

010001

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 051011-4

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

FINAL REPORT

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010002

Sample ID

0905C-1

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268259

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Reporting Limit (mg/L) |
|------------|----------------------|------------------------|
| Aluminum | <0.0600 | 0.0600 |
| Antimony | <0.0100 | 0.0100 |
| Arsenic | 0.0152 | 0.005 |
| Barium | <0.00500 | 0.00500 |
| Beryllium | <0.00500 | 0.00500 |
| Bismuth | <0.0100 | 0.0100 |
| Boron | 0.224 | 0.02 |
| Cadmium | <0.00500 | 0.00500 |
| Calcium | 5.27 | 0.05 |
| Chromium | <0.00500 | 0.00500 |
| Cobalt | <0.00500 | 0.00500 |
| Copper | <0.00500 | 0.00500 |
| Iron | <0.0500 | 0.0500 |
| Lanthanum | <0.00500 | 0.00500 |
| Lead | <0.00500 | 0.00500 |
| Lithium | 0.0930 | 0.01 |
| Magnesium | 1.01 | 0.05 |
| Manganese | 0.00542 | 0.005 |
| Molybdenum | 0.0442 | 0.005 |
| Nickel | <0.00500 | 0.00500 |
| Palladium | <0.00500 | 0.00500 |
| Phosphorus | 0.0345 | 0.02 |
| Potassium | 2.98 | 0.3 |
| Selenium | <0.0100 | 0.0100 |
| Silicon | 21.6 | 0.02 |
| Silver | <0.00500 | 0.00500 |
| Sodium | 101 | 0.25 |
| Strontium | 0.0397 | 0.005 |
| Sulfur | 13.6 | 0.02 |
| Thallium | <0.0100 | 0.0100 |
| Thorium | <0.0250 | 0.0250 |
| Tin | 0.0136 | 0.005 |
| Titanium | <0.00500 | 0.00500 |
| Tungsten | <0.0100 | 0.0100 |
| Uranium | <0.100 | 0.100 |
| Vanadium | <0.00500 | 0.00500 |
| Yttrium | <0.00500 | 0.00500 |
| Zinc | <0.00500 | 0.00500 |
| Zirconium | <0.00500 | 0.00500 |

SOUTHWEST RESEARCH INSTITUTE

DUPLICATE SUMMARY

010003

Sample ID

0905C-1

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268259D

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Duplicate Result (mg/L) | RPD |
|------------|----------------------|-------------------------|-------|
| Aluminum | <0.0600 | <0.0600 | 0.00% |
| Antimony | <0.0100 | <0.0100 | 0.00% |
| Arsenic | 0.0152 | 0.0127 | 17.9% |
| Barium | <0.00500 | <0.00500 | 0.00% |
| Beryllium | <0.00500 | <0.00500 | 0.00% |
| Bismuth | <0.0100 | <0.0100 | 0.00% |
| Boron | 0.224 | 0.226 | 0.89% |
| Cadmium | <0.00500 | <0.00500 | 0.00% |
| Calcium | 5.27 | 5.26 | 0.19% |
| Chromium | <0.00500 | <0.00500 | 0.00% |
| Cobalt | <0.00500 | <0.00500 | 0.00% |
| Copper | <0.00500 | <0.00500 | 0.00% |
| Iron | <0.0500 | <0.0500 | 0.00% |
| Lanthanum | <0.00500 | <0.00500 | 0.00% |
| Lead | <0.00500 | <0.00500 | 0.00% |
| Lithium | 0.0930 | 0.0891 | 4.28% |
| Magnesium | 1.01 | 1.01 | 0.00% |
| Manganese | 0.00542 | 0.00545 | 0.55% |
| Molybdenum | 0.0442 | 0.0444 | 0.45% |
| Nickel | <0.00500 | <0.00500 | 0.00% |
| Palladium | <0.00500 | <0.00500 | 0.00% |
| Phosphorus | 0.0345 | 0.0279 | 21.2% |
| Potassium | 2.98 | 3.11 | 4.27% |
| Selenium | <0.0100 | <0.0100 | 0.00% |
| Silicon | 21.6 | 21.6 | 0.00% |
| Silver | <0.00500 | <0.00500 | 0.00% |
| Sodium | 101 | 101 | 0.00% |
| Strontium | 0.0397 | 0.0397 | 0.00% |
| Sulfur | 13.6 | 13.6 | 0.00% |
| Thallium | <0.0100 | <0.0100 | 0.00% |
| Thorium | <0.0250 | <0.0250 | 0.00% |
| Tin | 0.0136 | 0.0137 | 0.73% |
| Titanium | <0.00500 | <0.00500 | 0.00% |
| Tungsten | <0.0100 | <0.0100 | 0.00% |
| Uranium | <0.100 | <0.100 | 0.00% |
| Vanadium | <0.00500 | <0.00500 | 0.00% |
| Yttrium | <0.00500 | <0.00500 | 0.00% |
| Zinc | <0.00500 | <0.00500 | 0.00% |
| Zirconium | <0.00500 | <0.00500 | 0.00% |

SOUTHWEST RESEARCH INSTITUTE

MATRIX SPIKE SUMMARY

010004

Sample ID

0905C-1

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268259S

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Spike Result (mg/L) | Spike Added (mg/L) | Recovery |
|------------|----------------------|---------------------|--------------------|----------|
| Aluminum | <0.0600 | 2.05 | 2.00 | 103% |
| Antimony | <0.0100 | 0.520 | 0.50 | 104% |
| Arsenic | 0.0152 | 2.11 | 2.00 | 105% |
| Barium | <0.00500 | 2.01 | 2.00 | 101% |
| Beryllium | <0.00500 | 0.0490 | 0.05 | 98.0% |
| Bismuth | NA | NA | NA | NA |
| Boron | NA | NA | NA | NA |
| Cadmium | <0.00500 | 0.0511 | 0.05 | 102% |
| Calcium | 5.27 | 25.0 | 20.0 | 98.7% |
| Chromium | <0.00500 | 0.198 | 0.20 | 99.0% |
| Cobalt | <0.00500 | 0.505 | 0.50 | 101% |
| Copper | <0.00500 | 0.258 | 0.25 | 103% |
| Iron | <0.0500 | 1.10 | 1.00 | 110% |
| Lanthanum | NA | NA | NA | NA |
| Lead | <0.00500 | 0.504 | 0.50 | 101% |
| Lithium | 0.0930 | 3.82 | 4.00 | 93.2% |
| Magnesium | 1.01 | 21.0 | 20.0 | 100% |
| Manganese | 0.00542 | 0.510 | 0.50 | 101% |
| Molybdenum | NA | NA | NA | NA |
| Nickel | <0.00500 | 0.498 | 0.50 | 99.6% |
| Palladium | NA | NA | NA | NA |
| Phosphorus | NA | NA | NA | NA |
| Potassium | 2.98 | 22.7 | 20.0 | 98.6% |
| Selenium | <0.0100 | 2.30 | 2.00 | 115% |
| Silicon | 21.6 | 25.6 | 4.00 | 100% |
| Silver | <0.00500 | 0.0481 | 0.05 | 96.2% |
| Sodium | 101 | 118 | 20.0 | 85.0% |
| Strontium | NA | NA | NA | NA |
| Sulfur | 13.6 | 17.7 | 4.00 | 103% |
| Thallium | <0.0100 | 2.10 | 2.00 | 105% |
| 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 | <0.00500 | 0.499 | 0.50 | 99.8% |
| Yttrium | NA | NA | NA | NA |
| Zinc | <0.00500 | 0.518 | 0.50 | 104% |
| Zirconium | NA | NA | NA | NA |

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010005

Sample ID

0905C-2

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268260

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Reporting Limit (mg/L) |
|------------|----------------------|------------------------|
| Aluminum | 0.349 | 0.06 |
| Antimony | <0.0100 | 0.0100 |
| Arsenic | 0.0137 | 0.005 |
| Barium | 0.0116 | 0.005 |
| Beryllium | <0.00500 | 0.00500 |
| Bismuth | <0.0100 | 0.0100 |
| Boron | 0.177 | 0.02 |
| Cadmium | <0.00500 | 0.00500 |
| Calcium | 3.84 | 0.05 |
| Chromium | <0.00500 | 0.00500 |
| Cobalt | <0.00500 | 0.00500 |
| Copper | <0.00500 | 0.00500 |
| Iron | 0.563 | 0.05 |
| Lanthanum | <0.00500 | 0.00500 |
| Lead | <0.00500 | 0.00500 |
| Lithium | 0.0774 | 0.01 |
| Magnesium | 0.413 | 0.05 |
| Manganese | 0.0115 | 0.005 |
| Molybdenum | 0.0450 | 0.005 |
| Nickel | <0.00500 | 0.00500 |
| Palladium | <0.00500 | 0.00500 |
| Phosphorus | 0.0580 | 0.02 |
| Potassium | 2.23 | 0.3 |
| Selenium | <0.0100 | 0.0100 |
| Silicon | 19.9 | 0.02 |
| Silver | <0.00500 | 0.00500 |
| Sodium | 106 | 0.25 |
| Strontium | 0.0275 | 0.005 |
| Sulfur | 15.7 | 0.02 |
| Thallium | <0.0100 | 0.0100 |
| Thorium | <0.0250 | 0.0250 |
| Tin | 0.0129 | 0.005 |
| Titanium | <0.00500 | 0.00500 |
| Tungsten | <0.0100 | 0.0100 |
| Uranium | <0.100 | 0.100 |
| Vanadium | <0.00500 | 0.00500 |
| Yttrium | <0.00500 | 0.00500 |
| Zinc | 0.0153 | 0.005 |
| Zirconium | <0.00500 | 0.00500 |

