl-rat 5440 mg/kg 3131a SRM ž 13446-18-9 20.0 228.8082 10001.0 228.7850 8.74 0.10 88.88 10000 1. Magnesium nitrate hexahydrate (Mg) IN030 момпазала

[19.923 sec]:58112.D# [Count] [Linear] [1] Spectrum No.1 1.0E8 **6.0**ES

100

00

80

10

0

90

- 4

30

0

0

m/z->

200

190

180

170

160

150

140

2000 1000

A-N/H

1.0日4

220 210 V-N/H

1 of 2

260

250

240

230

Printed: 3/16/2023, 1:45:26 PM

Certified Reference Material CRM





AR-1539 Certificate Number ANAB ISO 17034 Accredited

https://Absolutestandards.com

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

							Trace M	etals	Verifica	tion	by ICP-I	NS (L	Ja/mL)						
STATE OF THE PARTY		SCOPPOR		SESSION	STREET, SQUARE	ON STREET			ALC: UNKNOWN			100	WINDS AND AND ADDRESS OF	STANSON.	No. october Britain	CONSTRUCTION OF THE PERSON OF	THE REAL PROPERTY.	A COMPANY	NOW SENSON NAMED IN VOICE
₹	<0.02	ਲ	<0.02	Ď	<0.02	H	<0.02	ΙÏ	<0.02	ž	<0.02	占	<0.02	Se	<0.2	ę	<0.02	3	40.02
ક્ક	Ø 02	రే	40.2	À	<0.02	Ho	40.02	٦	<0.02	£	<0.02	2	40.02	Š	40.02	Te	<0.02	: 1	Q 005
As	40.2	ඊ	<0.02	習	Ø.02	되	40.02	Mg	L	ő	<0.02	됩	Ø.02	Ag	₹0.02	F	40.02	>	40.02
Ba	<0.02	ඊ	<0.02	3	<0.02	卢	40.02	Ma	<0.02	몺	40.02	2	Ø.02	Ž	<0.2	Ē	200	\$	8
2	40.01	ర	<0.02	5	₹0.02	F	40.2	Æ	<0.2	۵	<0.02	R	Ø.02	Š	Q 03	Ę	Ø 02	; >	000
Ä	<0.02	රි	<0.02	පී	₹0.02	.5	<0.02	Mo	<0.02	盂	<0.02	SH	40.02	02	40.02	S	40.0 2	Z	200
m	<0.02	ਹੋ	<0.02	Au	<0.02	P.	40.02	Nd	<0.02	×	40.2	8	40.02	Ţa	40.02	F	40.02	Z	4002
										No. of Lot, House, etc., in such such such such such such such such									

(T) = Target analyte

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.

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

^{*} 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).

Absolute Standards, Inc.

800-368-1131 www.absolutestandards.com



Certified Reference Material CRM

Nitric Acid

40.0

(mL)

Nitric Acid

Expanded

20510011

2.0%



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

CERTIFIED WEIGHT REPORT: Lot # Solvent:

Part Number: <u>58029</u> Lot Number: 102622

Description: Copper (Cu)

Expiration Date: 102625

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 1000

NIST Test Number: 6UTB 5E-05 Balance Uncertainty

Volume shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

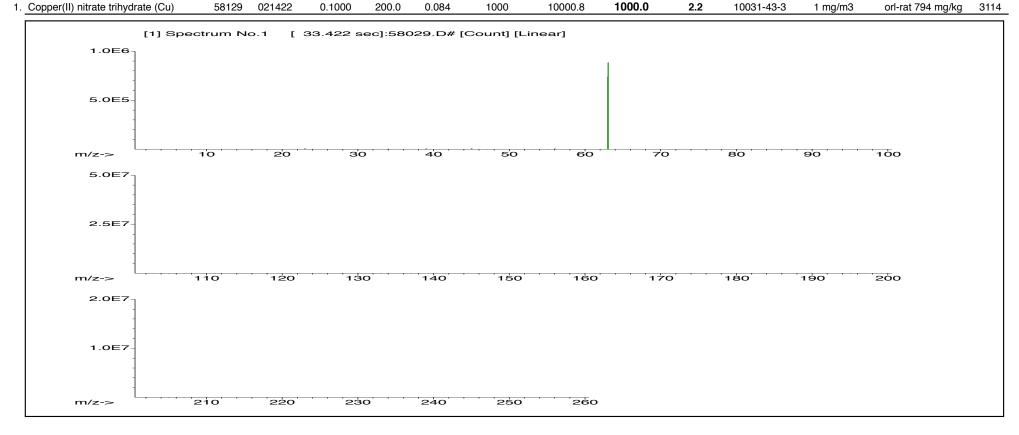
Formulated By: Eli Aliaga 102622

Lacus Denta

Reviewed By: Pedro L. Rentas 102622

SDS Information

Part Lot Dilution Initial Uncertainty Nominal Initial Final Uncertainty (Solvent Safety Info. On Attached pg.) NIST Compound OSHA PEL (TWA) SRM Number Number Factor Vol. (mL) Pipette (mL) Conc. (μ g/mL) Conc. (μ g/mL) Conc. (μ g/mL) +/- (μg/mL) CAS# LD50



