SOUTHWEST RESEARCH INSTITUTE NUCLEAR PROJECT CLIENT: Division 20 TASK ORDER: 040706-3 SRR: 26134 SDG: 247108 CASE: CNWRA VTSR: July 02, 2004 PROJECT#: 10542.02.002

# **Certificates of Analysis**

### FISHER SCIENTIFIC TRACEMETAL GRADE NITRIC ACID

#### **CERTIFICATE OF ANALYSIS**

Catalog No. A509	LotNo: 110 Release Date: Jan ExpiryDate: Jan	sa ry, 2004
Tests	Units	Value
Assay	%	70%
Color	APHA	<10
Aluminum	ppb	<0.5
Antimony	ppb	<0.1
Arsenic	ppb	<0.1
Barium	ppb	<0.1
Beryllium	ppb	<0.1
Bismuth	ppb	<0.1
Boron	ррь	<1
Cedmium	ppb	<0.1
Calcium	ppb	<1
Chromium	ppb	<0.2
Cobalt	ppb	<0.1
Copper	ppb	<0.1
tron	ppb	<1
Lead	ppb	<0.1
Lithium	ppb	<0.1
Magnesium	ppb	<0.2
Manganese	ppb	<0.1
Mercury	ppb	<0.2
Molybdenum	ddd	<0.1
Nickel	ppb	<0.1
Potass ium	dad	<0.2
Seienium	ppb	<0.1
Silver	ppb	<0.1
Sodium	ppb	<0.2
Strontium	ррб	<0.1
Thorium	ppb	<0.1
Tm	ррю	<0.1
Titanium	ppb	<0.1
Uranium	ppb	≪0.1
Vanedium	ppb	<0.1
Znc	ppb	<0.2
Zirconium	ppb	<0.1

Element concentrations are at the point of bottling. Concentrations of some elements in particular, Ca, Si, K, Na, B, Al, Mg & Mn will increase due to storage in glass bottles.

B Mikelver

Dr. B. McKelvey QA/QC Manager Fisher Scientific Chemical Division Pittsburgh. PA., 15275 Phone (412) 490-8300



INDRGANIC LABS/RADCHEM LABS DATE RECEIVED: \_\_\_\_\_06/01/04 DATE EXPIRED: \_\_\_\_\_01/01/3001\_100 DATE OPENED: \_\_\_\_\_06/01/04 DATE OPENED: \_\_\_\_\_06/01/04

#### FISHER SCIENTIFIC TRACEMETAL GRADE HYDROCHLORIC ACID

#### **CERTIFICATE OF ANALYSIS**

Catalog No. A	508				Lot No	b: 4	103101	
			Re	lea	æ Dat		tanua ry, 3	2004
							lanua ry, 1	
Tests			Uni	ta.				Value
Assay			*	,				35%
Color			API	٩A				<10
Aluminum			pp	ь				<0.5
Antimony			pp	b				<0.1
Arsenic			pp	b				<0.1
Barium			ρρ	b				<0.1
Beryllium			- pp	Ь				∢0.1
Bismuth			- PP	ь				<0.1
Boron			pp	b				<0.5
Cadmium			pp	ь				<0.1
Calcium			pp	Ь				<0.5
Chromium			ρp	Þ				<0.1
Coball			pp	ь				<0.1
Copper			pp	Þ				<0.1
iron			pp	ь				<0.5
Lead			ρp	Þ				<0.1
Lithium			ppi	b				<0.1
Magnesium			pp	Þ				<0.5
Manganese			pp	b				<0.1
Mercury			pp	b				<0.2
Molybdenum			pp	Þ				<0.1
Nickel			pp	b				≪0.1
Potass ium			pp	b				<0.1
Seienium			pp	ь				<0.1
Silver			pp	b				<0.1
Sodium			pp	b				≪0.5
Stronti um			pp	b				<0.1
Thorium			pp	5				<0.1
Tin			ppl	5				<0.1
Titanium			ppl	D				<0.1
Uranium			pp	D				<0.1
Vanadium			pp	D				<0.1
Znc			ppl	5				<0.5
Zirconium			ppl	5				<0.1
Element (	concentrations	910	of t	he	noint	of	hottling	

Element concentrations are at the point of bottling. Concentrations of some elements in particular, Ca, Si, K, Na, B, Al, Mg & Mn will increase due to storage in glass bottles.

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Dr. B. McKelvey QA/QC Manager

Fisher Scientific Chemical Division Pittsburgh, PA., 15275 Phone (412) 490-8300



INDRGANIC LABS/RADCHEM LABS DATE RECEIVED: <u>05/05/04</u> DATE EXPIRED: <u>01/0/ 3007</u> DATE OPENED: <u>05/05/04</u> INDRG: <u>4552-4557</u>PU: <u>F53373</u>

#### FISHER SCIENTIFIC TRACEMETAL GRADE HYDROCHLORIC ACID

#### **CERTIFICATE OF ANALYSIS**

Catalog No. A508	Lot No: 4103101	
	Refease Date: Janua ry, 200	4
	Expiry Date: January, 200	7
Tests	Units Ya	lue
Assay	% 3:	5%
Color	APHA <	10
Aluminum	ppb <(	0.5
Antimony	ppb <(	0.1
Arsenic	ppb <(	0.1
Banum	)> dqq	2.1
Beryllium	ppb <{	).1
Bismuth	ppb <(	),1
Seron	ppb <{	).5
Cedmium	ppb <(	).1
Calcium	ppb <(	).5
Chromium	ppb <0	1.1
Cobelt	ppb <(	).1
Copper	ppb <(	).1
Iron	ppb <(	.5
Lead	ppb <(	1.0
Lithium	)> dqt	).1
Magnesium	ppb <0	.5
Manganese	ppb <(	1.1
Mercury	ppb <0	
Molybdenum	ppb <<	1.1
Nickel	ppb <0	
Potass ium	ppb <c< td=""><td>1.1</td></c<>	1.1
Selenium	ppb <0	1.1
Silver	opb <0	1.1
Sodium	ppb <0	.5
Strontium	ppb <c< td=""><td>1.1</td></c<>	1.1
Thorium	ppb <0	.1
Tin	ppb <0	.1
Titanium	ppb <0	.1
Uranium	ppb <0	.1
Vanadium	0> dqq	.1
Zinc	ppb <0	.5
Zirconium	opb <0	1

INDRGANIC LABS/RADCHEM LABS DATE RECEIVED: 06/01/01 DATE EXPIRED: 01/01/01 DATE OPENED: 06/01/01 INDRG: 45%-4591 PD: E53393

Element concentrations are at the point of bottling. Concentrations of some elements in particular, Ca, Si, K, Na, B, Al, Mg & Mn will increase due to storage in glass bottles.

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Dr. B. McKelvey QA/QC Manager

Fisher Scientific Chemical Division Pitisburgh, PA., 15275 Phone (412) 490-8300



# SPEXertificate™ 010326

Certificate of Reference Material

Catalog Number: Description: Matrix: SPIKE-1Lot No.: 25-23ASSpike Sample Standard 15% Nitric Acid/tr Tartaric Acid - HF

This **ASSUR**<sup>Å</sup>**NCE** <sup>©</sup>certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

#### Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM	Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
Al	200	199.51	3101a	Pb	50	49.98	3128
As	200	199.89	3103a	Sb	50	50.02	3102a
Ba	200	199.68	3104a	v	50	49.95	3165
Se	200	200.10	3149	Zn	50	50.02	3168a
TL	200	200.07	3158	Cu	25	25.34	3114
Fe	100	99.91	3126a	Cr	20	20.04	3112a
Co	50	50.25	3113	Ag	5	5.00	3151
Mn	50	49.98	3132	Be	5	5.00	3105a
Ni	50	50.11	3136	Cd	5	4.99	3108

Spex Reference Multi: Lot #2-61BD, 17-55AS, 19-85ASREF

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/-0.5% on the average of all the certified concentrations with no single component exceeding +/-2%. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

- 2003 Certifying Officer: N. Kochertakota OCT . Date of Certification:

This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers

#### ISO/REMCO N280 Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

#### Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_s = s^2 m$  is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

k, = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+-U where X = True value (Labeled Value), U= Expanded uncertainty

U=ku, where k=2 is the coverage factor at the 95% confidence level

 $u_e$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_e \sqrt{\Sigma u_i^2}$ 

#### **Certification Traveler Report:**

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

#### Legal Notice:



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ABS/RADCHEM LABS

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Certificate of Reference Material

Catalog Number: Description: Matrix: ICAL-1 Lot No.: 25-176AS Instrument Calibration Standard 1 5% Nitric Acid

This ASSURANCE <sup>®</sup>certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
Ca	5,000	4,984.92	3109a
K	5,000	4,990.26	3141a
Mg	5,000	4,991.82	3131a
Na	5,000	4,998.07	3152a

Spex Reference Multi: Lot #10-100AS, 12-113AS, 5-198VY, 6-28VY-REF

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/-0.5% on the average of all the certified concentrations with no single element exceeding +/-2%. This includes uncertainty of measurements and other effects, such as transpiration losses. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

SEP\_\_\_\_ Certifying Officer: N. Kochertakola Date of Certification:

This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

010329

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement - Second Edition ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

#### Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

#### Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_s = s^2 m$  is employed to determine the sampling size

S = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty) m = the sub-sampling mass

k. • mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+/-U where X = True value (Labeled Value), U= Expanded uncertainty

 $U^{mku}$ , where k=2 is the coverage factor at the 95% confidence level

ue is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_{ev} \sqrt{\Sigma u_i^2}$ 

#### Certification Traveler Report:

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

#### Legal Notice:



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195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

of analysis certificate

### CUSTOM-GRADE SOLUTION

Catalog Number: CGSC1-1and CGSC1-5

Lot Number: W-SC02055

Starting Material: Starting Material Purity: Starting Material Lot No:

#### 1000 µg/mL Scandium IN 5% HNO, (abs)

INDRGANIC LABS/RADCHEM LABS DATE RECEIVED: 09/04/03 DATE EXPIRED: 10/01/2004 VOS DATE OPENED: 09/25/03 INDRG: 4201 PD: 52232

#### CERTIFIED CONCENTRATION: 1000 $\pm$ 5 $\mu$ g/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

n = number of measurements

Certified Value (x) =  $\frac{\sum x_{1}}{n}$ 

 $(\bar{x}) = mean$ 

Uncertainty  $(\pm) = 2[(\sum_{s} \frac{1}{s})^2]^{1/2}$ 

 $\sum S_i$  = The summation of all significant estimated errors.

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#### Classical Wet Assay: 1000 $\pm$ 5 $\mu$ g/mL Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

x<sub>i</sub> = individual results

#### Instrument Analysis: 995 $\pm$ 6 $\mu$ g/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3148a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN $\mu$ g/mL:

Sc<sub>2</sub>O<sub>3</sub> 99.99%

632-5721

Custom-Grade solutions tested for trace metallic impurities 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  $\mu m$  .

м-	check	ed by ICP-MS	0 - cl	necke	d by ICP-OES	i-sp	ectral	Interference	n - not	chec	ted for	s - solutio	m sta	ndard element
м	Çu	< 0.00060	M	Pb	0.00050	<u>0</u>	к	<5.01	M	Ta	< 0.00070	М	Zr	0.032
M	Co	< 0.00030	M	La	< 0.000050	M	Pt	<0.00020	n	S		<u>M</u>	Zn	0.0075
M	Cr	< 0.00050	Q	Fe	<0,16	<u>o</u>	P	ł	M	\$r	< 0.000050	M	Y	< 0.0040
M	Cs	< 0.000030	M	lr	< 0.00050	M	Pd	<0.00050	<u>0</u>	Na	<0.16	M	Yb	<0.00010
M	Се	< 0.00050	M	In	< 0.00010	<u>n</u>	Os		M	Ag	0.0050	M	v	< 0.00020
Q	Ca	0.016	М	Но	< 0.000050	M	NЬ	< 0.000050	Q	Si	< 0.034	M	U	< 0.00020
M	Cd	< 0.00030	M	Hf	0.0030	Q	NI	<0.084	Q	Se	<0.67	М	w	<0.0010
Ō	В	< 0.020	M	Au	< 0.00030	М	Nd	< 0.00020	<u>5</u>	Sc		<u>M</u>	Ті	< 0.0050
М	Bi	0.0043	M	Ge	< 0.00060	<u>M</u>	Мо	< 0.00020	M	Sm	<0.00010	M	Sn	< 0.00050
M	Be	< 0.000050	M	Ga	< 0.00010	<u>o</u>	Hg	i	Μ	Ru	<0.00020	M	Tm	< 0.000040
M	Ba	<0.0010	M	Gd	< 0.00010	<u>M</u>	Mn	<0.00040	M	Rb	< 0.00010	M	Th	0.0028
M	As	< 0.0010	M	Eu	< 0.00030	M	Mg	<0.0030	M	Rh	<0.00010	M	TI	<0.00010
Μ	Sb	< 0.000050	Μ	Er	< 0.00050	<u>M</u>	Łu	<0.000040	M	Re	< 0.00010	M	ТЬ	<0.000030
Q	AI	<0.070	M	Dγ	< 0.00060	м	Li	< 0.0010	M	Pr	< 0.000030	м	Te	< 0.0030

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.038 g/mL

QA:KL Rev.021303.75

Paul R. Haines

Quality Assurance Manager





Expires:

#### **QUALITY STANDARD DOCUMENTATION**

1. ISO 9001:2000 QMI Registered Quality System (Certificate Number 010105)



Members of IQ Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

- 2. ISO/IEC Guide 34-2000 "General Requirements for the Competence of Reference Material Producers" Reference Materials Production - Accredited A2LA Certificate 883.02
- 3. ISO/IEC17025-1999 "General Requirements for the Competence of Testing and Calibration" Chemical Testing -Accredited A2LA Certificate 883.01
- 4. MIL-STD-45662A
- 5. 10CFR50 Appendix B Nuclear Regulatory Commission Domestic Licencing of Production and Utilization Facilities
- 6. 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance

Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

#### STABILITY/ EXPIRATION DOCUMENTATION

 Shelf Life The length of time that a properly stored and packaged standard will remain within the specified uncertainty. Shelf life is affected by chemical stability and transpiration issues. Inorganic Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss is linear with time and limits the time a standard can be used with confidence. The smaller the bottle the higher the rate of transpiration. Inorganic Ventures' studies indicate that the shelf life of our 500 mL bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.

Expiration Date - <u>The date after which a standard solution should not be used.</u> A one year expiration data recommended by most state and federal regulatory agencies. Transpiration issues repeated use of solutions over a one year period may adversely affect the integrity of the standard.

#### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double delonized water that has been filtered through a 0.2 µm filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

#### **GLASSWARE CALIBRATION**

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

#### **BALANCE CALIBRATION**

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 454678. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

#### THERMOMETER CALIBRATION

The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

#### TECHNICAL SUPPORT

All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 INT'L 1-732-901-1900 FAX 1-732-901-1903 E-MAIL IVtech@ivstandards.com

## 010332 inorganic ventures

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

## CUSTOM-GRADE SOLUTION

Catalog Number: CGSC10-1and CGSC10-5

Lot Number: T-SC02053

Starting Material: Starting Material Purity: Starting Material Lot No:

#### 10,000 µg/mL Scandium IN 5% HNO, (abs)

INOF	RGANIC LABS	3/RADCHEM LA	BS
DATE	RECEIVED:	09/24/03	
DATE	EXPIRED:	10/01/2004	VOS
DATE	OPENED:	09/24/03	
INDRO	4262	FO: F500	3a

#### CERTIFIED CONCENTRATION: 10,047 $\pm$ 29 $\mu$ g/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\bar{x}$ ) =  $\sum x_i$ 

Uncertainty 
$$(\pm) = 2[(\sum_{s})^2]^{1/2}$$

 $(\bar{x}) = mean$ 

 $x_i = individual results$ n = number of measurements

ncertainty (±) = 
$$2[(\sum_{\$})^2]$$
 (n)<sup>1/2</sup>

 $\sum S_i$  = The summation of all significant estimated errors.

#### Classical Wet Assay: 10,047 $\pm$ 29 $\mu$ g/mL Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

#### Instrument Analysis: 9994 ± 41 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3148a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Sc203

99.999%

632-5721

Custom-Grade solutions tested for trace metallic impurities 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  $\mu m$  .

~		<0.070		<b>D</b>	<0.0000		Li	<0.010		ъ.	~0.00000		<b>T</b> -	<0.020
Q	AI	<0.070	M	Đy	< 0.0060	<u>M</u>	ч	<0.010	M	Pr	<0.00030	M	Tθ	<0.030
M	Sb	< 0.00050	M	Er	< 0.0050	M	Lu	< 0.00040	M	Re	< 0.0010	<u>M</u>	ТЬ	< 0.00030
Μ	As	<0.010	M	Eu	< 0.0030	M	Mg	<0.030	M	Rh	< 0.0010	M	TI	< 0.0010
M	Ba	<0.010	M	Gd	< 0.0010	M	Mn	<0.0040	M	Rb	< 0.0010	M	Th	0.028
M	Be	< 0.00050	Μ	Ga	< 0.0010	i	Hg		M	Ru	< 0.0020	M	Tm	< 0.00040
M	Bi	0.043	M	Ge	< 0.0060	Μ	Мо	<0.0020	м	Sm	<0.0010	M	Sn	< 0.0050
Q	в	<0.034	M	Au	<0.0030	M	Nd	<0.0020	5	Sc		D	Ti	
М	Cd	< 0.0030	M	Hf	0.030	<u>0</u>	Ni	<0.084	<u>o</u>	Se	< 0.67	M	w	<0.010
Q	Ca	0.17	м	Но	< 0.00050	M	Nb	<0.00050	Q	Si	<0.034	M	U	< 0.0020
M	Ce	< 0.0050	M	In	< 0.0010	ņ	Os		M	Ag	0.0050	M	v	<0.0020
M	Cs	< 0.00030	M	le	< 0.0050	M	₽d	< 0.0050	<u>o</u>	Na	<0.16	M	YЪ	< 0.0010
Μ	Çr	< 0.0050	<u>0</u>	Fe	< 0.16	1	P		M	Sr	<0.00050	M	Y	< 0.040
M	Co	< 0.0030	<u>M</u>	La	< 0.00050	M	Pt	< 0.0020	<u>n</u>	s		M	Zn	0.075
М	Cu	<0.0060	М	Pb	0.0050	Q	к	< 5.01	М	Ta	<0.0070	M	Zr	0.32
м -	chec	ked by ICP-MS	0-0	heck	ed by ICP-OES	i - sp	ectra	l interference	n - no	t che	cked for	s - solution	stand	lard element

## ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.073 g/mL

(over)

Expires:

QA:KL Aw.021 20300

Paul R. Haines

Quality Assurance Manager



#### **QUALITY STANDARD DOCUMENTATION**

1. ISO 9001:2000 QMI Registered Quality System (Certificate Number 010105)

Members of IQ Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungery (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA),



Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

- 2. ISO/IEC Guide 34-2000 "General Requirements for the Competence of Reference Material Producers" Reference Materials Production - Accredited A2LA Certificate 883.02
- 3. ISO/IEC17025-1999 "General Requirements for the Competence of Testing and Calibration" Chemical Testing -Accredited A2LA Certificate 883.01
- 4. MIL-STD-45662A
- 5. 10CFR50 Appendix B Nuclear Regulatory Commission Domestic Licencing of Production and Utilization Facilities
- 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

#### STABILITY/ EXPIRATION DOCUMENTATION

 Shelf Life The length of time that a properly stored and packaged standard will remain within the specified uncertainty. Shelf life is affected by chemical stability and transpiration issues. Inorganic Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss is linear with time and limits the time a standard can be used with confidence. The smaller the bottle the higher the rate of transpiration. Inorganic Ventures' studies indicate that the shelf life of our 500 mL bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.

Expiration Date - <u>The date after which a standard solution should not be used.</u> A one year expiration date is recommended by most state and federal regulatory agencies. Transpiration issues and repeated use of solutions over a one year period may adversely affect the integrity of the standard.

#### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double deionized water that has been filtered through a 0.2 µm filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

#### **GLASSWARE CALIBRATION**

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

#### **BALANCE CALIBRATION**

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 454678. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

#### THERMOMETER CALIBRATION

The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

#### **TECHNICAL SUPPORT**

All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 INT'L 1-732-901-1900 FAX 1-732-901-1903 E-MAIL IVtech@ivstandards.com

## inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com



 $Sc_2O_3$ 

99.99% 632-5721

### CUSTOM-GRADE SOLUTION

Catalog Number: CGSC1-1 and CGSC1-5

Lot Number: W-SC02058

Starting Material: Starting Material Purity: Starting Material Lot No: 1000 µg/mL Scandium IN 5% HNO3 (abs)

INDRGANIC LABS/RADCHEM LABS

DATE RECEIVED:	40/10/70
DATE EXPIRED:	08/01/2005 405
	40/10/70
INDRG: 4629	PO: F53406

#### CERTIFIED CONCENTRATION: 1005 $\pm$ 2 $\mu$ g/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\bar{x}$ ) =  $\frac{\sum x_i}{n}$ 

Uncertainty (±) =  $2[(\sum_{s_{1}})^{2}]^{1/2}$ (n)<sup>1/2</sup>

(x) = mean

an  $x_i$  = individual results n = number of measurements

 $\sum S_i$  = The summation of all significant estimated errors.

Classical Wet Assay: 1007  $\pm$  3  $\mu$ g/mL Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

#### Instrument Analysis: 1005 ± 2 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3148a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities 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  $\mu$ m.

				_						-			_	
<u>o</u>	AI	<0.070	M	Dy	<0.00060	M	Li	< 0.0010	M	Pr	< 0.000030	<u>M</u>	Te	< 0.0030
M	Sb	< 0.000050	м	Er	< 0.00050	M	Lu	<0.000040	M	Re	< 0.00010	M	To <	0.000030
м	As	<0.0010	Μ	Eu	< 0.00030	м	Mg	< 0.0030	M	Rh	<0.00010	М	TI	< 0.00010
M	Ba	<0.0010	м	Gd	< 0.00010	M	Mn	< 0.00040	М	Rb	<0.00010	M	Th	0.0028
M	Be	< 0.000050	м	Ga	< 0.00010	<u>0</u>	Hg	i	<u>M</u>	Ru	< 0.00020	М	Tm	< 0.000040
M	Bi	0.0043	М	Ge	< 0.00060	M	Mo	< 0.00020	<u>M</u>	Sm	< 0.00010	М	Sn	< 0.00050
Q	в	< 0.020	М	Au	< 0.00030	M	Nd	< 0.00020	<u>s</u>	\$c		М	Ti	< 0.0050
M	Cď	< 0.00030	м	Hf	0.0030	õ	Ni	< 0.084	<u>0</u>	Se	< 0.67	M	W	<0.0010
<u>o</u>	Ca	0.016	M	Но	< 0.000050	М	Nb	< 0.000050	Q	Si	< 0.034	M	U	<0.00020
M	Çе	< 0.00050	M	In	< 0.00010	n	Oş		M	Ag	0.0050	M	٧	< 0.00020
M	Cs	<0.000030	M	lr	< 0.00050	M	Pd	< 0.00050	<u>o</u>	Na	<0.16	M	Yb	< 0.00010
м	Cr	<0.00050	<u>0</u>	Fe	< 0.16	Q	Р	i	М	Sr	< 0.000050	М	Y	< 0.0040
M	Co	< 0.00030	М	La	< 0.000050	M	Pt	< 0.00020	n	s		м	Zn	0.0075
M	Cu	<0.00060	м	РЬ	0.00050	õ	к	<5.01	M	Ta	< 0.00070	<u>M</u>	Zr	0.032
M۰	check	ed by ICP-MS	0 - c	hecke	d by ICP-OES	i-sp	ectral	interference	n - not	check	ed for	s - solutio	n stai	ndard element

#### ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.038 g/mL

QA:KL ANV.0108040N

Paul R. Haines

Quality Assurance Manager Expires:



#### QUALITY STANDARD DOCUMENTATION

1. ISO 9001:2000 QMI Registered Quality System (Certificate Number 010105)



Members of IQ Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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#### THERMOMETER CALIBRATION

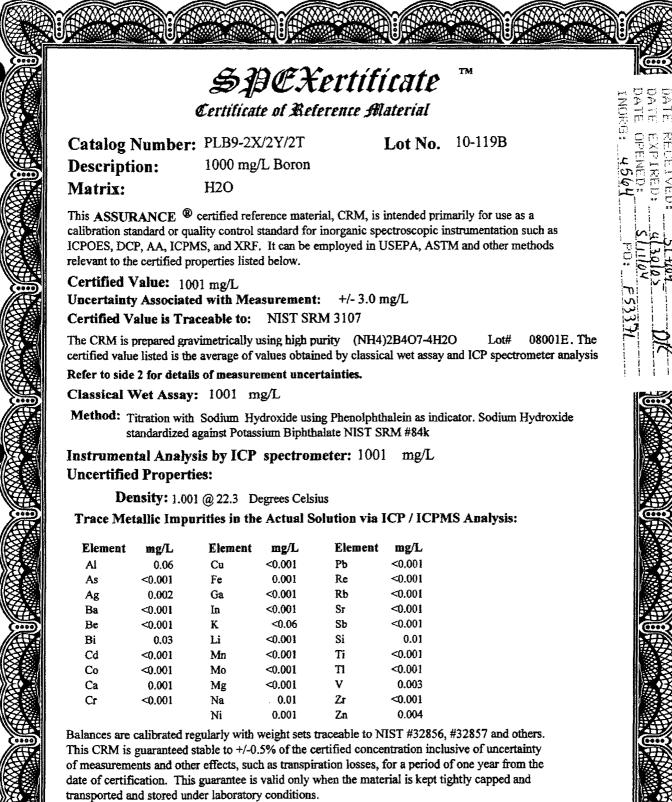
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All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 INT'L 1-732-901-1900 FAX 1-732-901-1903 E-MAIL IVtech@ivstandards.com

ABS



'114

APR

Date of Certification: \_

Certifying Officer: N. Kocherakota

This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement - Second Edition ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

#### Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

#### Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohim, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_s = s^2 m$  is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m =the sub-sampling mass

k, = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+/-U where X = True value (Labeled Value), U= Expanded uncertainty

 $U=ku_e$  where k=2 is the coverage factor at the 95% confidence level

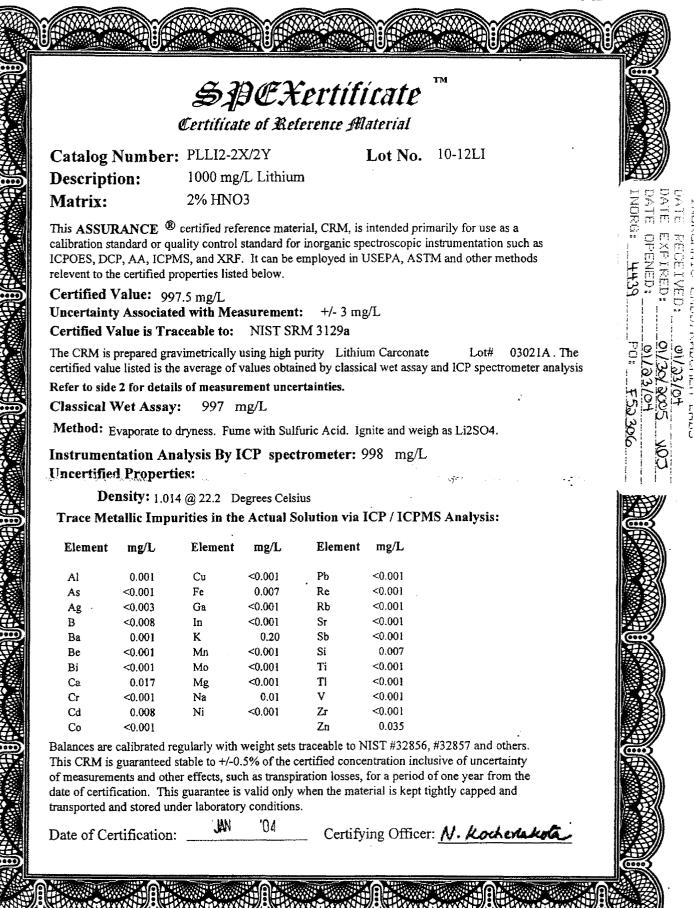
 $u_c$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_{ce} \sqrt{\Sigma u_i^2}$ 

#### **Certification Traveler Report:**

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

#### Legal Notice:





This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition ASTM Guide D6362-98

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ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

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#### Instructions for Use:

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U=ku, where k=2 is the coverage factor at the 95% confidence level

 $u_c$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_c \sqrt{\Sigma u_i^2}$ 

#### **Certification Traveler Report:**

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#### Legal Notice:



		-	te of Rei	terence Al	Í <b>CATE</b> ™ ateríal		
Catalog N	lumber:	PLMO9-	2X/2Y/21	Г	Lot No. 10-	-74MO	
Descriptio			/L Molyb				
Matrix:		H2O					NO
calibration star	ndard or qua , AA, ICPN	ality control 4S, and XRF	standard for . It can be	inorganic sp	intended primarily ectroscopic instruc JSEPA, ASTM an	nentation such as	HHH : 508
Certified V Uncertainty Certified Va	Associate	d with Mea		t: +/-3.0m LM #3134	g/L		
The CRM is proceeding of the CRM is proceeding of the certified value <b>Refer to side</b> 2	listed is the	average of v	values obtai	ned by classic		Lot# 03011C. The CP spectrometer analysis	° F
Classical W	et Assay	998 m	g/L				65
Method: Pro		saina 9 II.d.		<b>~</b>			б
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					nd weigh as MoO 999 mg/L	2 (C9H6NO)2.	e
Instrument Uncertified	al Analys	is by ICP			nd weigh as MoO: 999 mg/L	2 (C9H6NO)2.	6
Instrument Uncertified	al Analys Properti	is by ICP es:	spectron	neter:		2 (C9H6NO)2.	
Instrument Uncertified Den	al Analys Properti sity: 0.998	sis by ICP es: 89 @ 23.7 D	spectron egrees Cels	neter:			
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Instrument Uncertified Den Trace Mets	al Analys Properti sity: 0.998 allic Impu	is by ICP es: 39 @ 23.7 D rities in the	spectron egrees Cels e Actual S	neter: 9 ius olution via	999 mg/L ICP / ICPMS A		
Instrument Uncertified Den Trace Metz Element Al As	al Analys Properti isity: 0.998 allic Impu mg/L 0.002 0.04	sis by ICP es: 39 @ 23.7 D rities in the Element Cu Fe	spectron egrees Cels e Actual S mg/L 0.003 <0.10	neter: ius olution via Element Pb Re	999 mg/L ICP / ICPMS A mg/L 0.002 0.03		
Instrument Uncertified Den Trace Mets Element Al As Ag	al Analys Properti isity: 0.998 allic Impu mg/L 0.002 0.04 <0.001	sis by ICP es: 89 @ 23.7 D rities in the Element Cu Fe Ga	spectron egrees Cels e Actual S mg/L 0.003 <0.10 <0.001	neter: 9 ius olution via Element Re Rb	999 mg/L ICP / ICPMS A mg/L 0.002 0.03 ⊲0.001		
Instrument Uncertified Den Trace Mets Element Al As Ag	al Analys Properti isity: 0.998 allic Impu mg/L 0.002 0.04	sis by ICP es: 39 @ 23.7 D rities in the Element Cu Fe	spectron egrees Cels e Actual S mg/L 0.003 <0.10	neter: ius olution via Element Pb Re	999 mg/L ICP / ICPMS A mg/L 0.002 0.03		
Instrument Uncertified Den Trace Mets Element Al As Ag B	al Analys Properti isity: 0.998 allic Impu mg/L 0.002 0.04 <0.001 <0.006	sis by ICP es: 39 @ 23.7 D rities in the Element Cu Fe Ga In	spectron egrees Cels e Actual S mg/L 0.003 <0.10 <0.001 <0.001	neter: ius olution via Element Pb Re Rb Sr	099 mg/L ICP / ICPMS A mg/L 0.002 0.03 <0.001 <0.001		
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This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

#### Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

#### Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_3 = s^2 m$  is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

 $k_i = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+-U where X = True value (Labeled Value), U= Expanded uncertainty

U=ku, where k=2 is the coverage factor at the 95% confidence level

 $u_c$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_c \sqrt{\Sigma u_i^2}$ 

#### **Certification Traveler Report:**

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

#### Legal Notice:



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	Catalog 1	Number	: PLP9-2X	C/2Y/2T		Lot No.	9-150P	ia/ 3
5	Descripti	ion:	1000 mg	/L Phosph	norus			-   0   0   0   0   0   0
	Matrix:		H2O					1 20
	calibration sta ICPOES, DC relevent to th	andard or qu P, AA, ICPI e certified p	uality control MS, and XRF roperties liste	standard fo	r inorganic sp	ectroscopic i	marily for use as <b>a</b> nstrumentation such as "M and other methods	196052
	-	y Associate	02.5 mg/L ed with Mea aceable to:			g/L		
	The CRM is j	prepared gra	vimetrically	using high p	purity (NH4		Lot# W1002B. The and ICP spectrometer analysis	
	Refer to side	2 for detai	ls of measure	ement unce	rtainties.			民
5	Classical V	Wet Assay	<b>r:</b> 1003 r	ng/L				ē
	Method: P	recipitation	usino Maone	- sia Mixture	Filter ignit	e and weigh	as Mg2P2O7.	
		TOTION AN	IAIVSIS KV I	C P SDec				
			• •	or opto	u ometei .	1002 mg/L		170
	Uncertified	d Propert	ies:	-		1002 mg/L		
	Uncertified De	d Propert nsity: 0.99	<b>ies:</b> 196 @ 24.0 D	egrees Cels	ius			
	Uncertified De	d Propert nsity: 0.99	<b>ies:</b> 196 @ 24.0 D	egrees Cels	ius		IS Analysis:	(IBK)
	Uncertified De	d Propert nsity: 0.99	<b>ies:</b> 196 @ 24.0 D	egrees Cels	ius	ICP / ICPN		<b>XUBX</b>
	Uncertified De: Trace Met Element	d Propert nsity: 0.99 tallic Impu mg/L	ies: 196 @ 24.0 D urities in the Element	egrees Cels e Actual S mg/L	ius olution via Element	ICP / ICPM mg/L		XUX X
	Uncertified De Trace Met	d Propert nsity: 0.99 tallic Impu	ies: 96 @ 24.0 D arities in the	egrees Cels e Actual S	ius olution via	ICP / ICPN		XOX
	Uncertified De: Trace Met Element Al As	d Propert nsity: 0.99 tallic Impu mg/L 0.002	ies: 196 @ 24.0 D 11 urities in the Element Cu	egrees Cels e Actual S mg/L <0.001	ius olution via Element Pb	ICP / ICPM mg/L <0.001		
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This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

#### **Material Source:**

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

#### Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_s = s^2 m$  is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

 $k_s = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+-U where X = True value (Labeled Value), U= Expanded uncertainty

U=ku, where k=2 is the coverage factor at the 95% confidence level

 $u_c$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_c \sqrt{\Sigma u_i^2}$ 

#### Certification Traveler Report:

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

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			FEX e of Rel	erence M			
Catalog	Vinmbor	DI SIQ_23	7/2V/2T	-	Lot No. 10-07	751	
Catalog I		1000 mg/					5
Descripti	on:	-					
Matrix:		H2O / 0.4	1% F-				e
calibration sta	andard or qui P, AA, ICPN	ality control s AS, and XRF.	tandard for It can be e	inorganic spe	ntended primarily for ctroscopic instrume SEPA, ASTM and o	ntation such as	
Certified V	/alue: 999	8.5 mg/L					
			surement	: +/- 3 mg	/L		e e
Certified Va	alue is Tra	ceable to:	NIST SR	LM #3150			5
certified value	e listed is the	e average of v	alues obtai		2SiF6 al wet assay and ICF	Lot# 02021D. The spectrometer analysis	
Refer to side				rtainties.			1152
Classical V	Vet Assay	: 997 п	ng/L				17
				date and 8-Hy	droxy Quinoline. F	ilter, dry, and weigh as	
() Instrumen Uncertifier	C9H7ON)4(I tation An d Properti	H4)[Si(Mo12 alysis By I ies:	040)] CP spect	trometer: ]		ilter, dry, and weigh as	
(( Instrumen Uncertifier De	C9H7ON)4(1 tation An d Propertins nsity: 1.016	H4)[Si(Mo12 alysis By I ies: 0 @ 26.5 Do	O40)] CP spect	trometer: 1			
(( Instrumen Uncertifier De	C9H7ON)4(1 tation An d Propertins nsity: 1.016	H4)[Si(Mo12 alysis By I ies: 0 @ 26.5 Do	O40)] CP spect	trometer: 1	000 mg/L		
(( Instrumen Uncertifier De Trace Met	C9H7ON)4() tation An d Propertinsity: 1.01 tallic Impu	H4)[Si(Mo12 alysis By I ies: 0 @ 26.5 De rities in the Element Cu	O40)] CP spect egrees Cels e Actual S mg/L <0.001	trometer: 1 ius olution via 1 Element Pb	000 mg/L CP / ICPMS Ana mg/L <0.001		
(( Instrumen Uncertifier De Trace Met Element Al As	C9H7ON)4() tation An d Properti nsity: 1.01; tallic Impu mg/L 0.002 <0.001	H4)[Si(Mo12 alysis By I ies: 0 @ 26.5 De urities in the Element Cu Fe	O40)] CP spect egrees Cels e Actual S mg/L <0.001 0.020	trometer: 1 ius olution via 1 Element Pb Rb	000 mg/L CP / ICPMS Ans mg/L <0.001 <0.001		
(( Instrumen Uncertified De Trace Met Element Al As Ag	C9H7ON)4() tation An d Properti nsity: 1.01; tallic Impu mg/L 0.002 <0.001 <0.001	H4)[Si(Mo12 alysis By I ies: 0 @ 26.5 De urities in the Element Cu Fe Ga	O40)] CP spect egrees Cels e Actual S mg/L <0.001 0.020 <0.001	trometer: 1 ius olution via 1 Element Pb Rb Re	000 mg/L CP / ICPMS Ans mg/L <0.001 <0.001 <0.001		
(( Instrumen Uncertified De: Trace Met Element Al As Ag B	C9H7ON)4() tation An d Properti nsity: 1.01; tallic Impu mg/L 0.002 <0.001 <0.001 <0.003	H4)[Si(Mo12 alysis By I ies: 0 @ 26.5 De urities in the Element Cu Fe	O40)] CP spect egrees Cels e Actual S mg/L <0.001 0.020 <0.001 <0.001	trometer: 1 ius olution via 1 Element Pb Rb Re Sr	000 mg/L CP / ICPMS Ans mg/L <0.001 <0.001		
(( Instrumen Uncertified De Trace Met Element Al As Ag	C9H7ON)4() tation An d Properti nsity: 1.01; tallic Impu mg/L 0.002 <0.001 <0.001	H4)[Si(Mo12 alysis By I ies: 0 @ 26.5 De rities in the Element Cu Fe Ga In	O40)] CP spect egrees Cels e Actual S mg/L <0.001 0.020 <0.001	trometer: 1 ius olution via 1 Element Pb Rb Re	000 mg/L CP / ICPMS Ans mg/L <0.001 <0.001 <0.001 <0.001 <0.001		
(( Instrumen Uncertifier De: Trace Met Element Al As Ag B B Ba	C9H7ON)4() tation An d Properti nsity: 1.01; tallic Impu mg/L 0.002 <0.001 <0.001 <0.003 <0.001	H4) [Si(Mo12 alysis By I ies: 0 @ 26.5 De rities in the Element Cu Fe Ga In K	O40)] CP spect egrees Cels e Actual S mg/L <0.001 0.020 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001	trometer: 1 ius olution via 1 Element Pb Rb Re Sr Sb Ti Ti Ti	000 mg/L CCP / ICPMS Ans mg/L <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001		
(( Instrumen Uncertifier De: Trace Met Element Al As Ag B Ba Ba Be Bi Ca	C9H7ON)4() tation An d Properti nsity: 1.016 tallic Impu mg/L 0.002 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.018 <0.	H4) [Si(Mo12 alysis By I ies: 0 @ 26.5 De arities in the Element Cu Fe Ga In K Li Mg Mn	O40)] CP spect egrees Cels e Actual S mg/L <0.001 0.020 <0.001 <0.001 <0.010 <0.001 <0.001 <0.001 <0.001 <0.001	trometer: 1 ius olution via 1 Element Pb Rb Re Sr Sb Ti Ti Ti V	000 mg/L CP / ICPMS Ans mg/L <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001		
(( Instrumen Uncertified De Trace Met Element Al As Ag B Ba Ba Be Bi Ca Cr	C9H7ON)4() tation An d Properti nsity: 1.01 tallic Impu mg/L 0.002 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.002 <0.001 <0.001 <0.001 <0.002 <0.001 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.0	H4)[Si(Mo12 alysis By I ies: 0 @ 26.5 De rities in the Element Cu Fe Ga In K Li Mg Mn Mo	O40)] CP spect egrees Cels e Actual S mg/L <0.001 0.020 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001	trometer: 1 ius olution via 1 Element Pb Rb Re Sr Sb Ti Ti Ti V Zr	000 mg/L CP / ICPMS Ana mg/L <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001		
(( Instrumen Uncertified De Trace Met Element Al As Ag B Ba Ba Be Bi Ca Cr	C9H7ON)4() tation An d Properti nsity: 1.01 tallic Impu mg/L 0.002 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.002 <0.001 <0.001 <0.001 <0.002 <0.001 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.002 <0.0	H4) [Si(Mo12 alysis By I ies: 0 @ 26.5 De arities in the Element Cu Fe Ga In K Li Mg Mn	O40)] CP spect egrees Cels e Actual S mg/L <0.001 0.020 <0.001 <0.001 <0.010 <0.001 <0.001 <0.001 <0.001 <0.001	trometer: 1 ius olution via 1 Element Pb Rb Re Sr Sb Ti Ti Ti V	000 mg/L CP / ICPMS Ans mg/L <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001		
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ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

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The mathematical expression  $k_s = s^2 m$  is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty) m = the sub-sampling mass

k, = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

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The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty

 $U=ku_c$  where k=2 is the coverage factor at the 95% confidence level

 $u_c$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_{ce} \sqrt{\Sigma u_i^2}$ 

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#### Legal Notice:

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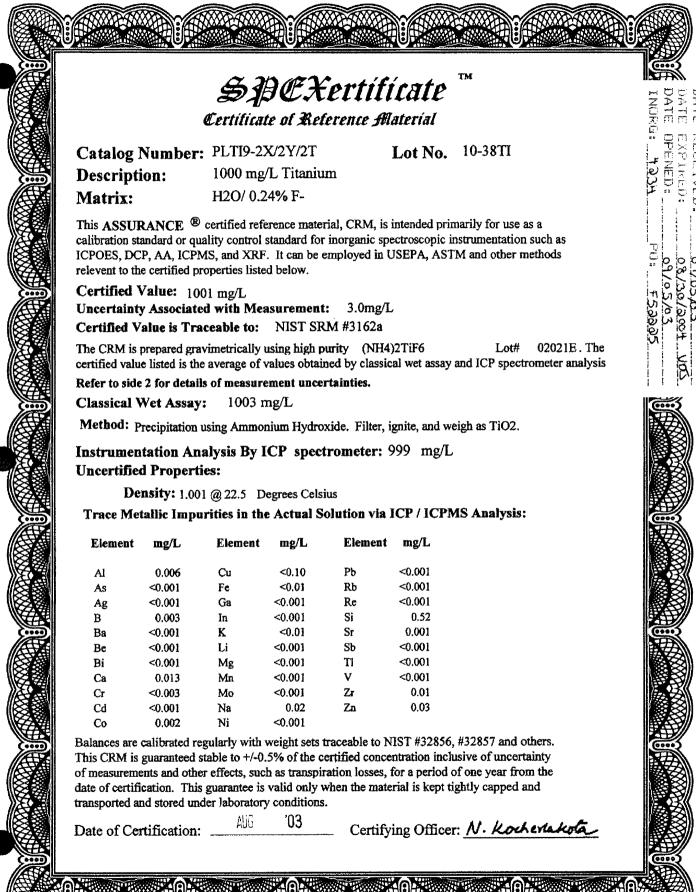




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UNDERANIC

ABS/RADCHEM LABS



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#### Legal Notice:





# SPCXertificate

Certificate of Reference Material

Catalog Number:PLSR2-2X/2Y/2TLot No.Description:1000 mg/L Strontium in 2% HNO3Matrix:2% HNO3

This ASSURANCE <sup>®</sup> certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevent to the certified properties listed below.