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010006

Sample ID

0905C-3

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268261

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Reporting Limit (mg/L) |
|------------|----------------------|------------------------|
| Aluminum | 0.204 | 0.06 |
| Antimony | <0.0100 | 0.0100 |
| Arsenic | 0.0169 | 0.005 |
| Barium | 0.00803 | 0.005 |
| Beryllium | <0.00500 | 0.00500 |
| Bismuth | <0.0100 | 0.0100 |
| Boron | 0.198 | 0.02 |
| Cadmium | <0.00500 | 0.00500 |
| Calcium | 4.15 | 0.05 |
| Chromium | <0.00500 | 0.00500 |
| Cobalt | <0.00500 | 0.00500 |
| Copper | <0.00500 | 0.00500 |
| Iron | 0.273 | 0.05 |
| Lanthanum | <0.00500 | 0.00500 |
| Lead | <0.00500 | 0.00500 |
| Lithium | 0.0546 | 0.01 |
| Magnesium | 0.286 | 0.05 |
| Manganese | <0.00500 | 0.00500 |
| Molybdenum | 0.00564 | 0.005 |
| Nickel | <0.00500 | 0.00500 |
| Palladium | <0.00500 | 0.00500 |
| Phosphorus | 0.0783 | 0.02 |
| Potassium | 3.52 | 0.3 |
| Selenium | <0.0100 | 0.0100 |
| Silicon | 33.7 | 0.02 |
| Silver | <0.00500 | 0.00500 |
| Sodium | 97.4 | 0.25 |
| Strontium | 0.0303 | 0.005 |
| Sulfur | 9.66 | 0.02 |
| Thallium | <0.0100 | 0.0100 |
| Thorium | <0.0250 | 0.0250 |
| Tin | 0.0112 | 0.005 |
| Titanium | <0.00500 | 0.00500 |
| Tungsten | <0.0100 | 0.0100 |
| Uranium | <0.100 | 0.100 |
| Vanadium | <0.00500 | 0.00500 |
| Yttrium | <0.00500 | 0.00500 |
| Zinc | <0.00500 | 0.00500 |
| Zirconium | <0.00500 | 0.00500 |

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010007

Sample ID

0905C-4

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268262

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Reporting Limit (mg/L) |
|------------|----------------------|------------------------|
| Aluminum | <0.0600 | 0.0600 |
| Antimony | <0.0100 | 0.0100 |
| Arsenic | 0.00841 | 0.005 |
| Barium | 0.00678 | 0.005 |
| Beryllium | <0.00500 | 0.00500 |
| Bismuth | <0.0100 | 0.0100 |
| Boron | 0.161 | 0.02 |
| Cadmium | <0.00500 | 0.00500 |
| Calcium | 15.8 | 0.05 |
| Chromium | <0.00500 | 0.00500 |
| Cobalt | <0.00500 | 0.00500 |
| Copper | <0.00500 | 0.00500 |
| Iron | <0.0500 | 0.0500 |
| Lanthanum | <0.00500 | 0.00500 |
| Lead | <0.00500 | 0.00500 |
| Lithium | 0.0478 | 0.01 |
| Magnesium | 1.10 | 0.05 |
| Manganese | <0.00500 | 0.00500 |
| Molybdenum | 0.00681 | 0.005 |
| Nickel | <0.00500 | 0.00500 |
| Palladium | <0.00500 | 0.00500 |
| Phosphorus | <0.0200 | 0.0200 |
| Potassium | 2.91 | 0.3 |
| Selenium | <0.0100 | 0.0100 |
| Silicon | 24.5 | 0.02 |
| Silver | <0.00500 | 0.00500 |
| Sodium | 53.1 | 0.25 |
| Strontium | 0.0440 | 0.005 |
| Sulfur | 8.54 | 0.02 |
| Thallium | <0.0100 | 0.0100 |
| Thorium | <0.0250 | 0.0250 |
| Tin | 0.00911 | 0.005 |
| Titanium | <0.00500 | 0.00500 |
| Tungsten | <0.0100 | 0.0100 |
| Uranium | <0.100 | 0.100 |
| Vanadium | <0.00500 | 0.00500 |
| Yttrium | <0.00500 | 0.00500 |
| Zinc | <0.00500 | 0.00500 |
| Zirconium | <0.00500 | 0.00500 |

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010008

Sample ID

0905C-5

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268263

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Reporting Limit (mg/L) |
|------------|----------------------|------------------------|
| Aluminum | <0.0600 | 0.0600 |
| Antimony | <0.0100 | 0.0100 |
| Arsenic | 0.0109 | 0.005 |
| Barium | <0.00500 | 0.00500 |
| Beryllium | <0.00500 | 0.00500 |
| Bismuth | <0.0100 | 0.0100 |
| Boron | 0.150 | 0.02 |
| Cadmium | <0.00500 | 0.00500 |
| Calcium | 15.4 | 0.05 |
| Chromium | <0.00500 | 0.00500 |
| Cobalt | <0.00500 | 0.00500 |
| Copper | <0.00500 | 0.00500 |
| Iron | <0.0500 | 0.0500 |
| Lanthanum | <0.00500 | 0.00500 |
| Lead | <0.00500 | 0.00500 |
| Lithium | 0.0400 | 0.01 |
| Magnesium | 1.28 | 0.05 |
| Manganese | <0.00500 | 0.00500 |
| Molybdenum | <0.00500 | 0.00500 |
| Nickel | <0.00500 | 0.00500 |
| Palladium | <0.00500 | 0.00500 |
| Phosphorus | 0.0234 | 0.02 |
| Potassium | 3.95 | 0.3 |
| Selenium | <0.0100 | 0.0100 |
| Silicon | 27.4 | 0.02 |
| Silver | <0.00500 | 0.00500 |
| Sodium | 48.8 | 0.25 |
| Strontium | 0.0639 | 0.005 |
| Sulfur | 7.47 | 0.02 |
| Thallium | <0.0100 | 0.0100 |
| Thorium | <0.0250 | 0.0250 |
| Tin | 0.00824 | 0.005 |
| Titanium | <0.00500 | 0.00500 |
| Tungsten | <0.0100 | 0.0100 |
| Uranium | <0.100 | 0.100 |
| Vanadium | 0.00535 | 0.005 |
| Yttrium | <0.00500 | 0.00500 |
| Zinc | <0.00500 | 0.00500 |
| Zirconium | <0.00500 | 0.00500 |

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010009

Sample ID

0905C-6

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268264

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Reporting Limit (mg/L) |
|------------|----------------------|------------------------|
| Aluminum | 1.33 | 0.06 |
| Antimony | <0.0100 | 0.0100 |
| Arsenic | 0.00993 | 0.005 |
| Barium | 0.0499 | 0.005 |
| Beryllium | <0.00500 | 0.00500 |
| Bismuth | <0.0100 | 0.0100 |
| Boron | 0.178 | 0.02 |
| Cadmium | <0.00500 | 0.00500 |
| Calcium | 9.63 | 0.05 |
| Chromium | 0.00633 | 0.005 |
| Cobalt | <0.00500 | 0.00500 |
| Copper | 0.00665 | 0.005 |
| Iron | 1.71 | 0.05 |
| Lanthanum | <0.00500 | 0.00500 |
| Lead | 0.0158 | 0.005 |
| Lithium | 0.0773 | 0.01 |
| Magnesium | 1.27 | 0.05 |
| Manganese | 0.0703 | 0.005 |
| Molybdenum | 0.0244 | 0.005 |
| Nickel | <0.00500 | 0.00500 |
| Palladium | <0.00500 | 0.00500 |
| Phosphorus | 0.0671 | 0.02 |
| Potassium | 2.42 | 0.3 |
| Selenium | <0.0100 | 0.0100 |
| Silicon | 24.2 | 0.02 |
| Silver | <0.00500 | 0.00500 |
| Sodium | 108 | 0.25 |
| Strontium | 0.0760 | 0.005 |
| Sulfur | 15.7 | 0.02 |
| Thallium | <0.0100 | 0.0100 |
| Thorium | <0.0250 | 0.0250 |
| Tin | 0.0122 | 0.005 |
| Titanium | <0.00500 | 0.00500 |
| Tungsten | <0.0100 | 0.0100 |
| Uranium | <0.100 | 0.100 |
| Vanadium | <0.00500 | 0.00500 |
| Yttrium | <0.00500 | 0.00500 |
| Zinc | 0.0478 | 0.005 |
| Zirconium | <0.00500 | 0.00500 |

