010001

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

FINAL REPORT

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010002

Sample ID
Base

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273124

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	3.17	0.500
Cadmium	<0.125	0.125
Calcium	17.3	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.375	0.375
Magnesium	3.32	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	<7.50	7.50
Selenium	<0.125	0.125
Silicon	5.90	0.500
Silver	<0.125	0.125
Sodium	119	6.25
Strontium	<0.125	0.125
Sulfur	10.0	0.500
Thallium	<0.250	0.250
Thorium	<0.750	0.750
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

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SOUTHWEST RESEARCH INSTITUTE

DUPLICATE SUMMARY

010003

Sample ID
Base

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/31/06

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 273124

SRR: 28643

Method: ICP SW846 6010B

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Duplicate Result (mg/L)	RPD
Aluminum	<1.25	<1.25	0.00%
Antimony	<0.250	<0.250	0.00%
Arsenic	<0.125	<0.125	0.00%
Barium	<0.125	<0.125	0.00%
Beryllium	<0.125	<0.125	0.00%
Bismuth	<0.250	<0.250	0.00%
Boron	3.17	3.18	0.31%
Cadmium	<0.125	<0.125	0.00%
Calcium	17.3	17.4	0.58%
Chromium	<0.125	<0.125	0.00%
Cobalt	<0.125	<0.125	0.00%
Copper	<0.125	<0.125	0.00%
Iron	<1.25	<1.25	0.00%
Lanthanum	<0.125	<0.125	0.00%
Lead	<0.125	<0.125	0.00%
Lithium	<0.375	<0.375	0.00%
Magnesium	3.32	3.24	2.44%
Manganese	<0.125	<0.125	0.00%
Molybdenum	<0.125	<0.125	0.00%
Nickel	<0.125	<0.125	0.00%
Palladium	<0.250	<0.250	0.00%
Phosphorus	<0.500	<0.500	0.00%
Potassium	<7.50	<7.50	0.00%
Selenium	<0.125	<0.125	0.00%
Silicon	5.90	5.95	0.84%
Silver	<0.125	<0.125	0.00%
Sodium	119	117	1.69%
Strontium	<0.125	<0.125	0.00%
Sulfur	10.0	10.2	1.98%
Thallium	<0.250	<0.250	0.00%
Thorium	<0.750	<0.750	0.00%
Tin	<0.125	<0.125	0.00%
Titanium	<0.125	<0.125	0.00%
Tungsten	<0.250	<0.250	0.00%
Uranium	<2.50	<2.50	0.00%
Vanadium	<0.125	<0.125	0.00%
Yttrium	<0.125	<0.125	0.00%
Zinc	<0.125	<0.125	0.00%
Zirconium	<0.125	<0.125	0.00%

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SOUTHWEST RESEARCH INSTITUTE

MATRIX SPIKE SUMMARY

010004

Sample ID
Base

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/31/06

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 273124

SRR: 28643

Method: ICP SW846 6010B

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Spike Result (mg/L)	Spike Added (mg/L)	Recovery
Aluminum	<1.25	46.8	50.0	93.6%
Antimony	<0.250	11.7	12.5	93.6%
Arsenic	<0.125	48.6	50.0	97.2%
Barium	<0.125	48.0	50.0	96.0%
Beryllium	<0.125	1.17	1.25	93.6%
Bismuth	NA	NA	NA	NA
Boron	NA	NA	NA	NA
Cadmium	<0.125	1.19	1.25	95.2%
Calcium	17.3	495	500	95.5%
Chromium	<0.125	4.66	5.00	93.2%
Cobalt	<0.125	12.0	12.5	96.0%
Copper	<0.125	5.92	6.25	94.7%
Iron	<1.25	27.4	25.0	109.6%
Lanthanum	NA	NA	NA	NA
Lead	<0.125	11.7	12.5	93.6%
Lithium	<0.375	93.4	100	93.4%
Magnesium	3.32	483	500	95.9%
Manganese	<0.125	11.9	12.5	95.2%
Molybdenum	NA	NA	NA	NA
Nickel	<0.125	11.7	12.5	93.6%
Palladium	NA	NA	NA	NA
Phosphorus	NA	NA	NA	NA
Potassium	<7.50	477	500	95.4%
Selenium	<0.125	50.5	50.0	101.0%
Silicon	NA	NA	NA	NA
Silver	<0.125	1.21	1.25	96.8%
Sodium	119	585	500	93.2%
Strontium	NA	NA	NA	NA
Sulfur	NA	NA	NA	NA
Thallium	<0.250	49.2	50.0	98.4%
Thorium	NA	NA	NA	NA
Tin	NA	NA	NA	NA
Titanium	NA	NA	NA	NA
Tungsten	NA	NA	NA	NA
Uranium	NA	NA	NA	NA
Vanadium	<0.125	11.8	12.5	94.4%
Yttrium	NA	NA	NA	NA
Zinc	<0.125	11.9	12.5	95.2%
Zirconium	NA	NA	NA	NA

NA- Not Applicable.

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SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010005

Sample ID
Sample #1

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/31/06

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 273125

SRR: 28643

Method: ICP SW846 6010B

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	5.05	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.375	0.375
Magnesium	3.11	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	<7.50	7.50
Selenium	<0.125	0.125
Silicon	<0.500	0.500
Silver	<0.125	0.125
Sodium	121	6.25
Strontium	<0.125	0.125
Sulfur	10.1	0.500
Thallium	<0.250	0.250
Thorium	<0.750	0.750
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

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SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET 010006

Sample ID
Sample #2

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273126

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	2.33	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.375	0.375
Magnesium	3.26	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	<7.50	7.50
Selenium	<0.125	0.125
Silicon	<0.500	0.500
Silver	<0.125	0.125
Sodium	120	6.25
Strontium	<0.125	0.125
Sulfur	10.4	0.500
Thallium	<0.250	0.250
Thorium	<0.750	0.750
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

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SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET 010007

Sample ID
Sample #3

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: 273127

Method: ICP SW846 6010B

Client: Division 20

Date Received: 01/31/06

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	1.30	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.375	0.375
Magnesium	3.23	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	11.1	7.50
Selenium	<0.125	0.125
Silicon	<0.500	0.500
Silver	<0.125	0.125
Sodium	123	6.25
Strontium	<0.125	0.125
Sulfur	10.8	0.500
Thallium	<0.250	0.250
Thorium	<0.750	0.750
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

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SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010008

Sample ID
Sample #4

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 01/31/06

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: 273128

SRR: 28643

Method: ICP SW846 6010B

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	<1.25	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.375	0.375
Magnesium	1.59	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	9.05	7.50
Selenium	<0.125	0.125
Silicon	<0.500	0.500
Silver	<0.125	0.125
Sodium	131	6.25
Strontium	<0.125	0.125
Sulfur	11.4	0.500
Thallium	<0.250	0.250
Thorium	<0.750	0.750
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

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SOUTHWEST RESEARCH INSTITUTE

LABORATORY CONTROL SAMPLE 010009

Sample ID
LCSW - B01H1 / B01H2

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: NA

Matrix: Liquid

Project No.: 06002.01.222

Lab System ID: NA

SRR: 28643

Method: ICP SW846 6010B

Task Order: 060131-9

Analysis	Sample Result (mg/L)	True Value (mg/L)	Recovery
Aluminum	46.4	50.0	92.8%
Antimony	11.6	12.5	92.8%
Arsenic	48.4	50.0	96.8%
Barium	47.8	50.0	95.6%
Beryllium	1.17	1.25	93.6%
Bismuth	NA	NA	NA
Boron	NA	NA	NA
Cadmium	1.18	1.25	94.4%
Calcium	479	500	95.8%
Chromium	4.65	5.00	93.0%
Cobalt	11.9	12.5	95.2%
Copper	5.88	6.25	94.1%
Iron	26.6	25.0	106.4%
Lanthanum	NA	NA	NA
Lead	11.6	12.5	92.8%
Lithium	93.0	100	93.0%
Magnesium	479	500	95.8%
Manganese	11.9	12.5	95.2%
Molybdenum	NA	NA	NA
Nickel	11.7	12.5	93.6%
Palladium	NA	NA	NA
Phosphorus	NA	NA	NA
Potassium	478	500	95.6%
Selenium	49.6	50.0	99.2%
Silicon	NA	NA	NA
Silver	1.18	1.25	94.4%
Sodium	477	500	95.4%
Strontium	NA	NA	NA
Sulfur	NA	NA	NA
Thallium	48.7	50.0	97.4%
Thorium	NA	NA	NA
Tin	NA	NA	NA
Titanium	NA	NA	NA
Tungsten	NA	NA	NA
Uranium	NA	NA	NA
Vanadium	11.8	12.5	94.4%
Yttrium	NA	NA	NA
Zinc	11.9	12.5	95.2%
Zirconium	NA	NA	NA

NA- Not Applicable.

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SOUTHWEST RESEARCH INSTITUTE

BLANK SUMMARY

010010

Sample ID
PBW - B01H1 / B01H2

Lab Name: Southwest Research Institute

Lab Code: SwRI

Matrix: Liquid

Lab System ID: NA

Method: ICP SW846 6010B

Client: Division 20

Date Received: NA

Project No.: 06002.01.222

SRR: 28643

Task Order: 060131-9

Analysis	Sample Result (mg/L)	Reporting Limit (mg/L)
Aluminum	<1.25	1.25
Antimony	<0.250	0.250
Arsenic	<0.125	0.125
Barium	<0.125	0.125
Beryllium	<0.125	0.125
Bismuth	<0.250	0.250
Boron	<0.500	0.500
Cadmium	<0.125	0.125
Calcium	<1.25	1.25
Chromium	<0.125	0.125
Cobalt	<0.125	0.125
Copper	<0.125	0.125
Iron	<1.25	1.25
Lanthanum	<0.125	0.125
Lead	<0.125	0.125
Lithium	<0.375	0.375
Magnesium	<1.25	1.25
Manganese	<0.125	0.125
Molybdenum	<0.125	0.125
Nickel	<0.125	0.125
Palladium	<0.250	0.250
Phosphorus	<0.500	0.500
Potassium	<7.50	7.50
Selenium	<0.125	0.125
Silicon	<0.500	0.500
Silver	<0.125	0.125
Sodium	<6.25	6.25
Strontium	<0.125	0.125
Sulfur	<0.500	0.500
Thallium	<0.250	0.250
Thorium	<0.750	0.750
Tin	<0.125	0.125
Titanium	<0.125	0.125
Tungsten	<0.250	0.250
Uranium	<2.50	2.50
Vanadium	<0.125	0.125
Yttrium	<0.125	0.125
Zinc	<0.125	0.125
Zirconium	<0.125	0.125

NA- Not Applicable.

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010011

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

Task Orders/01-QPP-015

Southwest Research Institute

Laboratory Task Order

TO #: 060131-9 Revision: 0

010012

SDG: 273124
VTSR: 01/31/06
CASE: CNWRA

SRR #'s: 28643
Client(s): Div. 20

Project(s): 06002.01.222
Manager(s): DAMMANN, MIKE
To PM: 02/13/06
To QA: 02/13/06
To Client: 02/16/06

Instructions

DIVISION 20 - CNWRA. 14-day TAT.
Using 13-day TAT for PM/preliminary, DRG/QAU; 16-day TAT hardcopy; subject to change.
Work is 10 CFR 50 Appendix B, 10 CFR Part 21, contact MARK EHNSTROM (ext. 3530) or CHARLIE BUTCHER (ext. 5928, pager 271-5172) or JO ANN BOYD (ext. 2169) BEFORE STARTING ANY WORK ON THIS TASK ORDER.

** NOTE ** Somewhere on your data, please make a notation indicating WHO and WHEN Mark Ehnstrom or Charlie Butcher or Jo Ann Boyd were contacted. This will help facilitate the final package to QA.

FIVE samples received for full ICP analyses. Point of Contact is XIHUA HE (x5194, xihua.he@swri.org).
CONTACT PM WITH ANY ADDITIONAL QUESTIONS.

Documents Related to this task order: 21164[COC 28643]

Test: DIL-DILUTION
Section: METALPREP

Holding: 28 days from CED
Prep, Dilution
Cnt: 5

System ID	Type	Cont	Matrix	Customer ID	CED	Method Date
273124		1	Liquid	Base Dup Spk	31 Jan 06	28 Feb 06
273125		1	Liquid	Sample #1	31 Jan 06	28 Feb 06
273125		2	Liquid	Sample #1	31 Jan 06	28 Feb 06
273126		1	Liquid	Sample #2	31 Jan 06	28 Feb 06
273126		2	Liquid	Sample #2	31 Jan 06	28 Feb 06
273127		1	Liquid	Sample #3	31 Jan 06	28 Feb 06
273127		2	Liquid	Sample #3	31 Jan 06	28 Feb 06
273128		1	Liquid	Sample #4	31 Jan 06	28 Feb 06
273128		2	Liquid	Sample #4	31 Jan 06	28 Feb 06

Test: ICP-SWRI
Section: METALS

Holding: 180 days from CED
ICP Analysis by SwRI Method
Cnt: 5

System ID	Type	Cont	Matrix	Customer ID	CED	Method Date
273124		1	Liquid	Base	31 Jan 06	30 Jul 06
273125		1	Liquid	Sample #1	31 Jan 06	30 Jul 06
273125		2	Liquid	Sample #1	31 Jan 06	30 Jul 06
273126		1	Liquid	Sample #2	31 Jan 06	30 Jul 06
273126		2	Liquid	Sample #2	31 Jan 06	30 Jul 06
273127		1	Liquid	Sample #3	31 Jan 06	30 Jul 06
273127		2	Liquid	Sample #3	31 Jan 06	30 Jul 06
273128		1	Liquid	Sample #4	31 Jan 06	30 Jul 06
273128		2	Liquid	Sample #4	31 Jan 06	30 Jul 06

ver 12/25/2005

Southwest Research Institute

Sample Receipt

Sample Receipt Number: 28643

010013

VTSR: 01/31/06

Time: 10:55:00

Project: 06002.01.222
Case #: CNWRA
Client: Div. 20

Manager: DAMMANN, MIKE
Logged in by: Dino.Roman
Creation Date: 01/31/06

Notes

Samples were received intact at 22.0 °C.

Parameters: Analysis/see Task Order.

See chain of custody as part of the SRR system for more information. Contact Project Manager for questions.

2 week TAT, as per COC.

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

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

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

Have SPQP (Latest Revision) available at the time of prep or analysis of samples.

All personnel must be QA Nuclear Certified.

POC: Xihua He, Div. 20 X5194
*** Dino.Roman Jan 31 2006 12:58PM ***

System ID	Customer ID	CED	Matrix	Containers	Special Reqs.
273124	Base	01/31/06	Liquid	1	
273125	Sample #1	01/31/06	Liquid	2	
273126	Sample #2	01/31/06	Liquid	2	
273127	Sample #3	01/31/06	Liquid	2	
273128	Sample #4	01/31/06	Liquid	2	
Containers: 9				**Samples: 5**	

These documents are associated with this receipt: 21164[COC 28643]

Thermometer: 027
Temperature: 22.0

Client: Div. 20

SR#: 28643

FRM-002

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01-QPP-015
Division 01
Revision 5
June 2004

Document No. 3

Division 01

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

010015

QUALITY PROJECT PLAN FOR PERFORMANCE OF CHEMICAL ANALYSES FOR COMMERCIAL NUCLEAR POWER PLANTS WITHIN THE DEPARTMENT OF ANALYTICAL AND ENVIONMENTAL 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 Quality Assurance Manager	(210) 522-2169	6/4/04 DATE
REZA KARIMI Director, Department of Analytical and Environmental Chemistry	(210) 522-2412	6/4/04 DATE
MICHAEL G. MACNAUGHTON Vice President, Chemistry and Chemical Engineering Division	(210) 522-5162	6/4/04 DATE
CHRISTOPHER HOBSON Quality Assurance Engineer	(210) 522-5838	6/4/2004 DATE

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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 then 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 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-CH/AN* 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

010024

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

Chain of Custody/Login Paperwork

21164

SAMPLE LIST/CHAIN OF CUSTODY

Southwest Research Institute®
Chemistry and Chemical Engineering Division
6220 Culebra Road
San Antonio, Texas 78238-5166

Shipper Name/Address:

Client: Div 20 Xihua He X5194

Client Purchase Order/Other ID: 1/31/06 8 CNWRA

Site/Zone ID:

Requested Turnaround:
- ☑ 2 Weeks
- ☐ 3 Weeks
- ☐ Other:

SwRI Contact: Xihua He X5194

Analyses Requested

Sample ID	Sample Collection Date (mm/dd/yy)	Sample Collection Time	Matrix Type	Sample Type	# of Containers	Complete Ion Analysis See Additional Page									
Base	1/31/06	9:00am	L		1	✓	0.45μm filtered only Base Sample								
#1	↓	↓	↓		2	✓									
#2					2	✓									
#3					2	✓									
#4					2	✓									

REMARKS
Preservation
- **a** = HCl to pH <2
- **b** = HNO_3 to pH <2
- **c** = H_2SO_4 to pH <2
- **d** = NaOH to pH >12
- **e** = Cool (4°C±2°C)
- **f** = Other (specify)

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

Temp: 22.0°C

Therm #: 027

Comments: Rec'd Intact

Relinquished by (Print/Signature)	Date	Time
Brian K Derby / [signature]	1/31/06	10:55
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time
Received by (Print/Signature)	Date	Time
Relinquished by (Print/Signature)	Date	Time

SwRI Project#: 20.06002.01.222

Received by SwRI Lab: (Signature) [signature]

Date: 1/31/06 Time: 1055

Samples Disposed: Date: Time:

Samples Disposed by:

SRC # 28443

010025

Div 01 COC Form 01-01-001, Rev 8/02

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS 21164

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

010026

Requester: Xihua He **Request Date:** 1/31/06
Project No.: 20.06002.01.272 **Phone No.:** x5194
Description of Work Requested: Complete ICP Analysis of All Solution Base then #4

☐ Optical Microscopy ☐ SEM ☐ Hardness ☐ Profilometer ☐ Auger ☐ Other

***QUALITY REQUIREMENTS:** The work requested is governed by the CNWRA Quality Assurance Program which addresses requirements of 10CFR50, Appendix B. Personnel performing this work shall be qualified under the CNWRA QA program or equivalently under the SwRI Nuclear QA program. Test and analysis methods shall be documented by approved procedures or recognized, standard methods. Measuring and test equipment shall be calibrated and controlled according to CNWRA and SwRI Nuclear QA program requirements.*

Sample Identification	Description
Base	Cl^- Solution pH 8.48
#1	↓
#2	
#3	
#4	

B. TO BE COMPLETED BY DIVISION PERFORMING WORK[1]

☐ Optical Microscopy ☐ SEM ☐ Hardness ☐ Profilometer ☐ Auger ☐ Other

Person Assigned: _____ **Signature:** _____
Division: _____ **Date:** _____

Make, Model & Serial No. of Equipment Used (*attach list if necessary*): _____

Software Used (If any): _____

Standards Used (If any): _____

Photographic Negative Numbers (If Applicable): _____

[1] Please sign and date any hardcopy of analysis or list of photographs (The photographs themselves need not be signed). If error occurred during entry, do not erase or overwrite, but strikeout with single line, initial and date, and then reenter correct information.

SAMPLE LOG-IN SHEET

010027

Lab Name
Southwest Research Institute

Received By (Print Name)
DINO ROMAN

Received By (Signature)

Log-in Date
01/31/2006

Case Number
CNWRA

Remarks: 06002.01.222

Sample Delivery Group No.

SAS Number
N/A

1.	Custody Seal(s)	Present/Absent* Intact/Broken
2.	Custody Seal Nos.	N/A
3.	Chain-of Custody Records	Present/Absent*
4.	Traffic Reports or Packing Lists	Present/Absent
5.	Airbill	Airbill/Sticker Present/Absent*
6.	Airbill No.	HAND DELIVERED
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	01/31/2006
12	Time Received	10:55:00

EPA Sample #	Corresponding Sample Tag #	Corresponding Assigned Lab #	Remarks Condition of Sample Shipment, etc
Base	None	273124	Intact
Sample #1	None	273125	Intact
Sample #2	None	273126	Intact
Sample #3	None	273127	Intact
Sample #4	None	273128	Intact

Sample Transfer

Fraction	Fraction
Area # Inorg Lab #2	Area #
By DINO ROMAN	By
On 01/31/2006	On

* Contact SMO and attach record of resolution

Reviewed By

Date 02.01.06

Logbook No. Sample Receipt (28643)

Logbook Page No. 5699 Section 3 of 4

010028

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

Copies of Login Book

Sample Login Book

Jan 31, 2006

SwRI Login Area
Division 1

Sample Receipt: 28642 | Project: 02749.004 | Client: Charter Oak Env.
VTSR Date: Jan 31, 2006 | VTSR Time: 08:15:00 | Manager: SCHELLER, LORRAINE

System ID	Customer Sample ID	Matrix
273113	SF-CEM-01-06	Water
273114	SFGAC-C-1-Lag- 25%-01-06	Water
273115	SFGAC-C-2-Lead- 100%-01-06	Water
273116	SFGAC-Influent -01-06	Water

Sample Receipt: 28643 | Project: 06002.01.222 | Client: Div. 20
VTSR Date: Jan 31, 2006 | VTSR Time: 10:55:00 | Manager: DAMMANN, MIKE

System ID	Customer Sample ID	Matrix
273124	Base	Liquid
273125	Sample #1	Liquid
273126	Sample #2	Liquid
273127	Sample #3	Liquid
273128	Sample #4	Liquid

Sample Receipt: 28644 | Project: 11987.02.001 | Client: Social & Scienti
VTSR Date: Jan 31, 2006 | VTSR Time: 13:25:00 | Manager: CAMANN, DAVID

System ID	Customer Sample ID	Matrix
273129	FAM 01294	Dust
273130	FAM 08472	Dust
273131	FAM 12909	Dust

Sample Receipt: 28645 | Project: 05965.05.004 | Client: KIDDE SAFETY
VTSR Date: Jan 31, 2006 | VTSR Time: 13:30:00 | Manager: TAN, CK

System ID	Customer Sample ID	Matrix
273132	06.01.24 Air Sample 3	Solid

010030

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

RAW DATA

DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

DL 2-6-06

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
pbw-B01H2	K_766	7.50	U		mg/L	7.5				0.300	0.727736589	0.728	1	7.5	0.029109464	02/01/06	11:46 AM
pbw-B01H2	Li670	0.375	U		mg/L	0.375				0.015	0.181896326	0.182	1	0.375	0.007275853	02/01/06	11:46 AM
pbw-B01H2	Na589	6.25	U		mg/L	6.25				0.250	0.925910596	0.926	1	6.25	0.037036424	02/01/06	11:46 AM
lcsw-B01H2	K_766	478			mg/L	7.5		95.6%	500	0.300	478.0735249	478	1	7.5	19.12294099	02/01/06	11:49 AM
lcsw-B01H2	Li670	93.0			mg/L	0.375		93.0%	100	0.015	93.00743948	93	1	0.375	3.720297579	02/01/06	11:49 AM
lcsw-B01H2	Na589	477			mg/L	6.25		95.4%	500	0.250	477.4395797	477	1	6.25	19.09758319	02/01/06	11:49 AM
273124	K_766	7.50	U		mg/L	7.5				0.300	5.161876377	5.16	1	7.5	0.206475055	02/01/06	11:52 AM
273124	Li670	0.375	U		mg/L	0.375				0.015	0.202527095	0.203	1	0.375	0.008101084	02/01/06	11:52 AM
273124	Na589	119			mg/L	6.25				0.250	118.5663302	119	1	6.25	4.742653209	02/01/06	11:52 AM
273124d	K_766	7.50	U		mg/L	7.5	0.0%			0.300	6.26149064	6.26	1	7.5	0.250459626	02/01/06	11:56 AM
273124d	Li670	0.375	U		mg/L	0.375	0.0%			0.015	0.123059751	0.123	1	0.375	0.00492239	02/01/06	11:56 AM
273124d	Na589	117			mg/L	6.25	1.7%			0.250	116.7971663	117	1	6.25	4.671886653	02/01/06	11:56 AM
273124s	K_766	477			mg/L	7.5		95.4%	500	0.300	477.0492052	477	1	7.5	19.08196821	02/01/06	11:59 AM
273124s	Li670	93.4			mg/L	0.375		93.4%	100	0.015	93.4120029	93.4	1	0.375	3.736480116	02/01/06	11:59 AM
273124s	Na589	585			mg/L	6.25		93.2%	500	0.250	585.3845087	585	1	6.25	23.41538035	02/01/06	11:59 AM
273125	K_766	7.50	U		mg/L	7.5				0.300	6.558979924	6.56	1	7.5	0.262359197	02/01/06	12:02 PM
273125	Li670	0.375	U		mg/L	0.375				0.015	0.172590035	0.173	1	0.375	0.006903601	02/01/06	12:02 PM
273125	Na589	121			mg/L	6.25				0.250	120.5221812	121	1	6.25	4.820887249	02/01/06	12:02 PM
273126	K_766	7.50	U		mg/L	7.5				0.300	5.109337438	5.11	1	7.5	0.204373498	02/01/06	12:05 PM
273126	Li670	0.375	U		mg/L	0.375				0.015	0.113958302	0.114	1	0.375	0.004558332	02/01/06	12:05 PM
273126	Na589	120			mg/L	6.25				0.250	119.588106	120	1	6.25	4.783524238	02/01/06	12:05 PM
273127	K_766	11.1			mg/L	7.5				0.300	11.11534858	11.1	1	7.5	0.444613943	02/01/06	12:08 PM
273127	Li670	0.375	U		mg/L	0.375				0.015	0.212201723	0.212	1	0.375	0.008488069	02/01/06	12:08 PM
273127	Na589	123			mg/L	6.25				0.250	122.5947328	123	1	6.25	4.903789311	02/01/06	12:08 PM
273128	K_766	9.05			mg/L	7.5				0.300	9.049682185	9.05	1	7.5	0.361987287	02/01/06	12:11 PM
273128	Li670	0.375	U		mg/L	0.375				0.015	0.193196599	0.193	1	0.375	0.007727864	02/01/06	12:11 PM
273128	Na589	131	✓		mg/L	6.25				0.250	130.8695945	131	1	6.25	5.23478378	02/01/06	12:11 PM

273128 for Na

$$\frac{5.23478\ \text{ug/ml} \times 5\ \text{ml}}{0.2\ \text{ml}} = 131\ \text{mg/L}$$

010031

✓ J Rawright 2/6/06

☐ 200.7 TAP No. 01-0406-028 Rev3/Jan06

☑ 6010B TAP No. 01-0406-130 Rev5/Jan06

☐ Other _____

QC STD. ID's	
CCV	06B01
CRI	
ICSA	
ICSAB	06B01

ICP CAL.STD. ID's	
Std0	06B01
Std1	
Std2	
Std3	
Std4	
Std5	
Std6	06B01

010032

K Li Na

PROJ. NO.	PROJECT	TO#	DATE	MATRIX	LOGBK PG
06002.01.222	Div. 20	060131-9	2-1-06	Liquid	62-265

INSTRUMENT: Spectro FILENAME: 060201

DL 2-1-06

File converted to wsl? ☐

EVOLUTION by Micro-Active Australia Pty Ltd 11:25:48 AM February 1, 2006 010033

Keep last result visible enabled ...
Starting run ...
Creating high priority queue entries ...
BACKGROUND CORRECTED INTENSITIES
Identity 1 : BLK_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 11:19:16 AM February 1, 2006

	K_766	Li670	Na589	Sc361
# 1	28.5	-30.5	71.0	3708.0
# 2	15.5	-27.5	74.0	3458.0
Mean	22.0	-29.0	72.5	3583.0
SD	9.2	2.1	2.1	176.8
%RSD	41.8	7.3	2.9	4.9

INTENSITIES
Identity 1 : BLK_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 11:19:16 AM February 1, 2006

	K_766	Li670	Na589	Sc361
# 1	0.0	-0.0	0.0	3708.0
# 2	0.0	-0.0	0.0	3458.0
Mean	0.0	-0.0	0.0	3583.0
SD	0.0	0.0	0.0	176.8
%RSD	37.2	2.4	7.9	4.9

BACKGROUND CORRECTED INTENSITIES
Identity 1 : CLP_STD1_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 11:22:18 AM February 1, 2006

	K_766	Li670	Na589
# 1	3981.5	24873.0	22102.0
# 2	3897.5	24265.0	21734.0
Mean	3939.5	24569.0	21918.0
SD	59.4	429.9	260.2
%RSD	1.5	1.7	1.2

INTENSITIES
Identity 1 : CLP_STD1_SC Identity 2 : Type : STD
Weight : 1.0000 Volume : 1.00 Printed : 11:22:18 AM February 1, 2006

	K_766	Li670	Na589
# 1	1.0	6.5	5.8
# 2	1.0	6.5	5.8
Mean	1.0	6.5	5.8
SD	0.0	0.0	0.0
%RSD	0.0	0.2	0.4

2/6/06

BACKGROUND CORRECTED INTENSITIES
Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 11:25:22 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	1675.5	12935.5	13803.5	3961.0	3961.0
# 2	1641.5	12658.5	13434.5	3864.0	3864.0

2-1-06

Mean	[illegible]	12797.0	13819.0	3912.5	3912.5
SD	24.0	195.9	260.9	68.6	68.6
%RSD	1.4	1.5	1.9	1.8	1.8

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APPARENT CONCENTRATIONS
EVOLUTION by Micro-Active Australia Pty Ltd 11:31:48 AM February 1, 2006

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 11:25:22 AM February 1, 2006

	K_766 ppm	Li670 ppm	Na589 ppm	Sc	Sc361 ppm
# 1	20.1444	5.0372	30.0200	3961.000 H	110.5690
# 2	20.2323	5.0531	29.9505	3864.000 H	107.8568
Mean	20.1883	5.0451	29.9853	3912.500 H	109.2129
SD	0.0622	0.0112	0.0491	68.589	1.9178
%RSD	0.3080	0.2220	0.1638	1.753	1.7560

Checking calibration verification ...
Identity 1 : CLP_CCV_SC Identity 2 :

Report name	Low limit	Value	High limit
K_766	18.000	20.188	22.000
Li670	4.500	5.045	5.500
Na589	27.000	29.985	33.000

BACKGROUND CORRECTED INTENSITIES
Identity 1 : Calibration blank Identity 2 : Type : CB
Weight : 1.0000 Volume : 1.00 Printed : 11:28:26 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	17.0	6.5	59.0	3810.5	3810.5
# 2	17.0	-3.5	65.0	3737.5	3737.5
Mean	17.0	1.5	62.0	3774.0	3774.0
SD	0.0	7.1	4.2	51.6	51.6
%RSD	0.0	471.4	6.8	1.4	1.4

APPARENT CONCENTRATIONS
Identity 1 : Calibration blank Identity 2 : Type : CB
Weight : 1.0000 Volume : 1.00 Printed : 11:28:26 AM February 1, 2006

	K_766 ppm	Li670 ppm	Na589 ppm	Sc	Sc361 ppm
# 1 L	-0.0811	0.0151 L	-0.0412	3810.500 H	106.3610
# 2 L	-0.0769	0.0110 L	-0.0246	3737.500 H	104.3199
Mean L	-0.0790	0.0130 L	-0.0329	3774.000 H	105.3404
SD	0.0030	0.0029	0.0117	51.619	1.4433
%RSD	3.7681	22.0366	35.5278	1.368	1.3701

Checking calibration blank ...
Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value	
K_766	0.100	-0.079	
Li670	0.010	0.013	Contaminated
Na589	0.050	-0.033	
Sc361	0.000	105.340	

BACKGROUND CORRECTED INTENSITIES
Identity 1 : CRI Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 11:31:30 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	28.0	256.0	46.5	3986.0	3986.0
# 2	19.0	252.0	69.5	3889.0	3889.0

Mean	23.5	254.0	58.0	3937.5	3937.5
SD	6.4	2.8	16.3	68.6	68.6
%RSD	27.1	1.1	28.0	1.7	1.7

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APPARENT CONCENTRATIONS
Identity 1 : CRI Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 11:31:30 AM February 1, 2006

		K_766 ppm		Li670 ppm		Na589 ppm		Sc		Sc361 ppm
# 1		0.0427		0.1113	L	-0.0742		3986.000	H	111.2680
# 2	L	-0.0606		0.1122	L	-0.0205		3889.000	H	108.5559
Mean	L	-0.0089		0.1117	L	-0.0474		3937.500	H	109.9119
SD		0.0731		0.0006		0.0380		68.589		1.9178
%RSD		817.4592		0.5584		80.2709		1.742		1.7448

Checking calibration verification ...
Identity 1 : CRI Identity 2 :

Report name	Low limit	Value	High limit	
Li670	0.090	0.112	0.110	Failed

BACKGROUND CORRECTED INTENSITIES
Identity 1 : ICSA Identity 2 : Type : INTRF
Weight : 1.0000 Volume : 1.00 Printed : 11:34:34 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	24.5	-17.5	11.5	3803.0	3803.0
# 2	37.5	-12.5	50.5	3707.0	3707.0
Mean	31.0	-15.0	31.0	3755.0	3755.0
SD	9.2	3.5	27.6	67.9	67.9
%RSD	29.7	23.6	89.0	1.8	1.8

APPARENT CONCENTRATIONS
Identity 1 : ICSA Identity 2 : Type : INTRF
Weight : 1.0000 Volume : 1.00 Printed : 11:34:34 AM February 1, 2006

		K_766 ppm		Li670 ppm		Na589 ppm		Sc		Sc361 ppm
# 1		0.0146		0.0054	L	-0.1491		3803.000	H	106.1513
# 2		0.1921		0.0073	L	-0.0573		3707.000	H	103.4671
Mean		0.1034		0.0063	L	-0.1032		3755.000	H	104.8092
SD		0.1255		0.0013		0.0649		67.882		1.8980
%RSD		121.4431		21.1709		62.9214		1.808		1.8109

BACKGROUND CORRECTED INTENSITIES
Identity 1 : ICSAB Identity 2 : Type : ICSAB
Weight : 1.0000 Volume : 1.00 Printed : 11:37:38 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	26.0	2631.5	102.0	3863.5	3863.5
# 2	15.0	2628.5	93.0	3857.5	3857.5
Mean	20.5	2630.0	97.5	3860.5	3860.5
SD	7.8	2.1	6.4	4.2	4.2
%RSD	37.9	0.1	6.5	0.1	0.1

APPARENT CONCENTRATIONS
Identity 1 : ICSAB Identity 2 : Type : ICSAB
Weight : 1.0000 Volume : 1.00 Printed : 11:37:38 AM February 1, 2006

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	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	0.0285	1.0604	0.0534	3863.500 H	107.8429
# 2 L	-0.1088	1.0609	0.0336	3857.500 H	107.6751

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Mean L	-0.0402	1.0607	0.0435	3860.500 H	107.7590
SD	0.0971	0.0003	0.0140	4.243	0.1186
%RSD	241.7490	0.0289	32.2824	0.110	0.1101

Checking interference check standard ...
Identity 1 : ICSAB Identity 2 :

Report name	Low limit	Value	High limit
Li670	0.800	1.061	1.200

BACKGROUND CORRECTED INTENSITIES
Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 11:40:40 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	1654.0	12827.0	13760.0	3983.0	3983.0
# 2	1649.0	12550.0	13437.0	3892.0	3892.0
Mean	1651.5	12688.5	13598.5	3937.5	3937.5
SD	3.5	195.9	228.4	64.3	64.3
%RSD	0.2	1.5	1.7	1.6	1.6

APPARENT CONCENTRATIONS
Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 11:40:40 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	19.7706	4.9675	29.7586	3983.000 H	111.1841
# 2	20.1777	4.9739	29.7394	3892.000 H	108.6397
Mean	19.9742	4.9707	29.7490	3937.500 H	109.9119
SD	0.2879	0.0045	0.0136	64.347	1.7992
%RSD	1.4412	0.0903	0.0456	1.634	1.6369

Checking calibration verification ...
Identity 1 : CLP_CCV_SC Identity 2 :

Report name	Low limit	Value	High limit
K_766	18.000	19.974	22.000
Li670	4.500	4.971	5.500
Na589	27.000	29.749	33.000

BACKGROUND CORRECTED INTENSITIES
Identity 1 : Calibration blank Identity 2 : Type : CB
Weight : 1.0000 Volume : 1.00 Printed : 11:43:44 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	24.5	-16.0	62.5	3862.0	3862.0
# 2	15.5	-6.0	53.5	3747.0	3747.0
Mean	20.0	-11.0	58.0	3804.5	3804.5
SD	6.4	7.1	6.4	81.3	81.3
%RSD	31.8	64.3	11.0	2.1	2.1

APPARENT CONCENTRATIONS
Identity 1 : Calibration blank Identity 2 : Type : CB
Weight : 1.0000 Volume : 1.00 Printed : 11:43:44 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm

# 1		[illegible]	[illegible]	L	-0.0331	3862.000 H	107.8009
# 2	L	-0.0968	0.0100	L	-0.0516	3747.000 H	104.5855
Mean	L	-0.0435	0.0080	L	-0.0434	3804.500 H	106.1932
SD		0.0754	0.0028		0.0117	81.317	2.2737
%RSD		173.4439	34.4185		26.9240	2.137	2.1411

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Checking calibration blank ...
Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value
K_766	0.100	-0.043
Li670	0.010	0.008
Na589	0.050	-0.043
Sc361	0.000	106.193

BACKGROUND CORRECTED INTENSITIES
Identity 1 : pbw-B01H2 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:46:48 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	26.0	-15.5	93.5	3893.5	3893.5
# 2	26.0	-10.5	95.5	3819.5	3819.5
Mean	26.0	-13.0	94.5	3856.5	3856.5
SD	0.0	3.5	1.4	52.3	52.3
%RSD	0.0	27.2	1.5	1.4	1.4

APPARENT CONCENTRATIONS
Identity 1 : pbw-B01H2 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:46:48 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	0.0260	0.0063	0.0328	3893.500 H	108.6817
# 2	0.0322	0.0082	0.0413	3819.500 H	106.6126
Mean	0.0291	0.0073	0.0370	3856.500 H	107.6471
SD	0.0044	0.0013	0.0061	52.326	1.4630
%RSD	15.1871	18.4217	16.3591	1.357	1.3591

BACKGROUND CORRECTED INTENSITIES
Identity 1 : lcsw-B01H2 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:49:52 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	1583.0	9455.0	8745.0	3925.0	3925.0
# 2	1554.0	9356.0	8618.0	3881.0	3881.0
Mean	1568.5	9405.5	8681.5	3903.0	3903.0
SD	20.5	70.0	89.8	31.1	31.1
%RSD	1.3	0.7	1.0	0.8	0.8

APPARENT CONCENTRATIONS
Identity 1 : lcsw-B01H2 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:49:52 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	19.1930	3.7189	19.1299	3925.000 H	109.5624
# 2	19.0529	3.7217	19.0652	3881.000 H	108.3322
Mean	19.1229	3.7203	19.0976	3903.000 H	108.9473
SD	0.0991	0.0020	0.0457	31.113	0.8699
%RSD	0.5182	0.0527	0.2395	0.797	0.7985

BACKGROUND CORRECTED INTENSITIES
Identity 1 : 273124 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:52:56 AM February 1, 2006

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	K_766	Li670	Na589	Sc	Sc361
# 1	37.5	-10.0	2223.0	3935.0	3935.0
# 2	43.5	-12.0	2196.0	3851.0	3851.0
Mean	40.5	-11.0	2209.5	3893.0	3893.0
SD	4.2	1.4	19.1	59.4	59.4
%RSD	10.5	12.9	0.9	1.5	1.5

APPARENT CONCENTRATIONS
Identity 1 : 273124 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:52:56 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	0.1638	0.0085	4.7196	3935.000 H	109.8420
# 2	0.2491	0.0077	4.7657	3851.000 H	107.4934
Mean	0.2065	0.0081	4.7427	3893.000 H	108.6677
SD	0.0603	0.0006	0.0325	59.397	1.6608
%RSD	29.2247	7.7193	0.6862	1.526	1.5283

BACKGROUND CORRECTED INTENSITIES
Identity 1 : 273124d Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:56:00 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	51.0	-20.5	2182.0	3929.0	3929.0
# 2	37.0	-17.5	2157.0	3828.0	3828.0
Mean	44.0	-19.0	2169.5	3878.5	3878.5
SD	9.9	2.1	17.7	71.4	71.4
%RSD	22.5	11.2	0.8	1.8	1.8

APPARENT CONCENTRATIONS
Identity 1 : 273124d Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:56:00 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	0.3306	0.0044	4.6367	3929.000 H	109.6743
# 2	0.1704	0.0054	4.7071	3828.000 H	106.8503
Mean	0.2505	0.0049	4.6719	3878.500 H	108.2623
SD	0.1133	0.0007	0.0498	71.418	1.9969
%RSD	45.2237	14.2791	1.0652	1.841	1.8445

BACKGROUND CORRECTED INTENSITIES
Identity 1 : 273124s Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:59:04 AM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	1595.0	9544.0	10743.5	3949.0	3949.0
# 2	1532.0	9327.0	10484.5	3848.0	3848.0
Mean	1563.5	9435.5	10614.0	3898.5	3898.5
SD	44.5	153.4	183.1	71.4	71.4
%RSD	2.8	1.6	1.7	1.8	1.8

APPARENT CONCENTRATIONS

Identity 1 : 273124B Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:59:04 AM February 1, 2006

	K_766 ppm	Li670 ppm	Na589 ppm	Sc	Sc361 ppm

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# 1	19.2214	3.7311	23.3976	3949.000 H	110.2335
# 2	18.9425	3.7419	23.4331	3848.000 H	107.4095
Mean	19.0820	3.7365	23.4154	3898.500 H	108.8215
SD	0.1972	0.0077	0.0251	71.418	1.9969
%RSD	1.0334	0.2051	0.1073	1.832	1.8350

BACKGROUND CORRECTED INTENSITIES
Identity 1 : 273125 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 12:02:08 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	45.0	-11.0	2262.0	3928.5	3928.5
# 2	45.0	-17.0	2224.0	3851.5	3851.5
Mean	45.0	-14.0	2243.0	3890.0	3890.0
SD	0.0	4.2	26.9	54.4	54.4
%RSD	0.0	30.3	1.2	1.4	1.4

APPARENT CONCENTRATIONS
Identity 1 : 273125 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 12:02:08 PM February 1, 2006

	K_766 ppm	Li670 ppm	Na589 ppm	Sc	Sc361 ppm
# 1	0.2568	0.0081	4.8138	3928.500 H	109.6603
# 2	0.2679	0.0057	4.8280	3851.500 H	107.5073
Mean	0.2624	0.0069	4.8209	3890.000 H	108.5838
SD	0.0078	0.0018	0.0101	54.447	1.5224
%RSD	2.9826	25.4331	0.2091	1.400	1.4020

BACKGROUND CORRECTED INTENSITIES
Identity 1 : 273126 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 12:05:12 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	25.5	-26.5	2237.0	3938.0	3938.0
# 2	54.5	-13.5	2203.0	3821.0	3821.0
Mean	40.0	-20.0	2220.0	3879.5	3879.5
SD	20.5	9.2	24.0	82.7	82.7
%RSD	51.3	46.0	1.1	2.1	2.1

APPARENT CONCENTRATIONS
Identity 1 : 273126 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 12:05:12 PM February 1, 2006

	K_766 ppm	Li670 ppm	Na589 ppm	Sc	Sc361 ppm
# 1	0.0162	0.0021	4.7467	3938.000 H	109.9259
# 2	0.3925	0.0070	4.8203	3821.000 H	106.6546
Mean	0.2044	0.0046	4.7835	3879.500 H	108.2902
SD	0.2661	0.0035	0.0521	82.731	2.3132
%RSD	130.2105	76.2869	1.0882	2.133	2.1361

BACKGROUND CORRECTED INTENSITIES
Identity 1 : 273127 Identity 2 : pg62-265 Type : SAMPLE

Weight : 1.0000 Volume : 1.00 Printed : 12:08:18 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	56.5	-10.0	2272.5	3913.5	3913.5
# 2	62.5	-10.0	2276.5	3847.5	3847.5

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Mean	59.5	-10.0	2274.5	3880.5	3880.5
SD	4.2	0.0	2.8	46.7	46.7
%RSD	7.1	0.0	0.1	1.2	1.2

APPARENT CONCENTRATIONS
Identity 1 : 273127 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 12:08:18 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	0.4010	0.0085	4.8561	3913.500 H	109.2409
# 2	0.4883	0.0085	4.9514	3847.500 H	107.3955
Mean	0.4446	0.0085	4.9038	3880.500 H	108.3182
SD	0.0617	0.0000	0.0674	46.669	1.3049
%RSD	13.8884	0.5618	1.3744	1.203	1.2047

BACKGROUND CORRECTED INTENSITIES
Identity 1 : 273128 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 12:11:22 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	53.0	-8.5	2545.5	3989.5	3989.5
# 2	54.0	-15.5	2359.5	3863.5	3863.5
Mean	53.5	-12.0	2452.5	3926.5	3926.5
SD	0.7	4.9	131.5	89.1	89.1
%RSD	1.3	41.2	5.4	2.3	2.3

APPARENT CONCENTRATIONS
Identity 1 : 273128 Identity 2 : pg62-265 Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 12:11:22 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	0.3453	0.0092	5.3532	3989.500 H	111.3659
# 2	0.3787	0.0063	5.1164	3863.500 H	107.8429
Mean	0.3620	0.0077	5.2348	3926.500 H	109.6044
SD	0.0236	0.0020	0.1675	89.095	2.4911
%RSD	6.5331	26.4865	3.1992	2.269	2.2728

BACKGROUND CORRECTED INTENSITIES
Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 12:13:18 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	1626.0	12494.5	13450.5	4036.5	4036.5
# 2	1586.0	12220.5	13300.5	4027.5	4027.5
Mean	1606.0	12357.5	13375.5	4032.0	4032.0
SD	28.3	193.7	106.1	6.4	6.4
%RSD	1.8	1.6	0.8	0.2	0.2

APPARENT CONCENTRATIONS
Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 12:13:18 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	19.1694	4.7751	28.6975	4036.500 H	112.6800
# 2	18.7330	4.6811	28.4393	4027.500 H	112.4284

010041

EVOLUTION by Micro-Active Australia Pty Ltd 12:19:48 PM February 1, 2006

Mean	18.9512	4.7281	28.5684	4032.000 H	112.5542
SD	0.3086	0.0665	0.1826	6.364	0.1779
%RSD	1.6285	1.4063	0.6391	0.158	0.1581

Checking calibration verification ...
Identity 1 : CLP_CCV_SC Identity 2 :

Report name	Low limit	Value	High limit
K_766	18.000	18.951	22.000
Li670	4.500	4.728	5.500
Na589	27.000	28.568	33.000

BACKGROUND CORRECTED INTENSITIES
Identity 1 : Calibration blank Identity 2 : Type : CB
Weight : 1.0000 Volume : 1.00 Printed : 12:16:22 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	13.0	-5.5	33.5	3825.5	3825.5
# 2	28.0	3.5	90.5	3758.5	3758.5
Mean	20.5	-1.0	62.0	3792.0	3792.0
SD	10.6	6.4	40.3	47.4	47.4
%RSD	51.7	636.4	65.0	1.2	1.2

APPARENT CONCENTRATIONS
Identity 1 : Calibration blank Identity 2 : Type : CB
Weight : 1.0000 Volume : 1.00 Printed : 12:16:22 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1 L	-0.1325	0.0102 L	-0.0994	3825.500 H	106.7804
# 2	0.0633	0.0139	0.0333	3758.500 H	104.9070
Mean L	-0.0346	0.0121 L	-0.0331	3792.000 H	105.8437
SD	0.1384	0.0026	0.0939	47.376	1.3247
%RSD	400.0698	21.3646	283.8715	1.249	1.2515

Checking calibration blank ...
Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value	
K_766	0.100	-0.035	
Li670	0.010	0.012	Contaminated
Na589	0.050	-0.033	
Sc361	0.000	105.844	

BACKGROUND CORRECTED INTENSITIES
Identity 1 : CRI Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 12:19:26 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	31.0	235.0	53.0	4004.0	4004.0
# 2	24.0	239.0	76.0	3885.0	3885.0
Mean	27.5	237.0	64.5	3944.5	3944.5
SD	4.9	2.8	16.3	84.1	84.1
%RSD	18.0	1.2	25.2	2.1	2.1

APPARENT CONCENTRATIONS
Identity 1 : CRI Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 12:19:26 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	0.0774	0.1028 L	-0.0606	4004.000 H	111.7713
# 2	0.0018	0.1071 L	-0.0058	3885.000 H	108.4440

EVOLUTION by Micro-Active Australia Pty Ltd 12:25:48 PM February 1, 2006

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Mean	0.0396	0.1049 L	-0.0332	3944.500 H	110.1076
SD	0.0535	0.0031	0.0388	84.146	2.3527
%RSD	134.9525	2.9315	116.6386	2.133	2.1368

Checking calibration verification ...
Identity 1 : CRI Identity 2 :

Report name	Low limit	Value	High limit
Li670	0.090	0.105	0.110

BACKGROUND CORRECTED INTENSITIES
Identity 1 : ICSA Identity 2 : Type : INTRF
Weight : 1.0000 Volume : 1.00 Printed : 12:22:30 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	14.5	-14.5	82.5	3838.0	3838.0
# 2	25.5	-14.5	64.5	3735.0	3735.0
Mean	20.0	-14.5	73.5	3786.5	3786.5
SD	7.8	0.0	12.7	72.8	72.8
%RSD	38.9	0.0	17.3	1.9	1.9

APPARENT CONCENTRATIONS
Identity 1 : ICSA Identity 2 : Type : INTRF
Weight : 1.0000 Volume : 1.00 Printed : 12:22:30 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1 L	-0.1141	0.0066	0.0109	3838.000 H	107.1299
# 2	0.0332	0.0065 L	-0.0257	3735.000 H	104.2500
Mean L	-0.0405	0.0066 L	-0.0074	3786.500 H	105.6899
SD	0.1042	0.0001	0.0259	72.832	2.0364
%RSD	257.4708	1.7279	350.7245	1.923	1.9268

BACKGROUND CORRECTED INTENSITIES
Identity 1 : ICSAB Identity 2 : Type : ICSAB
Weight : 1.0000 Volume : 1.00 Printed : 12:25:32 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	15.0	2596.0	64.5	3887.5	3887.5
# 2	25.0	2576.0	82.5	3829.5	3829.5
Mean	20.0	2586.0	73.5	3858.5	3858.5
SD	7.1	14.1	12.7	41.0	41.0
%RSD	35.4	0.5	17.3	1.1	1.1

APPARENT CONCENTRATIONS
Identity 1 : ICSAB Identity 2 : Type : ICSAB
Weight : 1.0000 Volume : 1.00 Printed : 12:25:34 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1 L	-0.1103	1.0399 L	-0.0316	3887.500 H	108.5139
# 2	0.0188	1.0475	0.0113	3829.500 H	106.8922
Mean L	-0.0457	1.0437 L	-0.0101	3858.500 H	107.7031
SD	0.0912	0.0053	0.0303	41.012	1.1467
%RSD	199.4055	0.5099	300.0345	1.063	1.0647

Checking interference check standard ...
Identity 1 : ICSAB Identity 2 :

Report name	Low limit	Value	High limit
Li670	0.800	1.044	1.200

EVOLUTION by Micro-Active Australia Pty Ltd 12:31:54 PM February 1, 2006

010043

BACKGROUND CORRECTED INTENSITIES
Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 12:28:40 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	1657.5	12627.5	13609.0	4013.0	4013.0
# 2	1622.5	12300.5	13280.0	3910.0	3910.0
Mean	1640.0	12464.0	13444.5	3961.5	3961.5
SD	24.7	231.2	232.6	72.8	72.8
%RSD	1.5	1.9	1.7	1.8	1.8

APPARENT CONCENTRATIONS
Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 12:28:40 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1	19.6627	4.8540	29.2088	4013.000 H	112.0229
# 2	19.7560	4.8529	29.2537	3910.000 H	109.1430
Mean	19.7094	4.8534	29.2313	3961.500 H	110.5830
SD	0.0659	0.0008	0.0318	72.832	2.0364
%RSD	0.3344	0.0166	0.1088	1.838	1.8415

Keep last result visible enabled ...