Certified Value: 1002.5 mg/L Uncertainty Associated with Measurement: +/- 3 mg/L Certified Value is Traceable to: NIST SRM 3153a

The CRM is prepared gravimetrically using high purity Strontium Carbonate Lot# 02001B. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1002 mg/L

Method: EDTA titration using Methyl Thymol Blue as indicator. EDTA standardized against Pb(NO3)2 NIST SRM #928.

Instrumentation Analysis By ICP spectrometer: 1003 mg/L Uncertified Properties:

Density: 1.010 @ 22.7 Degrees Celsius

Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.02	Cu	<0.001	Pb	<0.001
As	<0.001	Fe	0.001	Rb	<0.001
Ag	<0.002	Ga	< 0.001	Re	< 0.001
В	< 0.003	In	<0.001	Si	0.043
Ba	0.008	K	0.10	Sb	< 0.001
Be	<0.001	Li	0.007	Ti	<0.002
Bi	<0.001	Mg	< 0.003	Tl	<0.001
Ca	0.014	Mn	<0.001	v	<0.001
Cr	0.001	Mo	<0.001	Zr	< 0.001
Cd	< 0.001	Na	0.01	Zn	0.04
Co	<0.001	Ni	<0.001		

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to #/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.

- 2003

Date of Certification:

Certifying Officer: N. Kochesta.kg

9-166SR

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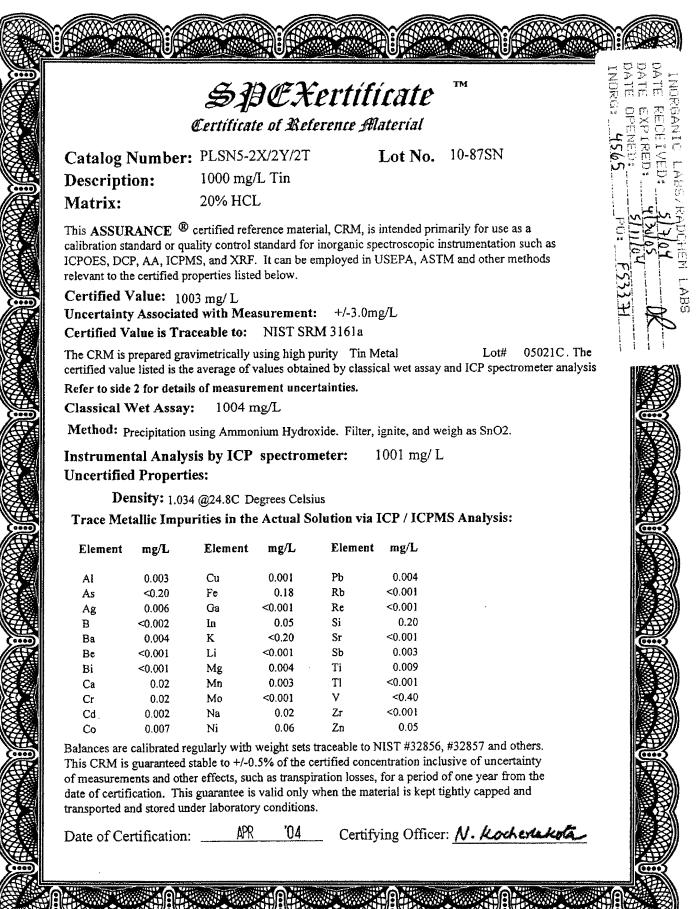
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ISO 9001 CERTIFIED



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This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

#### **Material Source:**

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#### Instructions for Use:

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#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_s = s^2 m$  is employed to determine the sampling size

S = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

 $k_s = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty

U=ku, where k=2 is the coverage factor at the 95% confidence level

 $u_c$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_{cr} \sqrt{\Sigma u_i^2}$ 

#### **Certification Traveler Report:**

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

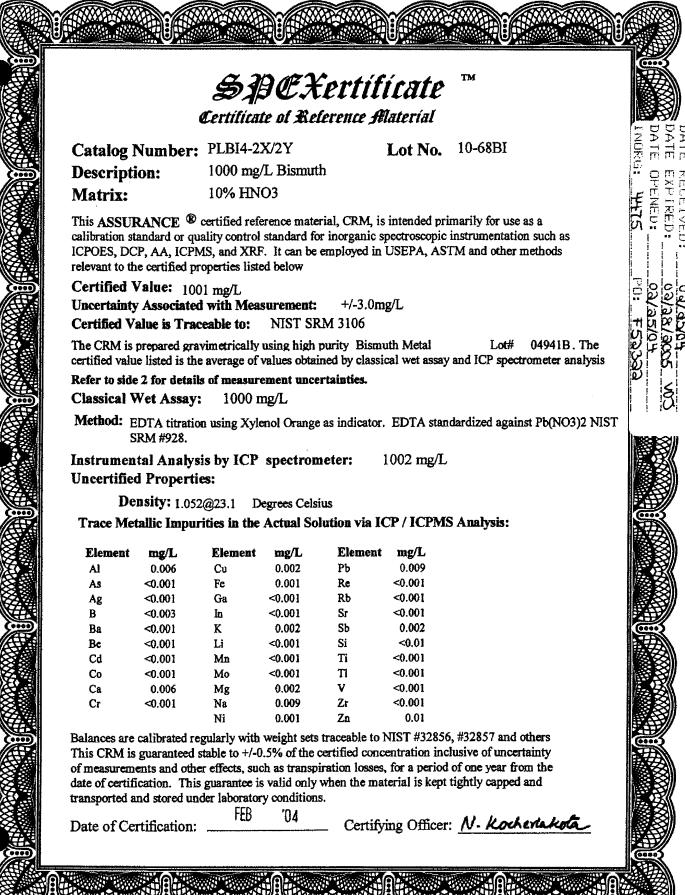
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The mathematical expression kess<sup>2</sup>m is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

k, = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+-U where X = True value (Labeled Value), U= Expanded uncertainty

U=kue where k=2 is the coverage factor at the 95% confidence level

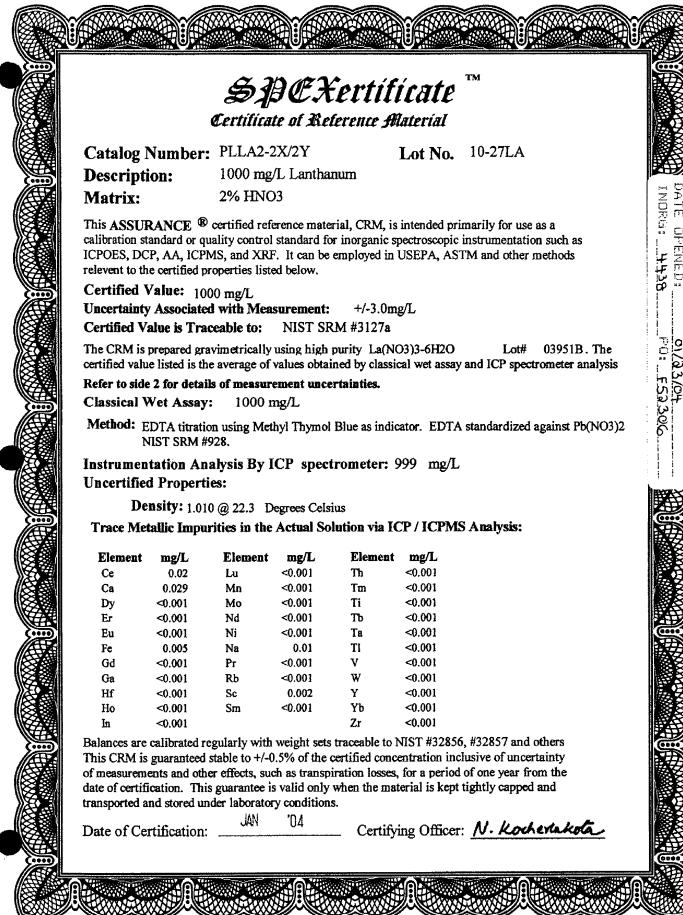
 $u_c$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_c \sqrt{\Sigma u_i^2}$ 

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#### Method of Preparation:

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The mathematical expression  $k_s = s^2 m$  is employed to determine the sampling size

S = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

 $k_s = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty

U=kue where k=2 is the coverage factor at the 95% confidence level

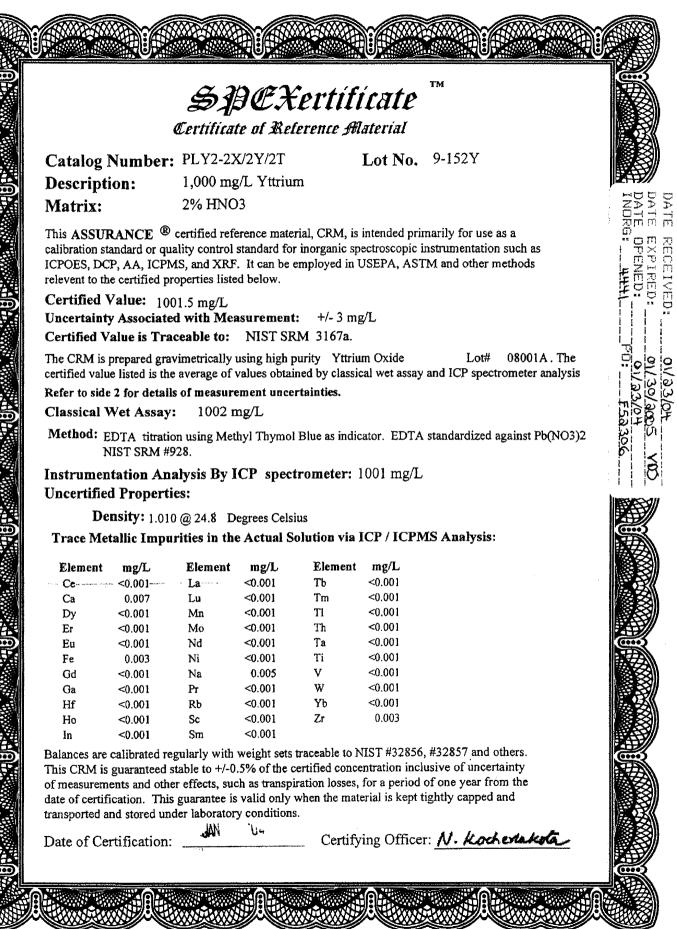
 $u_e$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_{or} \sqrt{\Sigma u_i^2}$ 

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ISO Guide 34: Quality system guidelines for the production of reference materials.

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## ISO/REMCO N280

## **Material Source:**

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#### **Instructions for Use:**

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#### Method of Preparation:

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#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 35, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_{s}=s^{2}m$  is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty) m = the sub-sampling mass

 $k_1 = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The uncertainty of the certified value listed on the reverse of this document is the total uncertainty U.

 $U = 2U_c + B mg/L$ 

Where U<sub>c</sub> = combined uncertainty components associated with volumetric and gravimetric factors, B is the uncertainty component of two independent methods of analysis (including the systematic and random uncertainties)

95% confidence limits =  $X \pm t_{0.95} \sqrt{\Sigma U_c^2}$ 

### where X = grand mean

 $t_{0.05}$  = the percentile of the student's t distribution for (k-1) degrees of freedom.

#### **Certification Traveler Report:**

All certified values reported were derived from the Traveler Report identified by the lot number of this CRM. For further information contact the certifying organization.

#### Legal Notice:



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	(	Certifical	te of Rel	ference M	aterial	
Catalog 3	Number:				Lot No.	10-108PD
Descript	ion:	1000 mg/	/L Palladi	um		
Matrix:		10% HC	l			
						narily for use as a
calibration st	andard or qua	lity control	standard for	r inorganic sp	ectroscopic i	nstrumentation such as
	CP, AA, ICPM ne certified pro			employed in t	JSEPA, ASI	M and other methods
	-	=				
Uncortaint	Value: 100	2.5 mg/L d with Mee	suramant	t: +/- 3 mg		
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	Wet Assay:					
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	ital Analys	=	spectror	neter:	1003 mg/L	
Uncertifie	d Properti	es:				
De	ensity: 1.017	'@23.6 D	egrees Cels	ius		
Trace Me	etallic Impu	rities in the	e Actual S	olution via	ICP / ICPN	IS Analysis:
Element	mg/L	Element	mg/L	Element	mg/L	
Al	0.01	Fe	0.024	Re	< 0.001	
Au	0.003	Ga	<0.001	Rh	0.001	
Ag	0.005	Ir	<0.001	Rb	<0.001	
B	<0.002	În M	< 0.001	Ru	<0.001 0.007	
Be Bi	<0.003 <0.001	Mg Mn	0.008 <0.001	Sn Te	<0.007	
Ca	0.014	Na	0.02	Ti	<0.001	
Cd	< 0.001	Ni	< 0.001	W	< 0.001	
Co	0.004	Pb	0.002	Zr	<0.001	
Cr	< 0.003	Pt	<0.001	Zn	1.0	
Cu Relences are	0.001	mlarky with	weight gets	traceable to N	JIST #27856	, #32857 and others.
This CRM is	canorated reg	table to +/-0	.5% of the o	certified conce	entration incl	usive of uncertainty
of measurem	ents and othe	r effects, suc	ch as transp	iration losses,	for a period	of one year from the
					erial is kept t	ightly capped and
transported a	and stored und		y condition ℃4	S.		•
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010359

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010361

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ASTM Guide D6362-98

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-	ramper.	PLTH2-2	2X/2Y		Lot No.	10-24TH	
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Trace M	etallic Impu						
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<b>Elemen</b> t Ce Ca	t <b>mg/L</b> 0.01 0.27	<b>Element</b> La Lu	<b>mg/L</b> 0.003 <0.001	Tb Tm	<0.001 <0.001		
<b>Elemen</b> t Ce	t <b>mg/L</b> 0.01	<b>Element</b> La	<b>mg/L</b> 0.003	Тъ	<0.001		
<b>Element</b> Ce Ca Dy	t mg/L 0.01 0.27 <0.001	<b>Element</b> La Lu Mn	<b>mg/L</b> 0.003 <0.001 <0.001	Tb Tm Ti	<0.001 <0.001 <0.002		
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NIST Technical Note 1297

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### ISO/REMCO N280

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#### Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_s=s^2m$  is employed to determine the sampling size

S = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty) m = the sub-sampling mass

 $k_s = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+/-U where X = True value (Labeled Value), U= Expanded uncertainty

U=ku, where k=2 is the coverage factor at the 95% confidence level

 $u_c$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_c \sqrt{\Sigma u_i^2}$ 

### **Certification Traveler Report:**

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

### Legal Notice:

SPEX CertiPrep reference materials are not for any cosmetic, drug or household application and are to be used only by qualified individuals who are trained in appropriate procedures. No claims against SPEX CertiPrep, Inc. of any kind whatsoever, whether based on breach of warranty, alleged negligence, or otherwise, with respect to this RM shall be greater than the purchase price. In no event shall SPEX CertiPrep, Inc. be liable for any loss of profits or any incidental, special, or consequential damages.



Certificate of Reference AlaterialCatalog Number:PLU2-2X/2YLot No. 10-127UDescription:1000 mg/L UraniumMatrix: $2\%$ HNO3This ASSURANCE © certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.Certified Value:1004 mg/LUncertainty Associated with Measurement: $+/-3.0$ mg/LCertified Value is Traceable to:NIST SRM #3164The CRM is prepared gravimetrically using high purityUranium(V,VI) OxideLot#Chertified value is is the average of values obtained by classical wet assay and ICP spectrometer analysisRefer to side 2 for details of measurement uncertainties.Classical Wet Assay:1004 mg/LMethod:Evaporate to dryness. Ignite and weigh as U3O8.Instrumental Analysis by ICP spectrometer:1005 mg/LUncertified Properties:Density:Inite and mg/LAl 0.005 Cu 0.01Pb 0.008As 0.004 Fe 0.011Rb 0.0003As 0.001K 0.002Sr 0.001Ag 0.001K 0.002Sr 0.001B 0.0003 In 0.001Sb 0.003B 0.0003 In 0.001Sb 0.003B 0.0001K 0.002Sr 0.001As 0.001K 0.002Sr 0.003B 0.0003 In 0.001Sb 0.003B 0.0003 In 0.001Sb 0.003B 0.0001M 0.002Sr 0.001<		Ð J	9CX	ertífi	cate	тм	010364	ALIE
Description:       1000 mg/L Uranium         Matrix:       2% HNO3         This ASSURANCE @ certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.         Certified Value:       1004 mg/L         Uncertainty Associated with Measurement:       +/- 3.0 mg/L         Certified Value is Traccable to:       NIST SRM #3164         The CRM is prepared gravimetrically using high purity       Uranium(V,VI) Oxide       Lot#         Classical Wet Assay:       1004 mg/L         Method:       Evaporate to dryness. Ignite and weigh as U3O8.         Instrumental Analysis by ICP spectrometer:       1005 mg/L         Uncertified Properties:       Density:         Density:       1.010 @ 21.6 Degrees Celsius         Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:         Element       mg/L         Al       0.005       Cu         Ag       0.001       Fe         0.002       Si       0.003         Ba       0.001       K       0.002         Ba       0.001       K       0.002         Ba       0.001       Si </th <th></th> <th>Certifica</th> <th>te of Refi</th> <th>erence M</th> <th>aterial</th> <th></th> <th></th> <th></th>		Certifica	te of Refi	erence M	aterial			
Matrix $2\%$ HNO3This ASSURANCE© certified reference material, CRM, is intended primarily for use as a calibration studard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified raperties listed below.Certified Value:1004 mg/LUncertainty Associated with Measurement:+/- 3.0 mg/LCertified Value is Traceable to:NIST SRM #3164The CRM is prepared gravimetrically using high purityUranium(V,VI) OxideLot#Chertified Value:1004 mg/LMethod:Evaporate to dryness. Ignite and weigh as U308.Instrumental Analysis by ICP spectrometer:1005 mg/LUncertified Properties:Density:1.010 @ 21.6Degrees CelsiusTrace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:Lementmg/LAl0.005Cu0.01Pb0.008As0.04Cu0.001B0.001Ca0.001B0.002Ca0.001Ca0.001Ca0.002Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001Ca0.001	Catalog Num	ber: PLU2-23	K/2Y		Lot No.	10-127U		
This ASSURANCE       © certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.         Certified Value: 1004 mg/L       Uncertainty Associated with Measurement: +/- 3.0 mg/L         Certified Value is Traceable to: NIST SRM #3164         The CRM is prepared gravimetrically using high purity Uranium(V,VI) Oxide Lot# 04001D. The certified value is the average of values obtained by classical wet assay and ICP spectrometer analysis         Refer to side 2 for details of measurement uncertainties.         Classical Wet Assay: 1004 mg/L         Method: Evaporate to dryness. Ignite and weigh as U308.         Instrumental Analysis by ICP spectrometer: 1005 mg/L         Uncertified Properties:         Density: 1.010 @ 21.6 Degrees Celsius         Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:         Element mg/L       Element mg/L         Al       0.005       Cu         Ag       0.001       Pb       0.003         Ag       0.001       K       0.022       Sr       0.003         Ba       0.001       K       0.022       Sr       0.003         Bit       0.001       Mit       0.002       Ti       0.001	<b>Description:</b>	1000 mg	/L Uraniun	n				P
calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below. <b>Certified Value:</b> 1004 mg/L <b>Uncertainty Associated with Measurement:</b> +/- 3.0 mg/L <b>Certified Value is Traceable to:</b> NIST SRM #3164 The CRM is prepared gravimetrically using high purity Uranium(V,VI) Oxide Lot# 04001D. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis <b>Refer to side 2 for details of measurement uncertainties.</b> <b>Classical Wet Assay:</b> 1004 mg/L <b>Method:</b> Evaporate to dryness. Ignite and weigh as U3O8. <b>Instrumental Analysis by ICP spectrometer:</b> 1005 mg/L <b>Uncertified Properties:</b> <b>Density:</b> 1.010 @ 21.6 Degrees Celsius <b>Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:</b> <b>Element mg/L Element mg/L</b> Al 0.005 Cu 0.01 Pb 0.008 As 0.04 Fe 0.41 Rb <0.001 Ag <0.001 Ga <0.001 Re <0.001 B <0.003 In <0.001 Si 0.03 Ba <0.001 K 0.022 Sr 0.003 Ba <0.001 K 0.022 Sr 0.003 Ba <0.001 Mg 0.002 Ti <0.001 Ga 0.09 Mn 0.003 TI <0.001 Ga 0.09 Mn 0.003 TI <0.001 Ga 0.09 Mn 0.003 TI <0.001 Ga 0.001 Na 0.08 Zr 0.002 Co <0.001 Ni <0.001 Zn 0.06	Matrix:	2% HNC	)3					1-1
Uncertainty Associated with Measurement: $\pm -3.0 \text{ mg/L}$ Certified Value is Traceable to: NIST SRM #3164The CRM is prepared gravimetrically using high purity Uranium(V,VI) Oxide Lot# 04001D. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysisRefer to side 2 for details of measurement uncertainties.Classical Wet Assay: 1004 mg/LMethod: Evaporate to dryness. Ignite and weigh as U3O8.Instrumental Analysis by ICP spectrometer: 1005 mg/LUncertified Properties:Density: 1.010 @ 21.6 Degrees CelsiusTrace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis:Element mg/LAl0.005Cu0.01Pb0.008As0.04Fe0.41Rb<0.001	calibration standard ICPOES, DCP, AA, relevant to the certif	or quality control ICPMS, and XRF ied properties liste	standard for . It can be e	inorganic spe	extroscopic in	nstrumentatio	on such as	
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The CRM is prepared gravimetrically using high purity Uranium(V,VI) Oxide Lot# 04001D. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis Refer to side 2 for details of measurement uncertainties. Classical Wet Assay: 1004 mg/L Method: Evaporate to dryness. Ignite and weigh as U3O8. Instrumental Analysis by ICP spectrometer: 1005 mg/L Uncertified Properties: Density: 1.010 @ 21.6 Degrees Celsius Trace Metallic Impurities in the Actual Solution via ICP / ICPMS Analysis: Element mg/L Element mg/L Element mg/L Al 0.005 Cu 0.01 Pb 0.008 As 0.04 Fe 0.41 Rb <0.001 Ag <0.001 Ga <0.001 Re <0.001 B <0.003 In <0.001 Si 0.03 Ba <0.001 K 0.022 Sr 0.003 Be <0.001 Li <0.001 Sb 0.003 Bi <0.001 Mg 0.002 Ti <0.001 Ca 0.09 Mn 0.003 TI <0.001 Cr <0.002 Mo 0.004 V 0.004 Cd <0.001 Na 0.08 Zr 0.002 Co <0.001 Ni <0.001 Zn 0.06					ng/L			1
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B<0.001 $Ga$ $A001$ $Si$ $0.03$ Ba<0.001K $0.022$ $Sr$ $0.003$ Be<0.001Li<0.001Sb $0.003$ Bi<0.001Mg $0.002$ Ti<0.001Ca $0.09$ Mn $0.003$ T1<0.001Cr<0.002Mo $0.004$ V $0.004$ Cd<0.001Na $0.08$ Zr $0.002$ Co<0.001Ni<0.001Zn $0.06$								
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	•							
Be         <0.001         Li         <0.001         Sb         0.003           Bi         <0.001								
Ca       0.09       Mn       0.003       T1       <0.001				Sb	0.003			
Cr         <0.002         Mo         0.004         V         0.004           Cd         <0.001	Be <0.00	•						
Cd         <0.001         Na         0.08         Zr         0.002           Co         <0.001	Bi <0.00							
Co <0.001 Ni <0.001 Zn 0.06	Bi <0.00 Ca 0.0							
	Bi <0.00 Ca 0.0 Cr <0.00							
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-100 LOW IN 2001 MILEO MADE IN $170.370$ to the control concentration inclusive of above matrix	Bi         <0.00           Ca         0.00           Cr         <0.00	01 Na 01 Ni ited regularly with	<0.001 weight sets t	raceable to N	IIST #32856	, #32857 and usive of unce	others. ertainty	K
This CRM is guaranteed stable to +/-0.5% of the certified concentration inclusive of uncertainty of measurements and other effects, such as transpiration losses, for a period of one year from the	Bi         <0.00           Ca         0.0           Cr         <0.00	01 Na 01 Ni nted regularly with nteed stable to +/-0	<0.001 weight sets t 0.5% of the co	raceable to N ertified conce	IIST #32856 Intration incl	usive of unce	rtainty	Y AL
of measurements and other effects, such as transpiration losses, for a period of one year from the date of certification. This guarantee is valid only when the material is kept tightly capped and transported and stored under laboratory conditions.	Bi<0.00Ca0.0Cr<0.00	01 Na 01 Ni nted regularly with nteed stable to +/-0 d other effects, suc . This guarantee is	<0.001 weight sets t 0.5% of the co ch as transpir s valid only v	raceable to N ertified conce ation losses, when the mate	IIST #32856 intration inclifor a period	usive of unce of one year fi	ertainty rom the	

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This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

**n1**0365

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement - Second Edition

ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

#### Material Source:

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#### Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### **Method of Preparation:**

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k = s^2 m$  is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

 $k_s = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+/-U where X = True value (Labeled Value), U= Expanded uncertainty

 $U=ku_e$  where k=2 is the coverage factor at the 95% confidence level

 $u_{e}$  is obtained by combining the individual element standard uncertainty components  $u_{i}$  and  $u_{e} \sqrt{\Sigma u_{i}^{2}}$ 

#### Certification Traveler Report:

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#### Legal Notice:

SPEX CertiPrep reference materials are not for any cosmetic, drug or household application and are to be used only by qualified individuals who are trained in appropriate procedures. No claims against SPEX CertiPrep, Inc. of any kind whatsoever, whether based on breach of warranty, alleged negligence, or otherwise, with respect to this RM shall be greater than the purchase price. In no event shall SPEX CertiPrep, Inc. be liable for any loss of profits or any incidental, special, or consequential damages.



				E <b>ETTÍT</b> terence A			010366	
Catalog	Number	: PLW9-2	X/2Y		Lot No.	9-177W		2
Descript	tion:	1000 mg	/L Tungst	ten				
Matrix:		H2O						
calibration s ICPOES, DO relevent to th <b>Certified</b>	tandard or qu CP, AA, ICPM ne certified pr <b>Value:</b> 1,0	ality control AS, and XRF coperties liste 100 mg/L	standard for F. It can be dead below.	r inorganic sp	ectroscopic i USEPA, AST	marily for use nstrumentation "M and other n	such as	0: E29918
	y Associate Value is Tra				g/L			<i>o</i> r
				ourity Amm	onium Tung	tate Lot#	02001H. The	
							rometer analysis	
Refer to side	e 2 for detail	s of measur	ement unce	rtainties.				
Classical	Wet Assay	: 1000 r	ng/L					Ē
Method: H	<sup>f</sup> ume with Su	lfuric Acid t	o dryness. I	gnite and we	igh as WO3.			
Trace Me	_	rities in the	e Actual S	olution via		IS Analysis:		
Element	mg/L	Element	mg/L	Element	mg/L			
Al	0.002	Cu	<0.001	Pb	<0.001			
As Ag	0.01	Fe	<0.01	Rb	< 0.001			
AP	<0.003 <0.005	Ga In	<0.001 <0.001	Re Si	0.004 .56			
	< 0.001	ĸ	0.05	Sr	<0.001			
B Ba	< 0.001	Li	< 0.001	Sb	0.001			
В		Mg	<0.001	Ti	< 0.001			
B Ba Be Bi	<0.001		~0.001	TI	<0.001			
B Ba Be Bi Ca	0.009	Mn	<0.001		0.007			
B Ba Be Bi Ca Cr	0.009 <0.001	Mo	0.005	V 7 <del>.</del>	0.001			11000
B Ba Bi Ca Cr Cd	0.009 <0.001 <0.001	Mo Na	0.005 0.03	Zr	< 0.001			
B Ba Bi Ca Cr Cd Co	0.009 <0.001 <0.001 0.001	Mo Na Ni	0.005 0.03 <0.001	Zr Zn	<0.001 0.01	#32857 and o	thers.	
B Ba Be Bi Ca Cr Cd Co Balances are This CRM is of measurem	0.009 <0.001 <0.001 calibrated reg guaranteed s ents and othe cation. This	Mo Na Ni gularly with table to +/-0. r effects, suc guarantee is	0.005 0.03 <0.001 weight sets t 5% of the co th as transpir valid only v	Zr Zn traceable to N ertified conce ration losses, when the mate	<0.001 0.01 IIST #32856, intration inclu for a period of	#32857 and o isive of uncert of one year from ghtly capped a	ainty m the	

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NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers

## ISO/REMCO N280

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m =the sub-sampling mass

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Catalog N	umbor	PLZR2-2	X/2Y/2T		Lot No.	10-05ZR		
-			L Zirconiu					-
Descriptio Matrix:		2% HNO						000
Refer to side 2 Classical We Method: Eva Instrumenta Uncertified	Adard or quai AA, ICPM certified pro- alue: 997 Associated ue is Trace epared gravi- listed is the for details et Assay: aporate to dr ation Anal Properties	lity control S, and XRF perties liste mg/L with Meas cable to: imetrically of measure 997 n yness. Fun tysis By I s:	standard for L It can be e ad below. surement: NIST SRI using high p values obtain ement uncer ng/L ne with Sulfu CP specti	inorganic sp mployed in W +/- 3.0 n M 3169 surity Zircon ied by classic tainties. uric Acid. Ig rometer: 9	ectroscopic USEPA, AST ng/L nyl Nitrate cal wet assay nite and wei	instrumentation TM and other : Lot# and ICP spect	n such as	
Trace Meta		-	egrees Celsiu Actual Solu		CP / ICPMS	S Analysis:		
Element	mg/L	Element	mg/L	Element	mg/L			
Al	0.03	Cu	0.002	Pb	0.002			
•	<0.001	Fe	0.017	Rb	< 0.001			
Ag	<0.05	Ga	< 0.001	Re	< 0.001			
	<0.004	ln 	< 0.001	Si	0.10			
	< 0.001	K	0.10	Sr	<0.001			
	<0.001	Li	0.002	Sb Ti	<0.001 <0.001			
Bi - Ca	<0.001 0.11	Mg Mn	0.003 <0.001	TI	<0.001 <0.001			
	<0.009	Mo	< 0.001	V	<0.001			
<u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>	0.004	Na	0.04	Zn	0.02			
	<0.001	Ni	<0.001					
Cd		ularly with				, #32857 and lusive of unce		

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		Certificat	e of Reti	erence Ma	aterial			
Catalog N	Number	PLNA2-3	3X/3Y	]	Lot No.	U8-1281	NA	
Descripti	on:	10,000 m	g/L Sodiu	m				ہیں 
Matrix:		5% HNO	3					NOR
This ASSUR calibration sta ICPOES, DCI relevent to the Certified V Uncertainty	ndard or qu P, AA, ICPI e certified p 7 <b>alue:</b> 99 7 <b>Associate</b>	aality control s MS, and XRF roperties liste 98 mg/L ed with Mea	standard for . It can be e d below. surement:	inorganic spe mployed in U +/- 30 m	ectroscopic JSEPA, AS	instrumentat	tion such as	ς <del>μη</del> μ :
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Classical V				cannies.				6
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Element	mg/L	Element	mg/L	Element	mg/L			
	0.02	Cu	0.003	Pb	<0.001			
Al	<0.003	Fe	0.03	Re	<0.001			
As	< 0.03	Ga	<0.001	Rb	<0.001			
As Ag		ln K	<0.001 0.14	Sr Sb	<0.002 <0.001			
As Ag B	< 0.03		0.14					
As Ag B Ba	0.03			Sn	<0.001			
As Ag B Ba Be	0.03 <0.02	Li	<0.002	Sn Ti	<0.001 <0.004			
As Ag B Ba Be Bi	0.03			Sn Ti Tl	<0.001 <0.004 <0.001			
As Ag B Ba Be	0.03 <0.02 <0.001	Li Mg	<0.002 0.30	Ti	<0.004			
As Ag B Ba Be Bi Ca	0.03 <0.02 <0.001 0.52	Li Mg Mn	<0.002 0.30 0.008	Ti Tl	<0.004 <0.001 <0.001 <0.001			
As Ag B Ba Be Bi Ca Cr	0.03 <0.02 <0.001 0.52 <0.004	Li Mg Mn Mo	<0.002 0.30 0.008 <0.001	Ti Ti V	<0.004 <0.001 <0.001			
As Ag B Ba Be Bi Ca Cr Cr Cd	0.03 <0.02 <0.001 0.52 <0.004 <0.001 <0.001	Li Mg Mn Mo Ni	<0.002 0.30 0.008 <0.001 <0.002	Ti Tl V Zr Zn	<0.004 <0.001 <0.001 <0.001 <0.03	6, #32857 at	nd others.	
As Ag B Ba Be Bi Ca Cr Cd Co Balances are This CRM is	0.03 <0.02 <0.001 0.52 <0.004 <0.001 <0.001 calibrated r guaranteed	Li Mg Mn Mo Ni egularly with stable to +/-0	<0.002 0.30 0.008 <0.001 <0.002 weight sets = .5% of the c	Ti Tl V Zr Zn traceable to N ertified conce	<0.004 <0.001 <0.001 <0.001 <0.03 NIST #3285 entration in	clusive of un	certainty	
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Certificate of Reference Material

### Catalog Number: Description: Matrix:

ICV-2A Lot No.: 24-84AS Initial Calibration Verification Standard II 5% Nitric Acid

This **ASSURANCE** <sup>©</sup>certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

#### Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM	Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
Ca	2,000	2,005.40	3109a	Ni	500	500.58	3136
K	2,000	1,997.89	3141a	V	500	504.23	3165
Mg	2,000	1,992.26	3131a	Cr	200	203.21	3112a
Na	2,000	1,992.99	3152a	Cu	200	199.75	3114
Al	1,000	1,005.90	3101a	Ag	100	100.46	3151
Ba	1,000	1,001.51	3104a	Be	100	100.04	3105a
Fe	1,000	1,003.17	3126a	Mn	100	100.64	3132
Co	500	505.10	3113	Zn	100	100.52	3168a

Spex Reference Multi: Lot #4-63BD, 14-125AS

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/-0.5% on the average of all the certified concentrations with no single component exceeding +/-2%. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

N	GV 2003	متخد بابه د
Date of Certification:	Certifying Offic	er: N. Kochertakota

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Catalog 1	Number	PLSB7-2	X/2Y/2T		Lot No.	10-43SB		
Descripti			L Antimor	ny				
Matrix:		H2O/0.6	Tart.Acid/t	r.HNO3				
calibration st	andard or qu P, AA, ICPI	ality control s MS, and XRF	standard for i . It can be er	inorganic spe	ectroscopic i	narily for use as a nstrumentation such a 'M and other methods	15 5	
Certified V	Value: 10	04 mg/ L						
Uncertaint	y Associate	ed with Mea			g/L			n e p
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The CRM is certified valu	prepared gra	wimetrically use average of v	using high pu values obtain	rity Antim ed by classic	iony Metal al wet assay	Lot# 0402 and ICP spectrometer	21A. The ranalysis	278
Refer to side	e 2 for detai	ls of measure	ement uncer	tainties.				K
Classical V	X7-4 4	r: 1005 n	ng/L					- + + ()
	wet Assay	. 10051	<del>-</del>					117
	-	dryness. Fun	•	c Acid. Ignit	e and weigh	as Sb2O4.		
Method: E	Evaporate to	dryness. Fun	ne with Nitric		e and weigh 1002 mg/ I			
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Method: E Instrumen Uncertifie De Trace Me Element Al As Ag	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impu mg/L 0.03 <0.001 <0.001	dryness. Fun sis by ICP ies: 6 @ 25.5 D urities in the Element Cu Fe Ga	egrees Celsin e Actual So mg/L 0.002 0.03 <0.001	eter: 3 Is Flution via 3 Element Pb Rb Re	1002 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001			
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impa mg/L 0.03 <0.001 <0.001 <0.001 <0.004	dryness. Fun sis by ICP ies: 6 @ 25.5 D urities in the Element Cu Fe Ga In	egrees Celsin egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001	eter: 3 Is Flution via 3 Element Pb Rb Re Sr	I 002 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001			
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B Ba	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impa mg/L 0.03 <0.001 <0.001 <0.004 <0.001	dryness. Fun sis by ICP ies: 6 @ 25.5 D urities in the Element Cu Fe Ga In K	egrees Celsin egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001 0.01	eter: 3 Is Flution via 3 Element Pb Rb Re Sr Si	I 002 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.01			
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B Ba Ba Ba	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impe mg/L 0.03 <0.001 <0.001 <0.004 <0.001 <0.001 <0.001 <0.001	dryness. Fun sis by ICP ies: 6 @ 25.5 D urities in the Element Cu Fe Ga In K Li	ne with Nitric spectrom egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001 0.01 <0.001 <0.001	eter: 3	I 002 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.01 <0.01 <0.03			
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B Ba Ba Be Bi	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impe mg/L 0.03 <0.001 <0.001 <0.004 <0.001 <0.001 <0.001 0.002	dryness. Fun sis by ICP ies: 6 @ 25.5 D urities in the Element Cu Fe Ga In K Li Mg	ne with Nitric spectrom egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001 0.01 <0.001 0.01 <0.001 0.03	eter: 3 Is Flution via 3 Element Pb Rb Re Sr Si	IOO2 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.001 <0.003 <0.003			
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B Ba Ba Be Bi Ca	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impe mg/L 0.03 <0.001 <0.001 <0.004 <0.001 <0.001 <0.001 <0.001 0.002 0.14	dryness. Fun sis by ICP ies: 6 @ 25.5 D urities in the Element Cu Fe Ga In K Li	ne with Nitric spectrom egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001 0.01 <0.001 <0.001	eter: 3	I 002 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.01 <0.01 <0.03			
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B Ba Ba Be Bi	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impe mg/L 0.03 <0.001 <0.001 <0.004 <0.001 <0.001 <0.001 0.002	dryness. Fun sis by ICP ies: 6 @ 25.5 D urities in the Element Cu Fe Ga In K Li Mg Mn	ne with Nitric spectrom egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001 0.01 <0.001 0.005 <0.001	eter: 3	IOO2 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.003 <0.001 <0.001 <0.001			
Method: E Instrumen Uncertified De Trace Me Element Al As Ag B Ba Ba Be Bi Ca Cr	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impe mg/L 0.03 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.002 0.14 <0.002	dryness. Fun sis by ICP ies: 6 @ 25.5 D urities in the Element Cu Fe Ga In K Li Mg Mn Mo	ne with Nitric spectrom egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001 0.01 <0.001 0.005 <0.001 <0.001 <0.001	eter: 3	IOO2 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.003 <0.001 <0.001 <0.001 <0.001			
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B Ba Ba Be Bi Ca Cr Cd Co Balances are	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impa mg/L 0.03 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.002 0.14 <0.002 <0.14 <0.002 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001	dryness. Fun sis by ICP ies: 6 @ 25.5 D arities in the Element Cu Fe Ga In K Li Mg Mn Mo Na Ni egularly with	ne with Nitric spectrom egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001 0.01 <0.001 0.005 <0.001 0.005 <0.001 0.005 <0.001 weight sets tr	eter: 3 Is Solution via 3 Element Pb Rb Re Sr Si Ti Ti Ti V Zr Zn raceable to N	I 002 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 0.02	//S Analysis: //S Analysis: ,#32857 and others.		
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B Ba Ba Be Bi Ca Cr Cd Co Balances are This CRM is	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impa mg/L 0.03 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.002 0.14 <0.002 <0.14 <0.002 <0.001 <0.001 colored	dryness. Fun sis by ICP ies: 6 @ 25.5 D prities in the Element Cu Fe Ga In K Li Mg Mn Mo Na Ni egularly with stable to +/-0.	ne with Nitric spectrom egrees Celsiu e Actual So mg/L 0.002 0.03 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.005 <0.001 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.00	eter: 3 solution via 3 Element Pb Rb Re Sr Si Ti Ti V Zr Zn raceable to N ertified conce	I 002 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.002	Analysis: MS Analysis: , #32857 and others. usive of uncertainty		
Method: E Instrumen Uncertifie De Trace Me Element Al As Ag B Ba Ba Be Bi Ca Cr Cd Co Balances are This CRM is of measurem	Evaporate to tal Analy d Propert ensity: 1.04 tallic Impa mg/L 0.03 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.002 0.14 <0.002 <0.14 <0.002 <0.001 calibrated ro guaranteed ents and oth	dryness. Fun sis by ICP ies: 6 @ 25.5 D nrities in the Element Cu Fe Ga In K Li Mg Mn Mo Na Ni egularly with stable to +/-0. er effects, suc	ne with Nitric spectrom egrees Celsin e Actual So mg/L 0.002 0.03 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.001 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.005 <0.00	eter: 1 Is Plution via 1 Element Pb Rb Re Sr Si Ti Ti Ti V Zr Zn raceable to N crtified conce ation losses,	I 002 mg/ I ICP / ICPN mg/L 0.009 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 <0.001 for a period	Analysis: MS Analysis: , #32857 and others. usive of uncertainty of one year from the		
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Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement - Second Edition ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

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#### **Instructions for Use:**

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression  $k_s=s^2m$  is employed to determine the sampling size

S = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

 $k_s = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+/-U where X = True value (Labeled Value), U= Expanded uncertainty

U=ku, where k=2 is the coverage factor at the 95% confidence level

 $u_e$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_{ev} \sqrt{\Sigma u_i^2}$ 

#### **Certification Traveler Report:**

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

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NORG:

DPENED:

982/64



Certificate of Reference Material

Catalog Number: Description: Matrix:

## ICV-2C Lot No.: 24-85AS Initial Calibration Verification Standard II 5% Nitric Acid

This **ASSURANCE** <sup>©</sup>certified reference material, CRM, is intended primarily for use as a calibration standard or quality control standard for inorganic spectroscopic instrumentation such as ICPOES, DCP, AA, ICPMS, and XRF. It can be employed in USEPA, ASTM and other methods relevant to the certified properties listed below.

The CRM is prepared from high purity single element concentrates of individual elements using Class A laboratory ware to give precise concentration.

Refer to side 2 for details of measurement uncertainties.

#### Instrumental Analysis by ICP Spectrometer:

Element	Labeled (mg/L)	Measured (mg/L)	NIST SRM
As	500	497.85	3103a
Pb	500	495.41	3128
Se	500	501.98	3149
TL	500	501.89	3158
Cd	100	99.77	3108

Spex Reference Multi: Lot #4-51BDREF, 15-39AS, 11-173AS

Balances are calibrated regularly with weight sets traceable to NIST#s 32856, 32867 and others. This CRM is guaranteed stable and accurate to +/- 0.5% on the average of all the certified concentrations with no single element exceeding +/- 2%. This includes uncertainty of measurements and other effects, such as transpiration losses. This guarantee is valid for a period of one year from the date of certification only when the material is kept tightly capped and transported and stored under laboratory conditions.

NOV --- 2000 Certifying Officer: N. Kochertakola Date of Certification:

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This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers ISO/REMCO N280

#### Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

#### Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

#### Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

#### **Homogeneity:**

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression k<sub>s</sub>=s<sup>2</sup>m is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty) m = the sub-sampling mass

 $k_s = mass$  of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

#### Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as X = x+-U where X = True value (Labeled Value), U= Expanded uncertainty

U=ku, where k=2 is the coverage factor at the 95% confidence level

 $u_e$  is obtained by combining the individual element standard uncertainty components  $u_i$  and  $u_{ee} \sqrt{\Sigma u_i^2}$ 

#### Certification Traveler Report:

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

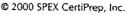
#### Legal Notice:

SPEX CertiPrep reference materials are not for any cosmetic, drug or household application and are to be used only by qualified individuals who are trained in appropriate procedures. No claims against SPEX CertiPrep, Inc. of any kind whatsoever, whether based on breach of warranty, alleged negligence, or otherwise, with respect to this RM shall be greater than the purchase price. In no event shall SPEX CertiPrep, Inc. be liable for any loss of profits or any incidental, special, or consequential damages.