SOUTHWEST RESEARCH INSTITUTE

SAMPLE ANALYSIS DATA SHEET

010010

Sample ID

0905C-7

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: 10/07/05

Matrix: Water

Project No.: 06002.01.242

Lab System ID: 268265

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Reporting Limit (mg/L) |
|------------|----------------------|------------------------|
| Aluminum | <0.0600 | 0.0600 |
| Antimony | <0.0100 | 0.0100 |
| Arsenic | <0.00500 | 0.00500 |
| Barium | <0.00500 | 0.00500 |
| Beryllium | <0.00500 | 0.00500 |
| Bismuth | <0.0100 | 0.0100 |
| Boron | <0.0200 | 0.0200 |
| Cadmium | <0.00500 | 0.00500 |
| Calcium | 9.86 | 0.0500 |
| Chromium | <0.00500 | 0.00500 |
| Cobalt | <0.00500 | 0.00500 |
| Copper | <0.00500 | 0.00500 |
| Iron | 9.90 | 0.0500 |
| Lanthanum | <0.00500 | 0.00500 |
| Lead | <0.00500 | 0.00500 |
| Lithium | <0.0100 | 0.0100 |
| Magnesium | 9.70 | 0.0500 |
| Manganese | <0.00500 | 0.00500 |
| Molybdenum | <0.00500 | 0.00500 |
| Nickel | <0.00500 | 0.00500 |
| Palladium | <0.00500 | 0.00500 |
| Phosphorus | <0.0200 | 0.0200 |
| Potassium | 9.51 | 0.3000 |
| Selenium | <0.0100 | 0.0100 |
| Silicon | <0.0200 | 0.0200 |
| Silver | <0.00500 | 0.00500 |
| Sodium | 10.2 | 0.2500 |
| Strontium | <0.00500 | 0.00500 |
| Sulfur | <0.0200 | 0.0200 |
| Thallium | <0.0100 | 0.0100 |
| Thorium | <0.0250 | 0.0250 |
| Tin | <0.00500 | 0.00500 |
| Titanium | <0.00500 | 0.00500 |
| Tungsten | <0.0100 | 0.0100 |
| Uranium | <0.100 | 0.100 |
| Vanadium | <0.00500 | 0.00500 |
| Yttrium | <0.00500 | 0.00500 |
| Zinc | <0.00500 | 0.00500 |
| Zirconium | <0.00500 | 0.00500 |

SOUTHWEST RESEARCH INSTITUTE

LABORATORY CONTROL SAMPLE

010011

Sample ID

LCSW - K12E2, K12H1

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: NA

Matrix: Water

Project No.: 06002.01.242

Lab System ID: NA

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | True Value (mg/L) | Recovery |
|------------|----------------------|-------------------|----------|
| Aluminum | 1.95 | 2.00 | 97.5% |
| Antimony | 0.503 | 0.500 | 101% |
| Arsenic | 2.04 | 2.00 | 102% |
| Barium | 2.00 | 2.00 | 100% |
| Beryllium | 0.0494 | 0.0500 | 98.8% |
| Bismuth | NA | NA | NA |
| Boron | NA | NA | NA |
| Cadmium | 0.0508 | 0.0500 | 102% |
| Calcium | 20.0 | 20.0 | 100% |
| Chromium | 0.197 | 0.200 | 98.5% |
| Cobalt | 0.499 | 0.500 | 99.8% |
| Copper | 0.250 | 0.250 | 100% |
| Iron | 1.09 | 1.00 | 109% |
| Lanthanum | NA | NA | NA |
| Lead | 0.498 | 0.500 | 99.6% |
| Lithium | 3.78 | 4.00 | 94.5% |
| Magnesium | 20.0 | 20.0 | 100% |
| Manganese | 0.504 | 0.500 | 101% |
| Molybdenum | NA | NA | NA |
| Nickel | 0.494 | 0.500 | 98.8% |
| Palladium | NA | NA | NA |
| Phosphorus | NA | NA | NA |
| Potassium | 19.0 | 20.0 | 95.0% |
| Selenium | 2.11 | 2.00 | 106% |
| Silicon | 4.03 | 4.00 | 101% |
| Silver | 0.0509 | 0.0500 | 102% |
| Sodium | 19.2 | 20.0 | 96.0% |
| Strontium | NA | NA | NA |
| Sulfur | 4.14 | 4.00 | 104% |
| Thallium | 2.07 | 2.00 | 104% |
| Thorium | NA | NA | NA |
| Tin | NA | NA | NA |
| Titanium | NA | NA | NA |
| Tungsten | NA | NA | NA |
| Uranium | NA | NA | NA |
| Vanadium | 0.493 | 0.500 | 98.6% |
| Yttrium | NA | NA | NA |
| Zinc | 0.502 | 0.500 | 100% |
| Zirconium | NA | NA | NA |

NA- Not Applicable.

SOUTHWEST RESEARCH INSTITUTE

BLANK SUMMARY

010012

Sample ID

PBW - K12E2, K12H1

Lab Name: Southwest Research Institute

Client: Division 20

Lab Code: SwRI

Date Received: NA

Matrix: Water

Project No.: 06002.01.242

Lab System ID: NA

SRR: 28120

Task Order: 051011-4

| Analysis | Sample Result (mg/L) | Reporting Limit (mg/L) |
|------------|----------------------|------------------------|
| Aluminum | <0.0600 | 0.0600 |
| Antimony | <0.0100 | 0.0100 |
| Arsenic | <0.00500 | 0.00500 |
| Barium | <0.00500 | 0.00500 |
| Beryllium | <0.00500 | 0.00500 |
| Bismuth | <0.0100 | 0.0100 |
| Boron | <0.0200 | 0.0200 |
| Cadmium | <0.00500 | 0.00500 |
| Calcium | <0.0500 | 0.0500 |
| Chromium | <0.00500 | 0.00500 |
| Cobalt | <0.00500 | 0.00500 |
| Copper | <0.00500 | 0.00500 |
| Iron | <0.0500 | 0.0500 |
| Lanthanum | <0.00500 | 0.00500 |
| Lead | <0.00500 | 0.00500 |
| Lithium | <0.0100 | 0.0100 |
| Magnesium | <0.0500 | 0.0500 |
| Manganese | <0.00500 | 0.00500 |
| Molybdenum | <0.00500 | 0.00500 |
| Nickel | <0.00500 | 0.00500 |
| Palladium | <0.00500 | 0.00500 |
| Phosphorus | <0.0200 | 0.0200 |
| Potassium | <0.300 | 0.300 |
| Selenium | <0.0100 | 0.0100 |
| Silicon | <0.0200 | 0.0200 |
| Silver | <0.00500 | 0.00500 |
| Sodium | <0.250 | 0.250 |
| Strontium | <0.00500 | 0.00500 |
| Sulfur | <0.0200 | 0.0200 |
| Thallium | <0.0100 | 0.0100 |
| Thorium | <0.0250 | 0.0250 |
| Tin | <0.00500 | 0.00500 |
| Titanium | <0.00500 | 0.00500 |
| Tungsten | <0.0100 | 0.0100 |
| Uranium | <0.100 | 0.100 |
| Vanadium | <0.00500 | 0.00500 |
| Yttrium | <0.00500 | 0.00500 |
| Zinc | <0.00500 | 0.00500 |
| Zirconium | <0.00500 | 0.00500 |

NA- Not Applicable.

Page 11 of 11

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**SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT**

CLIENT: Division 20

TASK ORDER: 051011-4

010013

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

Task Orders/01-QPP-015

Laboratory Task Order

010014

TO #: 051011-4 Revision: 0

SDG: 268259
 VTSR: 10/07/05
 CASE: CNWRA

SRR #s: 28120
 Client(s): Div. 20

Project(s): 06002.01.242
 Manager(s): DAMMANN, MIKE
 To PM: 10/28/05
 To QA: 10/28/05
 To Client: 11/03/05

Instructions

DIVISION 20 - CNWRA. 4-WEEK TAT.
 Work is 10 CFR 50 Appendix B, 10 CFR Part 21, contact MARK EHNSTROM (ext. 3530) 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 Jo Ann Boyd were contacted. This will help facilitate the final package to QA.

SEVEN samples received for analyses of MAJOR and MINOR elements by ICP. Point of Contact is BRADLEY WERLING (x6565).
 CONTACT PM WITH ANY ADDITIONAL QUESTIONS.