Checking calibration verification ...
Identity 1 : CLP_CCV_SC Identity 2 :

Report name	Low limit	Value	High limit
K_766	18.000	19.709	22.000
Li670	4.500	4.853	5.500
Na589	27.000	29.231	33.000

BACKGROUND CORRECTED INTENSITIES
Identity 1 : Calibration blank Identity 2 : Type : CB
Weight : 1.0000 Volume : 1.00 Printed : 12:31:44 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
# 1	16.0	-6.0	69.5	3815.5	3815.5
# 2	26.0	-11.0	81.5	3750.5	3750.5
Mean	21.0	-8.5	75.5	3783.0	3783.0
SD	7.1	3.5	8.5	46.0	46.0
%RSD	33.7	41.6	11.2	1.2	1.2

APPARENT CONCENTRATIONS
Identity 1 : Calibration blank Identity 2 : Type : CB
Weight : 1.0000 Volume : 1.00 Printed : 12:31:44 PM February 1, 2006

	K_766	Li670	Na589	Sc	Sc361
	ppm	ppm	ppm		ppm
# 1 L	-0.0941	0.0100 L	-0.0175	3815.500 H	106.5008
# 2	0.0383	0.0079	0.0130	3750.500 H	104.6833
Mean L	-0.0279	0.0090 L	-0.0023	3783.000 H	105.5921
SD	0.0936	0.0015	0.0215	45.962	1.2851
%RSD	335.5488	16.4689	950.0507	1.215	1.2171

Checking calibration blank ...
Identity 1 : Calibration blank Identity 2 :

Report name	CRDL	Value
K_766	0.100	-0.028
Li670	0.010	0.009
Na589	0.050	-0.002
Sc361	0.000	105.592

EVOLUTION by Micro-Active Australia Pty Ltd 12:42:20 PM February 1, 2006 010044

273124 for B

$\frac{0.12674 \text{ ug/ml} \times 5 \text{ ml}}{0.2 \text{ ml}} = 3.17 \text{ mg/L}$

DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

2-6-06

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
pbw-B01H1	Ag3280	0.125	U		mg/L	0.125				0.005	0.004	0.004	1	0.125	0.00016	02/01/06	12:18
pbw-B01H1	Al3082	1.25	U		mg/L	1.25				0.05	-0.11075	-0.111	1	1.25	-0.00443	02/01/06	12:18
pbw-B01H1	As1890	0.125	U		mg/L	0.125				0.005	0.0045	0.0045	1	0.125	0.00018	02/01/06	12:18
pbw-B01H1	B_2496	0.500	U		mg/L	0.5				0.02	0.129	0.129	1	0.5	0.00516	02/01/06	12:18
pbw-B01H1	Ba4934	0.125	U		mg/L	0.125				0.005	0.00025	0.00025	1	0.125	0.00001	02/01/06	12:18
pbw-B01H1	Be3130	0.125	U		mg/L	0.125				0.005	-0.0005	-0.0005	1	0.125	-0.00002	02/01/06	12:18
pbw-B01H1	Bi2230	0.250	U		mg/L	0.25				0.01	-0.03425	-0.0343	1	0.25	-0.00137	02/01/06	12:18
pbw-B01H1	Ca3179	1.25	U		mg/L	1.25				0.05	0.18175	0.182	1	1.25	0.00727	02/01/06	12:18
pbw-B01H1	Cd2265	0.125	U		mg/L	0.125				0.005	0.0005	0.0005	1	0.125	0.00002	02/01/06	12:18
pbw-B01H1	Co2286	0.125	U		mg/L	0.125				0.005	0.028	0.028	1	0.125	0.00112	02/01/06	12:18
pbw-B01H1	Cr2677	0.125	U		mg/L	0.125				0.005	-0.01175	-0.0118	1	0.125	-0.00047	02/01/06	12:18
pbw-B01H1	Cu3247	0.125	U		mg/L	0.125				0.005	-0.00475	-0.00475	1	0.125	-0.00019	02/01/06	12:18
pbw-B01H1	Fe2714	1.25	U		mg/L	1.25				0.05	0.07575	0.0758	1	1.25	0.00303	02/01/06	12:18
pbw-B01H1	La3988	0.125	U		mg/L	0.125				0.005	0.018	0.018	1	0.125	0.00072	02/01/06	12:18
pbw-B01H1	Mg2790	1.25	U		mg/L	1.25				0.05	0.10375	0.104	1	1.25	0.00415	02/01/06	12:18
pbw-B01H1	Mn2576	0.125	U		mg/L	0.125				0.005	-0.00125	-0.00125	1	0.125	-0.00005	02/01/06	12:18
pbw-B01H1	Mo2020	0.125	U		mg/L	0.125				0.005	0.015	0.015	1	0.125	0.0006	02/01/06	12:18
pbw-B01H1	Ni2316	0.125	U		mg/L	0.125				0.005	0.001	0.001	1	0.125	0.00004	02/01/06	12:18
pbw-B01H1	P_1782	0.500	U		mg/L	0.5				0.02	0.04675	0.0468	1	0.5	0.00187	02/01/06	12:18
pbw-B01H1	Pd3404	0.250	U		mg/L	0.25				0.01	0.0185	0.0185	1	0.25	0.00074	02/01/06	12:18
pbw-B01H1	S_1820	0.500	U		mg/L	0.5				0.02	-0.086	-0.086	1	0.5	-0.00344	02/01/06	12:18
pbw-B01H1	Sb2068	0.250	U		mg/L	0.25				0.01	0.03975	0.0398	1	0.25	0.00159	02/01/06	12:18
pbw-B01H1	Si2881	0.500	U		mg/L	0.5				0.02	0.21275	0.213	1	0.5	0.00851	02/01/06	12:18
pbw-B01H1	Pb220	0.125	U		mg/L	0.125				0.005	0.025	0.025	1	0.125	0.001	02/01/06	12:18
pbw-B01H1	Se196	0.125	U		mg/L	0.125				0.005	0.03125	0.0313	1	0.125	0.00125	02/01/06	12:18
pbw-B01H1	Sn1899	0.125	U		mg/L	0.125				0.005	-0.02375	-0.0238	1	0.125	-0.00095	02/01/06	12:18
pbw-B01H1	Sr4215	0.125	U		mg/L	0.125				0.005	0.0005	0.0005	1	0.125	0.00002	02/01/06	12:18
pbw-B01H1	Th2837	0.750	U		mg/L	0.75				0.03	-0.06375	-0.0638	1	0.75	-0.00255	02/01/06	12:18
pbw-B01H1	Ti3349	0.125	U		mg/L	0.125				0.005	-0.00025	-0.00025	1	0.125	-0.00001	02/01/06	12:18
pbw-B01H1	Tl1908	0.250	U		mg/L	0.25				0.01	-0.038	-0.038	1	0.25	-0.00152	02/01/06	12:18
pbw-B01H1	U_4090	2.50	U		mg/L	2.5				0.1	0.52125	0.521	1	2.5	0.02085	02/01/06	12:18
pbw-B01H1	V_2924	0.125	U		mg/L	0.125				0.005	-0.0065	-0.0065	1	0.125	-0.00026	02/01/06	12:18
pbw-B01H1	W_2079	0.250	U		mg/L	0.25				0.01	0.00575	0.00575	1	0.25	0.00023	02/01/06	12:18
pbw-B01H1	Y_3710	0.125	U		mg/L	0.125				0.005	-0.00175	-0.00175	1	0.125	-0.00007	02/01/06	12:18
pbw-B01H1	Zn2062	0.125	U		mg/L	0.125				0.005	0.0085	0.0085	1	0.125	0.00034	02/01/06	12:18
pbw-B01H1	Zr3496	0.125	U		mg/L	0.125				0.005	0	0	1	0.125	0	02/01/06	12:18
lcsw-B01H1	Ag3280	1.18			mg/L	0.125		94.4%	1.25	0.005	1.17625	1.18	1	0.125	0.04705	02/01/06	12:23
lcsw-B01H1	Al3082	46.4			mg/L	1.25		92.8%	50	0.05	46.40075	46.4	1	1.25	1.85603	02/01/06	12:23
lcsw-B01H1	As1890	48.4			mg/L	0.125		96.8%	50	0.005	48.394	48.4	1	0.125	1.93576	02/01/06	12:23
lcsw-B01H1	B_2496	0.500	U		mg/L	0.5			0	0.02	0.086	0.086	1	0.5	0.00344	02/01/06	12:23
lcsw-B01H1	Ba4934	47.8			mg/L	0.125		95.6%	50	0.005	47.803	47.8	1	0.125	1.91212	02/01/06	12:23
lcsw-B01H1	Be3130	1.17			mg/L	0.125		93.6%	1.25	0.005	1.172	1.17	1	0.125	0.04688	02/01/06	12:23

010045

DIV20_060131_9TJA

2/6/06

DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
lcsw-B01H1	Bi2230	0.250	U		mg/L	0.25			0	0.01	0.16075	0.161	1	0.25	0.00643	02/01/06	12:23
lcsw-B01H1	Ca3179	479			mg/L	1.25		95.8%	500	0.05	478.77825	479	1	1.25	19.15113	02/01/06	12:23
lcsw-B01H1	Cd2265	1.18			mg/L	0.125		94.4%	1.25	0.005	1.176	1.18	1	0.125	0.04704	02/01/06	12:23
lcsw-B01H1	Co2286	11.9			mg/L	0.125		95.2%	12.5	0.005	11.93875	11.9	1	0.125	0.47755	02/01/06	12:23
lcsw-B01H1	Cr2677	4.65			mg/L	0.125		93.0%	5	0.005	4.65325	4.65	1	0.125	0.18613	02/01/06	12:23
lcsw-B01H1	Cu3247	5.88			mg/L	0.125		94.1%	6.25	0.005	5.881	5.88	1	0.125	0.23524	02/01/06	12:23
lcsw-B01H1	Fe2714	26.6			mg/L	1.25		106.4%	25	0.05	26.5805	26.6	1	1.25	1.06322	02/01/06	12:23
lcsw-B01H1	La3988	0.125	U		mg/L	0.125			0	0.005	0.02125	0.0213	1	0.125	0.00085	02/01/06	12:23
lcsw-B01H1	Mg2790	479			mg/L	1.25		95.8%	500	0.05	479.33125	479	1	1.25	19.17325	02/01/06	12:23
lcsw-B01H1	Mn2576	11.9			mg/L	0.125		95.2%	12.5	0.005	11.85475	11.9	1	0.125	0.47419	02/01/06	12:23
lcsw-B01H1	Mo2020	0.125	U		mg/L	0.125			0	0.005	0.0215	0.0215	1	0.125	0.00086	02/01/06	12:23
lcsw-B01H1	Ni2316	11.7			mg/L	0.125		93.6%	12.5	0.005	11.67825	11.7	1	0.125	0.46713	02/01/06	12:23
lcsw-B01H1	P_1782	0.500	U		mg/L	0.5			0	0.02	0.09075	0.0908	1	0.5	0.00363	02/01/06	12:23
lcsw-B01H1	Pd3404	0.250	U		mg/L	0.25			0	0.01	-0.02125	-0.0213	1	0.25	-0.00085	02/01/06	12:23
lcsw-B01H1	S_1820	0.500	U		mg/L	0.5			0	0.02	-0.195	-0.195	1	0.5	-0.0078	02/01/06	12:23
lcsw-B01H1	Sb2068	11.6			mg/L	0.25		92.8%	12.5	0.01	11.556	11.6	1	0.25	0.46224	02/01/06	12:23
lcsw-B01H1	Si2881	0.500	U		mg/L	0.5			0	0.02	0.3275	0.328	1	0.5	0.0131	02/01/06	12:23
lcsw-B01H1	Pb220	11.6			mg/L	0.125		92.8%	12.5	0.005	11.6295	11.6	1	0.125	0.46518	02/01/06	12:23
lcsw-B01H1	Se196	49.6			mg/L	0.125		99.2%	50	0.005	49.6195	49.6	1	0.125	1.98478	02/01/06	12:23
lcsw-B01H1	Sn1899	0.125	U		mg/L	0.125			0	0.005	-0.02925	-0.0293	1	0.125	-0.00117	02/01/06	12:23
lcsw-B01H1	Sr4215	0.125	U		mg/L	0.125			0	0.005	0.01775	0.0178	1	0.125	0.00071	02/01/06	12:23
lcsw-B01H1	Th2837	0.750	U		mg/L	0.75			0	0.03	-0.58775	-0.588	1	0.75	-0.02351	02/01/06	12:23
lcsw-B01H1	Ti3349	0.125	U		mg/L	0.125			0	0.005	-0.00025	-0.00025	1	0.125	-0.00001	02/01/06	12:23
lcsw-B01H1	Tl1908	48.7			mg/L	0.25		97.4%	50	0.01	48.73325	48.7	1	0.25	1.94933	02/01/06	12:23
lcsw-B01H1	U_4090	2.50	U		mg/L	2.5			0	0.1	0.96125	0.961	1	2.5	0.03845	02/01/06	12:23
lcsw-B01H1	V_2924	11.8			mg/L	0.125		94.4%	12.5	0.005	11.762	11.8	1	0.125	0.47048	02/01/06	12:23
lcsw-B01H1	W_2079	0.250	U		mg/L	0.25			0	0.01	-0.0155	-0.0155	1	0.25	-0.00062	02/01/06	12:23
lcsw-B01H1	Y_3710	0.125	U		mg/L	0.125			0	0.005	-0.00525	-0.00525	1	0.125	-0.00021	02/01/06	12:23
lcsw-B01H1	Zn2062	11.9			mg/L	0.125		95.2%	12.5	0.005	11.92	11.9	1	0.125	0.4768	02/01/06	12:23
lcsw-B01H1	Zr3496	0.125	U		mg/L	0.125			0	0.005	0.001	0.001	1	0.125	0.00004	02/01/06	12:23
273124	Ag3280	0.125	U		mg/L	0.125				0.005	0.01275	0.0128	1	0.125	0.00051	02/01/06	12:27
273124	Al3082	1.25	U		mg/L	1.25				0.05	-0.07575	-0.0758	1	1.25	-0.00303	02/01/06	12:27
273124	As1890	0.125	U		mg/L	0.125				0.005	0.0145	0.0145	1	0.125	0.00058	02/01/06	12:27
273124	B_2496	3.17	√		mg/L	0.5				0.02	3.1685	3.17	1	0.5	0.12674	02/01/06	12:27
273124	Ba4934	0.125	U		mg/L	0.125				0.005	0.009	0.009	1	0.125	0.00036	02/01/06	12:27
273124	Be3130	0.125	U		mg/L	0.125				0.005	0	0	1	0.125	0	02/01/06	12:27
273124	Bi2230	0.250	U		mg/L	0.25				0.01	0.00375	0.00375	1	0.25	0.00015	02/01/06	12:27
273124	Ca3179	17.3			mg/L	1.25				0.05	17.28	17.3	1	1.25	0.6912	02/01/06	12:27
273124	Cd2265	0.125	U		mg/L	0.125				0.005	0.003	0.003	1	0.125	0.00012	02/01/06	12:27
273124	Co2286	0.125	U		mg/L	0.125				0.005	0.025	0.025	1	0.125	0.001	02/01/06	12:27
273124	Cr2677	0.125	U		mg/L	0.125				0.005	0.01725	0.0173	1	0.125	0.00069	02/01/06	12:27
273124	Cu3247	0.125	U		mg/L	0.125				0.005	0.00775	0.00775	1	0.125	0.00031	02/01/06	12:27

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DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
273124	Fe2714	1.25	U		mg/L	1.25				0.05	1.14375	1.14	1	1.25	0.04575	02/01/06	12:27
273124	La3988	0.125	U		mg/L	0.125				0.005	0.02425	0.0243	1	0.125	0.00097	02/01/06	12:27
273124	Mg2790	3.32			mg/L	1.25				0.05	3.3205	3.32	1	1.25	0.13282	02/01/06	12:27
273124	Mn2576	0.125	U		mg/L	0.125				0.005	0.00025	0.00025	1	0.125	0.00001	02/01/06	12:27
273124	Mo2020	0.125	U		mg/L	0.125				0.005	0.01175	0.0118	1	0.125	0.00047	02/01/06	12:27
273124	Ni2316	0.125	U		mg/L	0.125				0.005	0.006	0.006	1	0.125	0.00024	02/01/06	12:27
273124	P_1782	0.500	U		mg/L	0.5				0.02	0.076	0.076	1	0.5	0.00304	02/01/06	12:27
273124	Pd3404	0.250	U		mg/L	0.25				0.01	0.20775	0.208	1	0.25	0.00831	02/01/06	12:27
273124	S_1820	10.0			mg/L	0.5				0.02	10.03575	10	1	0.5	0.40143	02/01/06	12:27
273124	Sb2068	0.250	U		mg/L	0.25				0.01	0.103	0.103	1	0.25	0.00412	02/01/06	12:27
273124	Si2881	5.90			mg/L	0.5				0.02	5.90425	5.9	1	0.5	0.23617	02/01/06	12:27
273124	Pb220	0.125	U		mg/L	0.125				0.005	-0.00075	-0.00075	1	0.125	-0.00003	02/01/06	12:27
273124	Se196	0.125	U		mg/L	0.125				0.005	0.00875	0.00875	1	0.125	0.00035	02/01/06	12:27
273124	Sn1899	0.125	U		mg/L	0.125				0.005	-0.0065	-0.0065	1	0.125	-0.00026	02/01/06	12:27
273124	Sr4215	0.125	U		mg/L	0.125				0.005	0.00975	0.00975	1	0.125	0.00039	02/01/06	12:27
273124	Th2837	0.750	U		mg/L	0.75				0.03	-0.0505	-0.0505	1	0.75	-0.00202	02/01/06	12:27
273124	Ti3349	0.125	U		mg/L	0.125				0.005	0.00125	0.00125	1	0.125	0.00005	02/01/06	12:27
273124	Tl1908	0.250	U		mg/L	0.25				0.01	0.0275	0.0275	1	0.25	0.0011	02/01/06	12:27
273124	U_4090	2.50	U		mg/L	2.5				0.1	0.88675	0.887	1	2.5	0.03547	02/01/06	12:27
273124	V_2924	0.125	U		mg/L	0.125				0.005	-0.002	-0.002	1	0.125	-0.00008	02/01/06	12:27
273124	W_2079	0.250	U		mg/L	0.25				0.01	0.034	0.034	1	0.25	0.00136	02/01/06	12:27
273124	Y_3710	0.125	U		mg/L	0.125				0.005	0.0015	0.0015	1	0.125	0.00006	02/01/06	12:27
273124	Zn2062	0.125	U		mg/L	0.125				0.005	0.00775	0.00775	1	0.125	0.00031	02/01/06	12:27
273124	Zr3496	0.125	U		mg/L	0.125				0.005	0.00625	0.00625	1	0.125	0.00025	02/01/06	12:27
273124d	Ag3280	0.125	U		mg/L	0.125	0.0%			0.005	0.0035	0.0035	1	0.125	0.00014	02/01/06	12:32
273124d	Al3082	1.25	U		mg/L	1.25	0.0%			0.05	-0.15275	-0.153	1	1.25	-0.00611	02/01/06	12:32
273124d	As1890	0.125	U		mg/L	0.125	0.0%			0.005	0.04625	0.0463	1	0.125	0.00185	02/01/06	12:32
273124d	B_2496	3.18			mg/L	0.5	0.3%			0.02	3.17825	3.18	1	0.5	0.12713	02/01/06	12:32
273124d	Ba4934	0.125	U		mg/L	0.125	0.0%			0.005	0.0035	0.0035	1	0.125	0.00014	02/01/06	12:32
273124d	Be3130	0.125	U		mg/L	0.125	0.0%			0.005	-0.00075	-0.00075	1	0.125	-0.00003	02/01/06	12:32
273124d	Bi2230	0.250	U		mg/L	0.25	0.0%			0.01	-0.072	-0.072	1	0.25	-0.00288	02/01/06	12:32
273124d	Ca3179	17.4			mg/L	1.25	0.6%			0.05	17.386	17.4	1	1.25	0.69544	02/01/06	12:32
273124d	Cd2265	0.125	U		mg/L	0.125	0.0%			0.005	0.00275	0.00275	1	0.125	0.00011	02/01/06	12:32
273124d	Co2286	0.125	U		mg/L	0.125	0.0%			0.005	0.01	0.01	1	0.125	0.0004	02/01/06	12:32
273124d	Cr2677	0.125	U		mg/L	0.125	0.0%			0.005	-0.02525	-0.0253	1	0.125	-0.00101	02/01/06	12:32
273124d	Cu3247	0.125	U		mg/L	0.125	0.0%			0.005	-0.01625	-0.0163	1	0.125	-0.00065	02/01/06	12:32
273124d	Fe2714	1.25	U		mg/L	1.25	0.0%			0.05	0.2185	0.219	1	1.25	0.00874	02/01/06	12:32
273124d	La3988	0.125	U		mg/L	0.125	0.0%			0.005	0.00975	0.00975	1	0.125	0.00039	02/01/06	12:32
273124d	Mg2790	3.24			mg/L	1.25	2.4%			0.05	3.24325	3.24	1	1.25	0.12973	02/01/06	12:32
273124d	Mn2576	0.125	U		mg/L	0.125	0.0%			0.005	-0.003	-0.003	1	0.125	-0.00012	02/01/06	12:32
273124d	Mo2020	0.125	U		mg/L	0.125	0.0%			0.005	0.00525	0.00525	1	0.125	0.00021	02/01/06	12:32
273124d	Ni2316	0.125	U		mg/L	0.125	0.0%			0.005	-0.01	-0.01	1	0.125	-0.0004	02/01/06	12:32

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DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
273124d	P_1782	0.500	U		mg/L	0.5	0.0%			0.02	0.184	0.184	1	0.5	0.00736	02/01/06	12:32
273124d	Pd3404	0.250	U		mg/L	0.25	0.0%			0.01	0.01925	0.0193	1	0.25	0.00077	02/01/06	12:32
273124d	S_1820	10.2			mg/L	0.5	2.0%			0.02	10.2385	10.2	1	0.5	0.40954	02/01/06	12:32
273124d	Sb2068	0.250	U		mg/L	0.25	0.0%			0.01	0.0475	0.0475	1	0.25	0.0019	02/01/06	12:32
273124d	Si2881	5.95			mg/L	0.5	0.8%			0.02	5.94925	5.95	1	0.5	0.23797	02/01/06	12:32
273124d	Pb220	0.125	U		mg/L	0.125	0.0%			0.005	0.014	0.014	1	0.125	0.00056	02/01/06	12:32
273124d	Se196	0.125	U		mg/L	0.125	0.0%			0.005	0.03875	0.0388	1	0.125	0.00155	02/01/06	12:32
273124d	Sn1899	0.125	U		mg/L	0.125	0.0%			0.005	-0.02225	-0.0223	1	0.125	-0.00089	02/01/06	12:32
273124d	Sr4215	0.125	U		mg/L	0.125	0.0%			0.005	0.00975	0.00975	1	0.125	0.00039	02/01/06	12:32
273124d	Th2837	0.750	U		mg/L	0.75	0.0%			0.03	-0.135	-0.135	1	0.75	-0.0054	02/01/06	12:32
273124d	Ti3349	0.125	U		mg/L	0.125	0.0%			0.005	-0.00575	-0.00575	1	0.125	-0.00023	02/01/06	12:32
273124d	Tl1908	0.250	U		mg/L	0.25	0.0%			0.01	-0.0725	-0.0725	1	0.25	-0.0029	02/01/06	12:32
273124d	U_4090	2.50	U		mg/L	2.5	0.0%			0.1	0.63	0.63	1	2.5	0.0252	02/01/06	12:32
273124d	V_2924	0.125	U		mg/L	0.125	0.0%			0.005	-0.03175	-0.0318	1	0.125	-0.00127	02/01/06	12:32
273124d	W_2079	0.250	U		mg/L	0.25	0.0%			0.01	0.01	0.01	1	0.25	0.0004	02/01/06	12:32
273124d	Y_3710	0.125	U		mg/L	0.125	0.0%			0.005	-0.0035	-0.0035	1	0.125	-0.00014	02/01/06	12:32
273124d	Zn2062	0.125	U		mg/L	0.125	0.0%			0.005	0.0075	0.0075	1	0.125	0.0003	02/01/06	12:32
273124d	Zr3496	0.125	U		mg/L	0.125	0.0%			0.005	-0.02	-0.02	1	0.125	-0.0008	02/01/06	12:32
273124s	Ag3280	1.21			mg/L	0.125		96.8%	1.25	0.005	1.21175	1.21	1	0.125	0.04847	02/01/06	12:37
273124s	Al3082	46.8			mg/L	1.25		93.6%	50	0.05	46.84625	46.8	1	1.25	1.87385	02/01/06	12:37
273124s	As1890	48.6			mg/L	0.125		97.2%	50	0.005	48.60975	48.6	1	0.125	1.94439	02/01/06	12:37
273124s	B_2496	3.20		#DIV/0!	mg/L	0.5		#DIV/0!	0	0.02	3.19625	3.2	1	0.5	0.12785	02/01/06	12:37
273124s	Ba4934	48.0			mg/L	0.125		96.0%	50	0.005	47.95325	48	1	0.125	1.91813	02/01/06	12:37
273124s	Be3130	1.17			mg/L	0.125		93.6%	1.25	0.005	1.17475	1.17	1	0.125	0.04699	02/01/06	12:37
273124s	Bi2230	0.250	U	#DIV/0!	mg/L	0.25		#DIV/0!	0	0.01	0.1855	0.186	1	0.25	0.00742	02/01/06	12:37
273124s	Ca3179	495			mg/L	1.25		95.5%	500	0.05	495.00725	495	1	1.25	19.80029	02/01/06	12:37
273124s	Cd2265	1.19			mg/L	0.125		95.2%	1.25	0.005	1.19325	1.19	1	0.125	0.04773	02/01/06	12:37
273124s	Co2286	12.0			mg/L	0.125		96.0%	12.5	0.005	11.97025	12	1	0.125	0.47881	02/01/06	12:37
273124s	Cr2677	4.66			mg/L	0.125		93.2%	5	0.005	4.663	4.66	1	0.125	0.18652	02/01/06	12:37
273124s	Cu3247	5.92			mg/L	0.125		94.7%	6.25	0.005	5.91525	5.92	1	0.125	0.23661	02/01/06	12:37
273124s	Fe2714	27.4			mg/L	1.25		109.6%	25	0.05	27.37675	27.4	1	1.25	1.09507	02/01/06	12:37
273124s	La3988	0.125	U	#DIV/0!	mg/L	0.125		#DIV/0!	0	0.005	0.05225	0.0523	1	0.125	0.00209	02/01/06	12:37
273124s	Mg2790	483			mg/L	1.25		95.9%	500	0.05	482.8315	483	1	1.25	19.31326	02/01/06	12:37
273124s	Mn2576	11.9			mg/L	0.125		95.2%	12.5	0.005	11.867	11.9	1	0.125	0.47468	02/01/06	12:37
273124s	Mo2020	0.125	U	#DIV/0!	mg/L	0.125		#DIV/0!	0	0.005	0.0125	0.0125	1	0.125	0.0005	02/01/06	12:37
273124s	Ni2316	11.7			mg/L	0.125		93.6%	12.5	0.005	11.67075	11.7	1	0.125	0.46683	02/01/06	12:37
273124s	P_1782	0.500	U	#DIV/0!	mg/L	0.5		#DIV/0!	0	0.02	0.08075	0.0808	1	0.5	0.00323	02/01/06	12:37
273124s	Pd3404	0.250	U	#DIV/0!	mg/L	0.25		#DIV/0!	0	0.01	0.15825	0.158	1	0.25	0.00633	02/01/06	12:37
273124s	S_1820	10.2		#DIV/0!	mg/L	0.5		#DIV/0!	0	0.02	10.239	10.2	1	0.5	0.40956	02/01/06	12:37
273124s	Sb2068	11.7			mg/L	0.25		93.6%	12.5	0.01	11.674	11.7	1	0.25	0.46696	02/01/06	12:37
273124s	Si2881	6.13		#DIV/0!	mg/L	0.5		#DIV/0!	0	0.02	6.13025	6.13	1	0.5	0.24521	02/01/06	12:37
273124s	Pb220	11.7			mg/L	0.125		93.6%	12.5	0.005	11.72325	11.7	1	0.125	0.46893	02/01/06	12:37

010048

DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
273124s	Se196	50.5			mg/L	0.125		101.0%	50	0.005	50.4955	50.5	1	0.125	2.01982	02/01/06	12:37
273124s	Sn1899	0.125	U	#DIV/0!	mg/L	0.125		#DIV/0!	0	0.005	-0.0295	-0.0295	1	0.125	-0.00118	02/01/06	12:37
273124s	Sr4215	0.125	U	#DIV/0!	mg/L	0.125		#DIV/0!	0	0.005	0.027	0.027	1	0.125	0.00108	02/01/06	12:37
273124s	Th2837	0.750	U	#DIV/0!	mg/L	0.75		#DIV/0!	0	0.03	-0.64625	-0.646	1	0.75	-0.02585	02/01/06	12:37
273124s	Ti3349	0.125	U	#DIV/0!	mg/L	0.125		#DIV/0!	0	0.005	-0.00725	-0.00725	1	0.125	-0.00029	02/01/06	12:37
273124s	Tl1908	49.2			mg/L	0.25		98.4%	50	0.01	49.1805	49.2	1	0.25	1.96722	02/01/06	12:37
273124s	U_4090	2.50	U	#DIV/0!	mg/L	2.5		#DIV/0!	0	0.1	1.8935	1.89	1	2.5	0.07574	02/01/06	12:37
273124s	V_2924	11.8			mg/L	0.125		94.4%	12.5	0.005	11.78175	11.8	1	0.125	0.47127	02/01/06	12:37
273124s	W_2079	0.250	U	#DIV/0!	mg/L	0.25		#DIV/0!	0	0.01	0.0165	0.0165	1	0.25	0.00066	02/01/06	12:37
273124s	Y_3710	0.125	U	#DIV/0!	mg/L	0.125		#DIV/0!	0	0.005	-0.0105	-0.0105	1	0.125	-0.00042	02/01/06	12:37
273124s	Zn2062	11.9			mg/L	0.125		95.2%	12.5	0.005	11.93475	11.9	1	0.125	0.47739	02/01/06	12:37
273124s	Zr3496	0.125	U	#DIV/0!	mg/L	0.125		#DIV/0!	0	0.005	-0.017	-0.017	1	0.125	-0.00068	02/01/06	12:37
273125	Ag3280	0.125	U		mg/L	0.125				0.005	0.0035	0.0035	1	0.125	0.00014	02/01/06	12:42
273125	Al3082	1.25	U		mg/L	1.25				0.05	-0.24775	-0.248	1	1.25	-0.00991	02/01/06	12:42
273125	As1890	0.125	U		mg/L	0.125				0.005	0.01375	0.0138	1	0.125	0.00055	02/01/06	12:42
273125	B_2496	0.500	U		mg/L	0.5				0.02	0.07325	0.0733	1	0.5	0.00293	02/01/06	12:42
273125	Ba4934	0.125	U		mg/L	0.125				0.005	0.0005	0.0005	1	0.125	0.00002	02/01/06	12:42
273125	Be3130	0.125	U		mg/L	0.125				0.005	-0.00075	-0.00075	1	0.125	-0.00003	02/01/06	12:42
273125	Bi2230	0.250	U		mg/L	0.25				0.01	-0.0495	-0.0495	1	0.25	-0.00198	02/01/06	12:42
273125	Ca3179	5.05			mg/L	1.25				0.05	5.04725	5.05	1	1.25	0.20189	02/01/06	12:42
273125	Cd2265	0.125	U		mg/L	0.125				0.005	-0.00075	-0.00075	1	0.125	-0.00003	02/01/06	12:42
273125	Co2286	0.125	U		mg/L	0.125				0.005	0.033	0.033	1	0.125	0.00132	02/01/06	12:42
273125	Cr2677	0.125	U		mg/L	0.125				0.005	-0.0135	-0.0135	1	0.125	-0.00054	02/01/06	12:42
273125	Cu3247	0.125	U		mg/L	0.125				0.005	-0.004	-0.004	1	0.125	-0.00016	02/01/06	12:42
273125	Fe2714	1.25	U		mg/L	1.25				0.05	0.914	0.914	1	1.25	0.03656	02/01/06	12:42
273125	La3988	0.125	U		mg/L	0.125				0.005	0.01475	0.0148	1	0.125	0.00059	02/01/06	12:42
273125	Mg2790	3.11			mg/L	1.25				0.05	3.11325	3.11	1	1.25	0.12453	02/01/06	12:42
273125	Mn2576	0.125	U		mg/L	0.125				0.005	0.0155	0.0155	1	0.125	0.00062	02/01/06	12:42
273125	Mo2020	0.125	U		mg/L	0.125				0.005	0.0135	0.0135	1	0.125	0.00054	02/01/06	12:42
273125	Ni2316	0.125	U		mg/L	0.125				0.005	-0.0025	-0.0025	1	0.125	-0.0001	02/01/06	12:42
273125	P_1782	0.500	U		mg/L	0.5				0.02	0.046	0.046	1	0.5	0.00184	02/01/06	12:42
273125	Pd3404	0.250	U		mg/L	0.25				0.01	0.1115	0.112	1	0.25	0.00446	02/01/06	12:42
273125	S_1820	10.1			mg/L	0.5				0.02	10.10525	10.1	1	0.5	0.40421	02/01/06	12:42
273125	Sb2068	0.250	U		mg/L	0.25				0.01	-0.03	-0.03	1	0.25	-0.0012	02/01/06	12:42
273125	Si2881	0.500	U		mg/L	0.5				0.02	0.2905	0.291	1	0.5	0.01162	02/01/06	12:42
273125	Pb220	0.125	U		mg/L	0.125				0.005	-0.02625	-0.0263	1	0.125	-0.00105	02/01/06	12:42
273125	Se196	0.125	U		mg/L	0.125				0.005	0.06375	0.0638	1	0.125	0.00255	02/01/06	12:42
273125	Sn1899	0.125	U		mg/L	0.125				0.005	-0.076	-0.076	1	0.125	-0.00304	02/01/06	12:42
273125	Sr4215	0.125	U		mg/L	0.125				0.005	0.00375	0.00375	1	0.125	0.00015	02/01/06	12:42
273125	Th2837	0.750	U		mg/L	0.75				0.03	-0.1095	-0.11	1	0.75	-0.00438	02/01/06	12:42
273125	Ti3349	0.125	U		mg/L	0.125				0.005	-0.0025	-0.0025	1	0.125	-0.0001	02/01/06	12:42
273125	Tl1908	0.250	U		mg/L	0.25				0.01	-0.015	-0.015	1	0.25	-0.0006	02/01/06	12:42

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DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
273125	U_4090	2.50	U		mg/L	2.5				0.1	0.517	0.517	1	2.5	0.02068	02/01/06	12:42
273125	V_2924	0.125	U		mg/L	0.125				0.005	-0.009	-0.009	1	0.125	-0.00036	02/01/06	12:42
273125	W_2079	0.250	U		mg/L	0.25				0.01	0.0325	0.0325	1	0.25	0.0013	02/01/06	12:42
273125	Y_3710	0.125	U		mg/L	0.125				0.005	-0.00075	-0.00075	1	0.125	-0.00003	02/01/06	12:42
273125	Zn2062	0.125	U		mg/L	0.125				0.005	0.02575	0.0258	1	0.125	0.00103	02/01/06	12:42
273125	Zr3496	0.125	U		mg/L	0.125				0.005	-0.0055	-0.0055	1	0.125	-0.00022	02/01/06	12:42
273126	Ag3280	0.125	U		mg/L	0.125				0.005	0.01025	0.0103	1	0.125	0.00041	02/01/06	12:46
273126	Al3082	1.25	U		mg/L	1.25				0.05	-0.06975	-0.0698	1	1.25	-0.00279	02/01/06	12:46
273126	As1890	0.125	U		mg/L	0.125				0.005	0.031	0.031	1	0.125	0.00124	02/01/06	12:46
273126	B_2496	0.500	U		mg/L	0.5				0.02	0.03875	0.0388	1	0.5	0.00155	02/01/06	12:46
273126	Ba4934	0.125	U		mg/L	0.125				0.005	0.00175	0.00175	1	0.125	0.00007	02/01/06	12:46
273126	Be3130	0.125	U		mg/L	0.125				0.005	-0.00075	-0.00075	1	0.125	-0.00003	02/01/06	12:46
273126	Bi2230	0.250	U		mg/L	0.25				0.01	0.038	0.038	1	0.25	0.00152	02/01/06	12:46
273126	Ca3179	2.33			mg/L	1.25				0.05	2.33375	2.33	1	1.25	0.09335	02/01/06	12:46
273126	Cd2265	0.125	U		mg/L	0.125				0.005	0.003	0.003	1	0.125	0.00012	02/01/06	12:46
273126	Co2286	0.125	U		mg/L	0.125				0.005	0.016	0.016	1	0.125	0.00064	02/01/06	12:46
273126	Cr2677	0.125	U		mg/L	0.125				0.005	-0.003	-0.003	1	0.125	-0.00012	02/01/06	12:46
273126	Cu3247	0.125	U		mg/L	0.125				0.005	0.00075	0.00075	1	0.125	0.00003	02/01/06	12:46
273126	Fe2714	1.25	U		mg/L	1.25				0.05	0.62725	0.627	1	1.25	0.02509	02/01/06	12:46
273126	La3988	0.125	U		mg/L	0.125				0.005	0.03075	0.0308	1	0.125	0.00123	02/01/06	12:46
273126	Mg2790	3.26			mg/L	1.25				0.05	3.25675	3.26	1	1.25	0.13027	02/01/06	12:46
273126	Mn2576	0.125	U		mg/L	0.125				0.005	0.00725	0.00725	1	0.125	0.00029	02/01/06	12:46
273126	Mo2020	0.125	U		mg/L	0.125				0.005	0.013	0.013	1	0.125	0.00052	02/01/06	12:46
273126	Ni2316	0.125	U		mg/L	0.125				0.005	0.0075	0.0075	1	0.125	0.0003	02/01/06	12:46
273126	P_1782	0.500	U		mg/L	0.5				0.02	0.077	0.077	1	0.5	0.00308	02/01/06	12:46
273126	Pd3404	0.250	U		mg/L	0.25				0.01	0.01275	0.0128	1	0.25	0.00051	02/01/06	12:46
273126	S_1820	10.4			mg/L	0.5				0.02	10.427	10.4	1	0.5	0.41708	02/01/06	12:46
273126	Sb2068	0.250	U		mg/L	0.25				0.01	0.0995	0.0995	1	0.25	0.00398	02/01/06	12:46
273126	Si2881	0.500	U		mg/L	0.5				0.02	0.40225	0.402	1	0.5	0.01609	02/01/06	12:46
273126	Pb220	0.125	U		mg/L	0.125				0.005	0.02025	0.0203	1	0.125	0.00081	02/01/06	12:46
273126	Se196	0.125	U		mg/L	0.125				0.005	0.043	0.043	1	0.125	0.00172	02/01/06	12:46
273126	Sn1899	0.125	U		mg/L	0.125				0.005	0.0115	0.0115	1	0.125	0.00046	02/01/06	12:46
273126	Sr4215	0.125	U		mg/L	0.125				0.005	0.00225	0.00225	1	0.125	0.00009	02/01/06	12:46
273126	Th2837	0.750	U		mg/L	0.75				0.03	-0.08275	-0.0828	1	0.75	-0.00331	02/01/06	12:46
273126	Ti3349	0.125	U		mg/L	0.125				0.005	-0.001	-0.001	1	0.125	-0.00004	02/01/06	12:46
273126	Tl1908	0.250	U		mg/L	0.25				0.01	-0.0205	-0.0205	1	0.25	-0.00082	02/01/06	12:46
273126	U_4090	2.50	U		mg/L	2.5				0.1	1.05825	1.06	1	2.5	0.04233	02/01/06	12:46
273126	V_2924	0.125	U		mg/L	0.125				0.005	-0.0135	-0.0135	1	0.125	-0.00054	02/01/06	12:46
273126	W_2079	0.250	U		mg/L	0.25				0.01	0.07225	0.0723	1	0.25	0.00289	02/01/06	12:46
273126	Y_3710	0.125	U		mg/L	0.125				0.005	-0.00125	-0.00125	1	0.125	-0.00005	02/01/06	12:46
273126	Zn2062	0.125	U		mg/L	0.125				0.005	0.0105	0.0105	1	0.125	0.00042	02/01/06	12:46
273126	Zr3496	0.125	U		mg/L	0.125				0.005	0.00075	0.00075	1	0.125	0.00003	02/01/06	12:46

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DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
273127	Ag3280	0.125	U		mg/L	0.125				0.005	0.0165	0.0165	1	0.125	0.00066	02/01/06	12:51
273127	Al3082	1.25	U		mg/L	1.25				0.05	-0.20175	-0.202	1	1.25	-0.00807	02/01/06	12:51
273127	As1890	0.125	U		mg/L	0.125				0.005	0.0455	0.0455	1	0.125	0.00182	02/01/06	12:51
273127	B_2496	0.500	U		mg/L	0.5				0.02	0.06725	0.0673	1	0.5	0.00269	02/01/06	12:51
273127	Ba4934	0.125	U		mg/L	0.125				0.005	0.00025	0.00025	1	0.125	0.00001	02/01/06	12:51
273127	Be3130	0.125	U		mg/L	0.125				0.005	-0.00075	-0.00075	1	0.125	-0.00003	02/01/06	12:51
273127	Bi2230	0.250	U		mg/L	0.25				0.01	0.04	0.04	1	0.25	0.0016	02/01/06	12:51
273127	Ca3179	1.30			mg/L	1.25				0.05	1.30425	1.3	1	1.25	0.05217	02/01/06	12:51
273127	Cd2265	0.125	U		mg/L	0.125				0.005	0.00225	0.00225	1	0.125	0.00009	02/01/06	12:51
273127	Co2286	0.125	U		mg/L	0.125				0.005	0.0075	0.0075	1	0.125	0.0003	02/01/06	12:51
273127	Cr2677	0.125	U		mg/L	0.125				0.005	0.0005	0.0005	1	0.125	0.00002	02/01/06	12:51
273127	Cu3247	0.125	U		mg/L	0.125				0.005	0.001	0.001	1	0.125	0.00004	02/01/06	12:51
273127	Fe2714	1.25	U		mg/L	1.25				0.05	1.02525	1.03	1	1.25	0.04101	02/01/06	12:51
273127	La3988	0.125	U		mg/L	0.125				0.005	0.031	0.031	1	0.125	0.00124	02/01/06	12:51
273127	Mg2790	3.23			mg/L	1.25				0.05	3.23175	3.23	1	1.25	0.12927	02/01/06	12:51
273127	Mn2576	0.125	U		mg/L	0.125				0.005	0.01625	0.0163	1	0.125	0.00065	02/01/06	12:51
273127	Mo2020	0.125	U		mg/L	0.125				0.005	0.0095	0.0095	1	0.125	0.00038	02/01/06	12:51
273127	Ni2316	0.125	U		mg/L	0.125				0.005	-0.00675	-0.00675	1	0.125	-0.00027	02/01/06	12:51
273127	P_1782	0.500	U		mg/L	0.5				0.02	0.27775	0.278	1	0.5	0.01111	02/01/06	12:51
273127	Pd3404	0.250	U		mg/L	0.25				0.01	0.11325	0.113	1	0.25	0.00453	02/01/06	12:51
273127	S_1820	10.8			mg/L	0.5				0.02	10.769	10.8	1	0.5	0.43076	02/01/06	12:51
273127	Sb2068	0.250	U		mg/L	0.25				0.01	0.09075	0.0908	1	0.25	0.00363	02/01/06	12:51
273127	Si2881	0.500	U		mg/L	0.5				0.02	0.49425	0.494	1	0.5	0.01977	02/01/06	12:51
273127	Pb220	0.125	U		mg/L	0.125				0.005	0.001	0.001	1	0.125	0.00004	02/01/06	12:51
273127	Se196	0.125	U		mg/L	0.125				0.005	0.07025	0.0703	1	0.125	0.00281	02/01/06	12:51
273127	Sn1899	0.125	U		mg/L	0.125				0.005	-0.0135	-0.0135	1	0.125	-0.00054	02/01/06	12:51
273127	Sr4215	0.125	U		mg/L	0.125				0.005	0.002	0.002	1	0.125	0.00008	02/01/06	12:51
273127	Th2837	0.750	U		mg/L	0.75				0.03	-0.08475	-0.0848	1	0.75	-0.00339	02/01/06	12:51
273127	Ti3349	0.125	U		mg/L	0.125				0.005	-0.00025	-0.00025	1	0.125	-0.00001	02/01/06	12:51
273127	Tl1908	0.250	U		mg/L	0.25				0.01	-0.06125	-0.0613	1	0.25	-0.00245	02/01/06	12:51
273127	U_4090	2.50	U		mg/L	2.5				0.1	0.9645	0.965	1	2.5	0.03858	02/01/06	12:51
273127	V_2924	0.125	U		mg/L	0.125				0.005	-0.00025	-0.00025	1	0.125	-0.00001	02/01/06	12:51
273127	W_2079	0.250	U		mg/L	0.25				0.01	0.0325	0.0325	1	0.25	0.0013	02/01/06	12:51
273127	Y_3710	0.125	U		mg/L	0.125				0.005	-0.00125	-0.00125	1	0.125	-0.00005	02/01/06	12:51
273127	Zn2062	0.125	U		mg/L	0.125				0.005	0.107	0.107	1	0.125	0.00428	02/01/06	12:51
273127	Zr3496	0.125	U		mg/L	0.125				0.005	0.00225	0.00225	1	0.125	0.00009	02/01/06	12:51
273128	Ag3280	0.125	U		mg/L	0.125				0.005	0.0015	0.0015	1	0.125	0.00006	02/01/06	12:56
273128	Al3082	1.25	U		mg/L	1.25				0.05	-0.22075	-0.221	1	1.25	-0.00883	02/01/06	12:56
273128	As1890	0.125	U		mg/L	0.125				0.005	0.062	0.062	1	0.125	0.00248	02/01/06	12:56
273128	B_2496	0.500	U		mg/L	0.5				0.02	0.0655	0.0655	1	0.5	0.00262	02/01/06	12:56
273128	Ba4934	0.125	U		mg/L	0.125				0.005	0.001	0.001	1	0.125	0.00004	02/01/06	12:56
273128	Be3130	0.125	U		mg/L	0.125				0.005	-0.0005	-0.0005	1	0.125	-0.00002	02/01/06	12:56

010051

DIV. 20
TO#060131-9
Project No. 06002.01.222
Prep. Page 62-265

Sample ID	Element	Result	Qual (C)	Qual (Q)	Units	RL	%RPD	%Recovery	TV	rl	mg/L	sigwt	Dilution	Calc RL	ug/ml	Date	Time
273128	Bi2230	0.250	U		mg/L	0.25				0.01	-0.00275	-0.00275	1	0.25	-0.00011	02/01/06	12:56
273128	Ca3179	1.25	U		mg/L	1.25				0.05	1.105	1.11	1	1.25	0.0442	02/01/06	12:56
273128	Cd2265	0.125	U		mg/L	0.125				0.005	0.001	0.001	1	0.125	0.00004	02/01/06	12:56
273128	Co2286	0.125	U		mg/L	0.125				0.005	0.01575	0.0158	1	0.125	0.00063	02/01/06	12:56
273128	Cr2677	0.125	U		mg/L	0.125				0.005	0.00125	0.00125	1	0.125	0.00005	02/01/06	12:56
273128	Cu3247	0.125	U		mg/L	0.125				0.005	0.0025	0.0025	1	0.125	0.0001	02/01/06	12:56
273128	Fe2714	1.25	U		mg/L	1.25				0.05	0.59125	0.591	1	1.25	0.02365	02/01/06	12:56
273128	La3988	0.125	U		mg/L	0.125				0.005	0.012	0.012	1	0.125	0.00048	02/01/06	12:56
273128	Mg2790	1.59			mg/L	1.25				0.05	1.5915	1.59	1	1.25	0.06366	02/01/06	12:56
273128	Mn2576	0.125	U		mg/L	0.125				0.005	0.013	0.013	1	0.125	0.00052	02/01/06	12:56
273128	Mo2020	0.125	U		mg/L	0.125				0.005	0.01	0.01	1	0.125	0.0004	02/01/06	12:56
273128	Ni2316	0.125	U		mg/L	0.125				0.005	0.0245	0.0245	1	0.125	0.00098	02/01/06	12:56
273128	P_1782	0.500	U		mg/L	0.5				0.02	0.101	0.101	1	0.5	0.00404	02/01/06	12:56
273128	Pd3404	0.250	U		mg/L	0.25				0.01	0.047	0.047	1	0.25	0.00188	02/01/06	12:56
273128	S_1820	11.4			mg/L	0.5				0.02	11.417	11.4	1	0.5	0.45668	02/01/06	12:56
273128	Sb2068	0.250	U		mg/L	0.25				0.01	-0.00475	-0.00475	1	0.25	-0.00019	02/01/06	12:56
273128	Si2881	0.500	U		mg/L	0.5				0.02	0.46125	0.461	1	0.5	0.01845	02/01/06	12:56
273128	Pb220	0.125	U		mg/L	0.125				0.005	-0.00375	-0.00375	1	0.125	-0.00015	02/01/06	12:56
273128	Se196	0.125	U		mg/L	0.125				0.005	0.07425	0.0743	1	0.125	0.00297	02/01/06	12:56
273128	Sn1899	0.125	U		mg/L	0.125				0.005	-0.04275	-0.0428	1	0.125	-0.00171	02/01/06	12:56
273128	Sr4215	0.125	U		mg/L	0.125				0.005	0.00125	0.00125	1	0.125	0.00005	02/01/06	12:56
273128	Th2837	0.750	U		mg/L	0.75				0.03	-0.0705	-0.0705	1	0.75	-0.00282	02/01/06	12:56
273128	Ti3349	0.125	U		mg/L	0.125				0.005	0	0	1	0.125	0	02/01/06	12:56
273128	Tl1908	0.250	U		mg/L	0.25				0.01	-0.007	-0.007	1	0.25	-0.00028	02/01/06	12:56
273128	U_4090	2.50	U		mg/L	2.5				0.1	0.5185	0.519	1	2.5	0.02074	02/01/06	12:56
273128	V_2924	0.125	U		mg/L	0.125				0.005	-0.0075	-0.0075	1	0.125	-0.0003	02/01/06	12:56
273128	W_2079	0.250	U		mg/L	0.25				0.01	-0.01575	-0.0158	1	0.25	-0.00063	02/01/06	12:56
273128	Y_3710	0.125	U		mg/L	0.125				0.005	0.00025	0.00025	1	0.125	0.00001	02/01/06	12:56
273128	Zn2062	0.125	U		mg/L	0.125				0.005	0.0175	0.0175	1	0.125	0.0007	02/01/06	12:56
273128	Zr3496	0.125	U		mg/L	0.125				0.005	0.0025	0.0025	1	0.125	0.0001	02/01/06	12:56

010052

☐ 200.7 TAP No. 01-0406-028 Rev3/Jan06

☑ 6010B TAP No. 01-0406-130 Rev5/Jan06

☐ Other_____

QC STD. ID's	
CCV	06B01
CRI	
ICSA	
ICSAB	06B01

ICP CAL.STD. ID's	
Std0	06B01
Std1	
Std2	
Std3	
Std4	
Std5	
Std6	06B01

010053

PROJ. NO.	PROJECT	TO#	DATE	MATRIX	LOGBK PG
06002.01.222	Div. 20	0601319	2-1-06	Liquid	62-264

INSTRUMENT: Tracer FILENAME: B601319

TS 2-1-06

File converted to wsl? ☐

Method: DAILY2 Standard: blk
Run Time: 02/01/06 11:17:09

010054

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Avge	-.0000	.0004	-.0000	.0000	-.0000	.0003	-.0000
SDev	.0000	.0000	.0000	.0000	.0000	.0000	.0000
%RSD	20.17	2.704	48.92	163.3	22.21	.6778	163.4
#1	-.0000	.0004	-.0000	.0000	-.0000	.0003	.0000
#2	-.0000	.0004	-.0001	-.0000	-.0000	.0003	-.0000

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Avge	.0000	-.0000	-.0000	-.0000	.0002	.0000	.0002
SDev	.0000	.0000	.0000	.0000	.0000	.0000	.0000
%RSD	22.79	47.85	.7993	1713.	2.035	372.4	1.704
#1	.0000	-.0000	-.0000	-.0000	.0002	-.0000	.0002
#2	.0000	-.0000	-.0000	.0000	.0002	.0000	.0002

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Avge	-.0000	-.0000	-.0000	.0000	-.0000	-.0001	-.0110
SDev	.0000	.0000	.0000	.0000	.0000	.0000	.0002
%RSD	33.65	6.036	4.078	141.4	46.43	9.635	1.837
#1	-.0000	-.0000	-.0000	.0000	-.0000	-.0001	-.0112
#2	-.0000	-.0000	-.0000	.0000	-.0000	-.0001	-.0109

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Avge	-.0000	.0001	.0000	.0000	.0000	.0000	-.0011
SDev	.0000	.0000	.0001	.0000	.0000	.0000	.0000
%RSD	1083.	41.58	987.1	35.51	30.76	165.3	.1851
#1	-.0000	.0000	.0001	.0000	.0000	-.0000	-.0011
#2	.0000	.0001	-.0001	.0000	.0000	.0000	-.0011

Elem	Sc3613	1960/1	1960/2	Si2881	Sn1899	Sr4215	Th2837
Avge	116.4	-.0001	.0000	.0012	.0000	-.0000	.0000
SDev	.9	.0000	.0000	.0000	.0000	.0000	.0000
%RSD	.7961	3.734	64.84	.4498	110.7	.7992	.8263
#1	115.7	-.0001	.0000	.0012	.0000	-.0000	.0000
#2	117.1	-.0001	.0001	.0012	.0000	-.0000	.0000

Elem	Ti3349	Tl1908	U_4090	V_2924	W_2079	Y_3710	Zn2062
Avge	-.0001	-.0002	-.0005	-.0000	.0001	.0000	-.0000
SDev	.0000	.0001	.0000	.0000	.0001	.0000	.0000
%RSD	36.83	59.92	5.851	7.130	108.0	59.96	34.60
#1	-.0001	-.0003	-.0005	-.0000	.0002	.0000	-.0000
#2	-.0001	-.0001	-.0005	-.0000	.0000	.0000	-.0000

Elem	Zr3496
Avge	.0001
SDev	.0000
%RSD	10.57
#1	.0001
#2	.0001

2-1-06

2/6/06

010055

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1163840	10000	--	--	--	--	--
SDev	9301.989	.0000000	--	--	--	--	--
%RSD	.7992495	.0000000	--	--	--	--	--
#1	1157263	10000	--	--	--	--	--
#2	1170418	10000	--	--	--	--	--

Method: DAILY2 Standard: clp_std4
Run Time: 02/01/06 11:21:54

010056

Elem	Ag3280	As1890	2203/1	2203/2	Sb2068	1960/1	1960/2
Avge	.0789	.1017	.2928	.2562	.1480	.1859	.2001
SDev	.0000	.0001	.0020	.0002	.0001	.0011	.0000
%RSD	.0387	.0997	.6942	.0687	.0856	.5921	.0181
#1	.0789	.1018	.2942	.2561	.1481	.1867	.2001
#2	.0788	.1016	.2913	.2564	.1479	.1852	.2001

Elem	Tl1908
Avge	.1887
SDev	.0000
%RSD	.0021
#1	.1887
#2	.1887

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1164069	10000	--	--	--	--	--
SDev	2858.126	.0000000	--	--	--	--	--
%RSD	.2455289	.0000000	--	--	--	--	--
#1	1166090	10000	--	--	--	--	--
#2	1162048	10000	--	--	--	--	--

Standardization Rpt. 02/01/06 11:29:46 AM

Method: DAILY2 Standard: clp_std1
Run Time: 02/01/06 11:26:17

010057

Elem	Al3082	Ca3179	Fe2714	K_7664	Li6707	Mg2790	Na3302
Avge	.0962	.2281	.0876	.1808	3.001	.0898	.0074
SDev	.0001	.0003	.0001	.0003	.004	.0001	.0000
%RSD	.1573	.1230	.1179	.1679	.1494	.1038	.5057
#1	.0963	.2279	.0875	.1810	3.004	.0898	.0075
#2	.0961	.2283	.0877	.1805	2.998	.0899	.0074

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1152393	10000	--	--	--	--	--
SDev	401.6367	.0000000	--	--	--	--	--
%RSD	.0348524	.0000000	--	--	--	--	--
#1	1152109	10000	--	--	--	--	--
#2	1152677	10000	--	--	--	--	--

Method: DAILY2 Standard: clp_std5
Run Time: 02/01/06 11:29:57

010058

Elem	B_2496	Bi2230	Mo2020	P_1782	Si2881	Sn1899	Sr4215
Avge	.1553	.0272	.2715	.0332	.1509	.1406	2.517
SDev	.0002	.0001	.0003	.0000	.0000	.0001	.001
%RSD	.1056	.2844	.1071	.0306	.0056	.0662	.0252
#1	.1552	.0271	.2713	.0332	.1509	.1407	2.517
#2	.1554	.0272	.2717	.0332	.1509	.1405	2.518