203 Norcross Avenue • Metuchen, NJ 08840 USA 732-549-7144 • **1-800-LAB-SPEX** • Fax: 732-603-9647 CRMSales@spexcsp.com • www.spexcsp.com Always Providing Superior Quality... Unparalleled Service™



## inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."
- 2.0 DESCRIPTION OF CRM

Custom-Grade 10000 µg/mL Aluminum in 5% (abs) HNO3

Catalog Number:	CGAL10-1 and CGAL1	0-5
Lot Number: Starting Material:	W-AL04008 Al metal	
Starting Material Purity (%):	99.998460	INDRGANIC LABS/RADCHEM LABS 73.1.43
Starting Material Lot No Matrix:	607116 5% (abs) HNOз	DATE RECEIVED: 08/06/03 DATE EXPIRED: 09/01/0004 V03 DATE DEENED: 08/06/03
		INDRG: 4220 PO: F5224

#### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 10070 ± 31 µg/mL

Certified Density: 1.059 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>22 x</u>	(⊡a = mean x₁ = individual results
Uncertainty (±) = $2[(275)]^{21/2}$ (1) <sup>1/2</sup>	n = number of measurements BS = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SFM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	10006 ± 55 μg/mL. ICP Assay NIST SRM 3101a Lot Number: 992003
	Assay Method #2	<b>10070 ± 31 μg/mL</b> EDTA NIST SRM 928 Lot Number: 880710

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.; 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>5</u>	Al			M	Ðy	<	0.02695	Q	u		0.00011	M	Pr	<	0.00135		M	Тe	<	0.13473
м	Sb	<	0.00225	М	Er	<	0.02245	М	Lu	<	0.00180	M	Re	<	0.00449		M	ТЬ	<	0.00135
М	As	<	0.04491	М	Eu	<	0.01347	<u>0</u>	Mg		0.00470	M	Rh	<	0.00449		M	TI	<	0.00449
м	Ba	<	0.04491	м	Gd	<	0.00449	М	Mn	<	0.01796	M	Rb	<	0.00449		М	Th	<	0.00449
ō	Be	<	0.00017	м	Ga	<	0.00449	Q	Hg	<	0.00700	M	Ru	<	0.00898		М	Tm	<	0.00180
м	Bi	<	0.00180	м	Ge	<	0.02695	м	Мо	<	0.00898	M	Sm	<	0.00449		М	Sn	<	0.02245
<u>o</u>	в		0.01164	M	Au	<	0.01347	М	Nd	<	0.00898	M	Sc	<	0.04491		М	TI	<	0.22454
M	Cđ	<	0.01347	М	Hf	<	0.00898	Q	NI	<	0.00600	M	Se	<	0.03593		М	w	<	0.04491
<u>0</u>	Са		0.01903	М	Ho	<	0.00225	М	Nb	<	0.00225	<u>0</u>	Si		0.07389		М	υ	<	0.00898
M	Ce	<	0.02245	Q	In	<	0.03000	n	Os			M	Ag	<	0.00898		М	v	<	0.00898
М	Cs	<	0.00135	М	lr	<	0.02245	м	Pđ	<	0.02245	0	Na		0.03359		M	Yb	<	0.00449
Q	Cr		0.00336	Q	Fe		0.00493	Q	Р	<	0.03000	M	Sr	<	0.00225		M	Y	<	0.17963
М	Co	<	0.01347	М	La	<	0.00225	M	Pt	<	86800.0	Q	S	<	0.10000		М	Zn	<	0.08982
М	Çu	<	0.02695	М	Pb	<	0.01347	Q	к		0.02911	М	Ta	<	0.03144	ļ	М	Zr	<	0.02245
M - C	heck	æd	by ICP-MS	0.	Che	cke	by ICP-OES	i - S	ipectr	al I	nterference	n - I	Not C	hee	cked For	s	- 5	Solutio	on :	Standard Element

#### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 26.98154; +3, 6;A(H-O),\*

Chemical Compatibility - Soluble in HCl, HNO, HF and H<sub>2</sub>SO. Avoid neutral media. Soluble in strongly basic NaOH forming the Al(OH)<sub>4</sub>(H<sub>2</sub>O)<sub>2</sub>, species. Stable with most metals and inorganic anions. The phosphate is insoluble in water and only slightly soluble in acid.

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

Al Containing Samples (Preparation and Solution) - Metal (Best dissolved in HCI / HNO<sub>2</sub> ) a- Al<sub>2</sub>O<sub>2</sub> (Na<sub>2</sub>CO<sub>2</sub> fusion in Pt<sup>a</sup>); y- Al<sub>2</sub>O<sub>2</sub> (Soluble in acids such as HCI); Ores (Carbonate fusion in Pt<sup>a</sup> followed by HCI dissolution). Organic Matrices (suffuric/peroxide digestion or nitric / suffuric / perchloric acid decomposition, or dry ash and dissolution in dilute HCI. Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Atomic Spectroscopic into	Jernarion (ICh-Ce 2 nº	Hallsmadual View).		
Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at efforcs.)
ICP-OES 394.401 nm	0.05 / 0.006 µg/mL	1	atom	U, Ce
ICP-OES 396.152 nm	0.03 / 0.006 µg/mL	1	atom	<u>Mo</u> , Zr, Ce
ICP-0ES 167.078 nm	0.1 / 0.009 µg/mL	1	ion	Fe
ICP-MS 27 emu	30 ppt	nta	Μ'	'*C'*N, **C'*N, 'H'*C'*N, '*B'*O, **Cr*', **Fe*'

- HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM. 8.0
- HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous. 9.0

#### QUALITY STANDARD DOCUMENTATION 10.0

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 **Recognized by:** 

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA)

Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of IQ Net International Certification Network:

Argentina (IRAM), Australia (QAS), Austria (OQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT). Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Po of a DATE RECEIVED: 08/06/03 DATE EXPIRED: \_\_\_\_09/01/2003\_\_\_\_05 DATE OPENED: \_\_\_\_\_08/26/23\_\_\_\_ INORG: 4220 PD: F52224

#### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: February 13, 2003

**Expiration Date:** 



#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Prepared By:** JoAnn Struthers, QA Administrative Assistant

**Certificate Approved By:** Katalin Le, QC Supervisor

**Certifying Officer:** Paul Galnes, Chemist, Senior Technical Director

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## 010382 inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM

Custom-Grade 10000 µg/mL Calcium in 1.4% (abs) HNO3

Catalog Number:	CGCA10-1, CGCA10-2,	and CGCA10-5
Lot Number:	W-CA03022	
Starting Material:	CaO	
Starting Material Purity (%):	99.999389	
Starting Material Lot No Matrix:	C27L01 1.4% (abs) HNO3	INORGANIC DATE RECE

INORGANIC LABS	VRADCHEM LABS B. JAR 2
DATE RECEIVED:_	01/20/04
DATE EXPIRED:	03/01/2005_V03
DATE OPENED:	01/20/04
INORG: 4436	FO: <b>F53303</b>

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 9968 ± 18 µg/mL

Certified Density: 1.038 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\Box$ ) = $\underline{orx}$	(C):= mean
n	x, = Individual results
	n = number of measurements
Uncertainty $(\pm) = 2[(2\pi s_1)^2]^{4/2}$	IS = The summation of all significant estimated errors.
(1)* <sup>2</sup>	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 -	Assay Method #1	9968 ± 18 µg/mL
		ICP Assay NIST SRM 3109a Lot Number: 000622
	Assay Method #2	9973 ± 25 μg/mL
		EDTA NIST SRM 928 Lot Number: 880710

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos, and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

							,												
Q	A		0.00013	M	Dy	<	0.03067	Q	Li		0.00011	₩	Pr	<	0.00153	M	Te	<	0.15333
М	Sb	<	0.00256	М	Er	<	0.02556	М	Lu	<	0.00204	M	Re	<	0.00511	м	Tb	<	0.00153
М	As	<	0.05111	М	Eu	<	0.01533	Q	Mg		0.03453	M	Rh	<	0.00511	M	TI	<	0.00511
Q	Ba		0.00063	M	Gđ	<	0.00511	Q	Mn	<	0.00030	M	Rb	<	0.00511	M	Th	<	0.00511
Q	Be	<	0.00009	M	Ga	<	0.00511	Q	Hg	<	0.01100	M	Ru	<	0.01022	M	Tm	<	0.00204
M	Bi	<	0.00204	М	Ge	<	0.03067	Μ	Мо	<	0.01022	M	Sm	<	0.00511	м	Sn	<	0.02556
Q	в	<	0.00054	М	Au	<	0.01533	М	Nd	<	0.01022	Q	Sc	<	0.00002	M	Ti	<	0.25555
<u>0</u>	Cd	<	0.00450	М	Hf	<	0.01022	Q	Ni	<	0.00230	Q	Se	<	0.00620	М	w	<	0.05111
<u>s</u>	Ca			М	Ho	<	0.00256	М	Nb	<	0.00256	Q	Si		0.00253	M	ប	<	0.01022
М	Сө	<	0.02556	Q	In	<	0.00200	n	Os			М	Ag	<	0.01022	2	۷	<	0.00090
М	Cs	<	0.00153	М	Ir	<	0.02556	М	Pd	<	0.02556	Q	Na	<	0.00010	M	Yb	<	0.00511
Q	Cr		0.00183	<u>0</u>	Fe	<	0.00110	Q	Ρ	<	0.00480	Q	Sr		0.02021	M	Y	<	0.20444
<u>0</u>	Co	<	0.00120	M	La	<	0.00256	М	Pt	<	0.01022	Q	s		0.01053	Q	Zn		0.02232
<u>0</u>	Cu	<	0.00400	M	РЬ	<	0.01533	Q	κ	<	0.00170	М	Та	<	0.03578	M	Zr	<	0.02556
M - C	heck	ed	by ICP-MS	0-	Chec	ked	by ICP-OES	i-S	pecti	al I	nterference	n - 1	lot C	hec	ked For	s - 3	Soluti	on S	Standard Element

#### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 40.078, +2; & Ca(H,O),\*2 Chamical Compatibility - Soluble in HCI and HNO, Avoid H.SO., HF, H,PO. and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate and tungstate in neutral aqueous media.

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

Ca Containing Samples (Preparation and Solution) - Metal (best dissolved in diluted HNO,) Ores (Carbonate fusion in Pt\* tollowed by HCI dissolution); Organic Matrices (dry ash and dissolution in dilute HCI. Do not heat when dissolving to avoid precipitation of SiO<sub>2</sub>). The oxide, hydroxide, carbonate, phosphate, and fuoride of calcium are soluble in % levels of HCI or HNO<sub>2</sub>. The sulfates (gypsum, anhydrite, etc.), certain silicates and complex compounds require fusion with Na<sub>2</sub>CO<sub>2</sub> followed by HCI / water dissolution in protein when analyzing for the soluble in % levels of HCI or HNO<sub>2</sub>. water dissolution. Contamination is a very real problem when analyzing for trace levels.

Atomic Spectroscopic		s are given as <u>radial/axiai</u> view):	
Technique/Line	Estimated D.L.	Order Type Interferences (underlined indicate	s severe atvationos.)

	393.366 nm	0.0002/0.00004 µg/ml.			U, Ce
ICP-OES	396.847 nm 422.673 nm	0.0005/0.00006µg/mL 0.01/0.001µg/mL	1	ion atom	Th Ge
ICP-MS	44 amu	1200 ppt	n/a	M.	"O2"C, "Si"O, "Sr"?

- 8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### 10.0 QUALITY STANDARD DOCUMENTATION

- 10.1 ISO 9001:2000 Quality Management System Registration QMI Certificate Number 010105 Recognized by: Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) **Dutch Council for Accreditation (RVA)** Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01
- 10.3 ISO/IEC Guide 34 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02

#### **A2LA Mutual Recognition Agreement Partners:**

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS 3. 0. F 3 DATE RECEIVED: 01/20/04 DATE EXPIRED: 09/01/205 V03 DATE OPENED: 01/20/04 INORG: 4436 PO: F52303







11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

> Certification Date: July 23, 2003 EXPIRES **Expiration Date:**

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

Certificate Approved By:

Katalin Le, QC Supervisor

Certifying Officer:

Paul Gaines, Chemist, Senior Technical Director

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#### 0.386inorganic ventures 1 i v I a

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- DESCRIPTION OF CRM 2.0

Custom-Grade 10000 µg/mL Iron in 3.5% (abs) HNO3

Catalog Number:	CGFE10-1, CGFE10-2	, and CGFE10-5
Lot Number:	W-FE03030	
Starting Material:	Fe metal	
Starting Material Purity (%):	99.999569	
Starting Material Lot No Matrix:	23166 3.5% (abs) HNO3	INDRGANIC DATE RECE

INCRGANIC LABS	/RADCHEM LABS PS. 10F2
DATE RECEIVED:_	03/35/04
DATE EXPIRED:	03/01/2005 V03 03/25/04
DATE OPENED:	03/35/04
INDEG: 4470	PU: F50303

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

**Certified Concentration:** 10,016 ± 25 µg/mL

#### **Certified Density:** 1.050 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>erx</u>	(⊐) ≃ mean
n	x, = individual results
	n = number of measurements
Uncertainty (±) = <u>2[(ers)]<sup>2</sup>]<sup>1/2</sup></u>	ES = The summation of all significant estimated errors.
(N) <sup>1/2</sup>	(Most common are the errors from instrumental measurement,
	weighing, dilution to volume, and the fixed error reported on the
	NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	10,031 ± 33 μg/mL
		ICP Assay NIST SRM 3126a Lot Number: 000606
	Assay Method #2	10,016 ± 25 µg/mL
		EDTA NIST SRM 928 Lot Number: 880710

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

				•
<u>O</u> AI < 0.00270	<u>M</u> Dy < 0.02413	<u>O</u> LI < 0.00003	<u>M</u> Pr < 0.00121	<u>M</u> Te < 0.12066
<u>M</u> Sb < 0.00201	<u>M</u> Er < 0.02011	<u>M</u> Lu < 0.00161	<u>M</u> Re < 0.00402	<u>M</u> Tb < 0.00121
<u>M</u> As < 0.04022	<u>M</u> Eu < 0.01207	<u>O</u> Mg < 0.00006	<u>M</u> Rh < 0.00402	<u>M</u> TI < 0.00402
<u>M</u> Ba < 0.04022	<u>M</u> Gd < 0.00402	<u>O</u> Mn < 0.02000	<u>M</u> Rb < 0.00402	<u>M</u> Th < 0.00402
<u>O</u> Be < 0.00005	<u>M</u> Ga < 0.00402	<u>O</u> Hg < 0.01100	<u>M</u> Ru < 0.00804	<u>M</u> Tm < 0.00161
<u>M</u> Bi < 0.00161	į Ge	. <u>M</u> Mo < 0.00804	<u>M</u> Sm < 0.00402	<u>M</u> Sn < 0.02011
<u>O</u> B < 0.00090	<u>M</u> Au < 0.01207	<u>M</u> Nd < 0.00804	<u>M</u> Sc < 0.04022	<u>M</u> Ti < 0.20109
<u>M</u> Cd < 0.01207	<u>M</u> Hf < 0.00804	<u>O</u> Ni < 0.05000	<u>M</u> Se < 0.03218	<u>M</u> W < 0.04022
<u>O</u> Ca 0.00291	<u>M</u> Ho < 0.00201	<u>M</u> Nb < 0.00201	<u>O</u> Si < 0.01000	<u>M</u> U < 0.00804
<u>M</u> Ce < 0.02011	<u>M</u> in < 0.04022	<u>n</u> Os	<u>M</u> Ag < 0.00804	<u>M</u> V < 0.00804
<u>M</u> Cs < 0.00121	<u>M</u> Ir < 0.02011	<u>M</u> Pd < 0.02011	<u>O</u> Na 0.00776	<u>M</u> Yb < 0.00402
<u>M</u> Cr < 0.02011	<u>s</u> Fe	j P	<u>M</u> Sr < 0.00201	<u>M</u> Y < 0.16087
<u>O</u> Co < 0.00110	<u>M</u> La < 0.00201	<u>M</u> Pt < 0.00804	<u>O</u> S < 0.07200	<u>M</u> Zn 0.04876
<u>M</u> Cu < 0.02413	<u>M</u> Pb < 0.01207	<u>О</u> К < 0.00170	<u>M</u> Ta < 0.02815	<u>M</u> Zr < 0.02011
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 including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keeptightly sealed when not in use. Store and use at 20 ± 4 - C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 55.847; +3; & Fe(H-O).\*

Chamical Compatibility - Stable in HCl, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, HF and H<sub>2</sub>PO<sub>4</sub>. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

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

Fe Containing Samples (Preparation and Solution) - Metal (Soluble in HCI) Oxides (If the oxide has been at a high temperature then Na<sub>2</sub>CO<sub>2</sub> fusion in Pt<sup>\*</sup> tollowed by HCI dissolution otherwise dissolve in dilute HCI); Ores (See Oxides above using only the fusion approach).

	nation (ICP-OES D.	

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at alloncs.)
ICP-OES 238.204 nm	0.005 / 0.001 µg/mL	1	ion	Ru, Co
ICP-OES 239.562 nm	0.005 / 0.001 µg/mL	1	ion	Co, W, Cr
ICP-OES 259.940 nm	0.006 / 0.001 µg/mL	1	ion	Hf, Nb
ICP-MS 56 amu	970 ppt	nfa	M'	**Ar'*N*H, **Ar'*O, =Ar'*O'H, **Ar'*O, **Cl'*O'H, **Ca'*O

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c. (EMA)



 Members of IQ Net International Certification Network: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)
 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibrati - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS B. 204 2 DATE RECEIVED: 02/25/04 DATE EXPIRED: 03/04/2005 NOS DATE OPENED: 02/25/04 INDRG: 4470 PU: E52223



#### DATE OF CERTIFICATION AND PERIOD OF VALIDITY 11.0



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: March 20, 2003

**Expiration Date:** 



#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Prepared By:** JoAnn Struthers, QA Administrative Assistant

**Certificate Approved By:** Katalin Le, QC Supervisor

**Certifying Officer:** Paul Gaines, Chemist, Senior Technical Director

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## 010390 inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM

Custom-Grade 10000 µg/mL Potassium in 1.4% (abs) HNO3

Catalog Number:	CGK10-1, CGK10-2, ar	nd CGK10-5
Lot Number: Starting Material: Starting Material Purity (%): Starting Material Lot No Matrix:	<b>W-K02111</b> KNO3 99.997230 K18J19	INDRGANIC LABS/RADCHEM LABS
Wautz.	1.4% (abs) HNO3	INORG: 4320 PO: FS 2258

#### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 9930 ± 9 µg/mL

Certified Density: 1.024 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (🗂 = <u>@x</u> .)	(🖵) = mean
n	x, = individual results
	n = number of measurements
Uncertainty $(\pm) = 2[(ers_1)^2]^{1/2}$	ES = The summation of all significant estimated errors.
(1) <sup>1/2</sup>	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

<sup>□</sup> "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	9926 ± 62 µg/mL	
		ICP Assay NIST SRM 3141a Lot Number: 891312	
	Assay Method #2	9930 ± 9 μg/mL	

Gravimetric NIST SRM Lot Number: See Sec. 4.2

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

õ	AI	<	0.00090	M	Dy	<	0.02400	Q	Li	<	0.00003	М	Pr	<	0.00120	<u>M</u>	Те	<	0.11998
М	Sb	<	0.00200	M	Er	<	0.02000	М	Lu	<	0.00160	M	Re	<	0.00400	M	Tb	<	0.00120
М	As	<	0.03999	M	Eu	<	0.01200	Q	Mg		0.00100	Μ	Rh	<	0.00400	M	TI	<	0.00400
М	Ba	<	0.03999	м	Gd	<	0.00400	<u>0</u>	Mn	<	0.00003	м	Rb		0.49948	M	Th	<	0.00400
Q	Be	<	0.00020	м	Ga	<	0.00400	<u>0</u>	Hg	<	0.01500	M	Ru	<	0.00800	M	Тп	<	0.00160
М	BI	<	0.00160	Q	Ge	<	0.00150	м	Мо	<	0.00800	м	Sm	<	0.00400	l ⊾	Sn	<	0.02000
<u>0</u>	8	<	0.00060	Q	Au	<	0.00300	М	Nd	<	0.00800	<u>0</u>	Sc	<	0.00002	<u>0</u>	Ti	<	0.00070
. <u>м</u>	Cd	<	0.01200	M	Hf	<	0.00800	<u>0</u>	Ni	<	0.00230	<u>0</u>	Se	<	0.05000	M	w	<	0.03999
<u>0</u>	Ca		0.00075	M	Ho	<	0.00200	M	Nb	<	0.00200	Q	Si	<	0.00340	⊵	Ú	<	0.00800.0
М	Ce	<	0.02000	M	In	<	0.03999	n	Os			M	Ag	<	0.00800		v	<	0.00090
М	Cs	<	0.00120	M	lr	<	0.02000	M	Pd	<	0.02000	<u>0</u>	Na		0.21730	₽	į Yb	<	0.00400
м	Cr	<	0.02000	<u>0</u>	Fe		0.00212	Q	Ρ	۲	0.00250	м	Sr	<	0.00200	⊵	ΙY	<	0.15998
М	Co	<	0.01200	M	La	<	0.00200	M	Pt	<	0.00800	Q	S	<	0.07200	⊆	Zn		0.00050
М	Cu	<	0.02400	M	Pb	<	0.01200	<u>\$</u>	к			М	Ta	<	0.02800	M	Zr	<	0.02000
M - C	heck	(ed	by ICP-MS	0-	Che	kec	by ICP-OES	1-8	Spect	ral I	nterference	n - I	Not C	he	cked For	s -	Solu	lion	Standard Element

#### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following: ...

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keeptightly sealed when not in use. Store and use at 20 ± 476. Do not pipet from cortainer. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chamical Form in Solution - 29.0983; +1; (6); K'(eq)

(Coordination Number in parentheses is assumed, not certain.)

Chemical Compatibility - Soluble in HCI, HNO, H<sub>2</sub>SO, and HF aqueous matrices. Avoid use of HCIO, due to insolubility of the perchlorate. Stable with all metals and inorganic anions except CIO...

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

K Containing Samples (Preparation and Solution) - Metal (Dissolves very repidly in water); Ores (Sodium carbonate fusion in Pt\* followed by HCI dissolution-blank levels of K in sodium carbonate critical); Organic Matrices (Sulturic/peroxide digestion) Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axia) view):

Technique	Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at efforcs.)
ICP-OES	766.490 nm	0.4 / 0.001 µg/mL	1	atom	2 <sup>er</sup> order radiation from R.E.s on some optical designs
ICP-OES	771.531 nm	1.0 / 0.03 ug/mL	1	atom	2 <sup>er</sup> order radiation from R.E.s on some optical designs
ICP-OES	404.721 nm	1.1 / 0.05 µg/mL	1	atom	U. Ce.
ICP-MS	39 amu	10 ppt	na	M'	"ArH, "Na"O, "Se"



- 010392
- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of <u>1Q Net International Certification Network</u>: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium Columbia (ICONTEC), Czech Republic (CQS), Denmark (I



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



- 10.3 ISO/IEC Guide 34 2000 "General Requirements for the Competence of Reference Material Producers"

  Reference Materials Production Accredited A2LA Certificate Number 883.02
  A2LA Mutual Recognition Agreement Partners:
  Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Talpei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)
- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

#### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at lnorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

INORGANIC LABS/RADCHEM LAB DATE RECEIVED: \_///S DATE EXPIRED: \_/2/1 1304 DATE OPENED: 115103 INORG: 4320 PO: ES235

Certification Date: January 30, 2003

#### **Expiration Date:**



#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

Certificate Prepared By:

JoAnn Struthers, QA Administrative Assistant

**Certificate Approved By:** Katalin Le, QC Supervisor

folm Stutten Knonen an Pauk Again

Certifying Officer:

Paul Gaines, Chemist, Senior Technical Director



labs



195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

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certificate of analysis

inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade 10000 µg/mL Magnesium in 1.4% (abs) HNO3

Catalog Number:	CGMG10-1 and CGMG	10-5
Lot Number:	T-MG03006	
Starting Material:	Mg metal	
Starting Material Purity (%):	99,9968	I
Starting Material Lot No	RML91191	DA DA
Matrix:	1.4% (abs) HNO3	DA

INORGANIC LABS	RADCHEM LABSP9. 1 of 2
DATE RECEIVED:	07/31/03 08/01/3004 192 08/01/03
DATE EXPIRED:	08/01/2004 100
DATE OFENED:	08/01/03
INDRG: 4304	PD: <u>F52391</u>

#### **b.**0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 9921 ± 20 µg/mL

**Certified Density:** 

1.050 g/mL (measured at 22° C)

The Certified Value is the instrument analysis value. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (x) =  $\sum x_1$ (s) = meanx = individual results n = number of measurements Uncertainty (±) =  $2i(\sum_{s_i})^{s_i}$  $\Sigma S =$  The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

#### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

9921 ± 20 µg/mL

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 Assay Method #1

9998 ± 20 µg/mL EDTA NIST SRM 928 Lot Number: 880710

Assay Method #2

ICP Assay NIST SRM 3131a Lot Number: 991107

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.
- 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN μg/mL Custom-Grade solutions 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.

Q	ΙA		0.02454	М	Dy	<	0.02455	<u>Q</u>	Li		0.00797	М	Pr	<	0.00123	М	Te	<	0.12275
М	Sb		0.00306	М	Er	<	0.02046	М	Lu	<	0.00164	М	Re	<	0.00409	Μ	ТЬ	<	0.00123
М	As	<	0.04092	М	Eu	<	0.01228	<u>\$</u>	Mg			М	Rh	۲	0.00409	Μ	TI	<	0.00409
М	Ba	<	0.04092	М	Gd	<	0.00409	М	Mn	<	0.01637	М	Rb	<	0.00409	М	Th	<	0.00409
Q	Be	<	0.00017	М	Ga	<	0.00409	Q	Hg	<	0.00900	М	Ru	<	0.00818	М	Tm	<	0.00164
М	Bi	<	0.00164	М	Ge	<	0.02455	М	Мо	<	0.00818	М	Sm	<	0.00409	М	Sn	<	0.02046
<u>0</u>	B		0.00871	М	Au	<	0.01228	М	Nd	<	0.00818	Μ	Sc	<	0.04092	Q	TI		0.10206
М	Cd	<	0.01228	М	Hf	<	0.00818	Q	Ni		0.01404	М	Se	<	0.03273	М	W	<	0.04092
Q	Ca		0.01070	М	Но	<	0.00205	М	Nb	<	0.00205	₽	Si		0.03186	М	υ	<	0.00818
М	Ce	<	0.02046	М	In	<	0.04092	Ω	Qs			М	Ag	<	0.00818	М	v	<	0.00818
М	Cs	<	0.00123	М	ir	<	0.02046	М	Pđ	<	0.02046	<u>0</u>	Na		0.01817	М	Yb	<	0.00409
Q	Cr		0.02315	Q	Fe		0.02467	Q	P	<	0.01600	М	Sr	<	0.00205	М	Y	<	0.16367
М	Co	<	0.01228	М	La	<	0.00205	М	Pt	<	0.00818	ם	s			Q	Zn		0.01892
Q	Cu		0.00672	Q	Pb		0.03236	Q	κ	<	0.05000	M	Ta	<	0.02864	М	Zr	<	0.02046
M - C	heck	ed i	by ICP-MS	0 -	Chec	:ked	by ICP-OES	1-5	pectr	al ir	nterference	n - 1	Vot C	hec	ked For	s - S	Solutic	in S	standard Element

## 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

010396

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 24.305; +2; 6; Mg(H<sub>2</sub>O);<sup>12</sup>

Chemical Compatibility - Soluble in HCl, HNO, and H<sub>2</sub>SO, avoid HF, H<sub>2</sub>PO, and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicates, carbonates, hydroxides, oxides, and tungstates in neutral and slightly addic media.

Stability - 2-100 ppb levels stable for months in 1% HNO<sub>1</sub> / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-10% HNO<sub>1</sub> / LDPE container.

Mg Containing Samples (Preparation and Solution) - Metal (Best dissolved in dikuted HNO,); Oxide (Readily soluble in above compatible aqueous acidic solutions) Ores (Carbonate fusion in Pt<sup>®</sup> followed by HCI dissolution); Organic Matrices (Sulfuric / peroxide digestion or nitric / sulfuric / perchloric add decomposition, or dry ash and dissolution in dilute HCI).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view): Technique/Line ICP-OES 279.553 nm ICP-OES 280.270 nm Estimated D.L. Order Type Interferences (underlined indicates severe at = concs.) 0.0002 / 0.00003 µg/mL 0.0003 / 0.00005 µg/mL ion Th rn U, V U, Hf,Cr, Zr '∐™O, \*¶1'², \*\*Ca'² 1 ion ICP-OES 285.213 nm 0.002 / 0.00003 µg/mL 1 atom ICP-MS 24 amu 42 ppt nía M

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

## **10.0 QUALITY STANDARD DOCUMENTATION**

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA)



Members of <u>IQ Net International Certification Network</u>: Argentina (IRAM), Australia (QAS), Austria (ÕQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland/PCBC), Portugal (APCER), Singapore (PSB), Siovenia (SIQ), Spain (AENOR), Switzerland (SQS)

Poland (PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS P3-3-52 DATE RECEIVED: 07/31/03 DATE EXPIRED: 08/01/2004 V92 DATE OPENED: 08/01/03 INORG: 4304 P0: £53391

## 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at linorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: August 28, 2002

Expiration Date: EXPIRES

## 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Prepared By:** 

Debbie Newman, QA Administrator

Katalin Le, QC Supervisor

**Certificate Approved By:** 

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

Geblie Newman





195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 10000 µg/mL Sodium in 1.4% (abs) HNO3

Catalog Number:	CGNA10-1, CGNA10-2,	and CGNA10-5
Lot Number:	T-NA03006	
Starting Material:	Na2CO3	INORGANIC LABS/RADCHEM LABS 31#3
Starting Material Purity (%):	99.999936	DATE RECEIVED: 07/31/03
Starting Material Lot No Matrix:	42095 1.4% (abs) HNO3	DATE EXPIRED: 08/01/2004 VO DATE OPENED: 08/01/03 INORG: 4205 PD: 52391

## 30 CERTIFIED VALUES AND UNCERTAINTIES

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Certified Concentration: 10,005 ± 7 µg/mL
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Certified Density: 1.032 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (D) = <u>er x</u> u	
<b>n</b>	
Incertainty (+) = 21/2-5.32142	

(n)12

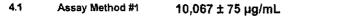
(C) = mean	
xi = individual results	
n = number of measuremen	ts
ES = The summation of all	significant estimated errors
(Most cormon are the error	s from instrumental measurement,
weighing, dilution to volume	, and the fixed error reported on the
NIST SRM certificate of ana	lysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

## 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ \*Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.



ICP Assay NIST SRM 3152a Lot Number: 990907

Assay Method #2

10,005 ± 7 μg/mL Gravimetric NIST SRM Lot Number: See Sec. 4.2

- 4.2 BALANCE CALIBRATION All balances are checked dally using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

		•		
<u>O</u> AI < 0.00090	<u>M</u> Dy < 0.02499	<u>O</u> Li < 0.00003	<u>M</u> Pr < 0.00125	<u>M</u> Te < 0.12494
<u>M</u> Sb < 0.00208	<u>M</u> Er < 0.02082	<u>M</u> Lu < 0.00167	<u>M</u> Re < 0.00417	<u>M</u> Tb < 0.00125
<u>M</u> As < 0.04165	<u>M</u> Eu < 0.01249	<u>O</u> Mg 0.00015	<u>M</u> Rh < 0.00417	<u>M</u> Tì < 0.00417
<u>M</u> Ba < 0.04165	<u>M</u> Gd < 0.00417	<u>O</u> Mn < 0.00003	<u>M</u> Rb < 0.00417	<u>M</u> Th < 0.00417
<u>O</u> Be < 0.00020	<u>M</u> Ga < 0.00417	<u>O</u> Hg < 0.01500	<u>M</u> Ru < 0.00833	<u>M</u> Tm < 0.00167
<u>M</u> Bi < 0.00167	<u>O</u> Ge < 0.00150	<u>M</u> Mo < 0.00833	<u>M</u> Sm < 0.00417	<u>M</u> Sn < 0.02082
<u>O</u> B < 0.00060	<u>O</u> Au < 0.00300	<u>M</u> Nd < 0.00833	<u>O</u> Sc < 0.00002	<u>O</u> TI < 0.00070
<u>M</u> Cd < 0.01249	<u>M</u> Hf < 0.00833	<u>O</u> Ni < 0.00230	<u>O</u> Se < 0.05000	<u>M</u> W < 0.04165
<u>O</u> Ca 0.00160	<u>M</u> Ho < 0.00208	<u>M</u> Nb < 0.00208	<u>O</u> SI < 0.00340	<u>M</u> U < 0.00833
<u>M</u> Ce < 0.02082	<u>M</u> In < 0.04165	<u>n</u> Os	<u>M</u> Ag < 0.00833	<u>O</u> V < 0.00090
<u>M</u> Cs 0.00104	<u>M</u> Ir < 0.02082	<u>M</u> Pd < 0.02082	<u>S</u> Na	<u>M</u> Yb < 0.00417
<u>M</u> Cr < 0.02082	<u>O</u> Fe < 0.00110	<u>Q</u> P < 0.04000	<u>M</u> Sr < 0.00208	<u>M</u> Y < 0.16658
<u>M</u> Co < 0.01249	<u>M</u> La < 0.00208	M Pt < 0.00833	<u>O</u> S < 0.07200	<u>O</u> Zn 0.00130
<u>O</u> Cu < 0.00140	<u>M</u> Pb < 0.01249	<u>Q</u> К 0.00873	<u>M</u> Ta < 0.02915	<u>M</u> Zr < 0.02082
M. Obselved by JOD MO	O Observed hullOD OF 0	2 On a studi Interferences	n Mat Charlend For	<ul> <li>Relution Classifierd File</li> </ul>

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 including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 %. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chamical Form in Solution - 22.98977; +1; (6); Na'(aq) largely ionic in nature (Coordination Number in parentheses is assumed, not certain.) Chemical Compatibility - Soluble in HCl, HNO, H<sub>2</sub>SO, and HF aquecus matrices. Stable with all metals and inorganic anions. Stability - 2-100 ppb levels stable for months in 1% HNO, / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO, / LDPE container.

Na Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in weter). Ores (Lithium carbonate fusion in graphite crucible followed by HCI dissolution - blank levels of Na in lithium carbonate critical); Organic Matrices (Sulfuric / peroxide digestion or nitric/sulfuric/perchloric acid decomposition).

	A	unic Spectrosc	opic Information	(ICP-OES D.L.	s are given as	<u>radial/axial</u> view);
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Technique	Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at attoncs.)
ICP-OES	589.595 nm	0.07/0.00009 µg/mL	1		2 <sup>er</sup> order radiation from R.E.s on some optical designs
ICP-OES	588,995 nm	0.03 / 0.006 µg/mL	1	atom	2 <sup>rd</sup> order radiation from R.E.s on some optical designs
ICP-OES	330.237 nm	2.0/0.09 µg/mL	1		Pd, Zn
ICP-MS	23 amu	310 ppt	n/a	M'	ATTITZ ACCIZ

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

## 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



- 10.3 ISO/IEC Guide 34 2000 "General Requirements for the Competence of Reference Material Producers"

  Reference Materials Production Accredited A2LA Certificate Number 883.02
  A2LA Mutual Recognition Agreement Partners:
  Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)
- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

## 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

INDRGANIC LABS/RADCHEM LABS B. D. of DATE RECEIVED: 07/31/03 DATE EXFIRED: 08/01/2004 VO DATE OPENED: 08/01/03 INDRG: 4005 FD: F5 D391 Certification Date: January 24, 2003 Expiration Date: January 24, 2003

## 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Prepared By:** 

Debble Newman, LIMS Administrator

Certificate Approved By:

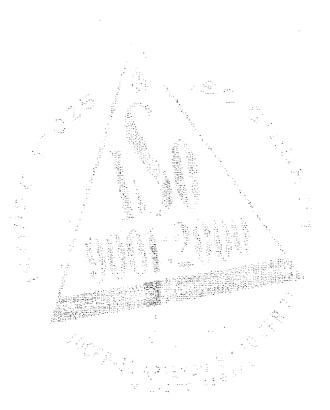
Katalin Le, QC Supervisor

Certifying Officer:

Paul Gaines, Chemist, Senior Technical Director

Gebbi Neuman

Pour Aaine



## 010402 inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Lithium in 0.1% (abs) HNO3

Catalog Number:	CGLI1-1 and CGLI1-5
Lot Number:	W-LI02073
Starting Material:	Li2CO3
Starting Material Purity (%):	99.997165
Starting Material Lot No	1123
Matrix:	0.1% (abs) HNO3

INDRGANIC LABS	RADCHEM LABS 19.1.4 2
DATE RECEIVED:	07/01/04
	08/01/2005 403
DATE OPENED:	07/01/04
INORG: 4628	PD: F53406

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 995 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>erx</u> ,	(C) = mean
n	x, = individual results
	n = number of measurements
Uncertainty (±) = $2[(e_{1}s_{1})^{2}]^{1/2}$	S = The summation of all significant estimated errors.
(n) <sup>1/2</sup>	(Most common are the errors from instrumental measurement,
	weighing, dilution to volume, and the fixed error reported on the
	NIST SPM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

## 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	995 ± 2 μg/mL
		ICP Assay NIST SRM 3129a Lot Number: 000505
	Assay Method #2	995±6µg/mL
		Gravimetric NIST SRM Lot Number: See Sec. 4.2

Certified Density: 1.004 g/mL (measured at 22° C)

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2, The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration tab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and guality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>O</u> AI 0.00120	<u>M</u> Dy < 0.01199	<u>s</u> Li M	<u>/</u> Pr < 0.00060	<u>M</u> Te < 0.05994
M Sb < 0.00100	<u>M</u> Er < 0.00999	<u>M</u> Lu < 0.00080 <u>M</u>	<u>M</u> Re < 0.00200	<u>M</u> Tb < 0.00060
<u>M</u> As < 0.01998	<u>M</u> Eu < 0.00599	Q Mg 0.00650	<u>∕</u> IRh < 0.00200	<u>M</u> TI < 0.00200
<u>M</u> Ba < 0.01998	<u>M</u> Gd < 0.00200	<u>O</u> Mn 0.00006 M	<u>∕l</u> Rb < 0.00200	<u>M</u> Th < 0.00200
<u>O</u> Be < 0.00020	<u>M</u> Ga < 0.00200	<u>O</u> Hg < 0.01500 №	<u>M</u> Ru < 0.00400	<u>M</u> Tm < 0.00080
<u>M</u> Bi < 0.00080	<u>M</u> Ge < 0.01199	<u>M</u> Mo < 0.00400 <u>M</u>	<u>M</u> Sm < 0.00200	<u>Q</u> Sn < 0.00600
<u>O</u> B 0.00020	<u>M</u> Au < 0.00599	<u>M</u> Nd < 0.00400 <u>M</u>	<u>M</u> Sc < 0.01998	<u>O</u> Ti < 0.00070
M_Cd < 0.00599	<u>M</u> Hf < 0.00400	<u>O</u> Ni < 0.00230 <u>N</u>	<u>M</u> Se < 0.01598	<u>O</u> W < 0.00400
<u>O</u> Ca 0.04050	<u>M</u> Ho < 0.00100	<u>M</u> Nb < 0.00100 S	Q Si 0.04650	<u>M</u> U < 0.00400
<u>M</u> Ce < 0.00999	<u>O</u> in < 0.00400	n Os 👖	M_Ag < 0.00400	<u>O</u> V 0.00009
<u>M</u> Cs < 0.00060	<u>M</u> Ir < 0.00999	<u>M</u> Pd < 0.00999	<u>0</u> Na 0.03200	<u>M</u> Yb < 0.00200
<u>M</u> Cr < 0.00999	Q Fe 0.00200	<u>Q</u> P < 0.00250	<u>0</u> Sr 0.00026	<u>M</u> Y < 0.07992
<u>M</u> Co < 0.00599	<u>M</u> La < 0.00100	<u>M</u> Pt < 0.00400	Q S 0.01250	<u>O</u> Zn 0.00145
<u>O</u> Cu 0.00100	<u>M</u> Pb < 0.00599	<u>О</u> К 0.00950	∭. Ta < 0.01399	<u>M</u> Zr < 0.00999
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 including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

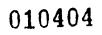
For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff



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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4  $\infty$ . Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 6.941; +1; (6); Li'(aq) large effective radius due to hydration sphere (Coordination Number in parentheses is assumed, not certain.)

**Chemical Compatibility** - Soluble in HCI, HNO, H<sub>2</sub>SO, and HF aquecus matrices. Stable with all metals and inorganic anions. **Stability** - 2-100 ppb levels stable for months in 1% HNO, / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO, / LDPE container.

Li Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water). Ores (Sodium carbonate tusion in Pt\* followed by HCI dissolution-blank levels of LI in sodium carbonate critical); Organic Matrices (Suituric / peroxide digestion or nitric / suituric / perchloric acid decomposition).

Atomic Spectroscopic	Information (ICP-DES D.L.	.s are given as ra	diai/axial view):

I MARINE OF	and a second back	The second s			
Technique/Line		Estimated D.L.	<u>Order</u>	Type	Interferences (underlined indicates severe at withoncs.)
ICP-OES	670.784 nm	0.002/0.00002 µg/mL	1	atom	2 <sup>re</sup> order rediation from R.E.s on some optical designs
ICP-OES	460.286 nm	0.9 / 0.04 µg/mL	1	atom	Zr, Th
ICP-OES	323.261 nm	1.1/0.05 ug/mL	1	atom	Sb. Th. Ni
ICP-MS	7 amu	10 ppt		n/a	M'
		••			

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

## 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by: Registrar Accreditation Board (ANSI-RAB)

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of <u>IQ Net International Certification Network</u>: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgiun Columbia (ICONTEC), Czech Republic (CQS), Denmark (I



Argentina (IRAM), Australia (QAS), Austria (ÖQŠ), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Baland (CCRC), Destruct (ADCER), Singerset (SIR), Italy (CISQ), Serie (AENOR), Submediated (SOS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"
 Reference Materials Production - Accredited A2LA Certificate Number 883.02
 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS B. 2 & a DATE RECEIVED: 07/01/04 DATE EXPIRED: 03/01/205 105 DATE OPENED: 07/01/04 INDRG: 4628 PD: F53406



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: August 12, 2003

Expiration Date:

EXPIRES 0122005

## 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Supervisor

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

folm Strutters Known in Park Aain

## 010406 inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 08/06/03 DATE EXPIRED: 09/01/2004 V03

DATE OPENED: 08/26/03

INORG: 4222 PO: F52224

# certificate of analysis

## **CUSTOM-GRADE SOLUTION**

1000  $\mu$ g/mL Silver in 3.5% HNO<sub>3</sub> (abs)

Catalog Number: CGAG1-1, CGAG1-2 and CGAG1-5

## Lot Number: T-AG02015

Starting Material: Starting Material Purity: Starting Material Lot No:

## CERTIFIED CONCENTRATION: 1001 $\pm$ 2 $\mu$ g/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Silver Metal

99.999%

F15I02

Certified Value  $\langle \bar{x} \rangle = \sum_{i=1}^{n} x_{i}$ 

Uncertainty (±) = 
$$2[(\sum_{s})^{2}]^{1/2}$$
  
(n)<sup>1/2</sup>

 $(\bar{x}) = mean$   $x_i = individual results$  n = number of measurements

 $\sum S_i$  = The summation of all significant estimated errors.

Classical Wet Assay: 1004  $\pm$  3 µg/mL Method: Volhard Titration vs NIST SRM 999a Potassium Chloride

Instrument Analysis: 1001 ± 2 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3151.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

## TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities 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  $\mu$ m.

