

010001

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 040827-12

SRR: 26440

SDG: 250244

CASE: CNWRA

VTSR: August 27, 2004

PROJECT#: 06002.01.141

FINAL REPORT

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010002

Sample ID
Soln A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250244

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	7105	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	221	2
Strontium	3.71	0.1

SOUTHWEST RESEARCH INSTITUTE

DUPLICATE SUMMARY

010003

Sample ID

Soln A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250244

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Duplicate Result (mg/L)	RPD
Calcium	7105	7107	0.03%
Magnesium	<1	<1	0.00%
Potassium	<2.5	<2.5	0.00%
Sodium	221	217	1.83%
Strontium	3.71	3.70	0.27%

SOUTHWEST RESEARCH INSTITUTE

MATRIX SPIKE SUMMARY

010004

Sample ID
Soln A

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250244

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Spike Result (mg/L)	Spike Added (mg/L)	Recovery
Calcium	7105	9237	2000	107%
Magnesium	<1	188	200	94.0%
Potassium	<2.5	213	200	107%
Sodium	221	2267	2000	102%
Strontium	3.71	44.4	40.0	102%

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010005

Sample ID

Soln B

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250245

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	1528	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	214	2
Strontium	0.803	0.1

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010006

Sample ID
Soln C

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250246

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	490	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	2199	2
Strontium	0.264	0.1

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET 010007

Sample ID

Soln D

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250247

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	146	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	2151	2
Strontium	<0.1	0.1

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET 010008

Sample ID

Soln E

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250248

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	48.2	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	2197	2
Strontium	<0.1	0.1

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010009

Sample ID

Soln F

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250249

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	20.4	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	2237	2
Strontium	<0.1	0.1

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010010

Sample ID

Soln G

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250250

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	5.58	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	2237	2
Strontium	<0.1	0.1

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010011

Sample ID

Soin H

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250251

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	2.01	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	2353	2
Strontium	<0.1	0.1

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET 010012

Sample ID

Soln I

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 08/27/04

Matrix: Water

Project No.: 06002.01.241

Lab System ID: 250252

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	101	1
Magnesium	94.8	1
Potassium	91.3	2.5
Sodium	96.0	2
Strontium	<0.1	0.1

SOUTHWEST RESEARCH INSTITUTE

LABORATORY CONTROL SAMPLE 010013

Sample ID

LCSW

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: NA

Matrix: Water

Project No.: 06002.01.241

Lab System ID: NA

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Calcium	210	200	105%
Magnesium	187	200	93.5%
Potassium	195	200	97.5%
Sodium	197	200	98.5%
Strontium	41.0	40.0	103%

NA- Not Applicable.

SOUTHWEST RESEARCH INSTITUTE

BLANK SUMMARY

010014

Sample ID

PBW

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: NA

Matrix: Water

Project No.: 06002.01.241

Lab System ID: NA

SRR: 26440

Task Order: 040827-12

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Calcium	<1	1
Magnesium	<1	1
Potassium	<2.5	2.5
Sodium	<2	2
Strontium	<0.1	0.1

NA- Not Applicable.

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

010015

TASK ORDER: 040827-12

SRR: 26440

SDG: 250244

CASE: CNWRA

VTSR: August 27, 2004

PROJECT#: 06002.01.141

Task Orders/01-QPP-015

Laboratory Task Order

TO #: 040827-12 Revision: 0

Project(s): 06002.01.141
 Manager(s): DAMMANN, MIKE
 To PM: 09/23/04
 To QA: 09/23/04
 To Client: 09/24/04

010016

SDG: 250244
 VTSR: 08/27/04
 CASE: CNWRA

SRR #s: 26440
 Client(s): DIV 20

Instructions

DIVISION 20 - CNWRA. 30-day TAT. Using 27-day TAT for report/PM, QAU, 28-day TAT for hardcopy (subject to change).

Point of Contact is BRADLEY WERLING (x6565). Analysis for Calcium, Magnesium, Sodium, Potassium, Strontium by ICP. Work is 10 CFR 50 Appendix B, 10 CFR Part 21. CONTACT Charlie Butcher (ext. 5928, pager 271-5172) BEFORE STARTING ANY WORK ON THIS TASK ORDER. If Charlie Butcher is not available, contact Rod Weber (ext. 3161). CONTACT PM WITH ANY ADDITIONAL QUESTIONS.

Documents Related to this task order: 12770[COC 26440]

Test: DIL-DILUTION
 Section: METALPREP

Holding: 28 days from CED

Prep, Dilution

Cnt: 9

System ID	Type	Cont	Matrix	Customer ID	CED	Method Date
250244		1	Water	Soln A	26 Aug 04	23 Sep 04
250245		1	Water	Soln B	26 Aug 04	23 Sep 04
250246		1	Water	Soln C	26 Aug 04	23 Sep 04
250247		1	Water	Soln D	26 Aug 04	23 Sep 04
250248		1	Water	Soln E	26 Aug 04	23 Sep 04
250249		1	Water	Soln F	26 Aug 04	23 Sep 04
250250		1	Water	Soln G	26 Aug 04	23 Sep 04
250251		1	Water	Soln H	26 Aug 04	23 Sep 04
250252		1	Water	Soln I	26 Aug 04	23 Sep 04

Test: ICP-SWRI
 Section: METALS

Holding: 180 days from CED

ICP Analysis by SwRI Method (Calcium, Magnesium, Sodium, Potassium, Strontium)

Cnt: 9

System ID	Type	Cont	Matrix	Customer ID	CED	Method Date
250244		1	Water	Soln A	26 Aug 04	22 Feb 05
250245		1	Water	Soln B	26 Aug 04	22 Feb 05
250246		1	Water	Soln C	26 Aug 04	22 Feb 05
250247		1	Water	Soln D	26 Aug 04	22 Feb 05
250248		1	Water	Soln E	26 Aug 04	22 Feb 05
250249		1	Water	Soln F	26 Aug 04	22 Feb 05
250250		1	Water	Soln G	26 Aug 04	22 Feb 05
250251		1	Water	Soln H	26 Aug 04	22 Feb 05
250252		1	Water	Soln I	26 Aug 04	22 Feb 05

010017

Southwest Research Institute

Sample Receipt

Sample Receipt Number: 26440

VTSR: 08/27/04

Time: 10:00:00

Project: 06002.01.141
Case #: CNWRA
Client: DIV 20

Manager: DAMMANN, MIKE
Logged in by: csauceda
Creation Date: 08/27/04

Notes

All samples hand delivered and received intact in a zip lock bag.
Thermometer 027 Temperature 22.0 °C.

Parameters: Analysis/Ca, Mg, NA, K, Sr by ICP, as per COC.

Note: See chain of custody as part of the SRR system for more information.

Note: Contact Project Manager for questions.

Note: TAT (4 weeks), as per COC.

Note: Project is Nuclear Safety Related, 10 CFR 50, Part 21, and Appendix B.

Note: For Div 01 contact Joann Boyd @ X2169 or 351-1617.

Note: For Institute QA contact Charlie Butcher X5928 or 271-5172 before starting any work on this project.

Note: Have SPQP (Latest Revision) on the bench at the time of prep or analysis of samples. Note: All personnel must be QA Nuclear Certified. POC: B. Werling X6565.

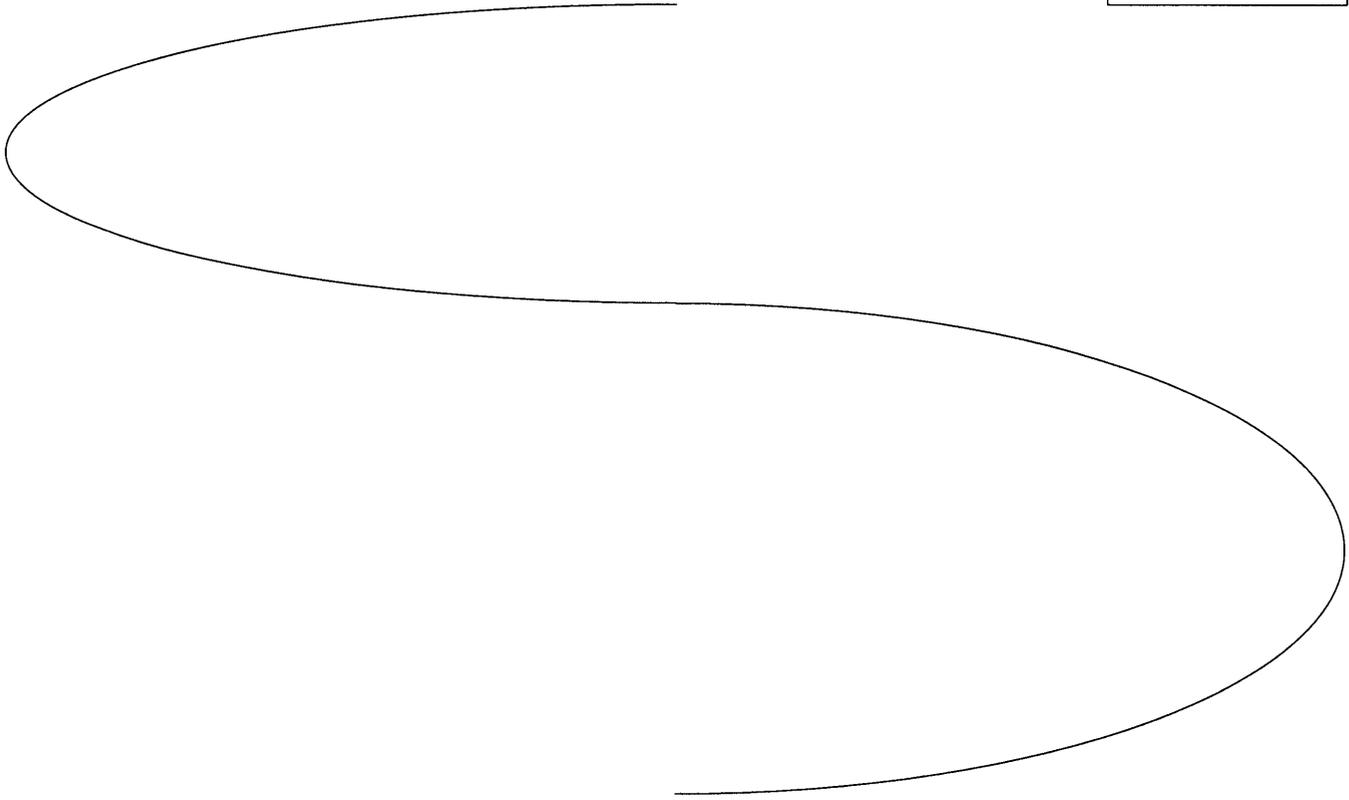
*** csauceda Aug 27 2004 3:20PM ***

System ID	Customer ID	CED	Matrix	Containers	Special Reqs.
250244	Soln A	08/26/04	Water	1	Oth
250245	Soln B	08/26/04	Water	1	Oth
250246	Soln C	08/26/04	Water	1	Oth
250247	Soln D	08/26/04	Water	1	Oth
250248	Soln E	08/26/04	Water	1	Oth
250249	Soln F	08/26/04	Water	1	Oth
250250	Soln G	08/26/04	Water	1	Oth
250251	Soln H	08/26/04	Water	1	Oth
250252	Soln I	08/26/04	Water	1	Oth

Containers: 9 **Samples: 9**

These documents are associated with this receipt: 12770[COC 26440]

Thermometer: 027
Temperature: 22.0



Client: DIV 20

SR#: 26440

FRM-002

Shipper Name/Address		SAMPLE LIST/CHAIN OF CUSTODY										Requested Turnaround:				
Bradley Herling CNWRA - Div. 20 Bldg. 57		Southwest Research Institute Chemistry and Chemical Engineering Division 6220 Culebra Road San Antonio, Texas 78238-5166										<input type="checkbox"/> 2 Weeks <input type="checkbox"/> 3 Weeks <input checked="" type="checkbox"/> Other: <u>4 weeks</u>				
												Client Purchase Order/Other ID				
Client		Analyses Requested										Mike Dammann				
Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	Ca, Mg, Ni, K, Sr by ICP								REMARKS		
Soln A	8/27/04		W		1	X							INTACT	Nuclear Safety related - use appropriate QA procedures		
Soln B						X										
Soln C						X										
Soln D						X										
Soln E						X										
Soln F						X										
Soln G						X										
Soln H						X										
Soln I						X										
Matrix Types: A - Air B - Biota D - Dust E - Emission/Stack L - Liquid P - Product Sd - Solid S - Soil SED - Sediment T - Tissue W - Water WP - Wipe		Sample Types: D - Duplicate ER - Equipment Rinsate ES - Environmental Sample FB - Field Blank FD - Field Duplicate MS - Matrix Spike MSD - Matrix Spike Dup TB - Trip Blank		Client: Div 20 SRR: 26440 Project #: 06002.01.141 Case #: CNWRA VTSR: 08/27/2004 Time: 10:00AM					Relinquished by (Print/Signature) Jan Brown		Date 8/27/04		Time 10:00am		SwRI Project: <u>12006002.01.141</u>	
Temp: 22.0°C		Therm #: 027		Received by (Print/Signature)					Date		Time		Received by SwRI Lab: (Signature)			
Comments: 653/100-101		Relinquished by (Print/Signature)					Date		Time		Date		Time		Samples Disposed:	
															Date	
															Time	
															Samples Disposed by:	

Client: Div 20
SRR: 26440
Project #: 06002.01.141
Case #: CNWRA
VTSR: 08/27/2004 Time: 10:00AM

010019

01-QPP-015
Division 01
Revision 5
June 2004

Document No. _____



Chemistry and Chemical
Engineering Division

QUALITY PROJECT PLAN FOR

**PERFORMANCE OF CHEMICAL ANALYSES
FOR COMMERCIAL NUCLEAR POWER PLANTS
WITHIN THE DEPARTMENT OF ANALYTICAL
AND ENVIRONMENTAL CHEMISTRY**

SOUTHWEST RESEARCH INSTITUTE
Chemistry and Chemical Engineering Division
6220 CULEBRA ROAD, SAN ANTONIO, TEXAS 78238

**QUALITY PROJECT PLAN FOR PERFORMANCE OF CHEMICAL ANALYSES
FOR COMMERCIAL NUCLEAR POWER PLANTS
WITHIN THE DEPARTMENT OF ANALYTICAL AND ENVIRONMENTAL CHEMISTRY**

SwRI AUTHORIZATION SIGNATORIES

This is to certify that this Quality Project Plan of Southwest Research Institute (SwRI) has been reviewed and approved by the following personnel:



JO ANN BOYD (210) 522-2169
Quality Assurance Manager

6/4/04

DATE



REZA KARIMI (210) 522-2412
Director, Department of Analytical and Environmental Chemistry

6/4/04

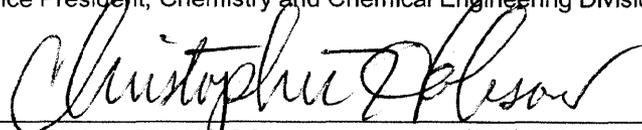
DATE



MICHAEL G. MACNAUGHTON (210) 522-5162
Vice President, Chemistry and Chemical Engineering Division

6/4/04

DATE



CHRISTOPHER HOBSON (210) 522-5838
Quality Assurance Engineer

6/4/2004

DATE

TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION.....	1
2.0 SCOPE.....	1
3.0 REFERENCES.....	1
4.0 APPLICABLE SECTIONS OF SwRI PROGRAM QUALITY PLAN (PQP-NUCLEAR).....	1
4.1 Indoctrination and Training.....	1
4.2 Qualification of Personnel.....	2
4.3 Design Control.....	2
4.4 Right of Access.....	2
4.5 Control of Supplier-Generated Documents.....	2
4.6 Acceptance of Services Only.....	3
4.7 Commercial Grade Items.....	3
4.8 Inspection.....	5
4.9 Inspection and Testing.....	5
4.10 Handling, Storage, Packaging, Preservation, and Delivery.....	5
4.11 Quality Assurance Records.....	6
4.12 10 CFR, Part 21.....	6
4.13 Certified Test Report.....	6
4.14 Valid Documents List.....	7
5.0 HISTORY OF REVISIONS.....	7

**PERFORMANCE OF CHEMICAL ANALYSES
FOR COMMERCIAL NUCLEAR POWER PLANTS WITHIN THE
DEPARTMENT OF ANALYTICAL AND ENVIRONMENTAL CHEMISTRY**

1.0 INTRODUCTION

This Quality Project Plan (QPP) defines the Quality Assurance (QA) program requirements for personnel providing the chemical analyses for commercial nuclear power plants. Southwest Research Institute (SwRI) **Program Quality Plan (PQP-Nuclear)**, *Nuclear Services* shall implement the QA requirements. Project activities controlled by the PQP-Nuclear shall be accomplished as specified by the appropriate sections of **01-QAP-004**, *Quality Assurance Plan for Analytical and Environmental Services* and/or nationally recognized testing methods as specified on individual purchase orders. This QPP shall be applied to all projects initiated for nuclear utilities in the Department of Analytical and Environmental Chemistry. If, as a result of complexity, duration, or other factors, it is determined that a unique, project-specific quality plan is required, the project QAE shall notify the Project Manager and a project-specific quality plan shall be generated in accordance with **SOP-01-4.2.1**, *Preparation and Revision of Documented Procedures*.

2.0 SCOPE

This Quality Project Plan shall be applied to the chemical analyses performed for commercial nuclear power plants by the Department of Analytical and Environmental Chemistry within the Chemistry and Chemical Engineering Division. Although the majority of the work performed for nuclear facilities resides within the Department of Analytical and Environmental Chemistry, other departments within the division may utilize this Quality Project Plan as deemed necessary when nuclear projects are conducted.

3.0 REFERENCES

- 3.1 *SwRI Quality System Manual – 2000*
- 3.2 *10 CFR 50, Appendix B, ASME NQA-1*
- 3.3 *SwRI Program Quality Plan (PQP-Nuclear), Nuclear Services*
- 3.4 *01-QAP-004, Quality Assurance Plan for Analytical and Environmental Services*

4.0 APPLICABLE SECTIONS OF SwRI PROGRAM QUALITY PLAN (PQP-NUCLEAR)**4.1 Indoctrination and Training**

- 4.1.1 Personnel performing duties affecting quality shall receive quality training to the *SwRI Program Quality Plan (PQP-Nuclear), Nuclear Services* prior to performing any work on projects for nuclear utilities. This training will be conducted either by Institute Quality Systems (IQS) or Division 01 Quality Assurance personnel and documentation shall be evident in the personnel training files maintained in Division

- 01 Quality Assurance.
- 4.1.2 Indoctrination and training of personnel shall be conducted in accordance with **SOP-01-6.2.1**, *Qualification and Training*.

4.2 Qualification of Personnel

- 4.2.1 Testing personnel shall be designated as qualified to perform applicable project activities as specified in **SOP-01-6.2.1**, *Qualification and Training*.
- 4.2.2 During the performance of each testing process, testing personnel shall have access to the necessary documented procedures, i.e., QPP, QAP, Task Order, Division Quality System Standard Operating Procedures (SOPs), and applicable test/analytical procedures (TAPs) available for ready reference.
- 4.2.3 Any person who has not performed testing activities associated with any particular method being used for nuclear utilities projects for a period of one year shall be reevaluated prior to the conduct of the test.
- 4.2.4 Quality Assurance personnel witnessing the testing process for nuclear utilities shall have documented evidence of qualifications maintained by Institute Quality Systems or Division 01 Quality Assurance.

4.3 Design Control

Not applicable to activities conducted within the Department of Analytical and Environmental Chemistry.

4.4 Right of Access

- 4.4.1 Procurement documents shall provide for access to the suppliers' facilities and records for surveillance, inspection, or audit by SwRI and clients.
- 4.4.2 Where appropriate, quality clause **Q32** shall be noted on the procurement documents to indicate that right of access for inspection and surveillance of activities associated with the order shall be afforded to SwRI and clients.

4.5 Control of Supplier-Generated Documents

- 4.5.1 Client documents shall be controlled in accordance with **SOP-01-4.2.1**, *Preparation and Revision of Documented Procedures*. These procedures provide the requirements for the preparation, review, approval, issue, distribution, and revision of documents controlled by the Chemistry and Chemical Engineering Division.
- 4.5.2 Documents may be controlled as Plans or Work Instructions and shall be accessible through the Division Intranet link, **Contract Requirements** as PDF files.
- 4.5.3 Nationally recognized test methods shall be of the most current issue or as specified in the purchase order. Task orders shall identify the applicable test methods to be used on the nuclear project.

4.6 Acceptance of Services Only

Not applicable to activities conducted within the Department of Analytical and Environmental Chemistry.

4.7 Commercial Grade Items

- 4.7.1 Where an item is to be incorporated into a test or deliverable to a client, and that item is not subject to design or specification requirements that are unique to nuclear facilities, used in applications other than nuclear facilities, and procured from the supplier on the specifications set forth in the manufacturers' published product and description, the item shall be considered "commercial grade".
- 4.7.2 Chemical reagents and standards used for testing purposes shall be ordered to specific chemical grades and certificates of analysis shall be required with each lot.
- 4.7.3 Controls for procurement planning, supplier selection, supplier performance evaluation, and acceptance of procured items and services other than chemical reagents and standards shall be as identified in **SOP-01-7.4.1, Purchasing**, and any referenced document within that procedure.
- 4.7.4 Receipt inspection of chemical reagents, standards, and test items for use on nuclear safety-related projects shall be performed by department personnel and documented on the *SwRI Receipt Traveler* or **FRM-109, Item Receipt Report**, as specified in **SOP-01-8.2.4, Monitoring and Measurement**. Any discrepancy such as a damaged container or container label shall be documented on the form and the client shall be contacted for disposition.
- 4.7.5 Prior or acceptance of a commercial grade item, the receipt inspection shall determine the following:
- (a) Damage was not sustained during shipment;
 - (b) The item has satisfied the specified acceptance criteria; and
 - (c) Specified documentation, as applicable to the item, was received and is acceptable.
- 4.7.6 Receipt inspection of chemical reagents and standards shall also consist of verification of chemical type, grade, container integrity, certificate of analysis, and shelf life, where applicable. Upon acceptance of chemical reagents and standards, the containers shall be labeled with the following:
- (a) Chemical name;
 - (b) Chemical grade;
 - (c) Lot code;

-
- (d) Date received; and
 - (e) Shelf life, when applicable.
- 4.7.7 Expired shelf life items shall not be used for testing purposes.
- 4.7.8 Lot codes of chemical reagents and standards used during equipment standardization and testing shall be recorded on the individual testing data sheets to provide traceability.
- 4.7.9 Samples supplied to SwRI for testing shall be received by the Sample Custodian and logged into the laboratory logbook. Sample documentation and sample custody shall be maintained in accordance with **TAP-01-0407-001**, *Sample Receipt Inspection*, and **TAP-01-0407-035**, *Organic and Inorganic Sample Security*.
- 4.7.10 Samples supplied to SwRI for testing shall be labeled with the following:
- (a) Sample control number;
 - (b) Purchase order number;
 - (c) Purchase order line item number, as applicable;
 - (d) Task order number;
 - (e) Nuclear QA label; and
 - (f) Sample retention date, when applicable.
- 4.7.11 In the event that samples are damaged upon receipt, a **Sample Discrepancy Record** shall be generated from the Division Intranet.
- 4.7.12 The testing task order shall list the project number, tests required, test methods required, and shall be labeled *Nuclear Quality*.
- 4.7.13 Identification and traceability shall be maintained in accordance with **SOP-01-7.5.1**, *Item Identification and Traceability*.

4.8 Inspection

- 4.8.1 Inspection for acceptance shall be performed by qualified persons other than those who conduct or directly supervise the work being inspected.
- 4.8.2 Institute Quality System (IQS) personnel shall perform surveillance activities as required to ensure compliance with the contract and this Quality Project Plan. Specific areas in which IQS may perform surveillance activities include, but are not limited to, the following:
- (a) Receiving inspection and labeling of chemical reagents, standards, and testing samples;
 - (b) Testing processes;
 - (c) Calibration and major equipment;
 - (d) Sample and record retention; and
 - (e) Test records.

4.9 Inspection and Testing

- 4.9.1 Required tests for acceptance shall be conducted under appropriate environmental conditions using the tools and equipment necessary to conduct the test in a manner to fulfill test requirements and acceptance criteria.
- 4.9.2 Tests shall be conducted, controlled, and verified in accordance with **SOP-01-8.2.4, *Monitoring and Measurement***.
- 4.9.3 Controls for measuring and test equipment shall be as specified in **SOP-01-7.6.1, *Control of Measuring and Test Equipment***.
- 4.9.4 Controls for identification, segregation, reporting, and resolution of nonconforming items and conditions shall be as specified in **SOP-01-8.3.1, *Nonconformance Reporting***.

4.10 Handling, Storage, Packaging, Preservation, and Delivery

- 4.10.1 Controls for handling, storage, packaging, preservation, and delivery of items are identified in **SOP-01-7.5.3, *Handling, Storage, Packaging, Protection, and Delivery of Items***.
- 4.10.2 Samples specified on the purchase order to be returned to the client shall be prepared and packaged as specified on the purchase order. Each package shall be marked legibly and indelibly with the purchase order/release number and line item number(s) relevant to the package.

4.11 Quality Assurance Records

- 4.11.1 Quality assurance records shall furnish documentary evidence that items or activities meet specified quality requirements. Documents that ensure this evidence include **TAP-01-0407-014**, *Inventory of Case File Purges*, and **SOP-01-4.2.4**, *Storage and Maintenance of Quality Records*. These documents and this QPP ensure that QA records shall be legible, identifiable, retrievable, and maintained in dual storage.
- 4.11.2 Records shall be traceable to associated items and activities and shall accurately reflect the work accomplished or information required.
- 4.11.3 Documents shall be considered valid records only if stamped, initialed or signed and dated by authorized personnel or otherwise authenticated.
- 4.11.4 Records of test analyses performed by the Department of Analytical and Environmental Chemistry are classified as *nonpermanent* and shall be retained for a minimum of five years. Nonpermanent records are those required to show evidence that an activity was performed in accordance with the applicable requirements, but need not be retained for the life of the item. Based on the use of the final data, the client shall be responsible for determining and implementing permanent storage requirements.
- 4.11.5 In order to satisfy duplicate storage requirements, one copy of the QA record shall be maintained by the Project Manager in Building 70 and a separate copy shall be maintained in the Division Quality Assurance Archives in Building 201. Storage requirements shall be as stated in **SOP-01-4.2.4**, *Storage and Maintenance of Quality Records*, to ensure protection against the risk of damage or destruction.

4.12 10 CFR, Part 21

- 4.12.1 SwRI procurement documents shall include requirements for reporting and approving disposition of supplier nonconformances and, when required, compliance to 10 CFR, Part 21.
- 4.12.2 The Manager of Institute Quality Assurance or Director of Institute Quality Systems shall determine if a nonconforming condition is reportable under 10 CFR, Part 21, and initiate reporting and condition in accordance with the SwRI Operating Policies and Procedures (OPP). Safety hazards or defects that could create a substantial safety hazard shall be reported. Substantial safety hazard means a loss of safety function to the extent that there is a major reduction in the degree of protection provided to public health and safety.

4.13 Certified Test Report

The Project Manager and Institute Quality Assurance Manager as complying with all contractual requirements shall certify test reports. The certified test report shall reference the purchase order/release number, the test methods performed, and the purchase

order/release line item number.

4.14 Valid Documents List

The Department of Analytical and Environmental Chemistry task order shall specify all applicable documents and appropriate document revision level for each document. The task order shall then serve as the Valid Documents List (VDL) for each individual project.

5.0 HISTORY OF REVISIONS

Versions 0 through 3 of this plan are maintained on record in Division 01 Quality Assurance.

Revision 4

Title of document changed from the Standard Project Quality Plan *SPQP-CHIAN* to Quality Project Plan, *QPP-015*

Extensive revision to comply with Project Quality Plan PQP-Nuclear, *Nuclear Services*, which replaces SwRI NQAPM, *Nuclear Quality Assurance Program Manual*.

Revision 5

Revised 4.1.1 to include designated Division 01 QA staff to conduct pertinent nuclear training sessions to the SwRI Program Quality Plan (PQP-Nuclear), *Nuclear Services*

Revised step 4.2.4 to include Division QA as an entity along with IQS, to maintain documented evidence of qualifications

010029

**SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT**

CLIENT: Division 20

TASK ORDER: 040827-12

SRR: 26440

SDG: 250244

CASE: CNWRA

VTSR: August 27, 2004

PROJECT#: 06002.01.141

Chain of Custody/Login Paperwork

12770

Shipper Name/Address Bradley Herling CNWRA - Div. 20 Bldg. 57		SAMPLE LIST/CHAIN OF CUSTODY Southwest Research Institute Chemistry and Chemical Engineering Division 6220 Culebra Road San Antonio, Texas 78238-5166						Requested Turnaround: <input type="checkbox"/> 2 Weeks <input type="checkbox"/> 3 Weeks <input checked="" type="checkbox"/> Other: <u>4 weeks</u>		
Client		Client Purchase Order/Other ID			Site/Zone ID			SwRI Contact Mike Dammann		
		Analyses Requested						REMARKS Preservation a = HCl to pH <2 b = HNO ₃ to pH <2 c = H ₂ SO ₄ to pH <2 d = NaOH to pH >12 e = Cool (4°C±2°C) f = Other (specify) <u>none</u>		
Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	Ca, Mg, Mn, K, Sr by ICP				
Soln A	8/27/04		W		1	X			INTACT Nuclear Safety related - use appropriate QA procedures POC - Brad Herling X 6565 Fax 5184 12006002.01.141	
Soln B						X				
Soln C						X				
Soln D						X				
Soln E						X				
Soln F						X				
Soln G						X				
Soln H						X				
Soln I						X				
Matrix Types: A - Air B - Biota D - Dust E - Emission/Stack L - Liquid P - Product Sd - Solid S - Soil SED - Sediment T - Tissue W - Water WP - Wipe		Sample Types: D - Duplicate ER - Equipment Rinsate ES - Environmental Sample FB - Field Blank FD - Field Duplicate MS - Matrix Spike MSD - Matrix Spike Dup TB - Trip Blank		Relinquished by (Print/Signature) Jon Brown			Date	Time	SwRI Project # 12006002.01.141	
Temp: 22.0°C		Therm #: 027		Received by (Print/Signature) <i>[Signature]</i>			Date	Time	Received by SwRI Lab: (Signature) <i>[Signature]</i>	
Comments: 653/100-101		Relinquished by (Print/Signature)			Date	Time	Date		Time	
							08/27/04		10:00 AM	
							Samples Disposed:		010030	
							Date	Time		
							Samples Disposed by:			

SAMPLE LOG-IN SHEET

010031

Lab Name Southwest Research Institute		Page 1 of 1	
Received By (Print Name) CYNTHIA SAUCEDA		Log-in Date 08/27/2004	
Received By (Signature) <i>Cynthia Saucedo</i>			
Case Number CNWRA	Sample Delivery Group No.	SAS Number N/A	
Remarks: 06002.01.141		Remarks: Condition of Sample Shipment, etc	
		Corresponding	
	EPA Sample #	Sample Tag #	Assigned Lab #
1. Custody Seal(s)	Present/ Absent Intact/Broken	Soln A	None
		Soln B	None
2. Custody Seal Nos.	<u>N/A</u>	Soln C	None
		Soln D	None
3. Chain-of Custody Records	Present /Absent*	Soln E	None
4. Traffic Reports or Packing Lists	Present/ Absent	Soln F	None
5. Airbill	Airbill/Sticker Present /Absent*	Soln G	None
		Soln H	None
6. Airbill No.	HAND DELIVERED	Soln I	None
7. Sample Tags	Present/ Absent		
Sample Tag Numbers	Listed/ Not listed on Chain of Custody		
8. Sample Condition	Intact /Broken*/ Leaking		
9. Cooler Temperature	22.0C		
10. Does Information on custody records, traffic reports, and sample tags agree?	Yes /No*		
11. Date Received at Lab	08/27/2004		
12. Time Received	10:00:00		
Sample Transfer			
Fraction INORGANIC	Fraction		
Area # COOLER 1B	Area # 4 08/27/2004		
By CYNTHIA SAUCEDA	By		
On 08/27/2004	On		
* Contact SMO and attach record of resolution			
Reviewed By <i>Cynthia A. Saucedo</i>	Logbook No.	Sample Receipt (26440)	
Date 08/27/2004	Logbook Page No.	5177 (SECTION 2 OF 5)	

010032

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 040827-12

SRR: 26440

SDG: 250244

CASE: CNWRA

VTSR: August 27, 2004

PROJECT#: 06002.01.141

Copies of Login Book

Sample Login Book

Aug 27, 2004

010033

SwRI Login Area
Division 1

Sample Receipt: 26438		Project: 06355.38.00X	Client: Bechtel BWXT Ida
VTSR Date: Aug 27, 2004		VTSR Time: 08:15:00	Manager: DAMMANN, MIKE
System ID	Customer Sample ID	Matrix	
250232	ECT111029A	Soil	
250233	ECT112019A	Soil	
250234	ECT113019A	Soil	
250235	ECT114019A	Soil	
250236	ECT115019A	Soil	
250237	ECT116019A	Soil	
250238	ECT117019A	Soil	
250239	ECT118019A	Soil	
250240	ECT119019A	Soil	
250241	ECT120019A	Soil	

Sample Receipt: 26439		Project: 10374.01.00X	Client: BATTELLE PNNL
VTSR Date: Aug 27, 2004		VTSR Time: 08:15:00	Manager: DAMMANN, MIKE
System ID	Customer Sample ID	Matrix	
250242	BV-ES32A-T-M-01	Solid	
250243	BV-ES32A-T-M-02	Solid	

Sample Receipt: 26440		Project: 06002.01.141	Client: DIV 20
VTSR Date: Aug 27, 2004		VTSR Time: 10:00:00	Manager: DAMMANN, MIKE
System ID	Customer Sample ID	Matrix	
250244	Soln A	Water	
250245	Soln B	Water	
250246	Soln C	Water	
250247	Soln D	Water	
250248	Soln E	Water	
250249	Soln F	Water	
250250	Soln G	Water	
250251	Soln H	Water	
250252	Soln I	Water	

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 040827-12

SRR: 26440

SDG: 250244

CASE: CNWRA

VTSR: August 27, 2004

PROJECT#: 06002.01.141

010034

RAW DATA

TRACE METALS PREPARATORY LABORATORY DIGESTION LOG

SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO, TEXAS 78228

BOOK / PAGE: 58 167

CLIENT(S): Div. 20 010035
 TASK ORDER(S): 040827-12 SDG(S): 250244
 PROJECT NO(S): 06002-01-241
 METHOD: 3005A 3050B 3050B-7.5 3010A 3020A 7760A 7740A HClO₄ HClO₄/H₂SO₄
 Microwave Fusion Teflon Rock OTHER dilution (LF 10)
 MATRIX: Water Soil Biota Solid Liquid TCLP Ext OTHER
 INSTRUMENT: GFAA ICP ICP-MS IC FLAA HYDRIDE OTHER
 ACID INORG #: HNO₃# ** HCl# ** H₂SO₄# HClO₄# HF#
 INTERNAL STD: Sc @ 10 PPM Be @ 10 PPM SOURCE: IV INORG# 4840 EXP: 11/05 AMT: 50µl
 Oven/Hotplate/ Block ID: N/A Temperature (°C):