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):

							Trace M	etals	Verifica	tion	by ICP-M	S (µ	g/mL)						
Al	< 0.02	Cd	<0.02	Dy	< 0.02	Hf	<0.02	Li	< 0.02	Ni	<0.02	Pr	< 0.02	Se	<0.2	Tb	< 0.02	W	<0.02
Sb	< 0.02	Ca	< 0.2	Er	< 0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	< 0.02	Si	< 0.02	Te	< 0.02	U	< 0.02
As	< 0.2	Ce	< 0.02	Eu	< 0.02	In	< 0.02	Mg	< 0.01	Os	< 0.02	Rh	< 0.02	Ag	< 0.02	Tl	< 0.02	V	< 0.02
Ba	< 0.02	Cs	< 0.02	Gd	< 0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	< 0.02
Be	< 0.01	Cr	< 0.02	Ga	< 0.02	Fe	< 0.2	Hg	<0.2	P	< 0.02	Ru	< 0.02	Sr	< 0.02	Tm	< 0.02	Y	< 0.02
Bi	< 0.02	Co	< 0.02	Ge	< 0.02	La	< 0.02	Mo	< 0.02	Pt	< 0.02	Sm	< 0.02	S	< 0.02	Sn	< 0.02	Zn	< 0.02
В	< 0.02	Cu	T	Au	< 0.02	Pb	< 0.02	Nd	< 0.02	K	<0.2	Sc	< 0.02	Ta	< 0.02	Ti	< 0.02	Zr	< 0.02

(T)= Target analyte

Physical Characterization: Certified by:

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).

Bur P. All

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



M5587 M5588 M5589 M5590 M5591 M5592

Material No.: 9530-33 Batch No.: 22D1462006 Manufactured Date: 2022-02-24 Retest Date: 2027-02-23

Revision No.: 0

Certificate of Analysis

Test	Specification	Result
ACS - Assay (as HCl) (by acid-base titrn)	36.5 - 38.0 %	37.6 %
ACS – Color (APHA)	≤ 10	5
ACS – Residue after Ignition	≤ 3 ppm	< 1 ppm
ACS – Specific Gravity at 60°/60°F	1.185 - 1.192	1.190
ACS – Bromide (Br)	≤ 0.005 %	< 0.005 %
ACS – Extractable Organic Substances	≤ 5 ppm	< 1 ppm
ACS – Free Chlorine (as Cl2)	≤ 0.5 ppm	< 0.5 ppm
Phosphate (PO4)	≤ 0.05 ppm	< 0.03 ppm
Sulfate (SO4)	≤ 0.5 ppm	< 0.5 ppm
Sulfite (SO₃)	≤ 0.8 ppm	0.3 ppm
Ammonium (NH4)	≤ 3 ppm	< 1 ppm
Trace Impurities – Arsenic (As)	≤ 0.010 ppm	< 0.003 ppm
Trace Impurities – Aluminum (Al)	≤ 10.0 ppb	0.2 ppb
Arsenic and Antimony (as As)	$\leq 5.0 ppb$	< 3.0 ppb
Trace Impurities – Barium (Ba)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Beryllium (Be)	≤ 1.0 ppb	< 1.0 ppb
Trace Impurities – Bismuth (Bi)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Boron (B)	≤ 20.0 ppb	1.4 ppb
Trace Impurities – Cadmium (Cd)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	48.0 ppb
Trace Impurities – Chromium (Cr)	≤ 1.0 ppb	< 0.4 ppb
Trace Impurities – Cobalt (Co)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities – Copper (Cu)	≤ 1.0 ppb	< 0.1 ppb
Trace Impurities – Gallium (Ga)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Germanium (Ge)	≤ 3.0 ppb	< 2.0 ppb
Trace Impurities – Gold (Au)	≤ 4.0 ppb	0.2 ppb
Heavy Metals (as Pb)	≤ 100 ppb	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 15 ppb	2 ppb

>>> Continued on page 2 >>>



Material No.: 9530-33 Batch No.: 22D1462006

Test	Specification	Result
Trace Impurities – Lead (Pb)	≤ 1.0 ppb	< 0.5 ppb
Trace Impurities – Lithium (Li)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Magnesium (Mg)	≤ 10.0 ppb	0.7 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	< 5.0 ppb
Trace Impurities - Nickel (Ni)	≤ 4.0 ppb	< 0.3 ppb
Trace Impurities - Niobium (Nb)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Potassium (K)	\leq 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	< 0.3 ppb
Trace Impurities – Sodium (Na)	≤ 100.0 ppb	< 5.0 ppb
Trace Impurities – Strontium (Sr)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Tantalum (Ta)	≤ 1.0 ppb	< 0.9 ppb
Trace Impurities – Thallium (Tl)	≤ 5.0 ppb	< 0.9 ppb
Trace Impurities – Tin (Sn)	≤ 5.0 ppb	< 0.8 ppb
Trace Impurities – Titanium (Ti)	≤ 1.0 ppb	0.3 ppb
Trace Impurities – Vanadium (V)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Zinc (Zn)	≤ 5.0 ppb	0.5 ppb
Trace Impurities - Zirconium (Zr)	≤ 1.0 ppb	< 0.1 ppb