Q	AI	< 0.00010	M	Dy	< 0.00060	Q	Li	< 0.000030	M	Pr	< 0.000030	<u>0</u>	Те	< 0.030	
m	Sb	< 0.000050	M	Er	< 0.00050	Ñ	Lu	< 0.000040	M	Re	< 0.00010	м М		< 0.000030	
ō	As	< 0.0050	M	Eu	< 0.00030	ō	Mg	< 0.000040	M	Rh	< 0.00010	M	Π	< 0.00010	
M	Ba	<0.0010	M	Gđ	< 0.00010	ō	Mn	< 0.00030	M	Rb	< 0.00010	M	Th	< 0.00010	
0	Be	< 0.00050	M	Ga	< 0.00010	ō	Hg	0.00090	M	Ru	< 0.00020	M	Ťm	< 0.000040	
M	8i	< 0.000040	M	Ge	< 0.00060	M	Мо	< 0.00020	M	Sm	< 0.00010	M	Sn	< 0.00050	
Q	8	<0.0020	Q	Au	< 0.012	M	Nđ	< 0.00020	M	Sc	< 0.0010	ō	Tì	<0.00070	
<u>0</u>	Cd	< 0.0020	M	Hf	< 0.00020	<u>0</u>	Ni	< 0.0070	<u>0</u>	Se	< 0.036	M	w	< 0.0010	
<u>0</u>	Са	< 0.000050	M	Ho	< 0.000050	M	Nb	< 0.000050	Q	Si	< 0.0030	M	U	< 0.00020	
M	Ce	< 0.00050	<u>0</u>	In	< 0.020	n	Os		ŝ	Ag		M	v	< 0.00020	
M	Cs	< 0.000030	M	Ir	< 0.00050	M	Pd	< 0.00050	<u>0</u>	Na	< 0.090	M	Yb	< 0.00010	
<u>0</u>	Cr	< 0.0020	<u>0</u>	Fe	< 0,00070	Q	Р	< 0.030	<u>M</u>	Sr	< 0.000050	M	Y	< 0.0040	
M	Co	< 0.00030	M	Le	< 0.000050	M	Pt	< 0.00020	Q	S	< 0.020	<u>0</u>	Zn	< 0.0010	
M	Cu	< 0.00060	М	Pb	< 0.00030	Q	к	< 0.0060	M	Ta	< 0.00070	<u>M</u>	Zr	< 0.00050	
м-	M - checked by ICP-MS		O - checked by ICP-OES			i - sp	i - spectral interference			n - not checked for			s - solution standard element		

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.024 g/mL QA:KL Norsal10200

Paul R. Haines

Quality Assurance Manager

Expires:







## QUALITY STANDARD DOCUMENTATION



(Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic

010407

(CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT),

(Ireland (INSA)), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

2.ISO/IEC Guide 34-2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate 883.02

3.ISO/IEC17025-1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing -Accredited A2LA Certificate 883.01

4.MIL-STD-45662A

5.10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licencing of Production and Utilization Facilities 6.10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

### STABILITY/ EXPIRATION DOCUMENTATION

Shelf Life -<u>The length of time that a properly stored and packaged standard will remain within the specified uncertainty.</u> Shelf life is affected by chemical stability and transpiration issues. Inorganic Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss is linear with time and limits the time a standard can be used with confidence. The smaller the bottle the higher the rate of transpiration. Inorganic Ventures' studies indicate that the shelf life of our 500 mL bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.

Expiration Date -<u>The date after which a standard solution should not be used.</u> A one year expiration date is recommended by most state and federal regulatory agencies. Transpiration issues and repeated use of solutions over a one year period may adversely affect the integrity of the standard.

### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double deionized water that has been filtered through a 0.2  $\mu$ m filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

### GLASSWARE CALIBRATION

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

## BALANCE CALIBRATION

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 45467B. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

### THERMOMETER CALIBRATION

The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

### TECHNICAL SUPPORT

All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 INT'L 1-732-901-1900 FAX 1-732-901-1903

E-MAIL IVtech@ivstandards.com





#### inorganic ventures 1 i v labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials." and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- **DESCRIPTION OF CRM** 2.0

Custom-Grade 1000 µg/mL Arsenic in 1.4% (abs) HNO3

Catalog Number:	CGAS1-1, CGAS1-2, a	nd CGAS1-5
Lot Number: Starting Material:	W-AS02022 POLYCRYSTALINE LU	MP
Starting Material Purity (%):	99.9989 <b>9</b> 4	
Starting Material Lot No	23115	
Matrix:	1.4% (abs) HNO3	INGRGANIC LABS/RADCHEM LABS <sup>9</sup> 162 Date Received: 01/30/04
CERTIFIED VALUES AND I	INCERTAINTIES	DATE EXPIRED: 03/01/3005 VDS

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

 $1014 \pm 3 \,\mu g/mL$ **Certified Concentration:** 

1.012 g/mL (measured at 22° C) **Certified Density:** 

The Certifled Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\Box = \underline{\alpha} \cdot x_{1}$ n

Uncertainty  $(\pm) = 2[(2rS_1)F]^{1/2}$ (n)<sup>12</sup>

(D) = mean x<sub>i</sub> = individual results n = number of measurements BS = The summation of all significant estimated errors. (Most cormon are the errors from instrumental measurement. weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

DATE OPENED: 01/30/04\_

INURG: 4433 PU: F52301

#### TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS 4.0

E "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1014 ± 3 μg/mL (Avg 2 runs)							
		ICP Assay NIST SRM 3103a Lot Number: 891003							
	Assay Method #2	1008 µg/mL Gravimetric NIST SRM Lot Number: See Sec. 4.2							

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.; 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and guality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>0</u>	Al		0.00038	м	Dy	<	0.01596	<u>0</u>	Ц		0.00009	М	Pr	<	0.00080		М	Те	<	0.07978	
<u>0</u>	Sþ	<	0.01000	М	Er	<	0.01330	М	Lu	<	0.00106	Q	Re	<	0.01000		M	ТЪ	<	0.00080	
<u>s</u>	As			M	Eu	<	0.00798	<u>o</u>	Mg		0.00009	М	Rh	<	0.00266	1	М	TI	<	0.00266	
M	Ва	<	0.02660	М	Gd	<	0.00266	Q	Mn	<	0.00003	M	Rb	<	0.00266		M	Th	<	0.00266	
M	Be	<	0.00133	М	Ga	<	0.00266	<u>0</u>	Hg	<	0.01200	M	Ru	<	0.00532		M	Tm	<	0.00106	
M	Bi	<	0.00106	М	Ge	<	0.01596	М	Мо	<	0.00532	м	Sm	<	0.00266		Q	Sn		0.00049	
Q	в	<	0.01200	M	Au	<	0.00798	М	Nd	<	0.00532	M	Sc	<	0.02660		M	Ti	<	0.13297	
М	Cd	<	0.00798	M	Hf	<	0.00532	М	Ni	<	0.02128	M	Se	<	0.02128		М	w	<	0.02660	
<u>0</u>	Ca		0.00189	M	Но	<	0.00133	<u>0</u>	Nb	<	0.00200	₽	Si		0.00415		M	υ	<	0.00532	
M	Ce	<	0.01330	м	In	<	0.02660	n	Os			M	Ag	<	0.00532		Μ	۷	<	0.00532	
M	Cs	<	0.00080	М	Ir	<	0.01330	М	Pd	<	0.01330	<u>0</u>	Na		0.00159		М	Yb	<	0.00266	
М	Cr	<	0.01330	<u>0</u>	Fe	<	0.00110	Q	P	<	0.00260	M	Sr	<	0.00133		M	Y	<	0.10638	
M	Co	<	0.00798	М	La	<	0.00133	M	Pt	<	0.00532	Q	S	<	0.02500	1	<u>0</u>	Zn		0.00057	
М	Cu	<	0.01596	М	Pb	<	0.00798	Q	ĸ		0.00132	М	Та	<	0.01862		M	Zr	<	0.01330	
M - 0	Check	ed	by ICP-MS	0 -	Chec	kec	by ICP-OES	i - S	pectr	all	nterference	n - 1	Not C	heo	ked For	5	3 - 5	Soluti	on	Standard Eler	nent

## 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4<sup>e</sup>C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 74.9216; mix of +3 and +5; 6; H<sub>2</sub>AsO<sub>4</sub> and HAsO<sub>2</sub>

**Charrical Competibility** Arsenic has no cationic chemistry. It is soluble in HCI, HNO<sub>4</sub>, H<sub>2</sub>PO<sub>4</sub>, H<sub>2</sub>SO<sub>4</sub> and HF aqueous *matrices* water and NH<sub>4</sub>OH . It is stable with most inorganic anions (forms arsenate when boiled with chromate) but many cationic metals form the insoluble arsenates under pH neutral conditions. When fluorinated and / or under acidic conditions arsenate formation is typically not a problem at moderate to low concentrations.

Stability - 2-100 ppb levels stable for months alone or mixed with other elements at equivalent levels in 1% HNOs / LDPE container, 1-10,000 ppm solutions chemically stable for years in 1-5% HNOs / LDPE container.

As Containing Samples (Preparation and Solution) - As<sup>4</sup> (soluble in 1:1 H<sub>2</sub>O / HNO<sub>3</sub>) Oxides (the oxide exists in crystalline and amorphous forms where the amorphoric form is more weter soluble. The oxides typically dissolve in dilute addic solutions when boiled). Minerals (One gram of powered sample is fused in a Ni<sup>a</sup> crucible with 10 grams of a 1:1 mix of K<sub>2</sub>CO<sub>3</sub> and KNO<sub>3</sub> and the melt extracted with hot water); Organic Matrices (0.2 to 0.5 grams of the sample are fused with 15 grams of a 1:1 Na<sub>2</sub>CO<sub>3</sub> / Na<sub>2</sub>O<sub>2</sub> mix in a Ni<sup>a</sup> crucible. The fuseate is extracted with water and additied with HNO<sub>3</sub>)

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

Technique	Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at alboncs.)
ICP-OES	189.042 nm	0.05 / 0.005 µg/mL	1	atom	Cr
ICP-OES	193.696 nm	0.1 / 0.01 µg/mL	1	atom	V, Ge
ICP-OES	228.812 nm	0.1 / 0.01 µg/mL	1	atom	Cd. Pt. Ir. Co
ICP-MS	75 amu	20 ppt	n/a	Μ'	"A/#CI, "*Co "O, "Ar #Ar'H, **Ar**CI, #A/#K, '**Nd*', '*Sm2'

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

## 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by: Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of <u>IQ Net International Certification Network</u>:



Argentina (IRAM), Australia (QAS), Austria (QQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"

 Reference Materials Production - Accredited A2LA Certificate Number 883.02
 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsciete/Observed)

INDREANIC LABS/RADCHEM LABS? 2002 DATE RECEIVED: 01/20/04 DATE EXFINED: 02/01/2005 103 DATE OPENED: 01/20/04 INDRE: 4433 PO: 5330





- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Paul Gaines, Chemist, Senior Technical Director

Certification Date: May 01, 2003

Expiration Date: EXPIRES 162005

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certifying Officer:

**Certificate Prepared By:** JoAnn Struthers, QA Administrative Assistant **Certificate Approved By:** Katalin Le, QC Supervisor

Jolen Stutten Known in in Pauk Aain



195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

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# certificate of analysis

- Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles." DATE
- DESCRIPTION OF CRM 2.0

Custom-Grade 1000 µg/mL Lead in 0.35% (abs) HNO3

Catalog Number: CGPB1-1, CGPB1-2, and CGPB1-5 Lot Number: W-PB02114 Starting Material: Pb(NO3)2 Starting Material Purity (%): 99.999974 Starting Material Lot No 22150 Matrix: 0.35% (abs) HNO3

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

**Certified Concentration:**  $1006 \pm 2 \,\mu g/mL$ 

**Certified Density:** 1.002 g/mL (measured at 22° C)

The Certified Value is the wet assay value. The following equations are used in the calculations of the certified value and the uncertainty:

Certified Value (🖾 = <u>er x</u> )	(C)1 = mean
n	x <sub>1</sub> = individual results
	n = number of measurements
Uncertainty (±) = <u>21(ers</u> , <del>711/2</del>	ES = The summation of all significant estimated errors.
(n) <sup>1/2</sup>	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS 4.0

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, welghing and volume dilution errors.

4.1	Assay Method #1	1005 ± 2 µg/mL
		ICP Assay NIST SRM 3128 Lot Number: 991504
	Assay Method #2	1006 ± 2 µg/mL
		EDTA NIST SRM 928 Lot Number: 880710

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

									•										
<u>0</u>	Al	<	0.00270	M	Dy	<	0.01193	<u>0</u>	Li	<	0.00002	М	Pr	<	0.00060	M	Te	<	0.05965
M	Sb	<	0.00099	M	Er	<	0.00994	М	Lu	<	0.00080	М	Re	<	0.00199	M	тъ	<	0.00060
M	As	<	0.01989	М	Eu	<	0.00597	Q	Mg		80000.0	õ	Rh	<	0.00900	<u>0</u>	TI		0.00130
M	Ba	<	0.01989	M	Gđ	<	0.00199	M	Mn	<	0.00795	М	Rb	<	0.00199	M	Th	<	0.00199
М	Be	<	0.00099	M	Ga	<	0.00199	<u>0</u>	Hg	<	0.01500	М	Ru	<	0.00398	м	Tm	<	0.00080
<u>0</u>	Bi	<	0.02000	M	Ge	<	0.01193	М	Мо	<	0.00398	М	Sm	<	0.00199	м	Sn	<	0.00994
õ	в	<	0.04000	M	Au	<	0.00597	M	Nd	<	0.00398	М	Sc	<	0.01989	M	ТІ	<	0.09942
М	Cd	<	0.00597	М	Hf	<	0.00398	М	Ni	<	0.01591	М	Se	<	0.01591	M	w	<	0.01989
Q	Ca		0.00009	M	Ho	<	0.00099	М	Nb	<	0.00099	õ	SI	<	0.00340	м	U	<	0.00398
M	Ce	<	0.00994	М	In	<	0.01989	Ω	Os			М	Ag	<	0.00398	M	v	<	0.00398
М	Cs	<	0.00060	М	Ir	<	0.00994	М	Pd	<	0.00994	<u>0</u>	Na	<	0.00600	M	Yb	<	0.00199
M	Cr	<	0.00994	Q	Fe		0.00011	<u>0</u>	Ρ	<	0.00500	М	Sr	<	0.00099	M	Y	<	0.07954
M	Co	<	0.00597	М	La	<	0.00099	M	Pt	<	0.00398	õ	s	<	0.10000	M	Zn	<	0.03977
M	Cu	<	0.01193	5	Pb			Q	к	<	0.00180	М	Та	<	0.01392	M	Zr	<	0.00994
M - Cł	neck	ed	by ICP-MS	0-	Che	xec	by ICP-OES	1 - S	pect	all	nterference	n - 1	Not C	heo	cked For	s - (	Soluti	on (	Standard Element

## 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4%. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 207.2; +2; 6; Pb(H<sub>2</sub>O),<sup>12</sup>

Chemical Competibility - Soluble in HCI, HF and HNO<sub>3</sub>. Avoid H<sub>2</sub>SO<sub>4</sub>. Stable with most metals and inorganic anions forming insoluble carbonate, borate, <u>sulfate</u>, sulfite, sulfide, phosphate, oxalate, <u>chromate</u>, tannate, iodate, and cyanide in neutral aqueous media.

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

**Pb Containing Samples (Preparation and Solution)** - Metal (Best dissolved in 1:1 H<sub>2</sub>O / HNO<sub>2</sub>.) Oxides (The many different Pb oxides are soluble in HNO<sub>2</sub> with the exception of PbO<sub>2</sub> which is soluble in HCl or HF); Ores and Aloys (Best attacked using 1:1 H<sub>2</sub>O / HNO<sub>3</sub>.) Organic Matrices (Dry ash and dissolve in dilute HCl.).

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

 Technique/Line
 Estimated B.L.
 Order
 Type
 Interferences (underlined indicates severe at affoncs.)

 ICP-OES
 168.215 nm
 0.03 / 0.003 µg/mL
 1
 ion
 Co

 ICP-OES
 220.353 nm
 0.04 / 0.005 µg/mL
 1
 ion
 Co

ICP-OES	220.353 nm	0.04/0.006 µgAnL	1	ion	Bi,Nb
ICP-OES	217.000 nm	0.09/0.03 µg/mL	1	atom	W, Ir, Hf, Sb, Th
ICP-MS	208 amu	5 ppt	n/a	Μ'	'≝Pt'®, '™Os'®O

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

## 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration • QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA)

Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of IQ Net International Certification Network:



Argentina (IRAM), Australia (QAS), Austria (QQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenja (SIQ), Spain (AENOR), Switzerland (SQS)

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Cellbration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)



#### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopen ed, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical i instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs Indica te a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under specalal conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

INORGANIC LABS/RADCHEM LABS
INORGANIC LABS/RADCHEM LABS/ 2 DATE RECEIVED: 1/3/03
DATE EXPIRED: 11/1/04 OL
DATE OPENED:13163
DATE EXPIRED: 11/1/04 DAL DATE OPENED: 11/1/04 DAL INORG: 4313 FO: FSDDS8

## Certification Date: January 23, 2003

## Expiration Date:

					72.5
 1	NOV	2	004	-	

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:

JoAnn Struthers, QA Administrative Assistant

Certifying Officer:

Certificate Approved By:

Paul Gaines, Chemist, Senior Technical Director

Katalin Le, QC Supervisor

Jolin Stutten Kornein an Pauk Kain

## 010416 inorganic ventures / iv labs



195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Antimony in 0.7% (abs) HNO3 / 3% Tartaric Acid

Catalog Number:	CGSB1-1, CGSB1-2 and CGSB1-5
Lot Number:	W-SB02078
Starting Material:	Sb shot
Starting Material Purity (%):	99.989188
Starting Material Lot No	D17L24
Matrix:	0.7% (abs) HNO3 / 3% Tartaric Acid

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration:	1005 ± 2 µg/mL
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n

Certified Density: 1.019 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>erx</u>

Uncertainty  $(\pm) = \frac{2[(275)]^{1/2}}{(1)^{1/2}}$ 

(C) = mean x₁ = individual results n = number of measurements ■S = The summation of all significant estimated errors (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

## 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are
reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1005 ± 2 μg/mL (Avg 2 runs)
		ICP Assay NIST SRM 3102a Lot Number: 990707
	Assay Method #2	1000 µg/mL
		Gravimetric NIST SRM Lot Number: See Sec. 4.2

INDRGANIC LABS/RADCHEM LABS B 4 of a DATE RECEIVED: 03/05/04 DATE EXPIRED: 03/07 2005 VD DATE OPENED: 03/05/04 INDRG: 4464 PD: F53333

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>0</u> A	d	0.04519	M	Dy	<	0.00597	Q	LI		0.00004	M	Pr	<	0.00030	M	Te	<	0.02983
<u>s</u> s	ь		М	Er	<	0.00497	М	Lu	<	0.00040	M	Re	<	0.00099	M	ТЪ	<	0.00030
<u>M</u> A	s ·	0.00994	М	Eu	<	0.00298	Q	Mg		0.00171	М	Rh	<	0.00099	М	тι		0.00040
<u>o</u> b	a	0.00003	M	Gd	<	0.00099	Q	Mn		0.00321	М	Rb	<	0.00099	Μ	Th	<	0.00099
<u>Q</u> B	e ·	0.00001	M	Ga	<	0.00099	<u>0</u>	Hg	<	0.01500	M	Ru	<	0.00199	M	Tm	<	0.00040
МВ	li	0.00170	M	Ge	<	0.00597	М	Мо	<	0.00199	М	Sm	<	0.00099	M	Sn		0.00050
<u>o</u> b	i	0.00100	Μ	Au	<	0.00298	М	Nđ	<	0.00199	Q	Sc	<	0.00016	Q	Ti		0.00131
мс	d 🗸	0.00298	М	Hf	<	0.00199	Q	Ni		0.00100	М	Se	<	0.49711	M	w	<	0.00994
<u>o</u> c	a	0.00884	Μ	Ho	<	0.00050	M	Nb	<	0.00050	Q	Si		0.00502	M	U	<	0.00199
<u>o</u> c	e ·	0.00300	М	In	<	0.00994	n	Os			М	Ag	<	0.00199	M	v	<	0.00199
мс	s ·	0.00030	₩	łr	<	0.00497	М	Pd	<	0.00497	Q	Na		0.00362	М	Yb	<	0.00099
οc	ਮ	0.00954	Q	Fe		0.01306	Q	Р	<	0.04000	М	Sr	<	0.00050	M	Y	<	0.03977
<u>м</u> с	•	0.00298	Q	La	<	0.00120	Μ	Pt	<	0.00199	i	s			Q	Zn		0.00141
<u>o</u> c	u	0.00321	M	Pb		0.00060	Q	к		0.01004	М	Та	<	0.00696	М	Zr	<	0.00497
M - Che	ecke	by ICP-MS	0-	Chec	kec	by ICP-OES	I - S	pect	rai I	nterference	n - I	Not C	hea	ked For	s - :	Soluti	on :	Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff



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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 . Do not pipet from container. Do not return portions removed for pipetling to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 121.75; +3; & Sb(O)C.H.O.\*

Chemical Compatibility - Stable in concentrated HCI, dilute or concentrated HF. Stable in dilute HNO, as the fluoride or tartrate complex. Avoid basic media. Stable with most metals and inorganic anions in acidic media as the tartrate provided the acidity is not too high or the acid is oxidizing causing loss of the stabilizing tartrate ion. The fluoride complex of artimony is stable in strong acid but you should only mix with other metals that are fluorinated.

Stability - 2-100 ppb levels stable for months in 1% HNO<sub>3</sub> / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-2% HNO<sub>3</sub> / LDPE container.

Sb Contraining Samples (Preparation and Solution) - Metal and alloys (Soluble in H<sub>2</sub>O / HF / HNO<sub>2</sub> mixture); Oxides (Soluble in HCI and tartaric acid or H<sub>2</sub>O / HF / HNO<sub>2</sub> mixtures ;) Ores (Fusion with Na<sub>2</sub>CO<sub>2</sub> in Pt<sup>®</sup> followed by dissolving the fuseste in a H<sub>2</sub>O / HF / HNO<sub>3</sub> mixture); Organic based (Sulfuric acid / hydrogen peroxide digestion)

- Al	tamic Sp	sectro	ecopic Info	mation (ICP-OES D	<u>radial/axial</u> view):			
I	echniqui	elline	•	Estimated D.L.	Order	Type	Interferences (underlined indicates	severe at afforcs.)
51	P-OES	206.8	333 nm	0.03 / 0.003 µg/mL	1	atom	Ta, Cr, Ge, Hf	•
10	P-OES	217.5	581 nm	0.05 / 0.005 µg/mL	1	atom	Nb, W, Re, Fe,	
IC	P-OES	231.1	47 nm	0.06 / 0.006 µg/mL	1	atom	NI, Co, Pt	
IC	P-MS	121	amu	5 ppt	n <b>la</b>	М'	™Pd™Ò, ™Y™Oz	

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

## 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Estidad Maximum da Accreditation a a (EM

Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of <u>IQ Net International Certification Network</u>: Amentina (IRAM) Australia (QAS) Austria (QQS) Belgium (Av

Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAi), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Boland (BCBC), Editoral (ABCEE), Signapore (SES), Slovensia (SEO), Spain (AENOR), Switzedand (SOS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02

**A2LA Mutual Recognition Agreement Partners:** 

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS B. 2042 DATE RECEIVED: 03/05/04 DATE EXPIRED: 03/01/3005 VD DATE OPENED: 02/05/04 INDRG: 4464 PD: E53303

#### DATE OF CERTIFICATION AND PERIOD OF VALIDITY 11.0



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: July 23, 2003 EXPIRES Expiration Date:

010419

#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

JoAnn Struthers, QA Administrative Assistant Certificate Prepared By:

**Certificate Approved By:** Katalin Le, QC Supervisor

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

folm Stutten Known in in Pauk Adain

INDRE: 4630 PD: 753406

ventures 1 labs inorganic

> 195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- **DESCRIPTION OF CRM** Custom-Grade 1000 µg/mL Selenium in 1.4% (abs) HNO3 2.0

Catalog Number:	CGSE1-1, CGSE1-2, an	d CGSE1-5
Lot Number:	X-QSE01091	
Starting Material:	Se shot	
Starting Material Purity (%):	99.997834	INORGANIC LABS/RADCHEM LABS 8102
Starting Material Lot No	I20L45	DATE RECEIVED: 07/01/04
Matrix:	1.4% (abs) HNO3	DATE EXPIRED: 08/01/205 105
		DATE OPENED:OT/01/04 INDRE: 4630 PD: 753406

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

Certified	Concentration:	1005 ±	2 µg/mL
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#### **Certified Density:** 1.009 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = $\underline{\alpha} \cdot \underline{x}$	(C) = mean
n	x, = individual results
	n = number of measurements
Uncertainty (±) = <u>2[(2+5)}]<sup>1/2</sup></u>	BS = The summation of all significant estimated errors.
(n) <sup>1/2</sup>	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

#### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1005 ± 2 μg/mL (Avg 2 runs) ICP Assay NIST SRM 3149 Lot Number: 992106								
	Assay Method #2	<b>1004 µg/mL</b> Gravimetric NIST SRM Lot Number: See Sec. 4.2								

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

Q A	N	0.00030	М	Dy	<	0.01196	<u>0</u>	Li	<	0.00003	М	Pr	<	0.00060	М	Те	<	0.05982
<u>M</u> S	Sb <	0.00100	М	Er	<	0.00997	М	Lu	<	0.00080	<u>0</u>	Re	<	0.00900	Μ	ТЪ	<	0.00060
<u>0</u> A	\s <	0.00500	М	Eu	<	0.00598	Q	Mg		0.00021	М	Rh	<	0.00199	М	тι	<	0.00199
<u>М</u> В	la <	0.01994	M	Gđ	<	0.00199	M	Mn	<	0.00798	М	Rb	<	0.00199	м	Th	<	0.00199
<u>o</u> b	le <	0.00009	М	Ga	<	0.00199	Q	Hg		0.01054	<u>0</u>	Ru	<	0.00700	Μ	Tm	<	0.00080
МВ	₿i <	0.00080	М	Ge	<	0.01196	Q	Мо	<	0.00400	М	Sm	<	0.00199	м	Sn	<	0.00997
<u>о</u> в	3 <	0.00006	М	Au	<	0.00598	М	Nd	<	0.00399	М	Sc	<	0.01994	Μ	Ti	<	0.09969
мс	d	0.00060	М	Hf	<	0.00399	Q	Ni		0.00028	<u>s</u>	Se			M	w	<	0.01994
<u>o</u> c	a	0.00100	М	Ho	<	0.00100	Q	Nb	<	0.00400	Q	Şi	<	0.00300	M	U	<	0.00399
<u>M</u> C	;e <	0.00997	M	In	<	0.01994	<u>n</u>	Os			М	Ag	<	0.00399	M	V	<	0.00399
<u>м</u> с	≿s <	0.00060	М	ir	<	0.00997	M	Pd	<	0.00997	<u>0</u>	Na		0.00402	M	Yb	<	0.00199
<u>м</u> с	Cr	0.00080	<u>0</u>	Fe		0.00271	<u>0</u>	Р	<	0.00300	М	Sr	<	0.00100	M	Y	<	0.07976
мс	:o <	0.00598	M	La	<	0.00100	M	Pt	<	0.00399	Q	s	<	0.04000	M	Zn		0.00400
<u>м</u> с	Cu	0.00130	М	Рb	<	0.00598	<u>0</u>	к		0.00060	М	Та	<	0.01396	Q	Zr		0.00005
M - Che	ecked	by ICP-MS	0 -	Chec	kec	i by ICP-OES	i - S	pectr	al I	nterference	n - I	Not C	heo	ked For	s - 3	Soluti	on	Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 %. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chamical Form in Solution - 78.96; +4; 6; H<sub>2</sub>SeO<sub>8</sub>

Chemical Compatibility - Soluble in HCI, HNO, HPO, HPO, HSO, and HF aqueous matrices and water. It is stable with most inorganic anions but many cationic metals form the insoluble selenites under pH neutral conditions. When fluorinated and/or under acidic conditions precipitation is typically not a problem at moderate to low concentrations.

Stability - 2-100 ppb levels - stable for months alone or mixed with other elements at equivalent levels - in 1 % HNO<sub>3</sub> / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO<sub>3</sub> / LDPE container.

Se Containing Samples (Preparation and Solution) - Metal (Solutie In HNO<sub>2</sub>); Oxides (Readily soluble in water); Minerals and alloys (Acid digestion with HNO<sub>2</sub> or HNO<sub>2</sub> / HF); Organic Matrices (Acid digestion with hot concentrated H<sub>2</sub>SO, accompanied by the careful dropwise addition of H<sub>2</sub>O<sub>2</sub> until clear)

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

Technique/Line	Estimated D.L.	Order	Туре	Interferences (underlined indicates severe at alboros.)
ICP-OES 196.026 nm	0.08 / 0.006 µg/mL	1	atom	Fe
ICP-OES 203.985 nm	0.2 / 0.05 µg/mL	1	atom	<u>Sb, ir, Cr, Ta</u>
1CP-OES 206.279 nm	0.3 / 0.16 µg/mL	1	atom	Cr. Pt
ICP-MS 82 amu	200 ppt	n/a	M'	'*C**Ci,

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

## 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) CON CONet

010422

Members of <u>IQ Net International Certification Network</u>: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland (PCRC), Portugal (ARCER), Singapore (PSR), Singapore (ASA), Sentence (AFAQ), Switzedand (SCS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"

 Reference Materials Production - Accredited A2LA Certificate Number 883.02
 A2LA Mutual Recognition Agreement Partners:
 Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA),

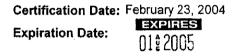
Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS/9347 DATE RECEIVED: 07/01/04 DATE EXPIRED: 08/01/2005 405 DATE OPENED: 07/01/04 INDRG: 4630 PO: F53404



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.



#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Manager

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

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## inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Thallium in 0.5% (abs) HNO3

Catalog Number:	CGTL1-1, CGTL1-2, and	CGTL1-5
Lot Number:	W-QTL01094	
Starting Material:	TLNO3	
Starting Material Purity (%):	99.996539	
Starting Material Lot No	22928	INOR
Matrix:	0.5% (abs) HNO3	DATE

INOF	RGANIC LABS	/RADCHEM LABS B-2+7
DATE	RECEIVED:	01/20/04
DATE	EXPIRED:	03/01/2005 VOS
DATE	OPENED:	91/20/04
INORG	+++35	PO: F53301

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration:  $1001 \pm 4 \ \mu g/mL$ 

Certified Density: 1.002 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\Box$ ) = $\underline{\mathscr{O}} \times \underline{\mathscr{O}}$	(C) = mean
n	x, = individual results
	n = number of measurements
Uncertainty (±) = <u>2[(@rsj)712</u>	S = The summation of all significant estimated errors.
(1)12	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SFM certificate of analysis.)

## 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1001 ± 4 μg/mL (Avg 2 runs)
		ICP Assay NIST SRM 3158 Lot Number: 993012
	Assay Method #2	1000 µg/mL
		Gravimetric NIST SRM Lot Number: See Sec. 4.2

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.
- 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL Custom-Grade solutions 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.

	1	1	1	1
<u>M</u> AI < 0.01000	<u>M</u> Dy < 0.00600	Q Li < 0.00002	<u>M</u> Pr < 0.00030	<u>M</u> Te < 0.03000
<u>M</u> Sb < 0.00050	<u>M</u> Er < 0.00500	<u>M</u> Lu < 0.00040	<u>M</u> Re < 0.00100	<u>M</u> Tb < 0.00030
<u>M</u> As < 0.01000	M Eu < 0.00300	<u>Q</u> Mg 0.00012	<u>M</u> Rh < 0.00100	<u>s</u> TI
<u>M</u> Ba < 0.01000	<u>M</u> Gd < 0.00100	<u>M</u> Mn < 0.00400	<u>M</u> Rb < 0.00100	<u>M</u> Th < 0.00100
<u>M</u> Be < 0.00050	<u>M</u> Ga < 0.00100	Q Hg < 0.01200	<u>M</u> Ru < 0.00200	<u>M</u> Tm < 0.00040
M Bi < 0.00040	<u>M</u> Ge < 0.00600	<u>M</u> Mo < 0.00200	<u>M</u> Sm < 0.00100	<u>M</u> Sn < 0.00500
<u>о</u> в < 0.00140	<u>M</u> Au < 0.00300	<u>M</u> Nd < 0.00200	<u>M</u> Sc < 0.01000	<u>M</u> Ti < 0.05000
<u>O</u> Cd 0.00150	<u>M</u> Hf < 0.00200	<u>M</u> Ni < 0.00800	<u>M</u> Se < 0.00800	<u>M</u> W < 0.01000
<u>O</u> Ca 0.00085	<u>M</u> Ho < 0.00050	<u>M</u> Nb < 0.00050	<u>Q</u> Si < 0.00340	<u>M</u> U < 0.00200
<u>M</u> Ce < 0.00500	<u>M</u> In < 0.01000	<u>n</u> Os	M_Ag0.04000	<u>M</u> V < 0.00200
<u>M</u> Cs < 0.00030	<u>M</u> ir < 0.00500	<u>M</u> Pd < 0.00500	<u>Q</u> Na 0.00050	<u>M</u> Yb < 0.00100
<u>M</u> Cr < 0,00500	<u>Q</u> Fe 0.00030	<u>O</u> P < 0.00260	<u>M</u> Sr < 0.00050	<u>M</u> Y < 0.04000
<u>M</u> Co < 0.00300	<u>M</u> La < 0.00050	<u>M</u> Pt < 0.00200	<u>O</u> S < 0.03000	<u>O</u> Zn 0.00110
<u>M</u> Cu < 0.00600	M Pb 0.00210	<u>Q</u> K < 0.00180	<u>M</u> Ta < 0.00700	<u>M</u> Zr ≤ 0.00500
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 including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

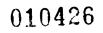
For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff



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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4%. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 204.383; +1; 6; 11(H,O), "

Chemical Compatibility - Soluble in HCI, HNO, and H,SO. Stable withmost metals and inorganic anions. The sulfite, thiocyanate and oxalate are moderately soluble; the phosphate and assente are slightly soluble and the sulfide is insoluble.

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

Th Containing Samples (Preparation and Solution) - Metal (Best dissolved in HNO, which forms chiefly the TI" ion.) Oxide (The thatlous oxide is readily soluble in water. The thatlic oxide requires high levels of acid) Ores (Carbonate fusion in Pt\* followed by HCI dissolution). Organic Matrices (Sulturic/peroxide digestion or dry ash and dissolution in HCI).

Alomic Sp	ectroscopic inn	ormation (ICP-OES D.I	<u>radial/axial</u> view);		
Technique	Line	Estimated D.L.	Order	<u>Type</u>	Interferences (underlined indicates severe at vationcs.)
ICP-OES	190.864 nm	0.04 / 0.004 µg/mL	1	ion	V, Ti
ICP-OES	276.787 nm	0.1 / 0.01 µg/mL	1	atom	Te, V, Fe, Cr
ICP-OES	351 .924 nm	0.2 / 0.02 µg/mL	1	atom	Th, Ce, Zr
ICP-MS	205 amu	2 ppt	n/a	M'	"°Os"O

- 8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA)



Members of IQ Net International Certification Network:

Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT). Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Backa DATE RECEIVED: 01/20/04 DATE EXPIRED: 03/01/3005 V03 DATE DPENED: 01/20/04 INDRG: 4425 FU: F50301



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: December 09, 2003

Expiration Date: EXPIRES 162005

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:

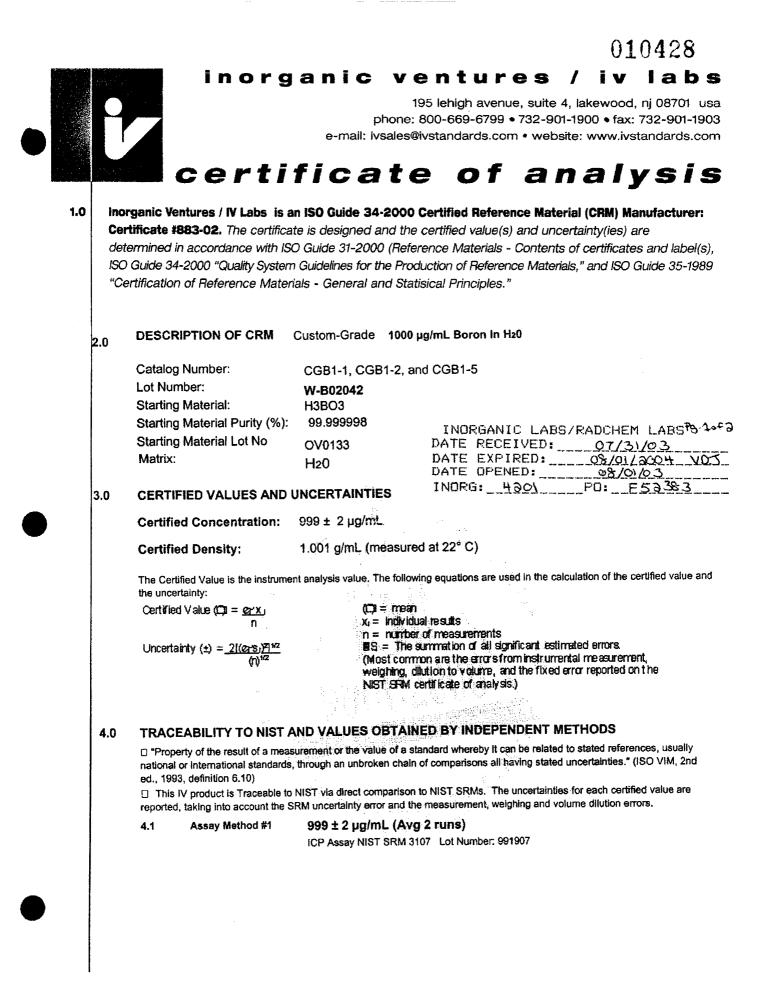
Debbie Newman, Production Manager

**Certificate Approved By:** Katalin Le, QC Manager

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

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- 4.2 BALANCE CALIBRATION All balances are checked dally using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

																•			
<u>0</u>	AI	<	0.00090	м	Dy	<	0.00600	<u>0</u>	Li	<	0.00002	М	Pr	<	0.00030	M	Те	<	0.03000
М	Sb	<	0.00050	м	Er	<	0.00500	М	Lu	<	0.00040	М	Re	<	0.00100	M	Тb	<	0.00030
М	As	<	0.01000	M	Eu	<	0.00300	<u>o</u>	Mg	<	0.00006	М	Rh	<	0.00100	M	TI	<	0.00100
<u>o</u>	8a	<	0.00010	M	Gd	<	0.00100	Q	Mn	<	0.00002	м	Rb	<	0.00100	M	Th	<	0.00100
<u>0</u>	Be	<	0.00017	<u>0</u>	Ga	<	0.00160	õ	Hg	<	0.01500	м	Ru	<	0.00200	M	Tm	<	0.00040
M	Bi	<	0.00040	м	Ge	<	0.00600	м	Мо	<	0.00200	М	Sm	<	0.00100	M	Sn	<	0.00500
<u>s</u>	в			M	Au	<	0.00300	M	Nd	<	0.00200	Q	Sc	<	0.00002	M	TI	<	0.05000
М	Cd	<	0.00300	M	Hf	<	0.00200	Q	Ni	<	0.00230	<u>0</u>	Se	<	0.00620	M	w	<	0.01000
Q	Ca	<	0.00007	м	Ho	<	0.00050	м	Nb	<	0.00050	õ	Si		0.00067	M	U	<	0.00200
Q	Ce	<	0.00300	M	In	<	0.01000	Ū	Os			M	Ag	<	0.00200	<u>0</u>	v	<	0.00083
M	Cs	<	0.00030	M	lr	<	0.00500	М	Pd	<	0.00500	<u>0</u>	Na	<	0.00010	M	Yb	<	0.00100
M	Cr	<	0.00500	<u>o</u>	Fe	<	0.00110	<u>0</u>	P	<	0.00250	M	Sr	<	0.00050	M	Y	<	0.04000
Q	Co	<	0.00110	M	La	<	0.00050	M	Pt	<	0.00200	₽	s	<	0.10000	<u>0</u>	Zn	<	0.00019
м	Cu	<	0.00600	M	Pb	<	0.00300	<u>0</u>	к	<	0.00300	M	Та	<	0.00700	М	Zr	<	0.00500
м - с	Check	ked	by ICP-MS	0-	Chec	kec	by ICP-OES	1-8	Spect	ral	Interference	n - 1	Not C	he	cked For	s - :	Soluti	on	Standard Element

## 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional Intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Humber; Chemical Form in Solution - 10.811; +3; 4; B(OH), and B(OH). Chemical Compatibility - Moderately soluble in HCI, HNO,, H<sub>2</sub>SO, and HF aqueous matrices and very soluble in NH.OH. Stable with all metals and inorganic anions at low to moderate ppm levels.

Stability - 2-100 ppb levels stable for months in 1% HNO, / LDPE container. 1-1,000 ppm solutions chemically stable for years in 1% HNO, / LDPE container. 1000 -10,000 ppm stable for years in diute NHJOH / LDPE container.

B Containing Samples (Preparation and Solution) - Metal (Crystalline form is scarcely attacked by acids or alkaline solutions; emorphous form is soluble in conc. HNO<sub>2</sub> or H<sub>2</sub>SO<sub>2</sub>); B(OH), (water solutile); Ores(avoid acid digestions and use caustic fusions in Pt<sup>-</sup>); Organic Matrices ( dry ash mixed with Na<sub>2</sub>CO<sub>2</sub> in Pt<sup>-</sup>set 450-€ then increase heat to 1000-€ to fuse; or perform a Na<sub>2</sub>O<sub>2</sub> fusion in a Ni=crucible / Parr bomb ).

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

Techniqu	Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at alboros.)
ICP-OES	249.773 nm	0.003/0.001 µg/mL	1	atom	W, Ce, Co, Th, Ta, Mn, Mo, Fe
ICP-OES	249.678 nm	0.004 / 0.003 µg/mL	1	atom	Os,W,Co,Cr,HI
ICP-OES	208.959 nm	0.007 / 0.0005 µg/mL	1	atom	Mo
ICP-MS	11amu	700 ppt	n/a	Μ'	

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network:



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT). Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" • Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS $\mathcal{P}_{3}$ DATE RECEIVED:07/31/03DATE EXFIRED:08/01/9004DATE OPENED:08/01/03INORG:4301PD:F53383



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: March 21, 2003

Expiration Date:

EXPIRES 122004-

### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Prepared By:** 

JoAnn Struthers, QA Administrative Assistant

Katalin Le, QC Supervisor

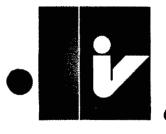
**Certificate Approved By:** 

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

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## **U10432**



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#### ventures ī labs inorganic /

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

### certificate of analysis

- Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- **DESCRIPTION OF CRM** Custom-Grade 1000 µg/mL Molybdenum In H20 tr. NH4OH 2.0

Catalog Number:	CGMO1-1, CGMO1-2, a	nd CGMO1-5
Lot Number:	W-MO01132	
Starting Material:	(NH4)6Mo7O24xH2O	
Starting Material Purity (%):	99.995947	
Starting Material Lot No	21410	
Matrix:	H20 tr. NH4OH	INORGAN

<b>Certified Density:</b>	0.998 g/mL (measured at 22° C)			
Certified Concentration:	1004 ± 2 µg/mL	INORG: 4471 PO: F53333		
CERTIFIED VALUES AND	UNCERIAINTIES	DATE OPENED: 03/35/04		
		DATE EXPIRED: 03/01/2005 VOS		
		DATE RECEIVED: 03/35/04		
Matrix:	H20 tr. NH4OH	INORGANIC LABS/RADUHEM LABS 8/1002		

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>erx</u> ,	(C) = mean
n	x <sub>i</sub> = individual results
	n = number of measurements
Uncertainty (±) = <u>21(2+5)/1+2</u>	BS = The summation of all significant estimated errors.
(I) <sup>1/2</sup>	(Most common are the errors from instrumental measurement,
	weighing, dilution to volume, and the fixed error reported on the
	NIST SRM certificate of analysis.)

#### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1004 ± 2 µg/mL (Avg 2 runs)					
		ICP Assay NIST SRM 3134 Lot Number: 891307					
	Assay Method #2	1008 µg/mL					
		Gravimetric NIST SRM Lot Number: See Sec. 4.2					

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.
- 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL Custom-Grade solutions 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.