Elem	Ti3349
Avge	2.851
SDev	.001
%RSD	.0428
#1	2.850
#2	2.851

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1177396	10000	--	--	--	--	--
SDev	6050.006	.0000000	--	--	--	--	--
%RSD	.5138463	.0000000	--	--	--	--	--
#1	1173118	10000	--	--	--	--	--
#2	1181674	10000	--	--	--	--	--

Method: DAILY2 Standard: clp_std2
Run Time: 02/01/06 11:33:38

010059

Elem	Ba4934	Be3130	Cr2677	Cu3247	Ni2316
Avge	.9798	1.386	.4181	.2965	.3146
SDev	.0014	.001	.0003	.0001	.0003
%RSD	.1375	.0365	.0788	.0401	.0909
#1	.9789	1.386	.4184	.2964	.3148
#2	.9808	1.386	.4179	.2965	.3144

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1161974	10000	--	--	--	--	--
SDev	8354.467	.0000000	--	--	--	--	--
%RSD	.7189894	.0000000	--	--	--	--	--
#1	1156066	10000	--	--	--	--	--
#2	1167881	10000	--	--	--	--	--

Method: DAILY2 Standard: clp_std3
Run Time: 02/01/06 11:37:18

010060

Elem	Cd2265	Co2286	Mn2576	V_2924	Zn2062
Avge	.9312	.1970	.9523	.1958	.2583
SDev	.0001	.0005	.0003	.0001	.0009
%RSD	.0064	.2500	.0264	.0709	.3413
#1	.9313	.1974	.9521	.1959	.2590
#2	.9312	.1967	.9525	.1957	.2577

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1163645	10000	--	--	--	--	--
SDev	7947.880	.0000000	--	--	--	--	--
%RSD	.6830159	.0000000	--	--	--	--	--
#1	1158025	10000	--	--	--	--	--
#2	1169265	10000	--	--	--	--	--

Method: DAILY2 Standard: clp_std6
Run Time: 02/01/06 11:40:58

010061

Elem	La3988	Na5889	Pd3404	S_1820	Th2837	U_4090	W_2079
Avge	.4776	.0399	.1927	.0299	.1013	.0627	.1713
SDev	.0005	.0001	.0007	.0001	.0001	.0001	.0000
%RSD	.1105	.1345	.3588	.2079	.1464	.2026	.0090
#1	.4772	.0399	.1922	.0298	.1014	.0627	.1713
#2	.4780	.0400	.1931	.0299	.1012	.0628	.1713

Elem	Y_3710	Zr3496
Avge	.7315	1.991
SDev	.0003	.001
%RSD	.0429	.0308
#1	.7317	1.990
#2	.7313	1.991

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1157558	10000	--	--	--	--	--
SDev	5756.556	.0000000	--	--	--	--	--
%RSD	.4973020	.0000000	--	--	--	--	--
#1	1153487	10000	--	--	--	--	--
#2	1161628	10000	--	--	--	--	--

Standardization Report 02/01/06 11:44:49 AM page 1

Method: DAILY2 Slope = Conc(SIR)/IR

010062

Element	Wavelen	High std	Low std	Slope	Y-intercept	Date Standardized
Ag3280	328.068	clp_std4	blk	25.3537	.000588	02/01/06 11:40:58
Al3082	308.215	clp_std1	blk	521.864	-.216376	02/01/06 11:40:58
As1890	189.042	clp_std4	blk	98.2798	.004804	02/01/06 11:40:58
B_2496	249.678	clp_std5	blk	64.3926	-.001420	02/01/06 11:40:58
Ba4934	493.409	clp_std2	blk	10.2059	.000145	02/01/06 11:40:58
Be3130	313.042	clp_std2	blk	3.60841	-.001187	02/01/06 11:40:58
Bi2230	223.061	clp_std5	blk	182.508	.001013	02/01/06 11:40:58
Ca3179	317.933	clp_std1	blk	219.188	-.001129	02/01/06 11:40:58
Cd2265	226.502	clp_std3	blk	10.7358	.000042	02/01/06 11:40:58
Co2286	228.616	clp_std3	blk	50.7556	.000567	02/01/06 11:40:58
Cr2677	267.716	clp_std2	blk	23.9150	.000011	02/01/06 11:40:58
Cu3247	324.753	clp_std2	blk	33.7584	-.007962	02/01/06 11:40:58
Fe2714	271.441	clp_std1	blk	571.171	-.002418	02/01/06 11:40:58
K_7664	766.491	clp_std1	blk	276.904	-.053767	02/01/06 11:40:58
La3988	398.853	clp_std6	blk	20.9548	.000665	02/01/06 11:40:58
Li6707	670.784	clp_std1	blk	3.33257	.000039	02/01/06 11:40:58
Mg2790	279.078	clp_std1	blk	278.119	.003464	02/01/06 11:40:58
Mn2576	257.610	clp_std3	blk	10.5005	-.000086	02/01/06 11:40:58
Mo2020	202.030	clp_std5	blk	36.8362	.000948	02/01/06 11:40:58
Na3302	330.232	clp_std1	blk	6596.65	.907230	02/01/06 11:40:58
Na5889	588.991	clp_std6	blk	19.7584	.217507	02/01/06 11:40:58
Ni2316	231.604	clp_std2	blk	31.7891	.000114	02/01/06 11:40:58
P_1782	178.287	clp_std5	blk	301.854	-.015147	02/01/06 11:40:58
2203/1	220.351	clp_std4	blk	34.1592	-.000351	02/01/06 11:40:58
2203/2	220.352	clp_std4	blk	39.0306	-.001306	02/01/06 11:40:58
Pd3404	340.458	clp_std6	blk	53.2608	-.001512	02/01/06 11:40:58
S_1820	182.040	clp_std6	blk	334.205	-.003423	02/01/06 11:40:58
Sb2068	206.838	clp_std4	blk	67.0463	.074486	02/01/06 11:40:58
Sc3613	361.384	blk	dark	.859129	.000000	02/01/06 11:40:58
1960/1	196.021	clp_std4	blk	53.7446	.007203	02/01/06 11:40:58
1960/2	196.022	clp_std4	blk	49.9912	-.002314	02/01/06 11:40:58
Si2881	288.158	clp_std5	blk	66.5524	-.081002	02/01/06 11:40:58
Pb220	220.353	NONE	NONE	1.00000	.000000	*NOT STANDARDIZED
Se196	196.026	NONE	NONE	1.00000	.000000	*NOT STANDARDIZED
Sn1899	189.989	clp_std5	blk	71.1841	-.001979	02/01/06 11:40:58
Sr4215	421.552	clp_std5	blk	3.97279	.000024	02/01/06 11:40:58
Th2837	283.730	clp_std6	blk	103.208	-.003857	02/01/06 11:40:58
Ti3349	334.941	clp_std5	blk	3.50800	.000312	02/01/06 11:40:58
Tl1908	190.864	clp_std4	blk	52.9461	.010283	02/01/06 11:40:58
U_4090	409.014	clp_std6	blk	157.325	.074736	02/01/06 11:40:58
V_2924	292.402	clp_std3	blk	51.0720	.001470	02/01/06 11:40:58
W_2079	207.914	clp_std6	blk	29.1984	-.003591	02/01/06 11:40:58
Y_3710	371.030	clp_std6	blk	13.6679	-.000123	02/01/06 11:40:58
Zn2062	206.200	clp_std3	blk	38.7264	.000133	02/01/06 11:40:58
Zr3496	349.621	clp_std6	blk	5.48711	-.000528	02/01/06 11:40:58

Analysis Report QC Standard 02/01/06 11:49:35 AM page 1

Method: DAILY2 Sample Name: icv/ccv Operator:
Run Time: 02/01/06 11:45:01
Comment:
Mode: CONC Corr. Factor: 1

010063

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.9693	9.856	5.087	4.841	10.02	.9697	5.052
SDev	.0016	.042	.011	.017	.01	.0013	.021
%RSD	.1696	.4264	.2205	.3509	.0978	.1364	.4079
#1	.9704	9.886	5.095	4.853	10.03	.9688	5.067
#2	.9681	9.827	5.079	4.829	10.01	.9706	5.038
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	1.000	10.00	5.000	5.000	10.00	1.000	5.000
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	19.79	.9966	5.066	1.977	2.015	10.28	18.72
SDev	.08	.0025	.005	.003	.011	.06	.07
%RSD	.4061	.2499	.0975	.1528	.5363	.5503	.3814
#1	19.73	.9948	5.062	1.975	2.023	10.24	18.77
#2	19.85	.9984	5.069	1.979	2.008	10.32	18.67
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	20.00	1.000	5.000	2.000	2.000	10.00	20.00
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.930	4.846	19.92	1.001	5.074	28.74	Q40.81
SDev	.004	.030	.00	.001	.001	.08	.38
%RSD	.0771	.6122	.0219	.1372	.0142	.2666	.9228
#1	4.932	4.867	19.92	.9998	5.073	28.68	Q41.07
#2	4.927	4.825	19.92	1.002	5.074	28.79	Q40.54
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Fail
Value	5.000	5.000	20.00	1.000	5.000	30.00	30.00
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.973	5.107	4.941	4.926	.9969	1.027	1.010
SDev	.010	.072	.034	.058	.0032	.018	.000
%RSD	.1966	1.415	.6889	1.178	.3176	1.730	.0321
#1	4.966	5.158	4.917	4.885	.9947	1.040	1.010
#2	4.980	5.056	4.965	4.967	.9991	1.014	1.011
Errors	QC Pass	QC Pass	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass
Value	5.000	5.000			1.000	1.000	1.000
Range	10.00	10.00			10.00	10.00	10.00

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010064

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	99.32	5.214	5.195	4.995	4.931	5.201	4.985
SDev	1.65	.010	.052	.016	.050	.038	.006
%RSD	1.666	.1890	1.008	.3142	1.014	.7346	.1139
#1	100.5	5.207	5.158	5.006	4.896	5.174	4.981
#2	98.15	5.221	5.232	4.984	4.966	5.228	4.989
Errors	NOCHECK	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass
Value				5.000	5.000	5.000	5.000
Range				10.00	10.00	10.00	10.00

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	5.015	.9846	4.828	5.148	1.038	4.968	1.068
SDev	.000	.0003	.007	.007	.024	.003	.001
%RSD	.0052	.0267	.1448	.1276	2.295	.0669	.0971
#1	5.014	.9845	4.833	5.143	1.021	4.971	1.067
#2	5.015	.9848	4.823	5.153	1.055	4.966	1.068
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	5.000	1.000	5.000	5.000	1.000	5.000	1.000
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	4.984	1.019	4.850
SDev	.006	.005	.004
%RSD	.1279	.4969	.0793
#1	4.988	1.015	4.853
#2	4.979	1.022	4.847
Errors	QC Pass	QC Pass	QC Pass
Value	5.000	1.000	5.000
Range	10.00	10.00	10.00

010065

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1156036	10000	--	--	--	--	--
SDev	19272.19	.0000000	--	--	--	--	--
%RSD	1.667094	.0000000	--	--	--	--	--
#1	1169663	10000	--	--	--	--	--
#2	1142408	10000	--	--	--	--	--

Analysis Report Blank Sample 02/01/06 11:54:21 AM page 1

Method: DAILY2 Sample Name: icb/ccb Operator: 010066
Run Time: 02/01/06 11:49:47
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0008	.0045	.0011	.0089	.0003	.0000	.0012
SDev	.0016	.0056	.0001	.0021	.0001	.0000	.0051
%RSD	201.9	124.4	11.15	23.97	29.22	69.45	424.0
#1	-.0003	.0005	.0010	.0104	.0004	.0000	-.0024
#2	.0019	.0085	.0012	.0074	.0003	.0000	.0049
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0500	.0050	.0500	.0050	.0050	.0100
Low	-.0050	-.0500	-.0050	-.0500	-.0050	-.0050	-.0100

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0016	.0001	.0005	.0003	.0001	.0151	.0085
SDev	.0015	.0003	.0005	.0001	.0006	.0214	.0137
%RSD	93.36	417.0	113.6	35.67	425.1	141.9	161.7
#1	.0005	-.0001	.0001	.0002	-.0003	-.0001	-.0012
#2	.0026	.0003	.0008	.0003	.0006	.0302	.0182
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0500	.0050	.0050	.0050	.0050	.0500	.1000
Low	-.0500	-.0050	-.0050	-.0050	-.0050	-.0500	-.1000

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0016	.0003	.0060	.0000	.0007	.0270	.0098
SDev	.0020	.0000	.0073	.0001	.0003	.3676	.0040
%RSD	124.9	12.61	122.4	968.7	45.20	1362.	41.16
#1	.0002	.0002	.0008	-.0001	.0010	L-.2330	.0070
#2	.0030	.0003	.0111	.0001	.0005	H.2870	.0127
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0050	.0500	.0050	.0050	.0500	.0500
Low	-.0050	-.0050	-.0500	-.0050	-.0050	-.0500	-.0500

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0008	-.0016	.0006	.0001	.0033	.0010	.0056
SDev	.0000	.0017	.0022	.0024	.0035	.0059	.0040
%RSD	.7388	103.3	344.0	1902.	104.7	593.6	72.40
#1	.0008	-.0004	-.0009	-.0016	.0009	.0051	.0027
#2	.0008	-.0028	.0022	.0019	H.0058	-.0032	.0085
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High	.0050	.0100			.0050	.0100	.0100
Low	-.0050	-.0100			-.0050	-.0100	-.0100

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010067

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	100.5	-.0001	.0033	.0035	.0003	.0022	-.0011
SDev	.0	.0037	.0027	.0048	.0024	.0030	.0020
%RSD	.0448	2895.	81.71	135.2	765.5	140.5	172.3
#1	100.5	-.0028	.0014	.0002	-.0014	.0000	-.0025
#2	100.6	.0025	.0052	.0069	.0020	.0043	.0002
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				.0100	.0030	.0050	.0050
Low				-.0100	-.0030	-.0050	-.0050

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0002	-.0030	.0002	.0027	.0442	.0002	.0031
SDev	.0000	.0002	.0000	.0005	.0575	.0000	.0002
%RSD	3.011	8.035	14.14	17.34	130.0	10.25	6.975
#1	.0002	-.0028	.0001	.0024	.0036	.0002	.0029
#2	.0002	-.0032	.0002	.0031	.0848	.0002	.0033
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0100	.0050	.0100	.1000	.0050	.0100
Low	-.0050	-.0100	-.0050	-.0100	-.1000	-.0050	-.0100

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0002	.0001	.0007
SDev	.0000	.0001	.0005
%RSD	10.53	47.11	66.74
#1	.0001	.0001	.0004
#2	.0002	.0001	.0010
Errors	LC Pass	LC Pass	LC Pass
High	.0050	.0050	.0050
Low	-.0050	-.0050	-.0050

010068

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1170034	10000	--	--	--	--	--
SDev	434.1636	.0000000	--	--	--	--	--
%RSD	.0371069	.0000000	--	--	--	--	--
#1	1169727	10000	--	--	--	--	--
#2	1170341	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: cri Operator:
Run Time: 02/01/06 11:54:32
Comment:
Mode: CONC Corr. Factor: 1

010069

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0193	.0990	.0218	.1039	.0206	.0099	-.0023
SDev	.0004	.0019	.0000	.0019	.0001	.0000	.0034
%RSD	1.972	1.973	.1440	1.850	.2809	.1593	146.6
#1	.0191	.0976	.0218	.1025	.0206	.0098	-.0047
#2	.0196	.1004	.0218	.1053	.0207	.0099	.0001
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK
Value	.0200	.1000	.0200	.1000	.0200	.0100	
Range	50.00	50.00	50.00	50.00	50.00	50.00	

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0017	.0099	.1000	.0195	.0492	.1128	.0029
SDev	.0005	.0000	.0004	.0009	.0005	.0001	.0066
%RSD	30.55	.1815	.3928	4.694	1.033	.0464	229.4
#1	.0013	.0099	.0997	.0189	.0489	.1129	-.0018
#2	.0020	.0099	.1003	.0202	.0496	.1128	.0075
Errors	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK
Value		.0100	.1000	.0200	.0500	.1000	
Range		50.00	50.00	50.00	50.00	50.00	

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0003	.0729	.0045	.0302	.0205	-.0924	.0010
SDev	.0003	.0001	.0009	.0002	.0011	.0464	.0016
%RSD	98.08	.1139	20.04	.5918	5.472	50.20	166.6
#1	-.0001	.0728	.0051	.0301	.0213	-.0596	.0021
#2	-.0005	.0729	.0038	.0303	.0197	-.1252	-.0002
Errors	NOCHECK	QC Pass	NOCHECK	QC Pass	QC Pass	NOCHECK	NOCHECK
Value		.1000		.0300	.0200		
Range		50.00		50.00	50.00		

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0815	.1074	.0095	.0053	-.0013	.0041	.1252
SDev	.0025	.0006	.0029	.0006	.0014	.0047	.0038
%RSD	3.077	.5589	30.22	11.10	112.8	114.3	3.012
#1	.0797	.1070	.0075	.0049	-.0023	.0008	.1225
#2	.0832	.1078	.0115	.0057	-.0003	.0074	.1278
Errors	QC Pass	QC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	QC Pass
Value	.0800	.1000					.1200
Range	50.00	50.00					50.00

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010070

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	99.13	.0135	.0120	.1131	.0067	.0125	.1005
SDev	.41	.0013	.0028	.0007	.0014	.0023	.0020
%RSD	.4140	9.441	23.49	.5984	20.11	18.41	1.961
#1	98.84	.0126	.0100	.1126	.0057	.0109	.0991
#2	99.42	.0144	.0140	.1136	.0076	.0141	.1019
Errors	NOCHECK	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass
Value				.1000	.0060	.0100	.1000
Range				50.00	50.00	50.00	50.00

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0209	-.0005	.0191	.0180	.1887	.0992	.0012
SDev	.0000	.0043	.0002	.0004	.0123	.0010	.0008
%RSD	.2076	811.3	1.192	1.979	6.522	1.046	64.87
#1	.0210	-.0035	.0189	.0183	.1974	.0985	.0006
#2	.0209	.0025	.0192	.0178	.1800	.0999	.0017
Errors	QC Pass	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK
Value	.0200		.0200	.0200	.2000	.1000	
Range	50.00		50.00	50.00	50.00	50.00	

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0001	.0408	.0895
SDev	.0001	.0000	.0007
%RSD	105.6	.0104	.8058
#1	-.0002	.0408	.0890
#2	-.0000	.0408	.0901
Errors	NOCHECK	QC Pass	QC Pass
Value		.0400	.1000
Range		50.00	50.00

010071

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1153779	10000	--	--	--	--	--
SDev	4830.954	.0000000	--	--	--	--	--
%RSD	.4187070	.0000000	--	--	--	--	--
#1	1150363	10000	--	--	--	--	--
#2	1157195	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: icsa Operator: 010072
Run Time: 02/01/06 11:59:17
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0018	510.5	-.0005	-.0149	.0023	.0001	-.0070
SDev	.0002	1.2	.0058	.0006	.0002	.0000	.0048
%RSD	8.428	.2377	1225.	4.245	7.735	30.55	67.61
#1	-.0017	511.3	.0036	-.0145	.0021	.0001	-.0037
#2	-.0019	509.6	-.0046	-.0154	.0024	.0001	-.0104
Errors	NOCHECK	QC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
Value		500.0					
Range		20.00					

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	460.7	.0036	-.0000	-.0016	.0009	187.3	-.0139
SDev	2.6	.0004	.0006	.0008	.0013	.0	.0120
%RSD	.5555	12.42	2150.	51.64	138.6	.0086	86.34
#1	458.9	.0039	.0004	-.0022	.0000	187.3	-.0054
#2	462.6	.0033	-.0004	-.0010	.0018	187.3	-.0223
Errors	QC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	QC Pass	NOCHECK
Value	500.0					200.0	
Range	20.00					20.00	

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0044	.0003	540.1	.0059	-.0003	.4088	.0041
SDev	.0010	.0001	.6	.0000	.0020	.1656	.0135
%RSD	22.02	15.67	.1054	.4419	754.2	40.53	332.0
#1	.0051	.0004	540.5	.0060	.0011	.5259	.0136
#2	.0037	.0003	539.7	.0059	-.0017	.2916	-.0055
Errors	NOCHECK	NOCHECK	QC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK
Value			500.0				
Range			20.00				

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0010	-.0062	.0301	-.0168	-.0023	.0018	.0215
SDev	.0005	.0018	.0047	.0022	.0008	.0035	.0242
%RSD	46.71	29.85	15.48	13.23	33.67	196.5	112.4
#1	.0014	-.0075	.0334	-.0184	-.0018	-.0007	.0386
#2	.0007	-.0049	.0268	-.0152	-.0029	.0043	.0044
Errors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
Value							
Range							

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010073

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	90.89	.0017	-.0018	.0416	-.0012	-.0006	-.0077
SDev	2.24	.0114	.0073	.0039	.0001	.0011	.0051
%RSD	2.469	688.3	402.7	9.279	6.357	165.7	66.22
#1	92.48	.0097	-.0070	.0443	-.0011	-.0014	-.0041
#2	89.30	-.0064	.0034	.0389	-.0012	.0001	-.0113
Errors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
Value							
Range							

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0161	-.0237	-.0008	.0027	-.0309	-.0011	.0037
SDev	.0001	.0006	.0003	.0061	.0077	.0007	.0093
%RSD	.4837	2.457	33.58	225.9	25.07	58.39	253.0
#1	.0161	-.0241	-.0010	.0070	-.0254	-.0016	.0103
#2	.0160	-.0233	-.0006	-.0016	-.0364	-.0007	-.0029
Errors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
Value							
Range							

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0007	.0079	-.0014
SDev	.0000	.0008	.0011
%RSD	5.732	10.10	78.64
#1	-.0007	.0084	-.0021
#2	-.0007	.0073	-.0006
Errors	NOCHECK	NOCHECK	NOCHECK
Value			
Range			

010074

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1057897	10000	--	--	--	--	--
SDev	26058.30	.0000000	--	--	--	--	--
%RSD	2.463217	.0000000	--	--	--	--	--
#1	1076323	10000	--	--	--	--	--
#2	1039471	10000	--	--	--	--	--

Analysis Report QC Standard 02/01/06 12:08:36 PM page 1

Method: DAILY2 Sample Name: icsab Operator:
Run Time: 02/01/06 12:04:02
Comment:
Mode: CONC Corr. Factor: 1

010075

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	1.095	503.6	1.061	1.038	.5367	.4969	.0073
SDev	.001	.6	.009	.000	.0005	.0004	.0054
%RSD	.1169	.1130	.8131	.0017	.0878	.0763	73.44
#1	1.095	503.2	1.055	1.039	.5370	.4967	.0035
#2	1.096	504.0	1.067	1.038	.5364	.4972	.0111
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK
Value	1.000	500.0	1.000	1.000	.5000	.5000	
Range	20.00	20.00	20.00	20.00	20.00	20.00	

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	456.0	.9880	.4981	.5043	.5547	184.9	.0044
SDev	2.1	.0019	.0015	.0012	.0007	.1	.0133
%RSD	.4568	.1947	.3094	.2349	.1301	.0763	303.3
#1	454.5	.9894	.4970	.5035	.5542	184.8	-.0050
#2	457.4	.9866	.4992	.5052	.5552	185.0	.0138
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK
Value	500.0	1.000	.5000	.5000	.5000	200.0	
Range	20.00	20.00	20.00	20.00	20.00	20.00	

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0048	1.186	532.9	.5095	1.042	.7594	-.0020
SDev	.0002	.002	.5	.0001	.003	.0218	.0031
%RSD	3.720	.1364	.1024	.0293	.2650	2.876	153.0
#1	.0047	1.187	532.5	.5096	1.044	.7749	-.0042
#2	.0050	1.185	533.3	.5093	1.040	.7440	.0002
Errors	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass	NOCHECK	NOCHECK
Value			500.0	.5000	1.000		
Range			20.00	20.00	20.00		

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.9572	1.032	1.050	1.003	.0021	.0060	1.063
SDev	.0029	.001	.003	.009	.0009	.0036	.015
%RSD	.2982	.0900	.3016	.9043	41.29	59.51	1.444
#1	.9592	1.031	1.048	.9965	.0015	.0086	1.074
#2	.9552	1.033	1.053	1.009	.0027	.0035	1.053
Errors	QC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	QC Pass
Value	1.000						1.000
Range	20.00						20.00

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010076

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	89.66	1.062	1.052	1.115	1.019	1.055	1.012
SDev	.26	.001	.010	.004	.007	.006	.003
%RSD	.2914	.1146	.9067	.3435	.6972	.5640	.2516
#1	89.84	1.063	1.045	1.112	1.014	1.051	1.013
#2	89.47	1.061	1.059	1.117	1.024	1.059	1.010
Errors	NOCHECK	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass
Value				1.000	1.000	1.000	1.000
Range				20.00	20.00	20.00	20.00

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	1.044	-.0191	.9611	1.015	.9805	.5103	.0006
SDev	.001	.0053	.0005	.003	.0119	.0013	.0022
%RSD	.0634	28.03	.0511	.2487	1.216	.2589	361.0
#1	1.043	-.0229	.9607	1.013	.9720	.5113	.0022
#2	1.044	-.0153	.9614	1.016	.9889	.5094	-.0009
Errors	QC Pass	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass	NOCHECK
Value	1.000			1.000	1.000	.5000	
Range	20.00			20.00	20.00	20.00	

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0005	.9734	.9230
SDev	.0001	.0004	.0017
%RSD	17.35	.0459	.1831
#1	-.0006	.9731	.9218
#2	-.0005	.9737	.9242
Errors	NOCHECK	QC Pass	QC Pass
Value		1.000	1.000
Range		20.00	20.00

010077

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1043468	10000	--	--	--	--	--
SDev	3089.350	.0000000	--	--	--	--	--
%RSD	.2960654	.0000000	--	--	--	--	--
#1	1045653	10000	--	--	--	--	--
#2	1041284	10000	--	--	--	--	--

Analysis Report QC Standard 02/01/06 12:13:22 PM page 1

Method: DAILY2 Sample Name: icv/ccv Operator: 010078
Run Time: 02/01/06 12:08:48
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.9688	9.824	5.066	4.830	9.980	.9692	5.030
SDev	.0006	.008	.005	.017	.001	.0007	.003
%RSD	.0573	.0783	.0897	.3594	.0098	.0683	.0531
#1	.9684	9.819	5.062	4.818	9.981	.9697	5.028
#2	.9692	9.830	5.069	4.842	9.979	.9687	5.032
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	1.000	10.00	5.000	5.000	10.00	1.000	5.000
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	19.77	.9928	5.058	1.975	2.013	10.24	18.71
SDev	.01	.0037	.011	.000	.003	.01	.03
%RSD	.0371	.3734	.2188	.0084	.1483	.0699	.1554
#1	19.77	.9954	5.066	1.975	2.011	10.25	18.69
#2	19.76	.9902	5.051	1.975	2.015	10.23	18.73
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	20.00	1.000	5.000	2.000	2.000	10.00	20.00
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.927	4.840	19.91	1.001	5.072	28.72	Q40.81
SDev	.001	.011	.01	.001	.005	.41	.12
%RSD	.0127	.2242	.0397	.0568	.0929	1.429	.2983
#1	4.926	4.832	19.92	1.001	5.069	28.43	Q40.72
#2	4.927	4.847	19.91	1.001	5.076	29.01	Q40.90
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Fail
Value	5.000	5.000	20.00	1.000	5.000	30.00	30.00
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.957	5.086	4.974	4.946	.9939	1.012	1.004
SDev	.011	.036	.007	.001	.0001	.006	.002
%RSD	.2177	.7170	.1481	.0165	.0105	.5848	.2433
#1	4.965	5.061	4.980	4.946	.9940	1.008	1.006
#2	4.950	5.112	4.969	4.947	.9938	1.016	1.002
Errors	QC Pass	QC Pass	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass
Value	5.000	5.000			1.000	1.000	1.000
Range	10.00	10.00			10.00	10.00	10.00

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010079

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	99.12	5.239	5.206	5.001	4.956	5.217	4.971
SDev	.44	.004	.002	.002	.002	.002	.002
%RSD	.4394	.0679	.0314	.0417	.0386	.0436	.0354
#1	98.81	5.236	5.205	4.999	4.957	5.215	4.969
#2	99.43	5.241	5.207	5.002	4.954	5.218	4.972
Errors	NOCHECK	NOCHECK	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass
Value				5.000	5.000	5.000	5.000
Range				10.00	10.00	10.00	10.00

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	5.011	.9791	4.826	5.128	1.028	4.965	1.071
SDev	.006	.0008	.001	.004	.022	.007	.001
%RSD	.1286	.0844	.0162	.0777	2.179	.1348	.1077
#1	5.006	.9785	4.825	5.125	1.044	4.960	1.072
#2	5.015	.9796	4.826	5.131	1.013	4.969	1.070
Errors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
Value	5.000	1.000	5.000	5.000	1.000	5.000	1.000
Range	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	4.983	1.018	4.857
SDev	.002	.002	.005
%RSD	.0412	.1599	.0969
#1	4.982	1.019	4.854
#2	4.985	1.017	4.860
Errors	QC Pass	QC Pass	QC Pass
Value	5.000	1.000	5.000
Range	10.00	10.00	10.00

010080

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1153636	10000	--	--	--	--	--
SDev	5141.373	.0000000	--	--	--	--	--
%RSD	.4456667	.0000000	--	--	--	--	--
#1	1150001	10000	--	--	--	--	--
#2	1157272	10000	--	--	--	--	--

Analysis Report Blank Sample 02/01/06 12:18:08 PM page 1

Method: DAILY2 Sample Name: icb/ccb Operator: 010081
Run Time: 02/01/06 12:13:34
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0010	.0041	.0023	.0097	.0004	.0001	.0047
SDev	.0014	.0100	.0004	.0009	.0005	.0001	.0034
%RSD	149.6	244.0	19.20	9.341	107.9	181.0	71.96
#1	.0020	.0112	.0020	.0103	.0007	.0001	.0071
#2	-.0001	-.0030	.0026	.0090	.0001	-.0000	.0023
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0500	.0050	.0500	.0050	.0050	.0100
Low	-.0050	-.0500	-.0050	-.0500	-.0050	-.0050	-.0100

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0043	.0002	.0003	.0001	.0003	.0160	.0182
SDev	.0052	.0004	.0011	.0004	.0001	.0322	.0416
%RSD	121.1	181.9	340.5	606.6	23.22	201.4	228.0
#1	.0079	.0006	.0011	-.0002	.0002	.0388	.0477
#2	.0006	-.0001	-.0005	.0003	.0003	-.0068	-.0112
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0500	.0050	.0050	.0050	.0050	.0500	.1000
Low	-.0500	-.0050	-.0050	-.0050	-.0050	-.0500	-.1000

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0015	.0003	.0111	.0000	.0019	H.0859	.0030
SDev	.0027	.0003	.0171	.0001	.0010	.3483	.0071
%RSD	182.9	84.17	153.8	646.3	49.49	405.4	232.7
#1	.0034	.0005	.0232	.0001	.0026	H.3322	.0081
#2	-.0004	.0001	-.0010	-.0000	.0013	L-.1604	-.0020
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC High	LC Pass
High	.0050	.0050	.0500	.0050	.0050	.0500	.0500
Low	-.0050	-.0050	-.0500	-.0050	-.0050	-.0500	-.0500

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0000	-.0005	.0027	.0009	.0036	.0001	.0015
SDev	.0002	.0010	.0004	.0011	.0057	.0108	.0022
%RSD	1295.	197.0	13.21	120.0	159.8	8945.	143.4
#1	.0001	.0002	.0030	.0016	H.0076	.0077	-.0000
#2	-.0002	-.0013	.0025	.0001	-.0005	-.0075	.0031
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High	.0050	.0100			.0050	.0100	.0100
Low	-.0050	-.0100			-.0050	-.0100	-.0100

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010082

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	98.22	.0019	.0034	.0044	.0015	.0029	-.0008
SDev	.90	.0003	.0029	.0044	.0008	.0020	.0024
%RSD	.9166	18.21	83.85	99.53	55.18	69.32	290.8
#1	97.59	.0017	.0014	.0075	.0021	.0015	.0009
#2	98.86	.0022	.0054	.0013	.0009	.0044	-.0025
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				.0100	.0030	.0050	.0050
Low				-.0100	-.0030	-.0050	-.0050

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0002	-.0016	.0002	.0058	.0560	.0005	.0047
SDev	.0003	.0001	.0003	.0017	.0537	.0000	.0035
%RSD	129.4	8.155	120.5	29.59	96.00	8.692	74.82
#1	.0004	-.0016	.0004	.0070	.0940	.0005	.0072
#2	.0000	-.0017	.0000	.0046	.0180	.0005	.0022
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0100	.0050	.0100	.1000	.0050	.0100
Low	-.0050	-.0100	-.0050	-.0100	-.1000	-.0050	-.0100

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0002	.0003	.0006
SDev	.0002	.0003	.0005
%RSD	62.76	85.69	78.07
#1	.0004	.0005	.0009
#2	.0001	.0001	.0003
Errors	LC Pass	LC Pass	LC Pass
High	.0050	.0050	.0050
Low	-.0050	-.0050	-.0050

010083

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1143194	10000	--	--	--	--	--
SDev	10447.50	.0000000	--	--	--	--	--
%RSD	.9138875	.0000000	--	--	--	--	--
#1	1135806	10000	--	--	--	--	--
#2	1150581	10000	--	--	--	--	--

Method: DAILY2 Sample Name: pbw-B01H1 pg62-264 Operator: 010084
Run Time: 02/01/06 12:18:20
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0002	-.0044	.0002	.0052	.0000	-.0000	-.0014
SDev	.0001	.0022	.0021	.0006	.0000	.0000	.0051
%RSD	30.48	50.30	1102.	11.39	241.9	78.87	373.8
#1	.0001	-.0060	.0016	.0056	.0000	-.0000	-.0050
#2	.0002	-.0029	-.0013	.0047	-.0000	-.0000	.0023
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0500	.0050	.0500	.0050	.0050	.0100
Low	-.0050	-.0500	-.0050	-.0500	-.0050	-.0050	-.0100

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0073	.0000	.0011	-.0005	-.0002	.0030	-.0013
SDev	.0005	.0000	.0004	.0006	.0004	.0133	.0031
%RSD	7.066	168.9	32.56	132.8	223.1	436.6	244.5
#1	.0069	.0001	.0014	-.0000	.0001	-.0063	-.0034
#2	.0076	-.0000	.0009	-.0009	-.0005	.0124	.0009
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0500	.0050	.0050	.0050	.0050	.0500	.1000
Low	-.0500	-.0050	-.0050	-.0050	-.0050	-.0500	-.1000

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0007	.0001	.0042	-.0001	.0006	H.1021	.0124
SDev	.0002	.0000	.0008	.0001	.0007	.2802	.0024
%RSD	33.39	12.69	19.67	140.8	117.5	274.4	19.24
#1	.0006	.0001	.0036	-.0000	.0001	H.3003	.0107
#2	.0009	.0001	.0047	-.0001	.0011	L-.0960	.0141
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC High	LC Pass
High	.0050	.0050	.0500	.0050	.0050	.0500	.0500
Low	-.0050	-.0050	-.0500	-.0050	-.0050	-.0500	-.0500

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0000	.0019	.0059	-.0015	.0007	-.0034	.0016
SDev	.0018	.0067	.0008	.0026	.0026	.0100	.0010
%RSD	3723.	358.3	13.78	179.2	346.5	291.1	63.97
#1	.0013	.0066	.0064	-.0033	-.0011	L-.0105	.0023
#2	-.0012	-.0029	.0053	.0004	.0026	.0036	.0009
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High	.0050	.0100			.0050	.0100	.0100
Low	-.0050	-.0100			-.0050	-.0100	-.0100

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010085

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	101.3	-.0006	.0022	.0085	.0010	.0013	-.0010
SDev	.1	.0030	.0007	.0013	.0015	.0006	.0014
%RSD	.1457	473.7	30.67	14.85	145.9	43.56	142.5
#1	101.2	-.0027	.0027	.0076	-.0000	.0009	-.0019
#2	101.4	.0015	.0017	.0094	.0020	.0016	.0000
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				.0100	.0030	.0050	.0050
Low				-.0100	-.0030	-.0050	-.0050

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0000	-.0026	-.0000	-.0015	.0209	-.0003	.0002
SDev	.0000	.0014	.0002	.0034	.0015	.0001	.0011
%RSD	41.75	52.93	1576.	223.9	7.124	53.00	450.6
#1	.0000	-.0016	.0001	.0009	.0198	-.0002	-.0005
#2	.0000	-.0035	-.0001	-.0039	.0219	-.0004	.0010
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0100	.0050	.0100	.1000	.0050	.0100
Low	-.0050	-.0100	-.0050	-.0100	-.1000	-.0050	-.0100

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0001	.0003	-.0000
SDev	.0001	.0002	.0006
%RSD	150.4	46.84	36750.
#1	.0000	.0002	.0005
#2	-.0001	.0005	-.0005
Errors	LC Pass	LC Pass	LC Pass
High	.0050	.0050	.0050
Low	-.0050	-.0050	-.0050

010086

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1178584	10000	--	--	--	--	--
SDev	1767.060	.0000000	--	--	--	--	--
%RSD	.1499308	.0000000	--	--	--	--	--
#1	1177334	10000	--	--	--	--	--
#2	1179833	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: lcsw-B01H1 Operator: 010087
Run Time: 02/01/06 12:23:05
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0471	1.856	1.936	.0034	1.912	.0469	.0064
SDev	.0007	.001	.005	.0017	.003	.0001	.0022
%RSD	1.513	.0739	.2824	48.56	.1610	.1357	33.61
#1	.0466	1.857	1.940	.0023	1.914	.0468	.0049
#2	.0476	1.855	1.932	.0046	1.910	.0469	.0080

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	19.15	.0470	.4776	.1861	.2352	1.063	16.19
SDev	.05	.0001	.0008	.0015	.0010	.008	.03
%RSD	.2452	.0987	.1709	.8006	.4342	.7345	.1903
#1	19.12	.0470	.4770	.1851	.2345	1.058	16.17
#2	19.18	.0471	.4781	.1872	.2360	1.069	16.21

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0009	.0002	19.17	.4742	.0009	16.93	24.32
SDev	.0008	.0001	.00	.0008	.0001	.21	.08
%RSD	89.28	43.41	.0120	.1769	15.14	1.265	.3479
#1	.0003	.0001	19.17	.4736	.0008	16.78	24.26
#2	.0014	.0002	19.17	.4748	.0010	17.09	24.38

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.4671	.0036	.4671	.4642	-.0009	-.0078	.4622
SDev	.0017	.0062	.0024	.0005	.0029	.0014	.0045
%RSD	.3599	171.6	.5169	.1167	341.8	17.63	.9783
#1	.4659	.0081	.4688	.4639	-.0029	-.0088	.4590
#2	.4683	-.0008	.4654	.4646	.0012	-.0068	.4654

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	101.0	1.977	1.989	.0131	.4652	1.985	-.0012
SDev	.8	.013	.015	.0044	.0004	.005	.0009
%RSD	.7455	.6463	.7327	33.54	.0953	.2755	77.15
#1	101.5	1.968	1.999	.0100	.4655	1.989	-.0005
#2	100.4	1.986	1.978	.0162	.4649	1.981	-.0018

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0007	-.0235	-.0000	1.949	.0385	.4705	-.0006
SDev	.0000	.0018	.0003	.001	.0377	.0011	.0023
%RSD	.5899	7.550	2698.	.0475	97.98	.2373	368.3
#1	.0007	-.0248	-.0002	1.950	.0118	.4697	-.0023
#2	.0007	-.0223	.0002	1.949	.0651	.4713	.0010

010088

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0002	.4768	.0000
SDev	.0001	.0012	.0010
%RSD	60.03	.2528	2379.
#1	-.0003	.4760	-.0007
#2	-.0001	.4777	.0008

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1175118	10000	--	--	--	--	--
SDev	8773.781	.0000000	--	--	--	--	--
%RSD	.7466298	.0000000	--	--	--	--	--
#1	1181322	10000	--	--	--	--	--
#2	1168914	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: 273124 Operator:
Run Time: 02/01/06 12:27:50
Comment:
Mode: CONC Corr. Factor: 1

010089

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0005	-.0030	.0006	.1267	.0004	.0000	.0002
SDev	.0005	.0028	.0020	.0013	.0001	.0000	.0070
%RSD	94.05	92.35	344.1	1.042	40.35	301.0	4643.
#1	.0009	-.0050	.0020	.1277	.0005	-.0000	.0051
#2	.0002	-.0011	-.0008	.1258	.0003	.0000	-.0048

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.6912	.0001	.0010	.0007	.0003	.0458	.1805
SDev	.0020	.0001	.0004	.0009	.0008	.0155	.0179
%RSD	.2838	117.1	42.08	131.4	252.2	33.88	9.936
#1	.6898	.0000	.0013	.0013	.0009	.0348	.1679
#2	.6926	.0002	.0007	.0000	-.0002	.0567	.1932

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0010	.0003	.1328	.0000	.0005	4.087	4.892
SDev	.0008	.0000	.0077	.0001	.0001	.130	.012
%RSD	79.45	11.73	5.768	700.6	10.05	3.191	.2474
#1	.0015	.0003	.1382	.0001	.0005	3.995	4.901
#2	.0004	.0003	.1274	-.0000	.0004	4.179	4.883

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0002	.0030	.0019	-.0010	.0083	.4014	.0041
SDev	.0005	.0062	.0019	.0005	.0047	.0051	.0031
%RSD	190.7	204.0	96.99	49.84	56.81	1.262	75.82
#1	.0006	-.0013	.0006	-.0007	.0050	.4050	.0063
#2	-.0001	.0074	.0033	-.0014	.0117	.3979	.0019

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	100.6	.0030	-.0010	.2362	-.0000	.0004	-.0003
SDev	.9	.0010	.0008	.0027	.0003	.0008	.0029
%RSD	.9373	33.09	75.98	1.150	821.6	236.4	1093.
#1	101.2	.0023	-.0015	.2381	-.0002	-.0002	.0018
#2	99.89	.0037	-.0005	.2343	.0002	.0009	-.0024

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0004	-.0020	.0001	.0011	.0355	-.0001	.0014
SDev	.0000	.0027	.0003	.0024	.0207	.0009	.0016
%RSD	9.790	132.2	439.6	218.4	58.43	1071.	118.0
#1	.0004	-.0001	.0002	.0028	.0501	.0005	.0025
#2	.0004	-.0039	-.0001	-.0006	.0208	-.0007	.0002

010090

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0001	.0003	.0003
SDev	.0001	.0000	.0010
%RSD	233.9	.6476	382.2
#1	.0002	.0003	.0010
#2	-.0000	.0003	-.0004

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1170384	10000	--	--	--	--	--
SDev	11055.61	.0000000	--	--	--	--	--
%RSD	.9446139	.0000000	--	--	--	--	--
#1	1178202	10000	--	--	--	--	--
#2	1162567	10000	--	--	--	--	--

Method: DAILY2 Sample Name: 273124d Operator:
Run Time: 02/01/06 12:32:36
Comment:
Mode: CONC Corr. Factor: 1

010091

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0001	-.0061	.0019	.1271	.0001	-.0000	-.0029
SDev	.0004	.0068	.0004	.0010	.0001	.0000	.0034
%RSD	290.3	111.4	19.79	.7637	32.86	97.40	116.8
#1	-.0002	-.0109	.0021	.1278	.0002	-.0001	-.0053
#2	.0004	-.0013	.0016	.1264	.0001	-.0000	-.0005

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.6954	.0001	.0004	-.0010	-.0007	.0087	.1640
SDev	.0023	.0000	.0002	.0006	.0001	.0143	.0095
%RSD	.3351	26.99	45.96	59.78	19.10	163.6	5.786
#1	.6938	.0001	.0005	-.0006	-.0006	-.0014	.1573
#2	.6971	.0001	.0003	-.0014	-.0007	.0189	.1708

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0004	.0002	.1297	-.0001	.0002	3.808	4.969
SDev	.0010	.0001	.0029	.0000	.0004	.153	.021
%RSD	254.7	27.72	2.217	13.70	165.9	4.017	.4276
#1	-.0003	.0001	.1277	-.0001	.0005	3.700	4.954
#2	.0011	.0002	.1318	-.0001	-.0000	3.917	4.984

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0004	.0074	.0046	-.0015	.0008	.4095	.0019
SDev	.0002	.0058	.0015	.0017	.0033	.0011	.0015
%RSD	53.23	78.72	33.43	118.8	425.3	.2796	77.80
#1	-.0003	.0115	.0035	-.0002	-.0016	.4104	.0009
#2	-.0006	.0033	.0056	-.0027	.0031	.4087	.0030

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	104.0	.0054	-.0004	.2380	.0006	.0016	-.0009
SDev	1.8	.0015	.0003	.0029	.0006	.0007	.0001
%RSD	1.756	28.69	82.73	1.208	114.4	46.71	15.34
#1	105.3	.0043	-.0006	.2359	.0010	.0010	-.0010
#2	102.7	.0065	-.0002	.2400	.0001	.0021	-.0008

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0004	-.0054	-.0002	-.0029	.0252	-.0013	.0004
SDev	.0000	.0020	.0002	.0023	.0294	.0001	.0025
%RSD	6.740	37.84	64.21	79.99	116.5	5.312	618.9
#1	.0004	-.0040	-.0001	-.0013	.0044	-.0012	-.0014
#2	.0004	-.0069	-.0003	-.0045	.0460	-.0013	.0022

010092

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0001	.0003	-.0008
SDev	.0001	.0000	.0005
%RSD	73.71	.7354	56.25
#1	-.0001	.0003	-.0005
#2	-.0002	.0003	-.0011

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1210108	10000	--	--	--	--	--
SDev	21270.48	.0000000	--	--	--	--	--
%RSD	1.757733	.0000000	--	--	--	--	--
#1	1225149	10000	--	--	--	--	--
#2	1195068	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: 273124s Operator:
Run Time: 02/01/06 12:37:21
Comment:
Mode: CONC Corr. Factor: 1

010093

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0485	1.874	1.944	.1279	1.918	.0470	.0074
SDev	.0023	.012	.010	.0010	.007	.0001	.0018
%RSD	4.708	.6236	.5201	.7789	.3869	.2068	24.11
#1	.0501	1.882	1.952	.1272	1.923	.0469	.0087
#2	.0469	1.866	1.937	.1286	1.913	.0471	.0062

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	19.80	.0477	.4788	.1865	.2366	1.095	16.93
SDev	.08	.0000	.0018	.0021	.0005	.017	.15
%RSD	.3867	.0015	.3693	1.135	.1959	1.582	.8899
#1	19.75	.0477	.4801	.1850	.2369	1.107	17.04
#2	19.85	.0477	.4776	.1880	.2363	1.083	16.82

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0021	.0003	19.31	.4747	.0005	21.68	30.49
SDev	.0028	.0000	.02	.0009	.0009	.01	.05
%RSD	132.7	2.030	.0805	.1900	180.0	.0405	.1704
#1	.0041	.0003	19.30	.4740	-.0001	21.69	30.45
#2	.0001	.0003	19.32	.4753	.0012	21.68	30.53

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.4668	.0032	.4699	.4684	.0063	.4096	.4670
SDev	.0020	.0014	.0090	.0005	.0018	.0123	.0001
%RSD	.4310	44.47	1.909	.1040	28.13	3.003	.0165
#1	.4654	.0022	.4763	.4688	.0076	.4009	.4670
#2	.4683	.0042	.4636	.4681	.0051	.4183	.4669

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	102.5	2.003	2.028	.2452	.4689	2.020	-.0012
SDev	1.7	.007	.069	.0101	.0033	.044	.0024
%RSD	1.620	.3438	3.410	4.130	.7070	2.171	204.4
#1	103.7	1.998	2.077	.2524	.4713	2.051	.0005
#2	101.3	2.008	1.979	.2381	.4666	1.989	-.0029

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0011	-.0259	-.0003	1.967	.0757	.4713	.0007
SDev	.0001	.0068	.0002	.006	.0964	.0022	.0047
%RSD	10.32	26.19	64.23	.2869	127.3	.4626	710.1
#1	.0012	-.0306	-.0004	1.971	.1439	.4697	.0040
#2	.0010	-.0211	-.0002	1.963	.0076	.4728	-.0027

010094

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0004	.4774	-.0007
SDev	.0002	.0025	.0003
%RSD	41.18	.5261	39.37
#1	-.0005	.4756	-.0009
#2	-.0003	.4792	-.0005

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1193055	10000	--	--	--	--	--
SDev	19404.42	.0000000	--	--	--	--	--
%RSD	1.626448	.0000000	--	--	--	--	--
#1	1206776	10000	--	--	--	--	--
#2	1179334	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: 273125 Operator:
Run Time: 02/01/06 12:42:06
Comment:
Mode: CONC Corr. Factor: 1

010095

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0001	-.0099	.0006	.0029	.0000	-.0000	-.0020
SDev	.0001	.0005	.0005	.0009	.0000	.0000	.0034
%RSD	101.2	5.181	89.92	30.83	132.4	27.64	170.5
#1	.0000	-.0096	.0009	.0036	.0000	-.0000	.0004
#2	.0003	-.0103	.0002	.0023	.0000	-.0000	-.0044

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.2019	-.0000	.0013	-.0005	-.0002	.0366	.2022
SDev	.0013	.0003	.0000	.0003	.0005	.0006	.0126
%RSD	.6537	879.9	.9109	54.34	274.8	1.505	6.257
#1	.2010	-.0002	.0013	-.0003	.0002	.0362	.2112
#2	.2028	.0002	.0013	-.0008	-.0005	.0370	.1933

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0006	.0002	.1245	.0006	.0005	3.935	4.879
SDev	.0005	.0000	.0009	.0000	.0004	.041	.003
%RSD	79.86	10.29	.7185	6.082	73.84	1.041	.0657
#1	.0003	.0002	.1252	.0007	.0008	3.964	4.881
#2	.0009	.0002	.1239	.0006	.0003	3.906	4.877

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0001	.0018	-.0006	-.0013	.0045	.4042	-.0012
SDev	.0002	.0038	.0008	.0004	.0001	.0026	.0077
%RSD	230.0	206.2	121.5	28.22	1.702	.6428	640.8
#1	.0001	.0045	-.0001	-.0010	.0044	.4024	-.0067
#2	-.0003	-.0008	-.0012	-.0015	.0045	.4061	.0043

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	102.8	-.0014	.0045	.0116	-.0011	.0026	-.0030
SDev	1.9	.0043	.0021	.0030	.0005	.0000	.0025
%RSD	1.889	311.9	47.18	25.71	46.91	.1016	82.25
#1	104.2	.0016	.0030	.0095	-.0007	.0026	-.0013
#2	101.4	-.0044	.0060	.0137	-.0014	.0026	-.0048

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0002	-.0044	-.0001	-.0006	.0207	-.0004	.0013
SDev	.0000	.0000	.0002	.0004	.0176	.0001	.0019
%RSD	14.98	.3418	167.2	63.68	84.95	17.14	142.6
#1	.0001	-.0044	.0000	-.0003	.0083	-.0003	-.0000
#2	.0002	-.0044	-.0002	-.0009	.0331	-.0004	.0026

010096

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0000	.0010	-.0002
SDev	.0002	.0001	.0001
%RSD	475.2	5.962	28.55
#1	.0001	.0010	-.0003
#2	-.0001	.0011	-.0002

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1196218	10000	--	--	--	--	--
SDev	22708.73	.0000000	--	--	--	--	--
%RSD	1.898378	.0000000	--	--	--	--	--
#1	1212275	10000	--	--	--	--	--
#2	1180160	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: 273126 Operator:
Run Time: 02/01/06 12:46:52
Comment:
Mode: CONC Corr. Factor: 1

010097

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0004	-.0028	.0012	.0016	.0001	-.0000	.0015
SDev	.0004	.0002	.0012	.0011	.0001	.0000	.0026
%RSD	102.2	8.908	94.27	71.06	113.1	64.64	172.9
#1	.0007	-.0026	.0004	.0008	.0000	-.0001	-.0003
#2	.0001	-.0030	.0021	.0023	.0001	-.0000	.0034

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0934	.0001	.0006	-.0001	.0000	.0251	.2197
SDev	.0001	.0000	.0002	.0002	.0002	.0054	.0007
%RSD	.1137	4.290	28.59	182.4	627.6	21.61	.3241
#1	.0933	.0001	.0005	-.0003	-.0001	.0289	.2192
#2	.0934	.0001	.0008	.0000	.0002	.0213	.2202

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0012	.0001	.1303	.0003	.0005	3.877	5.004
SDev	.0001	.0000	.0032	.0001	.0004	.110	.075
%RSD	6.972	12.62	2.485	18.82	71.76	2.837	1.505
#1	.0012	.0001	.1326	.0003	.0003	3.955	4.950
#2	.0013	.0001	.1280	.0003	.0008	3.800	5.057

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0003	.0031	.0038	-.0007	.0005	.4171	.0040
SDev	.0001	.0079	.0014	.0020	.0009	.0007	.0040
%RSD	26.33	255.8	35.36	284.8	184.1	.1742	99.08
#1	.0002	.0087	.0048	.0007	.0012	.4176	.0012
#2	.0004	-.0025	.0029	-.0021	-.0002	.4166	.0068

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	100.7	.0036	.0008	.0161	.0008	.0017	.0005
SDev	.7	.0020	.0002	.0019	.0018	.0006	.0015
%RSD	.6849	56.54	25.28	12.07	221.3	31.80	319.0
#1	101.2	.0051	.0006	.0147	.0021	.0021	.0015
#2	100.2	.0022	.0009	.0175	-.0005	.0013	-.0006

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0001	-.0033	-.0000	-.0008	.0423	-.0005	.0029
SDev	.0000	.0014	.0000	.0033	.0093	.0001	.0010
%RSD	7.028	41.46	94.61	404.4	22.02	19.51	35.65
#1	.0001	-.0043	-.0001	-.0032	.0489	-.0006	.0022
#2	.0001	-.0023	-.0000	.0015	.0357	-.0005	.0036

010098

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0001	.0004	.0000
SDev	.0000	.0001	.0001
%RSD	63.16	21.42	144.3
#1	-.0001	.0005	.0001
#2	-.0000	.0004	-.0000

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1172230	10000	--	--	--	--	--
SDev	8065.260	.0000000	--	--	--	--	--
%RSD	.6880271	.0000000	--	--	--	--	--
#1	1177933	10000	--	--	--	--	--
#2	1166527	10000	--	--	--	--	--

Method: DAILY2 Sample Name: 273127 Operator:
Run Time: 02/01/06 12:51:37
Comment:
Mode: CONC Corr. Factor: 1

010099

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0007	-.0081	.0018	.0027	.0000	-.0000	.0016
SDev	.0015	.0121	.0010	.0002	.0001	.0000	.0078
%RSD	235.3	150.1	53.21	6.177	463.8	125.9	487.7
#1	.0018	.0005	.0025	.0026	.0001	-.0000	.0071
#2	-.0004	-.0166	.0011	.0028	-.0000	-.0001	-.0039