Documents Related to this task order: 19531[COC 28120]

Test: DIL-DILUTION
 Section: METALPREP

Holding: 28 days from CED

Prep, Dilution

Cnt: 7

| System ID | Type | Cont | Matrix | Customer ID | CED | Method Date |
|-----------|------|------|--------|-------------|-----------|-------------|
| 268259 | | 1 | Water | 0905C-1 | 06 Oct 05 | 03 Nov 05 |
| 268260 | | 1 | Water | 0905C-2 | 06 Oct 05 | 03 Nov 05 |
| 268261 | | 1 | Water | 0905C-3 | 06 Oct 05 | 03 Nov 05 |
| 268262 | | 1 | Water | 0905C-4 | 06 Oct 05 | 03 Nov 05 |
| 268263 | | 1 | Water | 0905C-5 | 06 Oct 05 | 03 Nov 05 |
| 268264 | | 1 | Water | 0905C-6 | 06 Oct 05 | 03 Nov 05 |
| 268265 | | 1 | Water | 0905C-7 | 06 Oct 05 | 03 Nov 05 |

Test: ICP-SWRI
 Section: METALS

Holding: 180 days from CED

ICP Analysis by SwRI Method

Cnt: 7

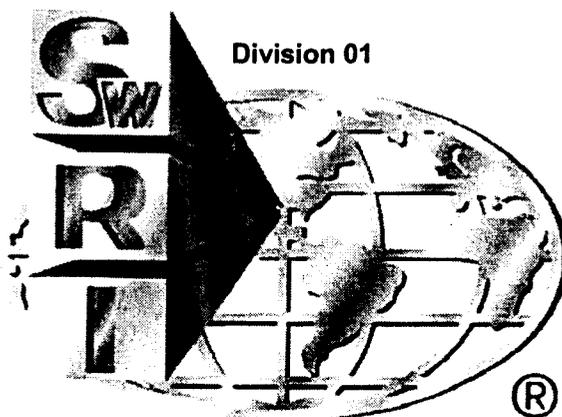
| System ID | Type | Cont | Matrix | Customer ID | CED | Method Date |
|-----------|------|------|--------|-------------|-----------|-------------|
| 268259 | | 1 | Water | 0905C-1 | 06 Oct 05 | 04 Apr 06 |
| 268260 | | 1 | Water | 0905C-2 | 06 Oct 05 | 04 Apr 06 |
| 268261 | | 1 | Water | 0905C-3 | 06 Oct 05 | 04 Apr 06 |
| 268262 | | 1 | Water | 0905C-4 | 06 Oct 05 | 04 Apr 06 |
| 268263 | | 1 | Water | 0905C-5 | 06 Oct 05 | 04 Apr 06 |
| 268264 | | 1 | Water | 0905C-6 | 06 Oct 05 | 04 Apr 06 |
| 268265 | | 1 | Water | 0905C-7 | 06 Oct 05 | 04 Apr 06 |

CONTROLLED COPY
IF STAMP IS NOT RED, THIS DOCUMENT IS UNCONTROLLED

01-QPP-015
Division 01
Revision 5
June 2004

010015

Document No. 3



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

010016

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

SwRI AUTHORIZATION SIGNATORIES

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



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

6/4/04

DATE



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

6/4/04

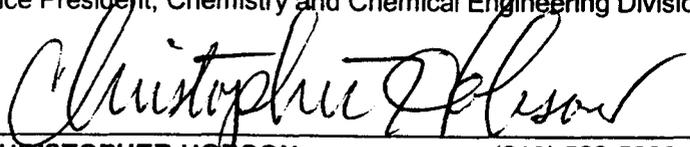
DATE



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

6/4/04

DATE



CHRISTOPHER HOBSON (210) 522-5838
Quality Assurance Engineer

6/4/2004

DATE

010017

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

010018

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

010019

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.

010020

4.6 Acceptance of Services Only

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

4.7 Commercial Grade Items

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

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- (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*.

010022

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.

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4.11 Quality Assurance Records

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

4.12 10 CFR, Part 21

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

4.13 Certified Test Report

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

order/release line item number.

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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

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 051011-4

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

010025

Chain of Custody/Login Paperwork

19531

| | | | |
|----------------------|----------------------------------|---|---|
| Shipper Name/Address | BRAD WERLING DIU 20 BLD 57 | SAMPLE LIST/CHAIN OF CUSTODY Southwest Research Institute® Chemistry and Chemical Engineering Division 6220 Culebra Road San Antonio, Texas 78238-5166 | Requested Turnaround: <input type="checkbox"/> 2 Weeks <input type="checkbox"/> 3 Weeks <input checked="" type="checkbox"/> Other: 4 weeks |
|----------------------|----------------------------------|---|---|

| | | | | |
|--------|-------|---|--------------|---------------------------------|
| Client | Du 20 | Client Purchase Order/Other ID CNWRA | Site/Zone ID | SwRI Contact Mike Dammann |
|--------|-------|---|--------------|---------------------------------|

| Sample ID | Sample Collection Date (mm/dd/yy) | Sample Collection Time | Matrix Type | Sample Type | # of Containers | Analyses Requested | Remarks |
|-----------|-----------------------------------|------------------------|-------------|-------------|-----------------|--------------------|---|
| 0905C-1 | 10-6-05 | | W | | 1 | X | REMARKS Preservation a = HCl to pH <2 b = HNO ₃ to pH <2 c = H ₂ SO ₄ to pH <2 d = NaOH to pH >12 e = Cool (4°C±2°C) f = Other (specify) Nuclear Safety related - use appropriate QA procedures. POC - Brad Werling phone - 6565 fax - 5784 |
| 0905C-2 | | | | | | X | |
| 0905C-3 | | | | | | X | |
| 0905C-4 | | | | | | X | |
| 0905C-5 | | | | | | X | |
| 0905C-6 | | | | | | X | |
| 0905C-7 | | | | | | X | |

| | | | |
|---|--|---|---|
| Matrix Types: A - Air B - Biota D - Dust E - Emission/Stack L - Liquid P - Product Sd - Solid S - Soil SED - Sediment T - Tissue W - Water WP - Wipe Temp: 22.0°C | 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 Therm #: 027 | Relinquished by (Print/Signature) <i>Mona Roberts</i> Date: 10/07/05 Time: 13:20 | SwRI Project#: 20.06002.242 |
| Received by (Print/Signature) Date: 10/7/05 Time: 1320 | | Relinquished by (Print/Signature) Date: Time: | Received by SwRI Lab (Signature) Date: 10/7/05 Time: 1320 |
| Comments: 733/579 Recd Intact | | Relinquished by (Print/Signature) Date: Time: | Samples Disposed: Date: Time: 010026 Samples Disposed by: |

SRI # 28120

SAMPLE LOG-IN SHEET

010027

Lab Name
Southwest Research Institute
Received By (Print Name)
DINO ROMAN
Received By (Signature)

Page 1 of 1
Log-in Date
10/07/2005

Case Number
CNWRA
Remarks: 06002.01.242

Sample Delivery Group No.

SAS Number
N/A
Remarks:
Condition of Sample
Shipment, etc

| | | EPA Sample # | Corresponding | | |
|--|--|--------------|---------------|----------------|--------|
| | | | Sample Tag # | Assigned Lab # | |
| 1. Custody Seal(s) | Present Absent* Intact/Broken | 0905C-1 | None | 268259 | Intact |
| 2. Custody Seal Nos. | N/A | 0905C-2 | None | 268260 | Intact |
| | | 0905C-3 | None | 268261 | Intact |
| 3. Chain-of-Custody Records | Present / Absent* | 0905C-4 | None | 268262 | Intact |
| 4. Traffic Reports or Packing Lists | Present Absent | 0905C-5 | None | 268263 | Intact |
| 5. Airbill | Airbill/Sticker Present / Absent* | 0905C-6 | None | 268264 | Intact |
| | | 0905C-7 | None | 268265 | Intact |
| 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 | 10/07/2005 | | | | |
| 12. Time Received | 13:20:00 | | | | |

Sample Transfer

| | |
|----------|----------|
| Fraction | Fraction |
| Area # | Area # |
| By | By |
| On | On |

Area # *DIR Inorg*
10/7/05 *Inorg*
CEB.

By
DINO ROMAN

On
10/07/2005

* Contact SMO and attach record of resolution

Reviewed By *Art Aguella*
Date *10.10.05*

Logbook No. Sample Receipt (28120)
Logbook Page No. 5583 Section 1 of 3

010028

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 051011-4

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

Copies of Login Book

Sample Login Book

Oct 07, 2005

010029

SwRI Login Area
Division 1

| Sample Receipt: 28119 | | Project: 06002.01.242 | Client: Div. 20 |
|-------------------------|--------------------|-----------------------|------------------------|
| VTSR Date: Oct 07, 2005 | | VTSR Time: 13:20:00 | Manager: DAMMANN, MIKE |
| System ID | Customer Sample ID | Matrix | |
| 268253 | 0905A-1 | Water | |
| 268254 | 0905A-2 | Water | |
| 268255 | 0905A-3 | Water | |
| 268256 | 0905A-4 | Water | |
| 268257 | 0905A-5 | Water | |
| 268258 | 0905A-6 | Water | |

| Sample Receipt: 28120 | | Project: 06002.01.242 | Client: Div. 20 |
|-------------------------|--------------------|-----------------------|------------------------|
| VTSR Date: Oct 07, 2005 | | VTSR Time: 13:20:00 | Manager: DAMMANN, MIKE |
| System ID | Customer Sample ID | Matrix | |
| 268259 | 0905C-1 | Water | |
| 268260 | 0905C-2 | Water | |
| 268261 | 0905C-3 | Water | |
| 268262 | 0905C-4 | Water | |
| 268263 | 0905C-5 | Water | |
| 268264 | 0905C-6 | Water | |
| 268265 | 0905C-7 | Water | |

| Sample Receipt: 28121 | | Project: 06662.11.00X | Client: TRC Environmental |
|-------------------------|--------------------|-----------------------|---------------------------|
| VTSR Date: Oct 07, 2005 | | VTSR Time: 14:00:00 | Manager: GOURLEY, CHRIS |
| System ID | Customer Sample ID | Matrix | |
| 268266 | M23-Blank-(3) | Liquid | |
| 268267 | M23-Blank-(2) | Liquid | |
| 268268 | M23-U2-5-(2) | Liquid | |
| 268269 | M23-U2-5-(3) | Liquid | |
| 268270 | M23-U2-6-(2) | Liquid | |
| 268271 | M23-U2-6-(3) | Liquid | |