<u>0</u>	Al	<	0.05000	₫	l	Dy	<	0.01198	Q	Li	<	0.01000	<u>0</u>	Pr	<	0.10000	i	Те		
M	Sb		0.00939	⊻	l	Er	<	0.00998	М	Lu	<	0.00080	М	Re	<	0.00200	M	ТЪ	<	0.00060
М	As	<	0.01997	M	1	Eu	<	0.00599	Q	Mg	<	0.05000	M	Rh	<	0.00200	М	ті	<	0.00200
M	Ba	<	0.01997	M	1	Gd	<	0.00200	М	Mn	<	0.00799	Μ	Rb		0.02445	М	Th	<	0.00200
Μ	Be	<	0.00100	M	<u>l</u>	Ga	<	0.00200	i	Hg			M	Ru	<	0.00399	M	Tm	<	0.00080
М	Bi	<	0.00080	M	l	Ge	<	0.01198	<u>s</u>	Мо			М	Sm	<	0.00200	М	Sn	<	0.00998
<u>0</u>	в	<	0.50000	M	ţ	Au	<	0.00599	Q	Nd	<	0.05000	2	Sc	<	0.05000	<u>0</u>	Ti	<	0.00500
õ	Cd	<	0.50000	M	1	Hf	<	0.00399	M	Ni	<	0.01597	М	Se	<	0.01597	M	W		0.05576
Q	Ca		0.00026	№	ļ	Ho	<	0.00100	Q	Nb	<	0.10000	Q	Si	<	0.10000	M	บ	<	0.00399
Q	Ce	<	0.05000	N	1	In		0.00235	n	Os			М	Ag	<	0.00399	M	v	<	0.00399
M	Cs	<	0.00060	N	1	lr	<	0.00998	M	Pd	<	0.00998	Q	Na	<	0.10000	M	Yb	<	0.00200
M	Cr	<	0.00998	<u>⊆</u>	2	Fe	<	0.50000	i	P			М	Sr	<	0.00100	M	Y	<	0.07987
М	Co	<	0.00599	M	1	La	<	0.00100	М	Pt	<	0.00399	ì	\$			M	Zn	<	0.03993
М	Cu	<	0.01198	Ŋ	1	Pb	<	0.00599	Q	к		0.00980	М	Та	<	0.01398	Μ	Zr	<	0.00998
M - C	Check	ed	by ICP-MS	0	- Ç	hec	kec	by ICP-OES	í - S	Spect	rai I	nterference	n - i	Not C	heo	ked For	<b>s</b> - 3	Soluti	on	Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

## 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010434

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 °C. Do not pipet from container. Do not return portions removed for pipetting to container.

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

Cherrical Compatibility - Mo is received in a NH.OH matrix giving the operator the option of using HCI or HF to stabilize addic solutions. The [MoO,]' is soluble in concertrated HCI [MoOC], diute HF / HNO, [MoOF,]' and basic media [MoO,]'. Stable at ppm levels with some metals provided it is fluorinated. Do not mixwith Alkaline or Rare Earths when HF is present. Stable with most inorganic anions provided it is in the [MoO,]' chemical form.

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the [MoOF,]\* for months in 1% HNO, / LDPE container. 1-10,000 ppm single element solutions as the [MoO,]\* chemically stable for years in 1% NH.OH in a LDPE container.

Mo Containing Samples (Preparation and Solution) - Metal (Solude in HF / HNO, or hot dilute HCI); Oxide (soluble in HF or NH.OH); Organic Matrices (Dry ash at 450 € in Pt\* and dissolve oxide with HF or HCI).

A come spectroscopic information (ICP-OES Dicts are given as <u>radial/axia)</u> view);											
Techniqu		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at values.)						
ICP-OES	202.030 nm	0.008 / 0.0002 µg/mL	1	ion	Os, Hf						
ICP-OES	203.844 nm	0.012 / 0.002 µg/mL	1	ion							
ICP-OES	204.598 nm	0.012 / 0.001 µg/mL	1	ion	ir. Ta						
ICP-MS	95 am u	3 ppt	n/a	M١	*AmKro, *Brro, *os; *abts						
ICP-MS	95 amu	3 ppt	n/a	м.	"Anakuo" "Ahuo" "Osu" anhtu						

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of <u>IQ Net International Certification Network</u>:



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Belgard (COSC), Desturad (ADCER), Since and (SSR), Since (AFAQ), Sentin (AENOR), Since and (SSR), Since and (

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIL LABS/RADCHEM LABS 3353 DATE RECEIVED: 03/03/005 V05 DATE EXPIRED: 03/03/0055 V05 DATE OPENED: 03/03/0055 V05 INORG: 4471 PO: F53333



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: July 23, 2003

**Expiration Date:** 

EXPIRES 122005

010435

#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

JoAnn Struthers, QA Administrative Assistant **Certificate Prepared By: Certificate Approved By:** Katalin Le, QC Supervisor

folm Stutten Known in in Pauk Aain

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

## n1n436

#### labs ïν 1 inorganic ventures

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

### certificate of analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Phosphorus in H<sub>2</sub>0

Catalog Number: CGP1-1, CGP1-2 and CGP1-5

Lot Number: W-P01123

Starting Material: Starting Material Purity: Starting Material Lot No:

Phosphoric Acid 99.999% J18804

INORGANIC LABS.	/RADCHEM LABS
DATE RECEIVED:	06/01/04
DATE EXPIRED:	06/01/2005 VOS
DATE OPENED:	06/01/04
INORG: 4593	PO: E53393

### CERTIFIED CONCENTRATION: 1006 $\pm 4 \mu g/mL$

The Certified Value is the wet assay value. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value  $(\hat{\mathbf{x}}) = \sum \mathbf{x}_{1}$ 

Uncertainty (±) =  $2[(\sum_{s})^{2}]^{1/2}$ 

 $(\bar{x}) = mean$ 

x<sub>i</sub> = individual results

n = number of measurements

 $\sum S_i$  = The summation of all significant estimated errors.

Classical Wet Assay: 1006  $\pm$  4  $\mu$ g/mL Method; Acidimetric Titration vs NIST SRM 84k KHP.

Instrument Analysis: 1002 ± 4 µg/mL Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3139a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

### TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN $\mu$ g/mL:

Custom-Grade solutions tested for trace metallic impurities 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  $\mu$ m.

이 제 제 제 제	Al Sb As Ba Be	<0.040 0.012 <0.0010 <0.0010 <0.00050	M M M M M M	Dy Er Eu Gd Ga	<0.00060 <0.00050 <0.00030 <0.00010 0.00070	M M M M O	Li Lu Mg Mn Hg	<0.0010 <0.000040 <0.0030 <0.00040 <0.020	M M M M M	Pr Re Rh Rb Ru	<0.000030 <0.00010 <0.00010 <0.00010 <0.00020	M M M M M	Te Tb Ti Th Tm	<0.0030 <0.000030 <0.00010 <0.00010 <0.000040
M	Bi	< 0.000040	M	Ge	< 0.00060	м	Мо	< 0.00020	M	Sm	< 0.00010	M	Sn	< 0.00050
M	8	< 0.0070	M	Au	< 0.00030	M	Nd	< 0.00020	۵	Sc		<u>n</u>	Ti	
M	Cđ	< 0.00030	M	Hf	< 0.00020	Q	Ni	< 0.050	0	Se	< 0.40	M	W	< 0.0010
0	Ca	< 0.010	M	Ho	< 0.000050	M	Nb	< 0.000050	<u>0</u>	Si	<0.020	M	U	< 0.00020
M	Ce	< 0.00050	M	In	< 0.030	<u>n</u>	Os		Μ	Ag	< 0.00020	M	ν	< 0.00020
м	Ċs	< 0.000030	M	hr	< 0.00050	M	Pd	< 0.00050	Q	Na	< 0.090	M	Yb	<0.00010
M	Cr	< 0.00050	0	Fe	<0.050	5	Р		м	Sr	< 0.000050	<u>M</u>	Y	< 0.0040
M	Co	< 0.00030	M	La	< 0.000050	м	Pt	< 0.00020	n	S		M	Zn	0.0035
M	Cu	0.080	M	Pb	< 0.00030	n	к		М	Та	< 0.00070	M	Zr	< 0.00050
м -	chec	ked by ICP-MS	0 - 0	check	ed by ICP-OES	i-sp	pectra	Il interference	n - no	t che	cked for	s - solution	stanc	lard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.001 g/mL

QA:KL ANV. DIDBOADN

Paul R. Haines Quality Assurance Manager

Expires:

(over)







### QUALITY STANDARD DOCUMENTATION

1. ISO 9001:2000 QMI Registered Quality System (Certificate Number 010105)

Members of IQ. Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium



(Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

- 2. ISO/IEC Guide 34-2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate 883.02
- ISO/IEC17025-1999 "General Requirements for the Competence of Testing and Calibration" Chemical Testing -3 Accredited A2LA Certificate 883.01
- 4. MIL-STD-45662A
- 5. 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licencing of Production and Utilization Facilities
- 6. 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance
- Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

### **STABILITY/ EXPIRATION DOCUMENTATION**

Shelf Life -	The length of time that a properly stored and packaged standard will remain within the specified uncertainty. Shelf life is affected by chemical stability and transpiration issues. Inorganic Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss is linear with time and limits the time a standard can be used with confidence. The smaller the bottle the higher the rate of transpiration. Inorganic Ventures' studies indicate that the shelf life of our 500 mL bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.
Expiration Date -	The date after which a standard solution should not be used. A one year expiration date is recommended by most state and federal regulatory agencies. Transpiration issues and repeated use of solutions over a one year period may adversely affect the integrity of standard.

#### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double deionized water that has been filtered through a 0.2 µm filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

### **GLASSWARE CALIBRATION**

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

#### BALANCE CALIBRATION

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 454678. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

#### THERMOMETER CALIBRATION

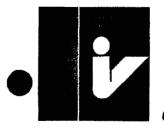
The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceabl to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

### **TECHNICAL SUPPORT**

All customers are encouraged to contact us for technical support for the proper use of our products.

FAX 1-732-901-1903 E-MAIL IVtech@ivstandards.com TEL 1-800-569-6799 INT'L 1-732-901-1900

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3.0

### inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM

Custom-Grade 1000 µg/mL Silicon in H20 tr. HNO3 tr. HF

	Catalog Number: Lot Number: Starting Material: Starting Material Purity (%): Starting Material Lot No Matrix:	CGSI1-1, CGSI1-2, and 0 W-SI02082 SiO2 99.996367 C05310C H20 tr. HNO3 tr. HF	INDRGANIC LABS/RADCHEM LABS 3.1.4.3 DATE RECEIVED: 01/20/04 DATE EXFIRED: 02/01/2005 V2
ł	CERTIFIED VALUES AND U	UNCERTAINTIES	DATE OPENED: 0/20/04 INORG: 4437 PO: 52303
	Certified Concentration:	1000 ± 5 µg/mL	

Certified Density: 1.002 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the cartified value and the uncertainty:

Certified Value ( $\Box$ ): =  $\underline{orx}$ , n

Uncertainty  $(\pm) = \frac{2[(e_{1}s_{1})^{2}]^{1/2}}{(n)^{1/2}}$ 

(□) = mean x<sub>i</sub> = individual results n = number of measurements ∎S = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1000 ± 5 µg/mL (Avg 2 runs)
		ICP Assay NIST SRM 3150 Lot Number: 991108
	Assay Method #2	1001 µg/mL
		Gravimetric NIST SRM Lot Number: See Sec. 4.2

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

				1
<u>O</u> AI 0.02730	<u>M</u> Dy < 0.01358	<u>Q</u> Li < 0.00009	<u>M</u> Pr < 0.00068	<u>M</u> Te < 0.06791
<u>M</u> Sb < 0.00113	<u>M</u> Er < 0.01132	<u>M</u> Lu < 0.00091	<u>M</u> Re < 0.00226	<u>M</u> Tb < 0.00068
<u>M</u> As < 0.02264	<u>M</u> Eu < 0.00679	Q Mg < 0.04991	<u>M</u> Rh < 0.00226	<u>M</u> TI < 0.00226
<u>M</u> Ba < 0.02264	<u>M</u> Gd < 0.00226	<u>M</u> Mn < 0.00906	<u>M</u> Rb < 0.00226	<u>M</u> Th < 0.00226
<u>O</u> Be < 0.00091	<u>M</u> Ga < 0.00226	<u>O</u> Hg < 0.04991	<u>M</u> Ru < 0.00453	<u>M</u> Tm < 0.00091
<u>M</u> BI < 0.00091	<u>M</u> Ge < 0.01358	<u>M</u> Mo < 0.00453	<u>M</u> Sm < 0.00226	<u>M</u> Sn < 0.01132
<u>O</u> B 0.02409	<u>M</u> Au < 0.00679	<u>M</u> Nd < 0.00453	<u>O</u> Sc < 0.00091	<u>Q</u> TI 0.01325
<u>M</u> Cd < 0.00679	<u>M</u> Hf < 0.00453	<u>0</u> Ni < 0.01044	<u>M</u> Se < 0.01811	<u>M</u> W < 0.02264
<u>O</u> Ca 0.00135	<u>M</u> Ho < 0.00113	M Nb < 0.00113	s Si	<u>M</u> U < 0.00453
<u>M</u> Ce < 0.01132	<u>M</u> In < 0.02264	<u>n</u> Os	<u>M</u> Ag < 0.00453	<u>O</u> V < 0.00408
<u>M</u> Cs < 0.00068	<u>M</u> ir < 0.01132	<u>M</u> Pd < 0.01132	<u>O</u> Na 0.02008	<u>M</u> Yb < 0.00226
<u>O</u> Cr < 0.00681	<u>O</u> Fe < 0.00499	<u>O</u> P < 0.02269	<u>O</u> Sr < 0.00032	<u>M</u> Y < 0.09055
<u>M</u> Co < 0.00679	<u>M</u> La < 0.00113	<u>M</u> Pt < 0.00453	<u>Q</u> S < 0.11342	<u>M</u> Zn < 0.04528
Q Cu < 0.00454	<u>M</u> Pb < 0.00679	<u>0</u> K < 0.00771	<u>M</u> Ta 0.00200	<u>M</u> Zr < 0.01132
M - Checked by ICP-MS	O - Checked by ICP-OES	5 I - Spectral Interference	n - Not Checked For	s - Solution Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 %. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Humber; Chemical Form in Solution - 28.0855; +4; 6; Sk(OH),(F),<sup>2</sup> Chemical Compatibility - Soluble in HCI, HF, H<sub>2</sub>PO, H<sub>2</sub>SO, and HNO, as the Sk(OH),(F),<sup>2</sup>. Avoid neutral to basic media. Unstable at ppm levels with metals that would pull F away (i.e. Do not mix with Alkaline or Rare Earths, or high levels of transition elements unless they are fluorinated). Stable with most inorganic anions with a tendency to hydrolyze forming silicic acid (silicic acid is soluble up to ~100 ppm in water) in all dilute acids except HF.

Stability - 2-100 ppb levels - stability unknown - (alone or mixed with all other metals) as the SI(OH), (F),\* . 1-10,000 ppm single element solutions as the SI(OH), (F),\* chemically stable for years in 2-5 % HNOs / trace HF in a LDPE container. Si Containing Samples (Preparation and Solution) - Metal (Soluble in 1:1:1 H<sub>2</sub>O / HF / HNOs) Oxide - SiOs, amorphic (Dissolve by heating in 1:1:1 H<sub>2</sub>O / HF / HNOs) Oxide - quartz (Fuse in Pt\*withNasCOs); Geological Samples (Fuse in Pt\*with Na<sub>2</sub>COs to lowed by HCI solution of the tuseate) Organic Matrices containing silicates and non volatile silicon compounds (Dry ash at 450~6 in Pt\* and dissolve by gently warming with 1:1:1 H<sub>2</sub>O / HF / H<sub>3</sub>OOs or tuse / ash with Na<sub>2</sub>COs and dissolve tuseate with HCI / H<sub>2</sub>O ). Silicone Oils - dimethyl silicones depolymentize to form volatile monomer units when heated (Measure directly in alcoholic KOH / xylene mixture where sample is treated first with the KOH at 60-100 ~6 to "unzip" the Si-O-Si polymeric structure or digest with concentrated H<sub>2</sub>SO/H<sub>2</sub>O<sub>2</sub> followed by cooling and dissolution of the dehydrated silica with HF.) Note that the direct analysis of silicone oils in an organic solvent will result in false high results due to high vapor pressure of volatile monomer units like hexamethylcyclictrisiloxane. The KOH forms the K<sub>2</sub>'Si(CH<sub>3</sub>)<sub>2</sub>O<sup>\*</sup> salt which is not volatile at room temperature.

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

Technique/Line	Estimated D.L.	Order	Ivpe	interferences (underlined indicates severe atvefoncs.)
CP-OES 251.611 nm	0.012/0.003 µg/mL	1	lon –	Ta, U, Zn, Th
ICP-OES 212.412 nm	0.02 / 0.01 µg/mL	1	lon	Hf, Os, <u>Mo</u> , Ta
ICP-OES 288,158 nm	0.03 / 0.004 µg/mL 1	ion	<u>Ta,</u> Ce	e, Cr, Cd, Th
ICP-MS 28 amu	4000 - 8000 ppt	n/a	М'	"N₄, "C™O

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

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for Information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of <u>IQ Net International Certification Network</u>:



Argentina (IRAM), Australia (QAS), Austria (ÔQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



 10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"
 Reference Materials Production - Accredited A2LA Certificate Number 883.02
 A2LA Mutual Recognition Agreement Partners: Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Talpei (CNLA), Czech Republic

Australia (NATA), Austra (BmwA), Beiglum (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taiper (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS/30.42 DATE RECEIVED: 01/2004 DATE EXFIRED: 02/01/2005 VOS DATE OPENED: 01/20/04 INDRG: 4437 FO: F52303

### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: February 24, 2003 Expiration Date:

010441

### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

 Certificate Prepared By:
 JoAnn Struthers, QA Administrative Assistant

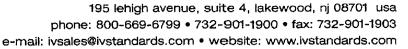
 Certificate Approved By:
 Katalin Le, QC Supervisor

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

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P.p.d.

#### inorganic ventures labs 1 i v



Uncertainty (±) =  $2[(\sum_{j=1}^{2})^{1/2}]^{1/2}$ 

# certificate of analysis

CUSTOM-GRADE SOLUTION

1000 µg/mL Titanium in 1.4% HNO, (abs) tr. HF This standard should not be prepared or stored in glass.

Catalog Number: CGTI1-1, CGTI1-2 and CGTI1-5

Lot Number: T-TI02039

Starting Material: Starting Material Purity: Starting Material Lot No: **Titanium Metal** 99.999% F29114

		S/RADCHEM	
DATE I	RECEIVED:	11/24/03	5
DATE I	EXPIRED:	13/01/20	204 VOS
DATE (	DPENED:	11/250	3
INORG	4330	P0:F5	52279

### CERTIFIED CONCENTRATION: 1010 $\pm$ 3 $\mu$ g/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value  $(\bar{x}) = \sum x_i$ 

 $(\bar{x}) = mean$ x<sub>i</sub> = individual results n = number of measurements

 $\sum S_i$  = The summation of all significant estimated errors.

Calculated Value: 1002 µg/mL Method: Calculated, based on starting material.

Instrument Analysis: 1010 ± 3 µg/mL (Average of 3 runs) Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3162a.

### TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN $\mu$ g/mL:

Custom-Grade solutions tested for trace metallic impurities by ICP-MS were analyzed in an ULPA-Fiitered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3  $\mu m.$ 

~		<0.010		<b>D</b>	< 0.00060			< 0.0010	24	Pr	< 0.000030		Te	< 0.0030
Q	AI	< 0.010	M	Dγ	<0.00060	M	Li	<0.0010	<u>M</u>	<b>C</b> 1	<0.000030	<u>M</u>	18	<0.0030
M	Sb	< 0.000050	M	Er	< 0.00050	M	Lu	< 0.000040	M	Re	<0.00010	M	ть	< 0.000030
M	As	< 0.0010	M	Eu	< 0.00030	<u>0</u>	Mg	< 0.020	M	Rh	<0.00010	M	TI	<0.00010
M	Ba	< 0.0010	M	Gd	< 0.00010	M	Mn	0.0020	M	Rb	< 0.00010	Μ	Th	< 0.00010
M	Be	< 0.000050	M	Ga	< 0.00010	<u>o</u>	Hg	<0.050	M	Ru	< 0.00020	M	Tm	<0.000040
M	Bi	< 0.000040	<u>M</u>	Ge	< 0.00060	M	Mo	< 0.00020	M	Sm	< 0.00010	Μ	Sn	< 0.00050
Q	8	<0.050	M	Au	< 0.00030	М	Nd	< 0.00020	Q	Sc	<0.0020	<u>5</u>	Ti	
M	Cd	< 0.00030	M	Hf	< 0.00020	<u>0</u>	Ni	< 0.050	Q	Se	< 0.40	M	w	<0.0010
₽	Ca	< 0.010	М	Но	< 0.000050	M	Nb	< 0.000050	Q	Si	< 0.010	M	U	<0.00020
M	Ce	< 0.00050	Q	In	< 0.020	n	Os		M	Ag	< 0.00020	M	V	<0.00020
M	Cs	< 0.000030	M	lr -	< 0.00050	M	Pd	< 0.00050	Q	Na	0.12	M	Yb	<0.00010
М	Cr	< 0.00050	<u>o</u>	Fe	<0.010	i	₽		M	Sr	< 0.000050	Μ	Y	<0,0040
M	Co	<0.00030	M	La	< 0.000050	<u>M</u>	Pt	<0.00020	Ĺ	S		M	Zn	0.19
Q	Cu	<0.040	M	Pb	< 0.00030	n	κ	0.23	M	Та	< 0.00070	M	Zr	<0.00050
м -	chec	ked by ICP-MS	0-0	:heck	ed by ICP-OES	i - sj	pectra	I interference	ri - no	t che	cked for	s - solution	stand	lard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.011 g/mL QA:KL Rev.0805020N

Paul R. Acines Quality Assurance Manager

(over)

Expires:



### QUALITY STANDARD DOCUMENTATION

1. ISO 9001:2000 QMI Registered Quality System (Certificate Number 010105)



Members of IQ Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

- ISO/IEC Guide 34-2000 "General Requirements for the Competence of Reference Material Producers" Reference Materials Production - Accredited A2LA Certificate 883.02
- 3. ISO/IEC17025-1999 "General Requirements for the Competence of Testing and Calibration" Chemical Testing -Accredited A2LA Certificate 883.01
- 4. MIL-STD-45662A
- 5. 10CFR50 Appendix B Nuclear Regulatory Commission Domestic Licencing of Production and Utilization Facilities
- 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

### STABILITY/ EXPIRATION DOCUMENTATION

- Shelf Life The length of time that a properly stored and packaged standard will remain within the specified uncertainty. Shelf life is affected by chemical stability and transpiration issues. Inorganic Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss is linear with time and limits the time a standard can be used with confidence. The smaller the bottle the higher the rate of transpiration. Inorganic Ventures' studies indicate that the shelf life of our 500 mL bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.
- Expiration Date The date after which a standard solution should not be used. A one year expiration date recommended by most state and federal regulatory agencies. Transpiration issues a repeated use of solutions over a one year period may adversely affect the integrity of the standard.

### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double deionized water that has been filtered through a 0.2 µm filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

### GLASSWARE CALIBRATION

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

#### **BALANCE CALIBRATION**

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 454678. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

### THERMOMETER CALIBRATION

The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

### **TECHNICAL SUPPORT**

All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 INT'L 1-732-901-1900 FAX 1-732-901-1903 E-MAIL IVtech@ivstandards.com



### inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Strontlum in 0.1% (abs) HNO3

010444

Catalog Number:CGSR1-1, CGSR1-2, and CGSR1-5Lot Number:W-SR01124Starting Material:SrCO3Starting Material Purity (%):99.996751Starting Material Lot No22593, 22878Matrix:0.1% (abs) HNO3DATEDATE

INORGANIC LABS/RADCHEM LABS 102 DATE RECEIVED: 9/2/04 DATE EXPIRED: 8/1/2005 DR DATE OPENED: 9/8/04 INDRG: 4635 PD: F53408

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

### Certified Concentration: 1004 ± 2 µg/mL

### Certified Density: 1.001 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>or x</u> )	(⊡) = mean
n	x, = individual resutts
Uncertainty (±) = <u>21(@rs</u> ,) <u>7112</u> (1) <sup>1/2</sup>	n = number of measurements ES = The summation of all significant estimated errors. (Most common are the errors from Instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1005 ± 2 μg/mL
		ICP Assay NIST SRM 3153a Lot Number: 990906
	Assay Method #2	1004 ± 2 μg/mL
		EDTA NIST SRM 928 Lot Number: 880710

- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos, 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

Q	Ai	<	0.00090	М	Dy	<	0.00055	Q	Li	<	0.00003	М	Pr	<	0.00003	Q	Te	<	0.10000
M	SÞ	<	0.00005	M	Er	<	0.00046	M	Lu	<	0.00004	м	Re	<	0.00009	M	Tb	<	0.00003
Q	As	<	0.00500	M	Eu	<	0.00028	<u>0</u>	Mg		0.00030	<u>0</u>	Rħ	<	0.00600	M	TI	<	0.00009
Q	Ba		0.02200	м	Gd	<	0.00009	Q	Mn	<	0.00003	i	Rb			M	Th	<	0.00009
<u>0</u>	Be	<	0.00009	М	Ga	<	0.00009	<u>0</u>	Hg	<	0.01500	<u>0</u>	Ru	<	0.00300	М	Tm	<	0.00004
M	Bi	<	0.00004	M	Ge	<	0.00055	М	Мо	<	0.00018	М	Sm	<	0.00009	M	Sn	<	0.00046
Q	в	<	0.00060	М	Au	<	0.00028	М	Nd	<	0.00018	м	Sc	<	0.00092	M	Ti	<	0,00459
M	Cd	<	0.00028	М	Hf	<	0.00018	Q	Ni	<	0.00300	Q	Se	<	0.05000	М	w	<	0.00092
<u>o</u>	Са		0.02500	М	Но	<	0.00005	М	Nb	<	0.00005	Q	Si	<	0.00340	M	U	<	0.00018
М	Ċe	<	0.00046	Q	In	<	0.00200	n	Os			M	Ag	<	0.00018	M	v	<	0.00018
M	Cs	<	0.00003	M	lr	<	0.00046	<u>0</u>	Pd	<	0.00400	<u>0</u>	Na		0.00410	M	Yb	<	0.00009
<u>0</u>	Cr	<	0.00080	Q	Fe	<	0.00110	õ	Ρ	<	0.00480	\$	Sr			₽	Υ	<	0.00004
М	Co	<	0.00028	Μ	La	<	0.00005	M	Pt	<	0.00018	ח	s			Ω ا	Zn		0.00720
<u>0</u>	Cu	<	0.00140	М	Pb	<	0.00028	Q	к	<	0.00170	M	Та	<	0.00064	M	Zr	<	0.00046
M - C	heck	ed	by ICP-MS	0 -	Chec	ked	by ICP-OES	i - S	pectr	al I	nterference	n - I	Not C	hea	ked For	s -	Soluti	on	Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4-€. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 87.62; +2; 6; Sr(H,O), '2

Chemical Compatibility - Soluble in HCI, and HNO, Avoid H,SO., HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate and tungstate in neutral aqueous media.

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

57 Containing Samples (Preparation and Solution) - Metal (Best dissolved in diluted HNO, ); Ores (Carbonete fusion in Pt\* followed by HCI dissolution); Organic Matrices (Dry ash and dissolution in dilute HCI).

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

Techniqu	e/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at affoncs.)
ICP-OES	407.771 nm	0.0004 / 0.00008 µg/mL	1	ion	U, Ce
ICP-OES	421.552 nm	0.0008 / 0.00004 µg/mL	1	ion	Rb
		0.07 / 0.003 µg/mL	1	atom	
ICP-MS	88 am u	1200 ppt	n/a	M'	*Ge+O, +**Yb+*, ***Lu+* , ***Hf**

- 8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 **Recognized by:** Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA)

Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of IQ Net International Certification Network: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT). Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS),

- Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01
- 10.3 ISO/IEC Guide 34 2000 "General Requirements for the Competence of Reference Material Producers' - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners: Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES) 10.4 10CFR50 Appendix B - Nuclear Regulatory Commission
- Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

#### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



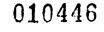
- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

INOF	RGANIC	LABS	/RADCHE	M LABS	øд
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DATE	EXPIRE	D: 8	112005		
was a regre press		~ ~	10.1.21		
INOR	i: <u>46</u>	35	PO:	DR/F53	408

Certification Date: October 22, 2003

**Expiration Date:** 







### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:

JoAnn Struthers, QA Administrative Assistant

Certificate Approved By:

Katalin Le, QC Supervisor

folm Stutten Known en Pour Aaine 010447

Certifying Officer:

Paul Gaines, Chemist, Senior Technical Director

### 010448 inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Tin in H20 tr. HNO3 tr. HF

Catalog Number:	CGSN1-1, CGSN1-2, and CGSN1-5
Lot Number:	X-SN01115
Starting Material:	Sn Shot
Starting Material Purity (%):	99.999438
Starting Material Lot No	G12M23
Matrix:	H20 tr. HNO3 tr. HF

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration:	995 ±2 µg/mL
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Certified Density: 0.998 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value  $(\Box) = \underline{arx}$ ,  $(\Box) = mean x_1 = individual results n = number of measurements$  $Uncertainty <math>(\pm) = \underline{2[(\underline{ars},)\underline{2}]^{1/2}}$  [B] = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SFM certificate of analysis.)

### 4.0 TRACEABILITY TO NIST AND VALVES OBTAINED BY INDEPENDENT METHODS

Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

Assay Method #1 995  $\pm 2 \mu g/mL$  (Avg 2 runs)

ICP Assay NIST SRM 3161a Lot Number: 993107

Assay Method #2

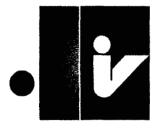
4.1

998 µg/mL

Gravimetric NIST SRM Lot Number: See Sec. 4.2

INDRGANIC LABS/RADCHEM LABS P3.1 of a

DATE	RECEIVED:	03/30/04
DATE	EXPIRED:	04/01/2005 102
DATE	OPENED:	03/30/04 PO:_E53361
INDRE	- 4512	PO:E53361



- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557076, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.
- 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL. Custom-Grade solutions 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.

			•	
<u>O</u> AI 0.00050	<u>M</u> Dy < 0.01205	<u>Q</u> Li < 0.00002	<u>M</u> Pr < 0.00060	<u>M</u> Te < 0.06026
<u>O</u> Sb < 0.01000	<u>M</u> Er < 0.01004	<u>M</u> Lu < 0.00080	<u>M</u> Re < 0.00201	<u>M</u> Tb < 0.00060
<u>M</u> As < 0.02009	<u>M</u> Eu < 0,00603	<u>O</u> Mg < 0.00003	<u>M</u> Rh < 0.00201	<u>M</u> TI < 0.00201
<u>O</u> Ba < 0.00070	<u>M</u> Gd < 0.00201	<u>M</u> Mn < 0.00804	<u>M</u> Rb < 0.00201	<u>M</u> Th < 0.00201
<u>M</u> Be < 0.00100	<u>M</u> Ga < 0.00201	<u>O</u> Hg < 0.01500	<u>M</u> Ru < 0.00402	<u>M</u> Tm < 0.00080
<u>M</u> Bi < 0.00080	<u>M</u> Ge < 0.01205	M Mo < 0.00402	M Sm < 0.00201	ş Sn
<u>Q</u> B < 0.01200	<u>M</u> Au < 0.00603	<u>M</u> Nd < 0.00402	<u>M</u> Sc < 0.02009	<u>M</u> Ti < 0.10043
<u>O</u> Cd 0.00009	<u>M</u> Hf < 0.00402	<u>Q</u> Ni < 0.01000	<u>M</u> Se < 0.01607	<u>M</u> W < 0.02009
<u>O</u> Ca < 0.00150	<u>M</u> Ho < 0.00100	<u>M</u> Nb < 0.00100	<u>O</u> Si < 0.00340	<u>M</u> U < 0.00402
M Ce < 0.01004	<u>M</u> in < 0.02009	<u>n</u> Os	<u>M</u> Ag < 0.00402	<u>M</u> V < 0.00402
<u>M</u> Cs < 0.00060	<u>M</u> Ir < 0.01004	M Pd < 0.01004	<u>Q</u> Na < 0.00010	<u>M</u> Yb < 0.00201
<u>M</u> Cr < 0.01004	<u>O</u> Fe < 0.00110	Q P < 0.00500	<u>M</u> Sr < 0.00100	<u>M</u> Y < 0.08035
<u>Q</u> Co < 0.00200	<u>M</u> La < 0.00100	<u>M</u> Pt < 0.00402	<u>n</u> S	M Zn ≤ 0.04017
<u>M</u> Cu < 0.01205	<u>M</u> Pb 0.00593	<u>Q</u> K < 0.00200	<u>M</u> Ta < 0.01406	<u>M</u> Zr < 0.01004
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 including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 × €. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 118.710; +4; 4,5, 6,7,8 Sn(OH),F,\* Chemical Compatibility - Soluble in HCI and dilute HF / HNO,. Avoid neutral to basic media. Unstable at pom levels with metals that would pull F away. (i.e. Do not mix with Alkaline or Rare Earths or high levels of transition elements unless they are fluorinated.) Stable with most inorganic anions provided it is in the chemical form shown above.

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the Sn(OH), F,\* for 1 year in 1% HNO, / LDPE container. 1-10,000 ppm single element solutions as the Sn(OH), F,\* chemically stable for years in 2-5% HNO, / trace HF in a LDPE container.

Sn Containing Samples (Preparation and Solution) - Metal (Solutie in HF /HNO, or HCI); Oxides - SnO (soluble in HCl), SnO, -very resistant to all acids including HF(Fusion with equal parts of Na<sub>2</sub>CO, and S. It is then soluble in water or dilute acids as the thiostannate.); Alloys (Treat first 0.1 g with 10 mL conc. H<sub>2</sub>SO, to boiling until the alloy disintegrates and nearly all of the sulturic acid is expelled. Then add 100 mL O<sub>2</sub> free water and 50 mL of conc HCI or transfer to a plastic container and add 1 mL HF in either case warming gently to bring about solution.) Organic Matrices (Volatility and precipitation of the insoluble stannic oxide are problems. Consultation of the literature should be made for individual matrices / Sn compounds.)

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

Technique/Line	Estimated D.L.	Order	Туре	Interferences (underlined indicates severe at valoncs.)
ICP-OES 189.989 nm	0.03/0.003 µg/mL	1	ion	
ICP-OES 242.949 nm	0.1 / 0.01 µg/mL	1	atom	W, Mo, Rh, Ta, Co
ICP-MS 120 amu	5 ppt	n/a	M'	'*Te, '*Ru*O, '*Pd*O

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

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

 10.1
 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105

 Recognized by:

 Registrar Accreditation Board (ANSI-RAB)

 Standards Council of Canada (SCC)

 Dutch Council for Accreditation (RVA)

 Entidad Mexicana de Acreditacion, a.c.(EMA)

 Members of IQ Net International Certification Network:

 Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA).

Argentina (IRAM), Australia (QAS), Austria (OQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland (PCRC), Podugal (APCER), Singapore (PSR), Slovenia (SIO), Spain (AENOR), Switzerland (SOS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



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10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02

#### A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zeatand (IANZ), Norway (NA), Portugat (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS 7-2.47 DATE RECEIVED: 03/30/04 DATE EXPIRED: 04/01/2005 V05 DATE DPENED: 03/30/04 INORG: 4512 PD: E53361

- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: February 11, 2004

Expiration Date:

### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

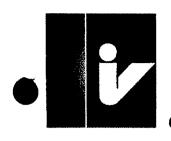
Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer:

Paul Gaines, Chemist, Senior Technical Director

folm Stutten Known in in Paux Aain



### inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Bismuth in 3.5% (abs) HNO3

Catalog Number:	CGBI1-1 and CGBI1-5	
Lot Number:	W-BI01089	
Starting Material:	Bi needles	
Starting Material Purity (%):	99.999090	T٢
Starting Material Lot No	G25L16	DAT
Matrix:	3.5% (abs) HNO3	DAI

INORGANIC LABS/RADCHEM LABS 19.2.4 2 DATE RECEIVED: 07/31/03 DATE EXPIRED: 08/01/2004 V03 DATE OPENED: 08/01/03 INORG: 4200 PO: F52383

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1002 ± 4 µg/mL

Certified Density: 1.026 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\Box$ ) =  $\underline{e_{TX}}$ 

Uncertainty (±) =  $2[(2r_{5})^{2}]^{1/2}$ (n)<sup>1/2</sup> (□) = mean
 x<sub>i</sub> = individual results
 n = number of measurements
 ■S = The summation of all significant estimated errors.
 (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

E "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1002 ± 4 µg/mL (Avg 2 runs)							
		ICP Assay NIST SRM 3106 Lot Number: 991212							
	Assay Method #2	1002 μg/mL							
		Gravimetric NIST SRM Lot Number: See Sec. 4.2							

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weights et. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

																1				
Q	AJ		0.00012	M	Dy	<	0.01202	<u>0</u>	Li	<	0.00002	M	Pr	<	0.00060	<u>N</u>	1	Te	<	0.06008
м	Sb	<	0.00100	M	Er	<	0.01001	М	Lu	<	0.00080	м	Re	<	0.00200	l ī	M	Тb	<	0.00060
M	As	<	0.02003	м	Eυ	<	0.00601	<u>0</u>	Mg		0.00070	M	Rh	<	0.00200	1	M	TI	<	0.00200
М	Ва	<	0.02003	м	Gd	<	0.00200	Q	Mn	<	0.00020	M	Rb	<	0.00200	Ň	A	Th	<	0.00200
М	Be	<	0.00100	м	Ga	<	0.00200	<u>0</u>	Hg	<	0.01500	M	Ru	<	0.00401	1	<u>N</u>	Tm	<	0.00080
<u>s</u>	ві			м	Ge	<	0.01202	М	Мо	<	0.00401	м	Sm	<	0.00200	1	M	Sn	<	0.01001
М	в	<	0.14018	м	Au	<	0.00601	<u>M</u>	Nd	<	0.00401	м	Sc	<	0.02003	1	M	Ti	<	0.10013
Q	Cd		0.00017	м	Hf	<	0.00401	М	Ni	<	0.01602	М	Se	<	0.01602	l	N	W	<	0.02003
Q	Ca		0.00245	м	Ho	<	0.00100	м	Nb	<	0.00100	<u>0</u>	SI		0.00105	1	M	U	<	0.00401
М	Ce	<	0.01001	Q	In		0.00105	n	Os			м	Ag	<	0.00401	1	M	v	<	0.00401
М	Cs	<	0.00060	M	łr	<	0.01001	<u>0</u>	Pd	<	0.00400	<u>0</u>	Na		0.00240	1	M	Yb	<	0.00200
Q	Cr		0.00020	₽	Fe		0.00014	<u>0</u>	Ρ	<	0.01000	м	Sr	<	0.00100	1	Ň	Y	<	0.08011
M	Co	<	0.00601	M	La	<	0.00100	М	Pt	<	0.00401	Q	S	<	0.03000	9	2	Zn		80000.0
Q	Cu		0.00014	Q	Pb		0.00135	Q	к		0.00039	M	Та	<	0.01402	l	M	Zr	<	0.01001
M - C	heck	ed	by ICP-MS	0-	Cheo	kec	by ICP-OES	i - S	pectr	ral I	Interference	n - I	Not C	he	cked For	S	- S	oluti	on	Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keeptightly sealed when not in use. Store and use at 20 ± 4~C. Do not pipal from container. Do not retum partions removed for pipetting to container. Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 208.9804; +3, 6 ;Bi(O)(H,O)."

Chemical Compatibility - Stable in HCI, HNO, H,SO, and HF, Avdid basic media forming insoluble hydroxide. Stable with most metals and inorganic anions in acidic media. Many saits that are insoluble in water are soluble in HCI, HNO, and HF. The major problem with Bit is its tendency to hydrolyze at higher concentrations or in dilute acid. Nitric acid solutions should be 5% to hold the Bi in solution in the 100 to 10000 µg/mL concentration range

Stability - 2-100 ppb levels stable for months in 1 % HNO, /LDPE container. 1-10,000 ppm solutions chemically stable for years in 5 - 7% HNO, /LDPE container.

Bi Containing Samples (Preparation and Solution) - Metal (soluble in HNO, ); Oxides (Soluble in HNO, ) Alloys (Dissolve in conc. 4:1 HCI /HNO, Heating may be required.); Organic based (dry ash at 450 - and dissolve ash in HNO, or acid digestion with conc. hct sulfuric acid adding hydrogen peroxide dropwise and carefully until dear.)

Aton	nic Spe	ectroscopic Infi	primation (ICP-OES 0.1	s are gi	ven as	
Tect	nnique	Line	Estimated D.L.	Order	Type	
ICP-	OES	223.061 nm	0.04 / 0.005 µg/mL	1	atom	Th, Ir, Ti Cu
ICP-	OES	306.772 nm	0.08 / 0.01 µg/mL	1	atom	<u>Th</u> , U, Zr, Hf, Fe
ICP-	OES	222.825 nm	0.1 / 0.02 µg/mL	1	atom	<u>Cr, Hf,</u> Ce, Os
ICP-	MS	209 amu	2 ppt	n/a	М'	

- 8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 **Recognized by:** 

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network:



Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



010454

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS B. 2. 0 DATE RECEIVED: 07/31/03 DATE EXPIRED: 08/01/2004 VOD DATE OPENED: 08/01/03 INDRG: 4200 PD: F52383



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: March 28, 2003

**Expiration Date:** 



#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

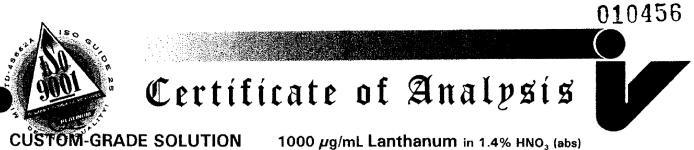
**Certificate Prepared By:** JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Supervisor

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

folm Stutten Known in



Lanthanum Oxide

99.999%

LA-0-5-017

Catalog Number: CGLA1-1 and CGLA1-5

Lot Number: T-QLA01057

Starting Material Purity:

Starting Material Lot No:

Starting Material:

INORGANIC LABS/RADCHEM LABS

DAIE	RECEIVED	08/26/05
DATE	EXPIRED:	09/01/2004 100
DATE	OP'ENED:	08/06/03
INOR	3: 4221	PO: F53034

### CERTIFIED CONCENTRATION: 1002 ± 3 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

= number of measurements

Certified Value ( $\bar{x}$ ) =  $\sum x_i$ 

 $x_i = individual results$  $(\bar{x}) = mean$ 

Uncertainty  $(\pm) = 2[(\sum_{s})^{2}]^{1/2}$ 

 $\sum S_i$  = The summation of all significant estimated errors.

Classical Wet Assay: 1002 ± 3 µg/mL Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

Instrument Analysis: 1007 ± 3 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3127a.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

## TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN $\mu$ g/mL:

Custom-Grade solutions tested for trace metallic impurities 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  $\mu$ m.

<u>o</u> .	AI	< 0.040	М	Dy	<0.00060	M	U	< 0.0010	Q	Pr	<0.020	M	Te	< 0.0030
Μ	Sb	< 0.000050	Μ	Er	0.0010	M	Lu	0.000040	M	Re	<0.00010	M	Тb	< 0.000030
M	As	< 0.0010	М	Eu	< 0.00030	M	Mg	< 0.0030	M	Rh	<0.00010	M	TI	< 0.00010
<u>0</u>	Ва	< 0.020	M	Gđ	0.039	M	Mn	< 0.00040	M	Rb	< 0.00010	M	Th	< 0.00010
M	Be	< 0.000050	M	Ga	<0.00010	<u>o</u>	Hg	< 0.030	M	Ru	< 0.00020	M	Τm	<0.000040
M	Bi	< 0.000040	М	Ge	< 0.00060	M	Мо	< 0.00020	M	Sm	0.00040	M	Sn	< 0.00050
<u>0</u>	В	<0.020	<u>M</u>	Au	< 0.00030	M	Nd	0.00020	M	Sc	<0.0010	М	Ti	< 0.0050
М	Cd	< 0.00030	Μ	Hf	< 0.00020	<u>0</u>	Ni	< 0.050	Q	Se	< 0.40	M	W	<0.0010
Q	Ca	< 0.010	M	Но	0.00010	M	Nb	< 0.000050	Q	Si	< 0.020	M	U	<0.00020
į	Се		<u>0</u>	In	< 0.030	<u>n</u> _	Qs		M	Ag	< 0.00020	<u>M</u>	v	< 0.00020
n	Cs		М	lr	< 0.00050	M	Pd	< 0.00050	Q	Na	< 0.090	<u>M</u>	Yb	< 0.00010
M	Cr	< 0.00050	Q	Fe	< 0.050	<u>0</u>	Ρ	< 0.050	M	Sr	< 0.000050	M	Y	< 0.0040
М	Co	< 0.00030	<u>\$</u>	La		M	Pt	< 0.00020	<u>n</u>	s		M	Zn	< 0.0020
M	Cu	< 0.00060	Μ	Pb	< 0.00030	n	К		M	Ta	< 0.00070	М	Zr	< 0.00050
м -	chec	ked by ICP-MS	0 - c	heck	ed by ICP-OES	i-sp	oectra	l interference	n - no	t che	cked for	s - soluti	on st	andard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.009 g/mL QA:KSL New.121702DN

(over)



# Inorganic Ventures, Inc.

195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701 Orders: 800-669-6799 · FAX (732) 901-1903 Technical Support: 800-569-6799

Quality Assurance Manager



### **QUALITY STANDARD DOCUMENTATION**

1. ISO 9001:2000 QMI Registered Quality System (Certificate Number 010105)



Members of IQ Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech

(SII), Italy (CIQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

- 2. ISO/IEC Guide 34-2000 "General Requirements for the Competence of Reference Material Producers" Reference Materials Production - Accredited A2LA Certificate 883.02
- 3. ISO/IEC17025-1999 "General Requirements for the Competence of Testing and Calibration" Chemical Testing Accredited A2LA Certificate 883.01
- 4. MIL-STD-45662A
- 5. 10CFR50 Appendix B Nuclear Regulatory Commission Domestic Licencing of Production and Utilization Facilities
- 6. 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

### **STABILITY/ EXPIRATION DOCUMENTATION**

- Shelf Life -The length of time that a properly stored and packaged standard will remain within the specified<br/>uncertainty. Shelf life is affected by chemical stability and transpiration issues. Inorganic<br/>Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss is linear with<br/>time and limits the time a standard can be used with confidence. The smaller the bottle the higher<br/>the rate of transpiration. Inorganic Ventures' studies indicate that the shelf life of our 500 mL<br/>bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.
- Expiration Date <u>The date after which a standard solution should not be used.</u> A one year expiration date is recommended by most state and federal regulatory agencies. Transpiration issues and repeated use of solutions over a one year period may adversely affect the integrity of the standard.

### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double deionized water that has been filtered through a 0.2 µm filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

### GLASSWARE CALIBRATION

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

### **BALANCE CALIBRATION**

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 454678. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

### THERMOMETER CALIBRATION

The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

### **TECHNICAL SUPPORT**

All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 INT'L 1-732-901-1900 FAX

FAX 1-732-901-1903

E-MAIL IVtech@ivstandards.com



#### inorganic ventures 1 ίΨ labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

### certificate of analysis

- Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- DESCRIPTION OF CRM 2.0

Custom-Grade 1000 µg/mL Palladium in 3.3% (abs) HCL

Catalog Number: CGPD1-1 and CGPD1-5 Lot Number: Starting Material: Starting Material Purity (%): Starting Material Lot No Matrix:

W-PD02019 Pd(NO3)2 99.999248 11974A-00

3.3% (abs) HCL

INORGANIC LAB	S/RADCHEM LABS P9. 404
DATE RECEIVED:	03/01/04
DATE EXPIRED;	03/01/2005 YDS
DATE OPENED:	03/01/04
INORG: 4477	PO: E52333

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

Certified Concentration: 994 ± 3 µg/mL

(1)12

**Certified Density:** 1.022 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value  $(\Box) = \underline{a_{T}x_{J}}$ Uncertainty  $(\pm) = 2[(2+5)]^{1/2}$ 

(C) = mean  $x_i = individual results$ n in number of measurements ES = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

#### TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS 4.0

Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	994 ± 3 μg/mL (Avg 2 runs)						
		ICP Assay NIST SRM 3138 Lot Number: 990207						
	Assay Method #2	1000 µg/mL						
		Gravimetric NIST SRM Lot Number: See Sec. 4.2						

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos, and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>0</u>	AI		0.00400	M	Dy	<	0.00060	<u>0</u>	Li	<	0.04000	М	Pr	<	0.00003	<u>0</u>	Te	<	0.01300
<u>0</u>	Sb	<	0.00500	м	Er	<	0.00050	М	Lu	<	0.00004	м	Re	<	0.00010	М	Tb	<	0.00003
<u>0</u>	As	<	0.01400	M	Eu	<	0.00030	<u>0</u>	Mg	<	0.01100	Q	Rh	<	0.00600	М	П	<	0.00010
M	Ba	<	0.00100	M	Gd	<	0.00010	Q	Mn	<	0.00650	м	Rb	<	0.00010	м	Th	<	0.00010
<u>0</u>	Be	<	0.00009	M	Ga	<	0.00010	<u>0</u>	Hg	<	0.01100	Q	Ru	<	0.00200	M	Tm	<	0.00004
М	Bi	<	0.00004	м	Ge	<	0.00060	м	Мо	<	0.00020	м	Sm	<	0.00010	으	Sn	<	0.00700
<u>0</u>	в	<	0.00090	<u>0</u>	Au	<	0.00300	M	Nd	<	0.00020	Q	Sc	<	0.00009	₽	Ti	<	0.00100
<u>0</u>	Cd	<	0.00600	M	Hf	<	0.00020	<u>0</u>	Ni		0.01800	M	Se	<	0.00080	M	W	<	0.00100
<u>0</u>	Ca		0.00700	M	Но	<	0.00005	М	Nb	<	0.00005	Q	Si		0.00600	м	υ	<	0.00020
M	Ce	<	0.00050	<u>0</u>	In	<	0.03300	n	Os			Q	Ag	<	0.00670	M	٧	<	0.00020
M	Cs	<	0.00003	м	lr	<	0.00050	<u>s</u>	Pd			<u>0</u>	Na		0.01500	<u>M</u>	Yb	<	0.00010
<u>0</u>	Сг		0.00450	<u>o</u>	Fe		0.04600	<u>0</u>	P		0.00600	M	Sr	<	0.00005	M	Y	<	0.00400
М	Co	<	0.00030	м	La	<	0.00005	<u>0</u>	Pt	<	0.00600	Q	S	<	0.02500	<u>0</u>	Zn	<	0.00060
<u>o</u>	Cu		0.00360	M	Рb	<	0.00030	<u>0</u>	ĸ,	<	0.02000	М	Ta	<	0.00070	М	Zr	<	0.00050
M - C	heck	ed	by ICP-MS	0-	Chec	:kec	by ICP-OES	I- S	pect	al l	nterference	n - I	Not C	hea	ked For	s -	Solut	ion	Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 %. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 106.42, +2, 6, Pd(H<sub>2</sub>O),<sup>24</sup> Chemical Compatibility - Stable in HCI, HNO,, H<sub>2</sub>SO, ,HF, H<sub>2</sub>PO. Avoid basic media. Stable with most metals and inorganic anions in acidic media. Avoid contact with water soluble organics such as aldehydes since Pd<sup>24</sup> is easily reduced. Stability - 2-100 ppb levels. 2ppb Pd is stable for 1 day in 1% HNO<sub>2</sub> /LDPE container. 10 ppb is stable for 3 days in 1% HNO<sub>2</sub> / LDPE container. 100 ppb levels. 2ppb Pd is stable for 46 months in 1% HNO<sub>2</sub> /LDPE container. 1-10,000 ppm solutions chemically stable for years in 1.5% HNO<sub>2</sub> / LDPE container.

Pd Containing Samples (Preparation and Solution) - Metal (Soluble in HNO<sub>2</sub> or Aqua Regia ), Oxides (Soluble in HCI) Ores ( Dissolve in HCI / HNO<sub>2</sub>).

Atomic Sp	ectroscopic int	ormation (ICP-OES D.I	Ls are giv	igen as <u>radial/axial</u> view);	
Technique	sline	Estimated D.L.	Order	Type Interferences (underlined indicates severe at valorics.	.)
ICP-OES	340.458 nm	0.04 / 0.003 µg/mL	1 atom	Ce, Th, Zr	
ICP-OES	363.470 nm	0.05 / 0.007 µg/mL	1 etom		
ICP-OES	229.651 nm	0.07 / 0.004 µg/mL	1 ion	Co	
ICP-MS	105 amu	2 ppt	nia	M' **Ar#*Cu, **Y**O	



- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network:



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCRC), Portugal (APCER), Singapore (PSB), Slovenja (SIQ), Spain (AENOR), Switzerland (SOS)

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners: Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT)

(SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at lnorganic Ventures / IV Labs Indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: March 14, 2003

**Expiration Date:** 

0122005

INDR	GANIC	LABS/	RADCHE	EM LA	BS Î	9.9%69
DATE	RECEIV	'ED:	_03/0	11/04		
DATE	RECEIV	D:	03/0	11/200	5	VD
DATE	OPENED	•	0.3/1	1/04		
	: 44					

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Prepared By:** JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Supervisor

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Paul Gaines, Chemist, Senior Technical Director Certifying Officer:



### inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."

### 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Sulfur in H20

Catalog Number:	CGS1-1 and CGS1-5	
Lot Number:	W-QS01098	INORGANIC LABS/RADCHEM LABS
Starting Material:	H2SO4	DATE RECEIVED: 1/5/03 1002
Starting Material Purity (%):	99.999965	DATE EXPIRED: 12/1 2004 DR
Starting Material Lot No Matrix:	N38818 H2O	DATE OPENED: 11/5/43 INORG: 43/7 FO: F52258

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

**Certified Concentration:** 1010 ± 2 µg/mL

Certified Density: 1.000 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>ex x</u>	(C)) = mean
n	x, = individual results
	n = number of measurements
Uncertainty (±) = <u>21(ers,)7112</u>	S = The summation of all significant estimated errors.
(ŋ) <sup>112</sup>	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the
	(Most common are the errors from instrumental measurement,

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

E This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	998 ± 8 µg/mL						
		ICP Assay NIST SRM 3154 Lot Number: 892205						
	Assay Method #2	1010 ± 2 μg/mL						
		Acidimetric NIST SRM 84k Lot Number: 84k						

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

				1			1					ŧ				1			
<u>0</u>	Al		0.00025	Μ	Dy	<	0.01197	Q	Li	<	0.00016	M	Pr	<	0.00060	M	Te	<	0.05984
M	Sb	<	0.00100	М	Er	<	0.00997	M	Lu	<	0.00080	М	Re	<	0.00200	M	Tb	<	0.00060
М	As	<	0.01995	М	Eu	<	0.00598	<u>0</u>	Mg	<	0.00004	M	Rh	<	0.00200	м	TI	<	0.00200
M	Ba	<	0.01995	M	Gd	<	0.00200	М	Mn	<	0.00798	M	Rb	<	0.00200	M	Th	<	0.00200
Q	Be	<	0.00200	M	Ga	<	0.00200	Q	Hg	<	0.01100	M	Ru	<	0.00399	М	Tm	<	0.00080
M	Bi	<	0.00080	M	Ge	<	0.01197	M	Мо	<	0.00399	М	Sm	<	0.00200	M	Sn	<	0.00997
<u>0</u>	в	<	0.00990	М	Au	<	0.00598	М	Nd	<	0.00399	M	Sc	<	0.01995	M	Т	<	0.09974
М	Cd	<	0.00598	M	Hf	<	0.00399	Q	Ni	<	0.00230	Q	Se	<	0.00620	M	W	<	0.01995
Q	Ca		0.00020	M	Но	<	0.00100	М	Nb	<	0.00100	Q	Si	<	0.00410	М	U	<	0.00399
М	Ce	<	0.00997	М	In	<	0.01995	n	Os			M	Ag	<	0.00399	M	v	<	0.00399
М	Cs	<	0.00060	М	Ir	<	0.00997	М	Pd	<	0.00997	Q	Na	<	0.00010	M	Yb	<	0.00200
М	Cr	<	0.00997	Q	Fe		0.00015	Q	P	<	0.00480	M	Sr	<	0.00100	M	Y	<	0.07979
М	Co	<	0.00598	М	La	<	0.00100	М	Pt	<	0.00399	ŝ	s			<u>o</u>	Zn		0.00125
Μ	Cu	<	0.01197	M	Pb	<	0.00598	Q	к	<	0.00170	М	Ta	<	0.01396	М	Zr	<	0.00997
M - C	heck	ed	by ICP-MS	0-	Cheo	kec	by ICP-OES	i-S	pectr	al I	nterference	n - ł	Not C	hea	cked For	<b>\$</b> - 1	Soluti	on	Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4~€. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 32.066, +6; 6; (0=), S(OH), Chemical Compatibility - Soluble in HCI, HNO, H,PO, and HF aqueous matrices water and NH,OH. Stable with all metals and inorganic anions at low to moderate ppm levels under acidic conditions except Ba and Pb and to a lesser extent Sr, and Ca. Stability - 2-100 ppb levels - stability unknown- in 1% HNO, / LDPE container. 1-10,000 ppm solutions chemically stable for years in LDPE container.

S Containing Samples (Preparation and Solution) - We most often get questions about the determination of S in Rocks, Silicates and insoluble sulfates (the finely powered sample is fused in a Pt\* crucible with 48 times its weight of Na,CO, + 0.5 grams KNO,. The fuseate is extracted with water. Any BaSO, present in the sample is transposed by the carbonate fusion to the BaCO, which is left behind in the water-insoluble residue. If PbSO, is present the fuseate should be boiled with a sodium carbonate saturated with CO, solution for 1 hour or more where the PbSO, will be transposed to the water insoluble carbonate which can be filtered off, Boiling the fuseate with a saturated carbonate solution is good insurance for samples containing Ba, Sr, and Ca. The Ba, Pb, Sr, Ca, free filtrate can be addited and measured by ICP.)

Atomic Spectroscopic Information (ICP-OES D.L.s are given as <u>radial/asial</u> view):										
Technique	Line	Estimated D.L.	Order	Type	Interferences funderlined indicates severe at afforcs.)					
ICP-OES	166.669nm	0.2/0.19 µg/mL	1	atom	\$I,B					
ICP-OES	182.034 nm	0.3 / 0.024 µg/mL	1	atom						
ICP-OES	143.328 nm	0.4 / 0.035 µg/mL	1	atom						
ICP-MS	32 amu	30,000 ppt	n/a	M٠	ՙՙOႇ, '™''O, `*N' <sup>™</sup> O, '™''O'H, '*N''O'H					

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### **10.0 QUALITY STANDARD DOCUMENTATION**

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of <u>IQ Net International Certification Network</u>:

Argentina (IRAM), Australia (QAS), Austra (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Te - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

#### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

INORGANIC LABS/RADCHEM LABS DATE RECEIVED: 11/5/03 DATE EXPIRED: 12/11/2014 DR DATE OPENED: 11/5/03 INORG: 43/7 PO: F52252

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:

JoAnn Struthers, QA Administrative Assistant

**Certificate Approved By:** Katalin Le, QC Supervisor

Certifying Officer:

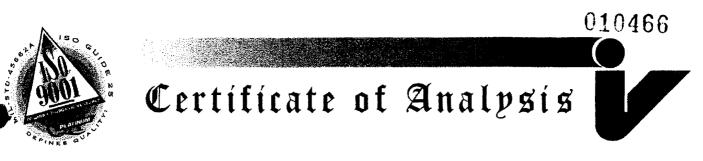
Paul Gaines, Chemist, Senior Technical Director

Expiration Date: EXPIRES

Certification Date: August 27, 2003

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## CUSTOM-GRADE SOLUTION

1000  $\mu$ g/mL Thorium in 3% HNO<sub>3</sub> (abs)

Catalog Number: CGTH1-1 and CGTH1-5

### Lot Number: T-TH01059

Starting Material: Starting Material Purity: Starting Material Lot No: Thorium Nitrate 99.999% C01L32

INDRGANIC LABS/	RADCHEM LABS
DATE RECEIVED:	10/08/03
DATE EXPIRED:	11/01/2004 VOT
DATE OPENED:	10/08/03
INORG: Hab3	PO: F53340

### CERTIFIED CONCENTRATION: 1001 $\pm$ 3 $\mu$ g/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\bar{x}$ ) =  $\sum x_i$ 

 $(\bar{x}) = mean$   $x_i = indiv$ 

x, = individual results

n = number of measurements  $\sum S_i =$ 

Uncertainty  $(\pm) = 2[(\sum_{s} j^2)^{1/2}]^{1/2}$ 

 $\sum S_i = The summation of all significant estimated errors.$ 

Classical Wet Assay: 1001  $\pm$  3  $\mu$ g/mL Method: EDTA Titration vs NIST SRM Lead Nitrate.

Instrument Analysis: 1002 ± 4 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3159.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

## TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN µg/mL:

Custom-Grade solutions tested for trace metallic impurities 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  $\mu$ m.

						. Pro 19		19 A.			1				
0	AI	< 0.00090	M	Dγ	0.0062		Q	Li	< 0.000030	M	Pr	0.00037	Q	Te	< 0.031
M	Sb	< 0.000050	<u>M</u>	Er	< 0.00050		M	Lu	< 0.000040	М	Re	< 0.00010	M	Тb	< 0.000030
Q	As	< 0.014	M	Εu	< 0.00030		Q	Mg	< 0.000060	M	Rh	< 0.00010	M	ΤI	< 0.00010
M	Ba	0.0050	M	Gd	0.0054		Q	Mn	< 0.000030	М	Rb	< 0.00010	<u>5</u>	Th	
<u>0</u>	Be	< 0.00020	M	Ga	<0.00010		i.	Hg	1997 - 1997 -	M	Ru	< 0.00020	<u>M</u>	Tm	< 0.000040
M	Bi	< 0.000040	M	Ge	< 0.00060		M	Mo	<0.00020	M	Sm	0.0095	M	Sn	< 0.00050
<u>0</u>	в	< 0.00060	M	Au	< 0.00030		M	Nd	0.0026	M	Sc	< 0.0010	<u>0</u>	Ti	< 0.00092
<u>0</u>	Cd	< 0.0045	М	Hf	< 0.00020		<u>0</u>	Ni	< 0.0023	M	Se	<0.010	M	W	<0.0010
<u>o</u>	Са	< 0.030	M	Ho	0.00022		M	Nb	< 0.000050	<u>0</u>	Si	< 0.0034	M	U	0.074
M	Се	< 0.00050	<u>0</u>	In	< 0.0020		n	Os		M	Ag	< 0.00020	M	ν	< 0.00020
м	Cs	< 0.000030	M	ir	< 0.00050		М	Pd	< 0.00050	<u>0</u>	Na	< 0.00010	M	Yb	< 0.00010
Q	Cr	< 0.00080	Q	Fe	< 0.0011		i	Р		M	Sr	< 0.000050	M	Y	< 0.0040
м	Co	< 0.00030	M	La	< 0.000050		Μ	Pt	< 0.00020	<u>0</u>	\$	< 0.072	Q	Zn	< 0.00058
М	Cu	< 0.00060	М	Pb	< 0.00030		<u>0</u>	к	< 0.0017	Μ	Ta	< 0.00070	M	Zr	0.0085

M - checked by ICP-MS

O - checked by ICP-OES

i - spectral interference n - not checked for

s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.022 g/mL QA:KL Nor 05040201





# Inorganic Ventures, Inc.

195 Lehigh Avenue • Suite 4 • Lakewood, NJ 08701 Orders: 800-669-6799 • FAX (732) 901-1903 Technical Support: 800-569-6799 Quality Assurance Manager



(over)

### QUALITY STANDARD DOCUMENTATION

1. ISO 9001:2000 QMI Registered Quality System (Certificate Number 010105)



Members of IQ Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech

(Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

- 2. ISO/IEC Guide 34-2000 "General Requirements for the Competence of Reference Material Producers" Reference Materials Production - Accredited A2LA Certificate 883.02
- 3. ISO/IEC17025-1999 "General Requirements for the Competence of Testing and Calibration" Chemical Testing Accredited A2LA Certificate 883.01
- 4. MIL-STD-45662A
- 5. 10CFR50 Appendix B Nuclear Regulatory Commission Domestic Licencing of Production and Utilization Facilities
- 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

### STABILITY/ EXPIRATION DOCUMENTATION

- Shelf Life -The length of time that a properly stored and packaged standard will remain within the specified<br/>uncertainty. Shelf life is affected by chemical stability and transpiration issues. Inorganic<br/>Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss is linear with<br/>time and limits the time a standard can be used with confidence. The smaller the bottle the higher<br/>the rate of transpiration. Inorganic Ventures' studies indicate that the shelf life of our 500 mL<br/>bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.
- Expiration Date <u>The date after which a standard solution should not be used.</u> A one year expiration date is recommended by most state and federal regulatory agencies. Transpiration issues and repeate use of solutions over a one year period may adversely affect the integrity of the standard.

### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double deionized water that has been filtered through a 0.2 µm filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

### GLASSWARE CALIBRATION

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

### **BALANCE CALIBRATION**

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 454678. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

### THERMOMETER CALIBRATION

The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

### **TECHNICAL SUPPORT**

All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 INT'L 1-732-901-1900 FAX 1-732-901-1903 E-MAIL IVtech@ivstandards.com





inorganic ventures

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

### certificate o f analysis

Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials." and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."

2.0

7

DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Uranium in 1% (abs) HNOs

Catalog Number:	CGU1-1 and CGU1-5			
Lot Number:	W-U01059			
Starting Material:	UO2(NO3)2.6H2O			
Starting Material Purity (%):	99.994419			
Starting Material Lot No	RB0018			
Matrix:	1% (abs) HNO3			

INORGANIC LABS/	RADCHEM LABS PS 1 of 2
DATE RECEIVED:	03/35/04
DATE EXPIRED:	03/01/205 405
DATE OPENED:	02/25/04
INDRG: 4473	PD: F53333

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

Certified Concentration:	997 ± 2 µg/mL	INOR
Certified Density:	1.021 g/mL (measure	d at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\Box I = \underline{Q_T X_I}$ Uncertainty (±) = 21(ers)/11 (n)

(C) = mean x<sub>i</sub> = individual results n = number of measurements S = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

#### 4.0<sup>\*</sup> TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties.\* (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 Assav Method #1

997 ± 2 µg/mL

ICP Assay NIST SRM 3164 Lot Number: 891509

Assay Method #2

### 1000 µg/mL

Gravimetric NIST SRM Lot Number: See Sec. 4.2

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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	A		0.05166		M	Dy	<	0.01494	М	Li	<	0.02490	M	Pr	<	0.00075	M	Te	<	0.07470
М	Sb	<	0.00125		M	Er	<	0.01245	М	Lu	<	0.00100	M	Re	<	0.00249	м	Тb		0.00003
M	As	<	0.02490	1	M	Eu	<	0.00747	М	Mg	<	0.07470	м	Rh	<	0.00249	м	TI	<	0.00249
М	Ba	<	0.02490		M	Gd		0.00310	М	Mn		0.00083	M	Rb	<	0.00249	М	Th	<	0.00249
M	Be	<	0.00125		M	Ga	<	0.00249	i	Hg			M	Ru	<	0.00498	M	Tm	<	0.00100
М	Bi	<	0.00100		M	Ge	<	0.01494	M	Мо		0.00093	M	Sm		0.00010	Q	Sn		0.10000
M	в				<u>N</u>	Aυ	<		M	Nd	<		M	Sc	<	0.02490	M	Tì		0.00258
M	Cd		0.00103		M	Hf	<	0.00498	м	Ni	<	0.01992	м	Se	<	0.01992	M	w	<	0.02490
Q	Ca		0.05395		M	Но		0.00052	м	Nb	<	0.00125	1	Si			s	U		
М	Ce		0.00010		M	in	<	0.02490	n	Os			M	Ag	<	0.00498	M	v	<	0.00498
M	Cs	<	0.00075	1	M	ir		0.01245	м	₽d	<	0.01245	0	Na		0.00664	м	Yb	<	
M	Cr	<	0.01245		M	Fe	<		i	Р			м	Sr	<	0.00125	м	Y		0.00062
M	Co		0.00747		M	La		0.00145	<u>M</u>	Pt	<	0.00498	1	s		•••••	M	Zn		0.00114
M	Cu		0.00072	•	M	Pb		0.00217	1	к			M	Та	<	0.01743	, <u>—</u> М		<	0.01245
		ed	by ICP-MS				kea	t by ICP-OES	i- ٤		ral	interference				cked For				Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff



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

Storage & Handling - Keep tightly sealed when not in use. Store and use at  $20 \pm 4$  %. Do not pipet from container. Do not return portions removed for pipetting to container. Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 238,0289; +6; 8; UO<sub>2</sub><sup>\*\*</sup> (uranyl)

Atomic Weight; Valence; Coordination Number; Chamical Form in Solution - 238.0289; +6; 8; UO,<sup>2</sup> (uranyl) Chemical Compatibility - Soluble in HCI and HNO, Avoid H,PO., H,SO, and HF matrices should not be a problem depending upon [U]. Although the UO,<sup>2</sup> ion is distinctly basic, any U<sup>11</sup> will precipitate in basic media. UO,<sup>2</sup> safts are generally soluble in water and UO,<sup>2</sup> is stable with most metals and inorganic anions. The uranyl phosphete is insoluble in water. UF, and UF, are water soluble:

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

U Containing Samples (Preparation and Solution) - Metal (Dissolves rapidly in HCI and HNO,) Oxide (Soluble in HNO,); Ores (Digest for 1-2 hours with 1 gram of creto 30 mL 1:1 HNO). Silica insolubles are removed by filtration after bringing the sample to fumes with conc. H,SO..)

At	omic	Spectroscop	xic Inform	natio	n (ICP-OES	D.L.s are	given as	radial/axea)	(IEW):

Technique	Line	Estimated D.L.	Order	Mpc	Interferences (underlined indicates severe at efforcs.)
ICP-OES	385.958 nm	0.3 / 0.01 µg/mL	1	ion	Th, Fe
ICP-OES	367.007 nm	0.3 / 0.02 µg/mL	1	ion	Th, Ce
ICP-OES	263.553 nm	0.3 / 0.01 µg/mL	1	ion	Ce, Ir, Th, Rh, W, Zr, Ta, Ti, Y, Hf, Fe, Re, Ru
ICP-MS	236 amu	2 ppt	n/a	M'	200Pb1002

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

Entidad Mexicana de Acreditación, a.c.(EMA)

Members of IQ Net International Certification Network:



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(CSC), Portugal (APC/ER), Singanore (PSR), Slovenia (SIO), Snain (AENOR), Switzerland (SQS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS B 30 2 DATE RECEIVED: 03/05/04 DATE EXPIRED: 03/01/3005 V05 DATE OPENED: 03/05/04 INDRG: 4473 PD: F53333

\*NOTICE TO ICP-MS USERS: The 235U in this standard is depleted. The certified abundances in Atom % are as follows:

		Natural Abundance	IV's Certified Abundance
	Isotope	Atom %	Atom %
Uranium	<sup>238</sup> U	99.3	99.8 ± 0.1
	<sup>235</sup> U	0.70	$0.204 \pm 0.002$

#### DATE OF CERTIFICATION AND PERIOD OF VALIDITY 11.0



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

### Certification Date: June 10, 2003

**Expiration Date:** 

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

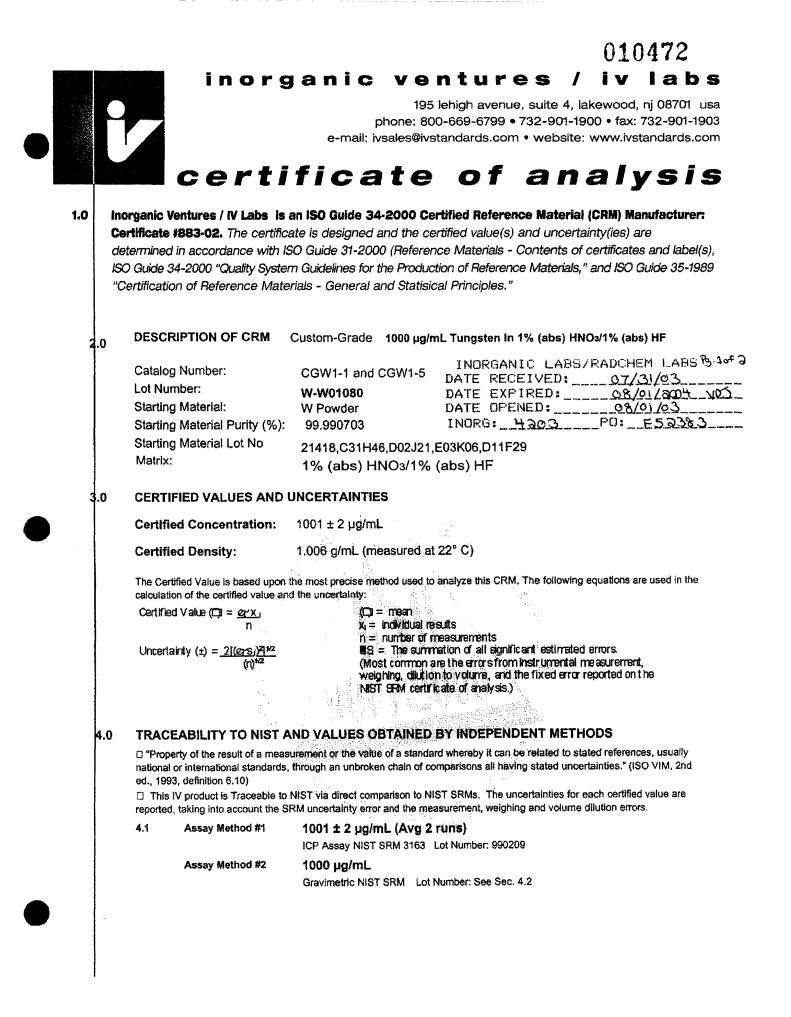
**Certificate Prepared By:** JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Supervisor

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

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- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos, and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>O</u> AI 0.01792	<u>M</u> Dy < 0.00595	<u>O</u> LI < 0.00008	<u>M</u> Pr < 0.00030	<u>M</u> Te < 0.02974
<u>M</u> Sb < 0.00050	<u>M</u> Er < 0.00496	<u>M</u> Lu < 0.00040	<u>i</u> Re	<u>м</u> ть < 0.00030
<u>M</u> As < 0.00991	<u>M</u> Eu < 0.00297	<u>O</u> Mg 0.00120	<u>M</u> Rh < 0.00099	<u>M</u> TI < 0.00099
<u>M</u> Ba < 0.00991	<u>M</u> Gd < 0.00099	<u>M</u> Mn < 0.00397	<u>M</u> Rb < 0.00099	<u>M</u> Th < 0.00099
<u>M</u> Be < 0.00050	<u>M</u> Ga < 0.00099	<u>O</u> Hg < 0.04778	<u>M</u> Ru < 0.00198	<u>M</u> Tm < 0.00040
<u>M</u> Bi < 0.00040	<u>M</u> Ge < 0.00595	<u>M</u> Mo 0.00050	<u>M</u> Sm < 0.00099	<u>M</u> Sn < 0.00496
<u>O</u> B < 1.19460	<u>M</u> Au < 0.00297	<u>M</u> Nd < 0.00198	<u>O</u> Sc < 0.00036	<u>M</u> Ti 0.00198
<u>M</u> Cd < 0.00297	<u>M</u> Hf < 0.00198	<u>M</u> Ni < 0.00793	<u>M</u> Se < 0.00793	<u>s</u> w
<u>O</u> Ca 0.00080	<u>M</u> Ho < 0.00050	<u>O</u> Nb < 0.06371	<u>O</u> SI < 0.01354	<u>M</u> U < 0.00198
<u>M</u> Ce < 0.00496	<u>M</u> In < 0.00991	<u>n</u> Os	<u>M</u> Ag < 0.00198	<u>M</u> V < 0.00198
<u>M</u> Cs < 0.00030	<u>M</u> Ir < 0.00496	<u>M</u> Pd < 0.00496	<u>O</u> Na 0.04778	<u>M</u> Yb < 0.00099
<u>M</u> Cr < 0.00496	<u>O</u> Fe < 0.03982	n P	<u>M</u> Sr < 0.00050	<u>M</u> Y < 0.03965
<u>M</u> Co < 0.00297	<u>M</u> La < 0.00050	<u>M</u> Pt < 0.00198	<u>n</u> S	<u>M</u> Zn < 0.01983
<u>M</u> Cu < 0.00595	<u>M</u> Pb 0.00060	<u>O</u> K 0.03146	<u>O</u> Ta < 0.39820	<u>M</u> Zr 0.00079
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 including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

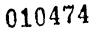
For the validation of analytical methods

For the preparation of "working reference samples"

For Interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff



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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 %. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 183.85; +6; 6,7,8,9 WOF, "(chemical form as received)

**Chemical Compatibility** - W is very readily hydrolyzed requiring 0.1 to 1% HF solutions for stable acidic solutions. The WOF<sub>s</sub>\* is soluble in % levels of HCI and HNO, provided it is in the WOF<sub>s</sub>\* form. Stable at ppm levels with some metals provided it is fluorinated. <u>Do not mix with Alkaline or Rare Earths</u>. Is best to be mixed only with other fluorinated metals (Ti, Zr, Hf, Nb, Ta, Mo, Si, Sn, Ge). Look for yellowWO, precipitate if mixed with other transition elements at higher levels indicating instability. The yellow WO, will form over a period of weeks even in trace HF, therefore, <u>HF levels of W multi-element blends should be ~ 1 %</u>. **Stability** - 2-100 ppb levels stable (Alone or mixed with all other metals that are at comparable levels) as the WOF<sub>s</sub>\* for months in 1% HNO, LDPE container. 1-10,000 ppm single element solutions as the WOF<sub>s</sub>\* chemically stable for years in 1% HF in an LDPE container.

W Containing Samples (Preparation and Solution) - Metal (Soluble in HF / HNO<sub>2</sub>); Oxide (Soluble in HF or NH.OH); Organic Matrices (Dry ash at 450  $\sim$  in Pt<sup>\*</sup> and dissolve oxide with HF).

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

Technique		Estimated D.L.	Order	Type	Interferences (underlined indicates severe at alboros.)
ICP-OES	207.911 nm	0.03/0.001 µg/mL	1	ion	Ru, In
ICP-OES	224.875 nm	0.05 / 0.005 µg/mL	1	ion	Co, Rh, Ag
ICP-OES	209.475 nm	0.05 / 0.005 µg/mL	1	ion	Mo
ICP-MS	182 amu	5 ppt	n/a	м.	' <b>**Er</b> **O

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

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for Information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by: Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network:



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCRC), Portugal (APCER), Singapore (PSR), Sovenja (SIQ), Spain (AENOR), Switzerland (SQS)

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BrnwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS 3000 DATE RECEIVED: 07/31/03 DATE EXPIRED: 03/01/2004 vo DATE OPENED: 08/01/03 INDRG: 4203 F0: F52383 CRM SHIELF LILL Certification Bala O IV Shell Life Des: 10 Years - 10 II and II and

- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: February 10, 2003

Expiration Date:

EXPIRES 122004-

010475

## 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

**Certificate Prepared By:** 

JoAnn Struthers, QA Administrative Assistant

Katalin Le, QC Supervisor

Certificate Approved By:

Certifying Officer:

Paul Gaines, Chemist, Senior Technical Director

Um Strutter



## inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Yttrium in 1.4% (abs) HNO3

Catalog Number:	CGY1-1, CGY1-2, and CGY1-5
Lot Number:	X-QY01101
Starting Material:	Y2O3
Starting Material Purity (%):	99.999727
Starting Material Lot No	9918901OYL
Matrix:	1. <b>4% (abs) HNO</b> з

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Density: 1.010 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\Box$ ) = $\underline{er'x}$	(C) = mean
n	x <sub>i</sub> = individual results
	n = number of measurements
Uncertainty $(\pm) = 2[(e_{1}s_{1})^{2}]^{1/2}$	BS = The summation of all significant estimated errors.
(1) <sup>42</sup>	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are
reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1004 ± 4 μg/mL	
		ICP Assay NIST SRM 3167a	Lot Number: 790412
	Assay Method #2	1006 ± 2 μg/mL	

EDTA NIST SRM 928 Lot Number: 880710

INDRGANIC LABS/RADCHEM LABS

DATE	RECEIVED:	03/30/04
NATE	EYPIRED:	MY CODG/10/40
NATE	IFFNED:	
INDRO	: <u>4513</u>	PD: F53361

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.
- 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL Custom-Grade solutions 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.

<u>O</u> AI	0.00024	<u>M</u> Dy < 0.00595	<u>M</u> Dy < 0.00595 <u>O</u> Li < 0.00002	<u>M</u> Pr < 0.00030	<u>M</u> Te < 0.02976
<u>Q</u> Sb	< 0.01000	<u>M</u> Er < 0.00496	M Er < 0.00496 M Lu < 0.00040	<u>M</u> Re < 0.00099	<u>M</u> Tb < 0.00030
M As	< 0.00992	<u>M</u> Eu < 0.00298	<u>M</u> Eu < 0.00298 Q Mg 0.00015	<u>M</u> Rh < 0.00099	<u>M</u> TI < 0.00099
<u>м</u> Ва	< 0.00992	<u>M</u> Gd < 0.00099	<u>M</u> Gd < 0.00099 <u>Q</u> Mn < 0.00002	<u>M</u> Rb < 0.00099	<u>M</u> Th < 0.00099
<u>M</u> Be	< 0.00050	<u>M</u> Ga < 0.00099	<u>M</u> Ga < 0.00099 <u>Q</u> Hg < 0.02000	<u>M</u> Ru < 0.00198	<u>M</u> Tm < 0.00040
M Bi	< 0.00040	<u>M</u> Ge < 0.00595	<u>M</u> Ge < 0.00595 <u>M</u> Mo < 0.00198	<u>M</u> Sm < 0.00099	<u>M</u> Sn < 0.00496
<u>о</u> в	0.00013	<u>M</u> Au < 0.00298	<u>M</u> Au < 0.00298 <u>M</u> Nd < 0.00198	Q Sc < 0.00003	<u>M</u> Ti < 0.04959
M Cd	< 0.00298	<u>M</u> Hf < 0.00198	<u>M</u> Hf < 0.00198 <u>M</u> Ni < 0.00794	<u>M</u> Se < 0.00794	<u>M</u> W < 0.00992
<u>O</u> Ca	0.00100	<u>M</u> Ho < 0.00050	<u>M</u> Ho < 0.00050 <u>M</u> Nb < 0.00050	<u>Q</u> Si 0.00170	<u>M</u> U < 0.00198
M Ce	< 0.00496	<u>M</u> In < 0.00992	<u>M</u> In < 0.00992 <u>n</u> Os	Q Ag < 0.02000	<u>Q</u> V < 0.00080
<u>M</u> Cs	< 0.00030	<u>M</u> Ir < 0.00496	<u>M</u> ir < 0.00496 <u>O</u> Pd < 0.10000	<u>O</u> Na < 0.05000	<u>M</u> Yb < 0.00099
<u>M</u> Cr	< 0.00496	<u>O</u> Fe 0.00070	Q Fe 0.00070 Q P < 0.07000	<u>Q</u> Sr < 0.00004	<u>s</u> Y
M Co	< 0.00298	<u>M</u> La < 0.00050	<u>M</u> La < 0.00050 <u>M</u> Pt < 0.00198	<u>Q</u> S < 0.04300	<u>O</u> Zn 0.00025
<u>M</u> Cu	< 0.00595	<u>M</u> Pb < 0.00298	<u>M</u> Pb < 0.00298 <u>O</u> K < 0.10000	<u>M</u> Ta < 0.00694	<u>Q</u> Zr < 0.00070
M - Checke	ed by ICP-MS	O - Checked by ICP-OES	S O - Checked by ICP-OES i - Spectral Interferenc	n - Not Checked For	s - Solution Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

# n10478

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 ℃. Do not pipet from container. Do not return portions removed for pipetting to cortainer.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 88.9059; +3; 6; Y(OH)(H,O),\*2

Chemical Compatibility - Soluble in HCI, H, SO, and HNO, Avoid HF, H, PO, and neutral to besic media. Stable with most metals and inorganic anions forming an insoluble carbonate, oxide, oxalate, and fluoride. Avoid mixing with elements / solutions containing moderate amounts of fuoride.

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

Y Containing Samples (Preparation and Solution) - Metal (Soluble in acids); Oxide (Dissolve by heating in H,O/HNO,); Ores (Carbonate fusion in Pt\* followed by HCI dissolution); Organic Matrices (Dry ash and dissolve in 1:1 H,O /HCI or HNO,). Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Techniqu		Estimated D.L.
ICP-OES	360.073 nm	0.005 / 0.00003
ICP-OES	371.030 nm	0.004 / 0.00007
ICP-OES	377.433 nm	0.005 / 0.0009 µ
ICP-MS	89 amu	0.8 ppt

Type Interferences (underlined indicates severe at afforcs.) Order 0.005 / 0.000036 µg/mL 0.004 / 0.00007 µg/mL

ion Ce. Th Ce ion Ta, Th ion

0.005 / 0.0009 µg/mL n/a M "Ge#O, '"Hf\*

- 8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### QUALITY STANDARD DOCUMENTATION 10.0

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA)



Members of IQ Net International Certification Network: Argentina (IRAM), Australia (QAS), Austria (OQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01

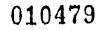


10:3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners: Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA),

Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS DATE RECEIVED: 03/30/04 DATE EXPIRED: 04/01/2005 VO DATE OPENED: 03/30/04 INORG: 4513 PD: F53361





- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: February 24, 2004

**Expiration Date:** 

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Manager

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

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## 010480 inorganic ventures / iv labs



195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

## certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Zirconium in H20 tr. HNO3 tr. HF

CGZR1-1 and CGZR1-5
W-ZR01056
ZrO2
99.994542
22855
H20 tr. HNO3 tr. HF

	/RADCHEM LABS PS 1 of 3
DATE RECEIVED:	01/23/04 08/01/2005 V03
DATE EXPIRED:	08/01/2005 VOS
DATE OPENED:	01/23/04
	PD: F57306

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1004 ± 2 µg/mL

Certified Density: 0.999 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>er x</u> ,	(⊐)) = mean
n	x <sub>1</sub> = Individual results
	n = number of measurements
Uncertainty (±) = <u>21(2r/s)</u> / <u>7112</u>	BS = The summation of all significant estimated errors.
(1)1/2	(Most common are the errors from instrumental measurement,
	weighing, dilution to volume, and the fixed error reported on the
	NIST SRM certificate of analysis.)

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

E "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1004 ± 2 µg/mL (Avg 2 runs)
		ICP Assay NIST SRM 3169 Lot Number: 990109
	Assay Method #2	1000 ug/mL

1000 μg/mL Gravimetric NIST SRM Lot Number: See Sec. 4.2

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>0</u>	AI		0.01416	M	D	У	<	0.01188	Q	Li	<	0.00012	M	Pr	<	0.00059	М	Те	<	0.05942	
М	Sb	<	0.00099	M	Ę	r	<	0.00990	M	Lu	<	0.00079	M	Re	<	0.00198	M	Тъ	<	0.00059	
М	As	<	0.01981	M	Ε	u	<	0.00594	<u>0</u>	Mg	<	0.00012	М	Rh	<	0.00198	М	TI	<	0.00198	
Μ	Ba	<	0.01981	M	G	đ	<	0.00198	Q	Mn	<	0.00401	М	Rb	<	0.00198	М	Th	<	0.00198	
Q	Be	<	0.40048	М	G	ia	<	0.00198	Q	Hg	<	0.04405	М	Ru	<	0.00396	М	Tm	<	0.00079	
М	Bi	<	0.00079	М	G	ie	<	0.01188	Q	Мо	<	0.40048	М	Sm	<	0.00198	M	Sn	<	0.00990	
M	в	<	0.13864	M	A	u	<	0.00594	М	Nd	<	0.00396	<u>0</u>	Sc	<	0.00064	Q	Π	<	0.16019	
Q	Cd	<	0.02123	M	н	lf		0.04403	Q	Ni		0.01214	М	Se	<	0.01585	M	w	<	0.01981	
<u>0</u>	Са		0.00809	Μ	Н	ю	<	0.00099	Q	Nb	<	0.08010	Q	Si	<	0.80096	М	υ	<	0.00396	
<u>M</u>	Ce	<	0.00990	M	ŀ	r	<	0.01981	n	Os			Q	Ag	<	0.40048	M	v	<	0.00396	-
М	Cs	<	0.00059	M	ir	-	<	0.00990	М	Pd	<	0.00990	Q	Na	<	0.02803	M	Yb	<	0.00198	
<u>0</u>	Cr	<	0.00881	Q	F	e		0.00344	Q	P	<	0.01922	М	Sr	<	0.00099	Q	Y	<	0.00401	
М	Co	<	0.00594	M	L	а	<	0.00099	Μ	Pt	<	0.00396	Q	s	<	0.28033	0	Zn	<	0.04005	
M	Cu	<	0.01188	M	F	ъ	<	0.00594	Q	к	<	0.00681	М	Ta	<	0.01386	<u>\$</u>	Zr			
M - C	Check	ed	by ICP-MS	0-	C	heck	ed	by ICP-OES	i - S	pect	ral	Interference	<b>n -</b> 1	Not C	he	cked For	<b>s</b> -	Solut	ion	Standard Eleme	nt

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
  - For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 ∞. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 91.224; +4; 6,7,8 Zr(F).\* Chemical Compatibility - Soluble in concentrated HCI, HF, H, SO, (very hot) and HNO,. Avoid H,PO, and neutral to basic media. Unstable at ppm levels with metals that would pull F away (i.e. Do not mix with Alkaline or Rare Earths or high levels of transition elements unless they are fluorinated ). Stable with most inorganic anions but precipitation with phosphate, oxalate, and tartrate with a tendency to hydrolyze forming the hydrated oxide in all diute acids except HF Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the Zr(F), + Zr(OH), F,

tor months in 1% HNO, / LDPE container. 1-10,000 ppm single element solutions as the Zr(F), \* chemically stable for years in 2-5% HNO, / trace HF in an LDPE container.