SAMPLE IDENTIFICATION	pH	WT (g)	I.V. (mL)	F.V. (mL)	
PBW-LO4E2			5	5	
LCSW-204E2 *			↓	↓	
250244			0.5 mL	↓	
↓ d			↓	↓	
↓ S *			↓	↓	
↓ 45			↓	↓	
↓ 46			↓	↓	
↓ 47			↓	↓	
↓ 48			↓	↓	
↓ 49			↓	↓	
↓ 50			↓	↓	
↓ 51			↓	↓	
↓ 52			↓	↓	
* Spiked 50µl Spike-11 (Spex, #4607, exp. 6/05)					
20µl TRAL-1 (Spex, #4767, exp. 9/05)					
100µl of 100ppm Sr (ISS-02-117-02, exp. 12/1/04)					
* ** RLB 02-048-03, 50% HCl, 8 1% HNO ₃ , exp. 2-4-04.					
11/4/04					
					LOCATION: N/A

PREPARED BY: [Signature] DATE: 11-4-04
 REVIEWED BY: [Signature] DATE: 11-5-04
 DISPOSAL INT/DATE/LOC: _____

TRACE METALS PREPARATORY LABORATORY DIGESTION LOG

SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO, TEXAS 78228

BOOK / PAGE: 58 168

010036

CLIENT(S): Div. 20

TASK ORDER(S): 040827-12 SDG(S): 250244

PROJECT NO(S): 06002.01.241

METHOD: 3005A 3050B 3050B-7.5 3010A 3020A 7760A 7740A HClO₄ HClO₄/H₂SO₄
 Microwave Fusion Teflon Rock OTHER Dilution (dt 100)

MATRIX: Water Soil Biota Solid Liquid TCLP Ext OTHER

INSTRUMENT: GFAA ICP ICP-MS IC FLAA HYDRIDE OTHER

ACID INORG #: HNO₃# HCl# H₂SO₄# HClO₄# HF#

INTERNAL STD: Sc @ 10 PPM Be @ 10 PPM SOURCE: 1V INORG# 4840 EXP: 11/05 AMT: 50µl

Oven/Hotplate/ Block ID: N/A Temperature (°C):

SAMPLE IDENTIFICATION	pH	WT (g)	I.V. (mL)	F.V. (mL)	
PBW-L04E3			5ml	5ml	
LCSW-L04E3 *			↓	↓	
250244			0.05 0.8ml		
d			↓	↓	
5 *			↓	↓	
45			↓	↓	
46			↓	↓	
47			↓	↓	
48			↓	↓	
49			↓	↓	
50			↓	↓	
51			↓	↓	
↓ 52			↓	↓	
* Spiked Soil Spike-1 (Spec, #1607, exp. 6/05)					
20µl ICAL-1 (Spec, # 4767, exp. 9/05)					
100 µl 100ppm Sr (SS-02-48117-02, exp. 12/1/04)					
** KE 11/4/04					
RLB 02-048-03			1% HNO ₃ , 5% HCl		
11/4/04 KE					
					LOCATION:

PREPARED BY: [Signature]

REVIEWED BY: [Signature]

DISPOSAL INT/DATE/LOC: _____

DATE: 11-4-04

DATE: 11-5-04

SwRI 02 117 010037

119

011 50

ISS-02-117-01

Khaled Edrisi

MDL Spiking Solution for M&E

HNO₃ INORG#: 4825

Make up in 100 ml volumetric flask in 1% HNO₃

Prepped By: Khaled Edrisi

Prep Date: 11/03/04

Exp Date: 12/01/04

INORG. #	Source	Expiration Date	Element	Stock Concentration (mg/L)	Amount added (ul)	Check	Final Concentration (ug/L)
4762	Inorganic Venture	10/01/05	Al	10000	25	✓	2.5
4464	Inorganic Venture	03/01/05	Sb	1000	25	✓	0.25
4433	Inorganic Venture	02/01/05	As	1000	25	✓	0.25
4465	Inorganic Venture	03/01/05	Ba	1000	25	✓	0.25
4592	Inorganic Venture	06/01/05	Be	1000	25	✓	0.25
4467	Inorganic Venture	03/01/05	Cd	1000	25	✓	0.25
4318	Inorganic Venture	12/01/04	Cr	1000	25	✓	0.25
4468	Inorganic Venture	03/01/05	Co	1000	25	✓	0.25
4469	Inorganic Venture	03/01/05	Cu	1000	25	✓	0.25
4774	Inorganic Venture	10/01/05	Pb	1000	25	✓	0.25
4434	Inorganic Venture	02/01/05	Mn	1000	25	✓	0.25
4471	Inorganic Venture	03/01/05	Mo	1000	25	✓	0.25
4472	Inorganic Venture	03/01/05	Ni	1000	25	✓	0.25
4630	Inorganic Venture	08/01/05	Se	1000	25	✓	0.25
4764	Inorganic Venture	10/01/05	Ag	1000	25	✓	0.25
4844	Inorganic Venture	12/01/05	Th	1000	25	✓	0.25
4435	Inorganic Venture	02/01/05	Tl	1000	25	✓	0.25
4828	Inorganic Venture	11/01/05	U	1000	25	✓	0.25
4321	Inorganic Venture	12/01/04	V	1000	25	✓	0.25
4319	Inorganic Venture	12/01/04	Zn	1000	250	✓	2.5

ISS 02-117-02

Elem. Source Inorg # exp. IC ppm Amt + FC ppm FV
 Sr IV 4635 9/1/05 1000 ~~50~~ 100ppm 5ml
 prep date 11-4-04 exp. 12-1-04
Khaled Edrisi

W. Range
 12/27/04

Trace Metals Reagent Logbook 010038

SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO, TEXAS 78228

BOOK / PAGE: 02 048

Reagent I.D.:	Preparation Description:	Prep Date:	Exp Date:	Initials:
RLB02-048-01	1% ^{11/21} Sodium tetraethylborate 1. Dissolve 2 G of KOH Inorg # <u>0136</u> in 100 mL V.F.; bring to volume with reagent water. 2. Transfer to Teflon bottle and chill. (Do next step very quickly to keep solution as cold as possible). 3. Add 5 mL KOH solution to 1 G bottle of Sodium tetraethylborate Inorg # <u>3876</u> shake and pour into 125 mL bottle of KOH solution. Cap and mix. 4. Repeat Step 3 above. 5. Mix the 100 mL Teflon bottle to dissolve completely. 6. Transfer equally into 8-25 mL Teflon tubes; freeze immediately. Do not use till completely frozen. Prep. Date <u>11/2/04</u> Expires: <u>11/9/04</u> Prep. By <u>BV</u>	11-2-04	11-9-04	BV
RLB02-048-02	2% Aqua Regia Div. (08) Dilute 10ml Aqua Regia in 500ml (5ml HNO ₃ # 4825, 15ml HCl 4818 FU-20ml)	11-2-04	2-2-05	KE
RLB02-048-03	1% HNO ₃ , 5% HCl Dilut 2ml HNO ₃ # 4818 4825 and 10ml HCl # 4818 to 200ml Di-water	11-4-04	2-4-05	KE
RLB02-048-04	1% ^{11/21} Sodium tetraethylborate 13. Dissolve 2 G of KOH Inorg # <u>0136</u> in 100 mL V.F.; bring to volume with reagent water. 14. Transfer to Teflon bottle and chill. (Do next step very quickly to keep solution as cold as possible). 15. Add 5 mL KOH solution to 1 G bottle of Sodium tetraethylborate Inorg # <u>4848</u> shake and pour into 125 mL bottle of KOH solution. Cap and mix. 16. Repeat Step 3 above. 17. Mix the 100 mL Teflon bottle to dissolve completely. 18. Transfer equally into 8-25 mL Teflon tubes; freeze immediately. Do not use till completely frozen. Prep. Date <u>11-4-04</u> Expires: <u>12-4-04</u> Prep. By <u>BV</u>	11-4-04	12-4-04	BV
RLB02-048-05	2% Aqua Regia, Dilute 20ml (5ml HNO ₃ # 4826 and 15ml HCl # 4819) to 1L	11-5-04	02-5-05	KE

SOUTHWEST RESEARCH INSTITUTE
6220 Culebra Rd
San Antonio, Texas 78228

010039

SPECTRO ICP DAILY LOG

ANALYST [Signature]
POWER: 1200

DATE 11-9-04
FLOWS:

Aux 40
Coolant 60
Mass Flow Controller 1054

CURRENT	PROPOSED	
5064	5058	Na
4787	4782	Fe
4950	4941	Sr

QC PREP DATE:	
CCV/ICV	<u>04102</u>
CRI	<u>[Signature]</u>
ICSA	<u>[Signature]</u>
ICSAB	<u>[Signature]</u>

CLP STD1 SC	<u>04102</u>
CLP STD2 SC	<u>04102</u>
CLP STD3 SC	<u>[Signature]</u>
CLP STD4 SC	<u>[Signature]</u>
CLP STD5 SC	<u>04102</u>
BLK SC	<u>04102</u>

FILE	CLIENT	TON	PROJECT NO.	METHOD	PREP PAGE
041109	DVZ	04527-12	06002.01.241	SWI	58167
041109	DVZ	1	06002.01.241	SWI	58168
<u>[Signature]</u> 11-9-04					

COMMENTS: _____

MAINTENANCE:	OTHER: _____
Cleaned Torch: _____ YES	_____
Changed Pump Tubing: <input checked="" type="checkbox"/> YES	_____
Cleaned Optics: _____ YES	_____
Polished Optics: _____ YES	_____

REVIEWED BY: [Signature] DATE: 11/14/04

ICP Calibration Blank/ICB/CCB Solution

13 002

ID: BLK- 04201

Date Prepared: 10-1-04

Prepared By: [Signature]

010040

Make up as needed in 1000ml volumetric flask.

Added 10 ml HNO3 INORG #: 4777

Added 50 ml HCL INORG #: 4797

Added 1000ul of 10000ppm Sc (INORG. VENT.) EXP. Date: ¹⁰⁻¹⁻⁰⁵~~10-5-04~~ INORG #: 4761

ICP Calibration Blank/ICB/CCB Solution

ID: BLK- 04218

Date Prepared: 10-18-04

Prepared By: [Signature]

Make up as needed in 1000ml volumetric flask.

Added 10 ml HNO3 INORG #: 4790

Added 50 ml HCL INORG #: 4816

Added 1000ul of 10000ppm Sc (INORG. VENT.) EXP. Date: 10-1-05 INORG #: 4761

ICP Calibration Blank/ICB/CCB Solution

ID: BLK- 04202

Date Prepared: 11-2-04

Prepared By: [Signature]

Make up as needed in 1000ml volumetric flask.

Added 10 ml HNO3 INORG #: 4825

Added 50 ml HCL INORG #: 4818

Added 1000ul of 10000ppm Sc (INORG. VENT.) EXP. Date: 10-1-05 INORG #: 4761

ICP Calibration Blank/ICB/CCB Solution

ID: BLK-

Date Prepared: _____

Prepared By: _____

Make up as needed in 1000ml volumetric flask.

Added _____ 10 ml HNO3 INORG #: _____

Added _____ 50 ml HCL INORG #: _____

Added _____ 1000ul of 10000ppm Sc (INORG. VENT.) EXP. Date: _____ INORG #: _____

ICP ICV/CCV SOLUTION

13 012

CCV-04102

Date Prepared: 11-2-04

Prepared By: *[Signature]*

010041

HNO3 INORG #: 4825

HCl INORG #: 4818

Make up as needed in 1000ml volumetric flask in 1% HNO3 AND 5% HCl.

Element	Std Conc (ppm)	Amt added	Check	Source	Inorg #	Stock Conc (ppm)	Exp Date
Sc	10	1ml		INORGVENT	4761	10000	10-1-05
B	5	5ml		SPEX	4564	1000	4-30-05
Li	5	5ml		SPEX	4439	1000	11-30-05
Mo	5	5ml		SPEX	4440	1000	8-30-05
P	5	5ml		SPEX	4758	1000	6-30-05
Si	5	5ml		SPEX	4616	1000	6-30-05
Ti	5	5ml		SPEX	4618	1000	8-30-05
Sr	5	5ml		SPEX	4759	1000	4-30-05
Sn	5	5ml		SPEX	4565	1000	2-28-05
Bi	5	5ml		SPEX	4475	1000	1-30-05
La	5	5ml		SPEX	4438	1000	1-30-05
Y	5	5ml		SPEX	4441	1000	1-15-05
Pd	1	1ml		SPEX	4417	1000	6-30-05
S	1	1ml		SPEX	4617	1000	6-30-05
Th	1	1ml		SPEX	4760	1000	6-30-05
U	1	1ml		SPEX	444619	1000	7-30-05
W	1	1ml		SPEX	4661	1000	7-30-05
Zr	5	5ml		SPEX	4566	1000	4-30-05
Na	10	1ml		SPEX	4443	10000	1-30-05
ICV-2A	vary	10ml		SPEX	4328	mix	11-30-04
ICV-2B	vary	1ml		SPEX	4329	mix	11-30-04
ICV-2C	vary	10ml		SPEX	4330	mix	11-30-04

[Handwritten notes on the right side of the table, including dates like 11-2-04, 1-30-05, 6-30-05, 8-30-05, 11-30-05, 1-15-05, 1-30-05, 1-5-05, 6-30-05, 8-30-05, 6-30-05]

Expiration Date: 11-30-04

ICP Calibration Standards

Date Prepared: 11-2-04 Prepared By: [Signature]

HNO3 INORG #: 4825 HCl INORG #: 4818

010042

Make up as needed in 500 ml volumetric flasks in 1% HNO3 and 5% HCl.

Prepared	Standard Name	Element	Std Conc (ppm)	Added ml	Check	Source	INORG #	Stock Conc (ppm)	Exp Date
11-2-04	STD1- OAL02	Al	50	2.50	/	INORVENT	4462	10000	10-1-05
		Ca	50	2.50	/	INORVENT	4436	10000	2-1-05
		Fe	50	2.50	/	INORVENT	4470	10000	3-1-05
		K	50	2.50	/	INORVENT	4320	10000	12-1-04
		Mg	25	1.25	/	INORVENT	4656	10000	8-1-05
		Na	50	2.50	/	INORVENT	4657	10000	8-1-05
		Li	10	5.00	/	INORVENT	4628	1000	8-1-05
		Sc	10	0.500	/	INORVENT	4761	10000	10-1-05
	STD2- OAL02	Ba	10	5.00	/	INORVENT	4465	1000	3-1-05
		Be	5	2.50	/	INORVENT	4592	1000	6-1-05
		Cr	10	5.00	/	INORVENT	4318	1000	12-1-04
		Cu	10	5.00	/	INORVENT	4469	1000	3-1-05
		Ni	10	5.00	/	INORVENT	4472	1000	3-1-05
		Sc	10	0.500	/	INORVENT	4761	10000	10-1-05
	STD3- OAL02	Cd	10	5.00	/	INORVENT	4467	1000	3-1-05
		Co	10	5.00	/	INORVENT	4468	1000	3-1-05
		Mn	10	5.00	/	INORVENT	4434	1000	2-1-05
		V	10	5.00	/	INORVENT	4321	1000	12-1-04
		Zn	10	5.00	/	INORVENT	4319	1000	12-1-05
		Sc	10	0.500	/	INORVENT	4761	10000	10-1-05
	STD4- OAL02	Ag	2	1.00	/	INORVENT	4764	1000	10-1-05
		As	10	5.00	/	INORVENT	4433	1000	2-1-05
		Pb	10	5.00	/	INORVENT	4774	1000	10-1-05
		Sb	10	5.00	/	INORVENT	4464	1000	3-1-05
		Se	10	5.00	/	INORVENT	4630	1000	8-1-05
		TL	10	5.00	/	INORVENT	4435	1000	2-1-05
		Sc	10	0.500	/	INORVENT	4761	10000	10-1-05
	STD5- OAL02	B	10	5.00	/	INORVENT	4466	1000	3-1-05
		Mo	10	5.00	/	INORVENT	4471	1000	3-1-05
		P	10	5.00	/	INORVENT	4593	1000	6-1-05
		Si	10	5.00	/	INORVENT	4437	1000	2-1-05
		Ti	10	5.00	/	INORVENT	4332	1000	12-1-04
		Sr	10	5.00	/	INORVENT	4635	1000	8-1-05
		Sn	10	5.00	/	INORVENT	4512	1000	4-1-05
		Bi	5	2.50	/	INORVENT	4658	1000	8-1-05
Sc	10	0.500	/	INORVENT	4761	10000	10-1-05		
11-2-04	STD6- OAL02	La	10	5.00	/	INORVENT	4763	1000	10-1-05
		Na	1	0.05	/	INORVENT	4657	10000	8-1-05
		Pd	10	5.00	/	INORVENT	4477	1000	3-1-05
		S	10	5.00	/	INORVENT	4317	1000	12-1-04
		Th	10	5.00	/	INORVENT	4844	1000	12-1-05
		U	10	5.00	/	INORVENT	4473	1000	3-1-05
		W	5	2.50	/	INORVENT	4660	1000	8-1-05
		Y	10	5.00	/	INORVENT	4513	1000	4-1-05
		Zr	10	5.00	/	INORVENT	4474	1000	3-1-05
		SC	10	0.500	/	INORVENT	4761	10000	10-1-05

Expiration Dates:

STD1: 12-1-04

STD4: 12-1-04

STD2: 12-1-04

STD5: 12-1-04

STD3: 12-1-04

STD6: 12-1-04

Div 20
to#040827-12
06002.01.241

JRangr
11/23/04

250244 for Ca

$$\frac{71.0498 \mu\text{g/ml} \times 5 \text{ml}}{0.05 \text{ml}}$$
 = 7105 mg/L

✓ RSpies
12/21/04

010043

system id	elem	result	qual	units	rl	tv	rec	ug/ml	rl	df	mg/L	date	time
250244	Ca317	7105		mg/L	1			71.0498	0.1	100	7104.98	11/09/04	16:34:03
250244	K 766	2.5	U	mg/L	2.5			0.2013	0.25	10	2.013	11/09/04	17:34:28
250244	Mg279	1	U	mg/L	1			0.0464	0.1	10	0.464	11/09/04	17:34:28
250244	Na589	221		mg/L	2			2.2082	0.2	100	220.82	11/09/04	16:34:03
250244	Sr421	3.71		mg/L	0.1			0.3705	0.01	10	3.705	11/09/04	17:34:28
250244d	Ca317	7107		mg/L	1			71.0653	0.1	100	7106.53	11/09/04	16:37:11
250244d	K 766	2.5	U	mg/L	2.5			0.1930	0.25	10	1.93	11/09/04	17:38:06
250244d	Mg279	1	U	mg/L	1			0.0054	0.1	10	0.054	11/09/04	17:38:06
250244d	Na589	217		mg/L	2			2.1743	0.2	100	217.43	11/09/04	16:37:11
250244d	Sr421	3.70		mg/L	0.1			0.3700	0.01	10	3.7	11/09/04	17:38:06
250244s	Ca317	9237		mg/L	1	2000	106.6%	92.3697	0.1	100	9236.97	11/09/04	16:40:19
250244s	K 766	213		mg/L	2.5	200	106.6%	21.3137	0.25	10	213.137	11/09/04	17:41:14
250244s	Mg279	188		mg/L	1	200	93.9%	18.7714	0.1	10	187.714	11/09/04	17:41:14
250244s	Na589	2267		mg/L	2	2000	102.3%	22.6671	0.2	100	2266.71	11/09/04	16:40:19
250244s	Sr421	44.4		mg/L	0.1	40	101.8%	4.4411	0.01	10	44.411	11/09/04	17:41:14
250245	Ca317	1528		mg/L	1			15.2765	0.1	100	1527.65	11/09/04	16:43:26
250245	K 766	2.5	U	mg/L	2.5			0.1210	0.25	10	1.21	11/09/04	17:44:21
250245	Mg279	1	U	mg/L	1			0.0253	0.1	10	0.253	11/09/04	17:44:21
250245	Na589	214		mg/L	2			2.1391	0.2	100	213.91	11/09/04	16:43:26
250245	Sr421	0.803		mg/L	0.1			0.0803	0.01	10	0.803	11/09/04	17:44:21
250246	Ca317	490		mg/L	1			4.9036	0.1	100	490.36	11/09/04	16:47:04
250246	K 766	2.5	U	mg/L	2.5			0.1392	0.25	10	1.392	11/09/04	17:47:29
250246	Mg279	1	U	mg/L	1			0.0075	0.1	10	0.075	11/09/04	17:47:29
250246	Na589	2199		mg/L	2			21.9860	0.2	100	2198.6	11/09/04	16:47:04
250246	Sr421	0.264		mg/L	0.1			0.0264	0.01	10	0.264	11/09/04	17:47:29
250247	Ca317	146		mg/L	1			1.4641	0.1	100	146.41	11/09/04	16:50:12
250247	K 766	2.5	U	mg/L	2.5			-0.0541	0.25	10	-0.541	11/09/04	17:51:07
250247	Mg279	1	U	mg/L	1			0.0075	0.1	10	0.075	11/09/04	17:51:07
250247	Na589	2151		mg/L	2			21.5075	0.2	100	2150.75	11/09/04	16:50:12
250247	Sr421	0.1	U	mg/L	0.1			0.0046	0.01	10	0.046	11/09/04	17:51:07
250248	Ca317	48.2		mg/L	1			4.8171	0.1	10	48.171	11/09/04	17:54:14
250248	K 766	2.5	U	mg/L	2.5			0.1770	0.25	10	1.77	11/09/04	17:54:14
250248	Mg279	1	U	mg/L	1			-0.0038	0.1	10	-0.038	11/09/04	17:54:14
250248	Na589	2197		mg/L	2			21.9678	0.2	100	2196.78	11/09/04	16:53:20
250248	Sr421	0.1	U	mg/L	0.1			0.0021	0.01	10	0.021	11/09/04	17:54:14
250249	Ca317	20.4		mg/L	1			2.0373	0.1	10	20.373	11/09/04	17:57:22
250249	K 766	2.5	U	mg/L	2.5			0.1085	0.25	10	1.085	11/09/04	17:57:22
250249	Mg279	1	U	mg/L	1			0.0108	0.1	10	0.108	11/09/04	17:57:22
250249	Na589	2237		mg/L	2			22.3671	0.2	100	2236.71	11/09/04	16:56:27
250249	Sr421	0.1	U	mg/L	0.1			0.0010	0.01	10	0.01	11/09/04	17:57:22

Div 20
to#040827-12
06002.01.241

system id	elem	result	qual	units	rl	tv	rec	ug/ml	rl	df	mg/L	date	time
250250	Ca317	5.58		mg/L	1			0.5580	0.1	10	5.58	11/09/04	18:10:07
250250	K 766	2.5	U	mg/L	2.5			0.1579	0.25	10	1.579	11/09/04	18:10:07
250250	Mg279	1	U	mg/L	1			0.0112	0.1	10	0.112	11/09/04	18:10:07
250250	Na589	2237		mg/L	2			22.3699	0.2	100	2236.99	11/09/04	17:09:11
250250	Sr421	0.1	U	mg/L	0.1			0.0000	0.01	10	0	11/09/04	18:10:07
250251	Ca317	2.01		mg/L	1			0.2009	0.1	10	2.009	11/09/04	18:13:15
250251	K 766	2.5	U	mg/L	2.5			0.1087	0.25	10	1.087	11/09/04	18:13:15
250251	Mg279	1	U	mg/L	1			0.0182	0.1	10	0.182	11/09/04	18:13:15
250251	Na589	2353		mg/L	2			23.5290	0.2	100	2352.9	11/09/04	17:12:20
250251	Sr421	0.1	U	mg/L	0.1			-0.0010	0.01	10	-0.01	11/09/04	18:13:15
250252	Ca317	101		mg/L	1			10.1366	0.1	10	101.366	11/09/04	18:16:23
250252	K 766	91.3		mg/L	2.5			9.1319	0.25	10	91.319	11/09/04	18:16:23
250252	Mg279	94.8		mg/L	1			0.9475	0.1	100	94.75	11/09/04	17:15:28
250252	Na589	96.0		mg/L	2			9.5958	0.2	10	95.958	11/09/04	18:16:23
250252	Sr421	0.1	U	mg/L	0.1			-0.0015	0.01	10	-0.015	11/09/04	18:16:23
lcsw-L04E2	Ca317	210		mg/L	1	200	104.8%	20.9516	0.1	10	209.516	11/09/04	17:31:20
lcsw-L04E2	K 766	195		mg/L	2.5	200	97.3%	19.4536	0.25	10	194.536	11/09/04	17:31:20
lcsw-L04E2	Mg279	187		mg/L	1	200	93.4%	18.6788	0.1	10	186.788	11/09/04	17:31:20
lcsw-L04E2	Sr421	41.0		mg/L	0.1	40	102.4%	4.0966	0.01	10	40.966	11/09/04	17:31:20
lcsw-L04E3	Na589	197		mg/L	2	200	98.5%	19.7059	0.2	10	197.059	11/09/04	16:30:25
pbw-L04E2	Ca317	1	U	mg/L	1			0.0062	0.1	10	0.062	11/09/04	17:28:12
pbw-L04E2	K 766	2.5	U	mg/L	2.5			0.0439	0.25	10	0.439	11/09/04	17:28:12
pbw-L04E2	Mg279	1	U	mg/L	1			0.0207	0.1	10	0.207	11/09/04	17:28:12
pbw-L04E2	Sr421	0.1	U	mg/L	0.1			-0.0005	0.01	10	-0.005	11/09/04	17:28:12
pbw-L04E3	Na589	2	U	mg/L	2			-0.0554	0.2	10	-0.554	11/09/04	16:27:17

010044

ICP ANALYSIS

010045

PROJ. NO.	PROJECT	TO#	DATE	MATRIX	LOGBK PG
<u>06002.01.0241</u>	<u>Div 20</u>	<u>040827.1211-9-04</u>		<u>Water</u>	<u>58167</u>
<u>06002.01.241</u>	<u>Div 20</u>		<u>11-9-04</u>	<u>Water</u>	<u>58168</u>

INSTRUMENT: Spectro FILENAME: 041109

INSTRUMENT DL: _____

010046

BACKGROUND CORRECTED INTENSITIES

Identity 1 : BLK_SC Identity 2 : Type : STD

Weight : 1.0000 Volume : 1.00 Printed : 3:38:42 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	10.5	13.5	-1.0	-5.5	20.0	-13.5	-18.5
# 2	6.5	13.5	1.0	-1.5	6.0	-10.5	6.5
Mean	8.5	13.5	0.0	-3.5	13.0	-12.0	-6.0
SD	2.8	0.0	1.4	2.8	9.9	2.1	17.7
%RSD	33.3	0.0	0.0	80.8	76.1	17.7	294.6

	Na589	Sc361	Sr421
# 1	55.0	4825.5	1.5
# 2	67.0	4828.5	0.5
Mean	61.0	4827.0	1.0
SD	8.5	2.1	0.7
%RSD	13.9	0.0	70.7

INTENSITIES

Identity 1 : BLK_SC Identity 2 : Type : STD

Weight : 1.0000 Volume : 1.00 Printed : 3:38:44 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0
# 2	0.0	0.0	0.0	-0.0	0.0	-0.0	0.0
Mean	0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%RSD	33.3	0.0	455093.9	80.8	76.2	17.7	294.5

	Na589	Sc361	Sr421
# 1	0.0	4825.5	0.0
# 2	0.0	4828.5	0.0
Mean	0.0	4827.0	0.0
SD	0.0	2.1	0.0
%RSD	13.9	0.0	70.7

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_STD1_SC Identity 2 : Type : STD

Weight : 1.0000 Volume : 1.00 Printed : 3:41:42 PM November 9, 2004

	Al396	Ca317	Fe259	K_766	Li670	Mg279	Na589
# 1	11488.5	12015.5	24150.0	4534.0	37509.0	29784.0	25408.5
# 2	11456.5	11999.5	24089.0	4539.0	37554.0	29714.0	25393.5
Mean	11472.5	12007.5	24119.5	4536.5	37531.5	29749.0	25401.0
SD	22.6	11.3	43.1	3.5	31.8	49.5	10.6
%RSD	0.2	0.1	0.2	0.1	0.1	0.2	0.0

1
2

Mean
SD
%RSD

DL 11-9-04

ASR
11/23/04

INTENSITIES

Identity 1 : CLP_STD1_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 3:41:42 PM November 9, 2004

010047

EVOLUTION by Micro-Active Australia Pty Ltd 3:51:40 PM November 9, 2004

	Al396	Ca317	Fe259	K_766	Li670	Mg279	Na589
# 1	2.4	2.5	5.1	1.0	7.9	6.3	5.3
# 2	2.4	2.5	5.1	1.0	7.9	6.3	5.3
Mean	2.4	2.5	5.1	1.0	7.9	6.3	5.3
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RSD	0.0	0.1	0.0	0.2	0.2	0.0	0.1

1
2

Mean
SD
RSD

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_STD2_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 3:44:06 PM November 9, 2004

	Be 313
# 1	45038.5
# 2	44819.5
Mean	44929.0
SD	154.9
RSD	0.3

INTENSITIES

Identity 1 : CLP_STD2_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 3:44:06 PM November 9, 2004

	Be 313
# 1	9.3
# 2	9.3
Mean	9.3
SD	0.0
RSD	0.0

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_STD5_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 3:46:44 PM November 9, 2004

	Sr421
# 1	9704.0
# 2	9624.0
Mean	9664.0
SD	56.6
RSD	0.6

INTENSITIES

Identity 1 : CLP_STD5_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 3:46:44 PM November 9, 2004

	Sr421
# 1	2.0
# 2	2.0

Mean 2.0
SD 0.0
RSD 0.1

010048

EVOLUTION by Micro-Active Australia Pty Ltd 4:17:50 PM November 9, 2004

	Al396	Ca317	Fe259	K_766	Li670	Mg279	Na589
# 1	2.4	2.5	5.1	1.0	7.9	6.3	5.3
# 2	2.4	2.5	5.1	1.0	7.9	6.3	5.3
Mean	2.4	2.5	5.1	1.0	7.9	6.3	5.3
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RSD	0.0	0.1	0.0	0.2	0.2	0.0	0.1

1
2

Mean
SD
RSD

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_STD2_SC Identity 2 : Type : STD
Height : 1.0000 Volume : 1.00 Printed : 3:44:06 PM November 9, 2004

Be 313
1 45038.5
2 44819.5
Mean 44929.0
SD 154.9
RSD 0.3

INTENSITIES

Identity 1 : CLP_STD2_SC Identity 2 : Type : STD
Height : 1.0000 Volume : 1.00 Printed : 3:44:06 PM November 9, 2004

Be 313
1 9.3
2 9.3
Mean 9.3
SD 0.0
RSD 0.0

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_STD5_SC Identity 2 : Type : STD
Height : 1.0000 Volume : 1.00 Printed : 3:46:44 PM November 9, 2004

Sr421
1 9704.0
2 9624.0
Mean 9664.0
SD 56.6
RSD 0.6

INTENSITIES

Identity 1 : CLP_STD5_SC Identity 2 : Type : STD
Height : 1.0000 Volume : 1.00 Printed : 3:46:44 PM November 9, 2004

Sr421
1 2.0
2 2.0

Mean 2.0
 D 0.0
 RSD 0.1

EVOLUTION by Micro-Active Australia Pty Ltd 4:17:50 PM November 9, 2004

010049

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_CCv_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 3:51:38 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	2437.5	8905.5	5069.5	5054.0	1871.5	19173.0	24360.0
# 2	2425.5	8866.5	5070.5	5006.0	1868.5	19149.0	24427.0
Mean	2431.5	8886.0	5070.0	5030.0	1870.0	19161.0	24393.5
D	8.5	27.6	0.7	33.9	2.1	17.0	47.4
RSD	0.3	0.3	0.0	0.7	0.1	0.1	0.2

	Na589	Sc	Sc361	Sr421
# 1	15651.5	4941.0	4941.0	4941.5
# 2	15600.5	4890.0	4890.0	4927.5
Mean	15626.0	4915.5	4915.5	4934.5
D	36.1	36.1	36.1	9.9
RSD	0.2	0.7	0.7	0.2

APPARENT CONCENTRATIONS

Identity 1 : CLP_CCv_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 3:51:38 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	10.1986	0.9674	20.3236	10.0925	19.7736	4.9199	19.7100
# 2	10.2544	0.9732	20.5396	10.1010	19.9491	4.9649	19.9703
Mean	10.2265	0.9703	20.4316	10.0967	19.8614	4.9424	19.8401
D	0.0395	0.0041	0.1527	0.0059	0.1241	0.0319	0.1840
RSD	0.3861	0.4240	0.7476	0.0588	0.6246	0.6447	0.9276

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1	29.6133	4941.000 H	102.3647	4.9431
# 2	29.8255	4890.000 H	101.3068	4.9805
Mean	29.7194	4915.500 H	101.8357	4.9618
D	0.1500	36.062	0.7480	0.0265
RSD	0.5049	0.734	0.7345	0.5331

Checking calibration verification ...

Identity 1 : CLP_CCv_SC Identity 2 :

Report name	Low limit	Value	High limit
Al396	9.000	10.226	11.000
Be 313	0.900	0.970	1.100
Ca317	18.000	20.432	22.000
Fe259	9.000	10.097	11.000
K_766	18.000	19.861	22.000
Li670	4.500	4.942	5.500
Mg279	18.000	19.840	22.000
Na589	27.000	29.719	33.000
Sr421	4.500	4.962	5.500

010050

Keep last result visible enabled ...
 Starting run ...
 Creating high priority queue entries ...

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 4:24:18 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	13.0	14.5	0.5	4.5	20.0	-18.5	-1.0
# 2	9.0	12.5	2.5	4.5	5.0	-24.5	-17.0
Mean	11.0	13.5	1.5	4.5	12.5	-21.5	-9.0
SD	2.8	1.4	1.4	0.0	10.6	4.2	11.3
RSD	25.7	10.5	94.3	0.0	84.9	19.7	125.7

	Na589	Sc	Sc361	Sr421
# 1	30.5	4899.5	4899.5	2.0
# 2	20.5	4874.5	4874.5	-1.0
Mean	25.5	4887.0	4887.0	0.5
SD	7.1	17.7	17.7	2.1
RSD	27.7	0.4	0.4	424.3

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 4:24:18 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0185	0.0001	0.0020	0.0162	0.0730 L	-0.0016	0.0042
# 2	0.0018 L	-0.0001	0.0102	0.0163 L	-0.0877 L	-0.0032 L	-0.0090
Mean	0.0101 L	-0.0000	0.0061	0.0162 L	-0.0073 L	-0.0024 L	-0.0024
SD	0.0118	0.0002	0.0058	0.0000	0.1136	0.0011	0.0093
RSD	116.7143	801.8701	94.4815	0.2024	1551.5740	46.1652	385.1516

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1 L	-0.0602	4899.500 H	101.5038	0.0010
# 2 L	-0.0791	4874.500 H	100.9853 L	-0.0020
Mean L	-0.0697	4887.000 H	101.2446 L	-0.0005
SD	0.0134	17.678	0.3667	0.0021
RSD	19.2410	0.362	0.3622	410.5511

Checking calibration blank ...

Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value
Al396	0.050	0.010
Be 313	0.050	-0.000
Ca317	0.050	0.006
Fe259	0.050	0.016
K_766	0.000	-0.007
Li670	0.050	-0.002
Mg279	0.050	-0.002
Na589	0.200	-0.070
Sc361	0.000	101.245
Sr421	0.050	-0.001

BACKGROUND CORRECTED INTENSITIES

Identity 1 : pbw-L04E3 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:27:34 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
EVOLUTION by Micro-Active Australia Pty Ltd 4:27:54 PM November 9, 2004							
# 1	8.5	16.5	-0.5	-1.5	11.0	-22.0	5.5
# 2	6.5	14.5	2.5	1.5	15.0	-10.0	11.5
Mean	7.5	15.5	1.0	0.0	13.0	-16.0	8.5
SD	1.4	1.4	2.1	2.1	2.8	8.5	4.2
XRSD	18.9	9.1	212.1	0.0	21.8	53.0	49.9

	Na589	Sc	Sc361	Sr421
# 1	25.5	4762.5	4762.5	-1.0
# 2	38.5	4745.5	4745.5	-1.0
Mean	32.0	4754.0	4754.0	-1.0
SD	9.2	12.0	12.0	0.0
XRSD	28.7	0.3	0.3	0.0

010051

APPARENT CONCENTRATIONS

Identity 1 : pbw-L04E3 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:27:34 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	0.0005	0.0004 L	-0.0021	0.0040 L	-0.0202 L	-0.0027	0.0096
# 2 L	-0.0081	0.0001	0.0104	0.0103	0.0246	0.0005	0.0147
Mean L	-0.0038	0.0002	0.0042	0.0072	0.0022 L	-0.0011	0.0121
SD	0.0061	0.0002	0.0088	0.0044	0.0316	0.0023	0.0036
XRSD	159.7833	62.4323	211.8168	61.4922	1429.0822	202.4755	29.5820

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1 L	-0.0684	4762.500	98.6621 L	-0.0021
# 2 L	-0.0425	4745.500	98.3095 L	-0.0021
Mean L	-0.0554	4754.000	98.4858 L	-0.0021
SD	0.0183	12.021	0.2493	0.0000
XRSD	33.0414	0.253	0.2532	0.1274

010052

BACKGROUND CORRECTED INTENSITIES

Identity 1 : lcsv-L04E3 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:30:50 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	466.0	439.5	5003.5	487.5	1763.5	-24.0	23666.0
# 2	467.0	447.5	5009.5	507.5	1785.5	-23.0	23529.0
Mean	466.5	443.5	5006.5	497.5	1774.5	-23.5	23597.5
SD	0.7	5.7	4.2	14.1	15.6	0.7	96.9
%RSD	0.2	1.3	0.1	2.8	0.9	3.0	0.4

	Na589	Sc	Sc361	Sr421
# 1	10093.0	4767.0	4767.0	3927.0
# 2	10004.0	4748.0	4748.0	3911.0
Mean	10048.5	4757.5	4757.5	3919.0
SD	62.9	13.4	13.4	11.3
%RSD	0.6	0.3	0.3	0.3

APPARENT CONCENTRATIONS

Identity 1 : lcsv-L04E3 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:30:50 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	1.9916	0.0481	20.7912	1.0155	19.3093 L	-0.0032	19.8474
# 2	2.0041	0.0492	20.8994	1.0610	19.6308 L	-0.0030	19.8114
Mean	1.9979	0.0486	20.8453	1.0383	19.4701 L	-0.0031	19.8294
SD	0.0088	0.0008	0.0765	0.0322	0.2273	0.0002	0.0254
%RSD	0.4419	1.6061	0.3671	3.1034	1.1675	5.4897	0.1281

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1	19.7541	4767.000	98.7554	4.0715
# 2	19.6577	4748.000	98.3613	4.0711
Mean	19.7059	4757.500	98.5584	4.0713
SD	0.0682	13.435	0.2787	0.0003
%RSD	0.3460	0.282	0.2828	0.0063

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250244 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:34:06 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	20.5	17.0	17214.5	1.5	27.0	-20.0	9.5
# 2	20.5	13.0	17409.5	5.5	26.0	-16.0	30.5
Mean	20.5	15.0	17312.0	3.5	26.5	-18.0	20.0
SD	0.0	2.8	137.9	2.8	0.7	2.8	14.8
%RSD	0.0	18.9	0.8	80.8	2.7	15.7	74.2

	Na589	Sc	Sc361	Sr421
# 1	1207.0	4820.0	4820.0	42.0
# 2	1186.0	4833.0	4833.0	40.0
Mean	1196.5	4826.5	4826.5	41.0
SD	14.8	9.2	9.2	1.4

RSD 1.2 0.2 0.2 3.4

PARENT CONCENTRATIONS

Identity 1 : 250244 df100 Identity 2 : pg58-168 Type : SAMPLE

SOLUTION by Micro-Active Australia Pty Ltd 4:40:54 PM November 9, 2004

010053

Weight : 1.0000 Volume : 1.00 Printed : 4:34:06 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0517	0.0004 H	70.7454	0.0102	0.1529 L	-0.0021	0.0128
# 2	0.0515 L	-0.0001 H	71.3543	0.0184	0.1413 L	-0.0010	0.0302
Mean	0.0516	0.0002 H	71.0498	0.0143	0.1471 L	-0.0016	0.0215
SD	0.0002	0.0003	0.4306	0.0058	0.0083	0.0008	0.0123
RSD	0.3253	189.9451	0.6060	40.3285	5.6108	47.6804	56.9984

	Na589 ppm	Sc ppm	Sc361 ppm	Sr421 ppm
# 1	2.2318	4820.000	99.8548	0.0421
# 2	2.1847	4833.000 H	100.1245	0.0399
Mean	2.2082	4826.500	99.9896	0.0410
SD	0.0333	9.192	0.1907	0.0015
RSD	1.5084	0.190	0.1907	3.7306

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250244d df100 Identity 2 : pg58-168 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 4:37:20 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	21.5	14.5	17291.0	-1.0	14.0	-15.0	-23.0
# 2	19.5	15.5	17265.0	-2.0	16.0	-11.0	9.0
Mean	20.5	15.0	17278.0	-1.5	15.0	-13.0	-7.0
SD	1.4	0.7	18.4	0.7	1.4	2.8	22.6
RSD	6.9	4.7	0.1	47.1	9.4	21.8	323.2

	Na589	Sc	Sc361	Sr421
# 1	1175.5	4821.5	4821.5	37.5
# 2	1177.5	4810.5	4810.5	38.5
Mean	1176.5	4816.0	4816.0	38.0
SD	1.4	7.8	7.8	0.7
RSD	0.1	0.2	0.2	1.9

PARENT CONCENTRATIONS

Identity 1 : 250244d df100 Identity 2 : pg58-168 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 4:37:22 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0560	0.0001 H	71.0376	0.0051	0.0111 L	-0.0008 L	-0.0141
# 2	0.0476	0.0002 H	71.0930	0.0030	0.0333	0.0003	0.0124
Mean	0.0518	0.0002 H	71.0653	0.0041	0.0222 L	-0.0003 L	-0.0008
SD	0.0059	0.0001	0.0392	0.0015	0.0157	0.0007	0.0188
RSD	11.4917	47.7573	0.0551	35.6288	70.8317	273.8750	2272.0433

	Na589 ppm	Sc ppm	Sc361 ppm	Sr421 ppm
# 1	2.1697	4821.500	99.8859	0.0374
# 2	2.1789	4810.500	99.6577	0.0385
Mean	2.1743	4816.000	99.7718	0.0380
SD	0.0005	7.770	0.1610	0.0000

%RSD 0.2971 0.162 0.1617 2.0768

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250244s df100 Identity 2 : pg58-168 Type : SAMPLE

010054

EVOLUTION by Micro-Active Australia Pty Ltd 4:44:22 PM November 9, 2004

Weight : 1.0000 Volume : 1.00 Printed : 4:40:36 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	478.0	440.0	22056.5	494.0	1828.0	-7.0	23570.0
# 2	474.0	443.0	22075.5	481.0	1828.0	-25.0	23812.0
Mean	476.0	441.5	22066.0	487.5	1828.0	-16.0	23691.0
SD	2.8	2.1	13.4	9.2	0.0	12.7	171.1
%RSD	0.6	0.5	0.1	1.9	0.0	79.5	0.7

	Na589	Sc	Sc361	Sr421
# 1	11471.0	4731.0	4731.0	3912.0
# 2	11504.0	4733.0	4733.0	3927.0
Mean	11487.5	4732.0	4732.0	3919.5
SD	23.3	1.4	1.4	10.6
%RSD	0.2	0.0	0.0	0.3

APPARENT CONCENTRATIONS

Identity 1 : 250244s df100 Identity 2 : pg58-168 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 4:40:36 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	2.0597	0.0485 H	92.3494	1.0367	20.1742	0.0013	19.9173
# 2	2.0413	0.0488 H	92.3899	1.0092	20.1656 L	-0.0035	20.1132
Mean	2.0505	0.0487 H	92.3697	1.0229	20.1699 L	-0.0011	20.0152
SD	0.0130	0.0002	0.0286	0.0195	0.0061	0.0034	0.1386
%RSD	0.6352	0.4645	0.0310	1.9021	0.0301	300.4801	0.6922

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1	22.6392	4731.000	98.0087	4.0868
# 2	22.6950	4733.000	98.0502	4.1007
Mean	22.6671	4732.000	98.0295	4.0937
SD	0.0395	1.414	0.0293	0.0099
%RSD	0.1742	0.030	0.0299	0.2408

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250245 df100 Identity 2 : pg58-168 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 4:43:52 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	16.0	15.0	3698.5	0.5	22.5	-5.5	70.0
# 2	11.0	16.0	3717.5	0.5	25.5	-12.5	29.0
Mean	13.5	15.5	3708.0	0.5	24.0	-9.0	49.5
SD	3.5	0.7	13.4	0.0	2.1	4.9	29.0
%RSD	26.2	4.6	0.4	0.0	8.8	55.0	58.6

	Na589	Sc	Sc361	Sr421
# 1	1169.5	4801.0	4801.0	12.0
# 2	1143.5	4815.0	4815.0	11.0
Mean	1156.5	4808.0	4808.0	11.5
SD	18.4	9.9	9.9	0.7
%RSD	1.6	0.2	0.2	6.1

APPARENT CONCENTRATIONS

Identity 1 : 250245 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:43:52 PM November 9, 2004

010055

EVOLUTION by Micro-Active Australia Pty Ltd 4:50:52 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0326	0.0002	15.2596	0.0082	0.1048	0.0017	0.0632
# 2	0.0109	0.0003	15.2934	0.0082	0.1369 L	-0.0001	0.0290
Mean	0.0217	0.0002	15.2765	0.0082	0.1208	0.0008	0.0461
SD	0.0154	0.0001	0.0239	0.0000	0.0227	0.0013	0.0242
%RSD	70.7415	32.8971	0.1564	0.0258	18.7519	166.7170	52.4145

	Na589 ppm	Sc ppm	Sc361 ppm	Sr421 ppm
# 1	2.1678	4801.000	99.4607	0.0113
# 2	2.1104	4815.000	99.7511	0.0103
Mean	2.1391	4808.000	99.6059	0.0108
SD	0.0405	9.899	0.2053	0.0008
%RSD	1.8951	0.206	0.2062	6.9568

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250246 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:47:08 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	10.0	15.0	1189.0	1.5	19.0	-19.5	-12.5
# 2	14.0	15.0	1187.0	1.5	26.0	-5.5	28.5
Mean	12.0	15.0	1188.0	1.5	22.5	-12.5	8.0
SD	2.8	0.0	1.4	0.0	4.9	9.9	29.0
%RSD	23.6	0.0	0.1	0.0	22.0	79.2	362.4

	Na589	Sc	Sc361	Sr421
# 1	11358.0	4813.0	4813.0	1.5
# 2	11246.0	4785.0	4785.0	1.5
Mean	11302.0	4799.0	4799.0	1.5
SD	79.2	19.8	19.8	0.0
%RSD	0.7	0.4	0.4	0.0

APPARENT CONCENTRATIONS

Identity 1 : 250246 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:47:08 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0066	0.0002	4.8935	0.0102	0.0660 L	-0.0020 L	-0.0054
# 2	0.0242	0.0002	4.9138	0.0102	0.1441	0.0017	0.0288
Mean	0.0154	0.0002	4.9036	0.0102	0.1050 L	-0.0001	0.0117
SD	0.0124	0.0000	0.0144	0.0000	0.0552	0.0026	0.0242
%RSD	80.9497	3.9207	0.2935	0.1243	52.6050	1792.8491	206.9482

	Na589 ppm	Sc ppm	Sc361 ppm	Sr421 ppm
# 1	22.0311	4813.000	99.7096	0.0005
# 2	21.9410	4785.000	99.1288	0.0005
Mean	21.9860	4799.000	99.4192	0.0005
SD	0.0637	19.799	0.4107	0.0000
%RSD	0.2897	0.413	0.4131	1.2235

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250247 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:50:24 PM November 9, 2004

010056

RESOLUTION by Micro-Active Australia Pty Ltd 4:53:56 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	10.0	14.0	357.0	-0.5	14.0	3.0	-26.5
# 2	8.0	13.0	352.0	2.5	36.0	-3.0	19.5
Mean	9.0	13.5	354.5	1.0	25.0	0.0	-3.5
D	1.4	0.7	3.5	2.1	15.6	4.2	32.5
RSD	15.7	5.2	1.0	212.1	62.2	0.0	929.3

	Na589	Sc	Sc361	Sr421
# 1	11132.0	4820.0	4820.0	0.5
# 2	10969.0	4772.0	4772.0	-1.5
Mean	11050.5	4796.0	4796.0	-0.5
D	115.3	33.9	33.9	1.4
RSD	1.0	0.7	0.7	282.8

APPARENT CONCENTRATIONS

Identity 1 : 250247 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:50:24 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0065	0.0001	1.4671	0.0061	0.0111	0.0039 L	-0.0170
# 2 L	-0.0018 L	-0.0000	1.4611	0.0123	0.2551	0.0024	0.0213
Mean	0.0024	0.0000	1.4641	0.0092	0.1331	0.0031	0.0021
D	0.0058	0.0001	0.0042	0.0044	0.1725	0.0011	0.0271
RSD	245.6403	723.4611	0.2896	47.4565	129.6108	35.6296	1261.5267

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1	21.5588	4820.000	99.8548 L	-0.0005
# 2	21.4562	4772.000	98.8592 L	-0.0026
Mean	21.5075	4796.000	99.3570 L	-0.0015
D	0.0725	33.941	0.7040	0.0015
RSD	0.3372	0.708	0.7086	94.6078

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250248 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 4:53:38 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	10.5	9.5	116.5	-2.0	14.5	-6.5	13.0
# 2	14.5	13.5	119.5	-4.0	13.5	-11.5	9.0
Mean	12.5	11.5	118.0	-3.0	14.0	-9.0	11.0
D	2.8	2.8	2.1	1.4	0.7	3.5	2.8
RSD	22.6	24.6	1.8	47.1	5.1	39.3	25.7

	Na589	Sc	Sc361	Sr421
# 1	11386.0	4831.5	4831.5	3.0
# 2	11277.0	4799.5	4799.5	2.0
Mean	11331.5	4815.5	4815.5	2.5
D	77.1	22.6	22.6	0.7
RSD	0.7	0.5	0.5	28.3

APPARENT CONCENTRATIONS

Identity 1 : 250248 df100 Identity 2 : pg58-168 Type : SAMPLE

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
RESOLUTION by Micro-Active Australia Pty Ltd 5:01:58 PM November 9, 2004							
# 1	0.0086 L	-0.0004	0.4776	0.0031	0.0162	0.0014	0.0157
# 2	0.0261	0.0000	0.4932 L	-0.0011	0.0063	0.0001	0.0125
Mean	0.0174 L	-0.0002	0.4854	0.0010	0.0112	0.0008	0.0141
D	0.0124	0.0003	0.0110	0.0029	0.0070	0.0009	0.0023
RSD	71.6953	146.9863	2.2675	292.5065	62.2974	120.7512	16.3540
	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm			
# 1	22.0006	4831.500 H	100.0933	0.0020			
# 2	21.9350	4799.500	99.4296	0.0010			
Mean	21.9678	4815.500	99.7615	0.0015			
D	0.0464	22.627	0.4694	0.0007			
RSD	0.2114	0.470	0.4705	46.3347			

010057

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250249 df100 Identity 2 : pg58-168 Type : SAMPLE
 Height : 1.0000 Volume : 1.00 Printed : 4:56:54 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	6.5	13.0	54.0	-3.0	17.0	-8.5	-17.0
# 2	6.5	13.0	52.0	-1.0	5.0	-3.5	-13.0
Mean	6.5	13.0	53.0	-2.0	11.0	-6.0	-15.0
D	0.0	0.0	1.4	1.4	8.5	3.5	2.8
RSD	0.0	0.0	2.7	70.7	77.1	58.9	18.9
	Na589	Sc	Sc361	Sr421			
# 1	11575.5	4842.0	4842.0	0.5			
# 2	11566.5	4818.0	4818.0	1.5			
Mean	11571.0	4830.0	4830.0	1.0			
D	6.4	17.0	17.0	0.7			
RSD	0.1	0.4	0.4	70.7			

PARENT CONCENTRATIONS

Identity 1 : 250249 df100 Identity 2 : pg58-168 Type : SAMPLE
 Height : 1.0000 Volume : 1.00 Printed : 4:56:54 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1 L	-0.0087 L	-0.0001	0.2209	0.0010	0.0430	0.0009 L	-0.0091
# 2 L	-0.0085 L	-0.0001	0.2138	0.0051 L	-0.0870	0.0022 L	-0.0058
Mean L	-0.0086 L	-0.0001	0.2174	0.0031 L	-0.0220	0.0016 L	-0.0074
D	0.0001	0.0000	0.0050	0.0029	0.0919	0.0009	0.0023
RSD	1.1389	8.9860	2.3171	93.5232	417.5494	58.4418	30.8711
	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm			
# 1	22.3200	4842.000 H	100.3111 L	-0.0005			
# 2	22.4143	4818.000	99.8133	0.0005			
Mean	22.3671	4830.000 H	100.0622	0.0000			
D	0.0666	16.971	0.3520	0.0007			
RSD	0.2979	0.351	0.3518	113353.1789			

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250249 df100 Identity 2 : pg58-168 Type : SAMPLE

	A1396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	2416.5	9022.5	5193.5	5132.0	1834.5	18955.0	22920.0
# 2	2428.5	9030.5	5177.5	5155.0	1808.5	18987.0	22934.0
Mean	2422.5	9026.5	5185.5	5143.5	1821.5	18971.0	22927.0
SD	8.5	5.7	11.3	16.3	18.4	22.6	9.9
%RSD	0.4	0.1	0.2	0.3	1.0	0.1	0.0

EVOLUTION by Micro-Active Australia Pty Ltd 5:06:24 PM November 9, 2004 **010058**

	Na589	Sc	Sc361	Sr421
# 1	15519.0	4940.5	4940.5	4962.0
# 2	15596.0	4918.5	4918.5	4964.0
Mean	15557.5	4929.5	4929.5	4963.0
SD	54.4	15.6	15.6	1.4
%RSD	0.3	0.3	0.3	0.0

APPARENT CONCENTRATIONS

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 5:01:48 PM November 9, 2004

	A1396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	10.1114	0.9802	20.8228	10.2492	19.3819	4.8645	18.5470
# 2	10.2074	0.9855	20.8515	10.3412	19.1913	4.8944	18.6414
Mean	10.1594	0.9828	20.8372	10.2952	19.2866	4.8795	18.5942
SD	0.0679	0.0037	0.0203	0.0650	0.1348	0.0212	0.0667
%RSD	0.6682	0.3788	0.0974	0.6313	0.6988	0.4346	0.3587

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1	29.3646	4940.500 H	102.3543	4.9641
# 2	29.6434	4918.500 H	101.8979	4.9883
Mean	29.5040	4929.500 H	102.1261	4.9762
SD	0.1972	15.556	0.3227	0.0171
%RSD	0.6682	0.316	0.3160	0.3441

Checking calibration verification ...

Identity 1 : CLP_CCV_SC Identity 2 :

Report name	Low limit	Value	High limit
A1396	9.000	10.159	11.000
Be 313	0.900	0.983	1.100
Ca317	18.000	20.837	22.000
Fe259	9.000	10.295	11.000
K_766	18.000	19.287	22.000
Li670	4.500	4.879	5.500
Mg279	18.000	18.594	22.000
Na589	27.000	29.504	33.000
Sr421	4.500	4.976	5.500

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 5:06:06 PM November 9, 2004

	A1396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	8.0	16.5	2.0	5.5	11.5	-14.5	46.5
# 2	9.0	16.5	1.0	3.5	15.5	-9.5	44.5
Mean	8.5	16.5	1.5	4.5	13.5	-12.0	45.5
SD	0.7	0.0	0.7	1.4	2.8	3.5	1.4
%RSD	8.2	0.0	47.1	31.1	21.0	29.5	3.1

	Na589	Sc	Sc361	Sr421
# 1	48.0	4871.0	4871.0	0.5
# 2	53.0	4844.0	4844.0	0.5

EVOLUTION by Micro-Active Australia Pty Ltd 5:09:24 PM November 9, 2004

010059

	Na589	Sc	Sc361	Sr421
mean	50.5	4857.5	4857.5	0.5
SD	3.5	19.1	19.1	0.0
RSD	7.0	0.4	0.4	0.0

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 5:06:08 PM November 9, 2004

	A1396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1 L	-0.0025	0.0003	0.0081	0.0183 L	-0.0175 L	-0.0006	0.0431
# 2	0.0020	0.0003	0.0041	0.0143	0.0266	0.0007	0.0417
mean L	-0.0002	0.0003	0.0061	0.0163	0.0046	0.0000	0.0424
SD	0.0032	0.0000	0.0029	0.0028	0.0312	0.0009	0.0010
RSD	1417.1824	2.2249	46.7908	17.4146	680.3706	4219.2118	2.3972

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1 L	-0.0261	4871.000 H	100.9127 L	-0.0005
# 2 L	-0.0159	4844.000 H	100.3526 L	-0.0005
mean L	-0.0210	4857.500 H	100.6326 L	-0.0005
SD	0.0072	19.092	0.3960	0.0000
RSD	34.3263	0.393	0.3935	0.3881

Checking calibration blank ...

Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value
A1396	0.050	-0.000
Be 313	0.050	0.000
Ca317	0.050	0.006
Fe259	0.050	0.016
K_766	0.000	0.005
Li670	0.050	0.000
Mg279	0.050	0.042
Na589	0.200	-0.021
Sc361	0.000	100.633
Sr421	0.050	-0.001

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250250 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:09:22 PM November 9, 2004

	A1396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	8.5	12.5	13.0	-4.0	17.5	-17.5	-34.5
# 2	6.5	11.5	16.0	-1.0	25.5	-11.5	7.5
mean	7.5	12.0	14.5	-2.5	21.5	-14.5	-13.5
SD	1.4	0.7	2.1	2.1	5.7	4.2	29.7
RSD	18.9	5.9	14.6	84.9	26.3	29.3	220.0

	Na589	Sc	Sc361	Sr421
# 1	11575.5	4835.0	4835.0	-1.0
# 2	11485.5	4790.0	4790.0	-3.0
mean	11530.5	4812.5	4812.5	-2.0
SD	63.6	31.8	31.8	1.4
RSD	0.5	0.7	0.7	0.7

APPARENT CONCENTRATIONS

Identity 1 : 250250 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:09:22 PM November 9, 2004

EVOLUTION by Micro-Active Australia Pty Ltd 5:16:24 PM November 9, 2004 010060

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1 L	-0.0001 L	-0.0001	0.0533 L	-0.0010	0.0487 L	-0.0014 L	-0.0236
# 2 L	-0.0084 L	-0.0002	0.0662	0.0051	0.1383	0.0001	0.0112
Mean L	-0.0042 L	-0.0002	0.0597	0.0020	0.0935 L	-0.0007 L	-0.0062
SD	0.0059	0.0001	0.0091	0.0043	0.0634	0.0011	0.0246
KRSD	139.3958	42.9537	15.2836	211.2347	67.7610	164.4054	399.0476

	Na589	Sc	Sc361	Sr421
	ppm	ppm	ppm	ppm
# 1	22.3525	4835.000 H	100.1659 L	-0.0020
# 2	22.3873	4790.000	99.2325 L	-0.0041
Mean	22.3699	4812.500	99.6992 L	-0.0031
SD	0.0246	31.820	0.6600	0.0015
KRSD	0.1098	0.661	0.6620	47.5551

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250251 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:12:40 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	12.0	15.5	9.5	-7.5	30.0	-8.0	11.0
# 2	13.0	14.5	8.5	-0.5	29.0	-19.0	19.0
Mean	12.5	15.0	9.0	-4.0	29.5	-13.5	15.0
SD	0.7	0.7	0.7	4.9	0.7	7.8	5.7
KRSD	5.7	4.7	7.9	123.7	2.4	57.6	37.7

	Na589	Sc	Sc361	Sr421
# 1	12078.0	4804.5	4804.5	0.0
# 2	12086.0	4786.5	4786.5	-2.0
Mean	12082.0	4795.5	4795.5	-1.0
SD	5.7	12.7	12.7	1.4
KRSD	0.0	0.3	0.3	141.4

APPARENT CONCENTRATIONS

Identity 1 : 250251 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:12:40 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	0.0153	0.0002	0.0392 L	-0.0082	0.1867	0.0010	0.0141
# 2	0.0198	0.0001	0.0352	0.0061	0.1770 L	-0.0019	0.0208
Mean	0.0175	0.0002	0.0372 L	-0.0011	0.1818 L	-0.0004	0.0175
SD	0.0032	0.0001	0.0028	0.0102	0.0069	0.0021	0.0047
KRSD	18.2496	42.0421	7.5921	956.6696	3.7917	491.8572	27.1680

	Na589	Sc	Sc361	Sr421
	ppm	ppm	ppm	ppm
# 1	23.4768	4804.500	99.5333 L	-0.0010
# 2	23.5813	4786.500	99.1599 L	-0.0031
Mean	23.5290	4795.500	99.3466 L	-0.0021
SD	0.0738	12.728	0.2640	0.0015
KRSD	0.3120	0.265	0.2657	71.0000

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250252 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:15:56 PM November 9, 2004

010061

RESOLUTION by Micro-Active Australia Pty Ltd 5:21:00 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	9.5	15.0	248.0	503.5	95.0	-6.0	1103.0
# 2	8.5	13.0	245.0	500.5	97.0	-9.0	1134.0
Mean	9.0	14.0	246.5	502.0	96.0	-7.5	1118.5
SD	0.7	1.4	2.1	2.1	1.4	2.1	21.9
RSD	7.9	10.1	0.9	0.4	1.5	28.3	2.0
	Na589	Sc	Sc361	Sr421			
# 1	542.0	4749.0	4749.0	0.0			
# 2	539.0	4737.0	4737.0	-2.0			
Mean	540.5	4743.0	4743.0	-1.0			
SD	2.1	8.5	8.5	1.4			
RSD	0.4	0.2	0.2	141.4			

PARENT CONCENTRATIONS

Identity 1 : 250252 df100 Identity 2 : pg58-168 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:15:56 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0050	0.0002	1.0344	1.0525	0.9102	0.0015	0.9333
# 2	0.0007 L	-0.0000	1.0245	1.0489	0.9351	0.0007	0.9618
Mean	0.0028	0.0001	1.0295	1.0507	0.9226	0.0011	0.9475
SD	0.0030	0.0002	0.0070	0.0025	0.0176	0.0006	0.0202
RSD	106.7522	189.3412	0.6817	0.2420	1.9056	49.7694	2.1274
	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm			
# 1	0.9526	4749.000	98.3821 L	-0.0010			
# 2	0.9494	4737.000	98.1332 L	-0.0031			
Mean	0.9510	4743.000	98.2576 L	-0.0021			
SD	0.0023	8.485	0.1760	0.0015			
RSD	0.2402	0.179	0.1791	71.3761			

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_CCv_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 5:20:48 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	2418.0	9064.0	5154.0	5128.0	1852.5	19041.5	22920.5
# 2	2424.0	9090.0	5162.0	5135.0	1851.5	19052.5	22703.5
Mean	2421.0	9077.0	5158.0	5131.5	1852.0	19047.0	22812.0
SD	4.2	18.4	5.7	4.9	0.7	7.8	153.4
RSD	0.2	0.2	0.1	0.1	0.0	0.0	0.7
	Na589	Sc	Sc361	Sr421			
# 1	15524.5	4942.0	4942.0	4956.5			
# 2	15588.5	4929.0	4929.0	4967.5			
Mean	15556.5	4935.5	4935.5	4962.0			
SD	45.3	9.2	9.2	7.8			
RSD	0.3	0.2	0.2	0.2			

PARENT CONCENTRATIONS

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 5:20:48 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
EVOLUTION by Micro-Active Australia Pty Ltd							010062
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	10.1146	0.9844	20.6582	10.2381	19.5675	4.8852	18.5418
# 2	10.1667	0.9899	20.7448	10.2791	19.6088	4.9009	18.4147
Mean	10.1406	0.9871	20.7015	10.2586	19.5881	4.8930	18.4783
SD	0.0368	0.0038	0.0613	0.0290	0.0292	0.0111	0.0899
XRSD	0.3628	0.3894	0.2959	0.2825	0.1491	0.2269	0.4863

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1	29.3661	4942.000 H	102.3854	4.9571
# 2	29.5657	4929.000 H	102.1157	4.9812
Mean	29.4659	4935.500 H	102.2506	4.9691
SD	0.1412	9.192	0.1907	0.0170
XRSD	0.4791	0.186	0.1865	0.3431

Checking calibration verification ...

Identity 1 : CLP_CCV_SC Identity 2 :

Report name	Low limit	Value	High limit
Al396	9.000	10.141	11.000
Be 313	0.900	0.987	1.100
Ca317	18.000	20.702	22.000
Fe259	9.000	10.259	11.000
K_766	18.000	19.588	22.000
Li670	4.500	4.893	5.500
Mg279	18.000	18.478	22.000
Na589	27.000	29.466	33.000
Sr421	4.500	4.969	5.500

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB

Weight : 1.0000 Volume : 1.00 Printed : 5:25:10 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	13.0	16.0	2.5	-1.0	14.5	-3.0	8.5
# 2	10.0	15.0	2.5	-2.0	21.5	-10.0	62.5
Mean	11.5	15.5	2.5	-1.5	18.0	-6.5	35.5
SD	2.1	0.7	0.0	0.7	4.9	4.9	38.2
XRSD	18.4	4.6	0.0	47.1	27.5	76.1	107.6
	Na589	Sc	Sc361	Sr421			
# 1	6.0	4856.5	4856.5	1.5			
# 2	40.0	4827.5	4827.5	-0.5			
Mean	23.0	4842.0	4842.0	0.5			
SD	24.0	20.5	20.5	1.4			
XRSD	104.5	0.4	0.4	282.8			

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB

Weight : 1.0000 Volume : 1.00 Printed : 5:25:10 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm						
# 1	0.0190	0.0003	0.0102	0.0051	0.0154	0.0024	0.0120
# 2	0.0064	0.0002	0.0103	0.0031	0.0926	0.0005	0.0567
Mean	0.0127	0.0002	0.0102	0.0041	0.0540	0.0014	0.0343
SD	0.0077	0.0001	0.0001	0.0010	0.0154	0.0001	0.0120
XRSD	0.0064	0.0002	0.0103	0.0031	0.0926	0.0005	0.0567

D	0.0089	0.0001	0.0000	0.0015	0.0546	0.0013	0.0316
RSD	69.8046	32.7834	0.4235	35.5070	101.1222	90.0587	92.1505

Na589 Sc Sc361 Sr421

EVOLUTION by Micro-Active Australia Pty Ltd 5:31:58 PM November 9, 2004

010063

	ppm		ppm		ppm
# 1 L	-0.1070	4856.500 H	100.6119		0.0005
# 2 L	-0.0408	4827.500 H	100.0104 L		-0.0015
Mean L	-0.0739	4842.000 H	100.3111 L		-0.0005
D	0.0468	20.506	0.4253		0.0014
RSD	63.2938	0.424	0.4240		279.0190

Checking calibration blank ...

Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value
Al396	0.050	0.013
Be 313	0.050	0.000
Ca317	0.050	0.010
Fe259	0.050	0.004
K_766	0.000	0.054
Li670	0.050	0.001
Mg279	0.050	0.034
Na589	0.200	-0.074
Sc361	0.000	100.311
Sr421	0.050	-0.001

BACKGROUND CORRECTED INTENSITIES

Identity 1 : pbv-L04E2 Identity 2 : pg58-167 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 5:28:24 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	5.0	12.0	0.5	4.5	16.0	-18.5	23.5
# 2	9.0	12.0	2.5	-0.5	18.0	-13.5	14.5
Mean	7.0	12.0	1.5	2.0	17.0	-16.0	19.0
D	2.8	0.0	1.4	3.5	1.4	3.5	6.4
RSD	40.4	0.0	94.3	176.8	8.3	22.1	33.5

	Na589	Sc	Sc361	Sr421
# 1	23.0	4838.0	4838.0	0.5
# 2	69.0	4799.0	4799.0	0.5
Mean	46.0	4818.5	4818.5	0.5
D	32.5	27.6	27.6	0.0
RSD	70.7	0.6	0.6	0.0

APPARENT CONCENTRATIONS

Identity 1 : pbv-L04E2 Identity 2 : pg58-167 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 5:28:24 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1 L	-0.0151 L	-0.0002	0.0020	0.0163	0.0323 L	-0.0017	0.0244
# 2	0.0024 L	-0.0002	0.0103	0.0061	0.0556 L	-0.0004	0.0170
Mean L	-0.0064 L	-0.0002	0.0062	0.0112	0.0439 L	-0.0011	0.0207
D	0.0124	0.0000	0.0058	0.0072	0.0165	0.0009	0.0052
RSD	194.2369	4.6530	94.5980	64.2652	37.5329	85.8585	25.0498

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1 L	-0.0740	4838.000 H	100.2282 L	-0.0005
# 2	0.0163	4799.000	99.4192 L	-0.0005

Mean	L	-0.0288	4818.500	99.8237	L	-0.0005
		0.0639	27.577	0.5720		0.0000
	RSD	221.5776	0.572	0.5730		0.5744

RESOLUTION by Micro-Active Australia Pty Ltd 5:35:24 PM November 9, 2004

010064

BACKGROUND CORRECTED INTENSITIES

Identity 1 : lcsav-L04E2 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:31:40 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	462.5	445.0	5027.0	490.0	1772.5	-17.5	22264.5
# 2	466.5	449.0	5017.0	487.0	1766.5	-13.5	22102.5
Mean	464.5	447.0	5022.0	488.5	1769.5	-15.5	22183.5
D	2.8	2.8	7.1	2.1	4.2	2.8	114.6
RSD	0.6	0.6	0.1	0.4	0.2	18.2	0.5

	Na589	Sc	Sc361	Sr421
# 1	9989.0	4758.5	4758.5	3939.0
# 2	10072.0	4737.5	4737.5	3932.0
Mean	10030.5	4748.0	4748.0	3935.5
D	58.7	14.8	14.8	4.9
RSD	0.6	0.3	0.3	0.1

APPARENT CONCENTRATIONS

Identity 1 : lcsav-L04E2 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:31:40 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	1.9800	0.0488	20.9262	1.0225	19.4435 L	-0.0015	18.7056
# 2	2.0064	0.0494	20.9771	1.0207	19.4638 L	-0.0005	18.6519
Mean	1.9932	0.0491	20.9516	1.0216	19.4536 L	-0.0010	18.6788
D	0.0187	0.0005	0.0360	0.0012	0.0143	0.0007	0.0380
RSD	0.9386	0.9744	0.1719	0.1207	0.0735	75.2960	0.2036

	Na589	Sc	Sc361	Sr421
	ppm	ppm	ppm	ppm
# 1	19.5844	4758.500	98.5791	4.0912
# 2	19.8362	4737.500	98.1435	4.1020
Mean	19.7103	4748.000	98.3613	4.0966
D	0.1780	14.849	0.3080	0.0077
RSD	0.9033	0.313	0.3131	0.1870

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250244 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:34:56 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	87.5	13.5	162354.5	0.5	26.0	-11.5	23.0
# 2	92.5	17.5	162896.5	0.5	35.0	-3.5	74.0
Mean	90.0	15.5	162625.5	0.5	30.5	-7.5	48.5
D	3.5	2.8	383.3	0.0	6.4	5.7	36.1
RSD	3.9	18.2	0.2	0.0	20.9	75.4	74.4

	Na589	Sc	Sc361	Sr421
# 1	11779.5	4678.0	4678.0	350.5
# 2	11723.5	4676.0	4676.0	352.5
Mean	11751.5	4677.0	4677.0	351.5

XRSD 0.3 0.0 0.0 0.4

APPARENT CONCENTRATIONS

Identity 1 : 250244 df10 Identity 2 : pg58-167 Type : SAMPLE

EVOLUTION by Micro-Active Australia Pty Ltd 5:41:56 PM November 9, 2004 010065

Weight : 1.0000 Volume : 1.00 Printed : 5:34:56 PM November 9, 2004

Table with 8 columns: Element (Al396, Be 313, Ca317, Fe259, K_766, Li670, Mg279), Concentration (ppm), and Sample ID (# 1, # 2, Mean, SD, XRSD).