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



Material No.: 9530-33 Batch No.: 22D1462006

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





M5609 M5610 M5611 M5612 Material No.: 9606-03 Batch No.: 23B0262006 Manufactured Date: 2023-01-13 Retest Date: 2028-01-12

Revision No.: 0

Certificate of Analysis

Test	Specification	Result
Assay (HNO3)	69.0 - 70.0 %	69.7 %
Appearance	Passes Test	Passes Test
Color (APHA)	≤ 10	5
Residue after Ignition	≤ 2 ppm	< 1 ppm
Chloride (Cl)	≤ 0.08 ppm	0.03 ppm
Phosphate (PO4)	≤ 0.10 ppm	< 0.03 ppm
Sulfate (SO4)	≤ 0.2 ppm	< 0.2 ppm
Trace Impurities – Aluminum (Al)	≤ 40.0 ppb	< 5.0 ppb
Arsenic and Antimony (as As)	≤ 5.0 ppb	< 2.0 ppb
Trace Impurities – Barium (Ba)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Beryllium (Be)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Bismuth (Bi)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Boron (B)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities – Cadmium (Cd)	≤ 50 ppb	< 1 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	3.1 ppb
Trace Impurities - Chromium (Cr)	≤ 30.0 ppb	2.8 ppb
Trace Impurities – Cobalt (Co)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Copper (Cu)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Gallium (Ga)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities - Germanium (Ge)	≤ 20 ppb	< 10 ppb
Trace Impurities – Gold (Au)	≤ 20 ppb	< 5 ppb
Heavy Metals (as Pb)	≤ 100 ppb	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 40.0 ppb	4.2 ppb
Trace Impurities – Lead (Pb)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Lithium (Li)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Magnesium (Mg)	≤ 20 ppb	< 1 ppb
Trace Impurities – Manganese (Mn)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Nickel (Ni)	≤ 20.0 ppb	< 5.0 ppb

>>> Continued on page 2 >>>



Material No.: 9606-03 Batch No.: 23B0262006

Test	Specification	Result
Trace Impurities - Niobium (Nb)	≤ 50.0 ppb	< 1.0 ppb
Trace Impurities – Potassium (K)	≤ 50 ppb	< 10 ppb
Trace Impurities - Silicon (Si)	≤ 50 ppb	< 10 ppb
Trace Impurities - Silver (Ag)	≤ 20.0 ppb	< 1.0 ppb
Trace Impurities – Sodium (Na)	≤ 150.0 ppb	< 5.0 ppb
Trace Impurities - Strontium (Sr)	≤ 30.0 ppb	< 1.0 ppb
Trace Impurities – Tantalum (Ta)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities - Thallium (TI)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities - Tin (Sn)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities - Titanium (Ti)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities - Vanadium (V)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Zinc (Zn)	≤ 20.0 ppb	< 1.0 ppb
Trace Impurities - Zirconium (Zr)	≤ 10.0 ppb	< 1.0 ppb
Particle Count - 0.5 µm and greater	≤ 60 par/ml	13 par/ml
Particle Count - 1.0 µm and greater	≤ 10 par/ml	3 par/ml

Nitric Acid CMOS



Material No.: 9606-03 Batch No.: 23B0262006

Specification Result Test

For Microelectronic Use

Country of Origin: USA

Packaging Site: Phillipsburg Mfg Ctr & DC



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



M5614 M5615 M5616 M5617 M5618 M5619

Material No.: 9530-33 Batch No.: 22E1662006 Manufactured Date: 2022-04-11 Retest Date: 2027-04-10