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0522	.0001	.0003	.0000	.0000	.0410	.2396
SDev	.0013	.0001	.0000	.0011	.0002	.0178	.0237
%RSD	2.426	150.2	2.910	4131.	501.3	43.48	9.891
#1	.0531	.0002	.0003	.0008	-.0001	.0536	.2563
#2	.0513	-.0000	.0003	-.0007	.0002	.0284	.2228

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0012	.0002	.1293	.0007	.0004	4.057	5.156
SDev	.0019	.0001	.0142	.0000	.0008	.368	.007
%RSD	155.8	42.65	10.99	5.017	196.5	9.068	.1365
#1	.0026	.0002	.1393	.0007	-.0001	4.317	5.160
#2	-.0001	.0001	.1192	.0006	.0009	3.797	5.151

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0003	.0111	.0036	-.0018	.0045	.4308	.0036
SDev	.0006	.0033	.0002	.0013	.0045	.0001	.0004
%RSD	208.7	29.84	4.615	75.86	98.83	.0335	11.03
#1	.0001	.0135	.0037	-.0027	.0077	.4309	.0034
#2	-.0007	.0088	.0035	-.0008	.0014	.4307	.0039

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	101.6	.0027	.0028	.0198	.0000	.0028	-.0005
SDev	.4	.0029	.0001	.0050	.0008	.0010	.0012
%RSD	.3988	105.2	4.815	25.33	1716.	37.51	219.6
#1	101.4	.0048	.0029	.0233	-.0005	.0036	-.0014
#2	101.9	.0007	.0027	.0162	.0006	.0021	.0003

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0001	-.0034	-.0000	-.0025	.0386	-.0000	.0013
SDev	.0001	.0011	.0002	.0007	.0566	.0002	.0008
%RSD	81.48	33.87	1530.	27.25	146.5	1454.	63.27
#1	.0001	-.0042	.0001	-.0020	.0786	-.0002	.0019
#2	.0000	-.0026	-.0001	-.0029	-.0014	.0001	.0007

010100

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0001	.0043	.0001
SDev	.0000	.0002	.0009
%RSD	61.08	4.711	971.2
#1	-.0000	.0044	.0007
#2	-.0001	.0041	-.0006

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1182994	10000	--	--	--	--	--
SDev	4786.406	.0000000	--	--	--	--	--
%RSD	.4046009	.0000000	--	--	--	--	--
#1	1179610	10000	--	--	--	--	--
#2	1186379	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: 273128 Operator:
Run Time: 02/01/06 12:56:22 010101
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0001	-.0088	.0025	.0026	.0000	-.0000	-.0001
SDev	.0000	.0042	.0039	.0015	.0000	.0000	.0032
%RSD	41.44	47.22	158.3	57.22	75.76	37.44	2666.
#1	.0001	-.0059	-.0003	.0037	.0000	-.0000	.0021
#2	.0000	-.0118	.0053	.0016	.0001	-.0000	-.0024

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0442	.0000	.0006	.0001	.0001	.0237	.3575
SDev	.0004	.0001	.0003	.0001	.0005	.0204	.0190
%RSD	.9423	182.9	43.28	101.2	480.8	86.38	5.320
#1	.0445	.0001	.0008	.0001	.0004	.0381	.3710
#2	.0439	-.0000	.0004	.0000	-.0002	.0092	.3441

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0005	.0001	.0637	.0005	.0004	4.232	5.446
SDev	.0001	.0000	.0005	.0000	.0005	.069	.015
%RSD	26.49	10.78	.8125	2.054	114.5	1.638	.2806
#1	.0006	.0001	.0640	.0005	.0007	4.281	5.436
#2	.0004	.0001	.0633	.0005	.0001	4.183	5.457

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0010	.0040	.0031	-.0018	.0019	.4567	-.0002
SDev	.0001	.0042	.0006	.0008	.0016	.0096	.0026
%RSD	10.45	102.5	18.01	44.65	83.80	2.108	1371.
#1	.0011	.0070	.0035	-.0024	.0030	.4499	-.0021
#2	.0009	.0011	.0027	-.0012	.0008	.4635	.0017

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899
Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	101.4	.0024	.0033	.0185	-.0002	.0030	-.0017
SDev	.9	.0004	.0009	.0028	.0003	.0007	.0016
%RSD	.9035	16.78	27.85	14.95	224.3	24.85	91.76
#1	100.7	.0021	.0026	.0165	-.0004	.0025	-.0028
#2	102.0	.0026	.0039	.0204	.0001	.0035	-.0006

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0001	-.0028	-.0000	-.0003	.0207	-.0003	-.0006
SDev	.0000	.0010	.0001	.0018	.0065	.0001	.0015
%RSD	44.46	35.93	2725.	615.9	31.22	27.24	245.7
#1	.0001	-.0035	-.0001	-.0015	.0253	-.0002	.0005
#2	.0000	-.0021	.0000	.0010	.0162	-.0004	-.0017

010102

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0000	.0007	.0001
SDev	.0000	.0001	.0001
%RSD	111.3	17.12	127.6
#1	.0000	.0008	.0002
#2	.0000	.0006	.0000

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1179825	10000	--	--	--	--	--
SDev	10762.17	.0000000	--	--	--	--	--
%RSD	.9121832	.0000000	--	--	--	--	--
#1	1172215	10000	--	--	--	--	--
#2	1187435	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: ccv2 Operator:
Run Time: 02/01/06 13:01:08
Comment:
Mode: CONC Corr. Factor: 1

010103

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.9680	9.876	5.025	4.803	9.865	.9680	5.026
SDev	.0032	.064	.012	.028	.046	.0006	.019
%RSD	.3295	.6453	.2396	.5766	.4641	.0627	.3844
#1	.9657	9.831	5.017	4.784	9.833	.9684	5.012
#2	.9703	9.921	5.034	4.823	9.898	.9676	5.040
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	1.100	11.00	5.500	5.500	11.00	1.100	5.500
Low	.9000	9.000	4.500	4.500	9.000	.9000	4.500

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	19.84	.9864	5.039	1.973	2.016	10.18	18.72
SDev	.02	.0015	.003	.001	.015	.02	.16
%RSD	.1060	.1542	.0689	.0385	.7323	.2397	.8793
#1	19.82	.9875	5.037	1.973	2.006	10.20	18.60
#2	19.85	.9854	5.042	1.974	2.026	10.17	18.83
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	22.00	1.100	5.500	2.200	2.200	11.00	22.00
Low	18.00	.9000	4.500	1.800	1.800	9.000	18.00

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.927	4.816	19.88	.9987	5.045	28.65	H40.67
SDev	.010	.014	.01	.0001	.005	.04	.25
%RSD	.1957	.2918	.0310	.0127	.0965	.1424	.6074
#1	4.920	4.806	19.88	.9986	5.042	28.62	H40.49
#2	4.933	4.826	19.88	.9988	5.048	28.68	H40.84
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC High
High	5.500	5.500	22.00	1.100	5.500	33.00	33.00
Low	4.500	4.500	18.00	.9000	4.500	27.00	27.00

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.879	5.040	4.883	4.917	.9982	.9961	1.002
SDev	.010	.023	.087	.006	.0038	.0094	.000
%RSD	.2038	.4646	1.779	.1304	.3804	.9464	.0489
#1	4.886	5.057	4.944	4.912	.9955	.9894	1.001
#2	4.872	5.024	4.821	4.921	1.001	1.003	1.002
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High	5.500	5.500			1.100	1.100	1.100
Low	4.500	4.500			.9000	.9000	.9000

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010104

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	97.32	5.139	5.182	5.006	4.905	5.168	4.948
SDev	.64	.106	.019	.018	.025	.022	.002
%RSD	.6526	2.057	.3709	.3601	.5032	.4340	.0364
#1	96.87	5.214	5.169	4.993	4.923	5.184	4.950
#2	97.77	5.064	5.196	5.019	4.888	5.152	4.947
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				5.500	5.500	5.500	5.500
Low				4.500	4.500	4.500	4.500

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	5.013	.9795	4.803	5.096	1.039	4.953	1.061
SDev	.019	.0052	.008	.026	.003	.004	.001
%RSD	.3808	.5316	.1654	.5035	.2484	.0840	.0504
#1	5.000	.9758	4.798	5.078	1.041	4.950	1.060
#2	5.027	.9832	4.809	5.114	1.038	4.956	1.061
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	5.500	1.100	5.500	5.500	1.100	5.500	1.100
Low	4.500	.9000	4.500	4.500	.9000	4.500	.9000

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	4.969	1.014	4.895
SDev	.007	.004	.002
%RSD	.1423	.4185	.0428
#1	4.964	1.017	4.897
#2	4.974	1.011	4.894
Errors	LC Pass	LC Pass	LC Pass
High	5.500	1.100	5.500
Low	4.500	.9000	4.500

010105

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1132686	10000	--	--	--	--	--
SDev	7394.216	.0000000	--	--	--	--	--
%RSD	.6528034	.0000000	--	--	--	--	--
#1	1127458	10000	--	--	--	--	--
#2	1137915	10000	--	--	--	--	--

Method: DAILY2 Sample Name: ccb2 Operator:
Run Time: 02/01/06 13:05:53
Comment:
Mode: CONC Corr. Factor: 1

010106

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0004	-.0067	.0028	.0090	.0002	-.0000	.0028
SDev	.0004	.0031	.0004	.0016	.0000	.0000	.0003
%RSD	94.22	46.00	14.61	17.72	3.319	1179.	8.786
#1	.0001	-.0045	.0031	.0101	.0002	.0000	.0027
#2	.0007	-.0089	.0025	.0079	.0002	-.0000	.0030
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0500	.0050	.0500	.0050	.0050	.0100
Low	-.0050	-.0500	-.0050	-.0500	-.0050	-.0050	-.0100

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0019	.0001	.0006	.0005	.0009	.0224	.0039
SDev	.0000	.0001	.0002	.0005	.0005	.0056	.0031
%RSD	1.270	40.60	27.15	90.67	55.85	24.87	79.79
#1	.0019	.0001	.0005	.0002	.0006	.0185	.0017
#2	.0019	.0002	.0007	.0008	.0013	.0264	.0061
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0500	.0050	.0050	.0050	.0050	.0500	.1000
Low	-.0500	-.0050	-.0050	-.0050	-.0050	-.0500	-.1000

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0012	.0002	.0063	.0001	.0023	H.1391	-.0012
SDev	.0003	.0001	.0018	.0001	.0004	.0208	.0041
%RSD	27.13	23.07	28.35	194.8	19.59	14.98	335.9
#1	.0010	.0003	.0050	-.0000	.0026	H.1538	.0017
#2	.0014	.0002	.0076	.0002	.0020	H.1243	-.0042
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC High	LC Pass
High	.0050	.0050	.0500	.0050	.0050	.0500	.0500
Low	-.0050	-.0050	-.0500	-.0050	-.0050	-.0500	-.0500

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0004	-.0062	.0030	.0009	.0037	.0019	.0041
SDev	.0001	.0001	.0031	.0029	.0019	.0059	.0018
%RSD	14.25	2.206	103.3	320.4	52.05	307.4	42.74
#1	.0004	-.0061	.0053	-.0011	H.0051	-.0023	.0053
#2	.0005	-.0063	.0008	.0030	.0023	.0061	.0029
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High	.0050	.0100			.0050	.0100	.0100
Low	-.0050	-.0100			-.0050	-.0100	-.0100

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010107

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	96.97	.0012	.0032	.0032	.0016	.0025	.0002
SDev	.57	.0055	.0024	.0015	.0009	.0002	.0000
%RSD	.5873	469.8	74.88	46.90	54.40	9.523	17.84
#1	97.37	-.0027	.0049	.0022	.0010	.0023	.0002
#2	96.57	.0050	.0015	.0043	.0023	.0027	.0002
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				.0100	.0030	.0050	.0050
Low				-.0100	-.0030	-.0050	-.0050

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0001	-.0009	.0002	.0056	.0399	.0004	.0032
SDev	.0000	.0013	.0002	.0001	.0001	.0014	.0005
%RSD	18.11	150.3	119.2	2.568	.2659	349.6	15.60
#1	.0001	-.0018	.0000	.0055	.0399	-.0006	.0028
#2	.0001	.0001	.0003	.0057	.0400	.0014	.0035
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0100	.0050	.0100	.1000	.0050	.0100
Low	-.0050	-.0100	-.0050	-.0100	-.1000	-.0050	-.0100

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0001	.0002	.0008
SDev	.0000	.0001	.0006
%RSD	51.10	39.83	71.67
#1	.0000	.0001	.0004
#2	.0001	.0002	.0013
Errors	LC Pass	LC Pass	LC Pass
High	.0050	.0050	.0050
Low	-.0050	-.0050	-.0050

010108

IntStd	1	2	3	4	5	6	
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1128630	10000	--	--	--	--	--
SDev	6550.637	.0000000	--	--	--	--	--
%RSD	.5804061	.0000000	--	--	--	--	--
#1	1133262	10000	--	--	--	--	--
#2	1123998	10000	--	--	--	--	--

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Method: DAILY2 Sample Name: cri Operator:
Run Time: 02/01/06 13:10:39
Comment:
Mode: CONC Corr. Factor: 1

010109

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0205	.0982	.0215	.1040	.0205	.0098	.0006
SDev	.0014	.0078	.0010	.0003	.0001	.0000	.0054
%RSD	6.794	7.925	4.463	.3288	.3534	.2481	871.0
#1	.0215	.1037	.0222	.1038	.0206	.0099	.0045
#2	.0195	.0927	.0208	.1042	.0205	.0098	-.0032
Errors	LC Pass	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass	NOCHECK
High	.0300		.0300	.1500	.0300	.0150	
Low	.0100		.0100	.0500	.0100	.0050	

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0047	.0103	.0997	.0207	.0504	.1349	.0208
SDev	.0026	.0002	.0013	.0003	.0001	.0179	.0314
%RSD	55.52	1.834	1.270	1.303	.2869	13.26	150.8
#1	.0066	.0104	.1006	.0209	.0503	.1476	.0430
#2	.0029	.0101	.0988	.0205	.0505	.1223	-.0014
Errors	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	NOCHECK
High		.0150	.1500	.0300	.0750	.1500	
Low		.0050	.0500	.0100	.0250	.0500	

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0016	.0727	.0107	.0302	.0214	.2878	.0173
SDev	.0022	.0001	.0088	.0000	.0005	.3350	.0129
%RSD	136.2	.1700	82.84	.1052	2.431	116.4	74.95
#1	.0031	.0726	.0169	.0302	.0210	.5247	.0264
#2	.0001	.0728	.0044	.0302	.0218	.0510	.0081
Errors	NOCHECK	LC Pass	NOCHECK	LC Pass	LC Pass	NOCHECK	NOCHECK
High		.1500		.0450	.0300		
Low		.0500		.0150	.0100		

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0805	.1003	.0061	.0039	.0045	-.0059	.1278
SDev	.0006	.0002	.0015	.0004	.0060	.0037	.0001
%RSD	.7136	.1971	23.92	10.72	134.7	62.55	.0847
#1	.0810	.1002	.0071	.0036	.0088	-.0085	.1279
#2	.0801	.1005	.0051	.0042	.0002	-.0033	.1278
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	LC Pass
High	.1200	.1500					.1800
Low	.0400	.0500					.0600

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010110

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	99.54	.0078	.0124	.1194	.0047	.0108	.1042
SDev	.78	.0020	.0009	.0046	.0002	.0013	.0019
%RSD	.7810	25.78	7.158	3.814	4.397	11.62	1.808
#1	100.1	.0064	.0117	.1227	.0048	.0100	.1028
#2	98.99	.0092	.0130	.1162	.0045	.0117	.1055
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				.1500	.0090	.0150	.1500
Low				.0500	.0030	.0050	.0500

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0211	-.0002	.0192	.0195	.2558	.0997	.0018
SDev	.0001	.0020	.0001	.0017	.0557	.0003	.0016
%RSD	.4606	1056.	.6396	8.710	21.79	.3501	90.40
#1	.0211	-.0016	.0192	.0183	.2952	.1000	.0030
#2	.0210	.0012	.0191	.0207	.2164	.0995	.0007
Errors	LC Pass	NOCHECK	LC Pass	LC Pass	NOCHECK	LC Pass	NOCHECK
High	.0300		.0300	.0300		.1500	
Low	.0100		.0100	.0100		.0500	

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0001	.0409	.0936
SDev	.0001	.0002	.0002
%RSD	153.5	.5532	.1758
#1	-.0000	.0410	.0935
#2	.0001	.0407	.0937
Errors	NOCHECK	LC Pass	NOCHECK
High		.0600	
Low		.0200	

010111

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1158454	10000	--	--	--	--	--
SDev	9005.712	.0000000	--	--	--	--	--
%RSD	.7773905	.0000000	--	--	--	--	--
#1	1164822	10000	--	--	--	--	--
#2	1152086	10000	--	--	--	--	--

Method: DAILY2 Sample Name: icsa Operator:
Run Time: 02/01/06 13:15:24
Comment:
Mode: CONC Corr. Factor: 1

010112

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0013	513.3	.0020	-.0168	.0022	.0001	.0004
SDev	.0001	.8	.0042	.0015	.0000	.0000	.0029
%RSD	7.913	.1638	210.2	8.809	1.434	12.36	687.8
#1	-.0012	513.9	.0050	-.0157	.0022	.0001	.0025
#2	-.0013	512.7	-.0010	-.0178	.0022	.0001	-.0017
Errors	NOCHECK	LC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
High		600.0					
Low		400.0					

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	462.1	.0041	.0004	-.0017	.0019	187.1	.0014
SDev	.9	.0000	.0007	.0001	.0000	.2	.0007
%RSD	.1980	.2458	180.2	6.925	2.224	.1311	49.82
#1	461.4	.0041	-.0001	-.0018	.0019	186.9	.0019
#2	462.7	.0041	.0009	-.0016	.0019	187.3	.0009
Errors	LC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	LC Pass	NOCHECK
High	600.0					240.0	
Low	400.0					160.0	

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0055	.0004	537.6	.0059	-.0008	.6410	.0070
SDev	.0001	.0000	.7	.0000	.0005	.1696	.0052
%RSD	2.485	7.952	.1309	.6710	57.09	26.46	75.27
#1	.0056	.0004	537.1	.0059	-.0005	.7610	.0107
#2	.0054	.0004	538.1	.0059	-.0011	.5211	.0033
Errors	NOCHECK	NOCHECK	LC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK
High			600.0				
Low			400.0				

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0007	-.0115	.0305	-.0180	.0016	.0040	.0083
SDev	.0017	.0047	.0027	.0024	.0015	.0014	.0000
%RSD	254.9	40.84	8.668	13.51	90.94	35.48	.0033
#1	.0019	-.0082	.0287	-.0163	.0027	.0030	.0083
#2	-.0005	-.0148	.0324	-.0197	.0006	.0050	.0083
Errors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
High							
Low							

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010113

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	88.58	.0021	-.0048	.0531	-.0018	-.0025	-.0057
SDev	.38	.0022	.0009	.0015	.0007	.0002	.0006
%RSD	.4296	106.4	18.15	2.918	41.11	5.981	10.86
#1	88.85	.0005	-.0042	.0542	-.0013	-.0026	-.0062
#2	88.31	.0036	-.0055	.0520	-.0023	-.0024	-.0053
Errors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
High							
Low							

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0161	-.0281	-.0008	.0018	-.0036	-.0021	.0037
SDev	.0000	.0024	.0001	.0005	.0091	.0001	.0056
%RSD	.2469	8.583	12.90	28.38	256.0	3.834	152.7
#1	.0161	-.0298	-.0009	.0022	-.0100	-.0020	.0076
#2	.0160	-.0264	-.0008	.0014	.0029	-.0021	-.0003
Errors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
High							
Low							

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0008	.0080	-.0014
SDev	.0001	.0003	.0003
%RSD	12.86	3.481	18.67
#1	-.0009	.0078	-.0016
#2	-.0007	.0082	-.0012
Errors	NOCHECK	NOCHECK	NOCHECK
High			
Low			

010114

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1030948	10000	--	--	--	--	--
SDev	4468.208	.0000000	--	--	--	--	--
%RSD	.4334075	.0000000	--	--	--	--	--
#1	1034108	10000	--	--	--	--	--
#2	1027789	10000	--	--	--	--	--

Analysis Report 02/01/06 01:24:43 PM page 1

Method: DAILY2 Sample Name: icsab Operator: 010115
Run Time: 02/01/06 13:20:09
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	1.096	507.4	1.059	1.036	.5305	.4971	.0106
SDev	.000	.1	.006	.005	.0011	.0002	.0071
%RSD	.0111	.0175	.6008	.4390	.2158	.0457	67.30
#1	1.096	507.3	1.055	1.033	.5296	.4969	.0056
#2	1.096	507.5	1.064	1.039	.5313	.4973	.0156
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	NOCHECK
High	1.200	600.0	1.200	1.200	.6000	.6000	
Low	.8000	400.0	.8000	.8000	.4000	.4000	

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	457.3	.9784	.4970	.5036	.5582	185.3	.0047
SDev	.6	.0020	.0009	.0013	.0008	.0	.0015
%RSD	.1226	.2083	.1891	.2528	.1358	.0149	31.31
#1	457.7	.9799	.4976	.5045	.5587	185.3	.0037
#2	456.9	.9770	.4963	.5027	.5577	185.3	.0058
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	NOCHECK
High	600.0	1.200	.6000	.6000	.6000	240.0	
Low	400.0	.8000	.4000	.4000	.4000	160.0	

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0050	1.185	533.6	.5084	1.035	.8357	.0059
SDev	.0002	.000	.6	.0006	.005	.2096	.0050
%RSD	4.128	.0362	.1164	.1142	.4649	25.08	85.01
#1	.0049	1.185	533.1	.5089	1.031	.6874	.0023
#2	.0052	1.186	534.0	.5080	1.038	.9839	.0094
Errors	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass	NOCHECK	NOCHECK
High		1.200	600.0	.6000	1.200		
Low		.8000	400.0	.4000	.8000		

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.9386	1.039	1.040	.9979	.0028	.0030	1.068
SDev	.0057	.011	.002	.0071	.0018	.0039	.010
%RSD	.6102	1.078	.1657	.7092	63.39	129.1	.9653
#1	.9427	1.047	1.041	.9929	.0016	.0058	1.061
#2	.9346	1.031	1.038	1.003	.0041	.0003	1.075
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	LC Pass
High	1.200	1.200					1.200
Low	.8000	.8000					.8000

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010116

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	89.28	1.049	1.054	1.121	1.012	1.053	1.017
SDev	.32	.003	.003	.001	.004	.001	.000
%RSD	.3622	.3105	.3171	.0630	.4096	.1086	.0346
#1	89.06	1.052	1.052	1.121	1.009	1.052	1.017
#2	89.51	1.047	1.057	1.120	1.015	1.054	1.017
Errors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High					1.200	1.200	1.200
Low					.8000	.8000	.8000

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	1.049	-.0165	.9606	1.012	.9845	.5091	.0038
SDev	.001	.0072	.0002	.002	.0039	.0002	.0014
%RSD	.0571	43.51	.0211	.1665	.3920	.0447	35.79
#1	1.048	-.0115	.9604	1.011	.9872	.5089	.0048
#2	1.049	-.0216	.9607	1.013	.9818	.5092	.0029
Errors	LC Pass	NOCHECK	LC Pass	LC Pass	NOCHECK	LC Pass	NOCHECK
High	1.200		1.200	1.200		.6000	
Low	.8000		.8000	.8000		.4000	

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	-.0006	.9690	.9450
SDev	.0002	.0006	.0022
%RSD	27.86	.0652	.2360
#1	-.0005	.9694	.9465
#2	-.0007	.9685	.9434
Errors	NOCHECK	LC Pass	NOCHECK
High		1.200	
Low		.8000	

010117

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1039216	10000	--	--	--	--	--
SDev	3780.900	.0000000	--	--	--	--	--
%RSD	.3638225	.0000000	--	--	--	--	--
#1	1036542	10000	--	--	--	--	--
#2	1041889	10000	--	--	--	--	--

Analysis Report 02/01/06 01:29:29 PM page 1

Method: DAILY2 Sample Name: ccv3 Operator: 010118
Run Time: 02/01/06 13:24:55
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.9676	9.854	5.027	4.788	9.806	.9702	4.993
SDev	.0002	.010	.002	.015	.012	.0004	.014
%RSD	.0215	.0993	.0450	.3146	.1248	.0383	.2802
#1	.9677	9.847	5.025	4.777	9.797	.9704	5.003
#2	.9674	9.861	5.028	4.798	9.814	.9699	4.983
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	1.100	11.00	5.500	5.500	11.00	1.100	5.500
Low	.9000	9.000	4.500	4.500	9.000	.9000	4.500

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	19.91	.9820	5.035	1.977	2.013	10.16	18.68
SDev	.01	.0021	.004	.002	.005	.00	.11
%RSD	.0559	.2118	.0756	.0782	.2475	.0045	.5920
#1	19.90	.9835	5.038	1.978	2.010	10.16	18.61
#2	19.92	.9806	5.033	1.975	2.017	10.16	18.76
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	22.00	1.100	5.500	2.200	2.200	11.00	22.00
Low	18.00	.9000	4.500	1.800	1.800	9.000	18.00

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.931	4.812	19.89	.9987	5.043	28.72	H40.48
SDev	.002	.009	.02	.0002	.013	.21	.08
%RSD	.0329	.1811	.0930	.0155	.2515	.7464	.2067
#1	4.930	4.805	19.90	.9988	5.035	28.87	H40.43
#2	4.932	4.818	19.88	.9986	5.052	28.57	H40.54
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC High
High	5.500	5.500	22.00	1.100	5.500	33.00	33.00
Low	4.500	4.500	18.00	.9000	4.500	27.00	27.00

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	4.857	5.050	4.926	4.898	1.004	.9962	1.004
SDev	.003	.027	.006	.009	.002	.0013	.001
%RSD	.0712	.5255	.1277	.1879	.1917	.1259	.0764
#1	4.854	5.031	4.922	4.891	1.003	.9971	1.004
#2	4.859	5.069	4.931	4.904	1.005	.9953	1.003
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High	5.500	5.500			1.100	1.100	1.100
Low	4.500	4.500			.9000	.9000	.9000

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010119

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	96.92	5.191	5.146	5.002	4.907	5.161	4.959
SDev	.58	.020	.019	.008	.008	.019	.007
%RSD	.6018	.3930	.3631	.1557	.1678	.3731	.1417
#1	96.50	5.176	5.133	4.996	4.902	5.148	4.954
#2	97.33	5.205	5.160	5.007	4.913	5.175	4.964
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				5.500	5.500	5.500	5.500
Low				4.500	4.500	4.500	4.500

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	5.020	.9773	4.804	5.078	1.037	4.951	1.062
SDev	.015	.0002	.000	.001	.018	.001	.001
%RSD	.3034	.0230	.0079	.0177	1.691	.0160	.0862
#1	5.009	.9775	4.804	5.077	1.024	4.950	1.061
#2	5.031	.9771	4.805	5.079	1.049	4.952	1.062
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	5.500	1.100	5.500	5.500	1.100	5.500	1.100
Low	4.500	.9000	4.500	4.500	.9000	4.500	.9000

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	4.966	1.014	4.927
SDev	.002	.003	.004
%RSD	.0365	.3268	.0790
#1	4.968	1.016	4.924
#2	4.965	1.012	4.930
Errors	LC Pass	LC Pass	LC Pass
High	5.500	1.100	5.500
Low	4.500	.9000	4.500

010120

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1128001	10000	--	--	--	--	--
SDev	6851.865	.0000000	--	--	--	--	--
%RSD	.6074343	.0000000	--	--	--	--	--
#1	1123156	10000	--	--	--	--	--
#2	1132846	10000	--	--	--	--	--

Analysis Report 02/01/06 01:34:14 PM page 1

Method: DAILY2 Sample Name: ccb3 Operator: 010121
Run Time: 02/01/06 13:29:41
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1890	B_2496	Ba4934	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	-.0003	-.0058	.0015	.0085	.0014	.0001	-.0031
SDev	.0003	.0091	.0015	.0009	.0018	.0001	.0049
%RSD	98.93	156.8	96.84	10.84	130.9	147.0	159.1
#1	-.0006	.0006	.0026	.0092	.0026	.0002	.0004
#2	-.0001	-.0122	.0005	.0079	.0001	-.0000	-.0066
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0500	.0050	.0500	.0050	.0050	.0100
Low	-.0050	-.0500	-.0050	-.0500	-.0050	-.0050	-.0100

Elem	Ca3179	Cd2265	Co2286	Cr2677	Cu3247	Fe2714	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0095	.0001	.0001	-.0002	.0004	.0220	.0119
SDev	.0117	.0001	.0003	.0000	.0003	.0009	.0016
%RSD	123.3	64.65	311.1	9.161	60.98	4.324	13.76
#1	.0177	.0001	.0003	-.0002	.0002	.0214	.0130
#2	.0012	.0000	-.0001	-.0002	.0006	.0227	.0107
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0500	.0050	.0050	.0050	.0050	.0500	.1000
Low	-.0500	-.0050	-.0050	-.0050	-.0050	-.0500	-.1000

Elem	La3988	Li6707	Mg2790	Mn2576	Mo2020	Na3302	Na5889
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0012	.0007	.0111	.0001	.0025	H.1144	.0123
SDev	.0005	.0007	.0140	.0000	.0010	.1019	.0113
%RSD	41.98	101.7	126.2	1.042	40.67	89.09	91.95
#1	.0016	.0011	.0211	.0001	.0033	.0423	.0202
#2	.0009	.0002	.0012	.0001	.0018	H.1864	.0043
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC High	LC Pass
High	.0050	.0050	.0500	.0050	.0050	.0500	.0500
Low	-.0050	-.0050	-.0500	-.0050	-.0050	-.0500	-.0500

Elem	Ni2316	P_1782	2203/1	2203/2	Pd3404	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0005	-.0008	.0036	-.0021	.0012	.0009	.0027
SDev	.0005	.0035	.0005	.0012	.0002	.0041	.0003
%RSD	115.4	417.0	13.65	58.58	16.30	446.0	12.94
#1	.0008	.0016	.0040	-.0030	.0013	-.0020	.0025
#2	.0001	-.0033	.0033	-.0012	.0011	.0039	.0029
Errors	LC Pass	LC Pass	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass
High	.0050	.0100			.0050	.0100	.0100
Low	-.0050	-.0100			-.0050	-.0100	-.0100

Elem	Sc3613	1960/1	1960/2	Si2881	Pb220	Se196	Sn1899

010122

Units	%R	ppm	ppm	ppm	ppm	ppm	ppm
Avge	99.48	.0017	.0022	.0033	-.0002	.0020	-.0008
SDev	1.37	.0015	.0012	.0015	.0007	.0013	.0004
%RSD	1.377	91.01	55.32	44.99	357.8	64.97	48.25
#1	100.5	.0028	.0031	.0022	-.0006	.0030	-.0005
#2	98.52	.0006	.0013	.0043	.0003	.0011	-.0011
Errors	NOCHECK	NOCHECK	NOCHECK	LC Pass	LC Pass	LC Pass	LC Pass
High				.0100	.0030	.0050	.0050
Low				-.0100	-.0030	-.0050	-.0050

Elem	Sr4215	Th2837	Ti3349	Tl1908	U_4090	V_2924	W_2079
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avge	.0007	-.0026	.0005	.0054	.0115	-.0001	.0031
SDev	.0009	.0017	.0008	.0002	.0159	.0002	.0008
%RSD	133.9	66.63	149.9	3.689	137.8	259.0	25.08
#1	.0014	-.0038	.0011	.0052	.0003	.0001	.0037
#2	.0000	-.0014	-.0000	.0055	.0227	-.0002	.0026
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	.0050	.0100	.0050	.0100	.1000	.0050	.0100
Low	-.0050	-.0100	-.0050	-.0100	-.1000	-.0050	-.0100

Elem	Y_3710	Zn2062	Zr3496
Units	ppm	ppm	ppm
Avge	.0005	.0000	.0003
SDev	.0006	.0002	.0003
%RSD	123.1	653.1	96.89
#1	.0010	.0002	.0005
#2	.0001	-.0001	.0001
Errors	LC Pass	LC Pass	LC Pass
High	.0050	.0050	.0050
Low	-.0050	-.0050	-.0050

010123

IntStd	1	2	3	4	5	6	7
Mode	*Counts	Time	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Sc	--	--	--	--	--	--
Wavlen	361.384	--	--	--	--	--	--
Avge	1157857	10000	--	--	--	--	--
SDev	15933.94	.0000000	--	--	--	--	--
%RSD	1.376158	.0000000	--	--	--	--	--
#1	1169124	10000	--	--	--	--	--
#2	1146590	10000	--	--	--	--	--

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SOUTHWEST RESEARCH INSTITUTE®

6220 Culebra Rd
San Antonio, Texas 78228

010124

TJA_2 TRACE ICP DAILY LOG

ANALYST [signature]

DATE 2-1-06

As 189.042 Profile Line

As Intensity: 619.002

PEAK POSITION .002014

VERNIER POSITION 746

STDs PREP DATE:	
CLP_STD1_SC	06B01
CLP_STD2_SC	↑
CLP_STD3_SC	↑
CLP_STD4_SC	↑
CLP_STD5_SC	↑
CLP_STD6_SC	↑
BLK_SC	06B01

QC PREP DATE:	
CCV/ICV	06B01
CRI	↑
ICSA	↑
ICSAB	06B01

COMMENTS	FILE	CLIENT	TO#	PROJECT NO.	METHOD
B601319	Y06JAN	OW. 20	060131-9	06002.01.222	6010B 62-264
B601142	Y06JAN	WDC	060114-2 060119-2	10203.22-234	6010B 61-270
↑	Y06JAN	WDC	060119-19	↑	6010B 61-271
↑	Y06JAN	WDC	060114-3	↑	6010B 61-271
B601142	Y06JAN	WDC	060119-3	10203.22.234	6010B 61-271

[signature] 2-1-06

COMMENTS: WDC soils

MAINTENANCE:

REVIEWED BY: Orduña DATE: 2/6/06

BOOK/ PAGE 19 260

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6220 Culebra Rd
San Antonio, Texas 78228

010125

SPECTRO ICP DAILY LOG

ANALYST: [illegible]

DATE: 2-1-06

POWER: 1200

FLOWS:
Aux 40
Coolant 60
Mass Flow Controller 567

CURRENT	PROPOSED	
5111	5098	Na
4758	4738	Fe
4940	4908	Sr

QC PREP DATE:	
CCV/ICV	06801
CRI	
ICSA	
ICSAB	06801

CLP_STD1_SC	06801
CLP_STD2_SC	
CLP_STD3_SC	
CLP_STD4_SC	
CLP_STD5_SC	
BLK_SC	06801

FILE	CLIENT	TO#	PROJECT NO.	METHOD	PREP PAGE
060201	Div 20	060131-9	06002.01.222	60105	60105 62-265

COMMENTS:

MAINTENANCE:

Cleaned Torch: _____ YES
Changed Pump Tubing: ✓ YES
Cleaned Optics: _____ YES
Polished Optics: _____ YES

OTHER:

REVIEWED BY: Oduña

DATE: 2/6/06

TRACE METALS PREPARATORY LABORATORY DIGESTION LOG

SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO, TEXAS 78228

BOOK / PAGE: 62 264

010126

CLIENT(S): Div. 220
TASK ORDER(S): 060131-9 SDG(S): 273124
PROJECT NO(S): 06062.01.222
METHOD: 3005A___3050B___3050B-7.5___3010A___3020A___7760A___7740A___$HClO_4$___$HClO_4/H_2SO_4$___
Microwave___Fusion___Teflon___Rock___OTHER dilutions
MATRIX: Water___Soil___Biota___Solid___Liquid ✓ TCLP Ext___OTHER___
INSTRUMENT: GFAA___ICP ✓ ICP-MS___IC___FLAA___HYDRIDE___OTHER___
ACID INORG #: HNO_3# 5497 HCl# 5612 H_2SO_4#___ $HClO_4$#___ HF#___ H_2O_2#___
INTERNAL STD: Sc @ 10 PPM ✓ Be @ 10 PPM___ SOURCE: IV INORG# 5404 EXP: 10-1-06 AMT: 50uL
Oven/Hotplate/ Block ID: N/A Temperature (°C): N/A

Sample Identification		df	WT(g)	I.V.(ml)	F.V.(ml)
PBW-B01H1		1		5	5
LCSW-B01H1*		1		5	5
273124		25		0.2	5
273124d		25		0.2	5
273124s*		25		0.2	5
273125		25		0.2	5
273126		25		0.2	5
273127		25		0.2	5
273128		25		0.2	5

*20uL ICAL-1 Spex#5288 exp. 06/06
*50uL Spike-1 #5197 Exp.4/30/06
PBW&LCSW are prepared as 5mls 1%HNO_3 / 5% HCL

Contacted: Charlie Butcher + Mark Ehnstrom 10:10 Am 2-1-06

2-1-06

LOCATION: N/A

PREPARED BY: DL DATE: 2-1-06
REVIEWED BY: John Wills DATE: 2-1-06
DISPOSAL INT/DATE/LOC:

FRM-191 (Rev 4/Jan 05)

TRACE METALS PREPARATORY LABORATORY DIGESTION LOG

SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO, TEXAS 78228

BOOK / PAGE: 62 265

CLIENT(S): Div. 20 010127
TASK ORDER(S): 060131-9 SDG(S): 273124
PROJECT NO(S): 06002.01.222
METHOD: 3005A___3050B___3050B-7.5___3010A___3020A___7760A___7740A___$HClO_4$___$HClO_4/H_2SO_4$___
Microwave___Fusion___Teflon___Rock___OTHER dilutions
MATRIX: Water___Soil___Biota___Solid___Liquid ✓ TCLP Ext___OTHER___
INSTRUMENT: GFAA___ICP ✓ ICP-MS___IC___FLAA___HYDRIDE___OTHER___
ACID INORG #: HNO_3# 5487 HCl# 5612 H_2SO_4#___ $HClO_4$#___ HF#___ H_2O_2#___
INTERNAL STD: Sc @ 10 PPM ✓ Be @ 10 PPM___SOURCE: JV INORG# 5404 EXP: 10-1-06 AMT: 5ml
Oven/Hotplate/ Block ID: N/A Temperature (°C): N/A

Sample Identification	df	WT(g)	I.V.(ml)	F.V.(ml)
PBW-B01H2	1		5	5
LCSW-B01H2*	1		5	5
273124	25		0.2	5
273124d	25		0.2	5
273124s*	25		0.2	5
273125	25		0.2	5
273126	25		0.2	5
273127	25		0.2	5
273128	25		0.2	5

*20uL Li IV# 5244 Exp. 6-1-06
*20uL ICAL-1 Spex#5288 exp. 06/06
*50uL Spike-1 #5197 Exp.4/30/06
PBW&LCSW are prepared as 5mls 1%HNO_3 / 5% HCL

Contacted: Charlie Butcher + Mark Ehnstrom 10:10 Am 2-1-06

2-1-06

LOCATION: N/A

PREPARED BY: ___ DATE: 2-1-06
REVIEWED BY: John Wilke DATE: 2-1-06
DISPOSAL INT/DATE/LOC: ___

FRM-191 (Rev 4/Jan 05)

ICP Calibration Blank/ICB/CCB Solution

ID: BLK- 05M01

Date Prepared: 12-1-05 Prepared By: [signature] 010128

Make up as needed in 1000ml volumetric flask.

Added ✓ 10 ml HNO3 INORG #: 5455

Added ✓ 50 ml HCL INORG #: 5422

Added ✓ 1000ul of 10000ppm Sc (INORG. VENT.) EXP. Date: 5-1-06 INORG #: 5175

ICP Calibration Blank/ICB/CCB Solution

ID: BLK- 06A05

Date Prepared: 1-5-06 Prepared By: [signature]

Make up as needed in 1000ml volumetric flask.

Added ✓ 10 ml HNO3 INORG #: 5485

Added ✓ 50 ml HCL INORG #: 5477

Added ✓ 1000ul of 10000ppm Sc (INORG. VENT.) EXP. Date: 5-1-06 INORG #: 5175

ICP Calibration Blank/ICB/CCB Solution

ID: BLK- 06A24

Date Prepared: 1-24-06 Prepared By: [signature]

Make up as needed in 1000ml volumetric flask.

Added ✓ 10 ml HNO3 INORG #: 1 5486

Added ✓ 50 ml HCL INORG #: 5480

Added ✓ 1000ul of 10000ppm Sc (INORG. VENT.) EXP. Date: 5-1-06 INORG #: 5175

ICP Calibration Blank/ICB/CCB Solution

ID: BLK- 06B01

Date Prepared: 2-1-06 Prepared By: [signature]

Make up as needed in 1000ml volumetric flask.

Added ✓ 10 ml HNO3 INORG #: 5487

Added ✓ 50 ml HCL INORG #: 5612

Added ✓ 1000ul of 10000ppm Sc (INORG. VENT.) EXP. Date: 5-1-06 INORG #: 5175

ICP ICV/CCV SOLUTION

010129

CCV- 06B01

Date Prepared: 2-1-06 Prepared By: DL

HNO3 INORG #: 5487 HCl INORG #: 5612

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	5175	10000	5-1-06
B	5	5ml	✓	SPEX	5585	1000	1-15-07
Li	5	5ml	✓	SPEX	5327	1000	8-15-06
Mo	5	5ml	✓	SPEX	5326	1000	8-15-06
P	5	5ml	✓	SPEX	5280	1000	6-30-06
Si	5	5ml	✓	SPEX	5038	1000	2-28-06
Ti	5	5ml	✓	SPEX	5040	1000	2-28-06
Sr	5	5ml	✓	SPEX	5246	1000	5-30-06
Sn	5	5ml	✓	SPEX	5037	1000	2-28-06
Bi	5	5ml	✓	SPEX	5432	1000	10-15-06
La	5	5ml	✓	SPEX	5325	1000	8-15-06
Y	5	5ml	✓	SPEX	5431	1000	10-15-06
Pd	1	1ml	✓	SPEX	5586	1000	1-15-07
S	1	1ml	✓	SPEX	5296	1000	7-15-06
Th	1	1ml	✓	SPEX	5358	1000	8-30-06
U	1	1ml	✓	SPEX	5279	1000	6-30-06
W	1	1ml	✓	SPEX	5312	1000	7-30-06
Zr	5	5ml	✓	SPEX	5039 #2-28-06	1000	2-28-06
Na	10	1ml	✓	SPEX	~~5587~~ 5589	10000	1-15-07
ICV-2A	vary	10ml	✓	SPEX	5429	mix	10-15-06
ICV-2B	vary	1ml	✓	SPEX	5430	mix	10-15-06
ICV-2C	vary	10ml	✓	SPEX	5428	mix	10-15-06

Expiration Date: 2-28-06

ICP Calibration Standards

010130

Date Prepared: 2-1-06 Prepared By: DL

HNO3 INORG #: 5487 HCl INORG #: 5612

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
2-1-06	STD1- 06801	Al	50	2.50	✓	INORVENT	5405	10000	10-1-06
		Ca	50	2.50	✓	INORVENT	5636	10000	3-1-07
		Fe	50	2.50	✓	INORVENT	5048	10000	3-1-06
		K	50	2.50	✓	INORVENT	5471	10000	12-1-06
		Mg	25	1.25	✓	INORVENT	5312	10000	8-1-06
		Na	50	2.50	✓	INORVENT	5310	10000	8-1-06
		Li	10	5.00	✓	INORVENT	5244	1000	6-1-06
		Sc	10	0.500	✓	INORVENT	5-175	10000	5-1-06
	STD2- 06801	Ba	10	5.00	✓	INORVENT	5027	1000	3-1-06
		Be	5	2.50	✓	INORVENT	5253	1000	6-1-06
		Cr	10	5.00	✓	INORVENT	5470	1000	12-1-06
		Cu	10	5.00	✓	INORVENT	5049	1000	3-1-06
		Ni	10	5.00	✓	INORVENT	5043	1000	3-1-06
		Sc	10	0.500	✓	INORVENT	5175	10000	5-1-06
	STD3- 06801	Cd	10	5.00	✓	INORVENT	5041	1000	3-1-06
		Co	10	5.00	✓	INORVENT	5044	1000	3-1-06
		Mn	10	5.00	✓	INORVENT	5634	1000	3-1-07
		V	10	5.00		INORVENT	5472	1000	12-1-06
		Zn	10	5.00	✓	INORVENT	5538	1000	2-1-07
		Sc	10	0.500	✓	INORVENT	5175	10000	5-1-06
	STD4- 06801	Ag	2	1.00	✓	INORVENT	5406	1000	10-1-06
		As	10	5.00	✓	INORVENT	5633	1000	3-1-07
		Pb	10	5.00	✓	INORVENT	5255	1000	6-1-06
		Sb	10	5.00	✓	INORVENT	5042	1000	3-1-06
		Se	10	5.00		INORVENT	5313	1000	8-1-06
		TL	10	5.00	✓	INORVENT	5635	1000	3-1-07
		Sc	10	0.500	✓	INORVENT	5175	10000	5-1-06
	STD5- 06801	B	10	5.00	✓	INORVENT	5047	1000	3-1-06
		Mo	10	5.00	✓	INORVENT	5050	1000	3-1-06
		P	10	5.00	✓	INORVENT	5254	1000	6-1-06
		Si	10	5.00	✓	INORVENT	5046	1000	3-1-06
		Ti	10	5.00	✓	INORVENT	5474	1000	12-1-06
		Sr	10	5.00	✓	INORVENT	5243	1000	6-1-06
		Sn	10	5.00	✓	INORVENT	5174	1000	5-1-06
		Bi	5	2.50	✓	INORVENT	5309	1000	8-1-06
		Sc	10	0.500	✓	INORVENT	5175	10000	5-1-06
2-1-06	STD6- 06801	La	10	5.00	✓	INORVENT	5407	1000	10-1-06
		Na	1	0.05	✓	INORVENT	5310	10000	8-1-06
		Pd	10	5.00	✓	INORVENT	5045	1000	3-1-06
		S	10	5.00	✓	INORVENT	5539	1000	2-1-07
		Th	10	5.00	✓	INORVENT	5469	1000	12-1-06
		U	10	5.00	✓	INORVENT	5408	1000	10-1-06
		W	5	2.50	✓	INORVENT	5308	1000	8-1-06
		Y	10	5.00	✓	INORVENT	5588	1000	2-1-07
		Zr	10	5.00		INORVENT	5311	1000	8-1-06
		SC	10	0.500	✓	INORVENT	5175	10000	5-1-06

Expiration Dates:

STD1: 3-1-06 **STD4:** 3-1-06

STD2: 3-1-06 **STD5:** 3-1-06

STD3: 3-1-06 **STD6:** 3-1-06

010131

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

Certificates of Analysis

.010132

Fisher Scientific

TRACEMETAL GRADE NITRIC ACID
CERTIFICATE OF ANALYSIS

B McKelvey

Dr. B. McKelvey
QA/QC Manager

CATALOG NUMBER: A509
LOT NUMBER: 1105042
RELEASE DATE: July, 2005
EXPIRY DATE: July, 2008

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 12/15/05
DATE EXPIRED: 11/12/08 OK
DATE OPENED: 12/13/05
INORG: 5484 3548 PO: F56647

Tests	Maximum Specification	Actual Value	Units
ASSAY (HNO_3, w/w):	67 - 70%	70%	% by w/w
Color:	10	<10	APHA

Analyte	Maximum Specification	Actual Value (in ppb)	Analyte	Maximum Specification	Actual Value (in ppb)
Aluminum (Al)	1 ppb	<0.5	Neodymium (Nd)	0.5 ppb	<0.1
Antimony (Sb)	1 ppb	<0.1	Nickel (Ni)	1 ppb	<0.1
Arsenic (As)	1 ppb	<0.1	Niobium (Nb)	0.5 ppb	<0.1
Barium (Ba)	1 ppb	<0.1	Palladium (Pd)	0.5 ppb	<0.1
Beryllium (Be)	1 ppb	<0.1	Platinum (Pt)	0.5 ppb	<0.1
Bismuth (Bi)	1 ppb	<0.1	Potassium (K)	1 ppb	<0.2
Boron (B)	1 ppb	<0.5	Praseodymium (Pr)	0.5 ppb	<0.1
Cadmium (Cd)	1 ppb	<0.1	Rhenium (Re)	0.5 ppb	<0.1
Calcium (Ca)	1 ppb	<0.5	Rhodium (Rh)	0.5 ppb	<0.1
Cerium (Ce)	0.5 ppb	<0.1	Rubidium (Rb)	0.5 ppb	<0.1
Cesium (Cs)	0.5 ppb	<0.1	Ruthenium (Ru)	0.5 ppb	<0.1
Chromium (Cr)	1 ppb	<0.5	Samarium (Sm)	0.5 ppb	<0.1
Cobalt (Co)	1 ppb	<0.1	Scandium (Sc)	0.5 ppb	<0.1
Copper (Cu)	1 ppb	<0.1	Selenium (Se)	1 ppb	<0.1
Dysprosium (Dy)	0.5 ppb	<0.1	Silver (Ag)	1 ppb	<0.1
Erbium (Er)	0.5 ppb	<0.1	Sodium (Na)	1 ppb	<0.2
Europium (Eu)	0.5 ppb	<0.1	Strontium (Sr)	1 ppb	<0.1
Gadolinium (Gd)	0.5 ppb	<0.1	Tantalum (Ta)	Information Only	<0.1
Gallium (Ga)	0.5 ppb	<0.1	Tellurium (Te)	0.5 ppb	<0.1
Germanium (Ge)	0.5 ppb	<0.1	Terbium (Tb)	0.5 ppb	<0.1
Gold (Au)	0.5 ppb	<0.1	Thallium (Tl)	0.5 ppb	<0.1
Hafnium (Hf)	0.5 ppb	<0.1	Thorium (Th)	1 ppb	<0.1
Holmium (Ho)	0.5 ppb	<0.1	Thulium (Tm)	0.5 ppb	<0.1
Indium (In)	0.5 ppb	<0.1	Tin (Sn)	1 ppb	<0.1
Iron (Fe)	1 ppb	<0.5	Titanium (Ti)	1 ppb	<0.1
Lanthanum (La)	0.5 ppb	<0.1	Tungsten (W)	0.5 ppb	<0.1
Lead (Pb)	1 ppb	<0.1	Uranium (U)	1 ppb	<0.1
Lithium (Li)	1 ppb	<0.1	Vanadium (V)	1 ppb	<0.1
Lutetium (Lu)	0.5 ppb	<0.1	Ytterbium (Yb)	0.5 ppb	<0.1
Magnesium (Mg)	1 ppb	<0.2	Yttrium (Y)	0.5 ppb	<0.1
Manganese (Mn)	1 ppb	<0.1	Zinc (Zn)	1 ppb	<0.2
Mercury (Hg)	1 ppb	<0.2	Zirconium (Zr)	1 ppb	<0.1
Molybdenum (Mo)	1 ppb	<0.1			

Analyte	Maximum Specification	Actual Value (in ppm)	Analyte	Maximum Specification	Actual Value (in ppm)
Chloride (Cl)	0.2 ppm	<0.2	Total Sulfur (S)	0.3 ppm	<0.3
Total Phosphorus (P)	0.01 ppm	<0.01			

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

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010133

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TRACEMETAL GRADE HYDROCHLORIC ACID
CERTIFICATE OF ANALYSIS

B McKelvey
Dr. B. McKelvey
QA/QC Manager

CATALOG NUMBER: A508
LOT NUMBER: 4105090
RELEASE DATE: October, 2005
EXPIRY DATE: October, 2008

Tests	Maximum Specification	Actual Value	Units
ASSAY (HCl, w/w)	34 - 37%	36%	% by w/w
Color:	10	<10	APHA

Analyte	Maximum Specification	Actual Value (in ppb)	Analyte	Maximum Specification	Actual Value (in ppb)
Aluminum (Al)	1 ppb	<0.5	Neodymium (Nd)	0.5 ppb	<0.1
Antimony (Sb)	1 ppb	<0.1	Nickel (Ni)	1 ppb	<0.1
Arsenic (As)	1 ppb	<0.1	Niobium (Nb)	0.5 ppb	<0.1
Barium (Ba)	1 ppb	<0.1	Palladium (Pd)	Information Only	<0.5
Beryllium (Be)	1 ppb	<0.1	Platinum (Pt)	Information Only	<0.5
Bismuth (Bi)	1 ppb	<0.1	Potassium (K)	1 ppb	<0.1
Boron (B)	1 ppb	<0.5	Praseodymium (Pr)	0.5 ppb	<0.1
Cadmium (Cd)	1 ppb	<0.1	Rhenium (Re)	0.5 ppb	<0.1
Calcium (Ca)	1 ppb	<0.5	Rhodium (Rh)	0.5 ppb	<0.1
Cerium (Ce)	0.5 ppb	<0.1	Rubidium (Rb)	0.5 ppb	<0.1
Cesium (Cs)	0.5 ppb	<0.1	Ruthenium (Ru)	0.5 ppb	<0.1
Chromium (Cr)	1 ppb	<0.1	Samarium (Sm)	0.5 ppb	<0.1
Cobalt (Co)	1 ppb	<0.1	Scandium (Sc)	0.5 ppb	<0.1
Copper (Cu)	1 ppb	<0.1	Selenium (Se)	1 ppb	<0.1
Dysprosium (Dy)	0.5 ppb	<0.1	Silver (Ag)	1 ppb	<0.1
Erbium (Er)	0.5 ppb	<0.1	Sodium (Na)	1 ppb	<0.5
Europium (Eu)	0.5 ppb	<0.1	Strontium (Sr)	1 ppb	<0.1
Gadolinium (Gd)	0.5 ppb	<0.1	Tantalum (Ta)	Information Only	<1
Gallium (Ga)	0.5 ppb	<0.1	Tellurium (Te)	0.5 ppb	<0.1
Gold (Au)	0.5 ppb	<0.1	Terbium (Tb)	0.5 ppb	<0.1
Hafnium (Hf)	0.5 ppb	<0.1	Thallium (Tl)	0.5 ppb	<0.1
Holmium (Ho)	0.5 ppb	<0.1	Thorium (Th)	1 ppb	<0.1
Indium (In)	0.5 ppb	<0.1	Thulium (Tm)	0.5 ppb	<0.1
Iron (Fe)	1 ppb	<0.5	Tin (Sn)	1 ppb	<0.1
Lanthanum (La)	0.5 ppb	<0.1	Titanium (Ti)	1 ppb	<0.1
Lead (Pb)	1 ppb	<0.1	Tungsten (W)	0.5 ppb	<0.1
Lithium (Li)	1 ppb	<0.1	Uranium (U)	1 ppb	<0.1
Lutetium (Lu)	0.5 ppb	<0.1	Vanadium (V)	1 ppb	<0.1
Magnesium (Mg)	1 ppb	<0.5	Ytterbium (Yb)	0.5 ppb	<0.1
Manganese (Mn)	1 ppb	<0.1	Yttrium (Y)	0.5 ppb	<0.1
Mercury (Hg)	1 ppb	<0.2	Zinc (Zn)	1 ppb	<0.5
Molybdenum (Mo)	1 ppb	<0.1	Zirconium (Zr)	1 ppb	<0.1

Analyte	Maximum Specification	Actual Value (in ppm)	Analyte	Maximum Specification	Actual Value (in ppm)
Bromide (Br)	10 ppm	<10	Total Sulphur (S)	0.3 ppm	<0.3
Total Phosphorus (P)	0.01 ppm	<0.01	Free Chlorine (Cl2)	0.5 ppm	<0.5

Element concentrations are at the point of bottling. Concentrations of some elements will increase due to the storage container.
Glass bottles: Al, B, Ca, K, Mg, Mn, Na & Si. Polyethylene bottles: Al, Ca, Fe, Na & Zn.