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250244d df10 Identity 2 : pg58-167 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 5:38:10 PM November 9, 2004

Table with 8 columns: Element (Al396, Be 313, Ca317, Fe259, K_766, Li670, Mg279), Intensity, and Sample ID (# 1, # 2, Mean, SD, XRSD).

APPARENT CONCENTRATIONS

Identity 1 : 250244d df10 Identity 2 : pg58-167 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 5:38:10 PM November 9, 2004

Table with 8 columns: Element (Al396, Be 313, Ca317, Fe259, K_766, Li670, Mg279), Concentration (ppm), and Sample ID (# 1, # 2, Mean, SD, XRSD).

RSD	0.2299	0.229	0.2291	0.3819
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BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250244s df10 Identity 2 : pg58-167 Type : SAMPLE

VOLUTION by Micro-Active Australia Pty Ltd 5:45:00 PM November 9, 2004

010066

Weight : 1.0000 Volume : 1.00 Printed : 5:41:26 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	536.0	428.0	166375.5	474.0	1875.5	-6.0	21653.5
# 2	539.0	429.0	166477.5	475.0	1881.5	-18.0	21576.5
Mean	537.5	428.5	166426.5	474.5	1878.5	-12.0	21615.0
SD	2.1	0.7	72.1	0.7	4.2	8.5	54.4
RSD	0.4	0.2	0.0	0.1	0.2	70.7	0.3

	Na589	Sc	Sc361	Sr421
# 1	22072.5	4605.0	4605.0	4136.5
# 2	22076.5	4602.0	4602.0	4136.5
Mean	22074.5	4603.5	4603.5	4136.5
SD	2.8	2.1	2.1	0.0
RSD	0.0	0.0	0.0	0.0

APPARENT CONCENTRATIONS

Identity 1 : 250244s df10 Identity 2 : pg58-167 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 5:41:26 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	2.3784	0.0485 H	715.6659	1.0220	21.2724	0.0015	18.7987
# 2	2.3935	0.0486 H	716.5714	1.0248	21.3549 L	-0.0018	18.7441
Mean	2.3859	0.0485 H	716.1186	1.0234	21.3137 L	-0.0002	18.7714
SD	0.0107	0.0001	0.6403	0.0020	0.0583	0.0023	0.0386
RSD	0.4475	0.2176	0.0894	0.1937	0.2737	1522.7945	0.2058

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1	44.8701	4605.000	95.3951	4.4396
# 2	44.9076	4602.000	95.3329	4.4425
Mean	44.8888	4603.500	95.3640	4.4411
SD	0.0265	2.121	0.0440	0.0020
RSD	0.0590	0.046	0.0461	0.0461

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250245 df10 Identity 2 : pg58-167 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 5:44:42 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	27.0	13.5	36248.0	-2.5	25.0	-14.0	25.0
# 2	32.0	13.5	36143.0	-2.5	23.0	-11.0	24.0
Mean	29.5	13.5	36195.5	-2.5	24.0	-12.5	24.5
SD	3.5	0.0	74.2	0.0	1.4	2.1	0.7
RSD	12.0	0.0	0.2	0.0	5.9	17.0	2.9

	Na589	Sc	Sc361	Sr421
# 1	11406.5	4815.0	4815.0	79.0
# 2	11271.5	4794.0	4794.0	79.0
Mean	11339.0	4804.5	4804.5	79.0
SD	95.5	14.8	14.8	0.0
RSD	0.8	0.3	0.3	0.0

PARENT CONCENTRATIONS

Identity 1 : 250245 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:44:42 PM November 9, 2004

010067

RESOLUTION by Micro-Active Australia Pty Ltd 5:51:30 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0798	0.0000 H	149.1208	0.0020	0.1314 L	-0.0005	0.0257
# 2	0.1020	0.0000 H	149.3402	0.0020	0.1107	0.0002	0.0250
Mean	0.0909	0.0000 H	149.2305	0.0020	0.1210 L	-0.0001	0.0253
SD	0.0157	0.0000	0.1551	0.0000	0.0147	0.0005	0.0005
RSD	17.2330	66.2382	0.1039	0.7855	12.1177	376.8107	2.0721

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1	22.1164	4815.000	99.7511	0.0801
# 2	21.9495	4794.000	99.3155	0.0804
Mean	22.0329	4804.500	99.5333	0.0803
SD	0.1180	14.849	0.3080	0.0003
RSD	0.5357	0.309	0.3095	0.3130

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250246 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:47:58 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	19.5	10.0	11643.5	-4.0	32.5	-8.5	-11.0
# 2	19.5	12.0	11590.5	2.0	18.5	0.5	17.0
Mean	19.5	11.0	11617.0	-1.0	25.5	-4.0	3.0
SD	0.0	1.4	37.5	4.2	9.9	6.4	19.8
RSD	0.0	12.9	0.3	424.3	38.8	159.1	660.0

	Na589	Sc	Sc361	Sr421
# 1	113648.0	4787.5	4787.5	27.0
# 2	113014.0	4751.5	4751.5	26.0
Mean	113331.0	4769.5	4769.5	26.5
SD	448.3	25.5	25.5	0.7
RSD	0.4	0.5	0.5	2.7

PARENT CONCENTRATIONS

Identity 1 : 250246 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:47:58 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0480 L	-0.0004	48.1754 L	-0.0011	0.2153	0.0009 L	-0.0042
# 2	0.0486 L	-0.0001	48.3195	0.0113	0.0631	0.0033	0.0193
Mean	0.0483 L	-0.0003	48.2474	0.0051	0.1392	0.0021	0.0075
SD	0.0005	0.0002	0.1019	0.0088	0.1076	0.0017	0.0166
RSD	0.9375	63.0742	0.2111	171.5799	77.3116	80.5527	220.6256

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1 H	222.6912	4787.500	99.1807	0.0269
# 2 H	223.1270	4751.500	98.4339	0.0260
Mean H	222.9091	4769.500	98.8073	0.0264
SD	0.3081	25.456	0.5280	0.0006
RSD	0.1382	0.534	0.5344	2.2174

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250247 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:51:14 PM November 9, 2004

010068

RESOLUTION by Micro-Active Australia Pty Ltd 5:54:56 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	12.0	13.5	3445.0	-0.5	9.0	-4.5	-6.5
# 2	8.0	9.5	3466.0	1.5	7.0	-17.5	12.5
Mean	10.0	11.5	3455.5	0.5	8.0	-11.0	3.0
SD	2.8	2.8	14.8	1.4	1.4	9.2	13.4
RSD	28.3	24.6	0.4	282.8	17.7	83.6	447.8

	Na589	Sc	Sc361	Sr421
# 1	111320.5	4809.0	4809.0	6.0
# 2	111388.5	4805.0	4805.0	5.0
Mean	111354.5	4807.0	4807.0	5.5
SD	48.1	2.8	2.8	0.7
RSD	0.0	0.1	0.1	12.9

PARENT CONCENTRATIONS

Identity 1 : 250247 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:51:14 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	0.0152	0.0000	14.1901	0.0061 L	-0.0432	0.0020 L	-0.0004
# 2 L	-0.0020 L	-0.0004	14.2885	0.0102 L	-0.0650 L	-0.0015	0.0154
Mean	0.0066 L	-0.0002	14.2393	0.0082 L	-0.0541	0.0002	0.0075
SD	0.0122	0.0003	0.0696	0.0029	0.0154	0.0024	0.0112
RSD	183.9524	145.0804	0.4886	35.4877	28.4947	970.7810	149.6454

	Na589	Sc	Sc361	Sr421
	ppm	ppm	ppm	ppm
# 1 H	217.1524	4809.000	99.6266	0.0051
# 2 H	217.4661	4805.000	99.5437	0.0041
Mean H	217.3092	4807.000	99.5851	0.0046
SD	0.2218	2.828	0.0587	0.0007
RSD	0.1021	0.059	0.0589	15.6279

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250248 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 5:54:28 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	13.5	12.0	1162.5	1.0	34.5	-24.0	-26.0
# 2	12.5	16.0	1165.5	4.0	23.5	-23.0	5.0
Mean	13.0	14.0	1164.0	2.5	29.0	-23.5	-10.5
SD	0.7	2.8	2.1	2.1	7.8	0.7	21.9
RSD	5.4	20.2	0.2	84.9	26.8	3.0	208.8

	Na589	Sc	Sc361	Sr421
# 1	112650.0	4784.5	4784.5	1.5
# 2	112858.0	4788.5	4788.5	4.5
Mean	112754.0	4786.5	4786.5	3.0
SD	147.1	2.8	2.8	2.1
RSD	0.1	0.1	0.1	70.7

PARENT CONCENTRATIONS

Identity 1 : 250248 df10 Identity 2 : pg58-167 Type : SAMPLE

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
RESOLUTION by Micro-Active Australia Pty Ltd 6:02:56 PM November 9, 2004 010069							
# 1	0.0220 L	-0.0002	4.8129	0.0092	0.2375 L	-0.0032 L	-0.0168
# 2	0.0176	0.0003	4.8213	0.0154	0.1164 L	-0.0029	0.0091
Mean	0.0198	0.0001	4.8171	0.0123	0.1770 L	-0.0031 L	-0.0038
SD	0.0031	0.0003	0.0059	0.0044	0.0856	0.0002	0.0183
RSD	15.6357	460.4817	0.1232	35.5082	48.3839	6.2150	481.1802

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1 H	220.8731	4784.500	99.1184	0.0005
# 2 H	221.0962	4788.500	99.2014	0.0036
Mean H	220.9847	4786.500	99.1599	0.0021
SD	0.1578	2.828	0.0587	0.0022
RSD	0.0714	0.059	0.0592	105.5676

BACKGROUND CORRECTED INTENSITIES

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	11.0	10.5	495.0	-1.5	25.5	-11.5	21.5
# 2	11.0	10.5	500.0	-3.5	20.5	-15.5	-7.5
Mean	11.0	10.5	497.5	-2.5	23.0	-13.5	7.0
SD	0.0	0.0	3.5	1.4	3.5	2.8	20.5
RSD	0.0	0.0	0.7	56.6	15.4	21.0	292.9

	Na589	Sc	Sc361	Sr421
# 1	115446.5	4828.0	4828.0	1.0
# 2	115583.5	4846.0	4846.0	3.0
Mean	115515.0	4837.0	4837.0	2.0
SD	96.9	12.7	12.7	1.4
RSD	0.1	0.3	0.3	70.7

APPARENT CONCENTRATIONS

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Mg279 ppm
# 1	0.0107 L	-0.0003	2.0309	0.0041	0.1361	0.0001	0.0228
# 2	0.0106 L	-0.0003	2.0438	0.0000	0.0808 L	-0.0009 L	-0.0012
Mean	0.0106 L	-0.0003	2.0373	0.0021	0.1085 L	-0.0004	0.0108
SD	0.0001	0.0000	0.0091	0.0029	0.0391	0.0007	0.0170
RSD	1.1660	0.9125	0.4475	139.4942	36.0407	189.8049	157.4040

	Na589 ppm	Sc	Sc361 ppm	Sr421 ppm
# 1 H	224.3186	4828.000 H	100.0207 L	-0.0000
# 2 H	223.7503	4846.000 H	100.3941	0.0020
Mean H	224.0345	4837.000 H	100.2074	0.0010
SD	0.4018	12.728	0.2640	0.0014
RSD	0.1794	0.263	0.2635	141.4508

BACKGROUND CORRECTED INTENSITIES

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	2418.5	9068.0	5174.5	5147.0	1828.5	18830.5	22079.5
EVOLUTION by Micro-Active Australia Pty Ltd 6:07:26 PM November 9, 2004							
# 2	2400.5	9062.0	5167.5	5146.0	1822.5	18845.5	22407.5
Mean	2409.5	9065.0	5171.0	5146.5	1825.5	18838.0	22243.5
SD	12.7	4.2	4.9	0.7	4.2	10.6	231.9
XRSD	0.5	0.0	0.1	0.0	0.2	0.1	1.0

010070

	Na589	Sc	Sc361	Sr421
# 1	15355.0	4933.0	4933.0	4940.0
# 2	15442.0	4905.0	4905.0	4934.0
Mean	15398.5	4919.0	4919.0	4937.0
SD	61.5	19.8	19.8	4.2
XRSD	0.4	0.4	0.4	0.1

APPARENT CONCENTRATIONS

Identity 1 : CLP_CCv_SC Identity 2 : Type : CV

Weight : 1.0000 Volume : 1.00 Printed : 6:02:38 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	10.1353	0.9867	20.7782	10.2948	19.3476	4.8399	17.8942
# 2	10.1172	0.9916	20.8685	10.3515	19.3945	4.8714	18.2636
Mean	10.1262	0.9892	20.8234	10.3231	19.3711	4.8556	18.0789
SD	0.0128	0.0035	0.0639	0.0401	0.0332	0.0223	0.2612
XRSD	0.1262	0.3562	0.3068	0.3885	0.1713	0.4585	1.4448
	Na589	Sc	Sc361	Sr421			
	ppm		ppm	ppm			
# 1	29.0973	4933.000 H	102.1987	4.9496			
# 2	29.4306	4905.000 H	101.6179	4.9718			
Mean	29.2640	4919.000 H	101.9083	4.9607			
SD	0.2356	19.799	0.4107	0.0157			
XRSD	0.8053	0.403	0.4030	0.3166			

Checking calibration verification ...

Identity 1 : CLP_CCv_SC Identity 2 :

Report name	Low limit	Value	High limit
Al396	9.000	10.126	11.000
Be 313	0.900	0.989	1.100
Ca317	18.000	20.823	22.000
Fe259	9.000	10.323	11.000
K_766	18.000	19.371	22.000
Li670	4.500	4.856	5.500
Mg279	18.000	18.079	22.000
Na589	27.000	29.264	33.000
Sr421	4.500	4.961	5.500

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB

Weight : 1.0000 Volume : 1.00 Printed : 6:06:58 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	11.0	15.5	1.5	-5.0	17.5	-8.5	24.0
# 2	10.0	17.5	7.5	-0.0	19.5	-1.5	40.0
Mean	10.5	16.5	4.5	-2.5	18.5	-5.0	32.0
SD	0.7	1.4	4.2	3.5	1.4	4.9	11.3
XRSD	6.7	8.6	94.2	141.4	7.6	99.0	25.4

	Na589	Sc	Sc361	Sr421
# 1	45.5	4896.0	4896.0	2.5
# 2	38.5	4852.0	4852.0	1.5

EVOLUTION by Micro-Active Australia Pty Ltd 6:10:30 PM November 9, 2004

Mean	42.0	4874.0	4874.0	2.0
SD	4.9	31.1	31.1	0.7
%RSD	11.8	0.6	0.6	35.4

010071

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 6:06:58 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	0.0101	0.0002	0.0061 L	-0.0029	0.0463	0.0010	0.0246
# 2	0.0062	0.0004	0.0306	0.0071	0.0697	0.0028	0.0379
Mean	0.0082	0.0003	0.0183	0.0021	0.0580	0.0019	0.0312
SD	0.0027	0.0002	0.0174	0.0071	0.0165	0.0013	0.0094
%RSD	33.4219	52.8840	94.6345	336.7075	28.4911	68.9506	30.2353

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1 L	-0.0314	4896.000 H	101.4312	0.0015
# 2 L	-0.0441	4852.000 H	100.5186	0.0005
Mean L	-0.0378	4874.000 H	100.9749	0.0010
SD	0.0090	31.113	0.6454	0.0007
%RSD	23.8756	0.638	0.6391	70.2754

Checking calibration blank ...

Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value
Al396	0.050	0.008
Be 313	0.050	0.000
Ca317	0.050	0.018
Fe259	0.050	0.002
K_766	0.000	0.058
Li670	0.050	0.002
Mg279	0.050	0.031
Na589	0.200	-0.038
Sc361	0.000	100.975
Sr421	0.050	0.001

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250250 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 6:10:14 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	11.0	10.0	136.0	28.0	26.0	-8.5	16.0
# 2	15.0	13.0	136.0	26.0	29.0	-5.5	-1.0
Mean	13.0	11.5	136.0	27.0	27.5	-7.0	7.5
SD	2.8	2.1	0.0	1.4	2.1	2.1	12.0
%RSD	21.8	18.4	0.0	5.2	7.7	30.3	160.3

	Na589	Sc	Sc361	Sr421
# 1	115293.0	4825.0	4825.0	0.0
# 2	115647.0	4830.0	4830.0	2.0
Mean	115470.0	4827.5	4827.5	1.0
SD	250.3	3.5	3.5	1.4
%RSD	0.2	0.1	0.1	14.4

APPARENT CONCENTRATIONS

Identity 1 : 250250 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 6:10:14 PM November 9, 2004

010072

EVOLUTION by Micro-Active Australia Pty Ltd 6:12:32 PM November 9, 2004

	Al396 ppm	Be 313 ppm	Ca317 ppm	Fe259 ppm	K_766 ppm	Li670 ppm	Hg279 ppm
# 1	0.0108 L	-0.0004	0.5583	0.0644	0.1417	0.0009	0.0182
# 2	0.0279 L	-0.0001	0.5578	0.0602	0.1741	0.0017	0.0041
Mean	0.0193 L	-0.0002	0.5580	0.0623	0.1579	0.0013	0.0112
SD	0.0121	0.0002	0.0004	0.0029	0.0229	0.0006	0.0100
CRSD	62.6690	105.5303	0.0732	4.7015	14.4930	42.5250	89.0506

	Na589 ppm	Sc ppm	Sc361 ppm	Sr421 ppm
# 1 H	224.1596	4825.000	99.9585 L	-0.0010
# 2 H	224.6153	4830.000 H	100.0622	0.0010
Mean H	224.3874	4827.500 H	100.0104 L	-0.0000
SD	0.3223	3.536	0.0733	0.0014
CRSD	0.1436	0.073	0.0733	227546.8797

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250251 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 6:13:30 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	7.0	12.0	50.5	-3.0	29.0	-22.0	30.5
# 2	11.0	10.0	47.5	-3.0	17.0	-20.0	1.5
Mean	9.0	11.0	49.0	-3.0	23.0	-21.0	16.0
SD	2.8	1.4	2.1	0.0	8.5	1.4	20.5
%RSD	31.4	12.9	4.3	0.0	36.9	6.7	128.2

	Na589	Sc	Sc361	Sr421
# 1	121285.5	4836.0	4836.0	0.5
# 2	121233.5	4826.0	4826.0	-0.5
Mean	121259.5	4831.0	4831.0	-0.0
SD	36.8	7.1	7.1	0.7
%RSD	0.0	0.1	0.19200799816.0	

APPARENT CONCENTRATIONS

Identity 1 : 250251 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 6:13:30 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1 L	-0.0065 L	-0.0002	0.2069	0.0010	0.1737 L	-0.0026	0.0302
# 2	0.0108 L	-0.0004	0.1950	0.0010	0.0436 L	-0.0021	0.0062
Mean	0.0021 L	-0.0003	0.2009	0.0010	0.1087 L	-0.0024	0.0182
SD	0.0122	0.0002	0.0084	0.0000	0.0920	0.0004	0.0169
%RSD	574.0197	55.6528	4.1830	0.8732	84.6598	15.3907	93.1456

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1 H	235.2800	4836.000 H	100.1867 L	-0.0005
# 2 H	235.6667	4826.000	99.9793 L	-0.0015
Mean H	235.4734	4831.000 H	100.0830 L	-0.0010
SD	0.2734	7.071	0.1467	0.0007
%RSD	0.1161	0.146	0.1466	70.6157

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 250252 df10 Identity 2 : pg58-167 Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 6:16:44 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	11.5	12.0	2498.0	5016.5	858.5	-16.5	11041.5
# 2	7.5	12.0	2475.0	5010.5	855.5	-26.5	10838.5
Mean	9.5	12.0	2486.5	5013.5	857.0	-21.5	10940.0
SD	2.8	0.0	16.3	4.2	2.1	7.1	143.5
%RSD	29.8	0.0	0.7	0.1	0.2	32.9	1.3

	Na589	Sc	Sc361	Sr421
# 1	5019.5	4860.0	4860.0	-0.5
# 2	5038.5	4858.0	4858.0	-0.5
Mean	5029.0	4859.0	4859.0	-0.5
SD	12.4	1.4	1.4	0.0
%RSD	0.25	0.03	0.03	0.00

SD 13.7 11.7 11.7 11.7
 XRSD 0.3 0.0 0.0 0.0

APPARENT CONCENTRATIONS

Identity 1 : 250252 df10 Identity 2 : pg58-167 Type : SAMPLE

EVOLUTION by Micro-Active Australia Pty Ltd 6:21:58 PM November 9, 2004

010074

Weight : 1.0000 Volume : 1.00 Printed : 6:16:46 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	0.0126 L	-0.0002	10.1814	10.1846	9.1462 L	-0.0012	9.0854
# 2 L	-0.0045 L	-0.0002	10.0918	10.1766	9.1176 L	-0.0038	8.9221
Mean	0.0040 L	-0.0002	10.1366	10.1806	9.1319 L	-0.0025	9.0038
SD	0.0121	0.0000	0.0634	0.0056	0.0203	0.0018	0.1155
XRSD	299.5701	0.2197	0.6250	0.0555	0.2218	75.1191	1.2823

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1	9.5754	4860.000 H	100.6845 L	-0.0015
# 2	9.6161	4858.000 H	100.6430 L	-0.0015
Mean	9.5958	4859.000 H	100.6638 L	-0.0015
SD	0.0288	1.414	0.0293	0.0000
XRSD	0.2999	0.029	0.0291	0.0097

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_CCY_SC Identity 2 : Type : CV

Weight : 1.0000 Volume : 1.00 Printed : 6:21:38 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	2440.0	9170.0	5256.5	5226.0	1834.0	18941.0	22513.0
# 2	2408.0	9091.0	5220.5	5183.0	1813.0	18792.0	22383.0
Mean	2424.0	9130.5	5238.5	5204.5	1823.5	18866.5	22448.0
SD	22.6	55.9	25.5	30.4	14.8	105.4	91.9
XRSD	0.9	0.6	0.5	0.6	0.8	0.6	0.4

	Na589	Sc	Sc361	Sr421
# 1	15453.5	4989.5	4989.5	4992.0
# 2	15388.5	4923.5	4923.5	4950.0
Mean	15421.0	4956.5	4956.5	4971.0
SD	46.0	46.7	46.7	29.7
XRSD	0.3	0.9	0.9	0.6

APPARENT CONCENTRATIONS

Identity 1 : CLP_CCY_SC Identity 2 : Type : CV

Weight : 1.0000 Volume : 1.00 Printed : 6:21:38 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	10.1095	0.9865	20.8685	10.3344	19.1849	4.8132	18.0389
# 2	10.1106	0.9911	21.0034	10.3867	19.2197	4.8393	18.1751
Mean	10.1101	0.9888	20.9359	10.3606	19.2023	4.8262	18.1070
SD	0.0008	0.0033	0.0954	0.0370	0.0246	0.0185	0.0963
XRSD	0.0081	0.3303	0.4556	0.3571	0.1282	0.3829	0.5319

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1	28.9518	4989.500 H	103.3707	4.9450
# 2	29.2176	4923.500 H	102.0017	4.9692
Mean	29.0847	4956.500 H	102.6862	4.9571
SD	0.1070	46.660	0.0600	0.0171

 KRSD 0.6462 0.942 0.9427 0.3442

Checking calibration verification ...

EVOLUTION by Micro-Active Australia Pty Ltd 6:26:28 PM November 9, 2004 010075

Identity 1 : CLP_CCv_SC Identity 2 :

Report name	Low limit	Value	High limit
Al396	9.000	10.110	11.000
Be 313	0.900	0.989	1.100
Ca317	18.000	20.936	22.000
Fe259	9.000	10.361	11.000
K_766	18.000	19.202	22.000
Li670	4.500	4.826	5.500
Mg279	18.000	18.107	22.000
Na589	27.000	29.085	33.000
Sr421	4.500	4.957	5.500

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 6:25:56 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
# 1	11.0	16.5	2.0	-3.0	24.5	-12.0	5.5
# 2	14.0	16.5	4.0	-0.0	17.5	-2.0	-20.5
Mean	12.5	16.5	3.0	-1.5	21.0	-7.0	-7.5
SD	2.1	0.0	1.4	2.1	4.9	7.1	18.4
KRSD	17.0	0.0	47.1	141.4	23.6	101.0	245.1

	Na589	Sc	Sc361	Sr421
# 1	39.5	4923.0	4923.0	2.5
# 2	39.5	4871.0	4871.0	1.5
Mean	39.5	4897.0	4897.0	2.0
SD	0.0	36.8	36.8	0.7
KRSD	0.0	0.8	0.8	35.4

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 6:25:58 PM November 9, 2004

	Al396	Be 313	Ca317	Fe259	K_766	Li670	Mg279
	ppm	ppm	ppm	ppm	ppm	ppm	ppm
# 1	0.0098	0.0003	0.0080	0.0011	0.1201	0.0001	0.0094
# 2	0.0231	0.0003	0.0163	0.0071	0.0473	0.0026 L	-0.0119
Mean	0.0165	0.0003	0.0122	0.0041	0.0837	0.0013 L	-0.0012
SD	0.0094	0.0000	0.0058	0.0042	0.0515	0.0018	0.0151
KRSD	57.0196	4.4174	47.8067	102.4986	61.4898	134.9655	1244.1846

	Na589	Sc	Sc361	Sr421
	ppm		ppm	ppm
# 1 L	-0.0433	4923.000 H	101.9913	0.0015
# 2 L	-0.0425	4871.000 H	100.9127	0.0005
Mean L	-0.0429	4897.000 H	101.4520	0.0010
SD	0.0006	36.770	0.7627	0.0007
KRSD	1.3251	0.751	0.7518	70.4150

Checking calibration blank ...

Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value
Al396	0.050	0.016
Be 313	0.050	0.000
Ca317	0.050	0.010

1317	0.050	0.012
259	0.050	0.004
766	0.000	0.084
670	0.050	0.001
279	0.050	-0.001

OLUTION by Micro-Active Australia Pty Ltd 6:36:28 PM November 9, 2004 010076

589	0.200	-0.043
361	0.000	101.452
421	0.050	0.001

**SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT**

CLIENT: Division 20

TASK ORDER: 040827-12

SRR: 26440

SDG: 250244

CASE: CNWRA

VTSR: August 27, 2004

PROJECT#: 06002.01.141

010077

Certificates of Analysis

010078

**FISHER SCIENTIFIC
TRACEMETAL GRADE NITRIC ACID
CERTIFICATE OF ANALYSIS**

Catalog No. A509

Lot No: 1104060

Release Date: July, 2004

Expiry Date: July, 2007

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	ppb	<0.5
Cadmium	ppb	<0.1
Calcium	ppb	<0.5
Chromium	ppb	<0.2
Cobalt	ppb	<0.1
Copper	ppb	<0.1
Iron	ppb	<0.5
Lead	ppb	<0.1
Lithium	ppb	<0.1
Magnesium	ppb	<0.2
Manganese	ppb	<0.1
Mercury	ppb	<0.2
Molybdenum	ppb	<0.1
Nickel	ppb	<0.1
Potassium	ppb	<0.2
Selenium	ppb	<0.1
Silver	ppb	<0.1
Sodium	ppb	<0.2
Strontium	ppb	<0.1
Thorium	ppb	<0.1
Tin	ppb	<0.1
Titanium	ppb	<0.1
Uranium	ppb	<0.1
Vanadium	ppb	<0.1
Zinc	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 McKelvey

Dr. B. McKelvey
QA/QC Manager

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

 **Fisher Chemical**
A Fisher Scientific Company

INORGANIC LABS/RAD/CHEM LABS
 DATE RECEIVED: 10/15/04
 DATE EXPIRES: 10/15/04
 DATE OPENED: 10/15/04
 INORG: 4822 → 4822 PO: F54761

010079

FISHER SCIENTIFIC
TRACEMETAL GRADE HYDROCHLORIC ACID

CERTIFICATE OF ANALYSIS

Catalog No. A508

Lot No: 4104030

Release Date: May, 2004

Expiry Date: May, 2007

Tests	Units	Value
Assay	%	35%
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	ppb	<0.5
Cadmium	ppb	<0.1
Calcium	ppb	<0.5
Chromium	ppb	<0.1
Cobalt	ppb	<0.1
Copper	ppb	<0.1
Iron	ppb	<0.5
Lead	ppb	<0.1
Lithium	ppb	<0.1
Magnesium	ppb	<0.5
Manganese	ppb	<0.1
Mercury	ppb	<0.2
Molybdenum	ppb	<0.1
Nickel	ppb	<0.1
Potassium	ppb	<0.1
Selenium	ppb	<0.1
Silver	ppb	<0.1
Sodium	ppb	<0.5
Strontium	ppb	<0.1
Thorium	ppb	<0.1
Tin	ppb	<0.1
Titanium	ppb	<0.1
Uranium	ppb	<0.1
Vanadium	ppb	<0.1
Zinc	ppb	<0.5
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. McKelvey

Dr. B. McKelvey
 QA/QC Manager

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

 **Fisher Chemical**
 A Fisher Scientific Company

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 10/13/04
 DATE EXPIRED: 10/13/04
 DATE OPENED: 10/13/04
 INDRG: 9815-29820 PO: F 54761

SPE Certificate™

010080

Certificate of Reference Material

Catalog Number: SPIKE-1 Lot No.: 26-28AS
Description: Spike Sample Standard 1
Matrix: 5% Nitric Acid/tr Tartaric Acid - HF

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.

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	198.56	3101a	Pb	50	50.06	3128
As	200	197.01	3103a	Sb	50	48.62	3102a
Ba	200	199.49	3104a	V	50	49.87	3165
Se	200	198.51	3149	Zn	50	49.70	3168a
TL	200	199.25	3158	Cu	25	25.15	3114
Fe	100	98.90	3126a	Cr	20	19.81	3112a
Co	50	50.04	3113	Ag	5	4.96	3151
Mn	50	49.90	3132	Be	5	4.92	3105a
Ni	50	50.16	3136	Cd	5	4.96	3108

Spex Reference Multi: Lot #4-24BD, 2-61BD, 17-55AS, 16-68AS

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.

JUN - - 2004

Date of Certification: _____ Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 6/30/04
DATE EXPIRED: 6/30/05
DATE OPENED: 6/16/04
INORG: 4607
FO: F53398
DR

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.

010081



INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 09/08/04
DATE EXPIRED: 09/15/2005 WJS
DATE OPENED: 09/08/04
INORG: 4767 PO: F54704

SPEXertificate™

010082

Certificate of Reference Material

Catalog Number: ICAL-1 **Lot No.:** 25-178AS
Description: Instrument Calibration Standard 1
Matrix: 5% Nitric Acid

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.

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.

Date of Certification: SEP 04 Certifying Officer: N. Kocherakota

Report 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

010083

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 $k_p = s^2 m$ 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_p = 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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

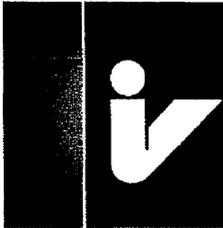
Certification Traveler Report:

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.





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e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

CUSTOM-GRADE SOLUTION

1000 µg/mL Scandium IN 5% HNO₃ (abs)

Catalog Number: CGSC1-1 and CGSC1-5

010084

Lot Number: **W-SC02058**

INORGANIC LABS/RADCHEM LABS

Starting Material: Sc₂O₃
Starting Material Purity: 99.99%
Starting Material Lot No: 632-5721

DATE RECEIVED: 10/26/04
DATE EXPIRED: 11/01/2005
DATE OPENED: 10/26/04
INORG: 4840 PO: F54768

CERTIFIED CONCENTRATION: 1005 ± 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:

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

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

(\bar{x}) = mean x_i = individual results n = number of measurements $\sum S_i$ = The summation of all significant estimated errors.

Classical Wet Assay: 1007 ± 3 µg/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 µm .

<u>O</u> Al <0.070	<u>M</u> Dy <0.00060	<u>M</u> Li <0.0010	<u>M</u> Pr <0.000030	<u>M</u> Te <0.0030
<u>M</u> Sb <0.000050	<u>M</u> Er <0.00050	<u>M</u> Lu <0.000040	<u>M</u> Re <0.00010	<u>M</u> Tb <0.000030
<u>M</u> As <0.0010	<u>M</u> Eu <0.00030	<u>M</u> Mg <0.0030	<u>M</u> Rh <0.00010	<u>M</u> Tl <0.00010
<u>M</u> Ba <0.0010	<u>M</u> Gd <0.00010	<u>M</u> Mn <0.00040	<u>M</u> Rb <0.00010	<u>M</u> Th 0.0028
<u>M</u> Be <0.000050	<u>M</u> Ga <0.00010	<u>O</u> Hg i	<u>M</u> Ru <0.00020	<u>M</u> Tm <0.000040
<u>M</u> Bi 0.0043	<u>M</u> Ge <0.00060	<u>M</u> Mo <0.00020	<u>M</u> Sm <0.00010	<u>M</u> Sn <0.00050
<u>O</u> B <0.020	<u>M</u> Au <0.00030	<u>M</u> Nd <0.00020	<u>s</u> Sc	<u>M</u> Ti <0.0050
<u>M</u> Cd <0.00030	<u>M</u> Hf 0.0030	<u>O</u> Ni <0.084	<u>O</u> Se <0.67	<u>M</u> W <0.0010
<u>O</u> Ca 0.016	<u>M</u> Ho <0.000050	<u>M</u> Nb <0.000050	<u>O</u> Si <0.034	<u>M</u> U <0.00020
<u>M</u> Ce <0.00050	<u>M</u> In <0.00010	<u>n</u> Os	<u>M</u> Ag 0.0050	<u>M</u> V <0.00020
<u>M</u> Cs <0.000030	<u>M</u> Ir <0.00050	<u>M</u> Pd <0.00050	<u>O</u> Na <0.16	<u>M</u> Yb <0.00010
<u>M</u> Cr <0.00050	<u>O</u> Fe <0.16	<u>O</u> P i	<u>M</u> Sr <0.000050	<u>M</u> Y <0.0040
<u>M</u> Co <0.00030	<u>M</u> La <0.000050	<u>M</u> Pt <0.00020	<u>n</u> S	<u>M</u> Zn 0.0075
<u>M</u> Cu <0.00060	<u>M</u> Pb 0.00050	<u>O</u> K <5.01	<u>M</u> Ta <0.00070	<u>M</u> Zr 0.032

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): 1.038 g/mL

QA:KL Rev.010804DN

Paul R. Gaines

Quality Assurance Manager

Expires:

EXPIRES
01/2005

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 - 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 μ 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 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

010086

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 Scandium in 5% (abs) HNO₃

Catalog Number: CGSC10-1, CGSC10-2, and CGSC10-5
 Lot Number: X-SC02061
 Starting Material: Sc₂O₃
 Starting Material Purity (%): 99.996918
 Starting Material Lot No BSC-632-1-5736
 Matrix: 5% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS ^{9/10/04}
 DATE RECEIVED: 09/01/04
 DATE EXPIRED: 10/01/2005 ^{WOS}
 DATE OPENED: 09/01/04
 INORG: 4761 PO: F53434

- 3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 10,007 ± 21 µg/mL

Certified Density: 1.071 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:

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

(\bar{x}) = mean
 x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i)^{1/2}}{(n)^{1/2}}$$

$\sum S$ = 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.)