Revision No.: 0

Certificate of Analysis

Test	Specification	Result
ACS – Assay (as HCI) (by acid-base titrn)	36.5 - 38.0 %	37.6 %
ACS – Color (APHA)	≤ 10	5
ACS – Residue after Ignition	≤ 3 ppm	< 1 ppm
ACS – Specific Gravity at 60°/60°F	1.185 - 1.192	1.190
ACS – Bromide (Br)	≤ 0.005 %	< 0.005 %
ACS – Extractable Organic Substances	≤ 5 ppm	< 1 ppm
ACS – Free Chlorine (as Cl2)	≤ 0.5 ppm	< 0.5 ppm
Phosphate (PO4)	≤ 0.05 ppm	< 0.03 ppm
Sulfate (SO4)	≤ 0.5 ppm	< 0.3 ppm
Sulfite (SO3)	≤ 0.8 ppm	0.3 ppm
Ammonium (NH4)	≤ 3 ppm	< 1 ppm
Trace Impurities – Arsenic (As)	≤ 0.010 ppm	< 0.003 ppm
Trace Impurities – Aluminum (Al)	≤ 10.0 ppb	< 0.2 ppb
Arsenic and Antimony (as As)	≤ 5.0 ppb	< 3.0 ppb
Trace Impurities – Barium (Ba)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Beryllium (Be)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Bismuth (Bi)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Boron (B)	≤ 20.0 ppb	< 5.0 ppb
Trace Impurities – Cadmium (Cd)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	37.0 ppb
Trace Impurities – Chromium (Cr)	≤ 1.0 ppb	< 0.4 ppb
Trace Impurities – Cobalt (Co)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities - Copper (Cu)	≤ 1.0 ppb	< 0.1 ppb
Trace Impurities - Gallium (Ga)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Germanium (Ge)	≤ 3.0 ppb	< 2.0 ppb
Trace Impurities - Gold (Au)	≤ 4.0 ppb	0.2 ppb
Heavy Metals (as Pb)	≤ 100 ppb	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 15 ppb	1 ppb

>>> Continued on page 2 >>>



Material No.: 9530-33 Batch No.: 22E1662006

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	1.0 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	< 0.2 ppb
Trace Impurities – Potassium (K)	$\leq 9.0 \text{ ppb}$	< 2.0 ppb
Trace Impurities - Selenium (Se), For Information Only		1.0 ppb
Trace Impurities - Silicon (Si)	≤ 100.0 ppb	< 0.4 ppb
Trace Impurities - Silver (Ag)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities – Sodium (Na)	\leq 100.0 ppb	1.9 ppb
Trace Impurities – Strontium (Sr)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities - Tantalum (Ta)	≤ 1.0 ppb	< 0.9 ppb
Trace Impurities – Thallium (Tl)	≤ 5.0 ppb	< 2.0 ppb
Trace Impurities - Tin (Sn)	≤ 5.0 ppb	< 0.8 ppb
Trace Impurities – Titanium (Ti)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Vanadium (V)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities - Zinc (Zn)	≤ 5.0 ppb	< 0.3 ppb
Trace Impurities – Zirconium (Zr)	≤ 1.0 ppb	< 0.1 ppb

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



Material No.: 9530-33 Batch No.: 22E1662006

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



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



M5614 M5615 M5616 M5617 M5618 M5619

Material No.: 9530-33 Batch No.: 22E1662006 Manufactured Date: 2022-04-11 Retest Date: 2027-04-10

Revision No.: 0

Certificate of Analysis

Test	Specification	Result
ACS – Assay (as HCI) (by acid-base titrn)	36.5 - 38.0 %	37.6 %
ACS – Color (APHA)	≤ 10	5
ACS – Residue after Ignition	≤ 3 ppm	< 1 ppm
ACS – Specific Gravity at 60°/60°F	1.185 - 1.192	1.190
ACS – Bromide (Br)	≤ 0.005 %	< 0.005 %
ACS – Extractable Organic Substances	≤ 5 ppm	< 1 ppm
ACS – Free Chlorine (as Cl2)	≤ 0.5 ppm	< 0.5 ppm
Phosphate (PO4)	≤ 0.05 ppm	< 0.03 ppm
Sulfate (SO4)	≤ 0.5 ppm	< 0.3 ppm
Sulfite (SO3)	≤ 0.8 ppm	0.3 ppm
Ammonium (NH4)	≤ 3 ppm	< 1 ppm
Trace Impurities – Arsenic (As)	≤ 0.010 ppm	< 0.003 ppm
Trace Impurities – Aluminum (Al)	≤ 10.0 ppb	< 0.2 ppb
Arsenic and Antimony (as As)	≤ 5.0 ppb	< 3.0 ppb
Trace Impurities – Barium (Ba)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Beryllium (Be)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Bismuth (Bi)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Boron (B)	≤ 20.0 ppb	< 5.0 ppb
Trace Impurities – Cadmium (Cd)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	37.0 ppb
Trace Impurities – Chromium (Cr)	≤ 1.0 ppb	< 0.4 ppb
Trace Impurities – Cobalt (Co)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities - Copper (Cu)	≤ 1.0 ppb	< 0.1 ppb
Trace Impurities - Gallium (Ga)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Germanium (Ge)	≤ 3.0 ppb	< 2.0 ppb
Trace Impurities - Gold (Au)	≤ 4.0 ppb	0.2 ppb
Heavy Metals (as Pb)	≤ 100 ppb	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 15 ppb	1 ppb