010030

**SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT**

CLIENT: Division 20

TASK ORDER: 051011-4

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

RAW DATA

TRACE METALS PREPARATORY LABORATORY DIGESTION LOG

SOUTHWEST RESEARCH INSTITUTE
 SAN ANTONIO, TEXAS 78228

BOOK / PAGE: 62 154

| | |
|--|-----------------------|
| CLIENT(S): <u>Div. 20</u> | 010032 |
| TASK ORDER(S): <u>0510114</u> | SDG(S): <u>268259</u> |
| PROJECT NO(S): <u>06002.011242</u> | |
| METHOD: 3005A <input type="checkbox"/> 3050B <input type="checkbox"/> 3050B-7.5 <input type="checkbox"/> 3010A <input type="checkbox"/> 3020A <input type="checkbox"/> 7760A <input type="checkbox"/> 7740A <input type="checkbox"/> HClO ₄ <input type="checkbox"/> HClO ₄ /H ₂ SO ₄ <input type="checkbox"/> | |
| Microwave <input type="checkbox"/> Fusion <input type="checkbox"/> Teflon <input type="checkbox"/> Rock <input type="checkbox"/> OTHER <input type="checkbox"/> | |
| MATRIX: Water <input type="checkbox"/> Soil <input checked="" type="checkbox"/> Biota <input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> TCLP Ext <input type="checkbox"/> OTHER <input type="checkbox"/> | |
| INSTRUMENT: GFAA <input type="checkbox"/> ICP <input checked="" type="checkbox"/> ICP-MS <input type="checkbox"/> IC <input type="checkbox"/> FLAA <input type="checkbox"/> HYDRIDE <input type="checkbox"/> OTHER <input type="checkbox"/> | |
| ACID INORG #: HNO ₃ # <u>5372</u> HCl# <u>5397</u> H ₂ SO ₄ # _____ HClO ₄ # _____ HF# _____ H ₂ O ₂ # _____ | |
| INTERNAL STD: Sc @ 10 PPM <input checked="" type="checkbox"/> Be @ 10 PPM <input type="checkbox"/> SOURCE: <input checked="" type="checkbox"/> INORG# <u>5404</u> EXP: <u>10-1-06</u> AMT: <u>50ul</u> | |
| Oven/Hotplate/ Block ID: <u>N/A</u> Temperature (°C): <u>N/A</u> | |

| Sample Identification | df | WT(g) | I.V.(ml) | F.V.(ml) | |
|-----------------------|----|-------|----------|----------|--|
| PBW-K12H2 | 1 | | 5 | 5 | |
| LCSW-K12H2* | 1 | | 5 | 5 | |
| 268259 | 1 | | 5 | 5 | |
| 268259d | 1 | | 5 | 5 | |
| 268259s* | 1 | | 5 | 5 | |
| 268260 | 1 | | 5 | 5 | |
| 268261 | 1 | | 5 | 5 | |
| 268262 | 1 | | 5 | 5 | |
| 268263 | 1 | | 5 | 5 | |
| 268264 | 1 | | 5 | 5 | |
| 268265 | 1 | | 5 | 5 | |

* 20ul ICAL-1 Spex#5288 exp.06/06 and 50ul Spike-1 SPEX #5197 exp. 3/06
 *20ul Li IV #5244 exp. 6/1/06 S IV#4917 1/1/06 Si IV#4999 3/1/06
 PBW&LCSW are prepared as 5mls 1%HNO₃/ 5% HCL

Contacted:
 Mark Ehnstrom
 on 10-12-05

LOCATION:
 N/A

PREPARED BY: [Signature] DATE: 10-12-05
 REVIEWED BY: John Wilks DATE: 10-12-05
 DISPOSAL INT/DATE/LOC: _____

SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

Balance #: 12

Thermometer #: G011

diH2O Temperature (°C): 21⁰⁰

| Eppendorf # | True Value (µL) | 1st Reading (g) | 2nd Reading (g) | 3rd Reading (g) |
|-------------|-----------------|---------------------------|---------------------------|-----------------------------|
| Lab30 | 1000 | .9964 | .9968 | .9963 |
| TMA1 | 1000 | 1.0022 | 1.0055 | 1.0045 |
| TMA2 | 1000 | 1.0046 | 1.0047 | 1.0021 |
| TMA3 | 1000 | not | Found | |
| TMA6 | 1000 | 1.0076 | 1.0042 | 1.0037 |
| TMB1 | 900 | .8959 | .9013 | .8910 |
| TMC1 | 800 | .7955 | .7947 | .7920 |
| TMDD1 | 750 | .7509 | .7522 | .7502 |
| TMD1 | 700 | .7024 | .7006 | .6992 |
| TMD2 | 700 | .7029 | .7025 | .6997 |
| TME1 | 600 | .5935 | .5896 | .5925 |
| TMF2 | 500 | .5010 | .4996 | .4999 |
| TMF5 | 500 | .5022 | .5036 | .5039 |
| ICF1 | 500 | .4973 | .4960 | .4947 |
| L30-500 | 500 | 0.5078 | .5071 | .5068 |
| TMG3 | 400 | .3952 | .3964 | .3948 |
| TMH1 | 300 | out | of | service |
| TMH2 | 300 | .3000 | .3025 | ^{KE} .2981 |
| TMJ1 | 250 | .2490 | .2499 | .2490 |
| TMJ2 | 250 | .2491 | ^{KE} .2483 | .2479 |
| TMJ3 | 250 | .2500 | .2498 | .2497 |
| TMK2 | 200 | .1999 | .2018 | .2010 |
| TML1 | 150 | .1489 | .1499 | .1499 |
| TMM1 | 120 | .1186 | .1190 | .1196 |
| TMN3 | 100 | out ^{KE} | of ^{KE} | service |
| ICN1 | 100 * | ^{KE} .0974 .0998 | ^{KE} .0959 .0982 | ^{KE} .0960 .091001 |
| TMQ1 | 80 | .0800 | .0797 | .0799 |
| TMR1 | 70 | out | of | service |
| TMS1 | 60 | " | " | " |
| LAB-30A | 50 | " | " | " |
| TMU1 | 40 | .0403 | .0398 | .0396 |
| TMU2 | 40 | .0397 | .0395 | .0393 |
| TMV1 | 30 | .0297 | .0297 | .0294 |
| L30-20 | 20 | .0200 | .0200 | .0199 |
| TMW1 | 25 | .0249 | .0249 | .0247 |
| TMY1 | 15 | out | of | service |

010033

* tip was lose. KE 9/21/05

Analyst: [Signature]

Date: 9-21-05

Reviewed by: [Signature]

Date: 9-21-05

SOUTHWEST RESEARCH INSTITUTE®

6220 Culebra Rd
San Antonio, Texas 78228

010035

TJA_2 TRACE ICP DAILY LOG

ANALYST [Signature]

DATE 10-12-05

As 189.042 Profile Line

As Intensity: 217.975

PEAK POSITION -0.36155

VERNIER POSITION 717

| | |
|---------------|--------------|
| QC PREP DATE: | |
| CCV/ICV | <u>05403</u> |
| CRI | |
| ICSA | |
| ICSAB | <u>05403</u> |

| | |
|-----------------|--------------|
| STDs PREP DATE: | |
| CLP STD1 SC | <u>05403</u> |
| CLP STD2 SC | |
| CLP STD3 SC | |
| CLP STD4 SC | |
| CLP STD5 SC | |
| CLP STD6 SC | |
| BLK SC | <u>05403</u> |

| COMMENTS | FILE | CLIENT | TO# | PROJECT NO. | METHOD |
|---|---------------|---------------|-----------------|----------------------|---------------------|
| <u>B510114</u> | <u>Y650C7</u> | <u>D.V.20</u> | <u>051011-4</u> | <u>06 002.01.242</u> | <u>60105 62-153</u> |
| <u>[Large Signature]</u> <u>10-12-05</u> | | | | | |
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| | | | | | |

COMMENTS: _____

MAINTENANCE:

REVIEWED BY: [Signature] DATE: 10-25-05

ICP Calibration Blank/ICB/CCB Solution

ID: BLK-05431

Date Prepared: 8-31-05

Prepared By: [Signature]

010036

Make up as needed in 1000ml volumetric flask.

Added 10 ml HNO3 INORG #: 5320

Added 50 ml HCL INORG #: 5338

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

ICP Calibration Blank/ICB/CCB Solution

ID: BLK-05403

Date Prepared: 10-3-05

Prepared By: [Signature]

Make up as needed in 1000ml volumetric flask.

Added 10 ml HNO3 INORG #: 5321

Added 50 ml HCL INORG #: 5397

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

ICP Calibration Blank/ICB/CCB Solution

ID: BLK-

Date Prepared: _____

Prepared By: _____

Make up as needed in 1000ml volumetric flask.