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** 10,005 ± 26 µg/mL
 ICP Assay NIST SRM 3148a Lot Number: 792111
- Assay Method #2** 10,007 ± 21 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>Q</u> Al < 0.00100	<u>M</u> Dy < 0.00598	<u>M</u> Li < 0.00997	<u>M</u> Pr < 0.00030	<u>M</u> Te < 0.02990
<u>M</u> Sb < 0.00050	<u>M</u> Er < 0.00498	<u>M</u> Lu < 0.00040	<u>M</u> Re < 0.00100	<u>M</u> Tb < 0.00030
<u>M</u> As < 0.00997	<u>M</u> Eu < 0.00299	<u>Q</u> Mg 0.00100	<u>M</u> Rh < 0.00100	<u>M</u> Tl < 0.00100
<u>M</u> Ba < 0.00997	<u>M</u> Gd < 0.00100	<u>M</u> Mn < 0.00399	<u>M</u> Rb < 0.00100	<u>M</u> Th 0.11759
<u>M</u> Be < 0.00050	<u>M</u> Ga < 0.00100	<u>Q</u> Hg < 0.01000	<u>M</u> Ru < 0.00199	<u>M</u> Tm < 0.00040
<u>M</u> Bi < 0.00040	<u>M</u> Ge < 0.00598	<u>M</u> Mo < 0.00199	<u>M</u> Sm < 0.00100	<u>M</u> Sn < 0.00498
<u>M</u> B < 0.06976	<u>M</u> Au < 0.00299	<u>M</u> Nd < 0.00199	<u>s</u> Sc	<u>Q</u> Tl < 0.00100
<u>M</u> Cd < 0.00299	<u>M</u> Hf < 0.00199	<u>Q</u> Ni < 0.00090	<u>M</u> Se < 0.00797	<u>M</u> W < 0.00997
<u>Q</u> Ca 0.11500	<u>M</u> Ho < 0.00050	<u>M</u> Nb < 0.00050	<u>Q</u> Si 0.02000	<u>M</u> U < 0.00199
<u>M</u> Ce < 0.00498	<u>M</u> In < 0.00997	<u>n</u> Os	<u>M</u> Ag < 0.00199	<u>M</u> V < 0.00199
<u>M</u> Cs < 0.00030	<u>M</u> Ir < 0.00498	<u>M</u> Pd < 0.00498	<u>Q</u> Na < 0.09000	<u>M</u> Yb < 0.00100
<u>Q</u> Cr 0.00470	<u>Q</u> Fe 0.00370	<u>n</u> P	<u>M</u> Sr < 0.00050	<u>Q</u> Y < 0.00100
<u>M</u> Co < 0.00299	<u>M</u> La < 0.00050	<u>M</u> Pt < 0.00199	<u>Q</u> S < 0.02500	<u>Q</u> Zn 0.00600
<u>Q</u> Cu < 0.00140	<u>M</u> Pb < 0.00299	<u>Q</u> K < 0.10000	<u>M</u> Ta < 0.00698	<u>Q</u> Zr 0.23000

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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 44.95591; +3, 6; $\text{Sc}(\text{H}_2\text{O})_9^{3+}$

Chemical Compatibility - Soluble in HCl, H_2SO_4 and HNO_3 . Avoid HF, H_3PO_4 and neutral to basic media. Stable with most metals and inorganic anions forming an insoluble carbonate, oxide, oxalate, and fluoride. Avoid mixing with elements / solutions containing moderate amounts of fluoride. The fluoride is soluble in excess HF forming ScF_4^- (not recommended for standard preparations).

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 5-10% HNO_3 / LDPE container. Small atomic radius increases hydrolysis requiring higher acid levels than other Rare Earths.

Sc Containing Samples (Preparation and Solution) - Metal (Soluble in acids); Oxide (Dissolve by heating in H_2O / HNO_3); Ores (Carbonate fusion in Pt° followed by HCl dissolution); Organic Matrices (Dry ash and dissolve in 1:1 H_2O / HCl or HNO_3), (Aqua Regia or nitric / perchloric / sulfuric acid digestions can be used. Exercise caution when using perchloric acid.)

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 = concs.)
ICP-OES 335.373 nm	0.004 / 0.00002 $\mu\text{g}/\text{mL}$	1	ion	
ICP-OES 337.215 nm	0.004 / 0.00002 $\mu\text{g}/\text{mL}$	1	ion	Ti, U, Ni, Rh
ICP-OES 424.683 nm	0.003 / 0.00002 $\mu\text{g}/\text{mL}$	1	ion	Ce
ICP-MS 45 amu	2.3 ppt	n/a	M'	^{10}B , ^{12}C , ^{28}Si , ^{30}Si , ^{86}Kr , ^{88}Kr , ^{90}Zr , ^{91}Zr

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 8/20/02

DATE RECEIVED: 09/01/04

DATE EXPIRED: 10/01/2005 WJS

DATE OPENED: 09/01/04

INORG: 4761 PO: F53434

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: July 01, 2004

Expiration Date:

EXPIRES
1/2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Nicholas Maida
Katalin Le
Paul R. Gaines

SPEXTM Certificate

Certificate of Reference Material

Catalog Number: PLB9-2X/2Y/2T

Lot No. 10-119B

Description: 1000 mg/L Boron

Matrix: H₂O

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: 1001 mg/L

Uncertainty Associated with Measurement: +/- 3.0 mg/L

Certified Value is Traceable to: NIST SRM 3107

The CRM is prepared gravimetrically using high purity (NH₄)₂B₄O₇·4H₂O Lot# 08001E. 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: 1001 mg/L

Method: Titration with Sodium Hydroxide using Phenolphthalein as indicator. Sodium Hydroxide standardized against Potassium Biphthalate NIST SRM #84k

Instrumental Analysis by ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 1.001 @ 22.3 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.06	Cu	<0.001	Pb	<0.001
As	<0.001	Fe	0.001	Re	<0.001
Ag	0.002	Ga	<0.001	Rb	<0.001
Ba	<0.001	In	<0.001	Sr	<0.001
Be	<0.001	K	<0.06	Sb	<0.001
Bi	0.03	Li	<0.001	Si	0.01
Cd	<0.001	Mn	<0.001	Ti	<0.001
Co	<0.001	Mo	<0.001	Tl	<0.001
Ca	0.001	Mg	<0.001	V	0.003
Cr	<0.001	Na	0.01	Zr	<0.001
		Ni	0.001	Zn	0.004

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.

Date of Certification: APR '04 Certifying Officer: N. Kocherakota

INORGANIC LABS/REDOX CHEM LABS
 DATE RECEIVED: 5/2/04
 DATE EXPIRED: 4/30/05
 DATE OPENED: 5/11/04
 INORG: 4564
 PO: P5337L
 DR

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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_1 and u_2 , $u_c = \sqrt{\sum u_i^2}$

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.



SPEXTM Certificate

Certificate of Reference Material

Catalog Number: PLLI2-2X/2Y

Lot No. 10-12LI

Description: 1000 mg/L Lithium

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: 997.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3129a

The CRM is prepared gravimetrically using high purity Lithium Carbonate Lot# 03021A. 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: 997 mg/L

Method: Evaporate to dryness. Fume with Sulfuric Acid. Ignite and weigh as Li₂SO₄.

Instrumentation Analysis By ICP spectrometer: 998 mg/L

Uncertified Properties:

Density: 1.014 @ 22.2 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.001	Cu	<0.001	Pb	<0.001
As	<0.001	Fe	0.007	Re	<0.001
Ag	<0.003	Ga	<0.001	Rb	<0.001
B	<0.008	In	<0.001	Sr	<0.001
Ba	0.001	K	0.20	Sb	<0.001
Be	<0.001	Mn	<0.001	Si	0.007
Bi	<0.001	Mo	<0.001	Ti	<0.001
Ca	0.017	Mg	<0.001	Tl	<0.001
Cr	<0.001	Na	0.01	V	<0.001
Cd	0.008	Ni	<0.001	Zr	<0.001
Co	<0.001			Zn	0.035

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.

Date of Certification: JAN '04

Certifying Officer: N. Kocherakota

DATE RECEIVED: 01/23/04
 DATE EXPired: 01/30/2005
 DATE OPENED: 01/23/04
 INDRG: 4439
 PU: F52306

Report of Certification

010093

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 $k_p = s^2 m$ 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_p = 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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.



010094

SPEXTM Certificate

Certificate of Reference Material

Catalog Number: PLMO9-2X/2Y/2T **Lot No.** 10-74MO
Description: 1000 mg/L Molybdenum
Matrix: H₂O

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: 998 mg/L
Uncertainty Associated with Measurement: +/-3.0mg/L
Certified Value is Traceable to: NIST SRM #3134

The CRM is prepared gravimetrically using high purity (NH₄)₆Mo₇(O)₂₄ Lot# 03011C. 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: 998 mg/L

Method: Precipitation using 8 Hydroxy Quinoline, filter, dry and weigh as MoO₂ (C₉H₆NO)₂.

Instrumental Analysis by ICP spectrometer: 999 mg/L

Uncertified Properties:

Density: 0.9989 @ 23.7 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.002	Cu	0.003	Pb	0.002
As	0.04	Fe	<0.10	Re	0.03
Ag	<0.001	Ga	<0.001	Rb	<0.001
B	<0.006	In	<0.001	Sr	<0.001
Ba	0.001	K	0.01	Sb	0.005
Be	<0.01	Li	<0.001	Si	<0.50
Bi	<0.001	Mg	0.10	Ti	0.004
Ca	0.01	Mn	0.001	Tl	<0.001
Cr	<0.002	Na	0.007	V	0.003
Cd	<0.10	Ni	<0.001	Zr	<0.001
Co	0.002			Zn	0.009

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.

Date of Certification: JAN 04 Certifying Officer: N. Kocherakota

DATE RECEIVED: 01/30/04
DATE EXPired: 01/30/2005 V05
DATE OPENED: 01/30/04
INORG: 4440 PO: F59296

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$, 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 $u_c = \sqrt{\sum u_i^2}$

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.

ISO 9001
CERTIFIED

010095

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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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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SPEXcertificate™

Certificate of Reference Material

010098

Catalog Number: PLSI9-2X/2Y/2T **Lot No.** 11-13SI

Description: 1000 mg/L Silicon

Matrix: H2O / 0.4% F-

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: 998.5 mg/L
Uncertainty Associated with Measurement: +/- 3 mg/L
Certified Value is Traceable to: NIST SRM #3150

The CRM is prepared gravimetrically using high purity (NH4)2SiF6 Lot# 02021D. 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: 997 mg/L

Method: Precipitation using Ammonium Molybdate and 8-Hydroxy Quinoline. Filter, dry, and weigh as (C9H7ON)4(H4)[Si(Mo12O40)]

Instrumental Analysis by ICP spectrometer: 1000 mg/L

Uncertified Properties:

Density: 1.010 @ 26.5 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.002	Cu	<0.001	Pb	<0.001
As	<0.001	Fe	0.020	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.003	In	<0.001	Sr	<0.001
Ba	<0.001	K	<0.010	Sb	0.03
Be	<0.001	Li	<0.001	Ti	<0.001
Bi	<0.001	Mg	<0.001	Tl	<0.001
Ca	0.018	Mn	<0.001	V	<0.001
Cr	<0.002	Mo	<0.001	Zr	0.05
Cd	<0.001	Na	0.02	Zn	0.06
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.

Date of Certification: JUN - - 2004 **Certifying Officer:** N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 06/25/04
 DATE EXPIRED: 06/30/2005
 DATE OPENED: 06/29/04
 INORG: 4616 PO: F53398

Report 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

010099

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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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

SPEXTM Certificate

Certificate of Reference Material

010100

Catalog Number: PLTI9-2X/2Y/2T **Lot No.** 10-38TI
Description: 1000 mg/L Titanium
Matrix: H₂O/ 0.24% F-

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: 1001 mg/L
Uncertainty Associated with Measurement: 3.0mg/L
Certified Value is Traceable to: NIST SRM #3162a

The CRM is prepared gravimetrically using high purity (NH₄)₂TiF₆ Lot# 02021E. 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: 1003 mg/L

Method: Precipitation using Ammonium Hydroxide. Filter, ignite, and weigh as TiO₂.

Instrumentation Analysis By ICP spectrometer: 999 mg/L

Uncertified Properties:

Density: 1.001 @ 22.5 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.006	Cu	<0.10	Pb	<0.001
As	<0.001	Fe	<0.01	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	0.003	In	<0.001	Si	0.52
Ba	<0.001	K	<0.01	Sr	0.001
Be	<0.001	Li	<0.001	Sb	<0.001
Bi	<0.001	Mg	<0.001	Tl	<0.001
Ca	0.013	Mn	<0.001	V	<0.001
Cr	<0.003	Mo	<0.001	Zr	0.01
Cd	<0.001	Na	0.02	Zn	0.03
Co	0.002	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.

Date of Certification: JUN -- 2004 Certifying Officer: N. Kocharakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 06/25/04
 DATE EXPIRED: 06/30/2005
 DATE OPENED: 06/29/04
 INDRG: 4618 PO: F53398

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.

010101



SPEXcertificate™

Certificate of Reference Material

010102

Catalog Number: PLSR2-2X/2Y/2T **Lot No.** 10-111SR
Description: 1000 mg/L Strontium in 2% HNO₃
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: 998 mg/L
Uncertainty Associated with Measurement: +/-3.0mg/L
Certified Value is Traceable to: NIST SRM #3153a

The CRM is prepared gravimetrically using high purity Strontium Carbonate Lot# 09031B. 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: 997 mg/L

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

Instrumental Analysis by ICP spectrometer: 999 mg/L
Uncertified Properties:

Density: 1.009 @ 24.1 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.001	Cu	<0.001	Pb	0.001
As	<0.001	Fe	0.001	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.004	In	<0.001	Si	0.002
Ba	0.02	K	0.015	Sb	<0.001
Be	<0.001	Li	<0.001	Ti	<0.001
Bi	<0.001	Mg	<0.001	Tl	<0.001
Ca	0.008	Mn	<0.001	V	<0.001
Cr	<0.004	Mo	<0.001	Zr	0.004
Cd	<0.001	Na	0.005	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.

Date of Certification: AUG 04 **Certifying Officer:** N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 09/01/04
 DATE EXPIRED: 08/30/2005 103
 DATE OPENED: 09/01/04
 INFO: 4759 PO: F53235

Report 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 $k_p = s^2 m$ 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_p = 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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.



010103

010104

SPEXTM Certificate

Certificate of Reference Material

Catalog Number: PLSN5-2X/2Y/2T

Lot No. 10-87SN

Description: 1000 mg/L Tin

Matrix: 20% HCL

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: 1003 mg/L

Uncertainty Associated with Measurement: +/-3.0mg/L

Certified Value is Traceable to: NIST SRM 3161a

The CRM is prepared gravimetrically using high purity Tin Metal Lot# 05021C. 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: Precipitation using Ammonium Hydroxide. Filter, ignite, and weigh as SnO₂.

Instrumental Analysis by ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 1.034 @24.8C Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.003	Cu	0.001	Pb	0.004
As	<0.20	Fe	0.18	Rb	<0.001
Ag	0.006	Ga	<0.001	Re	<0.001
B	<0.002	In	0.05	Si	0.20
Ba	0.004	K	<0.20	Sr	<0.001
Be	<0.001	Li	<0.001	Sb	0.003
Bi	<0.001	Mg	0.004	Ti	0.009
Ca	0.02	Mn	0.003	Tl	<0.001
Cr	0.02	Mo	<0.001	V	<0.40
Cd	0.002	Na	0.02	Zr	<0.001
Co	0.007	Ni	0.06	Zn	0.05

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.

Date of Certification: APR '04 Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 5/2/04
 DATE EXPIRED: 4/30/05
 DATE OPENED: 5/11/04
 INDRG: 4565 PO: 5333H

Report of Certification

010105

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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.



SPEX Certificate TM

Certificate of Reference Material

Catalog Number: PLBI4-2X/2Y

Lot No. 10-68BI

Description: 1000 mg/L Bismuth

Matrix: 10% 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: 1001 mg/L

Uncertainty Associated with Measurement: +/-3.0mg/L

Certified Value is Traceable to: NIST SRM 3106

The CRM is prepared gravimetrically using high purity Bismuth Metal Lot# 04941B. 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: 1000 mg/L

Method: EDTA titration using Xylenol Orange as indicator. EDTA standardized against Pb(NO₃)₂ NIST SRM #928.

Instrumental Analysis by ICP spectrometer: 1002 mg/L

Uncertified Properties:

Density: 1.052@23.1 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.006	Cu	0.002	Pb	0.009
As	<0.001	Fe	0.001	Re	<0.001
Ag	<0.001	Ga	<0.001	Rb	<0.001
B	<0.003	In	<0.001	Sr	<0.001
Ba	<0.001	K	0.002	Sb	0.002
Be	<0.001	Li	<0.001	Si	<0.01
Cd	<0.001	Mn	<0.001	Ti	<0.001
Co	<0.001	Mo	<0.001	Tl	<0.001
Ca	0.006	Mg	0.002	V	<0.001
Cr	<0.001	Na	0.009	Zr	<0.001
		Ni	0.001	Zn	0.01

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.

Date of Certification: FEB '04

Certifying Officer: N. Kocherakota

INORGANIC LABS/RAUCHEM LABS
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 02/28/05 W3
 DATE OPENED: 02/25/04
 INFO: WTS PD: F53322

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.

ISO 9001

CERTIFIED

SPEXTM Certificate

Certificate of Reference Material

Catalog Number: PLLA2-2X/2Y **Lot No.** 10-27LA
Description: 1000 mg/L Lanthanum
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: 1000 mg/L
Uncertainty Associated with Measurement: +/-3.0mg/L
Certified Value is Traceable to: NIST SRM #3127a

The CRM is prepared gravimetrically using high purity La(NO₃)₃·6H₂O Lot# 03951B. 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: 1000 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: 999 mg/L

Uncertified Properties:

Density: 1.010 @ 22.3 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Ce	0.02	Lu	<0.001	Th	<0.001
Ca	0.029	Mn	<0.001	Tm	<0.001
Dy	<0.001	Mo	<0.001	Ti	<0.001
Er	<0.001	Nd	<0.001	Tb	<0.001
Eu	<0.001	Ni	<0.001	Ta	<0.001
Fe	0.005	Na	0.01	Tl	<0.001
Gd	<0.001	Pr	<0.001	V	<0.001
Ga	<0.001	Rb	<0.001	W	<0.001
Hf	<0.001	Sc	0.002	Y	<0.001
Ho	<0.001	Sm	<0.001	Yb	<0.001
In	<0.001			Zr	<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.

Date of Certification: JAN '04 **Certifying Officer:** N. Kocherakota

INFORMATION: CRM/INSTRUMENTS
 DATE RECEIVED: 01/23/04
 DATE EXPURED: 01/30/2005 VDS
 DATE OPENED: 01/23/04
 INORG: 4438 PO: 553306

Report of Certification

010109

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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.



SPEXcertificate™

Certificate of Reference Material

Catalog Number: PLY2-2X/2Y/2T

Lot No. 9-152Y

Description: 1,000 mg/L Yttrium

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: 1001.5 mg/L

Uncertainty Associated with Measurement: +/- 3 mg/L

Certified Value is Traceable to: NIST SRM 3167a.

The CRM is prepared gravimetrically using high purity Yttrium Oxide Lot# 08001A. 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: 1001 mg/L

Uncertified Properties:

Density: 1.010 @ 24.8 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Ce	<0.001	La	<0.001	Tb	<0.001
Ca	0.007	Lu	<0.001	Tm	<0.001
Dy	<0.001	Mn	<0.001	Tl	<0.001
Er	<0.001	Mo	<0.001	Th	<0.001
Eu	<0.001	Nd	<0.001	Ta	<0.001
Fe	0.003	Ni	<0.001	Ti	<0.001
Gd	<0.001	Na	0.005	V	<0.001
Ga	<0.001	Pr	<0.001	W	<0.001
Hf	<0.001	Rb	<0.001	Yb	<0.001
Ho	<0.001	Sc	<0.001	Zr	0.003
In	<0.001	Sm	<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.

Date of Certification: JAN 04

Certifying Officer: N. Kocherakota

DATE RECEIVED: 01/23/04
 DATE EXP. DATED: 01/30/2005 VAD
 DATE OPENED: 01/23/04
 INFO: 444 PD: F52306

Report of Certification

010111

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

ASTM Guide D6362-98

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

ISO Guide 35: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

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 the certifying organization.

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

$$U = 2U_c + B \text{ mg/L}$$

Where U_c = 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)

$$95\% \text{ confidence limits} = \bar{X} \pm t_{0.05} \sqrt{\sum U_c^2}$$

where \bar{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:

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.



010112

SPEXTM Certificate

Certificate of Reference Material

Catalog Number: PLPD3-2X/2Y **Lot No.** 10-108PD
Description: 1000 mg/L Palladium
Matrix: 10% HCl

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: 1002.5 mg/L
Uncertainty Associated with Measurement: +/- 3 mg/L
Certified Value is Traceable to: NIST SRM 3138

The CRM is prepared gravimetrically using high purity Palladium Powder Lot# 01021A. 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: Precipitation using Glyoxime. Filter, dry, and weigh as Pd(C₄H₇O₂N₂)₂

Instrumental Analysis by ICP spectrometer: 1003 mg/L

Uncertified Properties:

Density: 1.017 @ 23.6 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.01	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	In	<0.001	Ru	<0.001
Be	<0.003	Mg	0.008	Sn	0.007
Bi	<0.001	Mn	<0.001	Te	<0.002
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	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.

Date of Certification: JAN 04 Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 01/13/04
 DATE EXPIRED: 01/15/2005
 DATE OPENED: 01/13/04
 INORG: 4417 PO: F5A299

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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.



SPEXTM Certificate

Certificate of Reference Material

Catalog Number: PLS9-2X/2Y/2T

Lot No. 10-122S

Description: 1000 mg/L Sulfur

Matrix: H₂O

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: 1001 mg/L

Uncertainty Associated with Measurement: +/-3.0mg/L

Certified Value is Traceable to: NIST SRM #3154

The CRM is prepared gravimetrically using high purity Ammonium Sulfate Lot# 05891M. 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: Precipitation using Barium Chloride. Filter, ignite and weigh as BaSO₄.

Instrumental Analysis by ICP spectrometer: 1000 mg/L

Uncertified Properties:

Density: 1.001 @ 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	<0.001	Cu	<0.001	Pb	<0.001
As	0.003	Fe	0.014	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.001	In	<0.001	Si	0.003
Ba	<0.001	K	<0.10	Sr	<0.001
Be	<0.001	Li	<0.001	Sb	<0.001
Bi	<0.001	Mg	0.005	Ti	<0.001
Ca	0.012	Mn	<0.002	Tl	<0.001
Cr	<0.001	Mo	<0.001	V	<0.001
Cd	<0.001	Na	0.01	Zr	<0.001
Co	<0.001	Ni	<0.001	Zn	<0.002

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.

Date of Certification: JUN - - 2004 Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 06/25/04
 DATE EXPIRED: 06/30/2005 105
 DATE OPENED: 06/29/04
 INFO: 4617 PO: F53398

Report 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

010115

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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.



SPEXcertificate™ 010116

Certificate of Reference Material

Catalog Number: PLTH2-2X/2Y **Lot No.** 11-15TH
Description: 1000 mg/L Thorium
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: 999 mg/L
Uncertainty Associated with Measurement: +/- 3.0 mg/L
Certified Value is Traceable to: NIST SRM #3159

The CRM is prepared gravimetrically using high purity Th(NO₃)₄·4H₂O Lot# 01851R. 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: 1000 mg/L

Method: EDTA titration using Xylenol Orange as indicator. EDTA standardized against Pb(NO₃)₂ NIST SRM #928.

Instrumental Analysis by ICP spectrometer: 998 mg/L

Uncertified Properties:

Density: 1.010 @ 22.0 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Ce	0.01	La	0.003	Tb	<0.001
Ca	0.27	Lu	<0.001	Tm	<0.001
Dy	<0.001	Mn	<0.001	Ti	<0.002
Er	<0.001	Mo	<0.001	Ta	<0.001
Eu	<0.001	Nd	0.003	Tl	<0.001
Fe	<0.01	Ni	<0.001	V	<0.001
Gd	<0.001	Na	0.04	W	<0.001
Ga	<0.001	Pr	<0.001	Y	0.002
Hf	<0.001	Rb	<0.001	Yb	<0.001
Ho	<0.001	Sc	<0.03	Zr	<0.001
In	<0.001	Sm	<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.

Date of Certification: Aug '04 Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 09/10/04
 DATE EXPIRED: 08/30/2005
 DATE OPENED: 09/01/04
 INORG: 4760 PO: F53435

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.

010117



203 Norcross Avenue • Metuchen, NJ 08840 USA

732-549-7144 • 1-800-LAB-SPEX • Fax: 732-603-9647 • CRMSales@spexcsp.com • www.spexcsp.com

SPEXTM Certificate

Certificate of Reference Material

010118

Catalog Number: PLU2-2X/2Y

Lot No. 10-127U

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 Traceable to: 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

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	Tl	<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

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.

Date of Certification: JUN - - 2004 Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 06/05/04
 DATE EXPIRED: 06/30/2005
 DATE OPENED: 06/29/04
 INORG: 4619 PO: F53398

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.



010119

DATE RECEIVED: 07/29/04
 DATE EXPIRED: 07/29/2005
 DATE OPENED: 07/29/04
 INORG: 4661 PD: F53417

SPEXcertificate™

010120

Certificate of Reference Material

Catalog Number: PLW9-2X/2Y

Lot No. 10-139W

Description: 1000 mg/L Tungsten

Matrix: H₂O

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: 1003 mg/L

Uncertainty Associated with Measurement: +/-3.0 mg/L

Certified Value is Traceable to: NIST SRM #3163

The CRM is prepared gravimetrically using high purity Ammonium Tungstate Lot# 02001H. 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: Fume with Sulfuric acid to dryness. Ignite and weigh as WO₃.

Instrumental Analysis by ICP spectrometer: 1002 mg/L

Uncertified Properties:

Density: 0.9998 @ 21.7 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.003	Cu	<0.001	Pb	<0.001
As	0.004	Fe	<0.01	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	0.003
B	<0.002	In	<0.001	Si	0.60
Ba	<0.001	K	0.13	Sr	<0.001
Bc	<0.01	Li	<0.001	Sb	0.001
Bi	<0.001	Mg	<0.001	Ti	<0.001
Ca	0.006	Mn	<0.001	Tl	<0.001
Cr	<0.003	Mo	0.004	V	<0.003
Cd	<0.001	Na	0.03	Zr	<0.001
Co	<0.001	Ni	<0.001	Zn	0.01

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.

Date of Certification: ⁰⁴ Certifying Officer: N. Kocherakota

Report of Certification

010121

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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.



SPEXcertificate™

Certificate of Reference Material

010122

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 5/27/04
 DATE EXPIRED: 4/30/05
 DATE OPENED: 5/11/04
 INDRGA: 4566 PU: P53321

Catalog Number: PLZR2-2X/2Y/2T **Lot No.** 10-05ZR
Description: 1000 mg/L Zirconium
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: 997 mg/L
Uncertainty Associated with Measurement: +/- 3.0 mg/L
Certified Value is Traceable to: NIST SRM 3169

The CRM is prepared gravimetrically using high purity Zirconyl Nitrate Lot# 11011C. 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: 997 mg/L

Method: Evaporate to dryness. Fume with Sulfuric Acid. Ignite and weigh as ZrO2.

Instrumentation Analysis By ICP spectrometer: 997 mg/L

Uncertified Properties:

Density: 1.010 @ 23.6 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.03	Cu	0.002	Pb	0.002
As	<0.001	Fe	0.017	Rb	<0.001
Ag	<0.05	Ga	<0.001	Re	<0.001
B	<0.004	In	<0.001	Si	0.10
Ba	<0.001	K	0.10	Sr	<0.001
Be	<0.001	Li	0.002	Sb	<0.001
Bi	<0.001	Mg	0.003	Ti	<0.001
Ca	0.11	Mn	<0.001	Tl	<0.001
Cr	<0.009	Mo	<0.001	V	<0.001
Cd	0.004	Na	0.04	Zn	0.02
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.

Date of Certification: APR 04 Certifying Officer: N. Kocherakota

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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.

ISO 9001
CERTIFIED

010123

SPEXcertificate™

010124

Certificate of Reference Material

Catalog Number: PLNA2-3X/3Y

Lot No. U8-128NA

Description: 10,000 mg/L Sodium

Matrix: 5% 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: 9998 mg/L

Uncertainty Associated with Measurement: +/- 30 mg/L

Certified Value is Traceable to: NIST SRM 3152a.

The CRM is prepared gravimetrically using high purity Sodium Carbonate Lot# 02021A. 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: 9998 mg/L

Method: Evaporate to dryness. Fume with Sulfuric Acid. Ignite and weigh as Na₂SO₄.

Instrumentation Analysis By ICP spectrometer: 9998 mg/L

Uncertified Properties:

Density: 1.049 @ 23.9 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	0.003	Pb	<0.001
As	<0.003	Fe	0.03	Re	<0.001
Ag	<0.03	Ga	<0.001	Rb	<0.001
B	<0.03	In	<0.001	Sr	<0.002
Ba	0.03	K	0.14	Sb	<0.001
Be	<0.02	Li	<0.002	Sn	<0.001
Bi	<0.001	Mg	0.30	Ti	<0.004
Ca	0.52	Mn	0.008	Tl	<0.001
Cr	<0.004	Mo	<0.001	V	<0.001
Cd	<0.001	Ni	<0.002	Zr	<0.001
Co	<0.001			Zn	<0.03

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.

Date of Certification: JAN 04

Certifying Officer: N. Kocherakota

INORGANIC LABS/RADIOCHEM LABS
DATE RECEIVED: 01/29/04
DATE EXPIRED: 01/30/2005
DATE OPENED: 01/29/04
INORG: 4443
PO: F52308

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_c = \sqrt{\sum u_i^2}$

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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CRMSales@spexcsp.com • www.spexcsp.com

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Certificate of Reference Material

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

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.

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.

Date of Certification: NGV -- 2003 Certifying Officer: N. Kocherakota

INORGANIC LABS/PADDOJEM LABS
DATE RECEIVED: 1/29/03
DATE EXPIRED: 1/30/04
DATE OPENED: 1/21/03
FORM: 4328 PO: F52278

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_{em} = \sqrt{\sum u_i^2}$

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.

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SPEX Certificate TM

Certificate of Reference Material

Catalog Number: PLSB7-2X/2Y/2T **Lot No.** 10-43SB
Description: 1000 mg/L Antimony
Matrix: H2O/0.6Tart.Acid/tr.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: +/-3.0mg/L
Certified Value is Traceable to: NIST SRM 3102a

The CRM is prepared gravimetrically using high purity Antimony Metal Lot# 04021A. 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: 1005 mg/L

Method: Evaporate to dryness. Fume with Nitric Acid. Ignite and weigh as Sb2O4.

Instrumental Analysis by ICP spectrometer: 1002 mg/L

Uncertified Properties:

Density: 1.046 @ 25.5 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.03	Cu	0.002	Pb	0.009
As	<0.001	Fe	0.03	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.004	In	<0.001	Sr	<0.001
Ba	<0.001	K	0.01	Si	<0.01
Be	<0.001	Li	<0.001	Ti	<0.003
Bi	0.002	Mg	0.005	Tl	<0.001
Ca	0.14	Mn	<0.001	V	<0.001
Cr	<0.002	Mo	<0.001	Zr	<0.001
Cd	<0.001	Na	0.005	Zn	0.02
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.

Date of Certification: NOV -- 2003 **Certifying Officer:** *N. Kocherakota*

INORGANIC LABS/EA/CHEM LABS
DATE RECEIVED: 11/20/03
DATE EXPIRED: 11/20/04
DATE OPENED: 11/21/03
INORG: 4329 PO: F52278

Report of Certification

010129

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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$, 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 $u_c = \sqrt{\sum u_i^2}$

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.



SPEX Certificate™

Certificate of Reference Material

Catalog Number: ICV-2C **Lot No.:** 24-85AS
Description: Initial Calibration Verification Standard II
Matrix: 5% Nitric Acid

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.

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.

Date of Certification: NOV - - 2003 Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 11/20/03
 DATE EXPIRED: 11/30/2004 NDS
 DATE OPENED: 11/21/03
 INDRG: 4330 PO: F52878

Report 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_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

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ 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 $u_{cr} = \sqrt{\sum u_i^2}$

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.



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inorganic ventures / iv labs

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 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 CGAL10-5
 Lot Number: X-AL04016
 Starting Material: Al metal
 Starting Material Purity (%): 99.996430
 Starting Material Lot No: 607116
 Matrix: 5% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS 1 of 2
 DATE RECEIVED: 09/01/04
 DATE EXPIRED: 10/01/2005 WOS
 DATE OPENED: 09/01/04
 INORG: 4762 PD: F53434

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 10,020 ± 40 µg/mL

Certified Density: 1.070 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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$\sum S$ = 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.)

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 10,020 ± 40 µg/mL
 ICP Assay NIST SRM 3101a Lot Number: 010808
 Assay Method #2 10,043 ± 87 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>s</u> Al	<u>M</u> Dy < 0.02419	<u>Q</u> Li 0.00166	<u>M</u> Pr < 0.00121	<u>M</u> Te < 0.12095
<u>M</u> Sb < 0.00202	<u>M</u> Er < 0.02016	<u>M</u> Lu < 0.00161	<u>M</u> Re < 0.00403	<u>M</u> Tb < 0.00121
<u>M</u> As < 0.04032	<u>M</u> Eu < 0.01210	<u>Q</u> Mg 0.00685	<u>M</u> Rh < 0.00403	<u>M</u> Tl < 0.00403
<u>M</u> Ba < 0.04032	<u>M</u> Gd < 0.00403	<u>M</u> Mn < 0.01613	<u>M</u> Rb < 0.00403	<u>M</u> Th < 0.00403
<u>Q</u> Be < 0.00017	<u>M</u> Ga < 0.00403	<u>Q</u> Hg < 0.00700	<u>M</u> Ru < 0.00806	<u>M</u> Tm < 0.00161
<u>M</u> Bi < 0.00161	<u>M</u> Ge < 0.02419	<u>M</u> Mo < 0.00806	<u>M</u> Sm < 0.00403	<u>M</u> Sn < 0.02016
<u>Q</u> B 0.00975	<u>M</u> Au < 0.01210	<u>M</u> Nd < 0.00806	<u>M</u> Sc < 0.04032	<u>Q</u> Ti 0.00705
<u>M</u> Cd < 0.01210	<u>M</u> Hf < 0.00806	<u>Q</u> Ni < 0.00600	<u>M</u> Se < 0.03225	<u>M</u> W < 0.04032
<u>Q</u> Ca 0.10166	<u>M</u> Ho < 0.00202	<u>M</u> Nb < 0.00202	<u>Q</u> Si 0.07884	<u>M</u> U < 0.00806
<u>M</u> Ce < 0.02016	<u>Q</u> In < 0.03000	<u>n</u> Os	<u>M</u> Ag < 0.00806	<u>M</u> V < 0.00806
<u>M</u> Cs < 0.00121	<u>M</u> Ir < 0.02016	<u>M</u> Pd < 0.02016	<u>Q</u> Na 0.06639	<u>M</u> Yb < 0.00403
<u>Q</u> Cr 0.00581	<u>Q</u> Fe 0.00954	<u>Q</u> P < 0.03000	<u>M</u> Sr < 0.00202	<u>M</u> Y < 0.16126
<u>M</u> Co < 0.01210	<u>M</u> La < 0.00202	<u>M</u> Pt < 0.00806	<u>Q</u> S < 0.10000	<u>Q</u> Zn 0.07676
<u>M</u> Cu < 0.02419	<u>M</u> Pb < 0.01210	<u>Q</u> K 0.01992	<u>M</u> Ta < 0.02822	<u>M</u> Zr < 0.02016

M - Checked by ICP-MS Q - 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 $20 \pm 4^\circ\text{C}$. 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; $\text{Al}(\text{H}_2\text{O})_6^{3+}$

Chemical Compatibility - Soluble in HCl, HNO_3 , HF and H_2SO_4 . Avoid neutral media. Soluble in strongly basic NaOH forming the $\text{Al}(\text{OH})_4(\text{H}_2\text{O})_2^-$ 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_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO_3 / LDPE container.