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INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/20/06
DATE EXPIRED: 10/1/2008 AR
DATE OPENED: 1/20/06
INORG: 5611 → 5616 PO: F 56676

010134

SPECertificate™

Certificate of Reference Material

Catalog Number: SPIKE-1 **Lot No.:** 28-176AS
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

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 4/18/05
DATE EXPIRED: 4/30/09
DATE OPENED: 4/18/05
INORG: 5197 FD: 55160

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.

1 of 2
5197

Date of Certification: APR. - - 2005 Certifying Officer: N. Kocherlakota

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010135

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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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

ISO 9001
CERTIFIED

2 of 2
5197

SPEX CertiPrep
203 Norcross Avenue • Metuchen, NJ 08840 USA
732 549 7144 • 1 800 LAB SPEX • Fax: 732 603 9647 • CRMSales@spexcerti.com • www.spexcerti.com

010136

SPEXertificate™

Certificate of Reference Material

Catalog Number: ICAL-1 **Lot No.:** 28-64AS
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	5011.87	3109a
K	5,000	5011.80	3141a
Mg	5,000	5020.86	3131a
Na	5,000	4995.13	3152a

Spex Reference Multi: Lot #6-28VY, 6-104VY, 25-178AS-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.

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 6/30/05
DATE EXPIRED: 6/30/06
DATE OPENED: 6/30/05
INORG: 5288 PO: 155205

Date of Certification: _____ Certifying Officer: N. Kocherlakota

© 2004 SPEX CertiPrep, Inc.

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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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

ISO 9001
CERTIFIED

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010138

inorganic ventures / iv labs

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phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
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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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Scandium in 5% (abs) HNO_3**

Catalog Number:	CGSC1-1, CGSC1-2, and CGSC1-5
Lot Number:	**X-SC02063**
Starting Material:	Sc2O3
Starting Material Purity (%):	99.996919
Starting Material Lot No	BSC-632-1-5736
Matrix:	5% (abs) HNO_3

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1007 ± 2 µg/mL

Certified Density: 1.037 g/mL (measured at 22° C)

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

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

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

Uncertainty $(\pm) = 2\left[\left(\frac{\Sigma s_i}{(n)}\right)^2\right]^{1/2}$

Σs_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** **1007 ± 2 µg/mL**
ICP Assay NIST SRM 3148a Lot Number: 792111

Assay Method #2 **1006 ± 2 µg/mL**
EDTA NIST SRM 928 Lot Number: 392110

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 9/23/05
DATE EXPIRED: 10/1/06
DATE OPENED: 9/27/05
INORG: 5404 PO: D20696435

pg. 1 of 1
5404

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.

O Al < 0.00100	M Dy < 0.00598	M Li < 0.00997	M Pr < 0.00030	M Te < 0.02990
M Sb < 0.00050	M Er < 0.00498	M Lu < 0.00040	M Re < 0.00100	M Tb < 0.00030
M As < 0.00997	M Eu < 0.00299	O Mg 0.00010	M Rh < 0.00100	M Tl < 0.00100
M Ba < 0.00997	M Gd < 0.00100	M Mn < 0.00399	M Rb < 0.00100	M Th 0.01175
M Be < 0.00050	M Ga < 0.00100	O Hg < 0.01000	M Ru < 0.00199	M Tm < 0.00040
M Bi < 0.00040	M Ge < 0.00598	M Mo < 0.00199	M Sm < 0.00100	M Sn < 0.00498
M B < 0.06976	M Au < 0.00299	M Nd < 0.00199	s Sc	O Ti < 0.00100
M Cd < 0.00299	M Hf < 0.00199	O Ni < 0.00090	M Se < 0.00797	M W < 0.00997
O Ca 0.01149	M Ho < 0.00050	M Nb < 0.00050	O Si 0.00200	M U < 0.00199
M Ce < 0.00498	M In < 0.00997	n Os	M Ag < 0.00199	M V < 0.00199
M Cs < 0.00030	M Ir < 0.00498	M Pd < 0.00498	O Na < 0.09000	M Yb < 0.00100
O Cr 0.00047	O Fe 0.00037	n P	M Sr < 0.00050	O Y < 0.00100
M Co < 0.00299	M La < 0.00050	M Pt < 0.00199	O S < 0.02500	O Zn 0.00060
O Cu < 0.00140	M Pb < 0.00299	O K < 0.10000	M Ta < 0.00698	O Zr 0.02298

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 Formin Solution - 44.95591; +3; 6; $Sc(H_2O)_6^{+2}$

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_6^{3-} (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^0 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)
ICP-OES 335.373 nm	0.004 / 0.00002 µg/mL	1	ion	
ICP-OES 337.215 nm	0.004 / 0.00002 µg/mL	1	ion	Ti, U, Ni, Rh
ICP-OES 424.683 nm	0.003 / 0.00002 µg/mL	1	ion	Ce
ICP-MS 45 amu	2.3 ppt	n/a	M^+	$^{16}O_2{}^{12}CH$, $^{29}Si^{16}O$, $^{90}Zr^{+2}$

8.0 HAZARDOUS INFORMATION

- Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY

- This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

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

Members of IQ Net International Certification Network:

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

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

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

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

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

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

Certification Date: December 14, 2004

Expiration Date: EXPIRES 1/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

010142

inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM

Custom-Grade **10000 µg/mL Scandium in 5% (abs) HNO_3**

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) HNO_3

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:

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

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

$(\bar{x})$ = 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** **10,005 ± 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

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 3/31/05
DATE EXPIRED: 5/1/06
DATE OPENED: 3/31/05
INORG: 5175 PO: 921106

1 of 4
5175

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.

O	Al	< 0.00100	M	Dy	< 0.00598	M	Li	< 0.00997	M	Pr	< 0.00030	M	Te	< 0.02990
M	Sb	< 0.00050	M	Er	< 0.00498	M	Lu	< 0.00040	M	Re	< 0.00100	M	Tb	< 0.00030
M	As	< 0.00997	M	Eu	< 0.00299	O	Mg	0.00100	M	Rh	< 0.00100	M	Tl	< 0.00100
M	Ba	< 0.00997	M	Gd	< 0.00100	M	Mn	< 0.00399	M	Rb	< 0.00100	M	Th	0.11759
M	Be	< 0.00050	M	Ga	< 0.00100	O	Hg	< 0.01000	M	Ru	< 0.00199	M	Tm	< 0.00040
M	Bi	< 0.00040	M	Ge	< 0.00598	M	Mo	< 0.00199	M	Sm	< 0.00100	M	Sn	< 0.00498
M	B	< 0.06976	M	Au	< 0.00299	M	Nd	< 0.00199	s	Sc		O	Ti	< 0.00100
M	Cd	< 0.00299	M	Hf	< 0.00199	O	Ni	< 0.00090	M	Se	< 0.00797	M	W	< 0.00997
O	Ca	0.11500	M	Ho	< 0.00050	M	Nb	< 0.00050	O	Si	0.02000	M	U	< 0.00199
M	Ce	< 0.00498	M	In	< 0.00997	n	Os		M	Ag	< 0.00199	M	V	< 0.00199
M	Cs	< 0.00030	M	Ir	< 0.00498	M	Pd	< 0.00498	O	Na	< 0.09000	M	Yb	< 0.00100
O	Cr	0.00470	O	Fe	0.00370	n	P		M	Sr	< 0.00050	O	Y	< 0.00100
M	Co	< 0.00299	M	La	< 0.00050	M	Pt	< 0.00199	O	S	< 0.02500	O	Zn	0.00600
O	Cu	< 0.00140	M	Pb	< 0.00299	O	K	< 0.10000	M	Ta	< 0.00698	O	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 ± 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 - 44.95591; +3; 6; $Sc(H_2O)_6^{+3}$

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_6^{3-} (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 µg/mL	1	ion	
ICP-OES 337.215 nm	0.004 / 0.00002 µg/mL	1	ion	Ti, U, Ni, Rh
ICP-OES 424.683 nm	0.003 / 0.00002 µg/mL	1	ion	Ce
ICP-MS 45 amu	2.3 ppt	n/a	M⁺	$^{16}O_2{}^{13}CH$, $^{29}Si^{16}O$, $^{90}Zr^{12}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - *This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.*

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"
- Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission
- Domestic Licensing of Production and Utilization Facilities

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

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

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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 01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Malda, QA Administrator	Nicholas Malda
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

010146

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/11/06
DATE EXPIRED: 1/15/07 DR
DATE OPENED: 1/12/06
INORG: 5585 PO: F56675

SPEXertificate™

Certificate of Reference Material

Catalog Number: PLB9-2X/2Y/2T **Lot No.** 11-166B
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: 1004 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 Ammonium Tetraborate, Lot #: 07031A. 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: Titration with Sodium Hydroxide using Phenolphthalein as indicator. Sodium Hydroxide standardized against Potassium Biphthalate NIST SRM #84k

Instrumental Analysis by ICP spectrometer: 1003 mg/L

Uncertified Properties:

Density: 1.00 @ 23.7 Degrees Celsius

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

As	0.004	Cu	<0.001	Pb	<0.001
Al	0.10	Fe	0.002	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
Ba	<0.001	In	<0.001	Sr	<0.001
Bi	<0.001	K	<0.01	Sb	<0.001
Be	<0.001	Li	<0.001	Si	0.04
Cr	<0.001	Mn	<0.001	Ti	<0.003
Co	0.002	Mg	v	Tl	<0.001
Cd	<0.001	Mo	<0.001	V	0.003
Ca	<0.001	Ni	<0.001	Zn	<0.01
		Na	0.03	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: _____ Certifying Officer: N. Kocherlakota

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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

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SPEX CertiPrep
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010148

SPEXertificate ™

Certificate of Reference Material

Catalog Number: PLLI2-2X/2Y **Lot No.** 11-120LI

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: 1002 mg/L

Uncertainty Associated with Measurement: +/- 3.0 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: 1003 mg/L

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

Instrumental Analysis by ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 1.013 @ 24.6 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	<0.001	Cu	0.02	Pb	0.008
Ag	<0.001	Fe	0.04	Rb	<0.001
As	0.06	Ga	<0.001	Re	<0.001
Bi	<0.001	In	<0.001	Sr	0.004
Be	<0.001	K	<0.20	Sb	0.004
B	<0.001	Li	<0.001	Si	<0.100
Ba	0.004	Mg	0.004	Tl	<0.001
Cr	<0.001	Mo	0.007	Ti	<0.001
Co	<0.001	Mn	0.004	V	0.006
Ca	0.012	Ni	<0.001	Zn	0.03
Cd	<0.001	Na	0.100	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.

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 8/4/05
DATE EXPIRED: 8/5/10
DATE OPENED: 8/6/05
INORG: 5327 PO: 15283

Date of Certification: AUG - 2005 Certifying Officer: N. Kocherakota

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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

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010150

SPEXertificate ™

Certificate of Reference Material

Catalog Number: PLMO9-2X/2Y/2T **Lot No.** 11-51MO

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: 1000 mg/L

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

Certified Value is Traceable to: NIST SRM #3134

The CRM is prepared gravimetrically using high purity (NH4)6(Mo)7(O)24-4H2OLot# 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: 1000 mg/L

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

Instrumental Analysis by ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 09989 @23.7 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
As	0.03	Cu	0.003	Pb	<0.001
Ag	<0.002	Fe	0.110	Rb	<0.001
Al	<0.002	Ga	<0.001	Re	0.030
Ba	<0.001	In	<0.001	Sr	<0.001
Be	<0.002	K	0.060	Sb	<0.001
B	<0.007	Li	<0.003	Si	<0.200
Bi	<0.001	Mn	0.002	Ti	0.003
Cd	<0.100	Mg	<0.001	Tl	<0.001
Ca	0.010	Ni	<0.001	V	0.004
Cr	<0.003	Na	<0.002	Zr	<0.001
Co	<0.001			Zn	0.006

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.

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 8/4/05
DATE EXPIRED: 8/15/06
DATE OPENED: 8/5/05
INORG: 5329 PO: F52683

Date of Certification: AUG - 2005 Certifying Officer: N. Kocherlakota

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010151

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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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

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010152

SPEXertificate ™

Certificate of Reference Material

Catalog Number: PLP9-2X/2Y/2T **Lot No.** 11-90P

Description: 1000 mg/L Phosphorus

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: 1000 mg/L

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

Certified Value is Traceable to: NIST SRM #3139a

The CRM is prepared gravimetrically using high purity (NH4)H2(PO4) Lot# 04941I. 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: 999 mg/L

Method: Precipitation using Magnesia Mixture. Filter, ignite and weigh as Mg2P2O7.

Instrumental Analysis by ICP spectrometer: 1000 mg/L

Uncertified Properties:

Density: 1.000 @ 24.3 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
As	<0.001	Cu	<0.001	Pb	<0.001
Ag	<0.009	Fe	0.02	Re	<0.001
Al	0.02	Ga	<0.001	Rb	<0.001
B	<0.002	In	<0.001	Si	0.01
Be	<0.001	K	<0.20	Sb	0.02
Ba	<0.001	Li	<0.001	Sr	<0.001
Bi	<0.001	Mo	0.002	Ti	0.006
Cr	<0.001	Mn	<0.001	Tl	0.003
Ca	0.025	Mg	0.002	V	<0.001
Cd	<0.001	Ni	<0.001	Zn	0.60
Co	<0.001	Na	0.009	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: _____ Certifying Officer: N. Kocherlakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 4/30/05
DATE EXPIRED: 4/30/06
DATE OPENED: 4/30/05
INORG: 5280 PO: 65205

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

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010154

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 3/28/05
DATE EXPIRED: 3/28/2006 DK
DATE OPENED: 3/28/05
INORG: 5038 FD: F55148

SPEXertificate™

Certificate of Reference Material

Catalog Number: PLSI9-2X/2Y/2T **Lot No.** 11-33SI

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: 1001.5 mg/L

Uncertainty Associated with Measurement: +/- 3.0 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: 1004 mg/L

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

Instrumental Analysis by ICP spectrometer: 999 mg/L

Uncertified Properties:

Density: 1.001 @ 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	0.003	Cu	<0.001	Pb	<0.001
Ag	<0.001	Fe	0.02	Rb	<0.001
As	<0.06	Ga	<0.001	Re	<0.001
Ba	<0.001	In	<0.001	Sr	<0.001
Be	<0.001	K	0.14	Sb	<0.001
B	<0.004	Li	0.008	Ti	<0.001
Bi	<0.001	Mo	<0.001	Tl	<0.001
Cd	<0.001	Mg	<0.001	V	<0.001
Ca	0.016	Mn	<0.001	Zn	0.002
Cr	<0.001	Na	0.003	Zr	0.002
Co	<0.001	Ni	<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: FEB '05 Certifying Officer: N. Kocherakota

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Report of Certification

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NIST Technical Note 1297
ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers
ISO/REMCO N280

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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

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DATE RECEIVED: 3/08/05
DATE EXPIRED: 3/08/06
DATE OPENED: 3/08/05
INORG: 5040 PO: F55148

SPEXertificate™

Certificate of Reference Material

Catalog Number: PLTI9-2X/2Y/2T **Lot No.** 10-172TI
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: 998 mg/L
Uncertainty Associated with Measurement: +/- 3.0 mg/L
Certified Value is Traceable to: NIST SRM #3162a

The CRM is prepared gravimetrically using high purity (NH4)TiF6 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: 999 mg/L

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

Instrumental Analysis by ICP spectrometer: 997 mg/L

Uncertified Properties:

Density: 1.000 @ 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	0.004	Cu	0.04	Pb	<0.001
As	<0.001	Fe	0.002	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.004	In	<0.001	Si	3.0
Ba	<0.001	K	<0.10	Sr	<0.001
Be	<0.001	Li	<0.001	Sb	<0.001
Bi	<0.001	Mg	<0.003	Tl	<0.001
Ca	0.012	Mn	<0.001	V	<0.001
Cr	<0.07	Mo	<0.001	Zr	0.004
Cd	<0.001	Na	0.02	Zn	0.004
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: FEB '05 Certifying Officer: N. Kocherlakota

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Report of Certification

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c = \sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

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SPEXertificate ™

Certificate of Reference Material

Catalog Number: PLSR2-2X/2Y/2T **Lot No.** 10-130SR
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: 1000 mg/L
Uncertainty Associated with Measurement: +/- 3.0 mg/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: 1000 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: 1000 mg/L
Uncertified Properties:

Density: 1.010 @ 23.5 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	0.006	Rb	<0.001
Ag	<0.001	Ga	<0.001	Re	<0.001
B	<0.001	In	<0.001	Si	0.012
Ba	0.02	K	0.20	Sr	<0.001
Be	<0.001	Li	<0.001	Sb	<0.001
Bi	<0.001	Mg	<0.001	Ti	<0.001
Ca	0.016	Mn	<0.001	Tl	<0.001
Cr	0.003	Mo	<0.001	V	0.003
Cd	<0.001	Na	0.004	Zr	
Co	<0.001	Ni	<0.001	Zn	<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.

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DATE RECEIVED: 5/24/05
DATE EXPIRED: 5/30/06
DATE OPENED: 5/24/05
INORG: 5246 PO: 145150

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1 of 2

Date of Certification: MAY - 2005 Certifying Officer: N. Kocherlakota

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Report of Certification

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EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition
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ISO Guide 31: Contents of certificates of reference materials
NIST Technical Note 1297
ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers
ISO/REMCO N280

Material Source:

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Instructions for Use:

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Method of Preparation:

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

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.
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k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

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$U=ku_c$ where k=2 is the coverage factor at the 95% confidence level
u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/28/2006
DATE OPENED: 3/28/05
INORG: 5037 PO: F55148

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Certificate of Reference Material

Catalog Number: PLSN5-2X/2Y/2T **Lot No.** 11-45SN

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: 997.5 mg/L

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

Certified Value is Traceable to: NIST SRM #3161

The CRM is prepared gravimetrically using high purity Tin Metal Lot# 10951C. 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: 999 mg/L

Method: Precipitation using Ammonium Hydroxide. Filter, ignite, and weigh as SnO2.

Instrumental Analysis by ICP spectrometer: 996 mg/L

Uncertified Properties:

Density: 1.041 @ 22.7 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
As	<0.10	Cu	<0.001	Pb	0.001
Ag	0.004	Fe	0.10	Re	<0.001
Al	0.007	Ga	<0.001	Rb	<0.001
B	<0.001	In	<0.01	Sb	0.002
Ba	<0.001	K	<0.20	Si	0.09
Be	<0.001	Li	<0.001	Sr	<0.001
Bi	<0.001	Mo	<0.001	Ti	<0.001
Co	0.007	Mn	<0.001	Tl	<0.001
Cd	<0.01	Mg	<0.001	V	<0.20
Ca	0.07	Na	0.045	Zn	0.70
Cr	0.007	Ni	0.045	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: FEB '05 Certifying Officer: N. Kocherlakota

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Report of Certification

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

Material Source:

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Method of Preparation:

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

Homogeneity:

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

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$U=ku_c$ where k=2 is the coverage factor at the 95% confidence level
u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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Certificate of Reference Material

Catalog Number: PLBI4-2X/2Y **Lot No.** 11-136BI

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: 1003 mg/L

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

Certified Value is Traceable to: NIST SRM #3106

The CRM is prepared gravimetrically using high purity Bismuth Metal Lot# 07931E. 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: 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 @ 25.1 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
As	<0.001	Cu	<0.001	Pb	0.002
Al	0.002	Fe	0.01	Rb	<0.001
Ag	<0.04	Ga	<0.001	Re	<0.001
B	<0.03	In	<0.001	Sb	<0.001
Ba	<0.001	K	0.01	Si	0.027
Be	<0.002	Li	<0.001	Sr	<0.001
Cr	<0.001	Mo	<0.001	Tl	<0.001
Co	<0.001	Mn	<0.001	Ti	<0.001
Cd	<0.001	Mg	<0.001	V	<0.001
Ca	0.04	Ni	0.002	Zr	<0.001
		Na	0.003	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.

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/17/05
DATE EXPIRED: 10/15/06
DATE OPENED: 10/17/05
INORG: 9437 PO: D20070630

Date of Certification: OCT - 2005 Certifying Officer: N. Kocherlakota

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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+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U = ku_c$ where k=2 is the coverage factor at the 95% confidence level
u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c = \sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

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Certificate of Reference Material

Catalog Number: PLLA2-2X/2Y **Lot No.** 11-32LA

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: +/- 3.0 mg/L

Certified Value is Traceable to: NIST SRM #3127a

The CRM is prepared gravimetrically using high purity Lanthanum Oxide Lot# 11901J. 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: 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: 1.011 @ 21.8 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Ce	0.007	Lu	<0.001	Tm	<0.001
Ca	12.00	Mn	<0.003	Ti	0.01
Dy	<0.001	Mo	<0.001	Tl	0.02
Er	<0.001	Nd	<0.001	Ta	<0.001
Eu	<0.001	Ni	<0.003	Tb	<0.001
Fe	0.02	Na	0.08	Th	<0.001
Ga	<0.001	Pr	<0.001	V	<0.001
Gd	<0.10	Rb	<0.001	W	<0.001
Hf	<0.001	Sc	0.003	Yb	<0.001
Ho	<0.001	Sm	<0.001	Y	0.003
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.

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DATE RECEIVED: 8/4/05
DATE EXPIRED: 8/15/06
DATE OPENED: 8/5/05
INORG: 5325 PO: F52433

Date of Certification: AUG - 2005 Certifying Officer: N. Kocherlakota

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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
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Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.
The mathematical expression $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

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Certificate of Reference Material

Catalog Number: PLY2-2X/2Y/2T **Lot No.** 11-84Y

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: 999 mg/L

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

Certified Value is Traceable to: NIST SRM #3167

The CRM is prepared gravimetrically using high purity Yttrium Oxide Lot# 04041A. 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.

Instrumental Analysis by ICP spectrometer: 997 mg/L

Uncertified Properties:

Density: 1.011 @ 24.0 Degrees Celsius

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

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

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DATE RECEIVED: 10/17/05
DATE EXPIRED: 10/15/06
DATE OPENED: 10/17/05
INORG: 531 PO: 0607030

Date of Certification: OCT - 2005 Certifying Officer: N. Kocherlakota

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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:

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Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.
The mathematical expression $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

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DATE RECEIVED: 1/11/06
DATE EXPIRED: 1/15/2007 DR
DATE OPENED: 1/12/06
INORG: 5586 PO: P56675

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Certificate of Reference Material

Catalog Number: PLPD3-2X/2Y **Lot No.** 12-18PD
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: 1003 mg/L
Uncertainty Associated with Measurement: +/- 3.0 mg/L
Certified Value is Traceable to: NIST SRM #3138
The CRM is prepared gravimetrically using high purity Palladium Metal, Lot #: 02041D. 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: Precipitation using Glyoxime. Filter, dry, and weigh as Pd(C4H7O2N2)2

Instrumental Analysis by ICP spectrometer: 1001 mg/L
Uncertified Properties:

Density: 1.020 @ 24.0 Degrees Celsius

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

Au	0.003	Fe	0.027	Ru	<0.001
Ag	0.01	Ga	<0.001	Rh	0.002
Al	0.005	Ir	<0.001	Rb	<0.001
Be	<0.005	In	<0.001	Re	<0.001
Bi	<0.001	Mg	0.003	Sn	0.03
B	<0.09	Mn	0.008	Te	<0.001
Co	<0.001	Ni	0.02	Ti	<0.002
Cu	0.002	Na	0.02	W	<0.001
Cr	0.006	Pt	<0.001	Zn	0.05
Cd	0.003	Pb	0.10	Zr	<0.001
Ca	0.014				

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. – – 2006 Certifying Officer: N. Kocherlakota

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

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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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DATE RECEIVED: 7/7/05
DATE EXPIRED: 7/31/2006 OK
DATE OPENED: 7/7/05
INORG: 5296 PO: 55207

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Certificate of Reference Material

Catalog Number: PLS9-2X/2Y/2T **Lot No.** 11-63S

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: 1001.5 mg/L

Uncertainty Associated with Measurement: +/- 3.0 mg/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: 1003 mg/L

Method: Precipitation using Barium Chloride. Filter, ignite and weigh as BaSO4.

Instrumental Analysis by ICP spectrometer: 1000 mg/L

Uncertified Properties:

Density: 1000 @ 23.2 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Ag	<0.001	Cu	<0.001	Pb	<0.001
Al	<0.001	Fe	0.01	Re	<0.001
As	<0.001	Ga	<0.001	Rb	<0.001
Be	<0.002	In	<0.001	Si	0.033
Ba	<0.001	K	0.009	Sb	<0.001
B	<0.001	Li	<0.001	Sr	<0.001
Bi	<0.001	Mg	0.004	Ti	<0.001
Cd	<0.001	Mn	<0.001	Tl	0.02
Co	<0.001	Mo	<0.001	V	<0.002
Ca	0.015	Na	0.01	Zn	0.03
Cr	<0.005	Ni	<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: JUL - 2005 Certifying Officer: N. Kocherlakota

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Certificate of Reference Material

Catalog Number: PLTH2-2X/2Y **Lot No.** 11-82TH

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: 1000 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: 1001 mg/L

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

Instrumental Analysis by ICP spectrometer: 999 mg/L

Uncertified Properties:

Density: 1.010 @ 24.1 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Ca	<0.02	Lu	<0.001	Th	<0.001
Ce	0.01	La	0.003	Tb	<0.001
Dy	<0.001	Mo	<0.001	Tm	<0.001
Er	<0.001	Mn	<0.001	Ta	<0.001
Eu	<0.001	Na	0.04	Tl	<0.001
Fe	<0.01	Nd	0.003	Ti	<0.001
Gd	<0.001	Ni	<0.001	V	<0.001
Ga	<0.001	Pr	<0.001	W	<0.001
Hf	<0.001	Rb	<0.001	Y	0.002
Ho	<0.0001	Sm	<0.001	Yb	<0.001
In	<0.001	Sc	<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.

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 8/31/05
DATE EXPIRED: 8/30/06
DATE OPENED: 8/31/05
INORG: 5358 PO: 0000040025

Date of Certification: AUG - 2005 Certifying Officer: N. Kocherlakota

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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010173

SPEXertificate ™

Certificate of Reference Material

Catalog Number: PLU2-2X/2Y **Lot No.** 11-124U

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: 1000 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 Triuranium Octaoxide 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: 1001 mg/L

Method: Evaporate to dryness. Ignite and weigh as U3O8.

Instrumental Analysis by ICP spectrometer: 999 mg/L

Uncertified Properties:

Density: 1.009 @ 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	0.01	Cu	0.01	Pb	0.04
Ag	<0.005	Fe	0.20	Re	<0.001
As	0.05	Ga	<0.001	Rb	<0.001
Bi	<0.001	In	<0.001	Si	<0.01
Ba	0.005	K	0.03	Sb	0.004
Be	<0.001	Li	<0.001	Sr	0.003
B	<0.001	Mg	0.003	Tl	0.001
Ca	0.05	Mn	0.004	Ti	0.006
Cd	<0.001	Mo	0.006	V	0.005
Co	0.001	Ni	<0.001	Zr	<0.003
Cr	<0.002	Na	0.10	Zn	0.007

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 4/30/05
DATE EXPIRED: 4/30/09
DATE OPENED: 4/30/05
INORG: 5279 PO: 155205

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:_____ Certifying Officer: N. Kocherlakota

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Report of Certification

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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SPEXertificate ™

Certificate of Reference Material

Catalog Number: PLW9-2X/2Y **Lot No.** 11-83W

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# M0600W. 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: Fume with Sulfuric Acid to dryness. Ignite and weigh as WO3.

Instrumental Analysis by ICP spectrometer: 1003 mg/L

Uncertified Properties:

Density: 1.000 @ 19.6 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Ag	<0.005	Cu	<0.001	Pb	<0.001
Al	0.006	Fe	0.001	Rb	<0.001
As	0.003	Ga	<0.001	Re	0.006
B	<0.003	In	<0.001	Sr	<0.001
Be	<0.001	K	<0.10	Sb	<0.001
Bi	<0.001	Li	<0.001	Si	0.52
Ba	<0.001	Mo	<0.001	Tl	<0.001
Ca	0.005	Mn	<0.001	Ti	<0.001
Cr	<0.001	Mg	<0.001	V	<0.001
Cd	<0.001	Ni	<0.001	Zr	<0.001
Co	<0.001	Na	0.09	Zn	0.005

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 7/26/05
DATE EXPIRED: 7/30/06
DATE OPENED: 7/26/05
INORG: 5341 PO: 15213

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: JUL - 2005 Certifying Officer: N. Kocherlakota

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Report of Certification

This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:
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EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition
ASTM Guide D6362-98
ISO Guide 34: Quality system guidelines for the production of reference materials.
ISO Guide 17025: Certification of reference materials, general and statistical principles
ISO Guide 31: Contents of certificates of reference materials
NIST Technical Note 1297
ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers
ISO/REMCO N280

Material Source:

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Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.
The mathematical expression $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

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DATE OPENED: 2/08/05
INORG: S039 PO: F55148

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Certificate of Reference Material

Catalog Number: PLZR2-2X/2Y/2T **Lot No.** 11-69ZR

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: 1004 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# 02041A. 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 ZrO2.

Instrumental Analysis by ICP spectrometer: 1004 mg/L

Uncertified Properties:

Density: 1.011 @ 22.6 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
As	<0.001	Cu	<0.001	Pb	<0.001
Ag	0.03	Fe	0.02	Re	<0.001
Al	0.004	Ga	<0.001	Rb	<0.001
Ba	<0.002	In	<0.001	Sb	<0.001
Be	<0.001	K	<0.20	Sr	<0.001
Bi	0.15	Li	<0.001	Si	<0.10
B	<0.004	Mn	<0.001	Tl	<0.001
Cr	<0.001	Mg	<0.001	Ti	<0.003
Cd	<0.001	Mo	<0.001	V	<0.001
Co	<0.002	Ni	<0.001	Zn	0.001
Ca	<0.001	Na	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: FEB '05 Certifying Officer: N. Kocherlakota

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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:

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Method of Preparation:

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

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.
The mathematical expression $k_s=s^2m$ is employed to determine the sampling size
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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:

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X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ where k=2 is the coverage factor at the 95% confidence level
u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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DATE RECEIVED: 1/11/06
DATE EXPIRED: 1/15/07
DATE OPENED: 1/18/06 DR
INORG: 5587 PO: F56675

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Certificate of Reference Material

Catalog Number: PLNA2-3X/3Y **Lot No.** X9-161NA
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: 9982 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# 05031C. 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: 9979 mg/L

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

Instrumental Analysis by ICP spectrometer: 9985 mg/L

Uncertified Properties:

Density: 1.051 @ 20.5 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.06	Cu	0.02	Pb	0.009
As	<0.006	Fe	0.02	Re	<0.001
Ag	<0.001	Ga	<0.001	Rb	<0.001
Bi	<0.001	In	<0.001	Si	0.01
Be	<0.02	K	0.50	Sb	<0.001
Ba	0.01	Li	0.003	Sr	<0.002
B	<0.30	Mg	0.50	Tl	<0.003
Cr	<0.02	Mn	0.007	Ti	<0.008
Cd	<0.001	Mo	<0.001	V	<0.005
Ca	0.42	Ni	<0.002	Zn	<0.03
Co	<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. -- 2006 Certifying Officer: N. Kocherlakota

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Report of Certification

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NIST Technical Note 1297
ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers
ISO/REMCO N280

Material Source:

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Instructions for Use:

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Method of Preparation:

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

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.
The mathematical expression $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

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$U=ku_c$ where k=2 is the coverage factor at the 95% confidence level
u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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Legal Notice:

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Certificate of Reference Material

Catalog Number: ICV-2A **Lot No.:** 29-175AS
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.

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	1,995.81	3109a	Ni	500	499.54	3136
K	2,000	1,995.56	3141a	V	500	499.79	3165
Mg	2,000	1,995.61	3131a	Cr	200	199.97	3112a
Na	2,000	1,995.63	3152a	Cu	200	199.98	3114
Al	1,000	989.06	3101a	Ag	100	99.44	3151
Ba	1,000	999.68	3104a	Be	100	99.16	3105a
Fe	1,000	995.89	3126a	Mn	100	100.03	3132
Co	500	500.41	3113	Zn	100	100.06	3168a

Spex Reference Multi: Lot # 1-58GM, 15-37AS, 11-171AS REF

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/14/05
DATE EXPIRED: 10/15/06
DATE OPENED: 10/14/05
INORG: 5429 PO: 0400070

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: OCT. — 2005 Certifying Officer: N. Kocherlakota

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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

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

010183

SPEXertificate ™

Certificate of Reference Material

Catalog Number: PLSB7-2X/2Y/2T **Lot No.** 11-02SB

Description: 1000 mg/L Antimony

Matrix: H2O / 0.6% Tart.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: 997 mg/L

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

Certified Value is Traceable to: NIST SRM #3102a

The CRM is prepared gravimetrically using high purity Antimony Metal Lot# 01041A. 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 nitric acid. Ignite and weigh as Sb2O4.

Instrumental Analysis by ICP spectrometer: 997 mg/L

Uncertified Properties:

Density: 1.003 @ 31.6 Degrees Celsius

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

Element	mg/L	Element	mg/L	Element	mg/L
Al	0.02	Cu	0.002	Pb	0.002
Ag	<0.001	Fe	35.00	Rb	<0.001
As	0.03	Ga	<0.001	Re	<0.001
Ba	0.005	In	<0.001	Sr	0.001
B	<0.50	K	0.90	Si	0.08
Bi	0.003	Li	<0.004	Ti	0.004
Be	<0.001	Mo	<0.001	Tl	0.01
Cr	<0.01	Mg	0.07	V	<0.004
Ca	4.00	Mn	<0.003	Zr	<0.001
Co	<0.001	Ni	<0.001	Zn	2.00
Cd	<0.001	Na	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.

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/14/05
DATE EXPIRED: 10/15/06
DATE OPENED: 10/14/05
INORG: 5430 PO: 0000010604

Date of Certification: OCT. -- 2005 Certifying Officer: N. Kocherlakota

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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 $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c=\sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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

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SPECertificate™

Certificate of Reference Material

Catalog Number: ICV-2C **Lot No.:** 29-176AS
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	499.69	3103a
Pb	500	499.61	3128
Se	500	499.91	3149
TL	500	499.92	3158
Cd	100	99.90	3108

Spex Reference Multi: Lot #11-34AS, 1-57MG, 15-39AS Reff

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DATE RECEIVED: 10/14/05
DATE EXPIRED: 10/15/06
DATE OPENED: 10/14/05
INORG: 5428 PO: 20070723

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: OCT. -- -- 2005 Certifying Officer: N. Kocherlakota

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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:

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Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.
The mathematical expression $k_s=s^2m$ is employed to determine the sampling size
s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)
m = the sub-sampling mass
k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as
X = x+/-U where X =True value (Labeled Value), U= Expanded uncertainty
$U=ku_c$ 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 $u_c = \sqrt{\Sigma u_i^2}$

Certification Traveler Report:

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

Legal Notice:

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inorganic ventures / iv labs

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

certificate of analysis

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

2.0 **DESCRIPTION OF CRM** Custom-Grade **10000 µg/mL Aluminum in 5% (abs) HNO_3**

Catalog Number:	CGAL10-1, CGAL10-2, and CGAL10-5
Lot Number:	**X-AL04021**
Starting Material:	Al metal
Starting Material Purity (%):	99.997990
Starting Material Lot No	607116
Matrix:	5% (abs) HNO_3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 10,030 ± 19 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

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

$\sum s_i$ = 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** **10,030 ± 19 µg/mL**
ICP Assay NIST SRM 3101a Lot Number: 010808

Assay Method #2 **10,022 ± 21 µg/mL**
EDTA NIST SRM 928 Lot Number: 392110

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DATE RECEIVED: 9/23/05
DATE EXPIRED: 10/1/06
DATE OPENED: 9/27/05
INORG: 5405 PO: D20060435

pg. 1 of 4
5405

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.

s	Al		M	Dy	< 0.03378	O	Li	< 0.00020	M	Pr	< 0.00169	M	Te	< 0.16892
M	Sb	< 0.00282	M	Er	< 0.02815	M	Lu	< 0.00225	M	Re	< 0.00563	M	Tb	< 0.00169
M	As	< 0.05631	M	Eu	< 0.01689	O	Mg	0.00498	M	Rh	< 0.00563	M	Tl	< 0.00563
M	Ba	< 0.05631	M	Gd	< 0.00563	M	Mn	< 0.02252	M	Rb	< 0.00563	M	Th	< 0.00563
O	Be	< 0.00017	M	Ga	< 0.00563	O	Hg	< 0.00700	M	Ru	< 0.01126	M	Tm	< 0.00225
M	Bi	< 0.00225	M	Ge	< 0.03378	M	Mo	< 0.01126	M	Sm	< 0.00563	M	Sn	< 0.02815
O	B	0.01173	M	Au	< 0.01689	M	Nd	< 0.01126	M	Sc	< 0.05631	O	Ti	0.00213
M	Cd	< 0.01689	M	Hf	< 0.01126	O	Ni	< 0.00600	M	Se	< 0.04505	M	W	< 0.05631
O	Ca	0.01013	M	Ho	< 0.00282	M	Nb	< 0.00282	O	Si	0.07462	M	U	< 0.01126
M	Ce	< 0.02815	M	In	< 0.05631	n	Os		M	Ag	< 0.01126	M	V	< 0.01126
M	Cs	< 0.00169	M	Ir	< 0.02815	M	Pd	< 0.02815	O	Na	0.06396	M	Yb	< 0.00563
O	Cr	0.00533	O	Fe	0.00586	O	P	< 0.03000	M	Sr	< 0.00282	M	Y	< 0.22523
M	Co	< 0.01689	M	La	< 0.00282	M	Pt	< 0.01126	O	S	< 0.10000	M	Zn	0.00450
M	Cu	< 0.03378	M	Pb	< 0.01689	O	K	0.01208	M	Ta	< 0.03942	M	Zr	< 0.02815

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 - 26.98154; +3; 6; $Al(H_2O)_6^{+3}$

Chemical Compatibility - Soluble in HCl, HNO_3, HF and H_2SO_4. Avoid neutral media. Soluble in strongly basic NaOH forming the $Al(OH)_4(H_2O)_2^{1-}$ 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^0);
γ- Al_2O_3 (Soluble in acids such as HCl); Ores (Carbonate fusion in Pt^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)
ICP-OES 394.401 nm	0.05 / 0.006 µg/mL	1	atom	U, Ce
ICP-OES 396.152 nm	0.03 / 0.006 µg/mL	1	atom	Mg, Zr, Ce
ICP-OES 167.078 nm	0.1 / 0.009 µg/mL	1	ion	Fe
ICP-MS 27 amu	30 ppt	n/a	M^+	$^{12}C^{15}N$, $^{13}C^{14}N$, $^{1}H^{12}C^{14}N$, $^{11}B^{16}O$, $^{54}Cr^{3+}$, $^{54}Fe^{2+}$

8.0 HAZARDOUS INFORMATION

- Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY

- This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

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

10.3 **ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"**
- Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 **10CFR50 Appendix B - Nuclear Regulatory Commission**
- Domestic Licensing of Production and Utilization Facilities

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

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

3 of 4
5405

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: December 28, 2004

Expiration Date: EXPIRES 1/2006

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

INORGANIC VENTURES
195 Lehigh Avenue, Suite 4
Lakewood, New Jersey 08701 · USA
inorganicventures.com
tel: 800.669.6799 · 732.901.1900
fax: 732.901.1903
info@inorganicventures.com

010191

CERTIFICATE OF ANALYSIS

1.0 **INORGANIC VENTURES** is an ISO Guide 34:2000 registered Certified Reference Material (CRM) Manufacturer (Certificate #883-02). The certificate is deigned and the data is determined in accordance with ISO Guide 31:2000 (Reference Materials-Contents of Certificates and Labels), 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 Principals."

2.0 DESCRIPTION OF CRM — 10000 µg/mL Calcium in 1.4% (abs) HNO3

Catalog Number:	CGCA10-1, CGCA10-2, and CGCA10-5
Lot Number:	**Y-CA03038**
Starting Material:	CaO
Starting Material Purity (%):	99.999046
Starting Material Lot No:	C27L01
Matrix:	1.4% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/30/06
DATE EXPIRED: 3/1/2007 DR
DATE OPENED: 1/31/06
INORG: 5636 PO: E56681

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 10,010 ± 23 µg/mL 9653 ± 22 µg/g

Certified Density: 1.037 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\Sigma x1}{n}$ ($\bar{x}$) = mean
x1 = individual results
n = number of measurements

Uncertainty $(\pm) = \frac{2[(\Sigma s1)2]^{1/2}}{(n)^{1/2}}$ $\Sigma s1$ = The summation of all significant estimated errors (Most common are the errors from instrumental measurement weighting, 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 an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **10,046 ± 35 µg/mL** **9688 ± 34 µg/g**
ICP Assay NIST SRM 3109a Lot Number: 000622

Assay Method #2 **10,010 ± 23 µg/mL** **9653 ± 22 µg/g**
EDTA NIST SRM 928 Lot Number: 928

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A glassware used in the manufacture and quality control of CRM's.

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

CRM's 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.

O Al < 0.00090	M Dy < 0.04250	O Li < 0.00002	M Pr < 0.00213	M Te < 0.21248
M Sb < 0.00354	M Er < 0.03541	M Lu < 0.00283	M Re < 0.00708	M Tb < 0.00213
M As < 0.07082	M Eu < 0.02125	O Mg 0.05319	M Rh < 0.00708	M Tl < 0.00708
O Ba 0.00038	M Gd < 0.00708	O Mn 0.00029	M Rb < 0.00708	M Th < 0.00708
O Be < 0.00009	M Ga < 0.00708	O Hg < 0.01100	M Ru < 0.01417	M Tm < 0.00283
M Bi < 0.00283	M Ge < 0.04250	M Mo < 0.01417	M Sm < 0.00708	M Sn < 0.03541
O B < 0.00054	M Au < 0.02125	M Nd < 0.01417	O Sc < 0.00002	M Ti < 0.35413
O Cd < 0.00450	M Hf < 0.01417	O Ni < 0.00230	O Se < 0.00620	M W < 0.07082
s Ca	M Ho < 0.00354	M Nb < 0.00354	O Si 0.00228	M U < 0.01417
M Ce < 0.03541	O In < 0.00200	n Os	M Ag < 0.01417	O V < 0.00090
M Cs < 0.00213	M Ir < 0.03541	M Pd < 0.03541	O Na 0.00950	M Yb < 0.00708
O Cr < 0.00080	O Fe < 0.00110	O P < 0.00480	O Sr 0.02849	M Y < 0.28330
O Co < 0.00120	M La < 0.00354	M Pt < 0.01417	O S < 0.02500	O Zn 0.00874
O Cu < 0.00400	M Pb < 0.02125	O K < 0.00170	M Ta < 0.04958	M Zr < 0.03541

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

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7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 40.078; +2; 6; Ca(H2O)6+2

Chemical Compatibility - Soluble in HCl and HNO3. Avoid H2SO4, HF, H3PO4 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 1-10% HNO3 / LDPE container.

Ca Containing Samples (Preparation and Solution) - Metal (best dissolved in diluted HNO3); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (dry ash and dissolution in dilute HCl. Do not heat when dissolving to avoid precipitation of SiO2) .The oxide, hydroxide, carbonate, phosphate, and fluoride of calcium are soluble in % levels of HCl or HNO3. The sulfates (gypsum, anhydrite, etc.), certain silicates and complex compounds require fusion with Na2CO3 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/axial view):

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe)
ICP-OES 393.366 nm	0.0002 / 0.00004 µg/mL	1	ion	U, Ce
ICP-OES 396.847 nm	0.0005 / 0.00006 µg/mL	1	ion	Th
ICP-OES 422.673 nm	0.01 / 0.001 µg/mL	1	atom	Ge
ICP-MS 44 amu	1200 ppt	n/a	M+	16O212C, 28Si16O, 88Sr

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)

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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 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 Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: May 09, 2005

Expiration Date: EXPIRES 01 MAR 2007

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, PhD., Technical Director

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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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **10000 µg/mL Iron in 4.8% (abs) HNO_3**

Catalog Number:	CGFE10-1, CGFE10-2, and CGFE10-5
Lot Number:	**X-FE03041**
Starting Material:	Fe metal
Starting Material Purity (%):	99.998667
Starting Material Lot No	23387
Matrix:	4.8% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/2006 DR
DATE OPENED: 2/28/05
INORG: 5048 PO: F55148

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 10,041 ± 21 µg/mL

Certified Density: 1.061 g/mL (measured at 22° C)

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

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

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** **10,041 ± 21 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

Assay Method #2 **10,017 ± 40 µg/mL**
ICP Assay NIST SRM 3126a Lot Number: 000606

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al	< 0.00270	M	Dy	< 0.02528	O	Li	< 0.00003	M	Pr	< 0.00126	M	Te	< 0.12640
M	Sb	< 0.00211	M	Er	< 0.02107	M	Lu	< 0.00169	M	Re	< 0.00421	M	Tb	< 0.00126
M	As	< 0.04213	M	Eu	< 0.01264	O	Mg	< 0.00006	M	Rh	< 0.00421	M	Tl	< 0.00421
M	Ba	< 0.04213	M	Gd	< 0.00421	O	Mn	< 0.05000	M	Rb	< 0.00421	M	Th	< 0.00421
O	Be	< 0.00005	M	Ga	< 0.00421	O	Hg	< 0.01100	M	Ru	< 0.00843	M	Tm	< 0.00169
M	Bi	< 0.00169	i	Ge		M	Mo	< 0.00843	M	Sm	< 0.00421	M	Sn	< 0.02107
O	B	< 0.00090	M	Au	< 0.01264	M	Nd	< 0.00843	M	Sc	< 0.04213	M	Ti	< 0.21066
M	Cd	< 0.01264	M	Hf	< 0.00843	O	Ni	< 0.00230	M	Se	< 0.03371	M	W	< 0.04213
O	Ca	0.03107	M	Ho	< 0.00211	M	Nb	< 0.00211	O	Si	0.01673	M	U	< 0.00843
M	Ce	< 0.02107	M	In	< 0.04213	n	Os		M	Ag	< 0.00843	M	V	< 0.00843
M	Cs	< 0.00126	M	Ir	< 0.02107	M	Pd	< 0.02107	O	Na	0.00956	M	Yb	< 0.00421
M	Cr	< 0.02107	s	Fe		i	P		M	Sr	< 0.00211	M	Y	< 0.16853
O	Co	0.01195	M	La	< 0.00211	M	Pt	< 0.00843	O	S	< 0.07200	M	Zn	0.08761
M	Cu	< 0.02528	M	Pb	< 0.01264	O	K	0.00239	M	Ta	< 0.02949	M	Zr	< 0.02107

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 - 55.847; +3; 6; $Fe(H_2O)_6^{3+}$

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 µg/mL	1	ion	Ru, Co
ICP-OES	239.562 nm	0.005 / 0.001 µg/mL	1	ion	Co, W, Cr
ICP-OES	259.940 nm	0.006 / 0.001 µg/mL	1	ion	Hf, Nb
ICP-MS	56 amu	970 ppt	n/a	M'	$^{40}Ar^{16}N^{1}H$, $^{40}Ar^{16}O$, $^{40}Ar^{17}O^{1}H$, $^{38}Ar^{18}O$, $^{37}Cl^{18}O^{1}H$, $^{40}Ca^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"
- Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission
- Domestic Licensing of Production and Utilization Facilities

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

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

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 22, 2004

Expiration Date: EXPIRES 1 M 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

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2 of 4

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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 Statisical 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:	**Y-K02129**
Starting Material:	KNO3
Starting Material Purity (%):	99.998112
Starting Material Lot No	B19P01
Matrix:	1.4% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/28/05
DATE EXPIRED: 12/01/06 (2)
DATE OPENED: 11/29/05
INORG: 5471 PO: D20024720

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 9983 ± 5 µg/mL 9759 ± 5 µg/g

Certified Density: 1.023 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\Sigma x_1}{n}$

$(\bar{x})$ = mean
x_1 = individual results
n = number of measurements

Uncertainty $(\pm) = \frac{2[(\Sigma s_1)^2]^{1/2}}{(n)^{1/2}}$

Σs_1 = 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 an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **9926 ± 36 µg/mL 9703 ± 35 µg/g**
ICP Assay NIST SRM 3141a Lot Number: 891312

Assay Method #2 **9983 ± 5 µg/mL 9759 ± 5 µg/g**
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 CRM's.

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

CRM's 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.

O Al 0.00072	M Dy < 0.00597	O Li < 0.00001	M Pr < 0.00030	M Te < 0.02986
M Sb < 0.00050	M Er < 0.00498	M Lu < 0.00040	M Re < 0.00100	M Tb < 0.00030
M As < 0.00995	M Eu < 0.00299	O Mg 0.00068	M Rh < 0.00100	M Tl < 0.00100
M Ba < 0.00995	M Gd < 0.00100	O Mn 0.00020	M Rb 0.55238	M Th < 0.00100
O Be < 0.00003	M Ga < 0.00100	O Hg < 0.00255	M Ru < 0.00199	M Tm < 0.00040
M Bi < 0.00040	O Ge < 0.00026	M Mo < 0.00199	M Sm < 0.00100	M Sn < 0.00498
O B < 0.00010	O Au < 0.00051	M Nd < 0.00199	O Sc < 0.00002	O Ti < 0.00012
M Cd < 0.00299	M Hf < 0.00199	O Ni < 0.00039	O Se < 0.00851	M W < 0.00995
O Ca 0.00357	M Ho < 0.00050	M Nb < 0.00050	O Si < 0.00058	M U < 0.00199
M Ce < 0.00498	M In < 0.00995	n Os	M Ag < 0.00199	O V < 0.00015
M Cs < 0.00030	M Ir < 0.00498	M Pd < 0.00498	O Na 0.15315	M Yb < 0.00100
M Cr < 0.00498	O Fe 0.00048	O P < 0.00043	M Sr < 0.00050	M Y < 0.03981
M Co < 0.00299	M La < 0.00050	M Pt < 0.00199	O S < 0.01225	O Zn 0.00068
M Cu < 0.00597	M Pb 0.08559	s K	M Ta < 0.00697	M Zr < 0.00498

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 - 29.0983; +1; (6); K^+(aq)
(Coordination Number in parentheses is assumed, not certain.)

Chemical Compatibility - Soluble in HCl, HNO_3, H_2SO_4 and HF aqueous matrices. Avoid use of $HClO_4$ due to insolubility of the perchlorate. Stable with all metals and inorganic anions except ClO_4^-.

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.

K Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Sodium carbonate fusion in Pt^0 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)
ICP-OES 766.490 nm	0.4 / 0.001 µg/mL	1	atom	2nd order radiation from R.E s on some optical designs
ICP-OES 771.531 nm	1.0 / 0.03 µg/mL	1	atom	2nd order radiation from R.E s on some optical designs
ICP-OES 404.721 nm	1.1 / 0.05 µg/mL	1	atom	U, Ce,
ICP-MS 39 amu	10 ppt	n/a	M^+	^{38}ArH, $^{23}Na^{16}O$, ^{78}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 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 Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: October 17, 2005

Expiration Date:

EXPIRES
01 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager Katalin Le

Certifying Officer: Paul Gaines, PhD., Technical Director Paul R Gaines

010203

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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade **10000 µg/mL Magnesium in 1.4% (abs) HNO_3**

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) HNO_3

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:

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

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

$(\bar{x})$ = 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** **10,039 ± 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

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 7/22/05
DATE EXPIRED: 8/1/06
DATE OPENED: 7/22/05
INORG: 5312 PO: F55213

Pg. 1 of 4
5312

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.

O	Al		0.04714	M	Dy	<	0.03601	O	Li		0.00623	M	Pr	<	0.00180	M	Te	<	0.18002
M	Sb	<	0.00300	M	Er	<	0.03000	M	Lu	<	0.00240	M	Re	<	0.00600	M	Tb	<	0.00180
M	As	<	0.06001	M	Eu	<	0.01800	s	Mg			M	Rh	<	0.00600	M	Tl	<	0.00600
M	Ba	<	0.06001	M	Gd	<	0.00600	O	Mn		0.07408	M	Rb	<	0.00600	M	Th	<	0.00600
O	Be	<	0.00017	M	Ga	<	0.00600	O	Hg	<	0.00900	M	Ru	<	0.01200	M	Tm	<	0.00240
M	Bi	<	0.00240	M	Ge	<	0.03601	M	Mo	<	0.01200	M	Sm	<	0.00600	M	Sn	<	0.03000
O	B		0.00303	M	Au	<	0.01800	M	Nd	<	0.01200	M	Sc	<	0.06001	O	Ti		0.09765
M	Cd	<	0.01800	M	Hf	<	0.01200	O	Ni		0.01229	M	Se	<	0.04801	M	W	<	0.06001
O	Ca		0.14984	M	Ho	<	0.00300	M	Nb	<	0.00300	O	Si		0.02357	M	U	<	0.01200
M	Ce	<	0.03000	M	In	<	0.06001	n	Os			M	Ag	<	0.01200	M	V	<	0.01200
M	Cs	<	0.00180	M	Ir	<	0.03000	M	Pd	<	0.03000	O	Na		0.02189	M	Yb	<	0.00600
O	Cr		0.02189	O	Fe		0.03704	O	P	<	0.01600	M	Sr	<	0.00300	M	Y		0.02021
M	Co	<	0.01800	M	La	<	0.00300	M	Pt	<	0.01200	n	S			O	Zn		0.00572
O	Cu		0.00674	O	Pb		0.02694	O	K	<	0.05000	M	Ta	<	0.04201	M	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 ± 4°C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 24.305; +2; 6; $Mg(H_2O)_6^{+2}$

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 Pt^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 ≈ concs.)
ICP-OES	279.553 nm	0.0002 / 0.00003 µg/mL	1	ion	Th
ICP-OES	280.270 nm	0.0003 / 0.00005 µg/mL	1	ion	U, V
ICP-OES	285.213 nm	0.002 / 0.00003 µg/mL	1	atom	U, Hf, Cr, Zr
ICP-MS	24 amu	42 ppt	n/a	M'	$^7Li^{18}O$, $^{48}Ti^{12}$, $^{48}Ca^{12}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

010206

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
1/02/06

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 R Gaines

010207

inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM

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

Catalog Number:	CGNA10-1, CGNA10-2, and CGNA10-5
Lot Number:	**X-QNA02148**
Starting Material:	Na2CO3
Starting Material Purity (%):	99.999819
Starting Material Lot No:	42063
Matrix:	1.4% (abs) HNO3

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:

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

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

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

4.1 **Assay Method #1** **10,019 ± 33 µg/mL**
ICP Assay NIST SRM 3152a Lot Number: 990907

Assay Method #2 **10,006 ± 6 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 7/22/05
DATE EXPIRED: 8/1/06
DATE OPENED: 7/22/05 (8)
INORG: 5310 PO: 155213

1 of 4
5310

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.