Added _____ 10 ml HNO3 INORG #: _____

Added _____ 50 ml HCL INORG #: _____

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

ICP Calibration Blank/ICB/CCB Solution

ID: BLK-

Date Prepared: _____

Prepared By: _____

Make up as needed in 1000ml volumetric flask.

Added _____ 10 ml HNO3 INORG #: _____

Added _____ 50 ml HCL INORG #: _____

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

ICP Calibration Standards

Date Prepared: 10-3-05 Prepared By: [Signature]

HNO3 INORG #: 5371 HCl INORG #: 5397 010037

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 |
|----------|----------------|---------|----------------|----------|-------|----------|--------------------------|------------------|----------|
| 10-3-05 | STD1- 05203 | Al | 50 | 2.50 | / | INORVENT | 5405 | 10000 | 10-1-06 |
| | | Ca | 50 | 2.50 | / | INORVENT | 4988 | 10000 | 2-1-06 |
| | | Fe | 50 | 2.50 | / | INORVENT | 5048 | 10000 | 3-1-06 |
| | | K | 50 | 2.50 | / | INORVENT | 4907 | 10000 | 12-1-05 |
| | | 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 | 5175 | 10000 | 5-1-06 |
| 10-3-05 | STD2- 05203 | 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 | 4906 | 1000 | 12-1-05 |
| | | 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 |
| 10-3-05 | STD3- 05203 | Cd | 10 | 5.00 | / | INORVENT | 5043 ¹⁰⁻²⁵⁻⁰⁵ | 1000 | 3-1-06 |
| | | Co | 10 | 5.00 | / | INORVENT | 5044 | 1000 | 3-1-06 |
| | | Mn | 10 | 5.00 | / | INORVENT | 4989 | 1000 | 2-1-06 |
| | | V | 10 | 5.00 | / | INORVENT | 4916 | 1000 | 1-1-06 |
| | | Zn | 10 | 5.00 | / | INORVENT | 4915 | 1000 | 1-1-06 |
| | | Sc | 10 | 0.500 | / | INORVENT | 5175 | 10000 | 5-1-06 |
| 10-3-05 | STD4- 05203 | Ag | 2 | 1.00 | / | INORVENT | 5406 | 1000 | 10-1-06 |
| | | As | 10 | 5.00 | / | INORVENT | 4947 | 1000 | 2-1-06 |
| | | 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 | 4990 | 1000 | 2-1-06 |
| | | Sc | 10 | 0.500 | / | INORVENT | 5175 | 10000 | 5-1-06 |
| 10-3-05 | STD5- 05203 | 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 | 4908 | 1000 | 12-1-05 |
| | | 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 | | |
| 10-3-05 | STD6- 05203 | 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 | 4917 | 1000 | 1-1-06 |
| | | Th | 10 | 5.00 | / | INORVENT | 4844 | 1000 | 12-1-05 |
| | | 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 | 5000 | 1000 | 3-1-06 |
| | | Zr | 10 | 5.00 | / | INORVENT | 5311 | 1000 | 8-1-06 |
| SC | 10 | 0.500 | / | INORVENT | 5175 | 10000 | 5-1-06 | | |

Expiration Dates:

STD1: 12-1-05 STD4: 12-1-05
 STD2: 12-1-05 STD5: 12-1-05
 STD3: 12-1-05 STD6: 12-1-05

ICP ICV/CCV SOLUTION

010038

CCV- 05203

Date Prepared: 10-3-05

Prepared By: DL

HNO3 INORG #: 5371

HCl INORG #: 5397

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 | 4966 | 1000 | 1-15-06 |
| 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 | 4912 | 1000 | 11-30-05 |
| La | 5 | 5ml | / | SPEX | 5325 | 1000 | 8-15-06 11-17-05 |
| Y | 5 | 5ml | / | SPEX | 4913 | 1000 | 11-30-05 |
| Pd | 1 | 1ml | / | SPEX | 4967 | 1000 | 1-15-06 10-17-05 |
| S | 1 | 1ml | / | SPEX | 5296 | 1000 | 7-15-06 |
| Th | 1 | 1ml | / | SPEX | 5354 | 1000 | 8-30-06 |
| U | 1 | 1ml | / | SPEX | 5279 | 1000 | 6-30-06 |
| W | 1 | 1ml | / | SPEX | 5314 | 1000 | 7-30-06 |
| Zr | 5 | 5ml | / | SPEX | 5039 | 1000 | 2-28-06 |
| Na | 10 | 1ml | / | SPEX | 4998 | 10000 | 1-30-06 |
| ICV-2A | vary | 10ml | / | SPEX | 4909 | mix | 11-30-05 |
| ICV-2B | vary | 1ml | / | SPEX | 4911 | mix | 11-30-05 |
| ICV-2C | vary | 10ml | / | SPEX | 4910 | mix | 11-30-05 |

Expiration Date: 11-30-05

Various ICP QC Solutions

010039

Date Prepared: 10-3-05 Prepared By: [Signature]

HNO3 INORG #: 5371 HCl INORG #: 5397

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

| Name: | Prepared | | SOURCE | INORG # | EXPR DATE | Stock Conc mg/L | AMT added | CHECK | |
|----------------|----------|--|------------|-----------|-----------|-----------------|-----------|--------|---|
| CRI - 05203 | 10-3-05 | | CRDL-1 | SPEX | 5874 | 3-15-06 | mix | 500 uL | ✓ |
| | | | CRI-Interm | INOR VENT | 56503 | 11-3-05 | mix | 5mL | ✓ |
| | | | Sc | INOR VENT | 5175 | 5-1-06 | 10000 | 500 uL | ✓ |

Expiration Date: 12-3-05
 28 34 5311 4-1-06 1000 520L ✓

| Name: | Prepared | | SOURCE | INORG # | EXPR DATE | Stock Conc mg/L | AMT added | CHECK | |
|-----------------|----------|--|--------|-----------|-----------|-----------------|-----------|--------|---|
| ICSA - 05203 | 10-3-05 | | INT-A1 | SPEX | 5306 | 7-15-06 | mix | 50 mL | ✓ |
| | | | Sc | INOR VENT | 5175 | 5-1-06 | 10000 | 500 uL | ✓ |

Expiration Date: 12-3-05

| Name: | Prepared | | SOURCE | INORG # | EXPR DATE | Stock Conc mg/L | AMT added | CHECK | |
|------------------|----------|-----------|----------------|-----------|-----------|-----------------|-----------|-------|---|
| ICSAB - 05203 | 10-3-05 | | INT-A1 | SPEX | 5306 | 7-15-06 | mix | 50 mL | ✓ |
| | | | INT-B1 (ILMO2) | SPEX | 4411 | 10-15-05 | mix | 5 mL | ✓ |
| | | | As | INOR VENT | 4947 | 2-1-06 | 1000 | 500uL | ✓ |
| | | | Se | INOR VENT | 5313 | 8-1-06 | 1000 | 500uL | ✓ |
| | | | Sb | INOR VENT | 5842 | 3-1-06 | 1000 | 500uL | ✓ |
| | | | Tl | INOR VENT | 4990 | 2-1-06 | 1000 | 500uL | ✓ |
| | | | B | INOR VENT | 5847 | 3-1-06 | 1000 | 500uL | ✓ |
| | | | Li | INOR VENT | 5244 | 6-1-06 | 1000 | 500uL | ✓ |
| | | | Mo | INOR VENT | 5250 | 3-1-06 | 1000 | 500uL | ✓ |
| | | | P | INOR VENT | 5254 | 6-1-06 | 1000 | 500uL | ✓ |
| | | | Si | INOR VENT | 5046 | 3-1-06 | 1000 | 500uL | ✓ |
| | | | Sr | INOR VENT | 5243 | 6-1-06 | 1000 | 500uL | ✓ |
| | | | Sn | INOR VENT | 5174 | 5-1-06 | 1000 | 500uL | ✓ |
| | | | Ti | INOR VENT | 4908 | 12-1-05 | 1000 | 500uL | ✓ |
| | Sc | INOR VENT | 5175 | 5-1-06 | 10000 | 500uL | ✓ | | |

Expiration Date: 12-3-05

For ILMO4 and IREAP

| Name: | Prepared | | SOURCE | INORG # | EXPR DATE | Stock Conc mg/L | AMT added | CHECK | |
|---------|----------|--|----------------------|-----------|-----------|-----------------|-----------|-------|--|
| ICSAB4- | | | INT-A1 | SPEX | | mix | 50 mL | | |
| | | | Analytes B (ILMO4.0) | SPEX | | mix | 5 mL | | |
| | | | Mo | INOR VENT | | | 1000 | 500uL | |
| | | | Th | INOR VENT | | | 1000 | 500uL | |
| | | | Ti | INOR VENT | | | 1000 | 500uL | |
| | | | U | INOR VENT | | | 1000 | 500uL | |
| | | | Zr | INOR VENT | | | 1000 | 500uL | |
| | | | Sc | INOR VENT | | | 10000 | 500uL | |