Al Containing Samples (Preparation and Solution) - Metal (Best dissolved in HCl / HNO_3); α - Al_2O_3 (Na_2CO_3 fusion in Pt^*); γ - Al_2O_3 (Soluble in acids such as HCl); Ores (Carbonate fusion in Pt^* followed by HCl dissolution); Organic Matrices (sulfuric/peroxide digestion or nitric / sulfuric / perchloric acid decomposition, or dry ash and dissolution in dilute HCl).

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

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at concs.)
ICP-OES 394.401 nm	0.05 / 0.008 $\mu\text{g}/\text{mL}$	1	atom	U, Ce
ICP-OES 396.152 nm	0.03 / 0.006 $\mu\text{g}/\text{mL}$	1	atom	<u>Mg</u> , Zr, Ce
ICP-OES 167.078 nm	0.1 / 0.009 $\mu\text{g}/\text{mL}$	1	ion	Fe
ICP-MS 27 amu	30 ppt	n/a	M	¹² C ¹⁴ N, ¹³ C ¹⁴ N, ¹ H ¹² C ¹⁴ N, ¹¹ B ¹⁰ O, ²⁴ Cr ²⁺ , ⁵⁴ Fe ²⁺

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 82 of 2

DATE RECEIVED: 09/01/04

DATE EXPIRED: 10/01/2005 VOS

DATE OPENED: 09/01/04

INORG: 4762 PO: F53434

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: January 23, 2004

Expiration Date:

EXPIRES
1/2005

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

JoAnn Struthers

Katalin Le

Paul Gaines



inorganic ventures / iv labs

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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 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: C27L01
 Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
 DATE RECEIVED: 01/20/04
 DATE EXPIRED: 02/01/2005 V03
 DATE OPENED: 01/20/04
 INORG: 4436 PO: F52303

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2t(\sigma_s)\sqrt{n}}{(n)^{1/2}}$$

σ_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.)

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 238090.
- 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 Al 0.00013	M Dy < 0.03067	Q Li 0.00011	M Pr < 0.00153	M Te < 0.15333
M Sb < 0.00256	M Er < 0.02556	M Lu < 0.00204	M Re < 0.00511	M Tb < 0.00153
M As < 0.05111	M Eu < 0.01533	Q Mg 0.03453	M Rh < 0.00511	M Tl < 0.00511
Q Ba 0.00063	M Gd < 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	M Ge < 0.03067	M Mo < 0.01022	M Sm < 0.00511	M Sn < 0.02556
Q B < 0.00054	M Au < 0.01533	M Nd < 0.01022	Q Sc < 0.00002	M Ti < 0.25555
Q Cd < 0.00450	M Hf < 0.01022	Q Ni < 0.00230	Q Se < 0.00620	M W < 0.05111
S Ca	M Ho < 0.00256	M Nb < 0.00256	Q Si 0.00253	M U < 0.01022
M Ce < 0.02556	Q In < 0.00200	n Os	M Ag < 0.01022	Q V < 0.00090
M Cs < 0.00153	M Ir < 0.02556	M Pd < 0.02556	Q Na < 0.00010	M Yb < 0.00511
Q Cr 0.00183	Q Fe < 0.00110	Q P < 0.00480	Q Sr 0.02021	M Y < 0.20444
Q Co < 0.00120	M La < 0.00256	M Pt < 0.01022	Q S 0.01053	Q Zn 0.02232
Q Cu < 0.00400	M Pb < 0.01533	Q K < 0.00170	M Ta < 0.03578	M Zr < 0.02556

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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valences; Coordination Number; Chemical Form in Solution - 40.078; +2; 6; $\text{Ca}(\text{H}_2\text{O})_6^{2+}$

Chemical Compatibility - Soluble in HCl and HNO_3 . Avoid H_2SO_4 , HF, H_3PO_4 , 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_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-10% HNO_3 / LDPE container.

Ca Containing Samples (Preparation and Solution) - Metal (best dissolved in diluted HNO_3), Ores (Carbonate fusion in Pt^4 followed by HCl dissolution); Organic Matrices (dry ash and dissolution in dilute HCl. Do not heat when dissolving to avoid precipitation of SiO_2). The oxide, hydroxide, carbonate, phosphate, and fluoride of calcium are soluble in % levels of HCl or HNO_3 . The sulfates (gypsum, anhydrite, etc.), certain silicates and complex compounds require fusion with Na_2CO_3 followed by HCl / water dissolution. Contamination is a very real problem when analyzing for trace levels.

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

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at all concs.)
ICP-OES 393.366 nm	0.0002 / 0.00004 $\mu\text{g}/\text{mL}$	1	ion	U, Ce
ICP-OES 398.847 nm	0.0005 / 0.00006 $\mu\text{g}/\text{mL}$	1	ion	Th
ICP-OES 422.673 nm	0.01 / 0.001 $\mu\text{g}/\text{mL}$	1	atom	Ge
ICP-MS 44 amu	1200 ppt	n/a	M	^{40}Ar , ^{44}C , $^{28}\text{Si}^{16}\text{O}$, ^{88}Sr

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 (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 (BrWA), 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 Pg. 2 of 2
 DATE RECEIVED: 01/20/04
 DATE EXPIRED: 03/01/2005 VDS
 DATE OPENED: 01/20/04
 INORG: 4436 PO: 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 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
1E2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

JoAnn Struthers

Certificate Approved By: Katalin Le, QC Supervisor

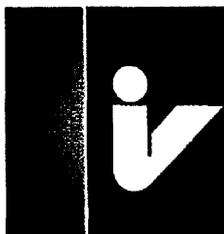
Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

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 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 23166
 Matrix: 3.5% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2

DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 v03
 DATE OPENED: 02/25/04
 INDRG: 4470 PU: F52323

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2\sqrt{\sum (e_i)^2}}{(n)^{1/2}}$$

$\sum e_i$ = 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 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 99.9965% efficient for the removal of particles down to 0.3 µm.

<u>O</u> Al < 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> Tl < 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 < 0.00181
<u>M</u> Bi < 0.00161	<u>I</u> 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> Tl < 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	<u>I</u> 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>O</u> K < 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 - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. 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; 6; $\text{Fe}(\text{H}_2\text{O})_6^{3+}$

Chemical Compatibility - Stable in HCl , HNO_3 , H_2SO_4 , HF and H_3PO_4 . Avoid basic media. Stable with most metals and inorganic anions in acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.

Fe Containing Samples (Preparation and Solution) - Metal (Soluble in HCl); Oxides (If the oxide has been at a high temperature then Na_2CO_3 fusion in Pt^* followed by HCl dissolution otherwise dissolve in dilute HCl); Ores (See Oxides above using only the fusion approach).

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 concs.)
ICP-OES 238.204 nm	0.005 / 0.001 $\mu\text{g}/\text{mL}$	1	ion	<u>Ru</u> , Co
ICP-OES 239.562 nm	0.005 / 0.001 $\mu\text{g}/\text{mL}$	1	ion	Co, <u>V</u> , Cr
ICP-OES 258.940 nm	0.005 / 0.001 $\mu\text{g}/\text{mL}$	1	ion	Hf, Nb
ICP-MS 56 amu	970 ppt	n/a	M ⁺	³⁹ Ar ⁺ N ⁺ H, ⁴⁰ Ar ⁺ O, ³⁹ Ar ⁺ O ⁺ H, ³⁸ Ar ⁺ O, ³⁷ Cl ⁺ O ⁺ H, ⁴⁰ Ca ⁺ O

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 (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 Pg. 2 of 2
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 VOS
 DATE OPENED: 02/25/04
 INORG: 4470 PU: F52323

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: March 20, 2003

Expiration Date:

EXPIRES
1/2/05

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

JoAnn Struthers

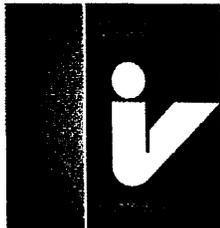
Katalin Le

Paul Gaines

010144

inorganic ventures / iv labs

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 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 Potassium In 1.4% (abs) HNO₃

Catalog Number: CGK10-1, CGK10-2, and CGK10-5

Lot Number: W-K02111

Starting Material: KNO₃

Starting Material Purity (%): 99.997230

Starting Material Lot No K18J19

Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 11/5/03 10/2
 DATE EXPIRED: 12/1/2004 DP
 DATE OPENED: 11/5/03
 INORG: 4320 PO: FS2256

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:

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

(\bar{x}) = mean
 x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$\sum s_i$ = 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** 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.

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> Al < 0.00090	<u>M</u> Dy < 0.02400	<u>Q</u> Li < 0.00003	<u>M</u> Pr < 0.00120	<u>M</u> Te < 0.11998
<u>M</u> Sb < 0.00200	<u>M</u> Er < 0.02000	<u>M</u> Lu < 0.00160	<u>M</u> Re < 0.00400	<u>M</u> Tb < 0.00120
<u>M</u> As < 0.03999	<u>M</u> Eu < 0.01200	<u>Q</u> Mg 0.00100	<u>M</u> Rh < 0.00400	<u>M</u> Tl < 0.00400
<u>M</u> Ba < 0.03999	<u>M</u> Gd < 0.00400	<u>Q</u> Mn < 0.00003	<u>M</u> Rb 0.49948	<u>M</u> Th < 0.00400
<u>Q</u> Be < 0.00020	<u>M</u> Ga < 0.00400	<u>Q</u> Hg < 0.01500	<u>M</u> Ru < 0.00800	<u>M</u> Tm < 0.00160
<u>M</u> Bi < 0.00160	<u>Q</u> Ge < 0.00150	<u>M</u> Mo < 0.00800	<u>M</u> Sm < 0.00400	<u>M</u> Sn < 0.02000
<u>Q</u> B < 0.00060	<u>Q</u> Au < 0.00300	<u>M</u> Nd < 0.00800	<u>Q</u> Sc < 0.00002	<u>Q</u> Ti < 0.00070
<u>M</u> Cd < 0.01200	<u>M</u> Hf < 0.00800	<u>Q</u> Ni < 0.00230	<u>Q</u> Se < 0.05000	<u>M</u> W < 0.03999
<u>Q</u> Ca 0.00075	<u>M</u> Ho < 0.00200	<u>M</u> Nb < 0.00200	<u>Q</u> Si < 0.00340	<u>M</u> U < 0.00800
<u>M</u> Ce < 0.02000	<u>M</u> In < 0.03999	<u>n</u> Os	<u>M</u> Ag < 0.00800	<u>Q</u> V < 0.00090
<u>M</u> Cs < 0.00120	<u>M</u> Ir < 0.02000	<u>M</u> Pd < 0.02000	<u>Q</u> Na 0.21730	<u>M</u> Yb < 0.00400
<u>M</u> Cr < 0.02000	<u>Q</u> Fe 0.00212	<u>Q</u> P < 0.00250	<u>M</u> Sr < 0.00200	<u>M</u> Y < 0.15998
<u>M</u> Co < 0.01200	<u>M</u> La < 0.00200	<u>M</u> Pt < 0.00800	<u>Q</u> S < 0.07200	<u>Q</u> Zn 0.00050
<u>M</u> Cu < 0.02400	<u>M</u> Pb < 0.01200	<u>S</u> K	<u>M</u> Ta < 0.02800	<u>M</u> Zr < 0.02000

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 - 29.0963; +1; (6); K'(aq)
(Coordination Number in parentheses is assumed, not certain.)

Chemical Compatibility - Soluble in HCl, HNO₃, H₂SO₄, and HF aqueous matrices. Avoid use of HClO₄ due to insolubility of the perchlorate. Stable with all metals and inorganic anions except ClO₄⁻.

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

K Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Sodium carbonate fusion in P1[®] followed by HCl dissolution-blank levels of K in sodium carbonate critical); Organic Matrices (Sulfuric peroxide digestion)

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 4000cs.)
ICP-OES 766.490 nm	0.4 / 0.001 µg/mL	1	atom	2 nd order radiation from R.E.s on some optical designs
ICP-OES 771.531 nm	1.0 / 0.03 µg/mL	1	atom	2 nd order radiation from R.E.s on some optical designs
ICP-OES 404.721 nm	1.1 / 0.05 µg/mL	1	atom	<u>U</u> , <u>Ce</u>
ICP-MS 39 amu	10 ppt	na	M'	³⁹ Ar, ³⁹ Na, ³⁹ O, ³⁹ Se

- 8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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 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: 12/1/04
 DATE OPENED: 11/5/03
 INORG: 4326 PO: ES2258

Certification Date: January 30, 2003
 Expiration Date:

EXPIRES
 122004

010147

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

JoAnn Struthers

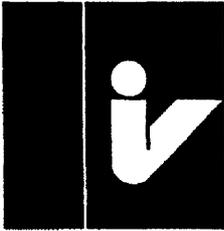
Certificate Approved By: Katalin Le, QC Supervisor

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

010148



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 Magnesium in 1.4% (abs) HNO₃

Catalog Number: CGMG10-1, CGMG10-2, and CGMG10-5
 Lot Number: X-MG03018
 Starting Material: Mg metal
 Starting Material Purity (%): 99.994984
 Starting Material Lot No: 91191
 Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
 DATE RECEIVED: 07/29/04
 DATE EXPIRED: 08/01/2005 vcs
 DATE OPENED: 07/29/04
 INORG: 4656 PO: F52417

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 10,039 ± 31 µg/mL

Certified Density: 1.051 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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$\sum s$ = 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.)

$$\text{Uncertainty } (\pm) = \frac{2(\sum s)^{1/2}}{(n)^{1/2}}$$

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 **10,039 ± 31 µg/mL**
 ICP Assay NIST SRM 3131a Lot Number: 991107
 Assay Method #2 **10,079 ± 21 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 UHPA-Filtered Clean Room. An UHPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

<u>Q</u> Al 0.04714	<u>M</u> Dy < 0.03601	<u>Q</u> Li 0.00623	<u>M</u> Pr < 0.00180	<u>M</u> Te < 0.18002
<u>M</u> Sb < 0.00300	<u>M</u> Er < 0.03000	<u>M</u> Lu < 0.00240	<u>M</u> Re < 0.00600	<u>M</u> Tb < 0.00180
<u>M</u> As < 0.06001	<u>M</u> Eu < 0.01800	<u>s</u> Mg	<u>M</u> Rh < 0.00600	<u>M</u> Tl < 0.00600
<u>M</u> Ba < 0.06001	<u>M</u> Gd < 0.00600	<u>Q</u> Mn 0.07408	<u>M</u> Rb < 0.00600	<u>M</u> Th < 0.00600
<u>Q</u> Be < 0.00017	<u>M</u> Ga < 0.00600	<u>Q</u> Hg < 0.00900	<u>M</u> Ru < 0.01200	<u>M</u> Tm < 0.00240
<u>M</u> Bi < 0.00240	<u>M</u> Ge < 0.03601	<u>M</u> Mo < 0.01200	<u>M</u> Sm < 0.00600	<u>M</u> Sn < 0.03000
<u>Q</u> B 0.00303	<u>M</u> Au < 0.01800	<u>M</u> Nd < 0.01200	<u>M</u> Sc < 0.06001	<u>Q</u> Ti 0.09765
<u>M</u> Cd < 0.01800	<u>M</u> Hf < 0.01200	<u>Q</u> Ni 0.01229	<u>M</u> Se < 0.04801	<u>M</u> W < 0.06001
<u>Q</u> Ca 0.14984	<u>M</u> Ho < 0.00300	<u>M</u> Nb < 0.00300	<u>Q</u> Si 0.02357	<u>M</u> U < 0.01200
<u>M</u> Ce < 0.03000	<u>M</u> In < 0.06001	<u>n</u> Os	<u>M</u> Ag < 0.01200	<u>M</u> V < 0.01200
<u>M</u> Cs < 0.00180	<u>M</u> Ir < 0.03000	<u>M</u> Pd < 0.03000	<u>Q</u> Na 0.02189	<u>M</u> Yb < 0.00600
<u>Q</u> Cr 0.02189	<u>Q</u> Fe 0.03704	<u>Q</u> P < 0.01600	<u>M</u> Sr < 0.00300	<u>M</u> Y 0.02021
<u>M</u> Co < 0.01800	<u>M</u> La < 0.00300	<u>M</u> Pt < 0.01200	<u>n</u> S	<u>Q</u> Zn 0.00572
<u>Q</u> Cu 0.00674	<u>Q</u> Pb 0.02694	<u>Q</u> K < 0.05000	<u>M</u> Ta < 0.04201	<u>M</u> Zr < 0.03000

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 $20 \pm 4^\circ\text{C}$. 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; $\text{Mg}(\text{H}_2\text{O})_6^{2+}$

Chemical Compatibility - Soluble in HCl, HNO_3 , and H_2SO_4 , avoid HF, H_3PO_4 , and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicates, carbonates, hydroxides, oxides, and tungstates in neutral and slightly acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-10% HNO_3 / LDPE container.

Mg Containing Samples (Preparation and Solution) - Metal (Best dissolved in diluted HNO_3); Oxide (Readily soluble in above compatible aqueous acidic solutions); Ores (Carbonate fusion in $\text{P}t^0$ followed by HCl dissolution); Organic Matrices (Sulfuric / peroxide digestion or nitric / sulfuric / perchloric acid decomposition, or dry ash and dissolution in dilute HCl).

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

Technique/line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at \pm concs.)
ICP-OES 279.553 nm	0.0002 / 0.00003 $\mu\text{g}/\text{mL}$	1	ion	Th
ICP-OES 280.270 nm	0.0003 / 0.00005 $\mu\text{g}/\text{mL}$	1	ion	U, V
ICP-OES 285.213 nm	0.002 / 0.00003 $\mu\text{g}/\text{mL}$	1	atom	U, Hf, Cr, Zr
ICP-MS 24 amu	42 ppt	n/a	M'	$^{69}\text{Li}^+$, $^{47}\text{Ti}^+$, $^{40}\text{Ca}^{+2}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 (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 Pg. 2 of 2

DATE RECEIVED: 07/29/04
 DATE EXPIRED: 08/01/2005 vps
 DATE OPENED: 07/29/04
 INORG: 4656 PD: F5347

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: April 15, 2004

Expiration Date:

EXPIRES
12/2005

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

JoAnn Struthers
Katalin Le
Paul Gaines



Inorganic ventures / iv labs

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 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 Sodium in 1.4% (abs) HNO₃

Catalog Number: CGNA10-1, CGNA10-2, and CGNA10-5

Lot Number: W-NA03010

Starting Material: Na₂CO₃

Starting Material Purity (%): 99.999819

Starting Material Lot No: 42063

Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS 19-10-02
 DATE RECEIVED: 07/29/04
 DATE EXPIRED: 08/01/2005 V05
 DATE OPENED: 07/29/04
 INORG: 4657 PO: F53417

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 10,006 ± 6 µg/mL

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:

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

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i^2)^{1/2}}{(n)^{1/2}}$$

\bar{x} = mean

x_i = individual results

n = number of measurements

$\sum s$ = 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.)

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 10,006 ± 6 µg/mL

Gravimetric NIST SRM Lot Number: See Sec. 4.2

Assay Method #2 10,019 ± 33 µg/mL

ICP Assay NIST SRM 3152a Lot Number: 990907

- 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 Al < 0.00090	M Dy < 0.00600	Q Li < 0.00003	M Pr < 0.00030	M Te < 0.02998
M Sb < 0.00050	M Er < 0.00500	M Lu < 0.00040	M Re < 0.00100	M Tb < 0.00030
M As < 0.00999	M Eu < 0.00300	Q Mg 0.00010	M Rh < 0.00100	M Tl < 0.00100
M Ba < 0.00999	M Gd < 0.00100	Q Mn < 0.00003	M Rb < 0.00100	M Th < 0.00100
Q Be < 0.00020	M Ga < 0.00100	Q Hg < 0.01500	M Ru < 0.00200	M Tm < 0.00040
M Bi < 0.00040	Q Ge < 0.00150	M Mo < 0.00200	M Sm < 0.00100	M Sn < 0.00500
Q B < 0.00060	Q Au < 0.00300	M Nd < 0.00200	Q Sc < 0.00002	Q Tl < 0.00070
M Cd < 0.00300	M Hf < 0.00200	Q Ni < 0.00230	Q Se < 0.05000	M W < 0.00999
Q Ca 0.00050	M Ho < 0.00050	M Nb < 0.00050	Q Si < 0.00340	M U < 0.00200
M Ce < 0.00500	M In < 0.00999	i Os	M Ag < 0.00200	Q V < 0.00090
M Cs < 0.00030	M Ir < 0.00500	M Pd < 0.00500	S Na	M Yb < 0.00100
M Cr < 0.00500	Q Fe < 0.00110	Q P < 0.04000	M Sr < 0.00050	M Y < 0.03997
M Co < 0.00300	M La < 0.00050	M Pt < 0.00200	Q S < 0.07200	Q Zn 0.00250
Q Cu < 0.00140	M Pb < 0.00300	Q K 0.04000	M Ta < 0.00700	M 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°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical 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, HNO₃, H₂SO₄, and HF aqueous matrices. Stable with all metals and inorganic anions.

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

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

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 all concs.)
ICP-OES 589.595 nm	0.07 / 0.0009 µg/mL	1	atom	2 nd order radiation from R.E.s on some optical designs
ICP-OES 588.995 nm	0.03 / 0.006 µg/mL	1	atom	2 nd order radiation from R.E.s on some optical designs
ICP-OES 330.237 nm	2.0 / 0.09 µg/mL	1	atom	<u>Pd, Zn</u>
ICP-MS 23 amu	310 ppt	n/a	M ⁺	⁴⁴ Ti ²⁺ , ⁴⁰ Ca ²⁺

- 8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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**

010154

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 (BrWA), 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: October 27, 2003

Expiration Date:

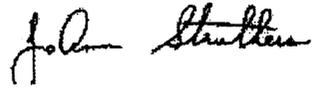
INORGANIC LABS/RADCHEM LABS pg. 2 of 2
 DATE RECEIVED: 07/29/04
 DATE EXPIRED: 08/01/2005 VOS
 DATE OPENED: 07/29/04
 INORG: 4657 PO: E53411

EXPIRES
 10/2005

010155

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

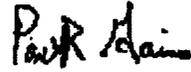
Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant



Certificate Approved By: Katalin Le, QC Supervisor



Certifying Officer: Paul Gaines, Chemist, Senior Technical Director





Inorganic ventures / iv labs

010156

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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 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

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 07/01/04
DATE EXPIRED: 08/01/2005 v03
DATE OPENED: 07/01/04
INORG: 4628 PO: F53406

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 995 ± 2 µg/mL
Certified Density: 1.004 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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i^2)^{1/2}}{(n)^{1/2}}$$

$\sum s_i^2$ = 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 #1 995 ± 2 µg/mL
ICP Assay NIST SRM 3129a Lot Number: 000505
Assay Method #2 995 ± 6 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> Al 0.00120	<u>M</u> Dy < 0.01199	<u>S</u> Li	<u>M</u> Pr < 0.00060	<u>M</u> Te < 0.05994
<u>M</u> Sb < 0.00100	<u>M</u> Er < 0.00999	<u>M</u> Lu < 0.00080	<u>M</u> Re < 0.00200	<u>M</u> Tb < 0.00060
<u>M</u> As < 0.01998	<u>M</u> Eu < 0.00599	<u>Q</u> Mg 0.00650	<u>M</u> Rh < 0.00200	<u>M</u> Tl < 0.00200
<u>M</u> Ba < 0.01998	<u>M</u> Gd < 0.00200	<u>Q</u> Mn 0.00006	<u>M</u> Rb < 0.00200	<u>M</u> Th < 0.00200
<u>Q</u> Be < 0.00020	<u>M</u> Ga < 0.00200	<u>Q</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> Sm < 0.00200	<u>Q</u> Sn < 0.00600
<u>Q</u> B 0.00020	<u>M</u> Au < 0.00599	<u>M</u> Nd < 0.00400	<u>M</u> Sc < 0.01998	<u>Q</u> Ti < 0.00070
<u>M</u> Cd < 0.00599	<u>M</u> Hf < 0.00400	<u>Q</u> Ni < 0.00230	<u>M</u> Se < 0.01598	<u>Q</u> W < 0.00400
<u>Q</u> Ca 0.04050	<u>M</u> Ho < 0.00100	<u>M</u> Nb < 0.00100	<u>Q</u> Si 0.04650	<u>M</u> U < 0.00400
<u>M</u> Ce < 0.00999	<u>Q</u> In < 0.00400	<u>I</u> Os	<u>M</u> Ag < 0.00400	<u>Q</u> V 0.00009
<u>M</u> Cs < 0.00060	<u>M</u> Ir < 0.00999	<u>M</u> Pd < 0.00999	<u>Q</u> Na 0.03200	<u>M</u> Yb < 0.00200
<u>M</u> Cr < 0.00999	<u>Q</u> Fe 0.00200	<u>Q</u> P < 0.00250	<u>Q</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	<u>Q</u> S 0.01250	<u>Q</u> Zn 0.00145
<u>Q</u> Cu 0.00100	<u>M</u> Pb < 0.00599	<u>Q</u> K 0.00950	<u>M</u> 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 $20 \pm 4^\circ\text{C}$. 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 HCl, HNO₃, H₂SO₄, and HF aqueous matrices. Stable with all metals and inorganic anions.

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

Li Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Sodium carbonate fusion in Pt^o followed by HCl dissolution-blank levels of Li in sodium carbonate critical); Organic Matrices (Sulfuric / peroxide digestion or nitric / sulfuric / perchloric acid decomposition).

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 all concs.)
ICP-OES 670.784 nm	0.002 / 0.00002 µg/mL	1	atom	2 nd order radiation 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 µg/mL	1	atom	<u>Sb, Th, Ni</u>
ICP-MS 7 amu	10 ppt		n/a	M ⁺

8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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 (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 7.0 of 2
 DATE RECEIVED: 07/01/04
 DATE EXPIRED: 03/01/2005 YES
 DATE OPENED: 07/01/04
 INORG: 4628 PO: F53406

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 12, 2003

Expiration Date: **EXPIRES**
01/2005

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

John Struthers
Katalin Le
Paul Gaines


inorganic ventures / iv labs

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 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 Barium in 0.1% (abs) HNO₃

Catalog Number: CGBA1-1, CGBA1-2, and 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

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/31/2005 V03
 DATE OPENED: 02/25/04
 INORG: 4465 PO: F52223

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1001 ± 1 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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i)^2}{(n)^{1/2}}$$

$\sum S$ = 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.)

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 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.

Q Al 0.00011	M Dy < 0.01269	Q Li < 0.00400	M Pr < 0.00063	M Te < 0.06343
M Sb < 0.00106	M Er < 0.01057	M Lu < 0.00085	M Re < 0.00211	Q Tb < 0.00390
M As < 0.02114	Q Eu < 0.00040	Q Mg 0.00009	M Rh < 0.00211	M Tl < 0.00211
s Ba	Q Gd < 0.00052	M Mn < 0.00846	M Rb < 0.00211	M Th < 0.00211
M Be < 0.00106	M Ga < 0.00211	Q Hg < 0.01200	M Ru < 0.00423	M Tm < 0.00085
M Bi < 0.00085	M Ge < 0.01269	M Mo < 0.00423	Q Sm < 0.00071	M Sn < 0.01057
M B < 0.14800	M Au < 0.00634	Q Nd < 0.00330	M Sc < 0.02114	M Ti < 0.10571
M Cd < 0.00634	M Hf < 0.00423	M Ni < 0.01691	M Se < 0.01691	M W < 0.02114
Q Ca 0.00072	M Ho < 0.00106	M Nb < 0.00106	Q Si < 0.00340	M U < 0.00423
M Ce < 0.01057	M In < 0.02114	n Os	M Ag < 0.00423	M V < 0.00423
M Cs < 0.00063	M Ir < 0.01057	M Pd < 0.01057	M Na < 0.21142	M Yb < 0.00211
M Cr < 0.01057	Q Fe 0.00062	Q P < 0.00260	Q Sr 0.00379	Q Y 0.00040
M Co < 0.00634	M La < 0.00106	M Pt < 0.00423	Q S < 0.02500	Q Zn < 0.00039
M Cu < 0.01269	M Pb 0.00020	Q K < 0.00180	Q Ta < 0.00690	M 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

010162

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. 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; 6; $\text{Ba}(\text{H}_2\text{O})_6^{2+}$

Chemical Compatibility - Soluble in HCl, and HNO_3 . Avoid H_2SO_4 , 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, sulfite and tungstate in neutral aqueous media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1 -10,000 ppm solutions chemically stable for years in 1-3.5% HNO_3 / LDPE container.

Ba Containing Samples (Preparation and Solution) - Metal (is best dissolved in diluted HNO_3) Ores/ Carbonate fusion in Pt^{a} followed by HCl dissolution. If sulfate is present dissolve the fuseate using HCl / tartaric acid to prevent BaSO_4 precipitate] 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 D.L.	Order	Type	Interferences (underlined indicates severe at all concs.)
ICP-OES 455.403 nm	0.002 / 0.0001 $\mu\text{g}/\text{mL}$	1	ion	Zr, U
ICP-OES 233.527 nm	0.004 / 0.0003 $\mu\text{g}/\text{mL}$	1	ion	
ICP-OES 230.424 nm	0.004 / 0.0005 $\mu\text{g}/\text{mL}$	1	ion	Mo, Ir, Co
ICP-MS 138 amu	1 ppt	n/a	M'	$^{121}\text{Sn}^{10}$, $^{127}\text{Te}^{10}$

8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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 (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 10CFR60 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 Pg. 2 of 2
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 VOS
 DATE OPENED: 02/25/04
 INORG: 4465 PO: F52323

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010163



- 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 28, 2003

Expiration Date:

EXPIRES
1/28/2005

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

JoAnn Struthers

Katalin Le

Paul R. Gaines


inorganic ventures / iv labs

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 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 Beryllium in 2% (abs) HNO₃

Catalog Number: CGBE1-1, CGBE1-2, and CGBE1-5
 Lot Number: W-BE01104
 Starting Material: Be(OOCCH₃)₂
 Starting Material Purity (%): 99.999897
 Starting Material Lot No: 01-10-01
 Matrix: 2% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS P3-1 of 2
 DATE RECEIVED: 06/01/04
 DATE EXPIRED: 06/01/2005 VDS
 DATE OPENED: 06/01/04
 INORG: 4592 PO: F53393

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2\sqrt{(\sum s_i)^2}}{(n)^{1/2}}$$

$\sum s_i$ = 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 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

- 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 Al < 0.00800	M Dy < 0.01305	Q Li < 0.00002	M Pr < 0.00065	M Te < 0.06525
M Sb < 0.00109	M Er < 0.01087	M Lu < 0.00087	M Re < 0.00218	M Tb < 0.00065
M As < 0.02175	M Eu < 0.00652	Q Mg < 0.00003	M Rh < 0.00218	M Tl < 0.00218
M Ba < 0.02175	M Gd < 0.00218	Q Mn < 0.00002	M Rb < 0.00218	M Th < 0.00218
s Be	M Ga < 0.00218	Q Hg < 0.01500	M Ru < 0.00435	M Tm < 0.00087
M Bi < 0.00087	M Ge < 0.01305	M Mo < 0.00435	M Sm < 0.00218	M Sn < 0.01087
Q B < 0.01200	M Au < 0.00652	M Nd < 0.00435	Q Sc < 0.00009	M Ti < 0.10874
M Cd < 0.00652	M Hf < 0.00435	M Ni < 0.65245	M Se < 0.01740	M W < 0.02175
Q Ca 0.00164	M Ho < 0.00109	M Nb < 0.00109	Q Si 0.00649	M U < 0.00435
M Ce < 0.01087	M In < 0.02175	n Os	M Ag < 0.00435	M V < 0.00435
M Cs < 0.00065	M Ir < 0.01087	M Pd < 0.01087	Q Na 0.00368	M Yb < 0.00218
Q Cr < 0.00900	Q Fe 0.00268	n P	M Sr < 0.00109	M Y < 0.08699
M Co < 0.00652	M La < 0.00109	M Pt < 0.00435	i S	M Zn < 0.04350
M Cu < 0.01305	M Pb < 0.00652	Q K < 0.10000	M Ta < 0.01522	M Zr < 0.01087

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 - 9.01218; +2; 4; Be(H₂O)₄²⁺

Chemical Compatibility - Soluble in HCl, HNO₃, H₂SO₄, and HF aqueous matrices. Stable with all metals and inorganic anions.

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

Be Containing Samples (Preparation and Solution) - Meta (is best dissolved in diluted H₂SO₄.) BeO (boiling nitric, hydrochloric, or sulfuric acids or KHSO₄ fusion). Ores (H₂SO₄/HF digestion or carbonate fusion in Pt⁺). Organic Matrices (sulfuric/peroxide digestion or nitric/sulfuric/perchloric acid decomposition, or dry ash and dissolution according to the BeO procedure above).

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 concs.)
ICP-OES 313.042 nm	0.0003 / 0.00009 µg/mL	1	ion	V, Ce, U
ICP-OES 234.861 nm	0.0003 / 0.00016 µg/mL	1	atom	Fe, Ta, Mo
ICP-OES 313.107 nm	0.0007 / 0.0005 µg/mL	1	ion	Ce, Th, Tm
ICP-MS 9 amu	4 ppt	n/a	M ⁺	

- 8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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 (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)**

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: January 08, 2004

Expiration Date:

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
DATE RECEIVED: 06/01/04
DATE EXPIRED: 06/01/2005 v05
DATE OPENED: 06/01/04
INORG: 4592 PD: F53393

EXPIRES
1/2005

010167

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Debbie Newman, Production Manager

Debbie Newman
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

010168


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
CUSTOM-GRADE SOLUTION 1000 µg/mL Chromium⁺³ in 1.4% HNO₃ (abs)
 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%
 F16122

 INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 11/5/03
 DATE EXPIRED: 12/1/04 DR
 DATE OPENED: 11/5/03
 INORG: 4318 PO: FS2258
CERTIFIED CONCENTRATION: 995 ± 3 µg/mL

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

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

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i^2)^{1/2}}{(n)^{1/2}}$$

 \bar{x} = mean

 x_i = individual results

 n = number of measurements

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

 Instrument Analysis: 995 ± 3 µg/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 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 µm.