O	Al	< 0.00090	M	Dy	< 0.00600	O	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	O	Mg	0.00010	M	Rh	< 0.00100	M	Tl	< 0.00100
M	Ba	< 0.00999	M	Gd	< 0.00100	O	Mn	< 0.00003	M	Rb	< 0.00100	M	Th	< 0.00100
O	Be	< 0.00020	M	Ga	< 0.00100	O	Hg	< 0.01500	M	Ru	< 0.00200	M	Tm	< 0.00040
M	Bi	< 0.00040	O	Ge	< 0.00150	M	Mo	< 0.00200	M	Sm	< 0.00100	M	Sn	< 0.00500
O	B	< 0.00060	O	Au	< 0.00300	M	Nd	< 0.00200	O	Sc	< 0.00002	O	Ti	< 0.00070
M	Cd	< 0.00300	M	Hf	< 0.00200	O	Ni	< 0.00230	O	Se	< 0.05000	M	W	< 0.00999
O	Ca	0.00050	M	Ho	< 0.00050	M	Nb	< 0.00050	O	Si	< 0.00340	M	U	< 0.00200
M	Ce	< 0.00500	M	In	< 0.00999	n	Os		M	Ag	< 0.00200	O	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	O	Fe	< 0.00110	O	P	< 0.04000	M	Sr	< 0.00050	M	Y	< 0.03997
M	Co	< 0.00300	M	La	< 0.00050	M	Pt	< 0.00200	O	S	< 0.07200	O	Zn	0.00250
O	Cu	< 0.00140	M	Pb	< 0.00300	O	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, HNO_3, H_2SO_4 and HF aqueous matrices. Stable with all metals and inorganic anions.
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.
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)
ICP-OES	589.595 nm	0.07 / 0.00009 µg/mL	1	atom	2nd order radiation from R.E.s on some optical designs
ICP-OES	588.995 nm	0.03 / 0.006 µg/mL	1	atom	2nd order radiation from R.E.s on some optical designs
ICP-OES	330.237 nm	2.0 / 0.09 µg/mL	1	atom	Pd, Zn
ICP-MS	23 amu	310 ppt	n/a	M^{+}	$^{46}Ti^{+2}$, $^{46}Ca^{+2}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"
- Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission
- Domestic Licensing of Production and Utilization Facilities

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

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

010210

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 11, 2004

Expiration Date: EXPIRES 10 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul R Gaines

010211

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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Lithium in 0.07% (abs) HNO_3**

Catalog Number:	CGLI1-1, CGLI1-2, and CGLI1-5
Lot Number:	**X-LI02079**
Starting Material:	Li_2CO_3
Starting Material Purity (%):	99.997165
Starting Material Lot No	1123
Matrix:	0.07% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 5/19/05
DATE EXPIRED: 6/1/06
DATE OPENED: 5/19/05
INORG: 5244 PO: 55189

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 999 ± 3 µg/mL

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

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

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

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

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
$\sum s_i$ = 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** **999 ± 1 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

Assay Method #2 **999 ± 3 µg/mL**
ICP Assay NIST SRM 3129a Lot Number: 000505

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al		0.00120	M	Dy	<	0.01199	S	Li			M	Pr	<	0.00060	M	Te	<	0.05994
M	Sb	<	0.00100	M	Er	<	0.00999	M	Lu	<	0.00080	M	Re	<	0.00200	M	Tb	<	0.00060
M	As	<	0.01998	M	Eu	<	0.00599	O	Mg		0.00650	M	Rh	<	0.00200	M	Tl	<	0.00200
M	Ba	<	0.01998	M	Gd	<	0.00200	O	Mn		0.00006	M	Rb	<	0.00200	M	Th	<	0.00200
O	Be	<	0.00020	M	Ga	<	0.00200	O	Hg	<	0.01500	M	Ru	<	0.00400	M	Tm	<	0.00080
M	Bi	<	0.00080	M	Ge	<	0.01199	M	Mo	<	0.00400	M	Sm	<	0.00200	O	Sn	<	0.00600
O	B		0.00020	M	Au	<	0.00599	M	Nd	<	0.00400	M	Sc	<	0.01998	O	Ti	<	0.00070
M	Cd	<	0.00599	M	Hf	<	0.00400	O	Ni	<	0.00230	M	Se	<	0.01598	O	W	<	0.00400
O	Ca		0.04050	M	Ho	<	0.00100	M	Nb	<	0.00100	O	Si		0.04650	M	U	<	0.00400
M	Ce	<	0.00999	O	In	<	0.00400	n	Os			M	Ag	<	0.00400	O	V		0.00009
M	Cs	<	0.00060	M	Ir	<	0.00999	M	Pd	<	0.00999	O	Na		0.03200	M	Yb	<	0.00200
M	Cr	<	0.00999	O	Fe		0.00200	O	P	<	0.00250	O	Sr		0.00026	M	Y	<	0.07992
M	Co	<	0.00599	M	La	<	0.00100	M	Pt	<	0.00400	O	S		0.01250	O	Zn		0.00145
O	Cu		0.00100	M	Pb	<	0.00599	O	K		0.00950	M	Ta	<	0.01399	M	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

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7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

010213

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 - 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, HNO_3, H_2SO_4 and HF aqueous matrices. Stable with all metals and inorganic anions.

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.

Li Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Sodium carbonate fusion in Pt^{0} 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)
ICP-OES 670.784 nm	0.002 / 0.00002 µg/mL	1	atom	2nd 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	**Sb, Th, Ni**
ICP-MS 7 amu	10 ppt		n/a	M

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

010214

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: December 10, 2004

Expiration Date: EXPIRES 01 JAN 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

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010215

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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Barium in 0.1% (abs) HNO_3**

Catalog Number:	CGBA1-1, CGBA1-2, and CGBA1-5
Lot Number:	**X-BA02027**
Starting Material:	$Ba(NO_3)_2$
Starting Material Purity (%):	99.999730
Starting Material Lot No	21879
Matrix:	0.1% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/18/05
DATE EXPIRED: 3/1/2006 DR
DATE OPENED: 2/18/05
INORG: 5027 PO: F55142

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1002 ± 3 µg/mL

Certified Density: 0.999 g/mL (measured at 22° C)

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

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

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

($\bar{x}$) = 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** **1002 ± 3 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

Assay Method #2 **996 ± 4 µg/mL**
ICP Assay NIST SRM 3104a Lot Number: 992907

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5027

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.

O	Al		0.00011	M	Dy	<	0.01269	O	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	O	Tb	<	0.00390
M	As	<	0.02114	O	Eu	<	0.00040	O	Mg		0.00009	M	Rh	<	0.00211	M	Tl	<	0.00211
s	Ba			O	Gd	<	0.00052	M	Mn	<	0.00846	M	Rb	<	0.00211	M	Th	<	0.00211
M	Be	<	0.00106	M	Ga	<	0.00211	O	Hg	<	0.01200	M	Ru	<	0.00423	M	Tm	<	0.00085
M	Bi	<	0.00085	M	Ge	<	0.01269	M	Mo	<	0.00423	O	Sm	<	0.00071	M	Sn	<	0.01057
M	B	<	0.14800	M	Au	<	0.00634	O	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
O	Ca		0.00072	M	Ho	<	0.00106	M	Nb	<	0.00106	O	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	O	Fe		0.00062	O	P	<	0.00260	O	Sr		0.00379	O	Y		0.00040
M	Co	<	0.00634	M	La	<	0.00106	M	Pt	<	0.00423	O	S	<	0.02500	O	Zn	<	0.00039
M	Cu	<	0.01269	M	Pb		0.00020	O	K	<	0.00180	O	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

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7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 137.33; +2; 6; $Ba(H_2O)_6^{+2}$

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[ ] 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 = concs.)
ICP-OES 455.403 nm	0.002 / 0.0001 µg/mL	1	ion	Zr, U
ICP-OES 233.527 nm	0.004 / 0.0003 µg/mL	1	ion	
ICP-OES 230.424 nm	0.004 / 0.0005 µg/mL	1	ion	Mo, Ir, Co
ICP-MS 138 amu	1 ppt	n/a	M'	$^{122}Sn^{16}O$, $^{122}Te^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

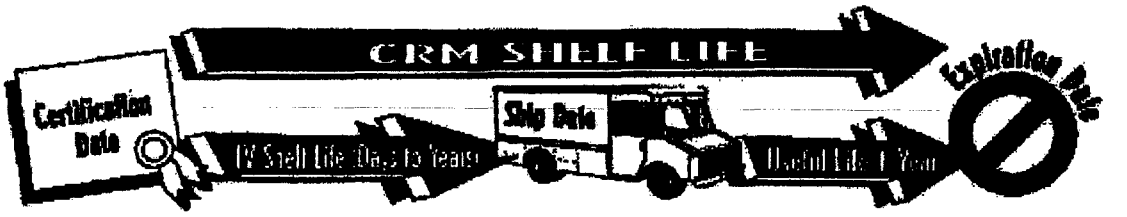
10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

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 05, 2004

Expiration Date:

EXPIRES
1 MAR 2006

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 R Gaines

010219

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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Beryllium in 2% (abs) HNO_3**

Catalog Number:	CGBE1-1, CGBE1-2, and CGBE1-5
Lot Number:	**Y-BE01107**
Starting Material:	Be(OOCCH3)2
Starting Material Purity (%):	99.999897
Starting Material Lot No	01-10-01
Matrix:	2% (abs) HNO_3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1008 ± 3 µg/mL

Certified Density: 1.022 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\sum x_1}{n}$

$(\bar{x})$ = mean
x_1 = individual results
n = number of measurements

Uncertainty $(\pm) = \frac{2[(\sum s_1)^2]^{1/2}}{(n)^{1/2}}$

$\sum s_1$ = 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** **1008 ± 3 µg/mL**
ICP Assay NIST SRM 3105a Lot Number: 892707

Assay Method #2 **1001 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 5/27/05
DATE EXPIRED: 6/1/06 (1y)
DATE OPENED: 5/27/05
INORG: 5253 PO: 55195

1 of 4
5253

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.

O	Al	< 0.00800	M	Dy	< 0.01305	O	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	O	Mg	< 0.00003	M	Rh	< 0.00218	M	Tl	< 0.00218
M	Ba	< 0.02175	M	Gd	< 0.00218	O	Mn	< 0.00002	M	Rb	< 0.00218	M	Th	< 0.00218
s	Be		M	Ga	< 0.00218	O	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
O	B	< 0.01200	M	Au	< 0.00652	M	Nd	< 0.00435	O	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
O	Ca	0.00164	M	Ho	< 0.00109	M	Nb	< 0.00109	O	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	O	Na	0.00368	M	Yb	< 0.00218
O	Cr	< 0.00900	O	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	O	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; $Be^{+}(H_2O)_4^{+2}$
Chemical Compatibility - Soluble in HCl, HNO_3, H_2SO_4 and HF aqueous matrices. Stable with all metals and inorganic anions.
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.
Be Containing Samples (Preparation and Solution) - Meta l(is best dissolved in diluted H_2SO_4); BeO (boiling nitric, hydrochloric, or sulfuric acids or $KHSO_4$ fusion); Ores (H_2SO_4/HF digestion or carbonate fusion in Pt^0); 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)
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 Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE). Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a 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 21, 2005

Expiration Date: EXPIRES 01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator — Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager — Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director — Paul R Gaines

010223

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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Chromium (+3) in 1.4% (abs) HNO3**

Catalog Number:	CGCR(3)1-1, CGCR(3)1-2, and CGCR(3)1-5
Lot Number:	**Y-CR02145**
Starting Material:	(NH4)2Cr2O7
Starting Material Purity (%):	99.997402
Starting Material Lot No:	D25M04
Matrix:	1.4% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/28/05
DATE EXPIRED: 12/01/06
DATE OPENED: 11/29/05
INORG: 5470 PO: DR0924720

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1006 ± 4 µg/mL 995 ± 4 µg/g

Certified Density: 1.011 g/mL (measured at 22° C)

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

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

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

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
Σs_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 an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **1006 ± 4 µg/mL 995 ± 4 µg/g (Avg 2 runs)**
ICP Assay NIST SRM 3112a Lot Number: 990607

Assay Method #2 **1004 ± 5 µg/mL 984 ± 5 µg/g (Avg. 2 runs)**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

1 of 4
5470

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 CRM's.

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

CRM's 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.

O	Al	< 0.00090	M	Dy	< 0.00598	O	Li	< 0.00002	M	Pr	< 0.00030	M	Te	< 0.02989
M	Sb	< 0.00050	M	Er	< 0.00498	M	Lu	< 0.00040	M	Re	< 0.00100	M	Tb	< 0.00030
M	As	< 0.00996	M	Eu	< 0.00299	O	Mg	< 0.00030	M	Rh	< 0.00100	M	Tl	< 0.00100
M	Ba	< 0.00996	M	Gd	< 0.00100	M	Mn	< 0.00399	M	Rb	< 0.00100	M	Th	< 0.00100
M	Be	< 0.00050	M	Ga	0.00080	O	Hg	< 0.01500	M	Ru	< 0.00199	M	Tm	< 0.00040
M	Bi	< 0.00040	M	Ge	< 0.00598	M	Mo	< 0.00199	M	Sm	< 0.00100	M	Sn	< 0.00498
O	B	< 0.01000	M	Au	< 0.00299	M	Nd	< 0.00199	M	Sc	< 0.00996	O	Ti	< 0.00100
M	Cd	< 0.00299	M	Hf	< 0.00199	M	Ni	< 0.00797	M	Se	< 0.00797	M	W	< 0.00996
O	Ca	0.00120	M	Ho	< 0.00050	M	Nb	< 0.00050	O	Si	0.00600	M	U	< 0.00199
M	Ce	< 0.00498	M	In	< 0.00996	n	Os		M	Ag	< 0.00199	O	V	< 0.02000
M	Cs	< 0.00030	M	Ir	< 0.00498	M	Pd	< 0.00498	O	Na	0.01700	M	Yb	< 0.00100
S	Cr		O	Fe	< 0.01000	O	P	< 0.04000	M	Sr	< 0.00050	M	Y	< 0.03985
M	Co	< 0.00299	M	La	< 0.00050	M	Pt	< 0.00199	i	S		O	Zn	< 0.00400
M	Cu	< 0.00598	M	Pb	0.05579	O	K	0.12000	M	Ta	< 0.00697	M	Zr	< 0.00498

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 cont return portions removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 51.9961; +3; 6; $Cr(H_2O)_6^{3+}$
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, HF, H_3PO_4. Avoid basic media. Stable with most me anions in acidic media.
Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically 1-5% HNO_3 / LDPE container.
Cr Containing Samples (Preparation and Solution) - Metal (soluble in HCl); Oxides/Ores (Chrome ore/oxides dissolve. The following procedures [A-D] are commonly used:

A. Fusion with $KHSO_4$ and extraction with hot KCl. The residue fused with Na_2CO_3 and $KClO_3$, 3:1.
B. Fusion with $NaKSO_4$ and NaF, 2:1.
C. Fusion with magnesia or lime and sodium or potassium carbonates, 4:1.
D. Fusion with Na_2O_2 or NaOH and KNO_3 or NaOH and Na_2O_2.

Nickel, iron, copper, or silver crucibles should be used for D. Platinum may be used for **A, B and C**); Organic Matrices (Ash at 450? C followed by one of the fusion methods above or sulfuric/hydrogen peroxide acid applicable to **non oxide** containing samples) .
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)
ICP-OES	205.552 nm	0.006 / 0.0008 µg/mL	1	ion	Os
ICP-OES	284.325 nm	0.008 / 0.0007 µg/mL	1	ion	
ICP-OES	276.654 nm	0.01 / 0.001 µg/mL	1	ion	Cu, Ta, V
ICP-MS	52 amu	40 ppt	n/a	M^+	$^{36}S^{16}O$, $^{36}Ar^{16}O$ - The ^{50}Cr, ^{53}Cr, ^{54}Cr lines suffer fro potential interferences from sulfur, chlorine and ar oxygen, nitrogen and carbon.

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)

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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 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 Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: September 21, 2005

Expiration Date: EXPIRES 01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager Katalin Le

Certifying Officer: Paul Gaines, PhD., Technical Director Paul R Gaines

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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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Copper in 2% (abs) HNO_3**

Catalog Number:	CGCU1-1, CGCU1-2, and CGCU1-5
Lot Number:	**X-CU02067**
Starting Material:	Cu shot
Starting Material Purity (%):	99.999437
Starting Material Lot No	K09C13
Matrix:	2% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/2006
DATE OPENED: 2/28/05 DR
INORG: 5049 PO: F55148

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1003 ± 3 µg/mL

Certified Density: 1.015 g/mL (measured at 22° C)

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

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

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

($\bar{x}$) = 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** **1003 ± 3 µg/mL**
EDTA NIST SRM 928 Lot Number: 392110

Assay Method #2 **1001 ± 2 µg/mL**
ICP Assay NIST SRM 3114 Lot Number: 891811

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

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

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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 - 63.546; +2; 6; $Cu(H_2O)_6^{2+}$

Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, HF, 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.

Cu Containing Samples (Preparation and Solution) - Metal (soluble in HNO_3); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO_3).

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	324.754 nm	0.06/.001 µg/mL	1	atom	Nb, U, Th, Mo, Hf
ICP-OES	224.700 nm	0.01/.001 µg/mL	1	ion	Pb, Ir, Ni, W
ICP-OES	219.958 nm	0.01/.002 µg/mL	1	atom	Th, Ta, Nb, U, Hf
ICP-MS	63 amu	10 ppt	n/a	M'	$^{45}Al^{23}Na$ $^{47}Ti^{16}O$, $^{14}N^{12}C^{35}Cl$, $^{16}O^{12}C^{35}Cl$, $^{40}Ca^{16}O$, $^{23}Na^{40}Ca$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

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

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

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

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

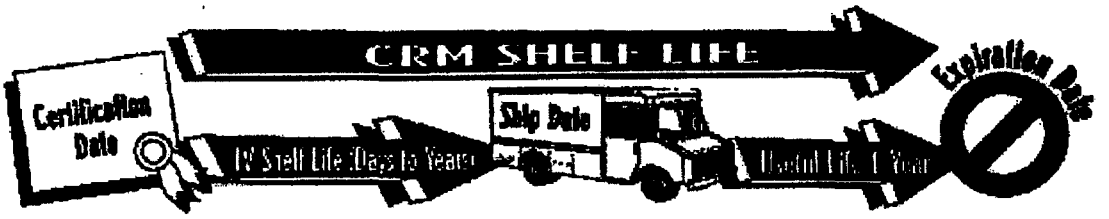
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a 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 16, 2004

Expiration Date: EXPIRES 1 MAR 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul Gaines

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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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Nickel in 1.4% (abs) HNO_3**

Catalog Number:	CGNI1-1, CGNI1-2, and CGNI1-5
Lot Number:	**X-NI02032**
Starting Material:	Ni pieces
Starting Material Purity (%):	99.999371
Starting Material Lot No	L06L02
Matrix:	1.4% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/2006
DATE OPENED: 3/28/05
INORG: 5043 PO: F55148

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1002 ± 3 µg/mL

Certified Density: 1.011 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:

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

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

($\bar{x}$) = 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** **999 ± 3 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

Assay Method #2 **1002 ± 3 µg/mL**
ICP Assay NIST SRM 3136 Lot Number: 000612

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1 of 1

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.

O	Al	< 0.00938	M	Dy	< 0.06577	O	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
O	As	< 0.01689	M	Eu	< 0.03289	O	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
O	Be	< 0.00626	M	Ga	< 0.01096	O	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	< 0.05481
O	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		O	Se	< 0.01877	M	W	< 0.10962
O	Ca	< 0.01157	M	Ho	< 0.00548	M	Nb	< 0.00548	O	Si	0.00188	M	U	< 0.02192
M	Ce	< 0.05481	M	In	< 0.10962	n	Os		M	Ag	< 0.02192	M	V	< 0.02192
M	Cs	< 0.00329	M	Ir	< 0.05481	M	Pd	< 0.05481	O	Na	0.00102	M	Yb	< 0.01096
M	Cr	< 0.05481	O	Fe	0.00156	O	P	< 0.31280	M	Sr	< 0.00548	M	Y	< 0.43849
O	Co	0.00182	M	La	< 0.00548	M	Pt	< 0.02192	O	S	< 0.07820	M	Zn	0.00189
M	Cu	< 0.06577	M	Pb	< 0.03289	O	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; $Ni(H_2O)_6^{2+}$
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, HF, 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.
Ni Containing Samples (Preparation and Solution) - Metal (Soluble in HNO_3); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO_3).
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	221.647 nm	0.01 / 0.0009 µg/mL	1	ion	Si
ICP-OES	232.003 nm	0.02 / 0.006 µg/mL	1	atom	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+	$^{40}Ca^{16}O^{1}H$, $^{44}Ca^{16}O$, $^{23}Na^{37}Cl$

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8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a 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 27, 2004

Expiration Date: EXPIRES 1 MAR 2006

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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

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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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Cadmium in 2% (abs) HNO_3**

Catalog Number:	CGCD1-1, CGCD1-2, and CGCD1-5
Lot Number:	**Y-QCD01109**
Starting Material:	Cd shot
Starting Material Purity (%):	99.998904
Starting Material Lot No	C14M30
Matrix:	2% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/2006
DATE OPENED: 2/28/05
INORG: 5041 PO: F55747

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1000 ± 3 µg/mL

DOC # 16214

Certified Density: 1.013 g/mL (measured at 22° C)

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

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

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

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

Σs_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** **1002 ± 3 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

Assay Method #2 **1000 ± 3 µg/mL**
ICP Assay NIST SRM 3108 Lot Number: 890312

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al	< 0.00090	M	Dy	< 0.01191	O	Li	< 0.00002	M	Pr	< 0.00060	O	Te	< 0.00700
M	Sb	0.00039	M	Er	< 0.00993	M	Lu	< 0.00079	M	Re	< 0.00199	M	Tb	< 0.00060
M	As	< 0.01985	M	Eu	< 0.00596	O	Mg	0.00002	M	Rh	< 0.00199	M	Tl	< 0.00199
M	Ba	< 0.01985	M	Gd	< 0.00199	M	Mn	< 0.00794	M	Rb	< 0.00199	M	Th	< 0.00199
M	Be	< 0.00099	M	Ga	< 0.00199	O	Hg	< 0.01200	M	Ru	< 0.00397	M	Tm	< 0.00079
M	Bi	< 0.00079	M	Ge	< 0.01191	M	Mo	< 0.00397	M	Sm	< 0.00199	M	Sn	< 0.00993
O	B	< 0.00900	M	Au	< 0.00596	M	Nd	< 0.00397	M	Sc	< 0.01985	M	Ti	< 0.09925
s	Cd		M	Hf	< 0.00397	O	Ni	< 0.00300	M	Se	< 0.01588	M	W	< 0.01985
O	Ca	0.00378	M	Ho	< 0.00099	M	Nb	< 0.00099	O	Si	< 0.00340	M	U	< 0.00397
M	Ce	< 0.00993	O	In	< 0.00200	n	Os		M	Ag	< 0.00397	M	V	< 0.00397
M	Cs	< 0.00060	M	Ir	< 0.00993	M	Pd	0.00691	M	Na	< 0.19849	M	Yb	< 0.00199
M	Cr	< 0.00993	O	Fe	< 0.00110	O	P	< 0.00300	M	Sr	< 0.00099	M	Y	< 0.07940
M	Co	< 0.00596	M	La	< 0.00099	M	Pt	< 0.00397	O	S	< 0.03000	O	Zn	0.00040
M	Cu	< 0.01191	M	Pb	< 0.00596	O	K	0.00015	M	Ta	< 0.01389	M	Zr	< 0.00993

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

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

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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
removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 112.41; +2; 4 ;$Cd_2(OH)(aq)^{3+}$ and Cd(C
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, and HF. Avoid basic media forming insoluble carbonate and hyc
most metals and inorganic anions in acidic media. The sulfide, carbonate, oxalate, phosphate, and cyanide are insoluble i
in HCl, HNO_3 and NH_4OH. The chloride, bromide and iodide are soluble in water. CdI_2 is one of the fewiodides soluble i
compounds of Cd are soluble in excess NaI, due to the formation of the complex ion, CdI_4^{-2}.
Stability - 2-100 ppb levels stable for months in 1% HNO_3/ LDPE container. 1-10,000 ppm solutions chemically stable fo
HNO_3/LDPE container.
Cd Containing Samples (Preparation and Solution) - Metal (soluble in HNO_3); Oxides (Soluble in HCl or HNO_3); Ores
HNO_3then take to fumes with H_2SO_4. The silica and lead sulfate are filtered off after addition of water.); Organic based (c
and dissolve ash in HCl) (sulfuric/peroxide acid 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)
ICP-OES	214.438 nm	0.003 / 0.0003 µg/mL	1	ion	Pt, Ir
ICP-OES	228.802 nm	0.003 / 0.0003 µg/mL	1	atom	Co, Ir, As, Pt
ICP-OES	226.502 nm	0.003 / 0.0003 µg/mL	1	ion	Ir
ICP-MS	111 amu	11 ppt	n/a	M^+	$^{95}Mo^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010238

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 19, 2005

Expiration Date: EXPIRES 1/19/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

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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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Cobalt in 2% (abs) HNO_3**

Catalog Number:	CGCO1-1, CGCO1-2, and CGCO1-5
Lot Number:	**X-CO01123**
Starting Material:	Co powder
Starting Material Purity (%):	99.999403
Starting Material Lot No	23171
Matrix:	2% (abs) HNO_3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/06 DR
DATE OPENED: 2/28/05
INORG: 5044 PO: F55148

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1003 ± 2 µg/mL

Certified Density: 1.016 g/mL (measured at 22° C)

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

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

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** **1007 ± 5 µg/mL**
ICP Assay NIST SRM 3181 Lot Number: 000630

Assay Method #2 **1003 ± 2 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al	0.00030	M	Dy	< 0.02394	O	Li	0.00001	M	Pr	< 0.00120	M	Te	< 0.11970
M	Sb	< 0.00200	M	Er	< 0.01995	M	Lu	< 0.00160	M	Re	< 0.00399	M	Tb	< 0.00120
O	As	< 0.10000	M	Eu	< 0.01197	O	Mg	0.00128	M	Rh	< 0.00399	M	Tl	< 0.00399
M	Ba	< 0.03990	M	Gd	< 0.00399	O	Mn	< 0.00400	M	Rb	< 0.00399	M	Th	< 0.00399
M	Be	< 0.00200	M	Ga	< 0.00399	O	Hg	< 0.05000	M	Ru	< 0.00798	M	Tm	< 0.00160
M	Bi	0.00020	M	Ge	< 0.02394	M	Mo	< 0.00798	M	Sm	< 0.00399	M	Sn	< 0.01995
O	B	0.00103	M	Au	< 0.01197	M	Nd	< 0.00798	M	Sc	< 0.03990	M	Ti	< 0.19949
M	Cd	< 0.01197	M	Hf	< 0.00798	O	Ni	< 0.02000	M	Se	< 0.03192	M	W	< 0.03990
O	Ca	0.00168	M	Ho	< 0.00200	M	Nb	< 0.00200	O	Si	< 0.00400	M	U	< 0.00798
M	Ce	< 0.01995	M	In	< 0.03990	n	Os		M	Ag	< 0.00798	M	V	< 0.00798
M	Cs	< 0.00120	M	Ir	< 0.01995	M	Pd	< 0.01995	O	Na	0.00095	M	Yb	< 0.00399
M	Cr	0.00080	O	Fe	< 0.00400	n	P		M	Sr	< 0.00200	M	Y	< 0.15960
s	Co		M	La	< 0.00200	M	Pt	< 0.00798	n	S		O	Zn	0.00020
M	Cu	0.00023	M	Pb	0.00150	O	K	0.00048	M	Ta	< 0.02793	M	Zr	< 0.01995

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 - 58.9332; +2; 6; $Co(H_2O)_6^{2+}$
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, HF, 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.
Co Containing Samples (Preparation and Solution) - Metal (soluble in HNO_3); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO_3).
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	238.892 nm	0.01/.002 µg/mL	1	ion	Fe, W, Ta
ICP-OES	228.616 nm	0.01/.001µg/mL	1	ion	
ICP-OES	237.862 nm	0.01/.002 µg/mL	1	ion	W, Re, Al, Ta
ICP-MS	59 amu	2 ppt	n/a	M+	$^{43}Ca^{16}O^{1}H$, $^{40}Ar^{16}O^{1}H$, $^{40}Ar^{19}Na$, $^{43}Ca^{16}O$, $^{25}Mg^{34}Cl$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of 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 perfomed 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 30, 2004

Expiration Date: EXPIRES 1 MAR 2006

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3 of 4

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 R Gaines

010243

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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Manganese in 2% (abs) HNO3**

Catalog Number:	CGMN1-1, CGMN1-2, and CGMN1-5
Lot Number:	**Y-MN02046**
Starting Material:	Mn pieces
Starting Material Purity (%):	99.949553
Starting Material Lot No:	G26P13
Matrix:	2% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/27/06
DATE EXPIRED: 3/1/2007
DATE OPENED: 1/27/06 DR
INORG: 5634 PO: F56650

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1009 ± 2 µg/mL

Certified Density: 1.014 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\Sigma x1}{n}$ ($\bar{x}$) = mean
x1 = individual results
n = number of measurements

Uncertainty $(\pm) = \frac{2[(\Sigma s1)2]^{1/2}}{(n)^{1/2}}$ $\Sigma s1$ = The summation of all significant estimated errors (Most common are the errors from instrumental measurement weighting, 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 an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **1003 ± 7 µg/mL**
ICP Assay NIST SRM 3132 Lot Number: 890903

Assay Method #2 **1009 ± 2 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

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1 of 4

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 CRM's.

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

CRM's 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.

O	Al	0.00075	M	Dy	< 0.02397	O	Li	< 0.00002	M	Pr	< 0.00120	M	Te	< 0.11985
M	Sb	0.00140	M	Er	< 0.01998	M	Lu	< 0.00160	M	Re	< 0.00400	M	Tb	< 0.00120
M	As	< 0.03995	M	Eu	< 0.01198	O	Mg	0.13054	M	Rh	< 0.00400	M	Tl	< 0.00400
M	Ba	< 0.03995	M	Gd	< 0.00400	s	Mn		M	Rb	< 0.00400	M	Th	< 0.00400
M	Be	< 0.00200	O	Ga	< 0.05000	i	Hg		M	Ru	< 0.00799	M	Tm	< 0.00160
M	Bi	< 0.00160	O	Ge	< 0.00300	M	Mo	0.00361	M	Sm	< 0.00400	M	Sn	< 0.01998
O	B	< 0.03700	M	Au	< 0.01198	M	Nd	< 0.00799	M	Sc	< 0.03995	O	Ti	< 0.00200
M	Cd	0.00120	M	Hf	< 0.00799	M	Ni	< 0.03196	M	Se	0.14041	M	W	< 0.03995
O	Ca	0.00603	M	Ho	< 0.00200	M	Nb	< 0.00200	O	Si	< 0.05000	M	U	< 0.00799
M	Ce	< 0.01998	M	In	< 0.03995	n	Os		M	Ag	< 0.00799	M	V	< 0.00799
M	Cs	< 0.00120	M	Ir	< 0.01998	M	Pd	< 0.01998	O	Na	0.00402	M	Yb	< 0.00400
M	Cr	0.10030	O	Fe	< 0.01000	i	P		M	Sr	0.00331	M	Y	< 0.15980
M	Co	0.01003	M	La	< 0.00200	M	Pt	< 0.00799	i	S		O	Zn	0.02510
M	Cu	0.00451	M	Pb	0.06018	O	K	0.02510	M	Ta	< 0.02797	M	Zr	< 0.01998

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

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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 - 54.9380; +2; 6; Mn(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.

Mn Containing Samples (Preparation and Solution) - Metal (Soluble in dilute acids); Oxides (Soluble in dilute acids); Ores (Dissolve with HCl. If silica is present add HF and then fume off silica by adding H2SO4 and heat to SO3 fumes - dense white fumes).

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)
ICP-OES 257.610 nm	0.0014 / 0.00002 µg/mL	1	ion	Ce, W, Re
ICP-OES 259.373 nm	0.0016 / 0.00002 µg/mL	1	ion	U, Ta, Mo, Fe, Nb
ICP-OES 260.569 nm	0.0021 / 0.00002 µg/mL	1	ion	Co
ICP-MS 55 amu	10 ppt	n/a	M+	40Ar14N1H, 39K16O, 37Cl18O, 40Ar15N, 38Ar17O, 6Ar18O1H , 38Ar16O1H, 37Cl17O1H, 23Na32S

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)

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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 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 Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: December 09, 2005

Expiration Date:

EXPIRES
01/2007

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, PhD., Technical Director

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4 of 4

010247

inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM

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

Catalog Number:	CGV1-1, CGV1-2, and CGV1-5
Lot Number:	**Y-QV01119**
Starting Material:	V2O5
Starting Material Purity (%):	99.986532
Starting Material Lot No:	Stractor 46
Matrix:	1.4% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/28/05
DATE EXPIRED: 12/01/06 (12)
DATE OPENED: 11/29/05
INORG: 5472 PO: D0024720

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1006 ± 3 µg/mL 992 ± 3 µg/g

Certified Density: 1.014 g/mL (measured at 22° C)

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

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

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

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

$\sum s_i$ = 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 an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **1007 ± 3 µg/mL** **993 ± 3 µg/g**
EDTA NIST SRM 928 Lot Number: 880710

Assay Method #2 **1006 ± 3 µg/mL** **992 ± 3 µg/g**
ICP Assay NIST SRM 3165 Lot Number: 992706

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.

O	Al	< 0.00600	M	Dy	< 0.00597	O	Li	< 0.00002	M	Pr	< 0.00030	M	Te	< 0.02984
M	Sb	0.04543	M	Er	< 0.00497	M	Lu	< 0.00040	M	Re	< 0.00100	M	Tb	< 0.00030
M	As	< 0.00995	M	Eu	< 0.00298	O	Mg	< 0.10000	M	Rh	< 0.00100	M	Tl	< 0.00100
M	Ba	< 0.00995	M	Gd	< 0.00100	M	Mn	0.00069	M	Rb	< 0.00100	M	Th	< 0.00100
M	Be	< 0.00050	M	Ga	< 0.00100	O	Hg	< 0.01200	M	Ru	< 0.00199	M	Tm	< 0.00040
M	Bi	< 0.00040	M	Ge	< 0.00597	M	Mo	0.01481	M	Sm	< 0.00100	M	Sn	< 0.00497
O	B	< 0.04000	M	Au	< 0.00298	M	Nd	< 0.00199	M	Sc	< 0.00995	M	Ti	< 0.04973
M	Cd	< 0.00298	M	Hf	< 0.00199	M	Ni	< 0.07957	M	Se	< 0.00796	M	W	< 0.00995
O	Ca	0.00596	M	Ho	< 0.00050	M	Nb	< 0.00050	O	Si	0.04964	M	U	< 0.00199
M	Ce	< 0.00497	M	In	< 0.00995	n	Os		M	Ag	< 0.00199	s	V	
M	Cs	< 0.00030	M	Ir	< 0.00497	M	Pd	< 0.00497	O	Na	< 0.01000	M	Yb	< 0.00100
O	Cr	< 0.10000	O	Fe	0.08936	O	P	< 0.10000	M	Sr	< 0.00050	M	Y	< 0.03978
O	Co	< 0.00200	M	La	< 0.00050	M	Pt	< 0.00199	n	S		M	Zn	< 0.01989
M	Cu	< 0.00597	M	Pb	< 0.00298	O	K	0.03276	M	Ta	< 0.00696	M	Zr	< 0.00497

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 - 50.9415; +5; 6; $H_2V_{10}O_{28}^{4-}$

Chemical Compatibility - Soluble in HCl, HNO_3, H_2SO_4, HF, H_3PO_4 and strong 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.

V Containing Samples (Preparation and Solution) - Metal (Fusion with NaOH or KOH in Ni^0 or Na_2CO_3 / KNO_3); Oxides (V_2O_3 - use HCl, V_2O_4 - use HCl or HNO_3, V_2O_5 - use concentrated acids); Ores (Na_2CO_3 / KNO_3 in Pt^0 ***caution - nitrates attack Pt***° followed by water extraction of fuseate); Organic Matrices (Ash at 450 ?C followed by dissolving according to V_2O_5 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.)
ICP-OES	309.311 nm	0.005 / 0.001 µg/mL	1	ion	Mg, U, Th
ICP-OES	292.402 nm	0.006 / 0.001 µg/mL	1	ion	Th
ICP-OES	290.882 nm	0.008 / 0.0008 µg/mL	1	atom	Hf, Nb
ICP-MS	51 amu	4 ppt	n/a	M^+	$^{34}S^{16}O^1H$, $^{35}Cl^{16}O$, $^{38}Ar^{13}C$, $^{38}Ar^{15}N$, $^{36}Ar^{14}N^1H$, $^{35}Cl^{14}N$, $^{34}S^{15}N$, $^{33}S^{12}O$, $^{34}S^{17}O$, $^{102}Ru^{+2}$, $^{102}Pd^{+2}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

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

Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01

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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a 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 11, 2005

Expiration Date: EXPIRES 01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul R 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 Statisical Principles."

2.0 DESCRIPTION OF CRM

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

Catalog Number:	CGZN1-1, CGZN1-2, and CGZN1-5
Lot Number:	**Y-ZN02028**
Starting Material:	Zn shot
Starting Material Purity (%):	99.999689
Starting Material Lot No:	D15M12
Matrix:	1.4% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/4/06
DATE EXPIRED: 3/1/2007
DATE OPENED: 1/4/06
INORG: 5538 PO: F56669

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1003 ± 2 µg/mL

Certified Density: 1.010 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\Sigma x1}{n}$

$(\bar{x})$ = mean
x1 = individual results
n = number of measurements

Uncertainty $(\pm) = \frac{2[(\Sigma s1)2]^{1/2}}{(n)^{1/2}}$

$\Sigma s1$ = The summation of all significant estimated errors (Most common are the errors from instrumental measurement weighting, 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 an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **1006 ± 5 µg/mL**
ICP Assay NIST SRM 3168a Lot Number: 001402

Assay Method #2 **1003 ± 2 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A glassware used in the manufacture and quality control of CRM's.

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

CRM's 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.

O	Al	0.00011	M	Dy	< 0.02420	O	Li	< 0.00003	M	Pr	< 0.00121	M	Te	< 0.12098
M	Sb	< 0.00202	M	Er	< 0.02016	M	Lu	< 0.00161	M	Re	< 0.00403	M	Tb	< 0.00121
M	As	< 0.04033	M	Eu	< 0.01210	O	Mg	< 0.00006	M	Rh	< 0.00403	M	Tl	< 0.00403
M	Ba	< 0.04033	M	Gd	< 0.00403	M	Mn	< 0.01613	M	Rb	< 0.00403	M	Th	< 0.00403
M	Be	< 0.00202	M	Ga	< 0.00403	O	Hg	< 0.01000	M	Ru	< 0.00807	M	Tm	< 0.00161
M	Bi	< 0.00161	M	Ge	< 0.02420	M	Mo	< 0.00807	M	Sm	< 0.00403	M	Sn	< 0.02016
O	B	0.00025	M	Au	< 0.01210	M	Nd	< 0.00807	M	Sc	< 0.04033	M	Ti	< 0.20164
M	Cd	< 0.01210	M	Hf	< 0.00807	O	Ni	0.00013	M	Se	< 0.03226	M	W	< 0.04033
O	Ca	0.00018	M	Ho	< 0.00202	M	Nb	< 0.00202	O	Si	0.00050	M	U	< 0.00807
M	Ce	< 0.02016	M	In	< 0.04033	n	Os		M	Ag	< 0.00807	M	V	< 0.00807
M	Cs	< 0.00121	M	Ir	< 0.02016	M	Pd	< 0.02016	O	Na	0.00200	M	Yb	< 0.00403
O	Cr	< 0.00100	O	Fe	0.00008	O	P	< 0.00300	M	Sr	< 0.00202	M	Y	< 0.16131
M	Co	< 0.01210	M	La	< 0.00202	M	Pt	< 0.00807	O	S	< 0.02000	s	Zn	
O	Cu	< 0.00050	M	Pb	< 0.01210	O	K	0.00025	M	Ta	< 0.02823	M	Zr	< 0.02016

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

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact IV Technical Staff

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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 ± °4C. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 65.39; +2; 4; Zn(OH)(aq)1+

Chemical Compatibility - Stable in HCl, HNO3, H2SO4 ,HF, H3PO4 Avoid basic media that promotes the formation of insoluble carbonate and hydroxide. Stable with most metals and inorganic anions in acidic media.

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

Zn Containing Samples (Preparation and Solution) - Metal (Soluble in HNO3); Oxides (Soluble in HCl); Ores (Dissolve in HCl /HNO3); Organic based (Dry ash at 450EC and dissolve ash in HCl) (Sulfuric/peroxide acid 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)
ICP-OES 213.856 nm	0.002 / 0.0004 µg/mL	1	atom	Ni, Cu, V
ICP-OES 202.548 nm	0.004 / 0.0002 µg/mL	1	ion	Nb, Cu, Co, Hf
ICP-OES 206.200 nm	0.006 / 0.0006 µg/mL	1	ion	Sb, Ta, Bi, Os
ICP-MS 66 amu	7 ppt	n/a	M+	50Ti16O,50Cr16O, 50V16O, 34S16O2, 32S16O18O, 32S17O2, 33S16O17O, 32S34S, 33S2

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)

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010254

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 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 Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: November 10, 2005

Expiration Date: EXPIRES 1E2007

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Malda, QA Administrator

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, PhD., Technical Director

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4064

010255

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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Silver in 3.5% (abs) HNO_3**

Catalog Number:	CGAG1-1, CGAG1-2, and CGAG1-5
Lot Number:	**Y-QAG01132**
Starting Material:	Ag shot
Starting Material Purity (%):	99.998444
Starting Material Lot No	J18M38
Matrix:	3.5% (abs) HNO_3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1003 ± 3 µg/mL

Certified Density: 1.025 g/mL (measured at 22° C)

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

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

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

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

$\sum s_i$ = 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** **1007 ± 3 µg/mL (Avg of 2 full assays)**
Volhard NIST SRM 999a Lot Number: 999a

Assay Method #2 **1003 ± 3 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3151 Lot Number: 992212

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 9/23/05
DATE EXPIRED: 10/1/06 (P)
DATE OPENED: 9/27/05
INORG: 5406 PO: DR2061635

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5406

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.

O	Al		0.00165	M	Dy	<	0.01198	O	Li		0.00001	M	Pr	<	0.00060	M	Te	<	0.05991
M	Sb	<	0.00100	M	Er	<	0.00998	M	Lu	<	0.00080	M	Re	<	0.00200	M	Tb	<	0.00060
M	As	<	0.01997	M	Eu	<	0.00599	O	Mg		0.00012	M	Rh	<	0.00200	M	Tl	<	0.00200
M	Ba	<	0.01997	M	Gd	<	0.00200	M	Mn	<	0.00799	M	Rb	<	0.00200	M	Th	<	0.00200
M	Be	<	0.00100	M	Ga	<	0.00200	O	Hg	<	0.01500	M	Ru	<	0.00399	M	Tm	<	0.00080
M	Bi	<	0.00080	M	Ge	<	0.01198	M	Mo	<	0.00399	M	Sm	<	0.00200	M	Sn	<	0.00998
M	B	<	0.13978	O	Au	<	0.00300	M	Nd	<	0.00399	M	Sc	<	0.01997	M	Ti	<	0.09984
O	Cd		0.00042	M	Hf	<	0.00399	O	Ni	<	0.00300	M	Se	<	0.01598	M	W	<	0.01997
O	Ca		0.00250	M	Ho	<	0.00100	M	Nb	<	0.00100	O	Si		0.00399	M	U	<	0.00399
M	Ce	<	0.00998	M	In	<	0.01997	n	Os			s	Ag			M	V	<	0.00399
M	Cs	<	0.00060	M	Ir	<	0.00998	O	Pd	<	0.00400	O	Na		0.00319	M	Yb	<	0.00200
M	Cr	<	0.00998	O	Fe		0.00100	O	P	<	0.00300	M	Sr	<	0.00100	M	Y	<	0.07987
M	Co	<	0.00599	M	La	<	0.00100	O	Pt	<	0.01700	O	S	<	0.02500	O	Zn	<	0.00040
O	Cu		0.00150	M	Pb		0.00199	O	K		0.00035	M	Ta	<	0.01398	M	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 ± 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 - 107.8682; +1; 6; $Ag(H_2O)_6^+$
Chemical Compatibility - Stable in HNO_3, and HF. **Avoid** basic media. Ag forms more insoluble salts than any other metal. It also is subject to photochemical reduction to the metal in HCl media although 10 µg/mL solutions in 10% HCl [$AgCl_x^{1-x}$] are commonly used in the analytical laboratory. The most common solubility problems exist with arsenate, arsenite , bromide, chloride, iodide, carbonate , chromate, cyanide, iodate, oxalate, oxide, sulfate, sulfide, tartrate, and thiocyanate in aqueous media. The addition of nitric acid renders many of these salts soluble.
Stability - 2-100 ppb levels stable for 75+ days when mixed with equivalent levels of all other elements including the precious metals (where chloride is present) when in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.
Ag Containing Samples (Preparation and Solution) - Metal (Soluble in HNO_3); Oxides (Soluble in HNO_3); Ores (Digestion with conc. HNO_3).
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)
ICP-OES 328.068 nm	0.007 / 0.0007 µg/mL	1	atom	Ce, Rh, V
ICP-OES 338.289 nm	0.013 / 0.001µg/mL	1	atom	Ce, Cr, Th
ICP-OES 243.779 nm	0.12 / 0.01 µg/mL	1	ion	Mn, Th, Ni, Rh
ICP-MS 107 amu	1 ppt	n/a	M^+	$^{91}Zr^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

010258

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, 2005

Expiration Date: EXPIRES 1 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator — Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager — Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director — Paul R Gaines

010259

INORGANIC VENTURES
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fax: 732.901.1903
info@inorganicventures.com

CERTIFICATE OF ANALYSIS

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/27/06
DATE EXPIRED: 3/1/2007 DR
DATE OPENED: 1/27/06
INORG: 5633 PO: F56680

1.0 **INORGANIC VENTURES** is an ISO Guide 34:2000 registered Certified Reference Material (CRM) Manufacturer (Certificate #883-02). The certificate is designed and the data is determined in accordance with ISO Guide 31:2000 (Reference Materials-Contents of Certificates and Labels), 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 Principals."

2.0 DESCRIPTION OF CRM — 1000 µg/mL Arsenic in 1.4% (abs) HNO3

Catalog Number:	CGAS1-1, CGAS1-2, and CGAS1-5
Lot Number:	**Y -AS02029**
Starting Material:	As Polycrystaline lump
Starting Material Purity (%):	99.999055
Starting Material Lot No:	23115
Matrix:	1.4% (abs) HNO3

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1004 ± 2 µg/mL 995 ± 2 µg/g

Certified Density: 1.009 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\sum x1}{n}$

$(\bar{x})$ = mean
x1 = individual results
n = number of measurements

Uncertainty $(\pm) = \frac{2[(\sum s1)2]^{1/2}}{(n)^{1/2}}$

$\sum s1$ = The summation of all significant estimated errors (Most common are the errors from instrumental measurement weighting, 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 an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **1004 ± 2 µg/mL 995 ± 2 µg/g (Avg 2 runs)**
ICP Assay NIST SRM 3103a Lot Number: 010713

Assay Method #2 **1003 ± 5 µg/mL 994 ± 5 µg/g**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A glassware used in the manufacture and quality control of CRM's.

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

CRM's 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.

O	Al	0.00038	M	Dy	< 0.01884	O	Li	< 0.00002	M	Pr	< 0.00094	M	Te	< 0.09418
O	Sb	< 0.01000	M	Er	< 0.01570	M	Lu	< 0.00126	O	Re	< 0.01000	M	Tb	< 0.00094
s	As		M	Eu	< 0.00942	O	Mg	0.00017	M	Rh	< 0.00314	M	Tl	< 0.00314
M	Ba	< 0.03139	M	Gd	< 0.00314	O	Mn	0.00005	M	Rb	< 0.00314	M	Th	< 0.00314
M	Be	< 0.00157	M	Ga	< 0.00314	O	Hg	< 0.01200	M	Ru	< 0.00628	M	Tm	< 0.00126
M	Bi	< 0.00126	M	Ge	< 0.01884	M	Mo	< 0.00628	M	Sm	< 0.00314	O	Sn	0.00073
O	B	< 0.01200	M	Au	< 0.00942	M	Nd	< 0.00628	M	Sc	< 0.03139	M	Ti	< 0.15697
M	Cd	< 0.00942	M	Hf	< 0.00628	O	Ni	< 0.00200	M	Se	< 0.02511	M	W	< 0.03139
O	Ca	0.00206	M	Ho	< 0.00157	O	Nb	< 0.00200	O	Si	0.00476	M	U	< 0.00628
M	Ce	< 0.01570	M	In	< 0.03139	n	Os		M	Ag	< 0.00628	M	V	< 0.00628
M	Cs	< 0.00094	M	Ir	< 0.01570	M	Pd	< 0.01570	O	Na	0.00159	M	Yb	< 0.00314
M	Cr	< 0.01570	O	Fe	< 0.00110	O	P	< 0.00260	M	Sr	< 0.00157	M	Y	< 0.12558
M	Co	< 0.00942	M	La	< 0.00157	M	Pt	< 0.00628	O	S	< 0.02500	O	Zn	0.00044
M	Cu	< 0.01884	M	Pb	< 0.00942	O	K	0.00048	M	Ta	< 0.02198	M	Zr	< 0.01570

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

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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 - 74.9216; mix of +3 and +5; 6; H_3AsO_4 and $HAsO_2$

Chemical Compatibility -Arsenic has no cationic chemistry. It is soluble in HCl, HNO_3, H_3PO_4, H_2SO_4 and HF aqueous matrices water and NH_4OH . It is stable with most inorganic anions (forms arsenate when boiled with chromate) but many cationic metals form the insoluble arsenates under pH neutral conditions. When fluorinated and / or under acidic conditions arsenate formation is typically not a problem at moderate to low concentrations.

Stability - 2-100 ppb levels stable for months alone or mixed with other elements at equivalent levels in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.

As Containing Samples (Preparation and Solution) - As0 (soluble in 1:1 H_2O / HNO_3); Oxides (the oxide exists in crystalline and amorphous forms where the amorphoric form is more water soluble. The oxides typically dissolve in dilute acidic solutions when boiled); Minerals (One gram of powered sample is fused in a Ni0 crucible with 10 grams of a 1:1 mix of K_2CO_3 and KNO_3 and the melt extracted with hot water); Organic Matrices (0.2 to 0.5 grams of the sample are fused with 15 grams of a 1:1 Na_2CO_3 / Na_2O_2 mix in a Ni0 crucible. The fuseate is extracted with water and acidified with HNO_3)

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)
ICP-OES189.042 nm	0.05 / 0.005 µg/mL	1	atom	Cr
ICP-OES193.696 nm	0.1 / 0.01 µg/mL	1	atom	V, Ge
ICP-OES 228.812 nm	0.1 / 0.01 µg/mL	1	atom	Cd, Pt, Ir, Co
ICP-MS 75 amu	20 ppt	n/a	M+	40Ar35Cl, 59Co16O, 36Ar38Ar1H, 38Ar37Cl, 6Ar39K, 150Nd2+,150Sm2+

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)

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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 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 Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: September 15, 2005

Expiration Date:

EXPIRES
01 MAR 2007

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, PhD., Technical Director

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010263

inorganic ventures / iv labs

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

certificate of analysis

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

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Lead in 0.35% (abs) HNO_3**

Catalog Number:	CGPB1-1, CGPB1-2, and CGPB1-5
Lot Number:	**X-PB02118**
Starting Material:	Pb(NO3)2
Starting Material Purity (%):	99.999974
Starting Material Lot No	22150
Matrix:	0.35% (abs) HNO_3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1005 ± 2 µg/mL

Certified Density: 1.001 g/mL (measured at 22° C)

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

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

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** **1005 ± 2 µg/mL**
EDTA NIST SRM 928 Lot Number: 880710

Assay Method #2 **1001 ± 4 µg/mL**
ICP Assay NIST SRM 3128 Lot Number: 991504

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 5/27/05
DATE EXPIRED: 6/1/06
DATE OPENED: 5/27/05
INORG: 5255(b) PO: 55195

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5255

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.

O	Al	< 0.00270	M	Dy	< 0.01193	O	Li	< 0.00002	M	Pr	< 0.00060	M	Te	< 0.05965
M	Sb	< 0.00099	M	Er	< 0.00994	M	Lu	< 0.00080	M	Re	< 0.00199	M	Tb	< 0.00060
M	As	< 0.01989	M	Eu	< 0.00597	O	Mg	0.00008	O	Rh	< 0.00900	O	Tl	0.00130
M	Ba	< 0.01989	M	Gd	< 0.00199	M	Mn	< 0.00795	M	Rb	< 0.00199	M	Th	< 0.00199
M	Be	< 0.00099	M	Ga	< 0.00199	O	Hg	< 0.01500	M	Ru	< 0.00398	M	Tm	< 0.00080
O	Bi	< 0.02000	M	Ge	< 0.01193	M	Mo	< 0.00398	M	Sm	< 0.00199	M	Sn	< 0.00994
O	B	< 0.04000	M	Au	< 0.00597	M	Nd	< 0.00398	M	Sc	< 0.01989	M	Ti	< 0.09942
M	Cd	< 0.00597	M	Hf	< 0.00398	M	Ni	< 0.01591	M	Se	< 0.01591	M	W	< 0.01989
O	Ca	0.00009	M	Ho	< 0.00099	M	Nb	< 0.00099	O	Si	< 0.00340	M	U	< 0.00398
M	Ce	< 0.00994	M	In	< 0.01989	n	Os		M	Ag	< 0.00398	M	V	< 0.00398
M	Cs	< 0.00060	M	Ir	< 0.00994	M	Pd	< 0.00994	O	Na	< 0.00600	M	Yb	< 0.00199
M	Cr	< 0.00994	O	Fe	0.00011	O	P	< 0.00500	M	Sr	< 0.00099	M	Y	< 0.07954
M	Co	< 0.00597	M	La	< 0.00099	M	Pt	< 0.00398	O	S	< 0.10000	M	Zn	< 0.03977
M	Cu	< 0.01193	s	Pb		O	K	< 0.00180	M	Ta	< 0.01392	M	Zr	< 0.00994

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 - 207.2; +2; 6; $Pb(H_2O)_6^{+2}$

Chemical Compatibility - Soluble in HCl, HF and HNO_3. Avoid H_2SO_4. Stable with most metals and inorganic anions forming insoluble carbonate, borate, sulfate, sulfite, sulfide, phosphate, oxalate, chromate, tannate, iodate, and cyanide 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 2-5% HNO_3 / LDPE container.