>>> Continued on page 2 >>>



Material No.: 9530-33 Batch No.: 22E1662006

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	1.0 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	< 0.2 ppb
Trace Impurities – Potassium (K)	$\leq 9.0 \text{ ppb}$	< 2.0 ppb
Trace Impurities - Selenium (Se), For Information Only		1.0 ppb
Trace Impurities – Silicon (Si)	≤ 100.0 ppb	< 0.4 ppb
Trace Impurities - Silver (Ag)	≤ 1.0 ppb	< 0.3 ppb
Trace Impurities – Sodium (Na)	≤ 100.0 ppb	1.9 ppb
Trace Impurities – Strontium (Sr)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Tantalum (Ta)	≤ 1.0 ppb	< 0.9 ppb
Trace Impurities – Thallium (Tl)	≤ 5.0 ppb	< 2.0 ppb
Trace Impurities - Tin (Sn)	≤ 5.0 ppb	< 0.8 ppb
Trace Impurities – Titanium (Ti)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities – Vanadium (V)	≤ 1.0 ppb	< 0.2 ppb
Trace Impurities - Zinc (Zn)	≤ 5.0 ppb	< 0.3 ppb
Trace Impurities – Zirconium (Zr)	≤ 1.0 ppb	< 0.1 ppb

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



Material No.: 9530-33 Batch No.: 22E1662006

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





M5620 M5621 M5622 M5623 M5624

Material No.: 9606-03 Batch No.: 23B0262006 Manufactured Date: 2023-01-13 Retest Date: 2028-01-12

Revision No.: 0

Certificate of Analysis

Test	Specification	Result
Assay (HNO3)	69.0 - 70.0 %	69.7 %
Appearance	Passes Test	Passes Test
Color (APHA)	≤ 10	5
Residue after Ignition	≤ 2 ppm	< 1 ppm
Chloride (Cl)	≤ 0.08 ppm	0.03 ppm
Phosphate (PO4)	≤ 0.10 ppm	< 0.03 ppm
Sulfate (SO4)	≤ 0.2 ppm	< 0.2 ppm
Trace Impurities – Aluminum (Al)	≤ 40.0 ppb	< 5.0 ppb
Arsenic and Antimony (as As)	≤ 5.0 ppb	< 2.0 ppb
Trace Impurities – Barium (Ba)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Beryllium (Be)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Bismuth (Bi)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Boron (B)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities – Cadmium (Cd)	≤ 50 ppb	< 1 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	3.1 ppb
Trace Impurities - Chromium (Cr)	≤ 30.0 ppb	2.8 ppb
Trace Impurities – Cobalt (Co)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Copper (Cu)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Gallium (Ga)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Germanium (Ge)	≤ 20 ppb	< 10 ppb
Trace Impurities – Gold (Au)	≤ 20 ppb	< 5 ppb
Heavy Metals (as Pb)	≤ 100 ppb	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 40.0 ppb	4.2 ppb
Trace Impurities – Lead (Pb)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Lithium (Li)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Magnesium (Mg)	≤ 20 ppb	< 1 ppb
Trace Impurities – Manganese (Mn)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Nickel (Ni)	≤ 20.0 ppb	< 5.0 ppb

>>> Continued on page 2 >>>



Material No.: 9606-03 Batch No.: 23B0262006

Test	Specification	Result
Trace Impurities - Niobium (Nb)	≤ 50.0 ppb	< 1.0 ppb
Trace Impurities – Potassium (K)	≤ 50 ppb	< 10 ppb
Trace Impurities - Silicon (Si)	≤ 50 ppb	< 10 ppb
Trace Impurities - Silver (Ag)	≤ 20.0 ppb	< 1.0 ppb
Trace Impurities – Sodium (Na)	≤ 150.0 ppb	< 5.0 ppb
Trace Impurities - Strontium (Sr)	≤ 30.0 ppb	< 1.0 ppb
Trace Impurities - Tantalum (Ta)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities - Thallium (TI)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities - Tin (Sn)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities - Titanium (Ti)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities - Vanadium (V)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Zinc (Zn)	≤ 20.0 ppb	< 1.0 ppb
Trace Impurities – Zirconium (Zr)	≤ 10.0 ppb	< 1.0 ppb
Particle Count - 0.5 µm and greater	≤ 60 par/ml	13 par/ml
Particle Count - 1.0 µm and greater	≤ 10 par/ml	3 par/ml