<u>Q</u> Al 0.0028	<u>M</u> Dy <0.00060	<u>M</u> Li <0.0010	<u>M</u> Pr <0.000030	<u>M</u> Te <0.0030
<u>M</u> Sb <0.000050	<u>M</u> Er <0.00050	<u>M</u> Lu <0.000040	<u>M</u> Re <0.00010	<u>M</u> Tb <0.000030
<u>M</u> As <0.0010	<u>M</u> Eu <0.00030	<u>Q</u> Mg <0.010	<u>M</u> Rh <0.00010	<u>M</u> Tl <0.00010
<u>M</u> Ba <0.0010	<u>M</u> Gd <0.00010	<u>Q</u> Mn <0.050	<u>M</u> Rb 0.0066	<u>M</u> Th <0.00010
<u>M</u> Be <0.000050	<u>M</u> Ga 0.00070	<u>Q</u> Hg <0.10	<u>M</u> Ru 0.017	<u>M</u> Tm <0.000040
<u>M</u> Bi <0.000040	<u>M</u> Ge <0.00060	<u>M</u> Mo <0.00020	<u>M</u> Sm <0.00010	<u>M</u> Sn <0.00050
<u>M</u> B <0.0070	<u>M</u> Au <0.00030	<u>M</u> Nd <0.00020	<u>M</u> Sc <0.0010	<u>M</u> Ti <0.0060
<u>M</u> Cd <0.00030	<u>M</u> Hf <0.00020	<u>Q</u> Ni <0.10	<u>i</u> Se <0.0010	<u>M</u> W <0.0010
<u>Q</u> Ca 0.0011	<u>M</u> Ho <0.000050	<u>M</u> Nb <0.000050	<u>Q</u> Si <0.10	<u>M</u> U <0.00020
<u>M</u> Ce <0.00050	<u>Q</u> In <0.10	<u>Q</u> Os <0.00050	<u>M</u> Ag 0.00070	<u>i</u> V <0.00010
<u>M</u> Cs <0.000030	<u>M</u> Ir <0.00050	<u>M</u> Pd <0.00050	<u>Q</u> Na 0.016	<u>M</u> Yb <0.00010
<u>s</u> Cr <0.10	<u>Q</u> Fe <0.10	<u>i</u> P <0.00020	<u>M</u> Sr <0.000050	<u>M</u> Y <0.0040
<u>Q</u> Co <0.10	<u>M</u> La <0.000050	<u>M</u> Pt <0.00020	<u>Q</u> S <0.10	<u>Q</u> Zn <0.10
<u>M</u> Cu <0.00060	<u>M</u> Pb 0.00039	<u>Q</u> K <0.00070	<u>M</u> Ta <0.00070	<u>M</u> Zr <0.00050

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): 1.010 g/mL

(over)

QA:KSL Rev. 090402JTS

Quality Assurance Manager

Expires:

EXPIRES
 11/2004

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 (SI), 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/IEC 17025-1999 "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 - 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 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 μ 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 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.

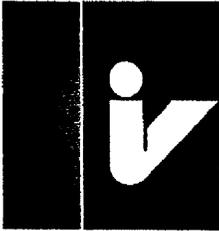
THERMOMETER CALIBRATION

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 Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Copper In 2% (abs) HNO₃

Catalog Number: CGCU1-1, CGCU1-2, and CGCU1-5
 Lot Number: W-CU02064
 Starting Material: Cu shot
 Starting Material Purity (%): 99.999437
 Starting Material Lot No: K09C13
 Matrix: 2% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 V05
 DATE OPENED: 02/25/04
 INORG: 4469 PO: F52323

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i^2)^{1/2}}{(n)^{1/2}}$$

$\sum s_i^2$ = 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 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, 217366/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 < 0.00090	<u>M</u> Dy < 0.03027	<u>O</u> Li < 0.00002	<u>M</u> Pr < 0.00151	<u>M</u> Te < 0.15134
<u>M</u> Sb < 0.00252	<u>M</u> Er < 0.02522	<u>M</u> Lu < 0.00202	<u>M</u> Re < 0.00504	<u>M</u> Tb < 0.00151
<u>M</u> As < 0.05045	<u>M</u> Eu < 0.01513	<u>O</u> Mg 0.00001	<u>M</u> Rh < 0.00504	<u>M</u> Tl < 0.00504
<u>M</u> Ba < 0.05045	<u>M</u> Gd < 0.00504	<u>M</u> Mn < 0.02018	<u>M</u> Rb < 0.00504	<u>M</u> Th < 0.00504
<u>M</u> Be < 0.00252	<u>M</u> Ga < 0.00504	<u>O</u> Hg < 0.01500	<u>M</u> Ru < 0.01009	<u>M</u> Tm < 0.00202
<u>M</u> Bi < 0.00202	<u>M</u> Ge < 0.03027	<u>M</u> Mo < 0.01009	<u>M</u> Sm < 0.00504	<u>O</u> Sn 0.00439
<u>M</u> B < 0.35312	<u>M</u> Au < 0.01513	<u>M</u> Nd < 0.01009	<u>M</u> Sc < 0.05045	<u>M</u> Tl < 0.25223
<u>M</u> Cd < 0.01513	<u>M</u> Hf < 0.01009	<u>M</u> Ni < 0.04036	<u>M</u> Se < 0.04036	<u>M</u> W < 0.05045
<u>O</u> Ca 0.00011	<u>M</u> Ho < 0.00252	<u>M</u> Nb < 0.00252	<u>O</u> Si < 0.00340	<u>M</u> U < 0.01009
<u>M</u> Ce < 0.02522	<u>M</u> In < 0.05045	<u>n</u> Os	<u>M</u> Ag < 0.01009	<u>O</u> V < 0.00300
<u>M</u> Cs < 0.00151	<u>M</u> Ir < 0.02522	<u>M</u> Pd < 0.02522	<u>O</u> Na 0.00044	<u>M</u> Yb < 0.00504
<u>M</u> Cr < 0.02522	<u>O</u> Fe 0.00054	<u>O</u> P < 0.00260	<u>M</u> Sr < 0.00252	<u>M</u> Y < 0.20178
<u>M</u> Co < 0.01513	<u>M</u> La < 0.00252	<u>M</u> Pt < 0.01009	<u>n</u> S	<u>M</u> Zn < 0.10089
<u>s</u> Cu	<u>M</u> Pb 0.00050	<u>O</u> K < 0.00180	<u>M</u> Ta < 0.03531	<u>M</u> Zr < 0.02522

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 010172

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 - 63.546 +2; $Cu(H_2O)_6^{2+}$

Chemical Compatibility - Stable in HCl, HNO₃, H₂SO₄, HF, H₃PO₄. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

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

Cu Containing Samples (Preparation and Solution) - Metal (soluble in HNO₃); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO₃).

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 100ppm)
ICP-OES 324.754 nm	0.06/0.01 µg/mL	1	atom	Nb, U, Th, Mo, Hf
ICP-OES 224.700 nm	0.01/0.01 µg/mL	1	ion	Pb, Ir, Ni, W
ICP-OES 219.958 nm	0.01/0.02 µg/mL	1	atom	Th, Ta, Nb, U, Hf
ICP-MS 63 amu	10 ppt	n/a	M'	⁴⁴ Ar ³⁹ Na ⁴⁷ Ti ⁵⁰ Cr, ⁵¹ Ni ⁵³ Cr, ⁵⁶ O ⁵⁷ Cr, ⁶⁴ Ca ⁶⁶ O, ⁶⁸ Na ⁶⁸ Ca

8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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 Pg. 2 of 2

DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 v03
 DATE OPENED: 02/25/04
 INDRB: 4469 PD: F52323

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: May 02, 2003

Expiration Date:

EXPIRES
1/2/05

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

JoAnn Struthers
Katalin Le
Paul Gaines


inorganic ventures / iv labs

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 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 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

INORGANIC LABS/RADCHEM LABS *Pg. 1 of 2*
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 VDS
 DATE OPENED: 02/25/04
 INORG: 4472 PO: F50303

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$\sum s_i$ = 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 CRM 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.

Q Al < 0.00938	M Dy < 0.06577	Q Li < 0.00006	M Pr < 0.00329	M Te < 0.32886
M Sb < 0.00548	M Er < 0.05481	M Lu < 0.00439	M Re < 0.01096	M Tb < 0.00329
Q As < 0.01689	M Eu < 0.03289	Q Mg 0.00002	M Rh < 0.01096	M Tl < 0.01096
M Ba < 0.10962	M Gd < 0.01096	M Mn < 0.04385	M Rb < 0.01096	M Th < 0.01096
Q Be < 0.00626	M Ga < 0.01096	Q Hg < 0.03441	M Ru < 0.02192	M Tm < 0.00439
M Bi < 0.00439	M Ge < 0.06577	M Mo < 0.02192	M Sm < 0.01096	M Sn < 0.06481
Q B < 0.03097	M Au < 0.03289	M Nd < 0.02192	M Sc < 0.10962	M Ti < 0.54811
M Cd < 0.03289	M Hf < 0.02192	S Ni	Q Se < 0.01877	M W < 0.10962
Q Ca < 0.01157	M Ho < 0.00548	M Nb < 0.00548	Q Si 0.00188	M U < 0.02192
M Ce < 0.05481	M In < 0.10962	□ Os	M Ag < 0.02192	M V < 0.02192
M Cs < 0.00329	M Ir < 0.05481	M Pd < 0.05481	Q Na 0.00102	M Yb < 0.01096
M Cr < 0.05481	Q Fe 0.00156	Q P < 0.31280	M Sr < 0.00548	M Y < 0.43849
Q Co 0.00182	M La < 0.00548	M Pt < 0.02192	Q S < 0.07820	M Zn 0.00189
M Cu < 0.06577	M Pb < 0.03289	Q K 0.00043	M Ta < 0.07674	M Zr < 0.05481

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 - 58.69; +2; 6; Ni(H₂O)₆²⁺

Chemical Compatibility - Stable in HCl, HNO₃, H₂SO₄, HF, H₃PO₄. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

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

Ni Containing Samples (Preparation and Solution) - Metal (Soluble in HNO₃); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO₃).

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 20ppm)
ICP-OES 221.647 nm	0.01 / 0.0009 µg/mL	1	ion	Si
ICP-OES 232.009 nm	0.02 / 0.006 µg/mL	1 atom	Cr, 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	n/a	M'	⁴⁴ Ca ¹⁰ H, ⁴⁴ Ca ¹⁰ O, ²³ Na ³ Cl

- 8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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 (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 (BrWA), 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: July 23, 2003

Expiration Date:

INORGANIC LABS/RADCHEM LABS Ps. 2062
DATE RECEIVED: 02/25/04
DATE EXPIRED: 03/01/2005 V02
DATE OPENED: 02/25/04
INORG: 4472 PU: F52323

EXPIRES
1/2005

010177

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

JoAnn Struthers

Certificate Approved By: Katalin Le, QC Supervisor

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

010178

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 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 Boron in H₂O

Catalog Number: CGB1-1, CGB1-2, and CGB1-5
 Lot Number: W-B02042
 Starting Material: H3BO3
 Starting Material Purity (%): 99.999998
 Starting Material Lot No: OV0133
 Matrix: H₂O

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 VOS
 DATE OPENED: 02/25/04
 INORG: 4466 PO: F52323

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 999 ± 2 µg/mL

Certified Density: 1.001 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:

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

$$\text{Uncertainty } (\pm) = \frac{2(s)}{(n)^{1/2}}$$

\bar{x} = mean

x_i = 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 #1 999 ± 2 µg/mL (Avg 2 runs)

ICP Assay NIST SRM 3107 Lot Number: 991907

- 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> Al < 0.00090	<u>M</u> Dy < 0.00600	<u>Q</u> 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	<u>M</u> Eu < 0.00300	<u>Q</u> Mg < 0.00006	<u>M</u> Rh < 0.00100	<u>M</u> Tl < 0.00100
<u>Q</u> Ba < 0.00010	<u>M</u> Gd < 0.00100	<u>Q</u> Mn < 0.00002	<u>M</u> Rb < 0.00100	<u>M</u> Th < 0.00100
<u>Q</u> Be < 0.00017	<u>Q</u> Ga < 0.00160	<u>Q</u> Hg < 0.01500	<u>M</u> Ru < 0.00200	<u>M</u> Tm < 0.00040
<u>M</u> 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>s</u> B	<u>M</u> Au < 0.00300	<u>M</u> Nd < 0.00200	<u>Q</u> Sc < 0.00002	<u>M</u> Ti < 0.05000
<u>M</u> Cd < 0.00300	<u>M</u> Hf < 0.00200	<u>Q</u> Ni < 0.00230	<u>Q</u> Se < 0.00620	<u>M</u> W < 0.01000
<u>Q</u> Ca < 0.00007	<u>M</u> Ho < 0.00050	<u>M</u> Nb < 0.00050	<u>Q</u> Si < 0.00067	<u>M</u> U < 0.00200
<u>Q</u> Ce < 0.00300	<u>M</u> In < 0.01000	<u>n</u> Os	<u>M</u> Ag < 0.00200	<u>Q</u> V < 0.00083
<u>M</u> Cs < 0.00030	<u>M</u> Ir < 0.00500	<u>M</u> Pd < 0.00500	<u>Q</u> Na < 0.00010	<u>M</u> Yb < 0.00100
<u>M</u> Cr < 0.00500	<u>Q</u> Fe < 0.00110	<u>Q</u> P < 0.00250	<u>M</u> Sr < 0.00050	<u>M</u> Y < 0.04000
<u>Q</u> Co < 0.00110	<u>M</u> La < 0.00050	<u>M</u> Pt < 0.00200	<u>Q</u> S < 0.10000	<u>Q</u> Zn < 0.00019
<u>M</u> Cu < 0.00600	<u>M</u> Pb < 0.00300	<u>Q</u> K < 0.00300	<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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 10.811; +3; 4; $\text{B}(\text{OH})_3$ and $\text{B}(\text{OH})_4^-$

Chemical Compatibility - Moderately soluble in HCl , HNO_3 , H_2SO_4 and HF aqueous matrices and very soluble in NH_4OH . Stable with all metals and inorganic anions at low to moderate ppm levels.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-1,000 ppm solutions chemically stable for years in 1% HNO_3 / LDPE container. 1000 -10,000 ppm stable for years in dilute NH_4OH / LDPE container.

Containing Samples (Preparation and Solution) - Metal (Crystalline form is scarcely attacked by acids or alkaline solutions; amorphous form is soluble in conc. HNO_3 or H_2SO_4); $\text{B}(\text{OH})_3$ (water soluble); Ores (avoid acid digestions and use caustic fusions in Pt); Organic Matrices (dry ash mixed with Na_2CO_3 in Pt at 450°C then increase heat to 1000°C to fuse; or perform a Na_2O_2 fusion in a Ni -crucible / Parr bomb).

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 600nm)
ICP-OES 249.773 nm	0.003 / 0.001 $\mu\text{g}/\text{mL}$	1	atom	W, Ce, Co, Th, Ta, Mn, Mo, Fe
ICP-OES 249.678 nm	0.004 / 0.003 $\mu\text{g}/\text{mL}$	1	atom	Os, W, Co, Cr, Hf
ICP-OES 208.959 nm	0.007 / 0.0005 $\mu\text{g}/\text{mL}$	1	atom	Mo
ICP-MS 11amu	700 ppt	n/a	M'	

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 (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 Pg. 2 of 2
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 VDS
 DATE OPENED: 02/25/04
 INORG: 4466 PO: F52323

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: March 21, 2003

Expiration Date:

EXPIRES
1st 2005

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



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 Molybdenum In H₂O tr. NH₄OH

Catalog Number: CGMO1-1, CGMO1-2, and CGMO1-5
 Lot Number: W-MO01132
 Starting Material: (NH₄)₆Mo₇O₂₄xH₂O
 Starting Material Purity (%): 99.995947
 Starting Material Lot No 21410
 Matrix: H₂O tr. NH₄OH

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
 DATE RECEIVED: 02/25/04
 DATE EXPIRED: 03/01/2005 VOS
 DATE OPENED: 02/25/04
 INORG: 4471 FO: F52323

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1004 ± 2 µg/mL

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$\sum S$ = 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 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>Q</u> Al < 0.05000	<u>M</u> Dy < 0.01198	<u>Q</u> Li < 0.01000	<u>Q</u> Pr < 0.10000	<u>i</u> Te
<u>M</u> Sb 0.00939	<u>M</u> Er < 0.00998	<u>M</u> Lu < 0.00080	<u>M</u> Re < 0.00200	<u>M</u> Tb < 0.00060
<u>M</u> As < 0.01997	<u>M</u> Eu < 0.00599	<u>Q</u> Mg < 0.05000	<u>M</u> Rh < 0.00200	<u>M</u> Tl < 0.00200
<u>M</u> Ba < 0.01997	<u>M</u> Gd < 0.00200	<u>M</u> Mn < 0.00799	<u>M</u> Rb 0.02445	<u>M</u> Th < 0.00200
<u>M</u> Be < 0.00100	<u>M</u> Ga < 0.00200	<u>i</u> Hg	<u>M</u> Ru < 0.00399	<u>M</u> Tm < 0.00080
<u>M</u> Bi < 0.00080	<u>M</u> Ge < 0.01198	<u>s</u> Mo	<u>M</u> Sm < 0.00200	<u>M</u> Sn < 0.00998
<u>Q</u> B < 0.50000	<u>M</u> Au < 0.00599	<u>Q</u> Nd < 0.05000	<u>Q</u> Sc < 0.05000	<u>Q</u> Tl < 0.00500
<u>Q</u> Cd < 0.50000	<u>M</u> Hf < 0.00399	<u>M</u> Ni < 0.01597	<u>M</u> Se < 0.01597	<u>M</u> W 0.05576
<u>Q</u> Ca 0.00026	<u>M</u> Ho < 0.00100	<u>Q</u> Nb < 0.10000	<u>Q</u> Si < 0.10000	<u>M</u> U < 0.00399
<u>Q</u> Ce < 0.05000	<u>M</u> In 0.00235	<u>n</u> Os	<u>M</u> Ag < 0.00399	<u>M</u> V < 0.00399
<u>M</u> Cs < 0.00060	<u>M</u> Ir < 0.00998	<u>M</u> Pd < 0.00998	<u>Q</u> Na < 0.10000	<u>M</u> Yb < 0.00200
<u>M</u> Cr < 0.00998	<u>Q</u> Fe < 0.50000	<u>i</u> P	<u>M</u> Sr < 0.00100	<u>M</u> Y < 0.07987
<u>M</u> Co < 0.00599	<u>M</u> La < 0.00100	<u>M</u> Pt < 0.00399	<u>i</u> S	<u>M</u> Zn < 0.03993
<u>M</u> Cu < 0.01198	<u>M</u> Pb < 0.00599	<u>Q</u> K 0.00980	<u>M</u> Ta < 0.01398	<u>M</u> Zr < 0.00998

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 $20 \pm 4^\circ\text{C}$. 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; $[\text{MoO}_4]^{2-}$ (chemical form as received)

Chemical Compatibility - Mo is received in a NH_4OH matrix giving the operator the option of using HCl or HF to stabilize acidic solutions. The $[\text{MoO}_4]^{2-}$ is soluble in concentrated HCl $[\text{MoOCl}_4]^{2-}$, dilute HF / HNO_3 , $[\text{MoOF}_4]^{2-}$ and basic media $[\text{MoO}_4]^{2-}$. Stable at ppm levels with some metals provided it is fluorinated. Do not mix with Alkaline or Rare Earths when HF is present. Stable with most inorganic anions provided it is in the $[\text{MoO}_4]^{2-}$ chemical form.

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the $[\text{MoOF}_4]^{2-}$ for months in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $[\text{MoO}_4]^{2-}$ chemically stable for years in 1% NH_4OH in a LDPE container.

Mo Containing Samples (Preparation and Solution) - Metal (Soluble in HF / HNO_3 or hot dilute HCl); Oxide (soluble in HF or NH_4OH); Organic Matrices (Dry ash at 450°C in Pt and dissolve oxide with HF or HCl).

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 $\mu\text{g/L}$ concs.)
ICP-OES 202.030 nm	0.008 / 0.0002 $\mu\text{g/mL}$	1	ion	Os, Hf
ICP-OES 203.844 nm	0.012 / 0.002 $\mu\text{g/mL}$	1	ion	
ICP-OES 204.598 nm	0.012 / 0.001 $\mu\text{g/mL}$	1	ion	Ir, Ta
ICP-MS 95 amu	3 ppt	na	M'	$^{40}\text{Ar}^{39}\text{K}^{40}\text{O}$, $^{79}\text{Br}^{81}\text{O}$, $^{134}\text{Os}^{136}$, $^{195}\text{Pt}^{197}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 Pg. 2 of 2

DATE RECEIVED: 02/25/04

DATE EXPIRED: 03/01/2005 VOS

DATE OPENED: 02/25/04

INORG: 4471 PO: F52323

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: July 23, 2003

Expiration Date:

EXPIRES
1/1/2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Supervisor

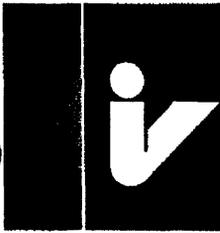
Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

JoAnn Struthers
Katalin Le
Paul Gaines

010186

inorganic ventures / iv labs

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 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com



certificate of analysis

CUSTOM-GRADE SOLUTION

1000 µg/mL Phosphorus in H₂O

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 ± 4 µg/mL

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

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

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

(\bar{x}) = mean

x_i = individual results

n = number of measurements

∑S_i = The summation of all significant estimated errors.

Classical Wet Assay: 1006 ± 4 µg/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 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 µm.

Q	Al	<0.040	M	Dy	<0.00060	M	Li	<0.0010	M	Pr	<0.000030	M	Te	<0.0030
M	Sb	0.012	M	Er	<0.00050	M	Lu	<0.000040	M	Re	<0.00010	M	Tb	<0.000030
M	As	<0.0010	M	Eu	<0.00030	M	Mg	<0.0030	M	Rh	<0.00010	M	Ti	<0.00010
M	Be	<0.0010	M	Gd	<0.00010	M	Mn	<0.00040	M	Rb	<0.00010	M	Th	<0.00010
M	Be	<0.000050	M	Ga	0.00070	Q	Hg	<0.020	M	Ru	<0.00020	M	Tm	<0.000040
M	Bi	<0.000040	M	Ge	<0.00060	M	Mo	<0.00020	M	Sm	<0.00010	M	Sn	<0.00050
M	B	<0.0070	M	Au	<0.00030	M	Nd	<0.00020	n	Sc		n	Ti	
M	Cd	<0.00030	Q	Hf	<0.00020	Q	Ni	<0.050	Q	Se	<0.40	M	W	<0.0010
Q	Ce	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	Q	Si	<0.020	M	U	<0.00020
M	Ce	<0.00050	M	In	<0.030	n	Os		M	Ag	<0.00020	M	V	<0.00020
M	Cs	<0.000030	M	Ir	<0.00050	M	Pd	<0.00050	Q	Ne	<0.090	M	Yb	<0.00010
M	Cr	<0.00050	Q	Fe	<0.050	s	P		M	Sr	<0.000050	M	Y	<0.0040
M	Co	<0.00030	M	La	<0.000050	M	Pt	<0.00020	n	S		M	Zn	0.0035
M	Cu	0.080	M	Pb	<0.00030	n	K		M	Ta	<0.00070	M	Zr	<0.00050

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): 1.001 g/mL

(over)

QA:KL Rev. 0108040M

Paul R. Gaines
 Quality Assurance Manager

Expires:

EXPIRES
 12/2005

010187

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 (CONTEC), 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 -** 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 μ 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 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.

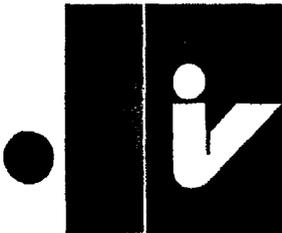
THERMOMETER CALIBRATION

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

010188

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 Silicon in H₂O tr. HNO₃ tr. HF

Catalog Number: CGSI1-1, CGSI1-2, and CGSI1-5
Lot Number: W-SI02082
Starting Material: SiO₂
Starting Material Purity (%): 99.996367
Starting Material Lot No: C05310C
Matrix: H₂O tr. HNO₃ tr. HF

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 01/20/04
DATE EXPIRED: 02/01/2005 V03
DATE OPENED: 01/20/04
INORG: 4437 PO: F52303

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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 certified value and the uncertainty:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2((\sum s_i)^2)^{1/2}}{(n)^{1/2}}$$

($\sum s_i$) = 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.

<u>Q</u> Al 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	<u>Q</u> Mg < 0.04991	<u>M</u> Rh < 0.00226	<u>M</u> Tl < 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>Q</u> Be < 0.00091	<u>M</u> Ga < 0.00226	<u>Q</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>Q</u> B 0.02409	<u>M</u> Au < 0.00679	<u>M</u> Nd < 0.00453	<u>Q</u> Sc < 0.00091	<u>Q</u> Ti 0.01325
<u>M</u> Cd < 0.00679	<u>M</u> Hf < 0.00453	<u>Q</u> Ni < 0.01044	<u>M</u> Se < 0.01811	<u>M</u> W < 0.02264
<u>Q</u> Ca 0.00135	<u>M</u> Ho < 0.00113	<u>M</u> Nb < 0.00113	<u>s</u> Si	<u>M</u> U < 0.00453
<u>M</u> Ce < 0.01132	<u>M</u> In < 0.02264	<u>l</u> Os	<u>M</u> Ag < 0.00453	<u>Q</u> V < 0.00408
<u>M</u> Cs < 0.00068	<u>M</u> Ir < 0.01132	<u>M</u> Pd < 0.01132	<u>Q</u> Na 0.02008	<u>M</u> Yb < 0.00226
<u>Q</u> Cr < 0.00681	<u>Q</u> Fe < 0.00499	<u>Q</u> P < 0.02269	<u>Q</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
<u>Q</u> Cu < 0.00454	<u>M</u> Pb < 0.00679	<u>Q</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 l - 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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 28.0855; +4; 6; $\text{Si}(\text{OH})_4(\text{F})_2^+$

Chemical Compatibility - Soluble in HCl, HF, H_3PO_4 , H_2SO_4 , and HNO_3 as the $\text{Si}(\text{OH})_4(\text{F})_2^+$. 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 $\text{Si}(\text{OH})_4(\text{F})_2^+$. 1-10,000 ppm single element solutions as the $\text{Si}(\text{OH})_4(\text{F})_2^+$ chemically stable for years in 2-5% HNO_3 / trace HF in a LDPE container.

Si Containing Samples (Preparation and Solution) - Metal (Soluble in 1:1:1 H_2O / HF / HNO_3); Oxide - SiO_2 , amorphous (Dissolve by heating in 1:1:1 H_2O / HF / HNO_3); Quartz (Fuse in Pt^{w} with Na_2CO_3); Geological Samples (Fuse in Pt^{w} with Na_2CO_3 followed by HCl solution of the fuseate); Organic Matrices containing silicates and non volatile silicon compounds (Dry ash at 450°C in Pt^{w} and dissolve by gently warming with 1:1:1 H_2O / HF / H_2SO_4 or fuse / ash with Na_2CO_3 and dissolve fuseate with HCl / H_2O); Silicone Oils - dimethyl silicones depolymerize to form volatile monomer units when heated (Measure directly in alcoholic KOH / xylene mixture where sample is treated first with the KOH at $60-100^\circ\text{C}$ to "unzip" the Si-O-Si polymeric structure or digest with concentrated $\text{H}_2\text{SO}_4/\text{H}_2\text{O}_2$ followed by cooling and dissolution of the dehydrated silica with HF.) Note that the direct analysis of silicone oils in an organic solvent will result in false high results due to high vapor pressure of volatile monomer units like hexamethylcyclotrisiloxane. The KOH forms the $\text{K}_2\text{Si}(\text{CH}_3)_2\text{O}^-$ salt which is not volatile at room temperature.

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

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at 4000nm)
ICP-OES 251.611 nm	0.012 / 0.003 $\mu\text{g}/\text{mL}$	1	Ion	Ta, U, Zr, Th
ICP-OES 212.412 nm	0.02 / 0.01 $\mu\text{g}/\text{mL}$	1	Ion	Hf, Os, <u>Mn</u> , Ta
ICP-OES 288.158 nm	0.03 / 0.004 $\mu\text{g}/\text{mL}$	1	Ion	Ta, Ce, Cr, Cd, Th
ICP-MS 28 amu	4000 - 8000 ppt	n/a	M	<u>N</u> , <u>C</u> , <u>O</u>

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

- 8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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 (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

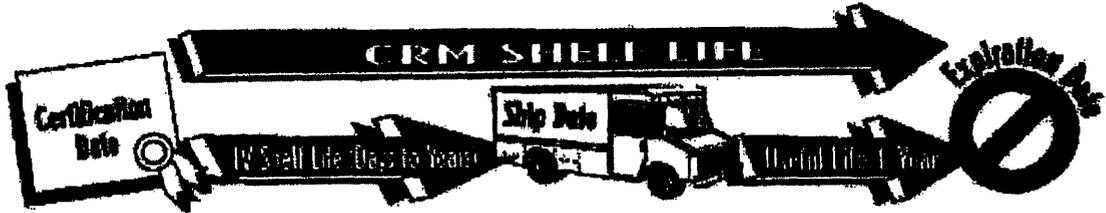
10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg 2 of 2
 DATE RECEIVED: 01/20/04
 DATE EXPIRED: 02/01/2005 YES
 DATE OPENED: 01/20/04
 INORG: 4437 PO: F52303

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010191



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, 2003

Expiration Date: **EXPIRES**
1 2005

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

010192



inorganic ventures / iv labs

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 e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

CUSTOM-GRADE SOLUTION

Catalog Number: CGT11-1, CGT11-2 and CGT11-5

1000 µg/mL Titanium in 1.4% HNO₃ (abs) tr. HF

This standard should not be prepared or stored in glass.

Lot Number: T-TI02039

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

Titanium Metal
 99.999%
 F29114

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 11/24/03
 DATE EXPIRED: 12/01/2004 v05
 DATE OPENED: 11/25/03
 INORG: 4330 PO: F52279

CERTIFIED CONCENTRATION: 1010 ± 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:

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

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i^2)^{1/2}]}{(n)^{1/2}}$$

(\bar{x}) = mean

x_i = 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 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 µm.

<u>Q</u> Al <0.010	<u>M</u> Dy <0.00060	<u>M</u> Li <0.0010	<u>M</u> Pr <0.000030	<u>M</u> Te <0.0030
<u>M</u> Sb <0.000050	<u>M</u> Er <0.00050	<u>M</u> Lu <0.000040	<u>M</u> Re <0.00010	<u>M</u> Tb <0.000030
<u>M</u> As <0.0010	<u>M</u> Eu <0.00030	<u>Q</u> Mg < 0.020	<u>M</u> Rh <0.00010	<u>M</u> Tl <0.00010
<u>M</u> Ba <0.0010	<u>M</u> Gd <0.00010	<u>M</u> Mn 0.0020	<u>M</u> Rb <0.00010	<u>M</u> Th <0.00010
<u>M</u> Be <0.000050	<u>M</u> Ga <0.00010	<u>Q</u> Hg <0.050	<u>M</u> Ru <0.00020	<u>M</u> Tm <0.000040
<u>M</u> Bi <0.000040	<u>M</u> Ge <0.00060	<u>M</u> Mo <0.00020	<u>M</u> Sm <0.00010	<u>M</u> Sn <0.00050
<u>Q</u> B <0.050	<u>M</u> Au <0.00030	<u>M</u> Nd <0.00020	<u>Q</u> Sc <0.0020	<u>s</u> Ti
<u>M</u> Cd <0.00030	<u>M</u> Hf <0.00020	<u>Q</u> Ni <0.050	<u>Q</u> Se <0.40	<u>M</u> W <0.0010
<u>Q</u> Ca <0.010	<u>M</u> Ho <0.000050	<u>M</u> Nb <0.000050	<u>Q</u> Si <0.010	<u>M</u> U <0.00020
<u>M</u> Ce <0.00050	<u>Q</u> In <0.020	<u>n</u> Os	<u>M</u> Ag <0.00020	<u>M</u> V <0.00020
<u>M</u> Cs <0.000030	<u>M</u> Ir <0.00050	<u>M</u> Pd <0.00050	<u>Q</u> Na 0.12	<u>M</u> Yb <0.00010
<u>M</u> Cr <0.00050	<u>Q</u> Fe <0.010	<u>i</u> P	<u>M</u> Sr <0.000050	<u>M</u> Y <0.0040
<u>M</u> Co <0.00030	<u>M</u> La <0.000050	<u>M</u> Pt <0.00020	<u>L</u> S	<u>M</u> Zn 0.19
<u>Q</u> Cu <0.040	<u>M</u> Pb <0.00030	<u>n</u> K 0.23	<u>M</u> Ta <0.00070	<u>M</u> Zr <0.00050

M - checked by ICP-MS

Q - checked by ICP-OES

i - spectral interference

n - not checked for

s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 1.011 g/mL

QA:KL Rev. 09/06/02/01

(over)

Paul R. Gaines
 Quality Assurance Manager

Expires:

EXPIRES
 12/01/04

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 - 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 μ 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 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.lvstandards.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 Strontium in 0.1% (abs) HNO₃

Catalog Number: CGSR1-1, CGSR1-2, and CGSR1-5

Lot Number: W-SR01124

Starting Material: SrCO₃

Starting Material Purity (%): 99.996751

Starting Material Lot No 22593, 22878

Matrix: 0.1% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS 102
 DATE RECEIVED: 7/6/04
 DATE EXPIRED: 8/1/2005 DR
 DATE OPENED: 7/8/04
 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:

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

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i^2)^{1/2}}{(n)^{1/2}}$$

\bar{x} = mean

x_i = individual results

n = number of measurements

$\sum s_i^2$ = 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

- 4.2 **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 Al < 0.00090	M Dy < 0.00055	Q Li < 0.00003	M Pr < 0.00003	Q Te < 0.10000
M Sb < 0.00005	M Er < 0.00046	M Lu < 0.00004	M Re < 0.00009	M Tb < 0.00003
Q As < 0.00500	M Eu < 0.00028	Q Mg 0.00030	Q Rh < 0.00600	M Tl < 0.00009
Q Ba 0.02200	M Gd < 0.00009	Q Mn < 0.00003	i Rb	M Th < 0.00009
Q Be < 0.00009	M Ga < 0.00009	Q Hg < 0.01500	Q Ru < 0.00300	M Tm < 0.00004
M Bi < 0.00004	M Ge < 0.00055	M Mo < 0.00018	M Sm < 0.00009	M Sn < 0.00046
Q B < 0.00060	M Au < 0.00028	M Nd < 0.00018	M Sc < 0.00092	M Ti < 0.00459
M Cd < 0.00028	M Hf < 0.00018	Q Ni < 0.00300	Q Se < 0.05000	M W < 0.00092
Q Ca 0.02500	M Ho < 0.00005	M Nb < 0.00005	Q Si < 0.00340	M U < 0.00018
M Ce < 0.00046	Q In < 0.00200	n Os	M Ag < 0.00018	M V < 0.00018
M Cs < 0.00003	M Ir < 0.00046	Q Pd < 0.00400	Q Na 0.00410	M Yb < 0.00009
Q Cr < 0.00080	Q Fe < 0.00110	Q P < 0.00480	s Sr	Q Y < 0.00004
M Co < 0.00028	M La < 0.00005	M Pt < 0.00018	n S	Q Zn 0.00720
Q Cu < 0.00140	M Pb < 0.00028	Q K < 0.00170	M Ta < 0.00064	M Zr < 0.00046

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 - 87.62; +2; 6; Sr(H₂O)₁₂

Chemical Compatibility - Soluble in HCl, and HNO₃. Avoid H₂SO₄, HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate and tungstate in neutral aqueous media.