Pb Containing Samples (Preparation and Solution) - Metal (Best dissolved in 1:1 H_2O / HNO_3.); Oxides (The many different Pb oxides are soluble in HNO_3 with the exception of PbO_2 which is soluble in HCl or HF); Ores and Alloys (Best attacked using 1:1 H_2O / HNO_3.); 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 = concs.)
ICP-OES 168.215 nm	0.03 / 0.003 µg/mL	1	ion	Co
ICP-OES 220.353 nm	0.04 / 0.006 µg/mL	1	ion	Bi, Nb
ICP-OES 217.000 nm	0.09 / 0.03 µg/mL	1	atom	W, Ir, Hf, Sb, Th
ICP-MS 208 amu	5 ppt	n/a	M+	$^{192}Pt^{16}O$, $^{192}Os^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

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

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

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

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

A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

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 17, 2004

Expiration Date: EXPIRES 01 JUN 2006

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 R Gaines

010267

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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Antimony in 0.7% (abs) HNO_3 / 3% Tartaric Acid**

Catalog Number:	CGSB1-1, CGSB1-2 and CGSB1-5
Lot Number:	**X-SB02083**
Starting Material:	Sb shot
Starting Material Purity (%):	99.993665
Starting Material Lot No	D29N32
Matrix:	0.7% (abs) HNO_3 / 3% Tartaric Acid

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/2006
DATE OPENED: 2/28/05
INORG: 5042 PO: F55147

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 999 ± 3 µg/mL

Certified Density: 1.020 g/mL (measured at 22° C)

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

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

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

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
Σs_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** **999 ± 3 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3102a Lot Number: 990707

Assay Method #2 **1001 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al	0.02186	M	Dy	< 0.00598	O	Li	< 0.00002	M	Pr	< 0.00030	M	Te	< 0.02988
s	Sb		M	Er	< 0.00498	M	Lu	< 0.00040	M	Re	< 0.00100	M	Tb	< 0.00030
M	As	< 0.00996	M	Eu	< 0.00299	O	Mg	0.00074	M	Rh	< 0.00100	M	Tl	0.00015
O	Ba	0.00011	M	Gd	< 0.00100	O	Mn	0.00139	M	Rb	< 0.00100	M	Th	< 0.00100
O	Be	< 0.00001	M	Ga	< 0.00100	O	Hg	< 0.01500	M	Ru	< 0.00199	M	Tm	< 0.00040
M	Bi	0.00386	M	Ge	< 0.00598	M	Mo	< 0.00199	M	Sm	< 0.00100	M	Sn	< 0.00498
O	B	0.00045	M	Au	< 0.00299	M	Nd	< 0.00199	O	Sc	< 0.00016	O	Ti	0.00056
M	Cd	< 0.00299	M	Hf	< 0.00199	O	Ni	0.00219	M	Se	< 0.00797	M	W	< 0.00996
O	Ca	0.00521	M	Ho	< 0.00050	M	Nb	< 0.00050	O	Si	0.00388	M	U	< 0.00199
O	Ce	< 0.00300	M	In	< 0.00996	n	Os		M	Ag	< 0.00199	M	V	< 0.00199
M	Cs	< 0.00030	M	Ir	< 0.00498	M	Pd	< 0.00498	O	Na	0.00298	M	Yb	< 0.00100
O	Cr	0.00696	O	Fe	0.00715	O	P	< 0.04000	M	Sr	< 0.00050	M	Y	< 0.03984
M	Co	0.00052	O	La	< 0.00120	M	Pt	< 0.00199	n	S		M	Zn	< 0.01992
O	Cu	0.00239	M	Pb	0.00040	O	K	0.00497	M	Ta	< 0.00697	M	Zr	< 0.00498

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

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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 Formin Solution - 121.75; +3 ; 6; $Sb(OH)_4O_2^{-1}$
Chemical Compatibility - Stable in concentrated HCl, dilute or concentrated HF. Stable in dilute HNO_3 as the fluoride or tartrate complex. Avoid basic media. Stable with most metals and inorganic anions in acidic media as the tartrate provided the acidity is not too high or the acid is oxidizing causing loss of the stabilizing tartrate ion. The fluoride complex of antimony is stable in strong acid but you should only mix with other metals that are fluorinated.
Stability - 2-100 ppb levels stable for months in 1% HNO_3/ LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-2% HNO_3/ LDPE container.
Sb Containing Samples (Preparation and Solution) - Metal and alloys (Soluble in H_2O / HF / HNO_3 mixture); Oxides (Soluble in HCl and tartaric acid or H_2O / HF / HNO_3 mixtures); Ores (Fusion with Na_2CO_3 in Pt followed by dissolving the fuseate in a H_2O / HF / HNO_3 mixture); Organic based (Sulfuric acid / hydrogen 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)
ICP-OES 206.833 nm	0.03 / 0.003 µg/mL	1	atom	Ta, Cr, Ge, Hf
ICP-OES 217.581 nm	0.05 / 0.005 µg/mL	1	atom	Nb, W, Re, Fe,
ICP-OES 231.147 nm	0.06 / 0.006 µg/mL	1	atom	Ni, Co, Pt, Pd, O, Y, Oz
ICP-MS 121 amu	5 ppt	n/a	M^+	

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

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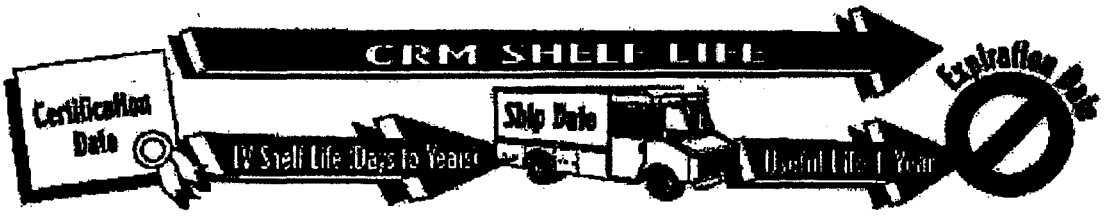
11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



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 22, 2004

Expiration Date:

EXPIRES
1 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	JoAnn Struthers, QA Administrative Assistant	
Certificate Approved By:	Katalin Le, QC Manager	
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	

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inorganic ventures / iv labs

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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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Selenium in 1.4% (abs) HNO_3**

Catalog Number:	CGSE1-1, CGSE1-2, and CGSE1-5
Lot Number:	**X-SE01106**
Starting Material:	Se shot
Starting Material Purity (%):	99.997834
Starting Material Lot No	I20L45
Matrix:	1.4% (abs) HNO_3

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1006 ± 2 µg/mL 997 ± 2 µg/g

Certified Density: 1.009 g/mL (measured at 22° C)

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

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

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

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** **1002 µg/mL 993 µg/g**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

Assay Method #2 **1006 ± 2 µg/mL 997 ± 2 µg/g (Avg 2 runs)**
ICP Assay NIST SRM 3149 Lot Number: 992106

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 7/22/05
DATE EXPIRED: 8/1/06
DATE OPENED: 7/22/05
INORG: 5313 PO: F55213

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al	0.00030	M	Dy	< 0.01196	O	Li	< 0.00003	M	Pr	< 0.00060	M	Te	< 0.05982
M	Sb	< 0.00100	M	Er	< 0.00997	M	Lu	< 0.00080	O	Re	< 0.00900	M	Tb	< 0.00060
O	As	< 0.00500	M	Eu	< 0.00598	O	Mg	0.00021	M	Rh	< 0.00199	M	Tl	< 0.00199
M	Ba	< 0.01994	M	Gd	< 0.00199	M	Mn	< 0.00798	M	Rb	< 0.00199	M	Th	< 0.00199
O	Be	< 0.00009	M	Ga	< 0.00199	O	Hg	0.01054	O	Ru	< 0.00700	M	Tm	< 0.00080
M	Bi	< 0.00080	M	Ge	< 0.01196	O	Mo	< 0.00400	M	Sm	< 0.00199	M	Sn	< 0.00997
O	B	< 0.00006	M	Au	< 0.00598	M	Nd	< 0.00399	M	Sc	< 0.01994	M	Ti	< 0.09969
M	Cd	0.00060	M	Hf	< 0.00399	O	Ni	0.00028	S	Se		M	W	< 0.01994
O	Ca	0.00100	M	Ho	< 0.00100	O	Nb	< 0.00400	O	Si	< 0.00300	M	U	< 0.00399
M	Ce	< 0.00997	M	In	< 0.01994	n	Os		M	Ag	< 0.00399	M	V	< 0.00399
M	Cs	< 0.00060	M	Ir	< 0.00997	M	Pd	< 0.00997	O	Na	0.00402	M	Yb	< 0.00199
M	Cr	0.00080	O	Fe	0.00271	O	P	< 0.00300	M	Sr	< 0.00100	M	Y	< 0.07976
M	Co	< 0.00598	M	La	< 0.00100	M	Pt	< 0.00399	O	S	< 0.04000	M	Zn	0.00400
M	Cu	0.00130	M	Pb	< 0.00598	O	K	0.00060	M	Ta	< 0.01396	O	Zr	0.00005

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 - 78.96; +4; 6; H_2SeO_3
Chemical Compatibility - Soluble in HCl, HNO_3, H_3PO_4, H_2SO_4 and HF aqueous matrices and water. It is stable with most inorganic anions but many cationic metals form the insoluble selenites under pH neutral conditions. When fluorinated and/or under acidic conditions precipitation is typically not a problem at moderate to low concentrations.
Stability - 2-100 ppb levels- stable for months alone or mixed with other elements at equivalent levels - in 1 % HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.
Se Containing Samples (Preparation and Solution) - Metal (Soluble in HNO_3); Oxides (Readily soluble in water); Minerals and alloys (Acid digestion with HNO_3or HNO_3 / HF); Organic Matrices (Acid digestion with hot concentrated H_2SO_4 accompanied by the careful dropwise addition of H_2O_2 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)
ICP-OES	196.026 nm	0.08 / 0.006 µg/mL	1	atom	Fe
ICP-OES	203.985 nm	0.2 / 0.05 µg/mL	1	atom	Sb, Ir, Cr, Ta
ICP-OES	206.279 nm	0.3 / 0.16 µg/mL	1	atom	Cr, Pt
ICP-MS	82 amu	200 ppt	n/a	M^+	$^{12}C^{35}Cl_2$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

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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 30, 2004

Expiration Date: EXPIRES 1.2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator — Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager — Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director — Paul R Gaines

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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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Thallium in 0.5% (abs) HNO3**

Catalog Number:	CGTL1-1, CGTL1-2, and CGTL1-5
Lot Number:	**Y-TL01093**
Starting Material:	TlNO3
Starting Material Purity (%):	99.999824
Starting Material Lot No:	G09P28
Matrix:	0.5% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/27/06
DATE EXPIRED: 3/1/2007 DR
DATE OPENED: 1/27/06
INORG: 56635 PO: E56680

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1002 ± 2 µg/mL 1000 ± 2 µg/g

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

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

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

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

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

4.1 **Assay Method #1** **1002 ± 2 µg/mL 1000 ± 2 µg/g (Avg. 2 runs)**
ICP Assay NIST SRM 3158 Lot Number: 993012

Assay Method #2 **1000 ± 5 µg/mL 998 ± 5 µg/g**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

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1 of 4

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.

M Al < 0.02018	M Dy < 0.01211	O Li < 0.00002	M Pr < 0.00061	M Te < 0.06055
M Sb < 0.00101	M Er < 0.01009	M Lu < 0.00081	M Re < 0.00202	M Tb < 0.00061
M As < 0.02018	M Eu < 0.00606	O Mg 0.00030	M Rh < 0.00202	s Tl
M Ba < 0.02018	M Gd < 0.00202	M Mn < 0.00807	M Rb < 0.00202	M Th < 0.00202
M Be < 0.00101	M Ga < 0.00202	O Hg < 0.01200	M Ru < 0.00404	M Tm < 0.00081
M Bi < 0.00081	M Ge < 0.01211	M Mo < 0.00404	M Sm < 0.00202	M Sn < 0.01009
O B < 0.00140	M Au < 0.00606	M Nd < 0.00404	M Sc < 0.02018	M Ti < 0.10091
O Cd < 0.00540	M Hf < 0.00404	O Ni < 0.00090	M Se < 0.01615	M W < 0.02018
O Ca 0.00015	M Ho < 0.00101	M Nb < 0.00101	O Si < 0.00340	M U < 0.00404
M Ce < 0.01009	M In < 0.02018	n Os	M Ag < 0.00404	M V < 0.00404
M Cs < 0.00061	M Ir < 0.01009	M Pd < 0.01009	O Na 0.00124	M Yb < 0.00202
M Cr < 0.01009	O Fe < 0.00100	O P < 0.00260	M Sr < 0.00101	M Y < 0.08073
M Co < 0.00606	M La < 0.00101	M Pt < 0.00404	O S < 0.03000	O Zn 0.00154
M Cu < 0.01211	M Pb < 0.00606	O K < 0.00180	M Ta < 0.01413	M Zr < 0.01009

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

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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 - 204.383; +1; 6; $Tl(H_2O)_6^{1+}$

Chemical Compatibility - Soluble in HCl, HNO_3 and H_2SO_4. Stable with most metals and inorganic anions. The sulfite, thiocyanate and oxalate are moderately soluble; the phosphate and arsenite are slightly soluble and the sulfide is insoluble.

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.

Tl Containing Samples (Preparation and Solution) - Metal (Best dissolved in HNO_3 which forms chiefly the Tl^{+} ion.); Oxide (The thallous oxide is readily soluble in water. The thallic oxide requires high levels of acid); Ores (Carbonate fusion in Pt^{0} followed by HCl dissolution); Organic Matrices (Sulfuric/peroxide digestion or dry ash and dissolution in HCl).

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

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicate severe)
ICP-OES	190.864 nm	0.04 / 0.004 µg/mL	1	ion	V, Ti
ICP-OES	276.787 nm	0.1 / 0.01 µg/mL	1	atom	Ta, V, Fe, Cr
ICP-OES	351.924 nm	0.2 / 0.02 µg/mL	1	atom	Th, Ce, Zr
ICP-MS	205 amu	2 ppt	n/a	M^{+}	$^{187}Os^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

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

Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01

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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

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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 23, 2005

Expiration Date: EXPIRES 01 MAR 2007

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

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010279

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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Boron in H_2O**

Catalog Number:	CGB1-1, CGB1-2, and CGB1-5
Lot Number:	**X-B02047**
Starting Material:	H_3BO_3
Starting Material Purity (%):	99.999998
Starting Material Lot No	OV0133
Matrix:	H_2O

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 8/28/05
DATE EXPIRED: 3/1/2006
DATE OPENED: 2/28/05
INORG: 5047 PO: F55148

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1005 ± 2 µg/mL

Certified Density: 0.999 g/mL (measured at 22° C)

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

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

Uncertainty (±) = $\frac{2[(\sum S_i)^2]^{1/2}}{(n)^{1/2}}$

($\bar{x}$) = 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.)

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

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

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

4.1 **Assay Method #1** **1005 ± 2 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3107 Lot Number: 991907

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INFO

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.

O	Al	< 0.00090	M	Dy	< 0.00600	O	Li	< 0.00002	M	Pr	< 0.00030	M	Te	< 0.03000
M	Sb	< 0.00050	M	Er	< 0.00500	M	Lu	< 0.00040	M	Re	< 0.00100	M	Tb	< 0.00030
M	As	< 0.01000	M	Eu	< 0.00300	O	Mg	< 0.00006	M	Rh	< 0.00100	M	Tl	< 0.00100
O	Ba	< 0.00010	M	Gd	< 0.00100	O	Mn	< 0.00002	M	Rb	< 0.00100	M	Th	< 0.00100
O	Be	< 0.00017	O	Ga	< 0.00160	O	Hg	< 0.01500	M	Ru	< 0.00200	M	Tm	< 0.00040
M	Bi	< 0.00040	M	Ge	< 0.00600	M	Mo	< 0.00200	M	Sm	< 0.00100	M	Sn	< 0.00500
s	B		M	Au	< 0.00300	M	Nd	< 0.00200	O	Sc	< 0.00002	M	Ti	< 0.05000
M	Cd	< 0.00300	M	Hf	< 0.00200	O	Ni	< 0.00230	O	Se	< 0.00620	M	W	< 0.01000
O	Ca	< 0.00007	M	Ho	< 0.00050	M	Nb	< 0.00050	O	Si	0.00067	M	U	< 0.00200
O	Ce	< 0.00300	M	In	< 0.01000	n	Os		M	Ag	< 0.00200	O	V	< 0.00083
M	Cs	< 0.00030	M	Ir	< 0.00500	M	Pd	< 0.00500	O	Na	< 0.00010	M	Yb	< 0.00100
M	Cr	< 0.00500	O	Fe	< 0.00110	O	P	< 0.00250	M	Sr	< 0.00050	M	Y	< 0.04000
O	Co	< 0.00110	M	La	< 0.00050	M	Pt	< 0.00200	O	S	< 0.10000	O	Zn	< 0.00019
M	Cu	< 0.00600	M	Pb	< 0.00300	O	K	< 0.00300	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 - 10.811; +3; 4; $B(OH)_3$ and $B(OH)_4^-$

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.

B 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); $B(OH)_3$ (water soluble); Ores(avoid acid digestions and use caustic fusions in Pt^0); Organic Matrices (dry ash mixed with Na_2CO_3 in Pt^0 at 450°C then increase heat to 1000°C to fuse; or perform a Na_2O_2 fusion in a Ni^0 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 ≈ concs.)
ICP-OES	249.773 nm	0.003 / 0.001 µg/mL	1	atom	W, Ce, Co, Th, Ta, Mn, Mo, Fe
ICP-OES	249.678 nm	0.004 / 0.003 µg/mL	1	atom	Os, W, Co, Cr, Hf
ICP-OES	208.959 nm	0.007 / 0.0005 µg/mL	1	atom	Mo
ICP-MS	11 amu	700 ppt	n/a	M^+	

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)
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:

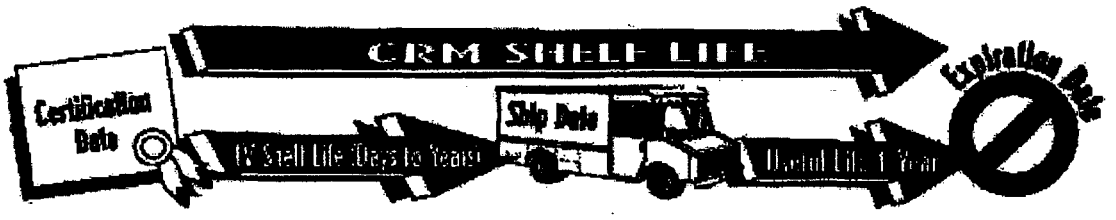
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (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.

Certification Date: April 13, 2004

Expiration Date: EXPIRES 1 MAR 2006

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 R Gaines

010283

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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Molybdenum in H_2O tr. NH_4OH**

Catalog Number:	CGMO1-1, CGMO1-2, and CGMO1-5
Lot Number:	**X-MO02004**
Starting Material:	$(NH_4)_6Mo_7O_{24}xH_2O$
Starting Material Purity (%):	99.995645
Starting Material Lot No	23221
Matrix:	H_2O tr. NH_4OH

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/2006
DATE OPENED: 2/28/05 DR
INORG: 5050 PO: F55148

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1002 ± 3 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:

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

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.)

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 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

Assay Method #2 **1002 ± 3 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3134 Lot Number: 891307

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al	< 0.05000	M	Dy	< 0.01202	O	Li	< 0.01000	O	Pr	< 0.10000	i	Te				
M	Sb	< 0.00100	M	Er	< 0.01002	M	Lu	< 0.00080	M	Re	0.00541	M	Tb	< 0.00060			
M	As	0.00801	M	Eu	< 0.00601	O	Mg	< 0.05000	M	Rh	< 0.00200	M	Tl	< 0.00200			
M	Ba	< 0.02004	M	Gd	< 0.00200	M	Mn	< 0.00801	M	Rb	< 0.00200	M	Th	< 0.00200			
M	Be	< 0.00100	M	Ga	< 0.00200	i	Hg		M	Ru	< 0.00401	M	Tm	< 0.00080			
M	Bi	< 0.00080	M	Ge	< 0.01202	s	Mo		M	Sm	< 0.00200	M	Sn	< 0.01002			
O	B	< 0.50000	M	Au	< 0.00601	O	Nd	< 0.05000	O	Sc	< 0.05000	O	Ti	< 0.00500			
O	Cd	< 0.50000	M	Hf	< 0.00401	M	Ni	< 0.01603	M	Se	< 0.01603	M	W	0.03907			
O	Ca	0.00150	M	Ho	< 0.00100	M	Nb	< 0.00100	O	Si	< 0.10000	M	U	< 0.00401			
O	Ce	< 0.05000	M	In	< 0.02004	n	Os		M	Ag	< 0.00401	M	V	< 0.00401			
M	Cs	< 0.00060	M	Ir	< 0.01002	M	Pd	< 0.01002	O	Na	< 0.10000	M	Yb	< 0.00200			
M	Cr	< 0.01002	O	Fe	< 0.50000	i	P		M	Sr	< 0.00100	M	Y	< 0.08014			
M	Co	< 0.00601	M	La	< 0.00100	M	Pt	< 0.00401	i	S		M	Zn	< 0.04007			
M	Cu	< 0.01202	M	Pb	< 0.00601	O	K	0.03500	M	Ta	< 0.01403	M	Zr	< 0.01002			

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

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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 - 95.94; +6; 6,7,8,9; $[MoO_4]^{-2}$ (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 $[MoO_4]^{-2}$ is soluble in concentrated HCl $[MoOCl_4]^{-2}$, dilute HF / HNO_3 $[MoOF_4]^{-2}$ and basic media $[MoO_4]^{-2}$. 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 $[MoO_4]^{-2}$ chemical form.

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the $[MoOF_4]^{-2}$ for months in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $[MoO_4]^{-2}$ 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 ≈ concs.)
ICP-OES	202.030 nm	0.008 / 0.0002 µg/mL	1	Ion	Os, Hf
ICP-OES	203.844 nm	0.012 / 0.002 µg/mL	1	Ion	
ICP-OES	204.598 nm	0.012 / 0.001 µg/mL	1	Ion	Ir, Ta
ICP-MS	95 amu	3 ppt	n/a	M⁺	$^{40}Ar^{39}K^{16}O$, $^{79}Br^{16}O$, $^{94}Os^{+}$, $^{94}Pt^{+}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

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

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

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

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

A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

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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 26, 2004

Expiration Date: EXPIRES 1 MAR 2006

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 R Gaines

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inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa
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e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

CUSTOM-GRADE SOLUTION 1000 µg/mL Phosphorus in H_2O

Catalog Number: CGP1-1, CGP1-2 and CGP1-5

Lot Number: **Y-P01127**

Starting Material:	Phosphoric Acid
Starting Material Purity:	99.999%
Starting Material Lot No:	J18804

CERTIFIED CONCENTRATION: 1000 ± 5 µg/mL

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

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n} \qquad \text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

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

Classical Wet Assay: 1004 ± 2 µg/mL
Method: Acidimetric Titration vs NIST SRM 84k KHP.

Instrument Analysis: 1000 ± 5 µg/mL
Method: Inductively Coupled Plasma Spectroscopy (ICP) vs NIST SRM 3139a Lot number 890607.

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.

O	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	Tl	<0.00010
M	Ba	<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	O	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	M	Hf	<0.00020	O	Ni	<0.050	O	Se	<0.40	M	W	<0.0010
O	Ca	<0.010	M	Ho	<0.000050	M	Nb	<0.000050	O	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	O	Na	<0.090	M	Yb	<0.00010
M	Cr	<0.00050	O	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): 0.999 g/mL

QA:KL Rev.020805CG

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 5/27/05
DATE EXPIRED: 6/1/06
DATE OPENED: 5/27/05
INORG: 5254 PO: 55185

Paul R. Haines
Quality Assurance Manager

1 of 2
5254

Expires: EXPIRES 01/2006

QUALITY STANDARD DOCUMENTATION

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

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

2. ISO/IEC 17025-1999 - Chemical Testing - Accredited A2LA (Certificate Number 883.01)
3. ISO/IEC Guide 34-2000 - Reference Materials Production - Accredited A2LA (Certificate Number 883.02)
4. 10CFR50 Appendix B
5. 10CFR21

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

STABILITY/ EXPIRATION DOCUMENTATION

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

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

PACKAGING DOCUMENTATION

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

GLASSWARE CALIBRATION

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

BALANCE CALIBRATION

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

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

THERMOMETER CALIBRATION

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

TECHNICAL SUPPORT

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

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

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inorganic ventures / iv labs

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

certificate of analysis

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

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Silicon in H_2O tr. HNO_3 tr. HF**

Catalog Number:	CGSI1-1, CGSI1-2, and CGSI1-5
Lot Number:	**X-SI02087**
Starting Material:	SiO_2
Starting Material Purity (%):	99.996367
Starting Material Lot No	C05310C
Matrix:	H_2O tr. HNO_3 tr. HF

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/2006 DR
DATE OPENED: 2/28/05
INORG: 50476 PO: F55148
DR 3/15/05

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 996 ± 2 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:

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

Uncertainty (±) = $\frac{2[(\Sigma s_i)^2]^{1/2}}{(n)^{1/2}}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
Σs = 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** **996 ± 2 µg/mL**
ICP Assay NIST SRM 3150 Lot Number: 991108

Assay Method #2 **999 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al	0.02730	M	Dy	< 0.01358	O	Li	< 0.00009	M	Pr	< 0.00068	M	Te	< 0.06791
M	Sb	< 0.00113	M	Er	< 0.01132	M	Lu	< 0.00091	M	Re	< 0.00226	M	Tb	< 0.00068
M	As	< 0.02264	M	Eu	< 0.00679	O	Mg	< 0.04991	M	Rh	< 0.00226	M	Tl	< 0.00226
M	Ba	< 0.02264	M	Gd	< 0.00226	M	Mn	< 0.00906	M	Rb	< 0.00226	M	Th	< 0.00226
O	Be	< 0.00091	M	Ga	< 0.00226	O	Hg	< 0.04991	M	Ru	< 0.00453	M	Tm	< 0.00091
M	Bi	< 0.00091	M	Ge	< 0.01358	M	Mo	< 0.00453	M	Sm	< 0.00226	M	Sn	< 0.01132
O	B	0.02409	M	Au	< 0.00679	M	Nd	< 0.00453	O	Sc	< 0.00091	O	Ti	0.01325
M	Cd	< 0.00679	M	Hf	< 0.00453	O	Ni	< 0.01044	M	Se	< 0.01811	M	W	< 0.02264
O	Ca	0.00135	M	Ho	< 0.00113	M	Nb	< 0.00113	s	Si		M	U	< 0.00453
M	Ce	< 0.01132	M	In	< 0.02264	n	Os		M	Ag	< 0.00453	O	V	< 0.00408
M	Cs	< 0.00068	M	Ir	< 0.01132	M	Pd	< 0.01132	O	Na	0.02008	M	Yb	< 0.00226
O	Cr	< 0.00681	O	Fe	< 0.00499	O	P	< 0.02269	O	Sr	< 0.00032	M	Y	< 0.09055
M	Co	< 0.00679	M	La	< 0.00113	M	Pt	< 0.00453	O	S	< 0.11342	M	Zn	< 0.04528
O	Cu	< 0.00454	M	Pb	< 0.00679	O	K	< 0.00771	M	Ta	0.00200	M	Zr	< 0.01132

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

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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 - 28.0855; +4; 6; $Si(OH)_x(F)_y^{2-}$

Chemical Compatibility - Soluble in HCl, HF, H_3PO_4, H_2SO_4 and HNO_3 as the $Si(OH)_x(F)_y^{2-}$. 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 $Si(OH)_x(F)_y^{2-}$. 1-10,000 ppm single element solutions as the $Si(OH)_x(F)_y^{2-}$ 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, amorphic (Dissolve by heating in 1:1:1 H_2O / HF / HNO_3); Oxide - quartz (Fuse in Pt° with Na_2CO_3); Geological Samples (Fuse in Pt° with Na_2CO_3 followed by HCl solution of the fusate); Organic Matrices containing silicates and non volatile silicon compounds (Dry ash at 450°C in Pt° and dissolve by gently warming with 1:1:1 H_2O / HF / H_2SO_4 or fuse / ash with Na_2CO_3 and dissolve fusate 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 °C to "unzip" the Si-O-Si polymeric structure or digest with concentrated H_2SO_4/H_2O_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 $K_2^+Si(CH_3)_2O^-$ salt which is not volatile at room temperature.

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

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe interferences.)
ICP-OES	251.611 nm	0.012 / 0.003 µg/mL	1	ion	Ta, U, Zn, Th
ICP-OES	212.412 nm	0.02 / 0.01 µg/mL	1	ion	Hf, Os, Mo, Ta
ICP-OES	288.158 nm	0.03 / 0.004 µg/mL	1	ion	Ta, Ce, Cr, Cd, Th
ICP-MS	28 amu	4000 - 8000 ppt	n/a	M^+	$^{14}N_2$, $^{12}C^{16}O$

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

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - *This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.*

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(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)

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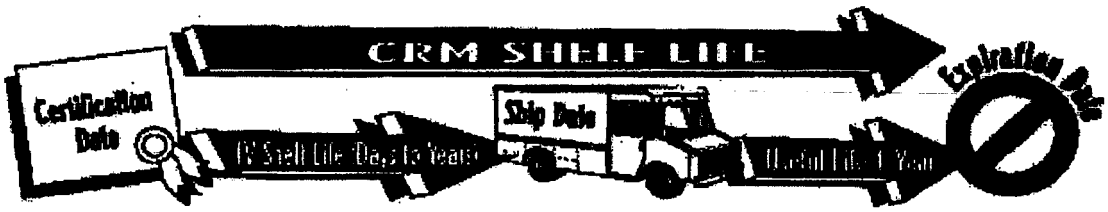
11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



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 24, 2004

Expiration Date: EXPIRES 1 MAR 2006

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 R Gaines

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inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Titanium in 1.4% (abs) HNO_3 tr.HF**

Catalog Number:	CGTI1-1, CGTI1-2, and CGTI1-5
Lot Number:	**X-TI02047**
Starting Material:	Ti granules
Starting Material Purity (%):	99.960814
Starting Material Lot No	K27M07
Matrix:	1.4% (abs) HNO_3 tr.HF

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1000 ± 3 µg/mL

Certified Density: 1.010 g/mL (measured at 22° C)

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

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

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

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

Σs_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 ± 3 µg/mL (Avg of 2 runs)**
ICP Assay NIST SRM 3162a Lot Number: 992801

Assay Method #2 **1002 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/28/05
DATE EXPIRED: 12/1/06
DATE OPENED: 11/29/05
INORG: 5474 PO: DR0026720

P. 1 of 4
5474

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.

O Al < 0.01201	M Dy < 0.01190	O Li < 0.00080	M Pr < 0.00060	M Te < 0.05951
M Sb < 0.00099	M Er < 0.00992	M Lu < 0.00079	M Re < 0.00198	M Tb < 0.00060
M As < 0.01984	M Eu < 0.00595	O Mg < 0.00040	M Rh < 0.00198	M Tl < 0.00198
M Ba < 0.01984	M Gd < 0.00198	O Mn 0.00161	M Rb < 0.00198	M Th < 0.00198
M Be < 0.00099	M Ga < 0.00198	O Hg < 0.06004	M Ru < 0.00397	M Tm < 0.00079
M Bi < 0.00079	M Ge < 0.01190	M Mo < 0.00397	M Sm < 0.00198	M Sn < 0.00992
O B < 0.00801	M Au < 0.00595	M Nd < 0.00397	O Sc < 0.00008	s Ti
M Cd < 0.00595	M Hf < 0.00397	M Ni < 0.01587	M Se < 0.01587	M W < 0.01984
O Ca < 0.00024	M Ho < 0.00099	M Nb < 0.00099	O Si < 0.01601	M U < 0.00397
M Ce < 0.00992	M In < 0.01984	n Os	M Ag < 0.00397	O V < 0.00801
M Cs < 0.00060	M Ir < 0.00992	M Pd < 0.00992	O Na 0.14051	M Yb < 0.00198
M Cr < 0.00992	O Fe < 0.00400	O P < 0.02001	M Sr. < 0.00099	M Y < 0.07935
M Co < 0.00595	M La < 0.00099	M Pt < 0.00397	i S	O Zn < 0.00080
O Cu < 0.01201	M Pb < 0.00595	O K 0.26095	M Ta < 0.01389	M Zr < 0.00992

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 Formin Solution - 47.867; +4; 6; $Ti(F)_6^{-2}$

Chemical Compatibility - Soluble in concentrated HCl, HF, H_3PO_4, H_2SO_4 and 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 with a tendency to hydrolyze forming the hydrated oxide in all dilute acids except HF.

Stability - 2-100 ppb levels stable (Alone or mixed with all other metals) as the $Ti(F)_6^{-2}$ for months in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $Ti(F)_6^{-2}$ chemically stable for years in 2-5% HNO_3 / trace HF in an LDPE container.

Ti Containing Samples (Preparation and Solution) - Metal (Soluble in H_2O / HF ***caution -powder reacts violently***); Oxide - lowtemperature history *anatase or rutile* (Dissolved by heating in 1:1:1 H_2O / HF / H_2SO_4); Oxide - high temperature history (~800? C) *brookite* (fuse in Pt^0 with $K_2S_2O_7$); Ores (fuse in Pt^0 with KF + $K_2S_2O_7$ - no KF if silica not present); Organic Matrices (Dry ash at 450? C in Pt^0 and dissolve by heating with 1:1:1 H_2O / HF / H_2SO_4 or fuse ash with pyrosulfate if oxide is as plastic pigment and likely in brookite crystalline form).

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

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe)
ICP-OES	334.941 nm	0.0038 / 0.000028 µg/mL	1	ion	Nb, Ta, Cr, U
ICP-OES	336.121 nm	0.0053 / 0.000034 µg/mL	1	ion	W, Mo, Co
ICP-OES	323.452 nm	0.0054 / 0.00092 µg/mL	1	ion	Ce, Ar, Ni
ICP-MS	48 amu	14 ppt	n/a	M^+	$^{32}S^{16}O$, $^{32}S^{14}N$, $^{14}N^{16}O^{18}O$, $^{14}N^{17}N_2$, $^{36}Ar^{12}C$, ^{48}Ca, $^{36}F^{12}X^{-2}$ (where X = Zr, Mo, Ru)]

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

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

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

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

Certification Date: December 14, 2004

Expiration Date: EXPIRES 01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

010297

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 Statisical 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:	**Y-SR01128**
Starting Material:	SrCO3
Starting Material Purity (%):	99.999250
Starting Material Lot No:	22878
Matrix:	0.1% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 5/19/05
DATE EXPIRED: 6/1/06
DATE OPENED: 5/19/05
INORG: 5243 PO: 55189

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1005 ± 2 µg/mL 1005 ± 2 µg/g

Certified Density: 1.000 g/mL (measured at 22° C)

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

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

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

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** **1005 ± 2 µg/mL** **1005 ± 2 µg/g**
EDTA NIST SRM 928 Lot Number: 392110

Assay Method #2 **1006 ± 4 µg/mL** **1006 ± 4 µg/g**
ICP Assay NIST SRM 3153a Lot Number: 990906

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1 of 4

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.

O	Al	0.00011	M	Dy	< 0.00595	O	Li	0.00013	M	Pr	< 0.00030	O	Te	< 0.10000
M	Sb	< 0.00050	M	Er	< 0.00496	M	Lu	< 0.00040	M	Re	< 0.00099	M	Tb	< 0.00030
O	As	< 0.00500	M	Eu	< 0.00297	O	Mg	0.00008	O	Rh	< 0.00600	M	Tl	< 0.00099
M	Ba	0.00197	M	Gd	0.00512	O	Mn	0.00003	i	Rb		M	Th	< 0.00099
O	Be	< 0.00009	M	Ga	< 0.00099	O	Hg	< 0.01500	O	Ru	< 0.00300	M	Tm	< 0.00040
M	Bi	< 0.00040	M	Ge	< 0.00595	M	Mo	< 0.00198	M	Sm	< 0.00099	M	Sn	< 0.00496
O	B	< 0.00060	M	Au	< 0.00297	M	Nd	< 0.00198	M	Sc	< 0.00991	M	Ti	< 0.04956
M	Cd	< 0.00297	M	Hf	< 0.00198	O	Ni	< 0.00300	O	Se	< 0.05000	M	W	< 0.00991
O	Ca	0.00447	M	Ho	< 0.00050	M	Nb	< 0.00050	O	Si	< 0.00340	M	U	< 0.00198
M	Ce	< 0.00496	O	In	< 0.00200	n	Os		M	Ag	< 0.00198	M	V	< 0.00198
M	Cs	< 0.00030	M	Ir	< 0.00496	O	Pd	< 0.00400	O	Na	0.00149	M	Yb	0.00059
O	Cr	< 0.00080	O	Fe	0.00044	O	P	< 0.00480	s	Sr		O	Y	< 0.00004
M	Co	< 0.00297	M	La	< 0.00050	M	Pt	< 0.00198	n	S		M	Zn	< 0.01982
O	Cu	< 0.00140	M	Pb	0.00016	O	K	< 0.00170	M	Ta	< 0.00694	M	Zr	< 0.00496

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

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2 of 4

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 ± °4C. Do not pipet from container. Do not return portions removed for pipetting to container.
Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 87.62; +2; 6; $Sr(H_2O)_6^{+2}$
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 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.
Sr Containing Samples (Preparation and Solution) - Metal (Best dissolved in diluted HNO_3); Ores (Carbonate fusion in Pt^0 followed by HCl dissolution); Organic Matrices (Dry ash and dissolution in dilute HCl).
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line		Estimated D.L.	Order	Type	Interferences (underlined indicates severe)
ICP-OES	407.771 nm	0.0004 / 0.00006 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^+	$^{72}Ge^{16}O$, $^{176}Yb^{+2}$, $^{176}Lu^{+2}$, $^{176}Hf^{+2}$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

010300

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, 2005

Expiration Date: EXPIRES 01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul R Gaines

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4 of 4

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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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Tin in H_2O tr HNO_3 tr HF**

Catalog Number:	CGSN1-1, CGSN1-2, and CGSN1-5
Lot Number:	**Y-QSN01140**
Starting Material:	Sn Shot
Starting Material Purity (%):	99.999438
Starting Material Lot No	G12M23
Matrix:	H_2O tr HNO_3 tr HF

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 994 ± 4 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:

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

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

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

$\sum s_i$ = 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** **994 ± 4 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
DATE RECEIVED: 3/31/05
DATE EXPIRED: 5/1/06
DATE OPENED: 3/31/05
INORG: 5124 PO: 521646

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.

O	Al	0.00050	M	Dy	< 0.01205	O	Li	< 0.00002	M	Pr	< 0.00060	M	Te	< 0.06026
O	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	O	Mg	< 0.00003	M	Rh	< 0.00201	M	Tl	< 0.00201
O	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	O	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	
O	B	< 0.01200	M	Au	< 0.00603	M	Nd	< 0.00402	M	Sc	< 0.02009	M	Ti	< [illegible]
O	Cd	0.00009	M	Hf	< 0.00402	O	Ni	< 0.01000	M	Se	< 0.01607	M	W	[illegible]
O	Ca	< 0.00150	M	Ho	< 0.00100	M	Nb	< 0.00100	O	Si	< 0.00340	M	U	[illegible]
M	Ce	< 0.01004	M	In	< 0.02009	n	Os		M	Ag	< 0.00402	M	V	[illegible]
M	Cs	< 0.00060	M	Ir	< 0.01004	M	Pd	< 0.01004	O	Na	< 0.00010	M	Yb	[illegible]
M	Cr	< 0.01004	O	Fe	< 0.00110	O	P	< 0.00500	M	Sr	< 0.00100	M	Y	[illegible]
O	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	O	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

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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 - 118.710; +4; 4,5, 6, 7,8; $Sn(OH)_xF_y^{2-}$

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 $Sn(OH)_xF_y^{2-}$ for 1 year in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $Sn(OH)_xF_y^{2-}$ 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 thiostannate.); 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)
ICP-OES	189.989 nm	0.03 / 0.003 µg/mL	1	ion	
ICP-OES	242.949 nm	0.1 / 0.01 µg/mL	1	atom	W, Mo, Rh, Ta, Co, ^{124}Te, $^{104}Ru^{16}O$, $^{106}Pd^{16}O$
ICP-MS	120 amu	5 ppt	n/a	M^+	

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

8.0 HAZARDOUS INFORMATION

- Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM

9.0 HOMOGENEITY

- This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

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

Members of IQ Net International Certification Network:

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

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

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

A2LA Mutual Recognition Agreement Partners:

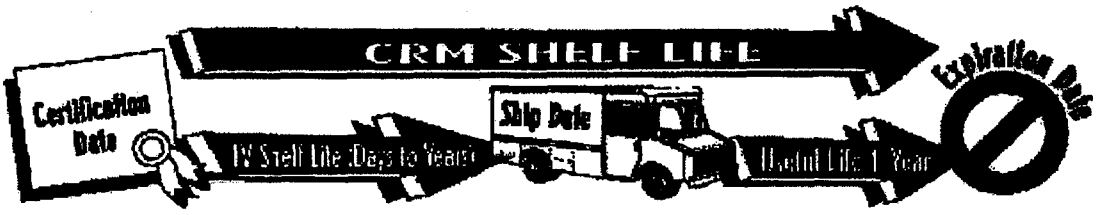
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY



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

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

Certification Date: February 01, 2005

Expiration Date: EXPIRES 01-2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

010305

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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Bismuth in 3.5% (abs) HNO_3**

Catalog Number:	CGBI1-1, CGBI1-2, and CGBI1-5
Lot Number:	**X-BI01093**
Starting Material:	Bi needles
Starting Material Purity (%):	99.999090
Starting Material Lot No	G25L16
Matrix:	3.5% (abs) HNO_3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1000 ± 2 µg/mL 976 ± 2 µg/g

Certified Density: 1.025 g/mL (measured at 22° C)

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

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

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

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 ± 2 µg/mL 976 ± 2 µg/g (Avg 2 runs)**
ICP Assay NIST SRM 3106 Lot Number: 991212

Assay Method #2 **1001 µg/mL 977 µg/g**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 7/22/05
DATE EXPIRED: 8/1/06
DATE OPENED: 7/22/05
INORG: 5309 PO: P55213

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5309

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.

O	Al	0.00012	M	Dy	< 0.01202	O	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	O	Mg	0.00070	M	Rh	< 0.00200	M	Tl	< 0.00200
M	Ba	< 0.02003	M	Gd	< 0.00200	O	Mn	< 0.00020	M	Rb	< 0.00200	M	Th	< 0.00200
M	Be	< 0.00100	M	Ga	< 0.00200	O	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
O	Cd	0.00017	M	Hf	< 0.00401	M	Ni	< 0.01602	M	Se	< 0.01602	M	W	< 0.02003
O	Ca	0.00245	M	Ho	< 0.00100	M	Nb	< 0.00100	O	Si	0.00105	M	U	< 0.00401
M	Ce	< 0.01001	O	In	0.00105	n	Os		M	Ag	< 0.00401	M	V	< 0.00401
M	Cs	< 0.00060	M	Ir	< 0.01001	O	Pd	< 0.00400	O	Na	0.00240	M	Yb	< 0.00200
O	Cr	0.00020	O	Fe	0.00014	O	P	< 0.01000	M	Sr	< 0.00100	M	Y	< 0.08011
M	Co	< 0.00601	M	La	< 0.00100	M	Pt	< 0.00401	O	S	< 0.03000	O	Zn	0.00008
O	Cu	0.00014	O	Pb	0.00135	O	K	0.00039	M	Ta	< 0.01402	M	Zr	< 0.01001

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 - 208.9804; +3; 6 ;$Bi(O)(H_2O)_x^{1+}$
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4 and HF. **Avoid** 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, HNO_3 and HF. The major problem with Bi^{3+} is its tendency to hydrolyze at higher concentrations or in dilute acid. Nitric acid solutions should be 5% to hold the Bi in solution in the 100 to 10000 µg/mL concentration range
Stability - 2-100 ppb levels stable for months in 1 % HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 5 - 7% HNO_3 / LDPE container.
Bi Containing Samples (Preparation and Solution) - Metal (soluble in HNO_3); Oxides (Soluble in HNO_3); Alloys (Dissolve in conc. 4:1 HCl /HNO_3. Heating may be required.); Organic based (dry ash at 450? C and dissolve ash in HNO_3 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)
ICP-OES	223.061 nm	0.04 / 0.005 µg/mL	1	atom	Th, Ir, Ti Cu
ICP-OES	306.772 nm	0.08 / 0.01 µg/mL	1	atom	Th, U, Zr, Hf, Fe
ICP-OES	222.825 nm	0.1 / 0.02 µg/mL	1	atom	Cr, Hf, Ce, Os
ICP-MS	209 amu	2 ppt	n/a	M^+	$^{193}Ir^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

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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 18, 2004

Expiration Date: EXPIRES 10 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator — Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager — Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director — Paul R Gaines

010309

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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Lanthanum in 1.4% (abs) HNO_3**

Catalog Number:	CGLA1-1, CGLA1-2, and CGLA1-5
Lot Number:	**X-QLA01072**
Starting Material:	La2O3
Starting Material Purity (%):	99.991832
Starting Material Lot No	RP-LA-0-5-017
Matrix:	1.4% (abs) HNO_3

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1003 ± 3 µg/mL

Certified Density: 1.010 g/mL (measured at 22° C)

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

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

$(\bar{x})$ = 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** **1003 ± 4 µg/mL**
ICP Assay NIST SRM 3127a Lot Number: 890402

Assay Method #2 **1003 ± 3 µg/mL**
EDTA NIST SRM 928 Lot Number: 392110

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 9/23/05
DATE EXPIRED: 10/1/06 (b)
DATE OPENED: 9/27/05
INORG: 5407 PO: D20[illegible]135

pg. 1 of 4
5407

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.

M Al < 0.00992	M Dy < 0.00595	O Li < 0.00002	M Pr < 0.00030	M Te < 0.02975
M Sb < 0.00050	M Er < 0.00496	M Lu < 0.00040	M Re < 0.00099	M Tb < 0.00030
M As < 0.00992	M Eu < 0.00298	O Mg 0.00281	M Rh < 0.00099	M Tl < 0.00099
M Ba < 0.00992	O Gd < 0.00080	O Mn < 0.00002	M Rb < 0.00099	M Th < 0.00099
M Be < 0.00050	M Ga < 0.00099	i Hg	M Ru < 0.00198	M Tm < 0.00040
M Bi < 0.00040	M Ge < 0.00595	M Mo < 0.00198	M Sm < 0.00099	M Sn < 0.00496
O B < 0.03600	M Au < 0.00298	M Nd 0.00020	O Sc < 0.00003	M Ti < 0.04958
M Cd < 0.00298	M Hf < 0.00198	M Ni < 0.00793	M Se < 0.00793	M W < 0.00992
O Ca 0.00903	M Ho < 0.00050	M Nb < 0.00050	O Si < 0.01000	M U < 0.00198
O Ce < 0.00300	M In < 0.00992	n Os	M Ag < 0.00198	O V < 0.00080
M Cs < 0.00030	M Ir < 0.00496	M Pd < 0.00496	O Na < 0.05000	M Yb < 0.00099
M Cr < 0.00496	O Fe < 0.00150	n P	O Sr < 0.00004	M Y < 0.03966
M Co < 0.00298	s La	M Pt < 0.00198	O S < 0.04300	O Zn 0.10539
M Cu < 0.00595	M Pb < 0.00298	O K < 0.10000	M Ta < 0.00694	O Zr < 0.00070

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 Formin Solution - 138.9055; +3; 6 to 8, 9,10 for some compounds; $La(OH)_x(H_2O)_x^{3+}$

Chemical Compatibility - Soluble in HCl, and HNO_3. Avoid HF, H_3PO_4, H_2SO_4 and neutral to basic media. Stable with most metals and inorganic anions forming an insoluble carbonate, oxide, oxalate, and fluoride and sparingly soluble sulfates (La - Eu exhibit low sulfate solubility). Avoid mixing with elements / solutions containing moderate amounts of fluoride.

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.

La Containing Samples (Preparation and Solution) - Metal (Soluble in acids); Oxide (Dissolved by heating in H_2O / HNO_3); Ores (Carbonate fusion in Pt^0 followed by HCl dissolution); Organic Matrices (Dry ash and dissolve in 1:1 H_2O / HCl or HNO_3).

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	333.749 nm	0.01 / 0.001 µg/mL	1	ion	
ICP-OES	408.672 nm	0.01 / 0.001 µg/mL	1	ion	Th
ICP-OES	412.323 nm	0.01 / 0.001 µg/mL	1	ion	Ce, Th
ICP-MS	139 amu	1 ppt	n/a	M^+	$^{123}Sb^{16}O$, $^{123}Te^{16}O$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

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

Members of IQ Net International Certification Network:

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

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

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

A2LA Mutual Recognition Agreement Partners:

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

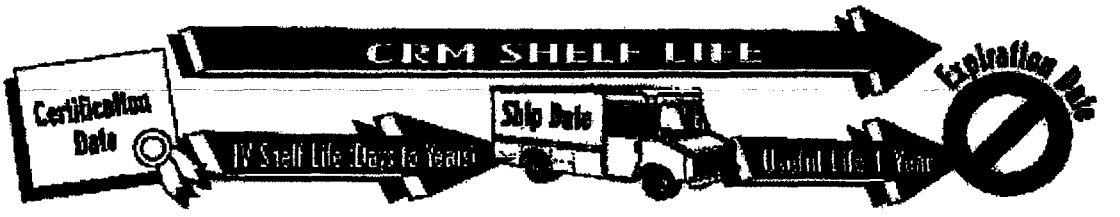
10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

010312

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 05, 2004

Expiration Date: EXPIRES 1 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

010313

inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa
phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
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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 Statisical Principles."

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Palladium in 3.3% (abs) HCl**

Catalog Number:	CGPD1-1, CGPD1-2, and CGPD1-5
Lot Number:	**X-PD02027**
Starting Material:	Pd(NO3)2
Starting Material Purity (%):	99.999248
Starting Material Lot No	11974A-00
Matrix:	3.3% (abs) HCl

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05 DR
DATE EXPIRED: 3/1/2006
DATE OPENED: 2/28/05
INORG: 5045 PO: F55148

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1004 ± 1 µg/mL

Certified Density: 1.022 g/mL (measured at 22° C)

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

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

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

$(\bar{x})$ = 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.)

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 ± 1 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3138 Lot Number: 990207

Assay Method #2 **1002 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al		0.00400	M	Dy	<	0.00060	O	Li	<	0.04000	M	Pr	<	0.00003	O	Te	<	0.01300
O	Sb	<	0.00500	M	Er	<	0.00050	M	Lu	<	0.00004	M	Re	<	0.00010	M	Tb	<	0.00003
O	As	<	0.01400	M	Eu	<	0.00030	O	Mg	<	0.01100	O	Rh	<	0.00600	M	Tl	<	0.00010
M	Ba	<	0.00100	M	Gd	<	0.00010	O	Mn	<	0.00650	M	Rb	<	0.00010	M	Th	<	0.00010
O	Be	<	0.00009	M	Ga	<	0.00010	O	Hg	<	0.01100	O	Ru	<	0.00200	M	Tm	<	0.00004
M	Bi	<	0.00004	M	Ge	<	0.00060	M	Mo	<	0.00020	M	Sm	<	0.00010	O	Sn	<	0.00700
O	B	<	0.00090	O	Au	<	0.00300	M	Nd	<	0.00020	O	Sc	<	0.00009	O	Ti	<	0.00100
O	Cd	<	0.00600	M	Hf	<	0.00020	O	Ni		0.01800	M	Se	<	0.00080	M	W	<	0.00100
O	Ca		0.00700	M	Ho	<	0.00005	M	Nb	<	0.00005	O	Si		0.00600	M	U	<	0.00020
M	Ce	<	0.00050	O	In	<	0.03300	n	Os			O	Ag	<	0.00670	M	V	<	0.00020
M	Cs	<	0.00003	M	Ir	<	0.00050	s	Pd			O	Na		0.01500	M	Yb	<	0.00010
O	Cr		0.00450	O	Fe		0.04600	O	P		0.00600	M	Sr	<	0.00005	M	Y	<	0.00400
M	Co	<	0.00030	M	La	<	0.00005	O	Pt	<	0.00600	O	S	<	0.02500	O	Zn	<	0.00060
O	Cu		0.00360	M	Pb	<	0.00030	O	K	<	0.02000	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

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 - 106.42; +2; 6; $Pd(H_2O)_6^{2+}$
Chemical Compatibility - Stable in HCl, HNO_3, H_2SO_4, HF, H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions in acidic media. Avoid contact with water soluble organics such as aldehydes since Pd^{2+} is easily reduced.
Stability - 2-100 ppb levels. 2ppb Pd is stable for 1 day in 1% HNO_3 / LDPE container. 10 ppb is stable for 3 days in 1% HNO_3 / LDPE container. 100 ppb is stable for ≥ 5 months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.
Pd Containing Samples (Preparation and Solution) - *Metal (Soluble in HNO_3 or Aqua Regia); Oxides (Soluble in HCl); Ores (* Dissolve in HCl / HNO_3).
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	340.458 nm	0.04 / 0.003 µg/mL	1	atom	Ce, Th, Zr
ICP-OES	363.470 nm	0.05 / 0.007 µg/mL	1	atom	
ICP-OES	229.651 nm	0.07 / 0.004 µg/mL	1	ion	Co
ICP-MS	105 amu	2 ppt	n/a	M+	$^{40}Ar^{65}Cu$, $^{89}Y^{16}O$

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8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a 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 13, 2004

Expiration Date: EXPIRES 1 MAR 2006

5045

3 of 4

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

010317

inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Sulfur in H_2O**

Catalog Number:	CGS1-1, CGS1-2, and CGS1-5
Lot Number:	**Y-S01074**
Starting Material:	H2SO4
Starting Material Purity (%):	99.999991
Starting Material Lot No	X48058
Matrix:	H_2O

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/4/2006
DATE EXPIRED: 3/1/2007 DR
DATE OPENED: 1/4/2006
INORG: 5539 PO: F56669

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1000 ± 2 µg/mL 1000 ± 2 µg/g

Certified Density: 1.000 g/mL (measured at 22° C)

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

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

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

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** **1001 ± 2 µg/mL 1001 ± 2 µg/g**
Acidimetric NIST SRM 84k Lot Number: 84k

Assay Method #2 **1000 ± 2 µg/mL 1000 ± 2 µg/g**
ICP Assay NIST SRM 3154 Lot Number: 892205

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al	< 0.00300	M	Dy	< 0.01201	O	Li	< 0.00016	M	Pr	< 0.00060	M	Te	< 0.06005
M	Sb	< 0.00100	M	Er	< 0.01001	M	Lu	< 0.00080	M	Re	< 0.00200	M	Tb	< 0.00060
M	As	< 0.02002	M	Eu	< 0.00601	O	Mg	< 0.00004	M	Rh	< 0.00200	M	Tl	< 0.00200
M	Ba	< 0.02002	M	Gd	< 0.00200	M	Mn	< 0.00801	M	Rb	< 0.00200	M	Th	< 0.00200
O	Be	< 0.00200	M	Ga	< 0.00200	O	Hg	< 0.01100	M	Ru	< 0.00400	M	Tm	< 0.00080
M	Bi	< 0.00080	M	Ge	< 0.01201	M	Mo	< 0.00400	M	Sm	< 0.00200	M	Sn	< 0.01001
O	B	< 0.00990	M	Au	< 0.00601	M	Nd	< 0.00400	M	Sc	< 0.02002	M	Ti	< 0.10008
M	Cd	< 0.00601	M	Hf	< 0.00400	O	Ni	< 0.00230	O	Se	< 0.00620	M	W	< 0.02002
O	Ca	< 0.00370	M	Ho	< 0.00100	M	Nb	< 0.00100	O	Si	< 0.00410	M	U	< 0.00400
M	Ce	< 0.01001	M	In	< 0.02002	n	Os		M	Ag	< 0.00400	M	V	< 0.00400
M	Cs	< 0.00060	M	Ir	< 0.01001	M	Pd	< 0.01001	O	Na	0.00007	M	Yb	< 0.00200
M	Cr	< 0.01001	O	Fe	< 0.00110	O	P	< 0.00480	M	Sr	< 0.00100	M	Y	< 0.08006
M	Co	< 0.00601	M	La	< 0.00100	M	Pt	< 0.00400	s	S		O	Zn	< 0.00040
M	Cu	< 0.01201	M	Pb	< 0.00601	O	K	< 0.00170	M	Ta	< 0.01401	M	Zr	< 0.01001

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

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7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010319

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 - 32.066; +6; 6; $(O=)_2S(OH)_2$

Chemical Compatibility - Soluble in HCl, HNO_3, H_3PO_4 and HF aqueous matrices water and NH_4OH. Stable with all metals and inorganic anions at low to moderate ppm levels under acidic conditions except Ba and Pb and to a lesser extent Sr, and Ca.