Zr Containing Samples (Preparation and Solution) - Metal (Soluble in H,O / HF / HNO.); Oxide - unlike TiO, the ZrO, is best tused in one of the following ways (Na,O, in Ni\*, Na,CO, in Pt\* or Borax in Pt\*), Organic Matrices (Dry ash at 450 \*C in Pt\* and dissolve by tusing with Na,CO, and dissolving in HF /HNO, /H,O).

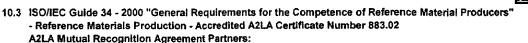
Atomic Spectroscopic Information (ICP-0ES D.L.s are given as <u>radial/axial</u> view):											
Technique		Estimated D.L.	<u>Örder</u>	Type	Interferences (underlined indicates severe at valloncs.)						
ICP-OES	343.823 nm	0.007 / 0.0004 µg/mL	1	ion	Hf, Nb						
ICP-OES	339.198 nm	0.008 / 0.0007 µg/mL	1	ion	Th, Mo						
ICP-OES	272.261 nm	0.018 / 0.001 µg/mL	1	ion	Cr. V. Th. W						
ICP-MS	90 amu	2 ppt	n/a	M	""Ge" <sup>f</sup> O, <sup>7</sup> "Se" <sup>f</sup> O,[' <sup>**</sup> X' <sup>*</sup> (where X = Hf, Ta, W)]						

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

- 8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safley Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### 10.0 **QUALITY STANDARD DOCUMENTATION**

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 **Recognized by:** Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) **Dutch Council for Accreditation (RVA)** Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT). Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS P3- 3 - 4 3 DATE RECEIVED: 01/03/04 DATE EXPIRED: 08/01/2005 V03 DATE DPENED: \_\_\_\_\_OI/23/04\_\_\_\_\_ INORG: 4442 PO: F53306





#### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

## 010483



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: March 19, 2003

**Expiration Date:** 

EXPIRES 0102005

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

**Certificate Approved By:** Katalin Le, QC Supervisor

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

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## inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Barium in 0.1% (abs) HNO3

Catalog Number:	CGBA1-1, CGBA1-2, ar	nd CGBA1-5
Lot Number:	W-BA02023	
Starting Material:	Ba(NO3)2	
Starting Material Purity (%):	99.999730	
Starting Material Lot No	21879	
Matrix:	0.1% (abs) HNO3	1NORGAN

abs) HNO3	INDRGANIC LABS/RADCHEM LABS B 1012
,	DATE RECEIVED: 03/35/04
INTIES	DATE EXPIRED: 03/01/2005 V03 DATE OPENED: 03/25/04
µg/mL	INDRG: 4465 PO: F52323

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1001 ± 1 µg/m

### Certified Density: 0.999 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>er x</u> ,	(⊏) = mean
n	x, = individual results
Uncertainty (±) = $2!(ers)?!^{42}$ (1) <sup>4/2</sup>	n = number of measurements BS = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SFM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

D This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	998 ± 4 µg/mL					
		ICP Assay NIST SRM 3104a Lot Number: 992907					
	Assay Method #2	1001 ± 1 µg/mL					
		Gravimetric NIST SRM Lot Number: See Sec. 4.2					

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>Q</u> AI 0.00011	<u>M</u> Dy < 0.01269	Q Li < 0.00400	<u>M</u> Pr < 0.00063	M_Te < 0.06343
<u>M</u> Sb < 0.00106	<u>M</u> Er ≤ 0.01057	<u>M</u> Lu < 0.00085	<u>M</u> Re < 0.00211	<u>O</u> Tb < 0.00390
<u>M</u> As < 0.02114	<u>O</u> Eu < 0.00040	<u>O</u> Mg 0.00009	<u>M</u> Rh < 0.00211	<u>M</u> TI < 0.00211
<u>s</u> Ba	<u>O</u> Gd < 0.00052	<u>M</u> Mn < 0.00846	<u>M</u> Rb < 0.00211	<u>M</u> Th < 0.00211
<u>M</u> Be < 0.00106	<u>M</u> Ga < 0.00211	<u>Q</u> Hg < 0.01200	<u>M</u> Ru < 0.00423	<u>M</u> Tm < 0.00085
<u>M</u> Bi < 0.00085	<u>M</u> Ge < 0.01269	<u>M</u> Mo < 0.00423	Q Sm < 0.00071	<u>M</u> Sn < 0.01057
<u>M</u> B < 0.14800	<u>M</u> Au < 0.00634	<u>Q</u> Nd < 0.00330	<u>M</u> Sc < 0.02114	M_Ti < 0.10571
<u>M</u> Cd < 0.00634	<u>M</u> Hf < 0.00423	<u>M</u> Ni < 0.01691	<u>M</u> Se < 0.01691	<u>M</u> W ≤ 0.02114
<u>O</u> Ca 0.00072	<u>M</u> Ho < 0.00106	<u>M</u> Nb < 0.00106	<u>O</u> Si < 0.00340	<u>M</u> U < 0.00423
<u>M</u> Ce < 0.01057	<u>M</u> In < 0.02114	<u>n</u> Os	<u>M</u> Ag < 0.00423	M V < 0.00423
<u>M</u> Cs < 0.00063	<u>M</u> Ir < 0.01057	<u>M</u> Pd < 0.01057	M Na < 0.21142	<u>M</u> Yb < 0.00211
<u>M</u> Cr < 0.01057	<u>O</u> Fe 0.00062	<u>Q</u> P < 0.00260	<u>O</u> Sr 0.00379	Q Y 0.00040
<u>M</u> Co < 0.00634	<u>M</u> La < 0.00106	<u>M</u> Pt < 0.00423	<u>Q</u> S < 0.02500	<u>Q</u> Zn < 0.00039
M Cu < 0.01269	M Pb 0.00020	<u>Q</u> K < 0.00180	<u>Q</u> Ta < 0.00690	<u>M</u> Zr < 0.01057
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 including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 137.33; +2; & Ba(HzO), '2

Chemical Compatibility - Soluble in HCl, and HNO<sub>2</sub>. Avoid H<sub>2</sub>SO<sub>4</sub>, HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate, iodate, molybdate, sulfate and tungstate in neutral aqueous media.

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

Ba Containing Samples (Preparation and Solution) - Metal(is best dissolved in diluted HNO<sub>2</sub>) Ores( Carbonate fusion in Pt<sup>®</sup> followed by HCI dissolution, If sultate is present dissolve the fuseate using HCI /tartaric acid to prevent BaSO<sub>4</sub> precipitate ), Organic Matrices (dry ash and dissolve in dilute HCI.)

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

Techniqu	e/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at valioncs.)
ICP-OES	455.403 nm	0.002 / 0.0001 µg/mL	1	ion	Zr, U
ICP-OES	233.527 nm	0.004 / 0.0003 µg/mL	1	ion	
ICP-OES	230.424 nm	0.004 / 0.0005 µg/mL	1	ion	Mo,Ir, Co
ICP-MS	138 amu	1 ppt	n/a	M'	<sup>122</sup> Sn <sup>18</sup> O, <sup>122</sup> Te <sup>16</sup> O

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c. (EMA)

Entidad Mexicana de Acreditacion, a.c. (EMA) Members of I<u>Q Net International Certification Network</u>:



- Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"
- Chemical Testing Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

 INORGANIC LABS/RADCHEM LABS P3-3+3

 DATE RECEIVED:
 03/35/04

 DATE EXPIRED:
 03/35/04

 DATE OPENED:
 03/35/04

 INORG:
 4465



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: July 28, 2003

**Expiration Date:** EXPIRES

182005

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

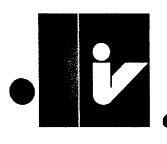
JoAnn Struthers, QA Administrative Assistant **Certificate Prepared By:** 

Certificate Approved By: Katalin Le, QC Supervisor

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director

folm Stratten Knowlin in Park Aain



## inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

## certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Beryllium in 2% (abs) HNO3

Catalog Number:CGBILot Number:W-BEStarting Material:Be(OStarting Material Purity (%):99.99Starting Material Lot No01-10Matrix:2% (

CGBE1-1, CGBE1-2, and CGBE1-5 **W-BE01104** Be(OOCCH3)2 99.999897 01-10-01

2% (abs) HNO3

INORGANIC L	ABS/RADCHEM	1 LABSP3-10F2
DATE RECEIVE	D: 06/01/0	<u>H</u>
DATE EXPIRED	): 00/01/3	2005 VOS
DATE OPENED:		
INORG: 4593	)PO:F	53393

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1007 ± 4 µg/mL

Certified Density: 1.023 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>ex x</u> ,	(🗇 = mean
n	x, = individual results
	n = number of measurements
Uncertainty (±) = <u>2[(ers,)7]<sup>1/2</sup></u>	BS = The summation of all significant estimated errors.
(n) <sup>1/2</sup>	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the
	NIST SPM certificate of analysis.)

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1007 ± 4 μg/mL ICP Assay NIST SRM 3105a Lot Number: 892707
	Assay Method #2	1002 μg/mL Gravimetric NIST SRM Lot Number: See Sec. 4.2

- BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights 4.2 used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard 4.3 thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NJST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090
- GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the 4.4 manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

Q	AI	<	0.00800	M	D	)y	<	0.01305	Q	Li	<	< 0	0.00002	М	Pr	<	0.00065	М	Te	<	0.06525
М	Sb	<	0.00109	Μ	E	r	<	0.01087	M	Lu	<	< 0	0.00087	M	Re	<	0.00218	М	Тb	<	0.00065
М	As	<	0.02175	M	E	u	<	0.00652	Q	Mg	<	< Ç	0.00003	М	Rh	<	0.00218	М	ТІ	<	0.00218
М	Ba	<	0.02175	M	G	d	<	0.00218	<u>0</u>	Mn	<	< 0	0.00002	М	Rb	<	0.00218	М	Th	<	0.00218
<u>s</u>	8e			М	G	ia	<	0.00218	Q	Hg	<	< 0	0.01500	М	Ru	<	0.00435	М	Tm	<	0.00087
М	Bi	<	0.00087	м	j G	Se	<	0.01305	M	Мо	<	< 0	0.00435	М	Sm	<	0.00218	М	Sn	<	0.01087
<u>0</u>	в	<	0.01200	M	A	U	<	0.00652	M	Nđ	<	< 0	0.00435	<u>0</u>	Sc	<	0.00009	М	Ti	<	0.10874
М	Cd	<	0.00652	м	I H	lf	<	0.00435	M	Ni	<	< 0	0.65245	М	Se	<	0.01740	M	w	<	0.02175
<u>0</u>	Ca		0.00164	М	н	io	<	0.00109	М	Nb	<	< 0	0.00109	<u>0</u>	Si		0.00649	M	U	<	0.00435
М	Се	<	0.01087	М	l Ir	ı	<	0.02175	Ū	Os				М	Ag	<	0.00435	M	v	<	0.00435
М	Cs	<	0.00065	M	Ir	•	<	0.01087	М	Pd	<	< (	0.01087	<u>0</u>	Na		0.00368	М	Yb	<	0.00218
Q	Cr	<	0.00900	Q	F	e		0.00268	n	Ρ				М	Sr	<	0.00109	M	Y	<	0.08699
М	Co	<	0.00652	M	L	8	<	0.00109	M	Pt	<	< 0	0.00435	i	S			M	Zn	<	0.04350
М	Cu	<	0.01305	M	P	ъ	<	0.00652	Q	к	<	< ¢	0.10000	М	Та	<	0.01522	М	Zr	<	0.01087
M - C	heck	ed	by ICP-MS	0	- Ch	eck	ed	by ICP-OES	i-S	pect	ral	Int	erference	n - I	lot C	he	ked For	s - S	Soluti	on :	Standard Element

#### 6.0 **INTENDED USE**

Te

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keeptightly sealed when not in use. Store and use at 20 ± 4. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 9.01218; +2; 4; Be'(H<sub>2</sub>O),<sup>12</sup> Chemical Compatibility - Soluble in HCl, HNOs, H<sub>2</sub>SO, and HF aquecus matrices. Stable with all metals and inorganic anions. Stability - 2-100 ppb levels stable for months in 1 % HNOs /LDPE container. 1-10,000 ppm solutions chemically stable for years in 5-10 % HNOs /LDPE container.

Be Containing Samples (Preparation and Solution) - Metal (is best dissolved in diluted H<sub>2</sub>SO<sub>4</sub>), BeO (boiling nitric, hydrochlaric, or sulturic adds or KHSO. fusion). Ores (H<sub>2</sub>SO. HF digestion or carbonate fusion in Pt<sup>a</sup>). Organic Matrices (sulfuric/peroxide digestion or nitric/sulfuric/perchloric acid decomposition, or dry ashand dissolution according to the BeO procedure above). Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

echnique/Line	-	Estimated D.L.	Order	Type	Interferences (underlined indicates	severe at withins)	
		COMINGED OF	YIY.		The second of th		

ICP-OES	313.042 nm 234.861 nm 313.107 nm	0.0003 / 0.00009 µg/mL 0.0003 / 0.00016 µg/mL 0.0007 / 0.0005 µg/mL	1 1 1	atom ion	V, Ce, U Fe, Ta, Mo Ce, Th, Tm
ICP-DES		4 ppt	n/a	M'	00, 11, 18



- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by: Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network: Amentina (IRAM) Australia (QAS) Austria (QOS) Beloium (Avinter), Brazil (ECAV), Canada (OMI), E



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbla (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT). Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Paleod (MSZC), Sector (ASE), Sector (A

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



- 10.3 ISO/IEC Guide 34 2000 "General Requirements for the Competence of Reference Material Producers"

  Reference Materials Production Accredited A2LA Certificate Number 883.02
  A2LA Mutual Recognition Agreement Partners:
  Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)
- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: January 08, 2004

**Expiration Date:** 



INORGANIC LABS/RADCHEM LABS 3.342 DATE RECEIVED: 06/01/04 DATE EXPIRED: 06/01/2005 VOS DATE OPENED: 06/01/04 INORG: 4592 PD: E53393

#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

Debbie Newman, Production Manager Certificate Prepared By:

Certificate Approved By:

Katalin Le, QC Manager

Dever Meuman xnormen an Paux Maine

Certifying Officer:

.

Paul Gaines, Chemist, Senior Technical Director

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#### 1 iv labs ventures inorganic

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

## certificate of analysis

### 1000 $\mu$ g/mL Chromium<sup>+3</sup> in 1.4% HNO<sub>3</sub> (abs) **CUSTOM-GRADE SOLUTION**

Catalog Number: CGCR(3)1-1, CGCR(3)1-2 and CGCR(3)1-5

Lot Number: W-QCR02033

**Starting Material:** Starting Material Purity: Starting Material Lot No:

Chromium	Metal
99.995%	
F16l22	

TNOR	GANIC LAB	SIRADCHEM	LABS
DATE	RECEIVED:	11503	DC SATSK
DATE	OPENED:	11/5/03	55568
INORG	i: <u>4318</u>	F'0;/_	57258

### CERTIFIED CONCENTRATION: 995 $\pm$ 3 $\mu$ g/mL

The Certified Value is the instrument analysis value. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (x) =  $\sum x_i$ 

(🛛) = mean

x<sub>i</sub> = individual results

Uncertainty (±) =  $2[(\sum_{s})^2]^{1/2}$ 

n = number of measurements

 $\sum S_i$  = The summation of all significant estimated errors.

Instrument Analysis: 995  $\pm$  3  $\mu$ g/mL (Avg of 3 runs) Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3112a.

Calculated Value: 1002 µg/mL

Method: Calculated, based on starting material.

### TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN $\mu$ g/mL:

Custom-Grade solutions tested for trace metallic impurities 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  $\mu$ m.

										_		-		
õ	Al	0.0028	M	Dγ	< 0.00060	M	Li	<0.0010	<u>M</u>	Pr	< 0.000030	V	Te Te	<0.0030
M	Sb	< 0.000050	м	Er	< 0.00050	M	Lu	< 0.000040	M	Re	<0.00010	V	t Tb	<0.000030
M	As	< 0.0010	M	Eu	< 0.00030	Q	Mg	<0.010	M	Rh	< 0.00010	N	T	<0.00010
M	Ba	< 0.0010	M	Gd	< 0.00010	Q	Mn	<0.050	M	Rb	0.0066	V	Th	<0.00010
M	8e	< 0.000050	M	Ga	0.00070	Q	Hg	<0.10	M	Ru	0.017	V	l Tm	< 0.000040
м	Bi	< 0.000040	м	Ge	< 0.00060	M	Mo	< 0.00020	M	Sm	< 0.00010	V	Sn Sn	< 0.00050
M	8	< 0.0070	м	Au	< 0.00030	М	Nd	<0.00020	M	Sc	< 0.0010	M	Ti	<0.0050
M	Cđ	< 0.00030	M	Hf	< 0.00020	Q	Ni	< 0.10	i	Se	•	Ň	i w	<0.0010
0	Ca	0.0011	м	Ho	< 0.000050	м	Nb	< 0.000050	<u>o</u>	Si	<0.10	Ň	U	<0.00020
M	Ce	< 0.00050	0	In	< 0.10	<u>n</u> _	Os		M	Ag	0.00070	į	ν	
м	Cs	< 0.000030	M	Ir	< 0.00050	M	Pd	< 0.00050	<u>o</u>	Na	0.016	Ň	ļ Yb	<0.00010
s	Cr		Q	Fe	<0.10	i	P		M	Sr	<0.000050	Ň	Ι Y	<0.0040
õ	Co	< 0.10	M	La	< 0.000050	M	Pt	< 0.00020	n	S		ç	Zn	<0.10
M	Cu	< 0.00060	M	Pb	0.00039	n	ĸ		M	Та	<0.00070	Ŋ	Zr	<0.00050
M -	ched	ked by ICP-MS	0 - 0	check	ed by ICP-OES	i- s	pectra	il interference	n - na	t che	cked for	s - solutio	n stan	dard element

i - spectral interference

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.010 g/mL

(over)

QA:KSL Rev. 080403.175

Paul R. Acimes

Expires:

Quality Assurance Manager

### QUALITY STANDARD DOCUMENTATION

1. ISO 9001:2000 QMI Registered Quality System (Certificate Number 010105)



Members of IQ Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech

Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

- 2. ISO/IEC Guide 34-2000 "General Requirements for the Competence of Reference Material Producers" Reference Materials Production - Accredited A2LA Certificate 883.02
- 3. ISO/IEC17025-1999 "General Requirements for the Competence of Testing and Calibration" Chemical Testing -Accredited A2LA Certificate 883.01
- 4. MIL-STD-45662A
- 5. 10CFR50 Appendix B Nuclear Regulatory Commission Domestic Licencing of Production and Utilization Facilities
- 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