Nitric Acid CMOS



Material No.: 9606-03 Batch No.: 23B0262006

Specification Result Test

For Microelectronic Use

Country of Origin: USA

Packaging Site: Phillipsburg Mfg Ctr & DC





M5625 M5626 M5627 M5628 M5629 M5630

Material No.: 9606-03 Batch No.: 23B0262006 Manufactured Date: 2023-01-13

Retest Date: 2028-01-12 Revision No.: 0

Certificate of Analysis

Test	Specification	Result
Assay (HNO3)	69.0 - 70.0 %	69.7 %
Appearance	Passes Test	Passes Test
Color (APHA)	≤ 10	5
Residue after Ignition	≤ 2 ppm	< 1 ppm
Chloride (Cl)	≤ 0.08 ppm	0.03 ppm
Phosphate (PO ₄)	≤ 0.10 ppm	< 0.03 ppm
Sulfate (SO ₄)	≤ 0.2 ppm	< 0.2 ppm
Trace Impurities – Aluminum (Al)	≤ 40.0 ppb	< 5.0 ppb
Arsenic and Antimony (as As)	≤ 5.0 ppb	< 2.0 ppb
Trace Impurities – Barium (Ba)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Beryllium (Be)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Bismuth (Bi)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Boron (B)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities – Cadmium (Cd)	≤ 50 ppb	< 1 ppb
Trace Impurities – Calcium (Ca)	≤ 50.0 ppb	3.1 ppb
Trace Impurities – Chromium (Cr)	≤ 30.0 ppb	2.8 ppb
Trace Impurities – Cobalt (Co)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Copper (Cu)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Gallium (Ga)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Germanium (Ge)	≤ 20 ppb	< 10 ppb
Trace Impurities – Gold (Au)	≤ 20 ppb	< 5 ppb
Heavy Metals (as Pb)	≤ 100 ppb	< 50 ppb
Trace Impurities – Iron (Fe)	≤ 40.0 ppb	4.2 ppb
Trace Impurities – Lead (Pb)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities – Lithium (Li)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Magnesium (Mg)	≤ 20 ppb	< 1 ppb
Trace Impurities – Manganese (Mn)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Nickel (Ni)	≤ 20.0 ppb	< 5.0 ppb

>>> Continued on page 2 >>>



Material No.: 9606-03 Batch No.: 23B0262006

Test	Specification	Result
Trace Impurities - Niobium (Nb)	≤ 50.0 ppb	< 1.0 ppb
Trace Impurities – Potassium (K)	≤ 50 ppb	< 10 ppb
Trace Impurities - Silicon (Si)	≤ 50 ppb	< 10 ppb
Trace Impurities - Silver (Ag)	≤ 20.0 ppb	< 1.0 ppb
Trace Impurities – Sodium (Na)	≤ 150.0 ppb	< 5.0 ppb
Trace Impurities - Strontium (Sr)	≤ 30.0 ppb	< 1.0 ppb
Trace Impurities - Tantalum (Ta)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities - Thallium (TI)	≤ 10.0 ppb	< 5.0 ppb
Trace Impurities - Tin (Sn)	≤ 20.0 ppb	< 10.0 ppb
Trace Impurities - Titanium (Ti)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities - Vanadium (V)	≤ 10.0 ppb	< 1.0 ppb
Trace Impurities – Zinc (Zn)	≤ 20.0 ppb	< 1.0 ppb
Trace Impurities – Zirconium (Zr)	≤ 10.0 ppb	< 1.0 ppb
Particle Count - 0.5 µm and greater	≤ 60 par/ml	13 par/ml
Particle Count - 1.0 µm and greater	≤ 10 par/ml	3 par/ml

Nitric Acid CMOS



Material No.: 9606-03 Batch No.: 23B0262006

Specification Result Test

For Microelectronic Use

Country of Origin: USA

Packaging Site: Phillipsburg Mfg Ctr & DC



N5285 NS286 9/7/2022 A.I

CORCO CHEMICAL CORPORATION

Manufacturers of ACS Reagents and Semiconductor Grade Chemicals

CERTIFICATE OF ANALYSIS

Date: 8/3/2022

Lot No 820803

Hydrogen Peroxide, ACS

Reagent Grade

TEST	MAXIMUM LIMITS	RESULT
Appearance	¿Colorless and free from suspended matter or sediment	Pass
Assay	29-32%	31.4%
Color (APHA)	10	5
Residue after Evaporation	0.002%	.0001%
Titratable Acid	0.0006 meq/g	< .0006 meq/g
Chloride (CI)	2 ppm	< 1 ppm
Nitrate (NO ₃)	2 ppm	< 1 ppm
Phosphate	2 ppm	< 1 ppm
Sulfate (SO ₄)	5 ppm	< .5 ppm
Ammonium (NH ₄)	5 ppm	< 1 ppm
Heavy Metals (as Pb)	1 ppm	< .1 ppm
Iron (Fe)	0.5 ppm	< .1 ppm
Sodium Stannate	200 – 300 ppb	Pass

^{***}Our Hydrogen Peroxide is considered un-stabilized because it is very slightly stabilized with Sodium Stannate, 500 ppb maximum, just for safety purposes.

Date of MFG: 8/2022 Retest date: 8/2024

Gina M. Rambo
Office Manager

Absolute Standards, Inc.