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

S Containing Samples (Preparation and Solution) - We most often get questions about the determination of S in Rocks, Silicates and insoluble sulfates (the finely powered sample is fused in a Pt^0 crucible with 6 times its weight of Na_2CO_3 + 0.5 grams KNO_3. The fuseate is extracted with water. Any $BaSO_4$ present in the sample is transposed by the carbonate fusion to the $BaCO_3$ which is left behind in the water-insoluble residue. If $PbSO_4$ is present the fuseate should be boiled with a sodium carbonate saturated with CO_2 solution for 1 hour or more where the $PbSO_4$ will be transposed to the water insoluble carbonate which can be filtered off. Boiling the fuseate with a saturated carbonate solution is good insurance for samples containing Ba, Sr, and Ca. The Ba, Pb, Sr, Ca, free filtrate can be acidified and measured by ICP.)

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)
ICP-OES	166.669nm	0.2 / 0.19 µg/mL	1	atom	Si, B
ICP-OES	182.034 nm	0.3 / 0.024 µg/mL	1	atom	
ICP-OES	143.328 nm	0.4 / 0.035 µg/mL	1	atom	
ICP-MS	32 amu	30,000 ppt	n/a	M*	$^{16}O_2$, $^{14}N^{18}O$, $^{15}N^{17}O$, $^{14}N^{17}O^1H$, $^{15}N^{16}O^1H$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

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

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

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

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

A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

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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 01, 2005

Expiration Date: EXPIRES 1 5 2007

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

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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 Statisical Principles."

2.0 DESCRIPTION OF CRM

Custom-Grade 1000 µg/mL Thorium in 3% (abs) HNO3

Catalog Number:	CGTH1-1, CGTH1-2, and CGTH1-5
Lot Number:	**Y-TH01065**
Starting Material:	Th(NO3)4x4H2O
Starting Material Purity (%):	99.998809
Starting Material Lot No:	X-25828-7
Matrix:	3% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/28/05
DATE EXPIRED: 12/1/06 (y)
DATE OPENED: 11/29/05
INORG: 5469 PO: D0092(720

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1001 ± 3 µg/mL 980 ± 3 µg/g

Certified Density: 1.021 g/mL (measured at 22° C)

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

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

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

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** **1002 ± 3 µg/mL** **981 ± 3 µg/g**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #2 **1001 ± 3 µg/mL** **980 ± 3 µg/g**
ICP Assay NIST SRM 3159 Lot Number: 992912

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

M	Al	< 0.00998	M	Dy	< 0.00599	O	Li	< 0.05000	M	Pr	< 0.00030	M	Te	< 0.02995
M	Sb	< 0.00050	M	Er	< 0.00499	M	Lu	< 0.00040	M	Re	< 0.00100	M	Tb	< 0.00030
M	As	< 0.00998	M	Eu	< 0.00300	O	Mg	< 0.02000	M	Rh	< 0.00100	M	Tl	< 0.00100
M	Ba	< 0.00998	M	Gd	< 0.00100	M	Mn	0.00049	M	Rb	< 0.00100	s	Th	
M	Be	< 0.00050	M	Ga	< 0.00100	i	Hg		M	Ru	< 0.00200	M	Tm	< 0.00040
M	Bi	< 0.00040	M	Ge	< 0.00599	M	Mo	< 0.00200	M	Sm	< 0.00100	M	Sn	< 0.00499
M	B	< 0.06987	M	Au	< 0.00300	M	Nd	0.00044	M	Sc	< 0.00998	M	Ti	< 0.04991
M	Cd	< 0.00300	M	Hf	< 0.00200	M	Ni	< 0.00799	M	Se	< 0.00799	M	W	< 0.00998
O	Ca	< 0.10000	M	Ho	< 0.00050	M	Nb	< 0.00050	i	Si		M	U	0.00406
M	Ce	0.00267	M	In	< 0.00998	n	Os		M	Ag	< 0.00200	M	V	< 0.00200
M	Cs	< 0.00030	M	Ir	< 0.00499	M	Pd	< 0.00499	O	Na	< 0.05000	M	Yb	< 0.00100
M	Cr	< 0.00499	O	Fe	< 0.05000	i	P		M	Sr	< 0.00050	M	Y	< 0.03993
M	Co	< 0.00300	M	La	0.00076	M	Pt	< 0.00200	i	S		M	Zn	0.00425
M	Cu	< 0.00599	M	Pb	< 0.00300	O	K	< 0.03000	M	Ta	< 0.00699	M	Zr	0.01978

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 - 232.0381; +4 ; 8; $Th(OH)^{3+}$ and $Th(OH)_2^{2+}$

Chemical Compatibility - Soluble in HCl, and HNO_3. Avoid H_3PO_4, H_2SO_4 and HF although solubilities may not be a problem depending upon pH and matrix (For example: ThF_4 is soluble in acids). Avoid neutral to basic media. Th^{4+} is stable with most metals and inorganic anions forming an insoluble carbonate, oxide, fluoride, oxalate, sulfate and phosphate in neutral to 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 2-5% HNO_3 / LDPE container.

Th Containing Samples (Preparation and Solution) - Metal (Soluble in Aqua Regia); Oxide (The heated oxide is not soluble in acids except hot conc. H_2SO_4); Ores (Na_2O_2 fusion at 480 ± 20?C for 7 minutes, cool and treat sintered mass with 50 mL cold water and stand until disintegrated. The mass is transferred to a beaker and acidified with HCl with 25 mL excess HCl added. Any residue is collected on a Whatman No. 42 filter, dried and ignited to 1000 ?C in Pt crucible and the ash treated with H_2SO_4 / HF and fumed. If residue remains, then treat it by peroxide fusion as 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)
ICP-OES	283.730 nm	0.07 / 0.007 µg/mL	1	ion	U, Zr
ICP-OES	283.231 nm	0.07 / 0.007 µg/mL	1	ion	U, Mo, Ti, Fe, Cr
ICP-OES	274.716 nm	0.08 / 0.008 µg/mL	1	ion	Ti, Ta, Fe, V
ICP-MS	232 amu	1 ppt	n/a	M^+	

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)
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.

Certification Date: April 15, 2005

Expiration Date: EXPIRES 01/2006

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

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inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM

Custom-Grade **1000 µg/mL Uranium in 1% (abs) HNO_3**

Catalog Number:	CGU1-1, CGU1-2, and CGU1-5
Lot Number:	**Y-QU01075**
Starting Material:	$UO_2(NO_3)_2.6H_2O$
Starting Material Purity (%):	99.994419
Starting Material Lot No	RB0018
Matrix:	1% (abs) HNO_3

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 997 ± 2 µg/mL

Certified Density: 1.007 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\sum x_1}{n}$

$(\bar{x})$ = mean
x_1 = individual results
n = number of measurements

Uncertainty (±) $= \frac{2[(\sum s_1)^2]^{1/2}}{(n)^{1/2}}$

$\sum s_1$ = 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** **997 ± 2 µg/mL (Avg 2 runs)**
ICP Assay NIST SRM 3164 Lot Number: 891509

Assay Method #2 **1002 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 9/23/05
DATE EXPIRED: 10/1/06
DATE OPENED: 9/27/05
INORG: 5408 PO: D20064435

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5408

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.

M	Al	0.05166	M	Dy	< 0.01494	M	Li	< 0.02490	M	Pr	< 0.00075	M	Te	< 0.07470
M	Sb	< 0.00125	M	Er	< 0.01245	M	Lu	< 0.00100	M	Re	< 0.00249	M	Tb	0.00003
M	As	< 0.02490	M	Eu	< 0.00747	M	Mg	< 0.07470	M	Rh	< 0.00249	M	Tl	< 0.00249
M	Ba	< 0.02490	M	Gd	0.00310	M	Mn	0.00083	M	Rb	< 0.00249	M	Th	< 0.00249
M	Be	< 0.00125	M	Ga	< 0.00249	i	Hg		M	Ru	< 0.00498	M	Tm	< 0.00100
M	Bi	< 0.00100	M	Ge	< 0.01494	M	Mo	0.00093	M	Sm	0.00010	O	Sn	< 0.10000
M	B	< 0.17429	M	Au	< 0.00747	M	Nd	< 0.00498	M	Sc	< 0.02490	M	Ti	0.00258
M	Cd	0.00103	M	Hf	< 0.00498	M	Ni	< 0.01992	M	Se	< 0.01992	M	W	< 0.02490
O	Ca	0.05395	M	Ho	0.00052	M	Nb	< 0.00125	i	Si		s	U	
M	Ce	0.00010	M	In	< 0.02490	n	Os		M	Ag	< 0.00498	M	V	< 0.00498
M	Cs	< 0.00075	M	Ir	< 0.01245	M	Pd	< 0.01245	O	Na	0.00664	M	Yb	< 0.00249
M	Cr	< 0.01245	M	Fe	< 0.49798	i	P		M	Sr	< 0.00125	M	Y	0.00062
M	Co	< 0.00747	M	La	0.00145	M	Pt	< 0.00498	i	S		M	Zn	0.00114
M	Cu	0.00072	M	Pb	0.00217	i	K		M	Ta	< 0.01743	M	Zr	< 0.01245

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 - 238.0289; +6 ; 8; UO_2^{2+}(uranyl)

Chemical Compatibility - Soluble in HCl and HNO_3. Avoid H_3PO_4. H_2SO_4 and HF matrices should not be a problem depending upon [U]. Although the UO_2^{2+} ion is distinctly basic, any U^{+4} will precipitate in basic media. UO_2^{2+}salts are generally soluble in water and UO_2^{2+} is stable with most metals and inorganic anions. The uranyl phosphate is insoluble in water. UF_4 and UF_6 are water soluble.

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.

U Containing Samples (Preparation and Solution) - Metal (Dissolves rapidly in HCl and HNO_3); Oxide (Soluble in HNO_3); Ores (Digest for 1-2 hours with 1 gram of ore to 30 mL 1:1 HNO_3. Silica insolubles are removed by filtration after bringing the sample to fumes with conc. H_2SO_4.)

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)
ICP-OES	385.958 nm	0.3 / 0.01 µg/mL	1	ion	Th, Fe
ICP-OES	367.007 nm	0.3 / 0.02 µg/mL	1	ion	Th, Ce
ICP-OES	263.553 nm	0.3 / 0.01 µg/mL	1	ion	Ce, Ir, Th, Rh, W, Zr, Ta, Ti, V, Hf, Fe, Re, Ru
ICP-MS	238 amu	2 ppt	n/a	M^+	$^{206}Pb^{16}O_2$

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a 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 23, 2005

Expiration Date:

EXPIRES
1 2006

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

010329

***NOTICE TO ICP-MS USERS:** The ^{235}U in this standard is depleted. The certified abundances in Atom % are as follows:

	Isotope	Natural Abundance Atom %	IV's Certified Abundance Atom %
Uranium	^{238}U	99.3	99.8 ± 0.1
	^{235}U	0.70	0.207 ± 0.002

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inorganic ventures / iv labs

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

certificate of analysis

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

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Tungsten in 0.1% (abs) HNO_3 1% (abs) HF**

Catalog Number:	CGW1-1, CGW1-2, and CGW1-5
Lot Number:	**Y-W01085**
Starting Material:	W Powder
Starting Material Purity (%):	99.993920
Starting Material Lot No	B23P45
Matrix:	0.1% (abs) HNO_3 1% (abs) HF

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 998 ± 2 µg/mL 991 ± 2 µg/g

Certified Density: 1.007 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\sum x_1}{n}$

$(\bar{x})$ = mean
x_1 = individual results
n = number of measurements

Uncertainty $(\pm) = \frac{2[(\sum s_1)^2]^{1/2}}{(n)^{1/2}}$

$\sum s_1$ = 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** **998 ± 2 µg/mL 991 ± 2 µg/g (Avg 2 runs)**
ICP Assay NIST SRM 3163 Lot Number: 990209

Assay Method #2 **1002 µg/mL 995 µg/g**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 7/22/05
DATE EXPIRED: 8/1/06
DATE OPENED: 7/22/05
INORG: 5308 PO: F55213

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5308

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.

O	Al	0.01998	M	Dy	< 0.00599	O	Li	< 0.00008	M	Pr	< 0.00030	M	Te	< 0.02995
M	Sb	< 0.00050	M	Er	< 0.00499	M	Lu	< 0.00040	i	Re		M	Tb	< 0.00030
M	As	< 0.00999	M	Eu	< 0.00300	O	Mg	0.00256	M	Rh	< 0.00100	M	Tl	< 0.00100
M	Ba	< 0.00999	M	Gd	< 0.00100	M	Mn	< 0.00399	M	Rb	< 0.00100	M	Th	< 0.00100
M	Be	< 0.00050	M	Ga	< 0.00100	O	Hg	< 0.04794	M	Ru	< 0.00200	M	Tm	< 0.00040
M	Bi	< 0.00040	M	Ge	< 0.00599	M	Mo	< 0.00200	M	Sm	< 0.00100	M	Sn	< 0.00499
O	B	0.07191	M	Au	< 0.00300	M	Nd	< 0.00200	O	Sc	< 0.00036	O	Ti	< 0.00360
M	Cd	< 0.00300	M	Hf	0.00100	O	Ni	< 0.03995	M	Se	< 0.00799	s	W	
O	Ca	0.00240	M	Ho	< 0.00050	O	Nb	< 0.06392	i	Si		M	U	< 0.00200
M	Ce	< 0.00499	M	In	< 0.00999	n	Os		M	Ag	< 0.00200	M	V	< 0.00200
M	Cs	< 0.00030	M	Ir	< 0.00499	M	Pd	< 0.00499	O	Na	0.05194	M	Yb	< 0.00100
M	Cr	< 0.00499	O	Fe	< 0.03995	n	P		M	Sr	< 0.00050	M	Y	< 0.03994
M	Co	< 0.00300	M	La	< 0.00050	M	Pt	< 0.00200	n	S		M	Zn	0.00120
M	Cu	< 0.00599	M	Pb	< 0.00300	O	K	0.03436	O	Ta	< 0.39951	M	Zr	< 0.00499

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 - 183.85; +6; 6,7,8,9; WOF_5^{-2} (chemical form as received)
Chemical Compatibility - W is very readily hydrolyzed requiring 0.1 to 1% HF solutions for stable acidic solutions. The WOF_5^{-2} is soluble in % levels of HCl and HNO_3 provided it is in the WOF_5^{-2} form. Stable at ppm levels with some metals provided it is fluorinated. Do not mix with Alkaline or Rare Earths. Is best to be mixed only with other fluorinated metals (Ti, Zr, Hf, Nb, Ta, Mo, Si, Sn, Ge). Look for yellow WO_3 precipitate if mixed with other transition elements at higher levels indicating instability. The yellow WO_3 will form over a period of weeks even in trace HF, therefore, HF levels of W multi- element blends should be ~ 1 %.
Stability - 2-100 ppb levels stable (Alone or mixed with all other metals that are at comparable levels) as the WOF_5^{-2} for months in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the WOF_5^{-2} chemically stable for years in 1% HF in an LDPE container.
W Containing Samples (Preparation and Solution) - Metal (Soluble in HF / HNO_3); Oxide (Soluble in HF or NH_4OH) ; Organic Matrices (Dry ash at 450 ?C in Pt^0 and dissolve oxide with HF).
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)
ICP-OES	207.911 nm	0.03 / 0.001 µg/mL	1	ion	Ru, In
ICP-OES	224.875 nm	0.05 / 0.005 µg/mL	1	ion	Co, Rh, Ag
ICP-OES	209.475 nm	0.05 / 0.005 µg/mL	1	ion	Mo
ICP-MS	182 amu	5 ppt	n/a	M^+	$^{168}Er^{16}O$

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

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(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)

010333

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 29, 2005

Expiration Date: EXPIRES 1 02006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator — Nicholas Maida

Certificate Approved By: Katalin Le, QC Manager — Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director — Paul R Gaines

010334

inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM

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

Catalog Number:	CGY1-1, CGY1-2, and CGY1-5
Lot Number:	**Y- Y01097**
Starting Material:	Y2O3
Starting Material Purity (%):	99.998662
Starting Material Lot No:	9918901OYL
Matrix:	1.4% (abs) HNO3

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/11/06
DATE EXPIRED: 3/1/2007 DR
DATE OPENED: 1/13/06
INORG: 5588 PO: F56675

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1001 ± 2 µg/mL

Certified Density: 1.010 g/mL (measured at 22° C)

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

Certified Value $(\bar{x}) = \frac{\sum x1}{n}$ $(\bar{x})$ = mean
x1 = individual results
n = number of measurements

Uncertainty $(\pm) = \frac{2[(\sum s1)2]^{1/2}}{(n)^{1/2}}$ $\sum s1$ = The summation of all significant estimated errors (Most common are the errors from instrumental measurement weighting, 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 an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **999 ± 4 µg/mL**
ICP Assay NIST SRM 3167a Lot Number: 790412

Assay Method #2 **1001 ± 2 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

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1 of 4

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 CRM's.

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

CRM's 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.

O	Al	0.00198	M	Dy	0.00030	O	Li	< 0.00002	M	Pr	< 0.00030	M	Te	< 0.02988
M	Sb	< 0.00050	M	Er	< 0.00498	M	Lu	< 0.00040	M	Re	< 0.00100	M	Tb	0.00099
M	As	< 0.00996	M	Eu	0.00027	O	Mg	0.00020	M	Rh	< 0.00100	M	Tl	< 0.00100
M	Ba	< 0.00996	M	Gd	< 0.00100	O	Mn	< 0.00002	M	Rb	< 0.00100	M	Th	< 0.00100
M	Be	< 0.00050	M	Ga	< 0.00100	O	Hg	< 0.02000	M	Ru	< 0.00199	M	Tm	0.00007
M	Bi	< 0.00040	M	Ge	< 0.00598	M	Mo	< 0.00199	M	Sm	0.00014	M	Sn	< 0.00498
O	B	< 0.00100	M	Au	< 0.00299	M	Nd	0.00008	O	Sc	< 0.00003	M	Ti	< 0.04980
M	Cd	< 0.00299	M	Hf	< 0.00199	M	Ni	< 0.00797	M	Se	< 0.00797	M	W	< 0.00996
O	Ca	0.00183	M	Ho	0.00006	M	Nb	< 0.00050	O	Si	< 0.00400	M	U	< 0.00199
M	Ce	0.00010	M	In	< 0.00996	n	Os		O	Ag	< 0.02000	O	V	< 0.00080
M	Cs	< 0.00030	M	Ir	< 0.00498	O	Pd	< 0.10000	O	Na	< 0.05000	M	Yb	0.00028
M	Cr	< 0.00498	O	Fe	0.00076	O	P	< 0.07000	O	Sr	< 0.00004	s	Y	
M	Co	< 0.00299	M	La	0.00025	M	Pt	< 0.00199	O	S	< 0.04300	O	Zn	0.01189
M	Cu	< 0.00598	M	Pb	< 0.00299	O	K	< 0.10000	M	Ta	< 0.00697	O	Zr	< 0.00070

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

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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 - 88.9059; +3; 6; Y(OH)(H2O)x+2

Chemical Compatibility - Soluble in HCl, H2SO4 and HNO3. Avoid HF, H3PO4 and neutral to basic media. Stable with most metals and inorganic anions forming an insoluble carbonate, oxide, oxalate, and fluoride. Avoid mixing with elements / solutions containing moderate amounts of fluoride.

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

Y Containing Samples (Preparation and Solution) - Metal (Soluble in acids); Oxide (Dissolve by heating in H2O/ HNO3); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (Dry ash and dissolve in 1:1 H2O / HCl or 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)
ICP-OES 360.073 nm	0.005 / 0.000036 µg/mL	1	ion	Ce, Th
ICP-OES 371.030 nm	0.004 / 0.00007 µg/mL	1	ion	Ce
ICP-OES 377.433 nm	0.005 / 0.0009 µg/mL	1	ion	Ta, Th
ICP-MS 89 amu	0.8 ppt	n/a	M+	73Ge16O, 178Hf+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)

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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 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 Labs concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

Certification Date: October 19, 2005
Expiration Date: EXPIRES 01/2007

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, PhD., Technical Director

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010338

inorganic ventures / iv labs

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

certificate of analysis

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

2.0 **DESCRIPTION OF CRM** Custom-Grade **1000 µg/mL Zirconium in H_2O tr. HNO_3 tr. HF**

Catalog Number:	CGZR1-1, CGZR1-2, and CGZR1-5
Lot Number:	**Y-ZR01062**
Starting Material:	ZrO_2
Starting Material Purity (%):	99.994542
Starting Material Lot No	22855
Matrix:	H_2O tr. HNO_3 tr. HF

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 995 ± 3 µg/mL 996 ± 3 µg/g

Certified Density: 0.999 g/mL (measured at 22° C)

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

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

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

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 ± 3 µg/mL 996 ± 3 µg/g**
ICP Assay NIST SRM 3169 Lot Number: 990109

Assay Method #2 **1001 µg/mL 1002 µg/g**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 7/22/05
DATE EXPIRED: 8/1/06
DATE OPENED: 7/22/05
INORG: 5311 PO: F55213

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4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

O	Al		0.01416	M	Dy	<	0.01188	O	Li	<	0.00012	M	Pr	<	0.00059	M	Te	<	0.05942
M	Sb	<	0.00099	M	Er	<	0.00990	M	Lu	<	0.00079	M	Re	<	0.00198	M	Tb	<	0.00059
M	As	<	0.01981	M	Eu	<	0.00594	O	Mg	<	0.00012	M	Rh	<	0.00198	M	Tl	<	0.00198
M	Ba	<	0.01981	M	Gd	<	0.00198	O	Mn	<	0.00401	M	Rb	<	0.00198	M	Th	<	0.00198
O	Be	<	0.40048	M	Ga	<	0.00198	O	Hg	<	0.04405	M	Ru	<	0.00396	M	Tm	<	0.00079
M	Bi	<	0.00079	M	Ge	<	0.01188	O	Mo	<	0.40048	M	Sm	<	0.00198	M	Sn	<	0.00990
M	B	<	0.13864	M	Au	<	0.00594	M	Nd	<	0.00396	O	Sc	<	0.00064	O	Ti	<	0.16019
O	Cd	<	0.02123	M	Hf		0.04403	O	Ni		0.01214	M	Se	<	0.01585	M	W	<	0.01981
O	Ca		0.00809	M	Ho	<	0.00099	O	Nb	<	0.08010	O	Si	<	0.80096	M	U	<	0.00396
M	Ce	<	0.00990	M	In	<	0.01981	n	Os			O	Ag	<	0.40048	M	V	<	0.00396
M	Cs	<	0.00059	M	Ir	<	0.00990	M	Pd	<	0.00990	O	Na	<	0.02803	M	Yb	<	0.00198
O	Cr	<	0.00881	O	Fe		0.00344	O	P	<	0.01922	M	Sr	<	0.00099	O	Y	<	0.00401
M	Co	<	0.00594	M	La	<	0.00099	M	Pt	<	0.00396	O	S	<	0.28033	O	Zn	<	0.04005
M	Cu	<	0.01188	M	Pb	<	0.00594	O	K	<	0.00681	M	Ta	<	0.01386	s	Zr		

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

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7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL 010340

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 - 91.224; +4; 6,7,8; $Zr(F)_6^{-2}$

Chemical Compatibility - Soluble in concentrated HCl, HF, H_2SO_4 (very hot) and HNO_3. Avoid H_3PO_4 and neutral to basic media. Unstable at ppm levels with metals that would pull F^- away (i.e. Do not mix with Alkaline or Rare Earths or high levels of transition elements unless they are fluorinated). Stable with most inorganic anions but precipitation with phosphate, oxalate, and tartrate with a tendency to hydrolyze forming the hydrated oxide in all dilute acids except HF .

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the $Zr(F)_6^{-2}$ + $Zr(OH)_4F_2^{-2}$ for months in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $Zr(F)_6^{-2}$ chemically stable for years in 2-5% HNO_3 / trace HF in an LDPE container.

Zr Containing Samples (Preparation and Solution) - Metal (Soluble in H_2O / HF / HNO_3); Oxide - unlike TiO_2 the ZrO_2 is best fused in one of the following ways (Na_2O_2 in Ni^0, Na_2CO_3 in Pt^0 or Borax in Pt^0); Organic Matrices (Dry ash at 450 °C in Pt^0 and dissolve by fusing with Na_2CO_3 and dissolving in HF / HNO_3 / H_2O).

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*)
ICP-OES	343.823 nm	0.007 / 0.0004 µg/mL	1	ion	Hf, Nb
ICP-OES	339.198 nm	0.008 / 0.0007 µg/mL	1	ion	Th, Mo
ICP-OES	272.261 nm	0.018 / 0.001 µg/mL	1	ion	Cr, V, Th, W
ICP-MS	90 amu	2 ppt	n/a	M^+	$^{74}Ge^{16}O$, $^{74}Se^{16}O$, [$^{180}X^{+2}$ (where X = Hf, Ta, W)]

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

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Saftey Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105
Recognized by:
Registrar Accreditation Board (ANSI-RAB)
Standards Council of Canada (SCC)
Dutch Council for Accreditation (RVA)
Entidad Mexicana de Acreditacion, a.c.(EMA)
Members of IQ Net International Certification Network:
Argentina (IRAM), Australia (QAS), Austria (ÖQS), Belgium (Avinter) , Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)

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

10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers" - Reference Materials Production - Accredited A2LA Certificate Number 883.02
A2LA Mutual Recognition Agreement Partners:
Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission - Domestic Licensing of Production and Utilization Facilities

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

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

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 IV Shelf Life - The period of time during which the concentration of the analyte(s) in a 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 16, 2005

Expiration Date:

EXPIRES
1 5 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By:	Nick Maida, QA Administrator	Nicholas Maida
Certificate Approved By:	Katalin Le, QC Manager	Katalin Le
Certifying Officer:	Paul Gaines, Chemist, Senior Technical Director	Paul R Gaines

010342

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

Pipette Calibrations

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SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

Balance #: 34 Thermometer #: 6011 diH20 Temperature (°C): 21/0343

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
Lab30	1000	1.0074	1.0043	1.0048
TMA1	1000	1.0018	1.0049	1.0037
TMA2	1000	.9979	.9985	1.0007
TMA3	1000	NOT	FOUND	
TMA6	1000	1.0153	1.0120	1.0151
TMB1	900	.9018	.9028	.9004
TMC1	800	.8005	.8004	.7998
TMDD1	750	.7589	.7561	.7558
TMD1	700	.7088	.7087	.7073
TMD2	700	.7061	.7020	.7022
TME1	600	~~.5999~~ .5999	.6001	~~.5989~~ .5989
TMF2	500 gw 1-24-06 x3 x2	~~.5099~~ .5046	~~.6001~~ .5041	~~.5089~~ .5048
TMF5	500	.5068	.5047	.5072
ICF1	500	.5045	.5038	.5024
L30-500	500	.5082	.5079	.5083
TMG3	400	.4009	.4021	.3998
TMH1	300	OUT	OF	SERVICE
TMH2	300	.3033	.3025	.3032
TMJ1	250 gw 1-24-06 x3	~~.2577~~ .2488	~~.2548~~ .2478	~~.2548~~ .2488
TMJ2	250	~~.2561~~ .2485	~~.2567~~ .2492	~~.2566~~ .2497
TMJ3	250	~~.2583~~ .2514	~~.2552~~ .2515	~~.2549~~ .2511
TMK2	200	.1987	.2008	.2010
TML1	150	.1498	.1501	.1503
TMM1	120	.1198	.1211	.1204
TMN3	100	OUT	OF	SERVICE
ICN1	100	.1004	.1012	.1007
TMQ1	80	.0799	.0799	.0800
TMR1	70	OUT	OF	SERVICE
TMS1	60	OUT	OF	SERVICE
LAB-30A	50	OUT	OF	SERVICE
TMU1	40	.0406	.0401	.0399
TMU2	40	.0409	.0400	.0400
TMV1	30	.0304	.0301	.0301
L30-20	20	.0202	.0202	.0201
TMW1	25	.0252	.0250	.0249
TMY1	15	OUT	OF	SERVICE

Analyst: John Wilke Date: 1-24-06

Reviewed by: [illegible] Date: 1-24-06

FRM-243-b (Rev 3/Mar 03)

Book/Page: 04 034

SwRI – Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

(Space provide for Inorganic Laboratories' Fixed Volume Pipette Verification Spreadsheet)

010344

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	1.0074	1.0043	1.0048	1.01	100.55
TMA1	1000	1.0018	1.0049	1.0037	1.00	100.35
TMA2	1000	0.9979	0.9985	1.0007	1.00	99.90
TMA3	1000	NOT	FOUND			
TMA6	1000	1.0153	1.0120	1.0151	1.01	101.41
TMB1	900	0.9018	0.9028	0.9004	0.90	100.19
TMC1	800	0.8005	0.8004	0.7998	0.80	100.03
TMDD1	750	0.7589	0.7561	0.7558	0.76	100.92
TMD1	700	0.7088	0.7087	0.7073	0.71	101.18
TMD2	700	0.7061	0.7020	0.7022	0.70	100.49
TME1	600	0.5999	0.6001	0.5989	0.60	99.94
TMF2	500	0.5046	0.5041	0.5048	0.50	100.90
TMF5	500	0.5068	0.5047	0.5072	0.51	101.25
ICF1	500	0.5045	0.5038	0.5024	0.50	100.71
L30-500	500	0.5082	0.5079	0.5083	0.51	101.63
TMG3	400	0.4009	0.4021	0.3998	0.40	100.23
TMH1	300	OUT	OF	SERVICE		
TMH2	300	0.3033	0.3025	0.3032	0.30	101.00
TMJ1	250	0.2488	0.2478	0.2480	0.25	99.28
TMJ2	250	0.2485	0.2492	0.2497	0.25	99.65
TMJ3	250	0.2514	0.2515	0.2511	0.25	100.53
TMK2	200	0.1987	0.2008	0.2010	0.20	100.08
TML1	150	0.1498	0.1501	0.1503	0.15	100.04
TMM1	120	0.1198	0.1211	0.1204	0.12	100.36
TMN3	100	OUT	OF	SERVICE		
ICN1	100	0.1004	0.1012	0.1007	0.10	100.77
TMQ1	80	0.0799	0.0799	0.0800	0.08	99.92
TMR1	70	OUT	OF	SERVICE		
TMS1	60	OUT	OF	SERVICE		
LAB-30A	50	OUT	OF	SERVICE		
TMU1	40	0.0400	0.0401	0.0399	0.04	100.00
TMU2	40	0.0409	0.0400	0.0400	0.04	100.75
TMV1	30	0.0304	0.0301	0.0301	0.03	100.67
L30-20	20	0.0202	0.0202	0.0201	0.02	100.83
TMW1	25	0.0252	0.0250	0.0249	0.03	100.13
TMY1	15	OUT	OF	SERVICE		

All 3 250mL pipettes failed @ 102% and above, re-verified by second technician (person) and where in acceptable ranges of 99% and 100%. JCW 1-24-06

FRM-246 (Rev 1/Mar 03)

Book/page: 08 045

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

JW 1-19-06

010345

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	0.0201	0.0199	0.0200	0.020	100.00
ADJ200-A	100	0.0992	0.0997	0.0999	0.100	99.60
	200	0.2003	0.2001	0.2017	0.201	100.35
	20					
ADJ200-C	100	OUT	OF	SERVICE		
	200					
	20	0.0199	0.0202	0.0200	0.020	100.17
ADJ200-D	100	0.0990	0.0991	0.0989	0.099	99.00
	200	0.2004	0.1989	0.1995	0.200	99.80
	20					
ADJ200-G	100					
	200					
	20					
ADJ200-H	100					
	200					
	20					
ADJ200-J	100					
	200					
	20					
ADJ200-K	100	NOT	IN USE-	GLOVEBOX		
	200					
	20					
ADJ200	100					
	200					
	20					
ADJ200	100					
	200					

FRM-247a (Rev 4/Apr 04)

Book/page: 08 046

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 34 Thermometer #: G011 diH20 Temperature (° C) 21 010346

	Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
20 µL – 200 µL		20	.0201	.0199	.0200
	ADJ200-A	100	.0992	.0997	.0999
		200	.2003	.2001	.2017
		20			
	ADJ200-C	100	OUT	OF	SERVICE
		200			
		20	.0199	.0202	.0200
	ADJ200-D	100	.0990	.0991	.0989
		200	.2004	.1989	.1995
		20			
	ADJ200-G	100			
		200			
		20			
	ADJ200-H	100		1-19-06	
		200			
		20			
	ADJ200-J	100			
		200			
		20			
	ADJ200-K	100	NOT	IN USE –	GLOVEBOX
		200			
		20			
	ADJ200	100		1-19-06	
		200			

Analyst: John Wilke Date: 1-19-06

Reviewed by: Noll Ofn Date: 02/07/06

Book/page: 08 047

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010347

SwRI – Div. 01, Inorganic Laboratory Adjustable Pipette Verification Spreadsheet

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)	Avg Wt (	% of True V
	20					
ADJ200-A	100					
	200					
	20					
ADJ200-C	100			JN 02/05/01		
	200					
	20					
ADJ200-D	100					
	200					
	20	TAKEN OUT OF			0.0000	0.00
ADJ200-G	100	SERVICE			0.0000	0.00
	200				0.0000	0.00
	20	0.0202	0.0201	0.0204	0.0202	101.17
ADJ200-H	100	0.0994	0.0993	0.0996	0.0994	99.43
	200	0.1989	0.1987	0.1989	0.1988	99.42
	20	0.0204	0.0202	0.0202	0.0203	101.33
ADJ200-J	100	0.0993	0.0994	0.0990	0.0992	99.23
	200	0.1991	0.1990	0.1994	0.1992	99.58

Book/page: 08 048

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 16 Thermometer #: _____ diH20 Temperature (° C) 010348

	Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
20 µL – 200 µL		20			
	ADJ200-A	100			
		200			
		20			
	ADJ200-C	100			
		200			
		20			
	ADJ200-D	100			
		200			
		20	* TAKEN OUT OF SERVICE		
	ADJ200-G *	100	01/26/06 BY WAN		PIPETTE
		200	FELL AND CRACKED *		
		20	0.0202	0.0201	0.0204
	ADJ200-H	100	0.0994	0.0993	0.0996
		200	0.1989	0.1987	0.1989
		20	0.0204	0.0202	0.0202
	ADJ200-J	100	0.0993	0.0994	0.0990
		200	0.1991	0.1990	0.1994
		20			
	ADJ200-K	100			
		200			
		20			
	ADJ200	100			
		200			

J.V. 02/01/06

Analyst: J. Van Date: 02/01/06

Reviewed by: [signature] Date: 02/07/06

Book/page: 08 103

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet) 010349

1-19-06

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	0.1005	0.1006	0.1004	0.101	100.50
ADJ1000-C	500	0.4935	0.4978	0.4991	0.497	99.36
	1000	1.0017	1.0016	1.0014	1.002	100.16
	100	0.0997	0.0998	0.0999	0.100	99.80
ADJ1000-D	500	0.4947	0.4938	0.4957	0.495	98.95
	1000	0.9932	0.9931	0.9940	0.993	99.34
	100	0.1009	0.1011	0.1013	0.101	101.10
ADJ1000-E	500	0.4947	0.4972	0.4958	0.496	99.18
	1000	0.9942	0.9938	0.9973	0.995	99.51
	100	0.1007	0.1003	0.1017	0.101	100.90
ADJ1000-F	500	0.4944	0.4977	0.4998	0.497	99.46
	1000	0.9983	0.9948	0.9953	0.996	99.61
	100					
ADJ1000-G	500					
	1000					
	100					
ADJ1000-H	500					
	1000					
	100					
ADJ1000-J	500					
	1000					
	100					
ADJ1000-K	500	NOT	IN USE-	GLOVEBOX		
	1000					
	100					
ADJ1000	500					
	1000					

FRM-247b (Rev 3/Apr 04)

Book/page: 08 104

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

010350

Balance #: 34 Thermometer #: G011 diH20 Temperature (° C) 21

100 µL – 1000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	100	.1005	.1006	.1004
ADJ1000-C	500	.4935	.4978	.4991
	1000	1.0017	1.0016	1.0014
	100	.0997	.0998	.0999
ADJ1000-D	500	.4947	.4938	.4957
	1000	.9932	.9931	.9940
	100	.1009	.1011	.1013
ADJ1000-E	500	.4947	.4972	.4958
	1000	.9942	.9938	.9973
	100	.1007	.1003	.1017
ADJ1000-F	500	.4944	.4977	.4998
	1000	.9983	.9948	.9953
	100			
ADJ1000-G	500			
	1000			
	100			
ADJ1000-H	500		1-19-06	
	1000			
	100			
ADJ1000-J	500			
	1000			
	100			
ADJ1000-K	500	NOT	IN USE	GLOVEBOX
	1000			
	100			
ADJ1000	500		1-19-06	
	1000			

Analyst: John Wilk Date: 1-19-06

Reviewed by: Nale Cyr Date: 02/07/06

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010351

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	0.0989	0.0982	0.0984	0.0985	98.50
ADJ1000-G	500	0.4983	0.4980	0.4979	0.4981	99.61
	1000	0.9952	0.9933	0.9942	0.9942	99.42
	100	0.0982	0.0977	0.0989	0.0983	98.27
ADJ1000-H	500	0.4944	0.4962	0.4924	0.4943	98.87
	1000	0.9855	0.9852	0.9899	0.9869	98.69
	100	0.1006	0.1011	0.1022	0.1013	101.30
ADJ1000-J	500	0.4979	0.4982	0.4992	0.4984	99.69
	1000	0.9925	0.9921	0.9945	0.9930	99.30

JV 02/01/06

JV 02/01/06

Book/page: 08 106

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 16 Thermometer #: G 011 diH20 Temperature (° C) 21.0

0 0352

100 µL – 1000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	100			
ADJ1000-C	500			
	1000			
	100			
ADJ1000-D	500			
	1000			
	100			
ADJ1000-E	500			
	1000			
	100			
ADJ1000-F	500			
	1000			
	100	0.0989	0.0982	0.0984
ADJ1000-G	500	0.4983	0.4980	0.4979
	1000	0.9952	0.9933	0.9942
	100	0.0982	0.0977	0.0989
ADJ1000-H	500	0.4944	0.4962	0.4924
	1000	0.9855	0.9852	0.9899
	100	0.1006	0.1011	0.1022
ADJ1000-J	500	0.4979	0.4982	0.4992
	1000	0.9925	0.9921	0.9945
	100			
ADJ1000-K	500			
	1000			
	100			
ADJ1000	500			
	1000			

J.V. 02/01/06

Analyst: [signature] Date: 02/01/06

Reviewed by: [signature] Date: 02/07/06

08 163

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

1-9-06

010353

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	0.5091	0.5083	0.5055	0.508	101.53
ADJ5000-C	2500	2.4916	2.4960	2.4954	2.494	99.77
	5000	5.0357	4.9774	4.9884	5.001	100.01
	500					
ADJ5000-G	2500	OUT	OF	SERVICE		
	5000					
	500					
ADJ5000-H	2500	OUT	OF	SERVICE		
	5000					
	500	0.4985	0.5042	0.4999	0.501	100.17
ADJ5000-I	2500	2.4856	2.4991	2.4974	2.494	99.76
	5000	4.9930	4.9970	5.0104	5.000	100.00
	500					
ADJ5000-J	2500					
	5000					
	500					
ADJ5000-K	2500					
	5000					
	500					
ADJ5000-L	2500					
	5000					
	500					
ADJ5000-M	2500	NOT	IN USE-	GLOVEBOX		
	5000					
	500	0.4978	0.4998	0.4954	0.498	99.53
ADJ5000-N	2500	2.4890	2.4925	2.4931	2.492	99.66
	5000	5.0179	5.0044	5.0118	5.011	100.23
vos 2/7/06	500	0.5047	0.5081	0.5059	0.506	101.25
ADJ5000-O	2500	2.4938	2.5032	2.5046	2.501	100.02
	5000	5.0324	5.0137	5.0088	5.018	100.37
	500					
ADJ5000	2500					
	5000					

FRM-247c (Rev 3/Apr 04)

Book/page: 08 164

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 01035

Balance #: 34 Thermometer #: G011 diH20 Temperature (° C) 21

500 µL – 5000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	500	.5091	.5083	.5055
ADJ5000-C	2500	2.4916	2.4960	2.4954
	5000	5.0357	4.9774	4.9884
	500			
ADJ5000-G	2500	OUT	OF	SERVICE
	5000			
	500			
ADJ5000-H	2500	OUT	OF	SERVICE
	5000			
	500	.4985	.5042	.4999
ADJ5000-I	2500	2.4856	2.4991	2.4974
	5000	4.9930	4.9970	5.0104
	500			
ADJ5000-J	2500			
	5000			
	500			
ADJ5000-K	2500			
	5000			
	500			
ADJ5000-L	2500			
	5000			
	500			
ADJ5000-M	2500	NOT	IN USE –	GLOVEBOX
	5000			
	500	.4978	.4998	.4954
ADJ5000-N	2500	2.4890	2.4925	2.4931
	5000	5.0179	5.0044	5.0118
	500	.5047	.5081	.5059
ADJ5000-O	2500	2.4938	2.5032	2.5046
	5000	5.0324	5.0137	5.0088
	500			
ADJ5000	2500			
	5000			

1-19-06

Analyst: John Wilber Date: 1-19-06

Reviewed by: Nale Ayn Date: 02/07/06

FRM-244 (c) (Rev 3/Apr 04)

Sheet/page: 08 165

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010355

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	0.5035	0.5024	0.5039	0.5033	100.65
ADJ5000-J	2500	2.5109	2.5014	2.5133	2.5085	100.34
	5000	5.0115	5.0119	5.0100	5.0111	100.22
	500				0.0000	0.00
ADJ5000-K	2500				0.0000	0.00
	5000				0.0000	0.00
	500	0.5099	0.5045	0.5108	0.5084	101.68
ADJ5000-L	2500	2.4900	2.4900	2.4925	2.4908	99.63
	5000	4.9822	4.9825	4.9766	4.9804	99.61

JV 02/01/06

JV 02/01/06

JV 02/01/06

Book/page: 08 166

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log 010356

Balance #: 16 Thermometer #: G011 diH20 Temperature (° C) 21

500 µL – 5000 µL

Eppendorf #	True Value (µL)	1st Reading (g)	2nd Reading (g)	3rd Reading (g)
	500			
ADJ5000-C	2500			
	5000			
	500			
ADJ5000-G	2500			
	5000			
	500			
ADJ5000-H	2500			
	5000			
	500			
ADJ5000-I	2500			
	5000			
	500	0.5035	0.5024	0.5039
ADJ5000-J	2500	2.5109	2.5014	2.5133
	5000	5.0115	5.0119	5.0100
	500	01/03/06 TAKEN		
ADJ5000-K	2500	OUT OF SERVICE		
	5000			
	500	0.5099	0.5045	0.5018
ADJ5000-L	2500	2.4900	2.4900	2.4925
	5000	4.9822	4.9825	4.9766
	500			
ADJ5000-M	2500			
	5000			
	500			
ADJ5000-N	2500			
	5000			
	500			
ADJ5000	2500			
	5000			
	500			
ADJ5000	2500			
	5000			

Analyst: [signature] Date: 02/01/06

Reviewed by: [signature] Date: 02/07/06

FRM-244 (c) (Rev 3/Apr 04)

SOUTHWEST RESEARCH INSTITUTE 010357
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

Balance Calibrations

Southwest Research Institute®
Division 01, Building 70
Inorganic's Balance Verification Log

010358

Balance Number	Asset Number	Manufacturer	Model Number	Location	Number of Places	Maximum Weight
12	010892	Mettler	XS 205	Lab 47	4th 5th	220 g 81 g

Date	Operator	Asset# 011988 Std Wt. 200 g Tolerance: 199.9800-200.0200 g Recorded Wt. (g)	Asset# 011997 Std Wt. 2 g Tolerance: 1.99980-2.00020 g Recorded Wt. (g)	Asset# 012002 Std Wt. 0.02 g Tolerance: 0.01995-0.02005 g Recorded Wt. (g)
1-16-06	KE	200.0009	2.0001	0.0201
01/17/06	JGV	200.0000	2.00001	0.02000
1-18-06	JW	200.0001	2.00000	0.01999
1-19-06	KE	200.0022	2.00003	0.02001
1-20-06	KE	200.0005	1.99998	0.01997
1-23-06	KE	199.9994	2.00002	0.02001
1-24-06	KE	199.9991	2.00001	0.01996
1-25-06	KE	200.0000	2.00004	0.02004
1-26-06	JW	199.9996	2.00002	0.02001
1-27-06	KE	199.9998	2.00003	0.02000
1-28-06	KE	199.9998	1.99994	0.01998
1-30-06	JW	199.9997	2.00000	0.01999
1-31-06	KE	199.9995	2.00003	0.01999
2-1-06	KE	199.9999	2.00003	0.02003
2-2-06	KE	200.0000	2.00068	0.02002
2/3/06	CO	199.9994	1.99999	0.01997
2-6-06	JW	199.9989	2.00000	0.01997
2-7-06	JW	199.9984	2.00000	0.01998

Comments:

Southwest Research Institute®
Division 01, Building 70
Inorganic's Balance Verification Log

010359

Balance Number	Asset Number	Manufacturer	Model Number	Location	Number of Places	Maximum Weight
19	003493	Denver	400	Lab 47	2	400 g

Date	Operator	Asset# 011990 Std Wt. 400 g Tolerance: 399.80-400.20 g Recorded Wt. (g)	Asset# 011997 Std Wt. 2 g Tolerance: 1.96-2.04 g Recorded Wt. (g)
1-16-06	KE	399.89	2.00
1-17-06	KE	399.88	2.00
1-18-06	JW	399.94	2.00
1/19/06	[illegible]	399.97	2.00
1-20-06	KE	399.99	2.01
1-23-06	KE	399.98	2.00
1-24-06	KE	399.96	2.00
1-25-06	KE	399.95	2.00
1-26-06	JW	399.97	2.01
1-27-06	KE	399.95	2.00
1-30-06	JW	399.94	2.00
1-31-06	KE	399.93	2.00
2-1-06	KE	399.95	2.00
2-2-06	KE	399.99	2.00
2-3-06	JW	399.98	2.00
2-6-06	JW	399.97	2.00
2-7-06	JW	399.98	2.01

Comments:

Southwest Research Institute®
Division 01, Building 70
Inorganic's Balance Verification Log

010360

Balance Number	Asset Number	Manufacturer	Model Number	Location	Number of Places	Maximum Weight
34	005420	Mettler	AG 245	Lab 47	4th 5th	210 g 41 g

Date	Operator	Asset# 011988 Std Wt. 200 g Tolerance: 199.9800-200.02000 g Recorded Wt. (g)	Asset# 011997 Std Wt. 2 g Tolerance: 1.99980-2.00020 g Recorded Wt. (g)	Asset# 012002 Std Wt. 0.02 g Tolerance: 0.01995-0.02005 g Recorded Wt. (g)
1-16-06	KE	200.0001	2.0001	0.0200
1-17-06	KE	199.9996	2.00000	0.02000
1-18-06	JW	199.9997	2.00000	0.02000
1-19-06	KE	200.0003	1.99998	0.01998
1-20-06	KE	200.0001	1.99998	0.02000
1-23-06	KE	200.00001	2.00001	0.01999
1-24-06	KE	199.9996	1.99998	0.01999
1-25-06	KE	199.9994	2.00001	0.02002
1-26-06	JW	199.9998	2.00000	0.02000
1-27-06	JW	199.9999	2.00000	0.02001
1-30-06	JW	199.9998	2.00001	0.02000
1-31-06	KE	199.9994	1.99998	0.02000
2-01-06	KE	200.0007	2.00002	0.02000
2-2-06	KE	199.9999	2.00001	0.02000
2-3-06	JW	199.9996	2.00000	0.02000
2-4-06	RSS	199.9999	2.00001	0.02000
2-6-06	JW	199.9996	2.00000	0.02000
2-7-06	JW	199.9999	2.00000	0.02001

Comments:

010361

SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT
CLIENT: Division 20
TASK ORDER: 060131-9
SRR: 28643
SDG: 273124
CASE: CNWRA
VTSR: January 31, 2006
PROJECT#: 06002.01.222

DI Water Verification

D.I. WATER SYSTEM NOTEBOOK
SOUTHWEST RESEARCH INSTITUTE
BUILDING 70

040031

Contact U.S. Filter (1-800-466-7873) for repairs/exchanges. (Make sure to have a P.O.)

010362

HIGH PURITY SYSTEM (HP)

DATE / TIME	INITIALS	RESISTIVITY MONITOR (M OHMS)	RESISTIVITY MONITOR QC LT.	QC LIGHTS QC 1	QC LIGHTS QC 2	USAGE (GALS)	COMMENTS
1/18/06 7pm	DR	18.05	✓	X	✓	13410.8	Waiting on USFilter
1/19/06 701pm	DR	18.04	✓	X	✓	13419.7	Waiting on USFilter
			DR 1/20/06				
1/20/06 540pm	DR	18.05	✓	✓	✓	13425.6	tank v-change, all OK
1/23/06 6pm	DR	18.05	✓	✓	✓	13439.8	✓
1/24/06 615pm	DR	18.05	✓	✓	✓	13469.7	✓
1/25/06 330pm	DR	18.06	✓	✓	✓	13480.3	✓
1/26/06 630pm	DR	18.05	✓	✓	✓	13519.0	✓
1/27/06 355pm	DR	18.05	✓	✓	✓	13538.9	✓
1/30/06 805pm	DR	18.06	✓	✓	✓	13567.5	✓
1/31/06 705pm	DR	18.05	✓	✓	✓	13583.8	✓
2/1/06 706pm	DR	18.06	✓	✓	✓	13598.1	✓
2/2/06 700pm	DR	18.05	✓	✓	✓	13626.1	✓
2/3/06 745pm	DR	18.06	✓	✓	✓	13648.5	✓
2/6/06 635pm	DR	18.06	✓	✓	✓	13674.8	✓

Legend: Check = Green (OK); X = Red (call for service)

LOW PURITY SYSTEM (LP)

DATE / TIME	INITIALS	QC LIGHTS QC 1	QC LIGHTS QC 2	USAGE (GALS)	COMMENTS
1/18/06 701pm	DR	✓	✓ 10.0	31053.1	Waiting on U.S. Filter
1/19/06 703pm	DR	X	✓ 10.0	31053.4	Call placed again to USFilter
1/20/06 2:02pm	DR	X	✓ 9.0	31055	Cal Sensor *
1/20/06 541pm	DR	✓	✓ 9.0	31057.2	tank v-change, all OK. ✓
1/23/06 601pm	DR	✓	✓ 8.5	31060.1	✓
1/24/06 616pm	DR	✓	✓ 9	31062.2	✓
1/25/06 331pm	DR	✓	✓ 8.5	31065.0	✓
1/26/06 631pm	DR	✓	✓ 8.5	31067.1	✓
1/27/06 356pm	DR	✓	✓ 8	31069.1 DR 1/30/06	✓
1/30/06 806pm	DR	X	✓ 8	31069.1	no usage
1/31/06 706pm	DR	✓	✓ 8	31070.9	✓
2/1/06 707pm	DR	✓	✓ 8.5	31074.0	✓
2/2/06 701pm	DR	✓	✓ 8.5	31076.7	✓
2/3/06 746pm	DR	X	✓ 8	31076.7	no usage
2/6/06 636pm	DR	✓	✓ 8	31078.3	✓

Legend: Check = Green (OK); X = Red (call for service)

* Found Sensor 19.9 and Left 20.0 on TV = 20.0 Call Sensor Ant 005612 Cal 1-16-06 due 1-16-08

FRM-019 (Rev 0/Jan 04)