DIV. 20
 TO#051011-4
 Project No. 06002.01.242
 Prep. Page 62-154

10-25-05

| 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-K12E2 | K_766 | 0.300 | U | | mg/L | 0.3 | | | | 0.300 | -0.254005175 | -0.254 | 1 | 0.3 | -0.254005175 | 10/12/05 | 11:05 AM |
| pbw-K12E2 | Li670 | 0.0100 | U | | mg/L | 0.01 | | | | 0.010 | -0.001378881 | -0.00138 | 1 | 0.01 | -0.001378881 | 10/12/05 | 11:05 AM |
| pbw-K12E2 | Na589 | 0.250 | U | | mg/L | 0.25 | | | | 0.250 | -0.032142214 | -0.0321 | 1 | 0.25 | -0.032142214 | 10/12/05 | 11:05 AM |
| lcsww-K12E2 | K_766 | 19.0 | | | mg/L | 0.3 | | 95.0% | 20 | 0.300 | 19.04840893 | 19 | 1 | 0.3 | 19.04840893 | 10/12/05 | 11:07 AM |
| lcsww-K12E2 | Li670 | 3.78 | | | mg/L | 0.01 | | 94.5% | 4 | 0.010 | 3.783373433 | 3.78 | 1 | 0.01 | 3.783373433 | 10/12/05 | 11:07 AM |
| lcsww-K12E2 | Na589 | 19.2 | | | mg/L | 0.25 | | 96.0% | 20 | 0.250 | 19.19257993 | 19.2 | 1 | 0.25 | 19.19257993 | 10/12/05 | 11:07 AM |
| 268259 | K_766 | 2.98 | | | mg/L | 0.3 | | | | 0.300 | 2.976803939 | 2.98 | 1 | 0.3 | 2.976803939 | 10/12/05 | 11:10 AM |
| 268259 | Li670 | 0.0930 | | | mg/L | 0.01 | | | | 0.010 | 0.092961362 | 0.093 | 1 | 0.01 | 0.092961362 | 10/12/05 | 11:10 AM |
| 268259 | Na589 | 101 | | | mg/L | 0.25 | | | | 0.250 | 101.4528329 | 101 | 1 | 0.25 | 101.4528329 | 10/12/05 | 11:10 AM |
| 268259d | K_766 | 3.11 | | | mg/L | 0.3 | 4.3% | | | 0.300 | 3.107241704 | 3.11 | 1 | 0.3 | 3.107241704 | 10/12/05 | 11:12 AM |
| 268259d | Li670 | 0.0891 | | | mg/L | 0.01 | 4.3% | | | 0.010 | 0.089073601 | 0.0891 | 1 | 0.01 | 0.089073601 | 10/12/05 | 11:12 AM |
| 268259d | Na589 | 101 | | | mg/L | 0.25 | 0.0% | | | 0.250 | 101.4751115 | 101 | 1 | 0.25 | 101.4751115 | 10/12/05 | 11:12 AM |
| 268259s | K_766 | 22.7 | | | mg/L | 0.3 | | 98.6% | 20 | 0.300 | 22.68449688 | 22.7 | 1 | 0.3 | 22.68449688 | 10/12/05 | 11:17 AM |
| 268259s | Li670 | 3.82 | | | mg/L | 0.01 | | 93.2% | 4 | 0.010 | 3.824518258 | 3.82 | 1 | 0.01 | 3.824518258 | 10/12/05 | 11:17 AM |
| 268259s | Na589 | 118 | | | mg/L | 0.25 | | 85.0% | 20 | 0.250 | 117.7827799 | 118 | 1 | 0.25 | 117.7827799 | 10/12/05 | 11:17 AM |
| 268260 | K_766 | 2.23 | | | mg/L | 0.3 | | | | 0.300 | 2.226071952 | 2.23 | 1 | 0.3 | 2.226071952 | 10/12/05 | 11:20 AM |
| 268260 | Li670 | 0.0774 | | | mg/L | 0.01 | | | | 0.010 | 0.077357503 | 0.0774 | 1 | 0.01 | 0.077357503 | 10/12/05 | 11:20 AM |
| 268260 | Na589 | 106 | | | mg/L | 0.25 | | | | 0.250 | 106.0660717 | 106 | 1 | 0.25 | 106.0660717 | 10/12/05 | 11:20 AM |
| 268261 | K_766 | 3.52 | | | mg/L | 0.3 | | | | 0.300 | 3.524019649 | 3.52 | 1 | 0.3 | 3.524019649 | 10/12/05 | 11:23 AM |
| 268261 | Li670 | 0.0546 | | | mg/L | 0.01 | | | | 0.010 | 0.05463495 | 0.0546 | 1 | 0.01 | 0.05463495 | 10/12/05 | 11:23 AM |
| 268261 | Na589 | 97.4 | | | mg/L | 0.25 | | | | 0.250 | 97.40502673 | 97.4 | 1 | 0.25 | 97.40502673 | 10/12/05 | 11:23 AM |
| 268262 | K_766 | 2.91 | | | mg/L | 0.3 | | | | 0.300 | 2.910121308 | 2.91 | 1 | 0.3 | 2.910121308 | 10/12/05 | 11:26 AM |
| 268262 | Li670 | 0.0478 | | | mg/L | 0.01 | | | | 0.010 | 0.047756955 | 0.0478 | 1 | 0.01 | 0.047756955 | 10/12/05 | 11:26 AM |
| 268262 | Na589 | 53.1 | | | mg/L | 0.25 | | | | 0.250 | 53.10852856 | 53.1 | 1 | 0.25 | 53.10852856 | 10/12/05 | 11:26 AM |
| 268263 | K_766 | 3.95 | | | mg/L | 0.3 | | | | 0.300 | 3.946860048 | 3.95 | 1 | 0.3 | 3.946860048 | 10/12/05 | 11:29 AM |
| 268263 | Li670 | 0.0400 | | | mg/L | 0.01 | | | | 0.010 | 0.040015883 | 0.04 | 1 | 0.01 | 0.040015883 | 10/12/05 | 11:29 AM |
| 268263 | Na589 | 48.8 | | | mg/L | 0.25 | | | | 0.250 | 48.78239772 | 48.8 | 1 | 0.25 | 48.78239772 | 10/12/05 | 11:29 AM |
| 268264 | K_766 | 2.42 | | | mg/L | 0.3 | | | | 0.300 | 2.419413286 | 2.42 | 1 | 0.3 | 2.419413286 | 10/12/05 | 11:40 AM |
| 268264 | Li670 | 0.0773 | | | mg/L | 0.01 | | | | 0.010 | 0.07729082 | 0.0773 | 1 | 0.01 | 0.07729082 | 10/12/05 | 11:40 AM |
| 268264 | Na589 | 108 | | | mg/L | 0.25 | | | | 0.250 | 107.8446175 | 108 | 1 | 0.25 | 107.8446175 | 10/12/05 | 11:40 AM |
| 268265 | K_766 | 9.51 | | | mg/L | 0.3 | | | | 0.300 | 9.505368689 | 9.51 | 1 | 0.3 | 9.505368689 | 10/12/05 | 11:43 AM |
| 268265 | Li670 | 0.0100 | U | | mg/L | 0.01 | | | | 0.010 | -0.006667845 | -0.00667 | 1 | 0.01 | -0.006667845 | 10/12/05 | 11:43 AM |
| 268265 | Na589 | 10.2 | | | mg/L | 0.25 | | | | 0.250 | 10.22925997 | 10.2 | 1 | 0.25 | 10.22925997 | 10/12/05 | 11:43 AM |

✓
APR 10/21/05

268265 for Na

$$\frac{10.2293 \text{ mg/L} \times 5 \text{ ml}}{5 \text{ ml}} = 10.2 \text{ mg/L}$$

010040

200.7 TAP No. 01-0406-028 Rev2/Mar02

6010B TAP No. 01-0406-130 Rev3/Mar05

Other _____

QC STD. ID's
CCV 05403
CRI 1
ICSA 1
ICSAB 05403

ICP CAL.STD.
ID's
Std0 05403
Std1 05403
Std2 _____
Std3 _____
Std4 _____
Std5 _____
Std6 _____

010041

Li K + Na

| PROJ. NO. | PROJECT | TO# | DATE | MATRIX | LOGBK PG |
|---------------------|----------------|-----------------|-----------------|--------------|---------------|
| <u>06002.01.242</u> | <u>Div. 20</u> | <u>051011-4</u> | <u>10-12-05</u> | <u>Water</u> | <u>62-154</u> |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |

INSTRUMENT: Spectro FILENAME: 051012

File converted to wsl?