### **STABILITY/ EXPIRATION DOCUMENTATION**

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Shelf Life -The length of time that a properly stored and packaged standard will remain within the<br/>specified uncertainty. Shelf life is affected by chemical stability and transpiration issues.<br/>Inorganic Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss<br/>is linear with time and limits the time a standard can be used with confidence. The smaller<br/>the bottle the higher the rate of transpiration. Inorganic Ventures' studies indicate that the<br/>shelf life of our 500 mL bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.Expiration Date -The date after which a standard solution should not be used. A one year expiration dat<br/>recommended by most state and federal regulatory agencies. Transpiration issues<br/>repeated use of solutions over a one year period may adversely affect the integrity of the<br/>standard.
```

### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double deionized water that has been filtered through a 0.2 μm filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

### **GLASSWARE CALIBRATION**

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

### **BALANCE CALIBRATION**

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 454678. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

### **THERMOMETER CALIBRATION**

The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

### **TECHNICAL SUPPORT**

All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 INT'L 1-732-901-1900 FAX 1-732-901-1903 E-MAIL IVtech@ivstandards.com

010494

#### ventures inorganic labs Γ Īν

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

### certificate analysis **o**f

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- **DESCRIPTION OF CRM** 2.0

Custom-Grade 1000 µg/mL Copper in 2% (abs) HNO3

Catalog Number:	CGCU1-1, CGCU1-2,	and CGCU1-5
Lot Number: Starting Material: Starting Material Purity (%):	<b>W-CU02064</b> Cu shot 99.999437	
Starting Material Lot No Matrix:	K09C13 2% (abs) HNO3	INGRGANIC LABS/RADCHEM LABS P3. 1. of a DATE RECEIVED: 03/35/04
CERTIFIED VALUES AND U	UNCERTAINTIES	DATE EXPIRED: 03/01/2005 V03 DATE OPENED: 03/25/04
Contified Concentrations	1005 + 0 +	INORG: 4469 PO: F53333

## 3.0

**Certified Concentration:** 1005 ± 2 µg/mL

#### **Certified Density:** 1.014 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\Box$ ) = $\underline{a_{TX}}$	(©) = mean
n	x, = individual results
	n = number of measurements
Uncertainty (±) = $2[(2r_5)^2]^{1/2}$	ES = The summation of all significant estimated errors.
(1) <sup>4/2</sup>	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SFM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

The "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1005 ± 2 μg/mL
		ICP Assay NIST SRM 3114 Lot Number: 891811
	Assay Method #2	1005 ± 2 μg/mL
		EDTA NIST SRM 928 Lot Number: 880710



- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>0</u>	Al	<	0.00090	M	Dy	<	0.03027	Q	Lí	<	0.00002	М	Pr	<	0.00151	M	Te	<	0.15134
М	Sb	<	0.00252	M	Er	<	0.02522	М	Lu	<	0.00202	M	Re	<	0.00504	м	ть	<	0.00151
М	As	<	0.05045	M	Eu	<	0.01513	<u>0</u>	Mg		0.00001	M	Rh	<	0.00504	м	τı	<	0.00504
М	Ва	<	0.05045	M	Gd	<	0.00504	M	Mn	<	0.02018	м	Rb	<	0.00504	M	Th	<	0.00504
м	Be	<	0.00252	м	Ga	<	0.00504	<u>0</u>	Hg	<	0.01500	M	Ru	<	0.01009	M	Τm	<	0.00202
М	Bi	<	0.00202	M	Ge	<	0.03027	М	Мо	<	0.01009	M	Sm	<	0.00504	₽	Sn		0.00439
М	в	<	0.35312	M	Au	<	0.01513	M	Nd	<	0.01009	M	Sc	<	0.05045	M	Ti	<	0.25223
M	Cd	<	0.01513	M	Hf	<	0.01009	M	Ni	<	0.04036	M	Se	<	0.04036	M	w	<	0.05045
<u>0</u>	Ca		0.00011	M	Ho	<	0.00252	М	Nb	<	0.00252	₫	Si	<	0.00340	M	U	<	0.01009
М	Ce	<	0.02522	M	In	<	0.05045	n	Os			M	Ag	<	0.01009	Q	v	<	0.00300
М	Cs	<	0.00151	M	lr	<	0.02522	M	Pd	<	0.02522	2	Na		0.00044	M	Yb	<	0.00504
М	Cr	<	0.02522	₽	Fe		0.00054	Q	P	<	0.00260	M	Sr	<	0.00252	M	Y	<	0.20178
м	Co	<	0.01513	М	La	<	0.00252	М	Pt	<	0.01009	n	s			M	Zn	<	0.10089
<u>s</u>	Cu			М	Pb		0.00050	Q	κ	<	0.00180	М	Та	<	0.03531	М	Zr	<	0.02522
M - (	Check	ed	by ICP-MS	0-	Cheo	ke	by ICP-OES	1 - 9	Spect	ral I	interference	n - I	Not C	he	cked For	<b>s</b> -	Soluti	on	Standard Element

### 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 €. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 63.546, +2; 6, Cu(H<sub>2</sub>O)<sub>2</sub>"

Chemical Compatibility - Stable in HCI, HNO2, H2SO., HF, HPO4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO<sub>3</sub> / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO<sub>3</sub> / LDPE container.

Cu Containing Samples (Preparation and Solution) - Metal (soluble in HNO, ) Oxides ( Soluble in HCI ); Ores ( Dissolve in HCI / HNOD. - - -Interfarences (underlined indicates severe at seboncs.) Nb, U, Th, Mo, Hr Pb, Ir, Ni, W

Atomic Spectroscop	ic Information (ICP-OES	D.L.s are given as	<u>radial/axial</u> view):	

lechnique		
ICP-OES	324.754 nm	
ICP-OES	224.700 nm	
ICP-OES	219.958 nm	
ICP-MS	63 amu	

Estimated D.L. 0.06/.001 µg/mL 0.01/.001µg/mL 0.01/.002 µg/mL n/a

Order Type 1 atom lon atom

፲፲, Ta, Nb, U, Hf "የ**Aታ™Na "Ti "**O, ''N'3C ≌Cl, "00°C ≌Cl, "Ca ®O, ¶Na\*€Ca M

- 8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

#### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA)



10 ppt



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazll (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS P3-2-72 DATE RECEIVED: 02/25/04 DATE EXPIRED: 03/01/2005 103 DATE OPENED: 02/35/04 INORG: 4469 PD: F53333

#### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

## 010497



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a property packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: May 02, 2003

### **Expiration Date:**

EXPIRES

#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

JoAnn Struthers, QA Administrative Assistant **Certificate Prepared By: Certificate Approved By:** Katalin Le, QC Supervisor Paul Gaines, Chemist, Senior Technical Director **Certifying Officer:** 

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## inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

## certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Nickel in 1.4% (abs) HNO3

Catalog Number:	CGNI1-1, CGNI1-2, and	CGNI1-5
Lot Number:	W-NI02030	
Starting Material:	Ni pieces	
Starting Material Purity (%):	99.999371	
Starting Material Lot No	L06L02	
Matrix:	1.4% (abs) HNO3	INDRG

INOF	REANIC LABS	RADCHEM LABS B.1.52
DATE	RECEIVED:	02/25/07
DATE	EXPIRED:	03/01/2005 105
DATE	OPENED:	02/35/04
INDRO	a: 4472	PO: F53333

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1002 ± 2 µg/mL

Certified Density: 1.011 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value ( $\Box$ ) = $\underline{g_{2}x_{1}}$	(C) = mean
n	x, = Individual results
	n = number of measurements
Uncertainty $(\pm) = 2[(2r_5)]^{1/2}$	S = The summation of all significant estimated errors
(t)) <sup>1/2</sup>	(Most common are the errors from instrumental measurement,
	weighing, dilution to volume, and the fixed error reported on the
	NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	999 ± 5 µg/mL					
		ICP Assay NIST SRM 3136 Lot Number: 000612					
	Assay Method #2	1002 ± 2 μg/mL					
		EDTA NIST SRM 928 Lot Number: 880710					

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.; 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.
- 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL Custom-Grade solutions 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.

	Bi B		0.00439 0.03097	M M	Ge Au		0.06577 0.03289	M M	Mo Nd	<	0.02192 0.02192	M			0.01096 0.10962	<u>М</u> М	Sn Ti		0.05481
				£⊻ M	Hf			ш S	Ni	`	0.02192	0	Se		0.01877	M	w		
			0.03289	<u>IVI</u>	1.0	`	0.02192	2	141			-	00	`	0.010/7	_		•	0.10962
00	Ca	<	0.01157	M	Ho	<	0.00548	М	Nb	<	0.00548	Q	Şi		0.00188	M	U	<	0.02192
M	Ce	<	0.05481	Μ	In	<	0.10962	D	0s			M	Ag	<	0.02192	M	۷	<	0.02192
M	Cs	<	0.00329	Μ	lr	<	0.05481	М	Pđ	<	0.05481	Q	Na		0.00102	М	Yb	<	0.01096
M	Cr	<	0.05481	Q	Fe		0.00156	Q	P	<	0.31280	M	Sr	<	0.00548	M	Y	<	0.43849
0	Co		0.00182	М	La	<	0.00548	М	Pt	<	0.02192	Q	s	<	0.07820	M	Zn		0.00189
M	Cu	<	0.06577	М	Pb	`<	0.03289	Q	κ		0.00043	М	Та	<	0.07674	М	Zr	<	0.05481
M - Ch	neck	ed	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 including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4%. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 58.69; +2; 6; Ni(H,O),\*

Chemical Compatibility - Stable in HCI, HNOs, H<sub>2</sub>SOs, HF, H<sub>2</sub>POs. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO<sub>9</sub> / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO<sub>9</sub> / LDPE container.

Ni Containing Samples (Preparation and Solution) - Metal (Soluble in HNO<sub>2</sub>), Oxides (Soluble in HCI), Ores (Dissolve in HCI/ HNO<sub>2</sub>).

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

Technique		Estimated D.L.	Order	Type Interfarences (underlined Indicates severe at valoncs.)
ICP-OES	221.647 nm	0.01 / 0.0009 µg/mL	1	ion Si
ICP-OES	232.003 nm	0.02 / 0.006 µg/mL 1	atom	<u>Cr</u> , Re, Os, Nb, Ag, Pt, Fe
ICP-OES	231.604 nm	0.02 / 0.002 µg/mL, 1	ion	Sb, Ta, Co
ICP-MS	60 amu	100 ppt	nia	M' **Ca'*O'H , **Ca'*O, **Na**Ci

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of <u>IQ Net International Certification Network</u>: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgiun Columbia (ICONTEC), Crach Benithic (COS), Denmark (I



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipel (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at lnorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: July 23, 2003

### Expiration Date:

INORGANIC LABS/RADCHEM LABS P3. 252 DATE RECEIVED: 03/35/04 DATE EXPIRED: 03/01/2005 V05 DATE OPENED: 03/35/04 INORG: 4473 F0: E53333

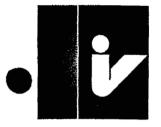


#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

JoAnn Struthers, QA Administrative Assistant Certificate Prepared By: **Certificate Approved By:** Katalin Le, QC Supervisor

folm Stutten Knonen an Pauk Aain

Paul Gaines, Chemist, Senior Technical Director **Certifying Officer:** 



#### inorganic ventures 1 iv

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

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#### certificate analysis O f

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."
- DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Cadmium in 2% (abs) HNOs 2.0

Ca	talog Number:	CGCD1-1, CGCD1-2,	and CGCD1-5	
Lo	t Number:	W-CD01127		
Sta	arting Material:	Cd shot		
Sta	arting Material Purity (%):	99.998904		
	arting Material Lot No	C14M30	INDRGANIC LABS	RADCHEM LABS Pg. 1 # 2
Ma	atrix:	2% (abs) HNO3	DATE RECEIVED:	02/25/04
			DATE EXPIRED:	03/01/2005 VOS
CE	RTIFIED VALUES AND U	INCERTAINTIES		03/35/04
-			INORG: 4467	F53323

## 3.0

**Certified Concentration:** 1007 ± 2 µg/mL

1.014 g/mL (measured at 22° C) **Certified Density:** 

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Centified Value (C) = <u>erx</u>	(C)I ≂ mean
n	x <sub>i</sub> = individual results
	n = number of measurements
Uncertainty $(\pm) = 2[(2rs_1)/2]^{1/2}$	BS = The summation of all significant estimated errors.
(1)/22	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS 4.0

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1007 ± 2 μg/mL
		EDTA NIST SRM 928 Lot Number: 880710
	Assay Method #2	1005 ± 5 μg/mL
		ICP Assay NIST SRM 3108 Lot Number: 890312

- 010503
- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>O</u> AI < 0.00090	<u>M</u> Dy < 0.01191	<u>Q</u> Li < 0.00002	<u>M</u> Pr < 0.00060	<u>O</u> Te < 0.00700
M Sb 0.00039	<u>M</u> Er < 0.00993	<u>M</u> Lu < 0.00079	<u>M</u> Re < 0.00199	<u>м</u> ть < 0.00060
<u>M</u> As < 0.01985	<u>M</u> Eu < 0.00596	<u>O</u> Mg 0.00002	<u>M</u> Rh < 0.00199	<u>M</u> TI < 0.00199
<u>M</u> Ba < 0.01985	<u>M</u> Gd < 0.00199	<u>M</u> Mn < 0.00794	<u>M</u> Rb < 0.00199	<u>M</u> Th < 0.00199
<u>M</u> Be < 0.00099	<u>M</u> Ga < 0.00199	<u>O</u> Hg < 0.01200	<u>M</u> Ru < 0.00397	<u>M</u> Tm < 0.00079
<u>M</u> Bi < 0.00079	<u>M</u> Ge < 0.01191	<u>M</u> Mo < 0.00397	<u>M</u> Sm < 0.00199	<u>M</u> Sn < 0.00993
<u>O</u> B < 0.00900	<u>M</u> Au < 0.00596	<u>M</u> Nd < 0.00397	<u>M</u> Sc < 0.01985	<u>M</u> Ti < 0.09925
<u>s</u> Cd	<u>M</u> Hf < 0.00397	<u>O</u> NI < 0.00300	<u>М</u> Se < 0.01588	<u>M</u> W < 0.01985
<u>O</u> Ca 0.00378	<u>M</u> Ho < 0.00099	<u>M</u> Nb < 0.00099	<u>O</u> Si < 0.00340	<u>M</u> U < 0.00397
<u>M</u> Ce < 0.00993	<u>O</u> in < 0.00200	<u>n</u> Os	<u>M</u> Ag < 0.00397	<u>M</u> V < 0.00397
<u>M</u> Cs < 0.00060	<u>M</u> Ir < 0.00993	· <u>M</u> Pd 0.00691	<u>M</u> Na < 0.19849	<u>M</u> Yb < 0.00199
<u>M</u> Cr < 0.00993	<u>O</u> Fe < 0.00110	<u>O</u> P < 0.00300	<u>M</u> Sr < 0.00099	<u>M</u> Y < 0.07940
<u>M</u> Co < 0.00596	<u>M</u> La < 0.00099	<u>M</u> Pt < 0.00397	<u>o</u> s < 0.03000	<u>Q</u> Zn 0.00040
<u>M</u> Cu < 0.01191	<u>M</u> Pb < 0.00596	<u>о</u> к 0.00015	<u>M</u> Ta < 0.01389	<u>M</u> Zr < 0.00993
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 including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 ∞. Do not pipet from cortainer. Do not return portions removed for pipetting to container. Atomic Weight; Valence; Coordination Number; Chamical Form in Solution - 112.41; +2; 4;Cd<sub>2</sub>(OH) (aq)" and Cd(OH)(aq)"

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 112.41; +2; 4; Cd<sub>2</sub>(OH) (aq)" end Cd(OH)(aq) " Chemical Compatibility - Stable in HCl, HNO<sub>2</sub>, H,SO<sub>2</sub>, and HF. Avoid basic media forming insoluble carbonate and hydroxide. Stable with most metals and inorganic anions in acidic media. The sulfide, carbonate, coalate, phosphate, and cyanide are insoluble in water and soluble in HCl, HNO<sub>2</sub> and NH.OH. The chloride, bromide and iodide are soluble inwater. Cdl<sub>2</sub> us one of the few iodides soluble in ethanol. All compounds of Cd are soluble in excess Nal, due to the formation of the complex ion, Cdl<sub>2</sub>". Stability - 2-100 ppb levels stable for months in 1% HNO<sub>2</sub> / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5 % HNO<sub>2</sub>/LDPE container.

Cd Containing Samples (Preparation and Solution) - Metal (soluble in HNO, ), Oxides (Soluble in HCl or HNO, ); Ores ( Dissolve in HCl / HNO, then take to fumes with H,SO... The silica and lead suitate are filtered off after addition of water. ); Organic based (dry ash at 450 °C and dissolve ash in HCl) (sulfuric/peroxide acid digestion).

нкатыс эр	AKOMIC Spectroscopic information (ICP-OES U.L.s are given as <u>radial/axial</u> view):				
Technique	Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at «Doncs.)
ICP-OES	214,438 nm	0.003/0.0003 µg/mL	1	ion	Pt, ir
ICP-OES	228.802 nm	0.003 / 0.0003 µg/mL	1	atom	Co, Ir, <u>As</u> , Pt
ICP-OES	226.502 nm	0.003/0.0003 µg/mL	1	ion	łr
ICP-MS	111 <b>a</b> mu	11 ppt	n/a	Μ.	**Mo**O

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001;2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA) Members of IQ Net International Certification Network:



- Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Delend (CCBC), Delende (ADCER), Seisconero (BSR), Sicilia (SIC), Savia (AENOR), Sultanda (CCS),
- Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners: Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS B. 2019 DATE RECEIVED: 03/35/04 DATE EXPIRED: 03/01/2005 VOS DATE OPENED: 02/25/04 INORG: 4467 PO: F52323



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: April 24, 2003

**Expiration Date:** 

EXPIRES 122605

010505

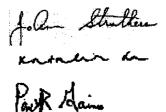
#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

**Certificate Prepared By:** JoAnn Struthers, QA Administrative Assistant

**Certificate Approved By:** Katalin Le, QC Supervisor

**Certifying Officer:** 

Paul Gaines, Chemist, Senior Technical Director



/RADCHEM LABS B 1 of a

DATE OPENED: 00/05/04 INORG: 4468 PU: F5232



iv labs I ventures inorganic

> 195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

## certificate of analysis

- Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- **DESCRIPTION OF CRM** Custom-Grade 1000 µg/mL Cobalt in 2% (abs) HNO3 2.0

Catalog Number:	CGC01-1, CGC01-2,	and CGCO1-5
Lot Number:	W-QC001114	
Starting Material:	Copowder	
Starting Material Purity (%):	99.995670	
Starting Material Lot No	22897	
Matrix:	2% (abs) HNO3	INORGANIC LABS/RADCHEM LABS B. 1. d DATE RECEIVED: 03/35/04
CERTIFIED VALUES AND I	INCERTAINTIES	DATE EXPIRED: 03/01/2005 100

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

**Certified Concentration:** 1002 ± 3 µg/mL

**Certified Density:** 1.016 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (C) = <u>erx</u> ,	(⊡) = mean
n	x, = individual results
Uncertainty (±) = $\frac{2[(g_{15})^{2}]^{1/2}}{(1)^{1/2}}$	n = number of measurements IS = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	998 ± 4 μg/mL				
		ICP Assay NIST SRM 3181 Lot Number: 000630				
	Assay Method #2	1002 ± 3 µg/mL				
		EDTA NIST SRM 928 Lot Number: 880710				

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

				•
<u>O</u> Al 0.00025	M Dy < 0.02419	<u>O</u> Li 0.00001	<u>M</u> Pr < 0.00121	<u>M</u> Te < 0.12097
<u>M</u> Sb < 0.00202	<u>M</u> Er < 0.02016	M_Lu < 0.00161	<u>M</u> Re < 0.00403	M Tb < 0.00121
<u>O</u> As < 0.10000	<u>M</u> Eu < 0.01210	<u>O</u> Mg 0.00045	<u>M</u> Rh < 0.00403	<u>M</u> TI < 0.00403
<u>M</u> Ba < 0.04032	<u>M</u> Gd < 0.00403	<u>Q</u> Mn 0.00003	<u>M</u> Rb < 0.00403	<u>M</u> Th < 0.00403
<u>M</u> Be < 0.00202	<u>M</u> Ga < 0.00403	<u>Q</u> Hg < 0.05000	<u>M</u> Ru < 0.00807	<u>M</u> Tm < 0.00161
<u>M</u> Bi < 0.00161	<u>M</u> Ge < 0.02419	<u>M</u> Mo < 0.00807	<u>M</u> Sm < 0.00403	<u>M</u> Sn < 0.02016
<u>O</u> B < 0.04000	<u>M</u> Au < 0.01210	<u>M</u> Nd < 0.00807	<u>M</u> Sc < 0.04032	<u>M</u> Ti < 0.20162
M_Cd < 0.01210	<u>M</u> Hf < 0.00807	<u>Q</u> Ni < 0.02000	<u>M</u> Se < 0.03226	<u>M</u> W < 0.04032
<u>O</u> Ca 0.00325	<u>M</u> Ho < 0.00202	<u>M</u> Nb < 0.00202	<u>O</u> Si < 0.00400	M U < 0.00807
<u>M</u> Ce < 0.0201 <del>6</del>	<u>M</u> in < 0.04032	<u>n</u> Os	<u>M</u> Ag < 0.00807	M V < 0.00807
<u>M</u> Cs < 0.00121	<u>M</u> Ir < 0.02016	<u>M</u> Pd < 0.02016	<u>O</u> Na 0.00138	<u>M</u> Yb < 0.00403
<u>M</u> Cr < 0.02016	<u>Q</u> Fe 0.00875	<u>n</u> P	<u>M</u> Sr < 0.00202	M Y < 0.16129
<u>s</u> Co	<u>M</u> La < 0.00202	M Pt < 0.00807	<u>n</u> S	<u>M</u> Zn < 0.08065
<u>M</u> Cu < 0.02419	<u>M</u> Pb < 0.01210	<u>О</u> К 0.03000	<u>M</u> Ta < 0.02823	<u>M</u> Zr < 0.02016
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 including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

- For the validation of analytical methods
- For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4.40. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 58.9332; +2; 6; Co(H,O).<sup>2</sup> Chemical Compatibility - Stable in HCI, HNO,, H,SO, ,HF, H,PO.. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

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

Co Containing Samples (Preparation and Solution) - Metal (soluble in HNO, ) Oxides (Soluble in HCI); Ores (Dissolve in HCI / HNO,).

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

Technique	Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at alborcs.)
ICP-OES	238.892 nm	0.01/.002 µg/mL	1	ion	Fe, W, Te
ICP-OES	228.616 nm	0.01/.001µg/mL	1	ion	
ICP-OES	237,862 nm	0.01/.002 ug/mL	1	ion	W, Re, Al, Ta
ICP-MS	59 amu	2 ppt	n/a	M	*ča*ó+H , *Ar*O+H , *Ar*Na, *Ca*O, *Mg*Cl

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous

## 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001;2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c. (EMA) Members of <u>IQ Net International Certification Network</u>: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgiun Columbia (ICONTEC), Czech Republic (COS), Demark (I



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 • 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"

Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

## 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: August 28, 2003

### Expiration Date:



INDRGANIC LABS/RADCHEM LABSP9.20F2 DATE RECEIVED: 03/35/04 DATE EXFIRED: 03/01/3005 V03 DATE OPENED: 03/25/04 INDRG: 4468 PO: F5333

010509

#### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Supervisor

folm Stutten Knowen & Pour Aaine

Paul Gaines, Chemist, Senior Technical Director Certifying Officer:



#### iv inorganic ventures 1 lahe

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

#### certificate analysis of

- Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: 1.0 Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- **DESCRIPTION OF CRM** Custom-Grade 1000 µg/mL Manganese in 2% (abs) HNO3 2.0

Catalog Number: Lot Number: Starting Material: Starting Material Purity (%): Starting Material Lot No Matrix:	CGMN1-1, CGMN1-2, W-MN02036 Mn pieces 99.995300 21563	, and CGMN1-5 INGRGANIC LABS/RADCHEM LABS
CERTIFIED VALUES AND U	2% (abs) HNO3 INCERTAINTIES	DATE RECEIVED: 01/20/04 DATE EXPIRED: 02/01/2005 103 DATE OPENED: 01/20/04
Certified Concentration:	1000 + 2 ug/mL	INORG: 4434 PD: 153391

#### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

**Certified Concentration:** 1000 ± 2 µg/mL

1.014 g/mL (measured at 22° C) **Certified Density:** 

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (🛱 = <u>er x</u> .)	(C) = mean
n	x, = individual results
	n = number of measurements
Uncertainty $(\pm) = 2i(2-5)^{2/12}$	ES = The summation of all significant estimated errors.
(1)12	(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

#### TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS 4.0

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1000 ± 2 μg/mL
		ICP Assay NIST SRM 3132 Lot Number: 890903
	Assay Method #2	1003 ± 3 μg/mL
		EDTA NIST SRM 928 Lot Number: 880710

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

								1								
<u>O</u> Al	0.00221	<u>≬</u> Dy	, <	0.02471	<u>0</u>	Li		0.00020	Μ	Pr	<	0.00124	M	Тө	<	0.12355
<u>M</u> Sb <	0.00206	≬ Er	<	0.02059	M	Lu	<	0.00165	Μ	Re	<	0.00412	M	Tb	<	0.00124
MAs <	0.04118	<u>∕</u> Eu	<	0.01236	Q	Mg		0.03350	M	Rh	<	0.00412	М	TI	<	0.00412
<u>M</u> Ba ≺	0.04118	<u>/</u> G	; <	0.00412	<u>s</u>	Mn			M	Rb	<	0.00412	M	Th	<	0.00412
<u>M</u> Be <	0.00206	2 G	a <	0.05000	i	Hg			М	Ru	<	0.00824	М	Tm	<	0.00165
<u>M</u> Bi <	0.00165	2 G	; <	0.00300	M	Мо	<	0.00824	М	Sm	<	0.00412	М	Sn	<	0.02059
QВ	0.00295	<u>/</u> Ai	; <	0.01236	M	Nd	<	0.00824	М	Sc	<	0.04118	М	Ti	<	0.20592
<u>M</u> Cd <	0.01236	<u>л</u> н	<	0.00824	М	Ni	<	0.03295	М	Se	<	0.03295	М	W	<	0.04118
Q Ca	0.00340	<u>A</u> Ho	, <	0.00206	Μ	Nb	<	0.00206	Q	Si		0.00275	М	U	<	0.00824
<u>M</u> Ce <	0.02059	∐ in	<	0.04118	n	Os			М	Ag	<	0.00824	M	۷	<	0.00824
M_Cs <	0.00124	<u>M</u> Ir	<	0.02059	М	Pd	<	0.02059	<u>0</u>	Na		0.00225	M	Yb	<	0.00412
<u>M</u> Cr ≺	0.02059	<u>)</u> Fe	• <	0.01000	1	Ρ			М	Sr	<	0.00206	М	Y	<	0.16474
<u>M</u> Co <	0.01236	VI La	<	0.00206	М	Pt	<	0.00824	i	S			<u>0</u>	Zn		0.00250
<u>M</u> Cu <	0.02471	N PI	) <	0.01236	Q	к		0.00105	М	Ta	<	0.02883	М	Zr	<	0.02059
M - Checked I	by ICP-MS O	- Ch	ecke	d by ICP-OES	i - S	pectr	al I	nterference	n - I	lot C	hea	ked For	s - 1	Soluti	on t	Standard Element

## 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

- For the validation of analytical methods
- For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

010512

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

Storage & Handling - Keeptightly sealed when not in use. Store and use at 20 ± 4%. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 54.9380; +2; 6; Mn(H<sub>2</sub>O),<sup>21</sup> Chemical Compatibility - Stable in HCl, HNO, H<sub>2</sub>SO, HF, H<sub>2</sub>PO,. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO<sub>9</sub> / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5 % HNO<sub>9</sub>LDPE container.

Mn Containing Samples (Preparation and Solution) - Metal (Soluble in dilute acids); Oxides (Soluble in dilute acids); Ores (Dissolve with HCL If silica is present add HF and then tume off silica by adding H<sub>2</sub>SO<sub>4</sub> and heat to SO<sub>2</sub> tumes - dense white tumes).

<ul> <li>Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view)</li> </ul>
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<u>Technique/Li</u>	ne	Estimated D.L.	Order	Type	interferences (underlined indicates severe at afforcs.)
ICP-OES 2	57.610nm	0.0014 / 0.00002 µg/mL	1	ion	Ce, W, Re
ICP-OES 2	59.373 nm	0.0016 / 0.00002 µg/mL	1	ion	U, Ta, Mo, Fe, Nb
ICP-OES 2	60.569 nm	0.0021 / 0.00002 µgAnL	1	ion	Co
ICP-MS 5	5 amu	10 ppt	n/a	M	*"Ar'"N'H, ""K""O, "'CI""O, ""Ar'"N, ""Ar'"O, ""Ar'"O'H,
					38Ar O'H, "CI'O'H, 2Na23

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

## 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by: Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of IQ Net International Certification Network:



Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Deleged (COSC), Destural (ASCE), Signapase (ISB), Signapase (ISC), Sacie (AFAQE), Suringeland (SOS),

Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS) 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration" - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipel (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)

INDRGANIC LABS/RADCHEM LABS 73. 3. 3 DATE RECEIVED: 01/20/04 DATE EXPIRED: 03/01/2005 V05

DATE OPENED:	01/20/04
INORG: 4434	PO: <u>F53301</u>

#### 11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

## 010513



- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: August 04, 2003

**Expiration Date:** EXPIRES 152005

#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

JoAnn Struthers, QA Administrative Assistant **Certificate Prepared By:** 

**Certificate Approved By:** Katalin Le, QC Supervisor

**CertifyIng Officer:** 

Paul Gaines, Chemist, Senior Technical Director

folm Strutten Kortnen da Pour Aaim

### 010514 inorganic ventures labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

## certificate of analysis

## **CUSTOM-GRADE SOLUTION**

1000 µg/mL Vanadium in 1.4% HNO3 (abs)

Catalog Number: CGV1-1, CGV1-2 and CGV1-5

Lot Number: T-V02032

Starting Material: Starting Material Purity: Starting Material Lot No:

	12171
Vanadium Pentoxide	DAT
99.999%	DAT
46	INC

INOF	RGANIC	LABS	/RADCHE	EM LA	BS
DATE	RECEIV	ED:	115/03		_
DATE	RECEIV RECEIV EXPIRE	D:	12/1/2	004	N
见角毛仁。	UFENED		115/15		
INDRE	i: <u>43</u> 2	2	P0:	F522	58

## CERTIFIED CONCENTRATION: 990 ± 2 µg/mL

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

n = number of measurements

Certified Value ( $\bar{x}$ ) =  $\sum x_i$ 

(x) = mean

 $x_i = individual results$ 

Uncertainty (±) =  $2[{\sum_{s} j^2}]^{1/2}$ 

 $\sum S_i$  = The summation of all significant estimated errors.

Classical Wet Assay: 993  $\pm$  4  $\mu$ g/mL Method: EDTA Titration vs NIST SRM 928 Lead Nitrate.

### Instrument Analysis: 990 ± 2 µg/mL

Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3165.

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

## TRACE METALLIC IMPURITIES DETERMINED BY ICP-MS AND ICP-OES IN $\mu a/mL$ :

Custom-Grade solutions tested for trace metallic impurities 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  $\mu$ m.

м	AI	0.0095	м	D٧	< 0.00060	M	Li	< 0.0010	м	Pr	~0.000000		<b>.</b>	10.0000
			tion of the second	υγ			Li		M	ы	<0.000030	M	Te	<0.0030
M	Sb	0.042	M	Er	< 0.00050	M	Ļu	< 0.000040	M	Re	<0.00010	M	ТЬ	< 0.000030
M	As	< 0.0010	M	Eu	< 0.00030	M	Mg	0.0089	M	Rh	<0.00010	M	TI	< 0.00010
м	Ba	< 0.0010	M	Gd	< 0.00010	1	Mn		M	Rb	< 0.00010	M	Th	< 0.00010
м	Be	<0.000050	M	Ga	<0.00010	i	Hg		M	Ru	< 0.00020	M	Tm	< 0.000040
M	Bi	< 0.000040	Μ	Ge	< 0.00060	M	Ma	0.016	M	Sm	<0.00010	M	Sn	< 0.00050
М	в	<0.0070	M	Au	< 0.00030	M	Nd	< 0.00020	М	Sc	< 0.0010	M	Ti	< 0.0050
М	Cđ	< 0.00030	M	Hf	<0.00020	õ	Ni	< 0.050	으	Se	<0.40	M	w	0.00055
<u>o</u>	Ca	< 0.010	M	Ho	< 0.000050	М	Nb	0.00024	<u>0</u>	Si	<0.030	M	υ	0.0011
M	Ce	< 0.00050	으	In	<0.070	<u>n</u>	Oş		М	Ag	0.00044	5	v	
M	Cs	< 0.000030	M	1r	< 0.00050	M	Pd	< 0.00050	<u>0</u>	Na	< 0.090	M	Yb	< 0.00010
õ	Cr	< 0.020	<u>0</u>	Fe	<0.050	l	Ρ		M	Sr	< 0.000050	M	Y	< 0.0040
Q	Co	< 0.050	М	La	< 0.000050	Μ	Pt	< 0.00020	<u>n.</u>	S		M	Zn	0.0041
M	Cu	< 0.00060	M	Pb	<0.00030	n	к		м	Та	<0.00070	M	Zr	< 0.00050
м -	chec	ked by ICP-MS	0-0	:heck	ed by ICP-OES	i-sp	oectra	l interference	n - no	t che	cked for	s - solution	stand	ard element

O - checked by ICP-OES

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.015 g/mL

i - spectral interference

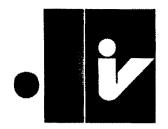
(over)

QA:KLRev.082202DK

Paul R. Haines

Quality Assurance Manager

Expires



## QUALITY STANDARD DOCUMENTATION

1. ISO 9001 QMI Registered Quality System (Certificate Number 010105)



Members of IQ Net : Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-

QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

- 2. ISO Guide 25 A2LA .Accredited (Certificate Number 0883-01)
- 3. MIL-STD-45662A
- 4. 10CFR50 Appendix B
- 5. 10CFR21

Please contact our Quality Assurance Department for further information and copies of documents pertaining to our Quality Standard certifications.

### STABILITY/ EXPIRATION DOCUMENTATION

Shelf Life -	The length of time that a properly stored and packaged standard will remain within the specified uncertainty. Shelf life is affected by chemical stability and transpiration issues. Inorganic Ventures' Standard Solutions are chemically stable indefinitely. Transpiration loss is linear with time and limits the time a standard can be used with confidence. The smaller the bottle the higher the rate of transpiration. Inorganic Ventures' studies indicate that the shelf life of our 500 mL bottle is 4 years and the shelf life of our 125 mL bottle is 21 months.
Expiration Date -	The date after which a standard solution should not be used. A one year expiration date is recommended by most state and federal regulatory agencies. Transpiration issues and repeated use of solutions over a one year period may adversely affect the integrity of the standard.

### PACKAGING DOCUMENTATION

Purified acid, 18 megohm double deionized water that has been filtered through a 0.2 µm filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

### **GLASSWARE CALIBRATION**

In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

### BALANCE CALIBRATION

All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 428359B and 454678. The NIST test number is 822/260017-98.

All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-8.

### THERMOMETER CALIBRATION

The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001.Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

### **TECHNICAL SUPPORT**

All customers are encouraged to contact us for technical support for the proper use of our products.

TEL 1-800-569-6799 FAX 1-732-901-1903 E-MAIL IVtech@ivstandards.com

## inorganic ventures / 010516 inorganic ventures / iv labs



195 lehigh avenue, suite 4, lakewood, nj 08701 usa phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

# certificate of analysis

- 1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statisical Principles."
- 2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Zinc in 1.4% (abs) HNO3

Catalog Number:	CGZN1-1, CGZN1-2, a	and CGZN1-5
Lot Number:	W-ZN02018	
Starting Material:	Zn shot	INORGANIC LABS/RADCHEM LABS
Starting Material Purity (%):	99.999889	DATE RECEIVED: 115/63 10 DATE EXPIRED: 12/11/2014
Starting Material Lot No Matrix:	J17L26 1.4% (abs) HNO3	DATE EXPIRED: 1/5/03 DATE OPENED: 1/5/03 INORG: 43/9 PD: F53358

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration:	1006 ± 3 µg/mL
Certified Density:	1.011 g/mL (measured at 22° C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty:

Certified Value (🟳 = <u>er X</u> )	(□) = mean
n	x, = individual results
Uncertainty (±) = $2[(2i_3)]^{2}[12]$ (n) <sup>1/2</sup>	n = number of measurements BS = The summation of all significant estimated errors. (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

## 4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

12 "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties," (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1	Assay Method #1	1002 ± 6 μg/mL ICP Assay NIST SRM 3168a Lot Number: 001402
	Assay Method #2	<b>1006 ± 3 μg/mL</b> EDTA NIST SRM 928 Lot Number: 880710

- 4.2 BALANCE CALIBRATION All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 Class 1 and 692476A Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 THERMOMETER CALIBRATION The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 GLASSWARE CALIBRATION In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

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

Custom-Grade solutions 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.

<u>0</u>	A	<	0.00200	M	Dy	<	0.02440	Q	LI		0.00001	М	Pr	<	0.00122	1	Δ	Те	<	0.12198	
М	Sb	<	0.00203	M	Er	۲	0.02033	М	Lu	<	0.00163	М	Re	<	0.00407	1	A	Tb	<	0.00122	
М	As	<	0.04066	M	Eu	<	0.01220	<u>0</u>	Mg		0.00011	М	Rh	<	0.00407	L	A	TI	<	0.00407	
М	Ba	<	0.04066	м	Gd	<	0.00407	М	Mn	<	0.01626	М	Rb	<	0.00407	1	1	Th	<	0.00407	
M	Ве	<	0.00203	M	Ga	<	0.00407	<u>0</u>	Hg	<	0.01000	м	Ru	<	0.00813	1	Λ	Tm	<	0.00163	
М	Bi	<	0.00163	M	Ge	<	0.02440	м	Мо	<	0.00813	м	Sm	<	0.00407	<u> 1</u>	A	Sn	<	0.02033	
<u>0</u>	в		0.00015	M	Au	<	0.01220	М	Nd	<	0.00813	М	Sc	<	0.04066	1	M	Ti	<	0.20331	
М	Cd	<	0.01220	M	Hf	<	0.00813	<u>0</u>	Ni		0.00009	М	Se	<	0.03253	1	M	W	<	0.04066	-
<u>0</u>	Са		0.00022	M	Ho	<	0.00203	М	Nb	<	0.00203	<u>0</u>	Si	<	0.00400	1	M	υ	۲	0.00813	
M	Çe	<	0.02033	M	In	<	0.04066	n	Os			M	Ag	<	0.00813	1	M	۷	<	0.00813	
М	Cs	<	0.00122	M	١r	<	0.02033	М	Pd	<	0.02033	<u>0</u>	Na		0.00055	1	M	Yb	<	0.00407	
<u>0</u>	Cr	<	0.00100	Q	Fe		0.00005	Q	Ρ	<	0.00300	M	Sr	<	0.00203	1	<u>v</u> i	Y	<	0.16264	
М	Со	<	0.01220	M	La	<	0.00203	M	Pt	<	0.00813	<u>0</u>	s	<	0.02000	5	3	Zn			
Q	Cu	<	0.00050	M	Pb	<	0.01220	<u>0</u>	к		0.00018	М	Та	<	0.02846	Į	M	Zr	<	0.02033	
M - (	Check	ed	by ICP-MS	0-	Chec	kec	by ICP-OES	1-8	spect	al I	nterference	n - I	Not C	hea	cked For	s	- S	oluti	on (	Standard Elei	ment

## 6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

- ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods

For the preparation of "working reference samples" For interference studies and the determination of correction coefficients

- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

## 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010518

Storage & Handling - Keep tightly sealed when not in use. Store and use at 20 ± 4 🔍 . Do not pipet from container. Do not return portions removed for pipetting to container Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 65.39, +2; 4; Zn(OH)(aq)" Chemical Compatibility - Stable in HCI, HNO, H,SO, HF, H,PO, Avoid basic media that promotes the formation of insoluble carbonate and hydroxide. Stable with most metals and inorganic anions in acidic media. Stability - 2-100 ppb levels stable for months in 1% HNO, /LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO, /LDPE container. Zn Containing Samples (Preparation and Solution) - Metal (Soluble in HNO, ); Oxides (Soluble in HCI ); Ores (Dissolve in HCI AHNO,); Organic based (Dry ash at 450 °C and dissolve ash in HCI) (Sulturic/peroxide add digestion) Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view): Technique/Line ICP-OES 213.856 nm ICP-OES 202.548 nm Estimated D.L. Order Type Interferences (underlined indicates severe elverboncs.) 0.002 / 0.0004 µg/mL 1 elom Ni, Cu, V 0.004 / 0.0002 µg/mL 1 ion Nb, Cu, Co, Hf ICP-OES Sb,Ta,Bl,Os M' \*\*Ti+O,\*Cr+O, \*V+O, +S+O₂,+S+O+O,+S+OO,,+S+O+O, 206.200 nm 0.006 / 0.0006 µg/mL 1 ion 66 amu ICP-MS 7 ppt n/a "S"S, "S,

- 8.0 HAZARDOUS INFORMATION Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.
- 9.0 HOMOGENEITY This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

### 10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105 Recognized by:

Registrar Accreditation Board (ANSI-RAB) Standards Council of Canada (SCC) Dutch Council for Accreditation (RVA) Entidad Mexicana de Acreditacion, a.c.(EMA)



 Members of IQ Net International Certification Network: Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belglum (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)
 10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibratic - Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"
 Reference Materials Production - Accredited A2LA Certificate Number 883.02
 A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

- 10.4 10CFR50 Appendix B Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities
- 10.5 10CFR21 Nuclear Regulatory Commission Reporting Defects and Non-Compliance
- 10.6 MIL-STD-45662A (Obsolete/Observed)





- 11.1 IV Shelf Life The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies (P-SP01020) of chemically-stable solutions performed at Inorganic Ventures / IV Labs indicate a CRM shelf-life of four years for solutions packaged in 500-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.
- 11.2 Expiration Date The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: May 02, 2003

### Expiration Date:

EXPIRES 122004-

### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:

JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Supervisor

Certifying Officer:

Paul Gaines, Chemist, Senlor Technical Director

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INOF	RGANIC LA	BS/RADCHEM	LABS
DATE	RECEIVED	): 11/5/03 _12/1/2004	240
DATE	EXPIRED:	12/1/2004	QK
DATE	OPENED:	1115/03	
INOR	5:_ <u>43/9</u>	Po:_ <i>F</i>	5258

SOUTHWEST RESEARCH INSTITUTE NUCLEAR PROJECT CLIENT: Division 20 TASK ORDER: 040706-3 SRR: 26134 SDG: 247108 CASE: CNWRA VTSR: July 02, 2004 PROJECT#: 10542.02.002

# **Pipette Calibrations**

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SwRI – Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

(Space provide for Inorganic Laboratories' Fixed Volume Pipette Verification Spreadsheet)

## SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Spreadsheet

Eppendorf #	True Value (uL)	1st Reading (g)	2nd Reading (g)	) 3rd Reading (g)	Avg Wt (g)	% of True Value
Lab30	1000	1.0072	1.0068	1.0054	1.01	100.65
TMA1	1000	1.0059	1.0072	1.0094	1.01	100.75
TMA2	1000	1.0040	1.0039	1.0021	1.00	100.33
TMA3	1000	OUT	OF	SERVICE		
TMA6	1000	1.0093	1.0086	1.0098	1.01	100.92
TMB1	900	0.9033		0.9013	0.90	100.24
TMC1	800	0.8002			0.80	100.08
TMDD1	750	0.7568			0.75	100.40
TMD1	700	0.7054			0.70	100.44
TMD2	700	0.7099		0.7031	0.71	100.90
TME1	600	0.6027			0.60	100.29
TMF2	500	0.5011			0.50	100.45
TMF5	500	0.5058			0.51	101.35
ICF1	500	0.5054		0.5030	0.50	100.77
L30-500	500	0.5013			0.50	100.07
TMG3	400	0.3946			0.39	98.65
TMH1	300	OUT	OF	SERVICE		
TMH2	300	0.3031	0.3001	0.3000	0.30	100.36
TMJ1	250	0.2524	0.2504		0.25	100.37
TMJ2	250	0.2501	0.2507	0.2502	0.25	100.13
TMJ3	250	0.2525	0.2530		0.25	101.03
TMK2	200	0.2015	0.2001	0.2012	0.20	100.47
TML1	150	0.1513	0.1516		0.15	100.73
TMM1	120	0.1210	0.1209	0.1203	0.12	100.61
TMN3	100	0.1026	0.1004	0.1004	0.10	101.13
ICN1	100	0.0990	0.1002	0.1001	0.10	99.77
TMQ1	80	0.0806	0.0804	0.0804	0.08	100.58
TMR1	70	OUT	OF	SERVICE		
TMS1	60	OUT	OF	SERVICE		
LAB-30A	50	NOT	FOUND			
TMU1	40	0.0404	0.0402	0.0400	0.04	100.50
TMU2	40	0.0399	0.0400	0.0399	0.04	99.83
TMV1	30	0.0300	0.0300	0.0299	0.03	99.89
L30-20	20	0.0201	0.0202	0.0201	0.02	100.67
TMW1	25	0.0251	0.0250	0.0251	0.03	100.27
TMY1	15	OUT	OF	SERVICE		

FRM-246 (Rev 1/Mar 03)

FRM-243-a (Rev 3/Mar 03)

03 034 Book/Page \_\_\_\_

## SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

1

 Balance #: 34
 Thermometer #: 601
 diH20 Temperature (°C): 2010522

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	]
Lab30	1000	1.0072	1.0068	1.0054	
TMA1	1000	1.0059	1.0072	1,0094	_
TMA2	1000	1.0040	1.0039	1.0021	
TMA3	1000	out	0F	Struice	
TMA6	1000	NOT 1.0093	10086 Found	1.0098	Found on
TMB1	900	.9033	,9018	,9013	701120 en 701204 90
TMC1	800	. 800 2	.8011	. 8007	
TMDD1	750	.7568	,7521	.7501	
TMD1	700	.7054	,7018	,7021	
TMD2	700	.7099	.7058	,7031	
TME1	600	,6027	,6018	.6007	
TMF2	500	. 5011	, 50.37	.5019	
TMF5	500	. 5058	,5084	,5060	
ICF1	500	. 5054	,5032	.5030	
L30-500	500	. 5013	, 4998	, 4999	
TMG3	400	3946	, 3948	. 3944	
TMH1	300	out	OF	Strvict	-
TMH2	300	. 3031	,3001	, 3000	
TMJ1	250	, 2524	.2504	. 2500	
TMJ2	250	. 2501	,2507	,2502	-
TMJ3	250	. 2525	,2530	,2522	-
TMK2	200	, 2015	. 2001	, 2012	
TML1	150	,1573	,1516	. 1504	
TMM1	120	.1210	,1209	.1263	_
TMN3	100	. 1226	, 1004	,1004	
ICN1	100	. 0990	,1002	,1001	
TMQ1	80	.0806	.0804	,0804	_
TMR1	70	out	24	Service	
TMS1	60	DUT	of	SEVUICE	
LAB-30A	50	NOT	Found		
TMU1	40	.0404	,0407	,0400	
TMU2	40	,0399	.0400	. 0399	
TMV1	30	,0300	,0300	,0299	
L30-20	20	.0201	. 020,2	,0 201	
TMW1	25	.0251	. 0250 0F	. 0251	
TMY1	15	OUT	of	SERVICE	
Analyst:	nyells	Date:	7-1-04		
Reviewed by:	Vale Q		07/12/04		
·		FRM-243b (Rev 3/N			

FRM-243b (Rev 3/Mar 03)

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## SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

010523

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	20	0.0204	0.0203	0.0203	0.020	101.67
ADJ200-A	100	0.1003	0.1001	0.0996	0.100	100.00
	200	0.2009	0.2017	0.2014	0.201	100.67
	20	0.0202	0.0203	0.0201	0.020	101.00
ADJ200-C	100	0.0998	0.0986	0.0991	0.099	99.17
	200	0.1990	0.1996	0.1989	0.199	99.58
	20	0.0200	0.0200	0.0200	0.020	100.00
ADJ200-D	100	0.0995	0.0999	0.0998	0.100	99.73
	200	0.1989	0.2003	0.1994	0.200	<b>99</b> .77
	20					
ADJ200-G	100					
	200					
	20					
ADJ200-H	100					
	200					
	20					
ADJ200-J	100					
<u> </u>	200					
	20	0.0201	0.0202	0.0204	0.020	101.17
ADJ200-K	100	0.0996	0.1002	0.1008	0.100	100.20
	200	0.2000	0.1998	0.1998	0.200	99.93
	20					
ADJ200	100					
	200					
	20					
ADJ200	100					
	200					

SwRI - Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

FRM-247a (Rev 4/Apr 04)

FRM-244 (Rev 2/Sept 02)

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SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log Balance #: <u>34</u> Thermometer #: <u>6011</u> diH20 Temperature (° C) <u>910524</u>

	Eppendorf #	True Value (µL)	1 <sup>st</sup> Reading (g)	2 <sup>nd</sup> Reading (g)	3 <sup>rd</sup> Reading (g)
		20	.0204	,0203	.0203
	ADJ200-A	100	,1003	,1001	.0996
		200	,2009	. 2017	. 2014
		20	, 0202	,0203	, 0201
	ADJ200-C	100	,0998	, 0986	,0991
		200	,1990	, 1996	,1989
		20	:0.200	,0300	,0200
	ADJ200-D	100	, 0995	,0999	. 0998
3		200	. 1989	,2003	. 1994
O		20			
200	ADJ200-G	100			
N		200			
		20			
	ADJ200-H	100		0207-2-0	E _
ユ		200		Le !	
20		20		-0	
2	ADJ200-J	100			
		200			
		20	,0201	0202	.0204
	ADJ200-K	100	,0996	1002 2000 29-20	4 .1008
L		200	12000	, 1998	,1998
		20			
	ADJ200	100		Q. 7.2-01	
		200	$\leq$	0	

Analyst: \_\_\_\_\_ Reviewed by

Date: 7-2-04 Date: 7/7/04

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## SwRI - Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010525

7/6/04

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	20				0.000	0.00
ADJ200-A	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200-C	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200-D	100				0.000	0.00
	200				0.000	0.00
	20	0.0204	0.0204	0.0203	0.020	101.83
ADJ200-G	100	0.0985	0.0982	0.0996	0.099	98.77
	200	0.1980	0.1978	0.1990	0.198	99.13
	20	0.0201	0.0200	0.0201	0.020	100.33
ADJ200-H	100	0.0988	0.0992	0.0987	0.099	98.90
	200	0.1988	0.1993	0.1984	0.199	99.42
	20	0.0202	0.0204	0.0204	0.020	101.67
ADJ200-J	100	0.0991	0.0994	0.0980	0.099	98.83
	200	0.1991	0.1979	0.1987	0.199	99.28
	20				0.000	0.00
ADJ200	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200	100				0.000	0.00
	200				0.000	0.00

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

FRM-247a (Rev 3/Oct 03)

Bala	ance #: <u>34</u>	Thermometer #	<u>G011</u>	diH20 Tempera	•
Г	Eppendorf #	True Value (µL)	1 <sup>st</sup> Reading (g)	2 <sup>nd</sup> Reading (g)	3 <sup>rd</sup> Reading (g)
		20			7
Γ	ADJ200-A	100			
Γ		200			
Γ		20		10/0	
	ADJ200-C	100		W	
		200		0	
Γ		20			
	ADJ200-D	100			
5		200	$\mathcal{L}$		
		20	0.0204	0.0204	0.0203
	ADJ200-G	100	0.0985	0.0982	0.0996
N		200	0.1980	0.1978	0.1990
1		20	0.0201	0.0200	Q0201
	ADJ200-H	100	0,0988	0.0992	0.0981
		200	0.1988	0.1993	0.1984
ЪГ		20	0.0202	0.0204	0.0204
N N	ADJ200-J	100	0.0991	0.0994	0.0980
		200	0.1991	0.1979	0.1987
		20			
	ADJ200-K	100		1 1,104	
		200		101	
		20	1		
Γ	ADJ200	100		U	
		200			

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## 06 101

## SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010527

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	100	0.1019	0.1018	0.1020	0.102	101.90
ADJ1000-C	500	0.4980	0.5004	0.4997	0.499	99.87
	1000	1.0011	1.0018	0.9979	1.000	100.03
	100	0.1020	0.1008	0.1018	0.102	101.53
ADJ1000-D	500	0.4934	0.4966	0.4971	0.496	99.14
	1000	1.0012	1.0011	1.0020	1.001	100.14
	100	0.1012	0.1007	0.1004	0.101	100.77
ADJ1000-E	500	0.4946	0.4968	0.4952	0.496	99.11
	1000	0.9938	0.9960	0.9968	0.996	99.55
	100	0.1010	0.1005	0.1001	0.101	100.53
ADJ1000-F	500	0.4994	0.5008	0.4978	0.499	99.87
	1000	0.9966	0.9999	1.0005	0.999	99.90
	100					
ADJ1000-G	500					
	1000					
	100					
ADJ1000-H	500					
	1000					
	100					
ADJ1000-J	500					
	1000					
	100	0.1007	0.1004	0.1001	0.100	100.40
ADJ1000-K	500	0.5022	0.5036	0.5040	0.503	100.65
	1000	1.0001	0.9998	1.0029	1.001	100.09
	100					
ADJ1000	500					
	1000					

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## SwRI Div. 01 - Inorganic Laboratory Adjustable Pipette Verification Log

 Balance #:
 31
 Thermometer #:
 GO 11
 diH20 Temperature (° C)
 010528

	Eppendorf #	True Value (µL)	1 <sup>st</sup> Reading (g)	2 <sup>nd</sup> Reading (g)	3 <sup>rd</sup> Reading (g)
		100	,1019	.1018	,1020
	ADJ1000-C	500	,4980	,5004	,4997
		1000	1.0011	1.0018	.9979
		100	,1020	,1008	.1018
	ADJ1000-D	500	.4934	. 496e6	.4971
		1000	1.0012	1.0011	1.0030
		100	,1012	,1007 -0953 94	
	ADJ1000-E	500	,4946	,4968	4952
		1000	,9938	.9960	.9968
コ		100	. 1010	.1005	.1001
0	ADJ1000-F	500	, 4994	5008	. 4978
000		1000	,9946	9999	1.0005
12		100			
	ADJ1000-G	500			
<b>'</b>		1000		19.00	$\geq$
3		100		Q07.00	
	ADJ1000-H	500		THE AND	
00		1000		C	
-		100			
	ADJ1000-J	500			
		1000			
		100	,1007	,1004	,1001
	ADJ1000-K	500	,5022	. 5036	.5040
		1000	1.0001	,9998	1.0029
		100		7.20+	>
	ADJ1000	500		Y	
		1000		6	

Analyst Reviewed by

\_\_\_\_ Date: <u>7-2-04</u> Date: <u>7/7/0</u> 04

FRM-244 (b) (Rev 4/Apr 04)

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## 06 103

## SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010529



Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	100				0.000	0.00
ADJ1000-C	500				0.000	0.00
	1000				0.000	0.00
	100				0.000	0.00
ADJ1000-D	500				0.000	0.00
	1000				0.000	0.00
	100				0.000	0.00
ADJ1000-E	500				0.000	0.00
	1000				0.000	0.00
	100				0.000	0.00
ADJ1000-F	500				0.000	0.00
	1000				0.000	0.00
	100	0.1013	0.1019	0.1010	0.101	101.40
ADJ1000-G	500	0.4939	0.4941	0.4968	0.495	98.99
	1000	0.9823	0.9811	0.9832	0.982	98.22
	100	0.0990	0.0996	0.0992	0.099	99.27
ADJ1000-H	500	0.4925	0.4942	0.4911	0.493	98.52
	1000	0.9827	0.9836	0.9856	0.984	98.40
	100	0.0991	0.1002	0.1005	0.100	99.93
ADJ1000-J	500	0.4962	0.4943	0.4980	0.496	99.23
	1000	0.9871	0.9913	0.9889	0.989	98.91
	100				0.000	0.00
ADJ1000	500				0.000	0.00
	1000				0.000	0.00
	100				0.000	0.00
ADJ1000	500		-		0.000	0.00
	1000				0.000	0.00

FRM-247b (Rev 2/Oct 03)

	SwRI Div. 01 -	<ul> <li>Inorganic Labor</li> </ul>	atory Adjustabl	e Pipette Verifica	ation Log
Bala	nce #: <u>34</u>	Thermometer #	<u>Go11</u>	diH20 Tempera	ture (° C) <u>7105</u>
	Eppendorf #	True Value (µL)	1 <sup>st</sup> Reading (g)	2 <sup>nd</sup> Reading (g)	3 <sup>rd</sup> Reading (g)
		100			
	ADJ1000-C	500			
		1000			
		100			
	ADJ1000-D	500		1.04	
		1000	la da	101	
		100		XX	
	ADJ1000-E	500			
┛Ĺ		1000			
ᆚ		100			
	ADJ1000-F	500			
		1000			
		100	0.1013	0.1019	0.1010
	ADJ1000-G	500	0.4939	0.4941	0.4968
<b>`</b>		1000	0.9823	0.9811	0.9832
5		100	0.0990	0.0996	0.0992
	ADJ1000-H	500	0.4925	0.4942	0.4911
3		1000	0.9827	0.9836	0.9856
		100	0.0991	0.1002	0.1005
	ADJ1000-J	500	0.4962	0.4943	0.4980
		1000	0.9871	0.9913	0.9889
		100			
	ADJ1000-K	500		17604	
		1000		17161	
		100		$\square$	
	ADJ1000	500		V	
		1000			

## SwRI Div. 01 - Inorganic Laboratory Adjustable Pipette Verification Log

In Analyst: Reviewed by:

Date: 04 Date:

Book/page: 06 104

FRM-244 (b) (Rev 4/Apr 04)

Book/page:\_\_\_

Nr. 204

## 06 161

## SwRI - Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010531

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	500	0.5056	0.5030	0.5031	0.504	100.78
ADJ5000-C	2500	2.4956	2.4948	2.4948	2.495	99.80
	5000	5.0400	5.0398	5.0421	5.041	100.81
	500					
ADJ5000-G	2500	OUT	OF	SERVICE		
	5000					
	500					
ADJ5000-H	2500	OUT	OF	SERVICE		
	5000					
	500	0.5025	0.4973	0.5040	0.501	100.25
ADJ5000-1	2500	2.5202	2.5176	2.5050	2.514	100.57
	5000	5.0111	5.0140	4.9979	5.008	100.15
	500					
ADJ5000-J	2500					
	5000					
	500					
ADJ5000-K	2500					
	5000	······································				
	500					
ADJ5000-L	2500					
	5000					
	500	0.5061	0.5024	0.5006	0.503	100.61
ADJ5000-M	2500	2.4991	2.4996	2.4980	2.499	99.96
	5000	5.0074	5.0048	5.0011	5.004	100.09
	500	0.5094	0.5046	0.5074	0.507	101.43
ADJ5000-N	2500	2.4984	2.5067	2.5001	2.502	100.07
	5000	5.0254	4.9996	4.9999	5.008	100.17
	500					
ADJ5000	2500					
	5000					
	500					
ADJ5000	2500					
	5000					

SwRI - Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

FRM-247c (Rev 3/Apr 04)

06 162 Book/page:\_

010532 SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 31

1	<b>_</b>	<u> </u>	L st m u ( )		
	Eppendorf #	True Value (µL)	1 <sup>st</sup> Reading (g)	2 <sup>nd</sup> Reading (g)	3 <sup>rd</sup> Reading (g)
		500	,5054	,5030	15031
	ADJ5000-C	2500	2.4956	2. 4948	9.4948
		5000	5.0400	5.0398	5,0421
		500			
	ADJ5000-G	2500	DUT	of	Stru.ce
		5000			
		500			
	ADJ5000-H	2500	OUT	οF	SERVICE
		5000			•
		500	5025	.4973	. 5040
[	ADJ5000-I	2500	2.5202	2.5176	5.5050
		5000	5.0111	5.0170	4.9979
2		500			
5000	ADJ5000-J	2500			
2		5000		1	
50		500		1209	
	ADJ5000-K	2500		Ju Io	
		5000			
-		500		1)	
4	ADJ5000-L	2500	$\mathcal{L}$	<u> </u>	
500		5000			
20		500	.50lei	,5024	sode
	ADJ5000-M	2500	2.1991	2.4996	2,4980
		5000	5.0074	5.0048	5.0011
Γ		500	.5094	.5046	,5074
Γ	ADJ5000-N	2500	2.1984	2.5067	2.5001
Γ		5000	5.0254	4.9996	4.9999
Γ		500			
F	ADJ5000	2500			
ſ		5000		07-2-04	>
F		500			
F	ADJ5000	2500	0	/	
F		5000	e		

Analyst: Reviewed by

Date: 7-2-04 Date: 7/7/04

FRM-244 (c) (Rev 3/Apr 04)

Book/page: 06 163

SwRI - Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010533

tickal--of 7/6/04

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (g)	% of True Value
	500				0.000	0.00
ADJ5000-C	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000-G	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000-H	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000-I	2500				0.000	0.00
	5000				0.000	0.00
	500	0.5068	0.5093	0.5049	0.507	101.40
ADJ5000-J	2500	2.4984	2.4924	2.4972	2.496	99.84
	5000	5.0151	5.0265	5.0194	5.020	100.41
	500	0.5066	0.5026	0.5031	0.504	100.82
ADJ5000-K	2500	2.4946	2.4927	2.4910	2.493	99.71
	5000	4.9937	4.9891	4.9953	4.993	99.85
	500	0.4958	0.4990	0.4981	0.498	99.53
ADJ5000-L	2500	2.4796	2.4792	2.4775	2.479	99.15
	5000	4.9738	4.9633	4.9662	4.968	99.36
	500				0.000	0.00
ADJ5000	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000	2500		•		0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000	2500				0.000	0.00
	5000				0.000	0.00

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

FRM-247c (Rev 2/Mar 03)

FRM-244 (Rev 2/Sept 02)

Ba	alance #: <u>34</u>	Thermometer #	Gou	diH20 Temperature (° C) $9105$		
	Eppendorf #	True Value (µL)	1 <sup>st</sup> Reading (g)	2 <sup>nd</sup> Reading (g)	3 <sup>rd</sup> Reading (g)	
		500				
	ADJ5000-C	2500				
		5000				
		500				
	ADJ5000-G	2500		110101		
		5000		11	· ·	
		500	Nt			
1	ADJ5000-H	2500		0		
	· · · · · · · · · · · · · · · · · · ·	5000		······································		
		500				
1	ADJ5000-I	2500				
		5000	$\mathcal{L}$			
괴		500	0.5068	0.5093	0.5049	
D	ADJ5000-J	2500	24984	2.4924	2.4912	
5000		5000	5,0151	5.0265	5.0194	
2		500	0.5066	0.5026	0.5031	
	ADJ5000-K	2500	2.4946	2.4927	2,4910	
		5000	4.9931	4.9891	4.9953	
<b>-</b> [		500	0.4958	0.4990	0.4981	
4	ADJ5000-L	2500	2.4796	2.4792	2.4775	
D		5000	4.9738	4.9633	4.9662	
200		500				
•	ADJ5000-M	2500				
Γ		5000				
Γ		500				
Γ	ADJ5000-N	2500		1 04		
ſ		5000		26		
Ī		500	And			
f	ADJ5000	2500		ľ.		
Ī		5000		0		
ſ		500				
ľ	ADJ5000	2500				
F		5000	(			

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7/6/04 Date: DU Date:

Book/page: 06 164

FRM-244 (c) (Rev 3/Apr 04)

010535 SOUTHWEST RESEARCH INSTITUTE NUCLEAR PROJECT CLIENT: Division 20 TASK ORDER: 040706-3 SRR: 26134 SDG: 247108 CASE: CNWRA VTSR: July 02, 2004 PROJECT#: 10542.02.002

# **Balance Calibrations**

## Southwest Research Institute® **Division 01 BALANCE VERIFICATION LOG**

BALANCE #:	LOCATION:	SERIAL #:	<b>TOLERANCE:</b>	COMMENTS:
12	Bldg. 70 Lab 27	1122510787	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
6-30-04	2,0000	2.0000	KE	SW! 99-T50526-19
1-1-04	2.0000	2-0000	KE	r
7-2-04	2.0000	2.0000	KE	N
7-(0)4	2.0000	2.0000	fee	
1-7-04	2.0000	1,9999	ler	· ·
7-8-24	2.0000	J.000D	- Lev	
7-904	2.0000	5.0001	Je -	
7-12-04	2.0000	5.0000	Jer	•.
······································				

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If balance is out of limits, clean the balance and re-calibrate using Class "S" weights. If balance is still out of limits, place a "DO NOT USE" sign on it and call (DQA) for service.

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FRM-112 (Rev 2/Aug 03)

## Southwest Research Institute **Division 01 BALANCE VERIFICATION LOG**

2# LAB #:	SERIAL #:	TOLERANCE:	
		±0.05	
41	0068597		
Std Wt (g)	Recorded Wt (g)	Operator	ELGA TEOLUE
		Der	SN: 99-J5064-5
		Clee	1
		Ber.	
10.00		1-00.)	
10,00	10	- The	
	10.00	Ofe	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
	10.00	ge	
10.00	2-1	0	
	Std Wt (g) 10.00 10.00 10.00 10.00 10.00 10.00 10.00	Std Wt (g)         Recorded Wt (g) $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$	Std Wt (g)Recorded Wt (g)Operator $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$ $10.00$

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights. If balance is still out of limits, place a "DO NOT USE" sign on it and call (x5896) for service.

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FRM-112 (Rev 1/Dec 99)

010537

## Southwest Research Institute® **Division** 01 **BALANCE VERIFICATION LOG**

<b>BALANCE #:</b>	LOCATION:	SERIAL #:	<b>TOLERANCE:</b>	COMMENTS:
34	Bldg. 70 Lab 27	1116031935	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
6-24-04	2.0000	2.0001	KE	5N:99-J50526-15
6-25-04	2.0000	2.0000	105	0
6-28-04	2.0000	2.0000	Jen _	
6-29-04	2.0000	2,0000	6	N
6-30-04	2.0000	1.9999	KE	N
7-1-04	2.0000	2.0000	KÉ	N
7-2-04	2.0000	2.0000	ke	<u>r</u>
7-6-04	20000	2.0000	Lee_	
7.7.04	2,0000	J.0000	Lev.	
7-8-04	2.0000	2.0000	yer	11

J

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights. If balance is still out of limits, place a "DO NOT USE" sign on it and call (DQA) for service.

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## Southwest Research Institute Division 01 BALANCE VERIFICATION LOG

<b>BALANCE #:</b>	LOCATION:	SERIAL #:	<b>TOLERANCE:</b>	COMMENTS:
34	Bldg. 70 Lab 27	1116031935	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
7-9-04	2.0000	J.00000	See	SN: 350526-15
7-1204	2-0000	I.0000	ge	
			0	
			1	

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.

If balance is still out of limits, place a "DO NOT USE" sign on it and call (DQA) for service.

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FRM-112 (Rev 2/Aug 03)

SOUTHWEST RESEARCH INSTITUTE NUCLEAR PROJECT CLIENT: Division 20 TASK ORDER: 040706-3 SRR: 26134 SDG: 247108 CASE: CNWRA VTSR: July 02, 2004 PROJECT#: 10542.02.002

# **DI Water Verification**

## D.I. WATER SYSTEM NOTEBOOK SOUTHWEST RESEARCH INSTITUTE BUILDING 70



Contact U.S. Filter (1-800-466-7873) for repairs/exchanges. (Make sure to have a P.O.)

HIGH PURITY SYSTEM (HP)

## 010541

		RESISTIVITY	MONITOR	QC LI	GHTS	USAGE	
DATE / TIME	INITIALS	(M OHMS)	QC LT.	QC 1	QC 2	(GALS)	COMMENTS
Aldgy Sidopm	DR.	18,04	7	7	)	2785,8	$\sim$
7764 Giolom	DR	16.03	U U	レ		2798.6	-
7/8/04 4:30pm	pp	18.04	V	$\frac{\nu}{\nu}$	)	2803,7	
7/9/04 5:05pm	DR	18.03	Ĺ	7	)	2819.7	
VINOY SOSPM	DR	18.04	Ĺ	2	)	2845.2	
				•			

Legend: Check = Green (OK); X = Red (call for service)

## LOW PURITY SYSTEM (LP)

		QCI	LIGHTS	USAGE	
DATE / TIME	INITIALS	QC 1	QC 2	(GALS)	COMMENTS
AKION SIDOPM	PR		(A)	955.9	
Holy GUIDM	pR	7	(12)4	956,1	P.O. BUCHURA USF, Hor CANEd. TANKenhange BACK on line.
7/8/04 4:30 pm	DR	5	(17.1) X	957.0	P.O. BILINIA" USF, How CAlled.
Heley Sizsem	PR	~	(15.5) V	957.6	TANKenhange. BACK online.
Filley Sidem	DR	V	1167	958.1	
			1		

Legend: Check = Green (OK); X = Red (call for service)