800-368-1131 www.absolutestandards.com





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

082922

082922

Certified Reference Material CRM

CERTIFIED WEIGHT REPORT:

Part Number:

Lot Number:

Description:

Expiration Date:

NIST Test Number:

56138 082922 Solvent: 20510011

Lot #

Nitric Acid

2% 20.0 Nitric Acid

(mL)

Recommended Storage:

Ambient (20 °C)

Strontium (Sr)

Nominal Concentration (µg/mL):

10000

Lot

Number

082925

6UTB

5E-05 Balance Uncertainty

Purity (%)

Weight shown below was diluted to (mL):

1000.12 0.058 Flask Uncertainty

(%)

Expanded Uncertainty

Reviewed By:

Formulated By:

SDS Information (Solvent Safety Info. On Attached pg.)

NIST SRM

Compound

IN017 SRZ022018A1

Conc. (µg/mL) 10000

Nominal

0.10

(%)

Uncertainty Assay

24.2756

Target

Weight (g)

Actual

Actual

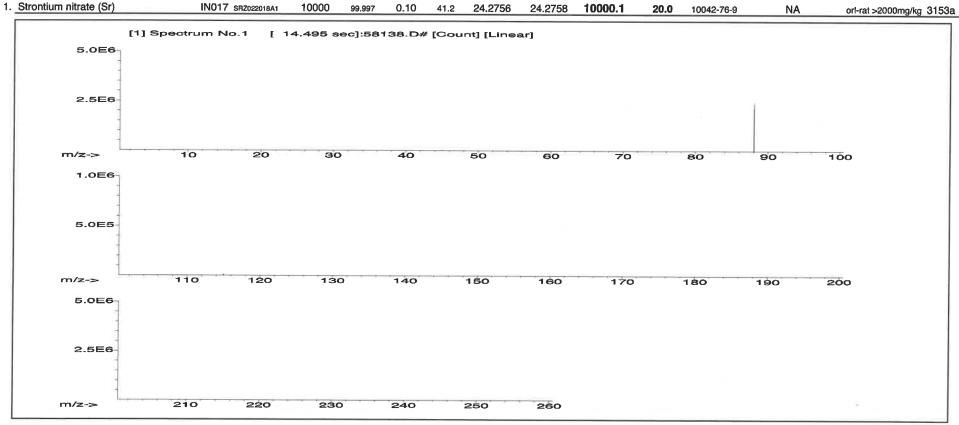
Weight (g) Conc. (μ g/mL) +/- (μ g/mL)

CAS#

OSHA PEL (TWA)

Lawrence Barry

Pedro L. Rentas





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):

							Trace Me	tals	Verifica	tion	by ICP-I	MS ((µg/mL)						
Al	<0.02	Cd	<0.02	Dy	<0.02	Hf	<0.02	Li	<0.02	Ni	<0.02	Pr	<0.02	Se	<0.2	Тъ	<0.02	l w	<0.02
Sb	<0.02	Ca	< 0.2	Er	<0.02	Но	< 0.02	Lu	< 0.02	Nb	< 0.02	Re	<0.02	Si	< 0.02	Te	<0.02	Ū	<0.02
As	<0.2	Ce	< 0.02	Eu	<0.02	In	< 0.02	Mg	<0.01	Os	<0.02	Rh	<0.02	Ag	< 0.02	TI	< 0.02	V	< 0.02
Ba	<0.02	Cs	< 0.02	Gd	<0.02	Ir	< 0.02	Mn	< 0.02	Pd	< 0.02	Rb	< 0.02	Na	< 0.2	Th	< 0.02	Yb	<0.02
Be	<0.01	Cr	< 0.02	Ga	<0.02	Fe	<0.2	Hg	< 0.2	P	< 0.02	Ru	<0.02	Sr	T	Tm	< 0.02	Y	< 0.02
Bi	<0.02	Co	< 0.02	Ge	<0.02	La	< 0.02	Mo	< 0.02	Pt	<0.02	Sm	<0.02	s	< 0.02	Sn	< 0.02	Zn	< 0.02
В	<0.02	Cu	<0.02	Au	<0.02	Pb	< 0.02	Nd	<0.02	K	<0.2	Sc	<0.02	Ta	< 0.02	Ti	<0.02	Zr	<0.02

(T)= Target analyte

Physical Characterization:

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

Certified by:

Bur P. All

- * 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).