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

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

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

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at concs.)
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
ICP-OES 460.733 nm	0.07 / 0.003 µg/mL	1	atom	Ce
ICP-MS 88 amu	1200 ppt	n/a	M	⁷⁶ Ge ⁺ , ¹⁷⁶ Yb ⁺ , ¹⁷⁴ Lu ⁺ , ¹⁷⁴ Hf ⁺

- 8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety 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**

010196

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 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 2082
 DATE RECEIVED: 7/8/04
 DATE EXPIRED: 8/1/2005
 DATE OPENED: 7/8/04
 INORG: 4635 PO: DR/F53408

Certification Date: October 22, 2003

Expiration Date:

EXPIRES
 01 2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

JoAnn Struthers

Certificate Approved By: Katalin Le, QC Supervisor

Katalin Le #10197

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines



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 H₂O 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: H₂O tr. HNO₃ tr. HF

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 995 ± 2 µg/mL

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\sum s_i$) = 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 **995 ± 2 µg/mL (Avg 2 runs)**
 ICP Assay NIST SRM 3161a Lot Number: 993107
- Assay Method #2 **998 µg/mL**
 Gravimetric NIST SRM Lot Number: See Sec. 4.2

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2

DATE RECEIVED: 03/30/04
 DATE EXPIRED: 04/01/2005 VOS
 DATE OPENED: 03/30/04
 INORG: 4512 PO: 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 $\mu\text{g/mL}$

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 Al	0.00050	M Dy	< 0.01205	Q Li	< 0.00002	M Pr	< 0.00060	M Te	< 0.06026
Q Sb	< 0.01000	M Er	< 0.01004	M Lu	< 0.00080	M Re	< 0.00201	M Tb	< 0.00060
M As	< 0.02009	M Eu	< 0.00603	Q Mg	< 0.00003	M Rh	< 0.00201	M Tl	< 0.00201
Q Ba	< 0.00070	M Gd	< 0.00201	M Mn	< 0.00804	M Rb	< 0.00201	M Th	< 0.00201
M Be	< 0.00100	M Ga	< 0.00201	Q Hg	< 0.01500	M Ru	< 0.00402	M Tm	< 0.00080
M Bi	< 0.00080	M Ge	< 0.01205	M Mo	< 0.00402	M Sm	< 0.00201	s Sn	
Q B	< 0.01200	M Au	< 0.00603	M Nd	< 0.00402	M Sc	< 0.02009	M Ti	< 0.10043
Q Cd	0.00009	M Hf	< 0.00402	Q Ni	< 0.01000	M Se	< 0.01607	M W	< 0.02009
Q Ca	< 0.00150	M Ho	< 0.00100	M Nb	< 0.00100	Q Si	< 0.00340	M U	< 0.00402
M Ce	< 0.01004	M In	< 0.02009	n Os		M Ag	< 0.00402	M V	< 0.00402
M Cs	< 0.00060	M Ir	< 0.01004	M Pd	< 0.01004	Q Na	< 0.00010	M Yb	< 0.00201
M Cr	< 0.01004	Q Fe	< 0.00110	Q P	< 0.00500	M Sr	< 0.00100	M Y	< 0.08035
Q Co	< 0.00200	M La	< 0.00100	M Pt	< 0.00402	n S		M Zn	< 0.04017
M Cu	< 0.01205	M Pb	0.00593	Q K	< 0.00200	M Ta	< 0.01406	M 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

010200

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. 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 $\text{Sn}(\text{OH})_4^{4-}$

Chemical Compatibility - Soluble in HCl and dilute HF / HNO_3 . 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 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 $\text{Sn}(\text{OH})_4^{4-}$ for 1 year in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $\text{Sn}(\text{OH})_4^{4-}$ chemically stable for years in 2.5% HNO_3 / trace HF in a LDPE container.

Sn Containing Samples (Preparation and Solution) - Metal (Soluble in HF / HNO_3 or HCl); Oxides - SnO (soluble in HCl), SnO_2 - very resistant to all acids including HF (Fusion with equal parts of Na_2CO_3 and S. It is then soluble in water or dilute acids as the stannate.); Alloys (Treat first 0.1 g with 10 mL conc. H_2SO_4 to boiling until the alloy disintegrates and nearly all of the sulfuric acid is expelled. Then add 100 mL O_2 free water and 50 mL of conc HCl 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	Type	Interferences (underlined indicates severe at 400nm)
ICP-OES 189.989 nm	0.03 / 0.003 $\mu\text{g}/\text{mL}$	1	ion	
ICP-OES 242.949 nm	0.1 / 0.01 $\mu\text{g}/\text{mL}$	1	atom	W, Mo, Rh, Ta, Co
ICP-MS 120 amu	5 ppt	n/a	M	¹²⁵ Te, ¹⁰¹ Ru ⁴⁺ , ¹⁰⁶ Pd ⁴⁺

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

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 (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 P3-2 of 2

DATE RECEIVED: 03/30/04
 DATE EXPIRED: 04/01/2005
 DATE OPENED: 03/30/04
 INORG: 4512 PD: E53361

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010201



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 11, 2004

Expiration Date:

EXPIRES
1/1/2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

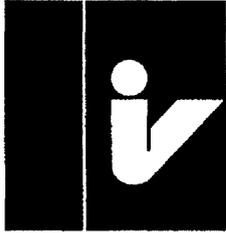
JoAnn Struthers

Certificate Approved By: Katalin Le, QC Manager

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines



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 Bismuth in 3.5% (abs) HNO₃

Catalog Number: CGBI1-1, CGBI1-2, and CGBI1-5

Lot Number: X-BI01091

Starting Material: Bi needles

Starting Material Purity (%): 99.999090

Starting Material Lot No G25L16

Matrix: 3.5% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
 DATE RECEIVED: 07/29/04
 DATE EXPIRED: 08/01/2005 V05
 DATE OPENED: 07/29/04
 INORG: 4658 PD: F53417

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 999 ± 2 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:

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

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i^2)^{1/2}}{(n)^{1/2}}$$

\bar{x} = mean

x_i = individual results

n = number of measurements

$\sum s_i^2$ = 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 #1 999 ± 2 µg/mL (Avg 2 runs)

ICP Assay NIST SRM 3106 Lot Number: 991212

Assay Method #2 1003 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.

Q Al	0.00012	M Dy	< 0.01202	Q Li	< 0.00002	M Pr	< 0.00060	M Te	< 0.06008
M Sb	< 0.00100	M Er	< 0.01001	M Lu	< 0.00080	M Re	< 0.00200	M Tb	< 0.00060
M As	< 0.02003	M Eu	< 0.00601	Q Mg	0.00070	M Rh	< 0.00200	M Tl	< 0.00200
M Ba	< 0.02003	M Gd	< 0.00200	Q Mn	< 0.00020	M Rb	< 0.00200	M Th	< 0.00200
M Be	< 0.00100	M Ga	< 0.00200	Q Hg	< 0.01500	M Ru	< 0.00401	M Tm	< 0.00080
s Bi		M Ge	< 0.01202	M Mo	< 0.00401	M Sm	< 0.00200	M Sn	< 0.01001
M B	< 0.14018	M Au	< 0.00601	M Nd	< 0.00401	M Sc	< 0.02003	M Ti	< 0.10013
Q Cd	0.00017	M Hf	< 0.00401	M Ni	< 0.01602	M Se	< 0.01602	M W	< 0.02003
Q Ca	0.00245	M Ho	< 0.00100	M Nb	< 0.00100	Q Si	0.00105	M U	< 0.00401
M Ce	< 0.01001	Q In	0.00105	n Os		M Ag	< 0.00401	M V	< 0.00401
M Cs	< 0.00060	M Ir	< 0.01001	Q Pd	< 0.00400	Q Na	0.00240	M Yb	< 0.00200
Q Cr	0.00020	Q Fe	0.00014	Q P	< 0.01000	M Sr	< 0.00100	M Y	< 0.08011
M Co	< 0.00601	M La	< 0.00100	M Pt	< 0.00401	Q S	< 0.03000	Q Zn	0.00008
Q Cu	0.00014	Q Pb	0.00135	Q K	0.00039	M Ta	< 0.01402	M Zr	< 0.01001

M - Checked by ICP-MS Q - 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 010204

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 - 208.9804; +3, 6; Bi(O)(H₂O)₃

Chemical Compatibility - Stable in HCl, HNO₃, H₂SO₄ and HF. Acid basic media forming insoluble hydroxide. Stable with most metals and inorganic anions in acidic media. Many salts that are insoluble in water are soluble in HCl, HNO₃ and HF. The major problem with Bi³⁺ 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% HNO₃ /LDPE container. 1-10,000 ppm solutions chemically stable for years in 5-7% HNO₃ /LDPE container.

Bi Containing Samples (Preparation and Solution) - Metal (soluble in HNO₃); Oxides (Soluble in HNO₃); Alloys (Dissolve in conc. 4:1 HCl/HNO₃. Heating may be required.); Organic based (dry ash at 450°C and dissolve ash in HNO₃ or acid digestion with conc. hot sulfuric acid adding hydrogen peroxide dropwise and carefully until clear.)

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 effects)
ICP-OES 223.061 nm	0.04 / 0.005 µg/mL	1	atom	<u>Th, Ir, Tl</u> Cu
ICP-OES 308.772 nm	0.08 / 0.01 µg/mL	1	atom	<u>Th, U, Zr, Hf, Fe</u>
ICP-OES 222.825 nm	0.1 / 0.02 µg/mL	1	atom	<u>Cr, Hf, Ce, Os</u>
ICP-MS 209 amu	2 ppt	n/a	M ⁺	<u>²⁰⁹Pb, ²⁰⁹Bi</u>

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety 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 - 1995 "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

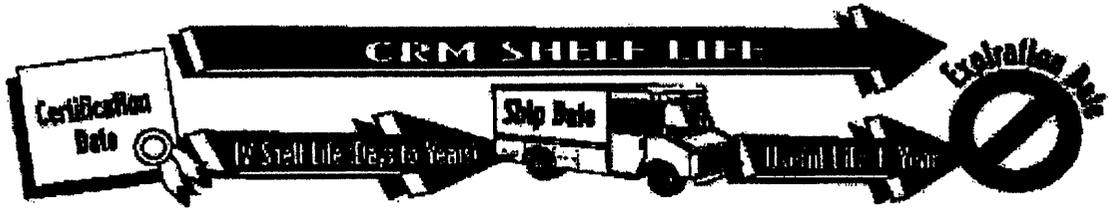
10.6 MIL-STD-45662A (Obsolete/Observed)

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2

DATE RECEIVED: 07/29/04
 DATE EXPIRED: 08/31/2005 v03
 DATE OPENED: 07/29/04
 INORG: 4658 PD: F5347

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010205



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 19, 2004

Expiration Date:

EXPIRES
1/2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

JoAnn Struthers

Certificate Approved By: Katalin Le, QC Manager

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

010206

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 040827-12

SRR: 26440

SDG: 250244

CASE: CNWRA

VTSR: August 27, 2004

PROJECT#: 06002.01.141

Pipette Calibrations

SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

Balance #: _____ Thermometer #: _____ diH2O Temperature (°C): 010207

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
Lab30	1000 ^{KE}	1.011809 ^{11/1/04}	1.0107	1.0093
TMA1	1000	1.0099	1.0033	1.0060
TMA2	1000	1.0125	1.0109	1.0076
TMA3	1000	* Not Found		
TMA6	1000	1.0059	1.0087	1.0050
TMB1	900 ^{KE}	0.9085 0.9009 ^{11/1/04}	0.9017	0.8993
TMC1	800	0.8016	0.7997	0.7990
TMDD1	750	Not Found		
TMD1	700	0.6960	0.6976	0.6964
TMD2	700	0.7069	0.7030	0.7004
TME1	600	0.5973	0.5952	0.5984
TMF2	500	0.4973	0.4978	0.4973
TMF5	500	0.5003	0.5021	0.5011
ICF1	500	* Not Found		
L30-500	500	0.5024	0.5046	0.5033
TMG3	400	0.3932	0.3921	0.3938
TMH1	300	out of service		
TMH2	300	0.2983	0.2999	0.2989
TMJ1	250	0.2471	0.2487	0.2487
TMJ2	250	0.2486	0.2494	0.2486
TMJ3	250	0.2545	0.2530	0.2527
TMK2	200	0.1989	0.1989	0.1987
TML1	150 ^{KE}	0.1476 0.1500 ^{11/1/04}	0.1507	0.1499
TMM1	120	0.1185	0.1195	0.1184
TMN3	100	0.1000	0.0997	0.0994
ICN1	100	0.0993	0.0995	0.0992
TMQ1	80	0.0798	0.0795	0.0795
TMR1	70	out of service		
TMS1	60	out of service		
LAB-30A	50	Not Found		
TMU1	40	0.0396	0.0394	0.0393
TMU2	40	0.0392	0.0395	0.0398 ^{KE} ^{11/1/04}
TMV1	30	0.0295	0.0296	0.0295
L30-20	20	0.0199	0.0200	0.0199
TMW1	25	0.0245	0.0246	0.0246
TMY1	15	Not Found	out of service	

Analyst: [Signature] Date: 11-1-04

Reviewed by: [Signature] Date: 12/22/04

SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

(Space provide for Inorganic Laboratories' Fixed Volume Pipette Verification Spreadsheet)

Kendall
11/1/04

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	1.0109	1.0107	1.0093	1.01	101.03
TMA1	1000	1.0099	1.0033	1.006	1.01	100.64
TMA2	1000	1.0125	1.0109	1.0076	1.01	101.03
TMA3	1000	NOT	FOUND			
TMA6	1000	1.0059	1.0087	1.005	1.01	100.65
TMB1	900	0.9009	0.9017	0.8993 0.899	0.90	100.06 <i>12/02</i>
TMC1	800	0.8016	0.7997	0.799	0.80	100.01
TMDD1	750	NOT	FOUND			
TMD1	700	0.696	0.6976	0.6964	0.70	99.52
TMD2	700	0.7069	0.703	0.7004	0.70	100.49
TME1	600	0.5973	0.5952	0.5984	0.60	99.49
TMF2	500	0.4973	0.4978	0.4973	0.50	99.49
TMF5	500	0.5003	0.5021	0.5011	0.50	100.23
ICF1	500	NOT	FOUND			
L30-500	500	0.5024	0.5046	0.5033	0.50	100.69
TMG3	400	0.3932	0.3921	0.3938	0.39	98.26
TMH1	300	OUT	OF	SERVICE		
TMH2	300	0.2983	0.2999	0.2989	0.30	99.68
TMJ1	250	0.2471	0.2487	0.2487	0.25	99.27
TMJ2	250	0.2486	0.2494	0.2486	0.25	99.55
TMJ3	250	0.2545	0.2530	0.2527	0.25	101.36
TMK2	200	0.1989	0.1989	0.1987	0.20	99.42
TML1	150	0.1500	0.1507	0.1499	0.15	100.13
TMM1	120	0.1185	0.1195	0.1184	0.12	99.00
TMN3	100	0.1000	0.0997	0.0994 0.0992	0.10	99.67 <i>12/02/04</i>
ICN1	100	0.0993	0.0995	0.0992	0.10	99.33
TMQ1	80	0.0798	0.0795	0.0795	0.08	99.50
TMR1	70	OUT	OF	SERVICE		
TMS1	60	OUT	OF	SERVICE		
LAB-30A	50	OUT	OF	SERVICE		NOT FOUND <i>12/02/04</i>
TMU1	40	0.0396	0.0394	0.0393	0.04	98.58
TMU2	40	0.0392	0.0395	0.0398	0.04	98.75
TMV1	30	0.0295	0.0296	0.0295	0.03	98.44
L30-20	20	0.0199	0.0200	0.0199	0.02	99.67
TMW1	25	0.0245	0.0246	0.0246	0.02	98.27
TMY1	15	OUT	OF	SERVICE		

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010209

Richard J. [Signature] 10/5/04

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
	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				0.000	0.00
ADJ200-G	100	0.0203	0.0204	0.0203	0.020	101.67
	200	0.0987	0.0986	0.0992	0.099	98.83
	200	0.1974	0.1981	0.1979	0.198	98.90
ADJ200-H	20	0.0203	0.0202	0.0202	0.020	101.17
	100	0.0991	0.0984	0.0994	0.099	98.97
	200	0.1981	0.1979	0.1985	0.198	99.08
ADJ200-J	20	0.0199	0.0200	0.0202	0.020	100.17
	100	0.0990	0.0997	0.0990	0.099	99.23
	200	0.1994	0.2002	0.1987	0.199	99.72
ADJ200	20				0.000	0.00
	100				0.000	0.00
	200				0.000	0.00
ADJ200	20				0.000	0.00
	100				0.000	0.00
	200				0.000	0.00
ADJ200	20				0.000	0.00
	100				0.000	0.00
	200				0.000	0.00

FRM-247a (Rev 3/Oct 03)

FRM-244 (Rev 2/Sept 02)

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 34

Thermometer #: G011

diH2O Temperature (° C) 21.0210

Eppendorf #	True Value (µL)	1 st Reading (g)	2 nd Reading (g)	3 rd Reading (g)
ADJ200-A	20			
	100			
	200			
ADJ200-C	20			
	100			
	200			
ADJ200-D	20			
	100			
	200			
ADJ200-G	20	0.0203	0.0204	0.0203
	100	0.0981	0.0986	0.0992
	200	0.1974	0.1981	0.1979
ADJ200-H	20	0.0203	0.0202	0.0202
	100	0.0991	0.0984	0.0994
	200	0.1981	0.1979	0.1985
ADJ200-J	20	0.0199	0.0200	0.0202
	100	0.0990	0.0997	0.0990
	200	0.1994	0.2002	0.1987
ADJ200-K	20			
	100			
	200			
ADJ200	20			
	100			
	200			

20 µL - 200 µL

Analyst: [Signature]
 Reviewed by: [Signature]

Date: 10/5/04
 Date: 10/5/04

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

*A Darwin
10/22*

010211

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
	20	0.0203	0.0206	0.0202	0.020	101.83
ADJ200-A	100	0.0998	0.0993	0.0996	0.100	99.57
	200	0.2001	0.1998	0.2004	0.200	100.05
	20	"	"	"		
ADJ200-C	100	OUT	OF SERVICE			
	200	"	"	"		
	20	0.0202	0.0210	0.0202	0.020	102.33
ADJ200-D	100	0.0992	0.1003	0.1005	0.100	100.00
	200	0.2004	0.2008	0.2003	0.201	100.25
	20				0.000	0.00
ADJ200-G	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200-H	100				0.000	0.00
	200				0.000	0.00
	20				0.000	0.00
ADJ200-J	100				0.000	0.00
	200				0.000	0.00
	20	0.0200	0.0201	0.0199	0.020	100.00
ADJ200-K	100	0.1000	0.0999	0.0995	0.100	99.80
	200	0.2000	0.2001	0.2000	0.200	100.02
	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 Log 010212

Balance #: 34

Thermometer #: G-011

diH2O Temperature (°C) 21

Eppendorf #	True Value (µL)	1 st Reading (g)	2 nd Reading (g)	3 rd Reading (g)
ADJ200-A	20	.0203	.0206	.0202
	100	.0999	.0993	.0996
	200	.2001	.1998	.2004
ADJ200-C	20	"	"	"
	100	OUT	OF	SERVICE
	200	"	"	"
ADJ200-D	20	.0202	.0210	.0202
	100	.0992	.1003	.1005
	200	.2004	.2008	.2003
ADJ200-G	20	AD 10-22-04		
	100			
	200			
ADJ200-H	20	AD 10-22-04		
	100			
	200			
ADJ200-J	20	AD 10-22-04		
	100			
	200			
ADJ200-K	20	.0200	.0201	.0199
	100	.1000	.0999	.0995
	200	.2000	AD 10/22 AD 10/22 AD 10/22 .2001	AD 10/22 AD 10/22 AD 10/22 .2000
ADJ200	20	AD 10/22		
	100			
	200			

20 µL - 200 µL

Analyst: Ann Davis / John Wilkes
 Reviewed by: Wally Wilkes

Date: 10-23-04
 Date: 10/26/04

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010213

Richard J. [Signature] 10/5/04

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				0.000	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	0.1007	0.1001	0.1012	0.101	100.67
ADJ1000-G	500	0.4927	0.4918	0.4929	0.492	98.49
	1000	0.9843	0.9866	0.9840	0.985	98.50
	100	0.0983	0.0979	0.0989	0.098	98.37
ADJ1000-H	500	0.4941	0.4947	0.4939	0.494	98.85
	1000	0.9942	0.9961	0.9956	0.995	99.53
	100	0.1011	0.1004	0.1010	0.101	100.83
ADJ1000-J	500	0.4967	0.4977	0.4965	0.497	99.39
	1000	0.9951	0.9939	0.9960	0.995	99.50
	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

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010214

Balance #: _____ Thermometer #: _____ diH2O Temperature (° C) _____

Eppendorf #	True Value (µL)	1 st Reading (g)	2 nd Reading (g)	3 rd Reading (g)
ADJ1000-C	100			
	500			
	1000			
ADJ1000-D	100			
	500			
	1000			
ADJ1000-E	100			
	500			
	1000			
ADJ1000-F	100			
	500			
	1000			
ADJ1000-G	100	0.1007	0.1001	0.1012
	500	0.4927	0.4918	0.4929
	1000	0.9843	0.9866	0.9840
ADJ1000-H	100	0.0983	0.0979	0.0989
	500	0.4941	0.4947	0.4939
	1000	0.9942	0.9961	0.9956
ADJ1000-J	100	0.1011	0.1004	0.1010
	500	0.4967	0.4977	0.4965
	1000	0.9951	0.9939	0.9960
ADJ1000-K	100			
	500			
	1000			
ADJ1000	100			
	500			
	1000			

100 µL – 1000 µL

Analyst: [Signature]
 Reviewed by: [Signature]

Date: 10/5/04
 Date: 10/26/04

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

A Darwin 10/22

010215

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	0.1008	0.1004	0.1008	0.101	100.67
ADJ1000-C	500	0.5002	0.4999	0.4999	0.500	100.00
	1000	1.0014	1.0009	1.0012	1.001	100.12
	100	0.1009	0.1010	0.1004	0.101	100.77
ADJ1000-D	500	0.4988	0.5063	0.4992	0.501	100.29
	1000	0.9969	1.0123	0.9976	1.002	100.23
	100	0.1015	0.1013	0.1025	0.102	101.77
ADJ1000-E	500	0.5003	0.4994	0.4981	0.499	99.85
	1000	1.0008	1.0011	0.9971	1.000	99.97
	100	0.1003	0.0999	0.1002	0.100	100.13
ADJ1000-F	500	0.5018	0.5009	0.5001	0.501	100.19
	1000	1.0012	1.0024	1.0013	1.002	100.16
	100				0.000	0.00
ADJ1000-G	500				0.000	0.00
	1000				0.000	0.00
	100				0.000	0.00
ADJ1000-H	500				0.000	0.00
	1000				0.000	0.00
	100				0.000	0.00
ADJ1000-J	500				0.000	0.00
	1000				0.000	0.00
	100	0.0995	0.0998	0.0995	0.100	99.60
ADJ1000-K	500	0.4999	0.5001	0.5011	0.500	100.07
	1000	1.0009	1.0011	1.0015	1.001	100.12
	100				0.000	0.00
ADJ1000	500				0.000	0.00
	1000				0.000	0.00

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010216

Balance #: 34

Thermometer #: G011

diH2O Temperature (° C) 21

Eppendorf #	True Value (µL)	1 st Reading (g)	2 nd Reading (g)	3 rd Reading (g)
ADJ1000-C	100	.1008	.1004	.1008
	500	.5002	.4999	.4999
	1000	1.0014	1.0009	1.0012
ADJ1000-D	100	.1009	.1010	.1004
	500	.4988	.5063	.4982
	1000	.9969	AD 10/22 -10: 1.0123	.9976
ADJ1000-E	100	.1015	AD 10/23 -10: .4994 .1013	.1025
	500	.5003	.4994	.4991
	1000	1.0008	1.0011	.9971
ADJ1000-F	100	.1003	.0999	.1006
	500	.5018	.5009	.5001
	1000	1.0012	1.0024	1.0013
ADJ1000-G	100			
	500			
	1000			
ADJ1000-H	100			
	500		AD 10/22	
	1000			
ADJ1000-J	100			
	500			
	1000			
ADJ1000-K	100	.0995	.0998	.0995
	500	.4999	.5001	.5011
	1000	1.0009	1.0011	1.0015
ADJ1000	100			
	500		AD 10/22	
	1000			

100 µL – 1000 µL

Analyst: James Paul John Willey
 Reviewed by: Walter C. [Signature]

Date: 10/22/04
 Date: 10/26/04

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

Michael H. King 10/5/04

010217

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
	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	0.5061	0.5024	0.5021	0.504	100.71
ADJ5000-J	2500	2.5106	2.5060	2.4978	2.505	100.19
	5000	5.0501	5.0483	5.0477	5.049	100.97
	500	0.5054	0.5032	0.5044	0.504	100.87
ADJ5000-K	2500	2.5031	2.5011	2.4993	2.501	100.05
	5000	4.9993	5.0031	5.0047	5.002	100.05
	500	0.5006	0.5019	0.5009	0.501	100.23
ADJ5000-L	2500	2.5199	2.5170	2.5079	2.515	100.60
	5000	5.0335	5.0291	5.0382	5.034	100.67
	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 Log

Balance #: 34

Thermometer #: G011

diH2O Temperature (° C) 21 010218

Eppendorf #	True Value (µL)	1 st Reading (g)	2 nd Reading (g)	3 rd Reading (g)
	500			
ADJ5000-C	2500			
	5000			
	500			
ADJ5000-G	2500			
	5000			
	500			
ADJ5000-H	2500			
	5000			
	500			
ADJ5000-I	2500			
	5000			
	500	0.5061	0.5024	0.5021
ADJ5000-J	2500	2.5106	2.5060	2.4978
	5000	5.0501	5.0483	5.0477
	500	0.5054	0.5032	0.5044
ADJ5000-K	2500	2.5031	2.5011	2.4993
	5000	4.9993	5.0031	5.0047
	500	0.5006	0.5019	0.5009
ADJ5000-L	2500	2.5199	2.5170	2.5079
	5000	5.0335	5.0291	5.0382
	500			
ADJ5000-M	2500			
	5000			
	500			
ADJ5000-N	2500			
	5000			
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			

500 µL – 5000 µL

Analyst: *Lincoln*
 Reviewed by: *Wade*

Date: 10/5/04
 Date: 10/26/04

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010219

A Darwin 10/22

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
	500	0.4969	0.5012	0.4992	0.499	99.82
ADJ5000-C	2500	2.4901	2.4937	2.4915	2.492	99.67
	5000	4.9692	4.9963	4.9945	4.987	99.73
	500	"	"	"		
ADJ5000-G	2500	OUT	OF	ORDER		
	5000	"	"	"		
	500	"	"	"		
ADJ5000-H	2500	OUT	OF	ORDER		
	5000	"	"	"		
	500	"	"	"		
	500	0.4989	0.5033	0.4979	0.500	100.01
ADJ5000-I	2500	2.4855	2.4970	2.4907	2.491	99.64
	5000	4.9815	4.9724	4.9868	4.980	99.60
	500				0.000	0.00
ADJ5000-J	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000-K	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
ADJ5000-L	2500				0.000	0.00
	5000				0.000	0.00
	500				0.000	0.00
	500	0.5063	0.5057	0.5026	0.505	100.97
ADJ5000-M	2500	2.4953	2.4935	2.4948	2.495	99.78
	5000	4.9956	4.9814	4.9837	4.927990	99.79
	500	0.5001	0.5012	0.5015	0.501	100.19
ADJ5000-N	2500	2.4998	2.5000	2.4996	2.500	99.99
	5000	5.0002	4.9999	4.9998	5.000	100.00
	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

FRM-247c (Rev 3/Apr 04)

FRM-244 (Rev 2/Sept 02)

010220

Book/page: 07 152

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 34Thermometer #: G011diH2O Temperature (° C) 21

Eppendorf #	True Value (µL)	1 st Reading (g)	2 nd Reading (g)	3 rd Reading (g)
ADJ5000-C	500	.4969	.5012	.4992
	2500	2.4961	2.4937	2.4915
	5000	4.9692	4.9963	4.9945
ADJ5000-G	500	"	"	"
	2500	OUT	OF	ORDER
	5000	"	"	"
ADJ5000-H	500	"	"	"
	2500	OUT	OF	ORDER
	5000	"	"	"
ADJ5000-I	500	.4999	.5033	.4989
	2500	2.4855	2.4970	2.4907
	5000	4.9815	4.9724	4.9868
ADJ5000-J	500			
	2500			
	5000			
ADJ5000-K	500			
	2500			
	5000			
ADJ5000-L	500			
	2500			
	5000			
ADJ5000-M	500	.5063	.5057	.5026
	2500	2.4953	2.4935	2.4948
	5000	4.9956	4.9894	4.9837
ADJ5000-N	500	^{AD 10/22} 5.000, 5.001	.5012	.5015
	2500	2.4998	2.5000	2.4996
	5000	5.0002	4.9999	4.9998
ADJ5000	500			
	2500			
	5000			
ADJ5000	500			
	2500			
	5000			

Analyst: John WillisDate: 10/22/04Reviewed by: [Signature]Date: 10/26/04

010221

**SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT**

CLIENT: Division 20

TASK ORDER: 040827-12

SRR: 26440

SDG: 250244

CASE: CNWRA

VTSR: August 27, 2004

PROJECT#: 06002.01.141

Balance Calibrations

Southwest Research Institute
Division 01
BALANCE VERIFICATION LOG

BALANCE #:	LOCATION:	SERIAL #:	TOLERANCE:	COMMENTS:
12	Bldg. 70 Lab 27	1122510787	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
10-30-04	2.0000	2.0000	KE	SN: 99-J50526-15
11-1-04	2.0000	2.0000	KE	~
11-2-04	2.0000	2.0000	KE	~
11-3-04	2.0000	2.0000	KE	~
11-4-04	2.0000	2.0000	KE	~
11-5-04	2.0000	2.0000	KE	~
11-6-04	2.0000	2.0000	KE	~
11-8-04	2.0000	2.0000	KE	~
11-9-04	2.0000	2.0000	KE	~
11-10-04	2.0000	2.0000	KE	~

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.

Southwest Research Institute®
 Division 01
BALANCE VERIFICATION LOG

BALANCE #:	LOCATION:	SERIAL #:	TOLERANCE:	COMMENTS:
19	Bldg. 70 Lab 27	0068597	±0.05	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
10-30-04	10.00	10.00	KE	SN:99-JSD624-S
11-1-04	10.00	10.01	KE	"
11-2-04	10.00	10.00	KS	"
11-3-04	10.00	10.01	KE	"
11-4-04	10.00	10.00	KE	"
11-10-5-04	10.00	10.00	KS	"
11-10-8-04	10.00	10.05	T. OIB	"
11-9-04	10.00	10.01	KE	"
11-9-04	10.00	10.00	T. OIB	" in Lab 28
11-10-04	10.00	10.00	KE	"

KE
 11/9/04
 11/10/04

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.

Southwest Research Institute®
 Division 01
BALANCE VERIFICATION LOG

BALANCE #:	LOCATION:	SERIAL #:	TOLERANCE:	COMMENTS:
34	Bldg. 70 Lab 27	1116031935	±0.0005	
Date	Std Wt (g)	Recorded Wt (g)	Operator	
10-28-04	2.0000	2.0001	Jew	SN-99-550526-15
10-29-04	2.0000	2.0000	KE	~
10-30-04	2.0000	2.0000	KE	~
11-1-04	2.0000	2.0001	KE	~
11-2-04	2.0000	2.0000	KE	~
11-3-04	2.0000	2.0000	KE	~
11-4-04	2.0000	2.0000	KE	~
11-5-04	2.0000	2.0000	KE	~
11-6-04	2.0000	2.0000	KE	~
11-8-04	2.0000	2.0000	KE	~

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.

010225

**SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 040827-12
SRR: 26440
SDG: 250244
CASE: CNWRA
VTSR: August 27, 2004
PROJECT#: 06002.01.141**

DI Water Verification

D.I. WATER SYSTEM NOTEBOOK

SOUTHWEST RESEARCH INSTITUTE

BUILDING 70

740012

Contact U.S. Filter (1-800-466-7873) for repairs/exchanges. (Make sure to have a P.O.)

HIGH PURITY SYSTEM (HP)

010226

DATE / TIME	INITIALS	RESISTIVITY MONITOR		QC LIGHTS		USAGE (GALS)	COMMENTS
		(M OHMS)	QC LT.	QC 1	QC 2		
10/20/04 6:30pm	DR	18.03	✓	X	✓	5000.8	U.S. Filter called and changed out tank on line.
10/20/04 8pm	DR	18.03	✓	X	✓	5009.1	U.S. Filter called again.
10/20/04 6:30pm	DR	18.04	✓	X	✓	5050.9	waiting on filter
10/25/04 8:30pm	DR	18.04	✓	✓	✓	5078.4	hand change. All ok
10/26/04 7:40pm	DR	18.03	✓	✓	✓	5118.1	All ok ✓
10/27/04 9:40pm	DR	18.05	✓	✓	✓	5173.6	✓
10/28/04 10:40pm	DR	18.04	✓	✓	✓	5215.9	✓
10/29/04 6pm	DR	18.04	✓	✓	✓	5258.8	✓
11/1/04 9:40pm	DR	18.04	✓	✓	✓	5271.0	✓
11/2/04 9:30pm	DR	17.89	✓	✓	✓	5294.3	✓ <small>MIXED 250 Type I change!</small>
11/3/04 11:20pm	DR	19.89	✓	✓	✓	5316.0	✓
11/4/04 10pm	DR	17.90	✓	✓	✓	5348.6	✓
11/5/04 8pm	DR	17.91	✓	✓	✓	5387.2	✓
11/9/04 8:50pm	DR	17.91	✓	✓	✓	5493.3	✓
11/10/04 8:20pm	DR	17.91	✓	✓	✓	5533.1	✓
11/16/04 6:10pm	DR	17.91	✓	✓	✓	5569.3	✓

Legend: Check = Green (OK); X = Red (call for service)

LOW PURITY SYSTEM (LP)

DATE / TIME	INITIALS	QC LIGHTS		USAGE (GALS)	COMMENTS
		QC 1	QC 2		
11/20/04 6:37pm	DR	✓	(9) ✓	29695.2	U.S. Filter tank and change out tank. Tank was supposed to be for High Purity.
10/20/04 8pm	DR	✓	(9) ✓	29695.8	✓
10/20/04 6:30pm	DR	✓	(8.5) ✓	29696.9	✓
10/25/04 8:30pm	DR	✓	(8.5) ✓	29703.2	✓
10/26/04 7:40pm	DR	✓	(15) ✓	29731.9	✓
10/27/04 9:40pm	DR	✓	(12.5) ✓	29744.1	✓
10/28/04 10:40pm	DR	✓	(10.5) ✓	29744.7	✓
10/29/04 6pm	DR	✓	(10) ✓	29748.3	✓
11/1/04 9:40pm	DR	✓	(9) ✓	29750.3	✓
11/2/04 9:30pm	DR	✓	(9.5) ✓	29761.1	✓
11/3/04 11:20pm	DR	✓	(9.5) ✓	29761.8	✓
11/4/04 10pm	DR	✓	(10) ✓	29771.3	✓
11/5/04 8pm	DR	✓	(9.5) ✓	29772.5	✓
11/9/04 8:50pm	DR	✓	(9) ✓	29775.4	✓
11/10/04 8:20pm	DR	✓	(9.5) ✓	29778.5	✓
11/16/04 6:50pm	DR	✓	(9.5) ✓	29782.2	✓

Legend: Check = Green (OK); X = Red (call for service)