Absolute Standards, Inc. 800-368-1131

www.absolutestandards.com



Certified Reference Material CRM M5545,M5546,M5547,M5548 RD:05/08/2 RD:05/08/2023



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

050223

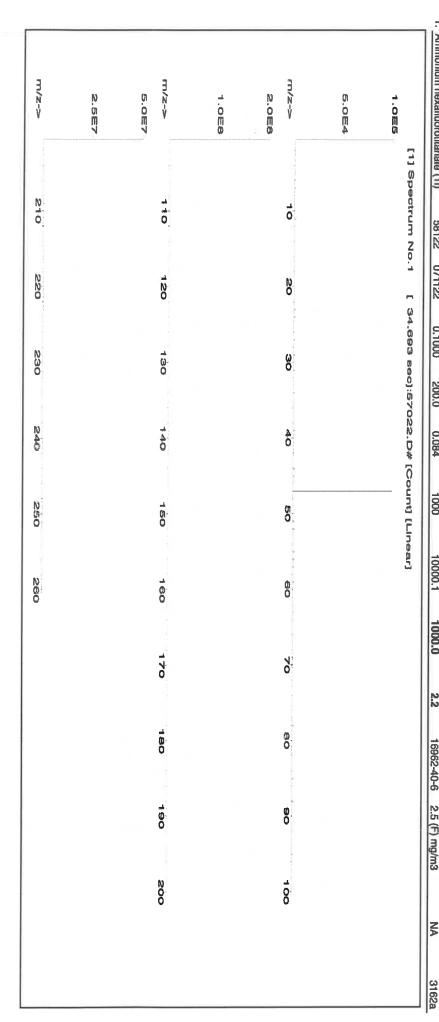
CERTIFIED WEIGHT REPORT: Recommended Storage: **Expiration Date:** Part Number: Description: Lot Number: 57022 050223 Ambient (20 °C) 050226 Titanium (Ti) 21110221 2.0% Lot # Nitric Acid Solvent: 画 40.0 Nitric Acid Formulated By: Lawrence Barry

1 Ammonium heveftioretitemete (TI) EB139 071199 0 1000 0000 0000	Compound			Volume shown below was diluted to (mL): 2000.02	NIST Test Number:
500	Number	Part		was dilute	
074400	Number Number	Lot		id to (mL):	6UTB
	Factor	Dilution		2000.02	
9	Vol. (ml.)	initial		0.058	5E-05
	Pipette (mL)	Initial Uncertainty Nominal		0.058 Flask Uncertainty	5E-05 Balance Uncertainty
	Vol. (ml.) Pipette (ml.) Conc. (µg/ml.) Conc. (µg/ml.) Conc. (µg/ml.) +/- (µg/ml.)	Nominal		\$	bainty
	Conc. (µg/mL)	Initial			
	Conc. (µg/mL)	Final			
	+/- (µg/mL)	Uncertainty	Expanded		Reviewed By:
	CAS#	(Solvi			
	CAS# OSHA PEL (TWA)	(Solvent Safety Info. On Attached pg.)	SDS Info		Pedro L. Rentas
	WA)	o. On Attac	SDS Information		as
	LD50	thed pg.)			050223
	SRM	NIST		1	[23]

Nominal Concentration (µg/mL):

1000

CDI	- 750	CAS# OSHA PEL (TWA)	#SA?	+/- (m/ml)	Cone (un/ml)	Conc. (ug/ml.)	Vol. (ml.) Pipette (ml.) Conc. (ua/ml.) Conc. (ua/ml.) Conc. (ua/ml.)	Pipette (mL)	Vol. (mL)	Factor	Number	Number Number	pound
NIST	tached pg.)	(Solvent Safety Info. On Attached pg.	(\$)	Uncertainty	Final	Initial	Nominal	Uncertainty Nominal	initial	Dilution	Lot	Part	
	'n	SDS Information		Expanded									





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

<0.02	72		Ħ	<0.02	Ta	40.02	જ	40.2	K	<0.02	Nd	<0.02	Pb	40,02	Au	40.02	5	4J.02	5
40,02	Zn	40.02	Sn	<0.02	S	40.02	Sm	<0.02	7	<0.02	Мо	40.02	7	A).02	පි	A0.02	රි	6.02	<u>B</u>
40,022	۲	∆ 0.02	Ħ	40.02	Sr	40.02	Ru	40.02	Ď	40.2	Ж	02	장	<0.02	င္အ	40,02	ਨ	\$0.01	Ве
40.02	¥	40.02	þ	402	Na	40.02	Rb	40,02	2	40,02	M	40.02	Ħ	△0.02	පි	A),02	ಜ	\$0.02	Ba
40,02	<	0.02	∄	40.02	Ag	<0.02	Rh	₫002	0°	40.01	Мg	40.02	F	<0.02	핃	40.02	රී	40.2	As
40.02	ч	40.02	급	40.02	Si	40.02	Re	<0.02	¥	<0.02	Ē	A0.02	Но	<0.02	퍾	40.2	ದಿ	\$0.02	Ş
40.02	₩	40.02	17	<0.2	Se	<0.02	Pr	40.02	Z	<0.02	Ľ	40.02	Hí	△0.02	Dy	∆0.02	Ω	<0.02	A
W	Manual Property					ROZERSKOM		Machine III	Minorita		MINISTER	With laws its error	DOVESTIES.		SECTION S			Section 1	
						g/mL)	S (MC	by ICP-M	tion	Verifica	etals	Irace M							Γ

(T)= Target analyte

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.

* 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 # 57022

Lot # 050223