010042

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 : 10:35:46 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc361 |
|------|-------|-------|-------|--------|
| # 1 | 37.5 | -19.0 | 86.0 | 3831.0 |
| # 2 | 35.5 | -8.0 | 65.0 | 3716.0 |
| Mean | 36.5 | -13.5 | 75.5 | 3773.5 |
| SD | 1.4 | 7.8 | 14.8 | 81.3 |
| %RSD | 3.9 | 57.6 | 19.7 | 2.2 |

INTENSITIES

Identity 1 : BLK_SC Identity 2 : Type : STD

Weight : 1.0000 Volume : 1.00 Printed : 10:35:46 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc361 |
|------|-------|-------|-------|--------|
| # 1 | 0.0 | -0.0 | 0.0 | 3831.0 |
| # 2 | 0.0 | -0.0 | 0.0 | 3716.0 |
| Mean | 0.0 | -0.0 | 0.0 | 3773.5 |
| SD | 0.0 | 0.0 | 0.0 | 81.3 |
| %RSD | 1.7 | 55.8 | 17.6 | 2.2 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_STD1_SC Identity 2 : Type : STD

Weight : 1.0000 Volume : 1.00 Printed : 10:38:38 AM October 12, 2005

| | K_766 | Li670 | Na589 |
|------|--------|---------|---------|
| # 1 | 3788.0 | 23239.5 | 20385.5 |
| # 2 | 3758.0 | 22980.5 | 20194.5 |
| Mean | 3773.0 | 23110.0 | 20290.0 |
| SD | 21.2 | 183.1 | 135.1 |
| %RSD | 0.6 | 0.8 | 0.7 |

INTENSITIES

Identity 1 : CLP_STD1_SC Identity 2 : Type : STD

Weight : 1.0000 Volume : 1.00 Printed : 10:38:40 AM October 12, 2005

| | K_766 | Li670 | Na589 |
|------|-------|-------|-------|
| # 1 | 0.9 | 5.8 | 5.1 |
| # 2 | 1.0 | 5.8 | 5.1 |
| Mean | 0.9 | 5.8 | 5.1 |
| SD | 0.0 | 0.0 | 0.0 |
| %RSD | 0.2 | 0.0 | 0.1 |

Handwritten signature
10/21/05

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV

Weight : 1.0000 Volume : 1.00 Printed : 10:41:34 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|---------|---------|--------|--------|
| # 1 | 1566.5 | 11963.5 | 12810.5 | 4107.5 | 4107.5 |
| # 2 | 1565.5 | 11906.5 | 12694.5 | 4081.5 | 4081.5 |
| Mean | 1566.0 | 11935.0 | 12752.5 | 4094.5 | 4094.5 |

Handwritten signature
10-12-05

| | | | | | |
|------|-----|------|------|------|------|
| SD | 0.7 | 40.3 | 82.0 | 18.4 | 18.4 |
| %RSD | 0.0 | 0.3 | 0.6 | 0.4 | 0.4 |

APPARENT CONCENTRATIONS

EVOLUTION by Micro-Active Australia Pty Ltd 10:48:38 AM October 12, 2005

010043

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 10:41:34 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|---------|--------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 19.7667 | 5.0091 | 30.4505 | 4107.500 H | 108.8665 |
| # 2 | 19.8828 | 5.0169 | 30.3665 | 4081.500 H | 108.1763 |
| Mean | 19.8247 | 5.0130 | 30.4085 | 4094.500 H | 108.5214 |
| SD | 0.0821 | 0.0056 | 0.0594 | 18.385 | 0.4880 |
| %RSD | 0.4143 | 0.1112 | 0.1954 | 0.449 | 0.4497 |

Checking calibration verification ...

Identity 1 : CLP_CCV_SC Identity 2 :

| Report name | Low limit | Value | High limit |
|-------------|-----------|--------|------------|
| K_766 | 18.000 | 19.825 | 22.000 |
| Li670 | 4.500 | 5.013 | 5.500 |
| Na589 | 27.000 | 30.409 | 33.000 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 10:45:28 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|-------|--------|--------|
| # 1 | 32.0 | -19.0 | 90.5 | 3873.0 | 3873.0 |
| # 2 | 7.0 | -22.0 | 42.5 | 3813.0 | 3813.0 |
| Mean | 19.5 | -20.5 | 66.5 | 3843.0 | 3843.0 |
| SD | 17.7 | 2.1 | 33.9 | 42.4 | 42.4 |
| %RSD | 90.7 | 10.3 | 51.0 | 1.1 | 1.1 |

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 10:45:28 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--------|-----------|-----------|----------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 L | -0.0750 L | -0.0023 | 0.0330 | 3873.000 H | 102.6414 |
| # 2 L | -0.4168 L | -0.0038 L | -0.0871 | 3813.000 H | 101.0486 |
| Mean L | -0.2459 L | -0.0030 L | -0.0270 | 3843.000 H | 101.8450 |
| SD | 0.2417 | 0.0010 | 0.0849 | 42.426 | 1.1263 |
| %RSD | 98.2824 | 34.7083 | 314.0668 | 1.104 | 1.1059 |

Checking calibration blank ...

Identity 1 : Calibration blank Identity 2 :

| Report name | CRDL | Value |
|-------------|-------|---------------------|
| K_766 | 0.100 | -0.246 Contaminated |
| Li670 | 0.010 | -0.003 |
| Na589 | 0.050 | -0.027 |
| Sc361 | 0.000 | 101.845 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CRI Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 10:48:20 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|-----|-------|-------|-------|--------|--------|
| # 1 | 32.0 | 208.0 | 79.5 | 3943.5 | 3943.5 |
| # 2 | 25.0 | 214.0 | 93.5 | 3861.5 | 3861.5 |

| | | | | | |
|------|------|-------|------|--------|--------|
| Mean | 28.5 | 211.0 | 86.5 | 3902.5 | 3902.5 |
| SD | 4.9 | 4.2 | 9.9 | 58.0 | 58.0 |
| %RSD | 17.4 | 2.0 | 11.4 | 1.5 | 1.5 |

EVOLUTION by Micro-Active Australia Pty Ltd 10:54:38 AM October 12, 2005

APPARENT CONCENTRATIONS

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Identity 1 : CRI Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 10:48:20 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--------|---------|--------|----------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 L | -0.0829 | 0.0967 | 0.0015 | 3943.500 H | 104.5129 |
| # 2 L | -0.1701 | 0.1013 | 0.0413 | 3861.500 H | 102.3361 |
| Mean L | -0.1265 | 0.0990 | 0.0214 | 3902.500 H | 103.4245 |
| SD | 0.0617 | 0.0032 | 0.0282 | 57.983 | 1.5392 |
| %RSD | 48.7727 | 3.2791 | 131.5671 | 1.486 | 1.4883 |

Checking calibration verification ...

Identity 1 : CRI Identity 2 :
 Report name Low limit Value High limit
 Li670 0.090 0.099 0.110

BACKGROUND CORRECTED INTENSITIES

Identity 1 : ICSA Identity 2 : Type : INTRF
 Weight : 1.0000 Volume : 1.00 Printed : 10:51:14 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|-------|--------|--------|
| # 1 | 19.5 | -23.5 | 75.5 | 3769.5 | 3769.5 |
| # 2 | 24.5 | -25.5 | 84.5 | 3688.5 | 3688.5 |
| Mean | 22.0 | -24.5 | 80.0 | 3729.0 | 3729.0 |
| SD | 3.5 | 1.4 | 6.4 | 57.3 | 57.3 |
| %RSD | 16.1 | 5.8 | 8.0 | 1.5 | 1.5 |

APPARENT CONCENTRATIONS

Identity 1 : ICSA Identity 2 : Type : INTRF
 Weight : 1.0000 Volume : 1.00 Printed : 10:51:14 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--------|-----------|---------|----------|----------|---------|
| | ppm | ppm | ppm | | ppm |
| # 1 L | -0.2393 L | -0.0046 | 0.0002 | 3769.500 | 99.8938 |
| # 2 L | -0.1612 L | -0.0057 | 0.0285 | 3688.500 | 97.7436 |
| Mean L | -0.2002 L | -0.0051 | 0.0144 | 3729.000 | 98.8187 |
| SD | 0.0552 | 0.0008 | 0.0200 | 57.276 | 1.5205 |
| %RSD | 27.5922 | 16.0274 | 139.3664 | 1.536 | 1.5386 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : ICSAB Identity 2 : Type : ICSAB
 Weight : 1.0000 Volume : 1.00 Printed : 10:54:10 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|--------|-------|--------|--------|
| # 1 | 2.0 | 2290.5 | 67.0 | 3761.5 | 3761.5 |
| # 2 | 15.0 | 2281.5 | 83.0 | 3761.5 | 3761.5 |
| Mean | 8.5 | 2286.0 | 75.0 | 3761.5 | 3761.5 |
| SD | 9.2 | 6.4 | 11.3 | 0.0 | 0.0 |
| %RSD | 108.1 | 0.3 | 15.1 | 0.0 | 0.0 |

APPARENT CONCENTRATIONS

Identity 1 : ICSAB Identity 2 : Type : ICSAB
 Weight : 1.0000 Volume : 1.00 Printed : 10:54:10 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--|-------|-------|-------|----|-------|
|--|-------|-------|-------|----|-------|

| | ppm | ppm | ppm | ppm | ppm |
|-------|---------|----------|---------|----------|---------|
| # 1 L | -0.4861 | 1.0521 L | -0.0216 | 3761.500 | 99.6814 |
| # 2 L | -0.3023 | 1.0480 | 0.0202 | 3761.500 | 99.6814 |

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| | | | | | |
|--------|---------|----------|-----------|----------|---------|
| Mean L | -0.3942 | 1.0500 L | -0.0007 | 3761.500 | 99.6814 |
| SD | 0.1300 | 0.0029 | 0.0296 | 0.000 | 0.0000 |
| %RSD | 32.9666 | 0.2768 | 4353.0238 | 0.000 | 0.0000 |

010045

Checking interference check standard ...

| Report name | Low limit | Value | High limit |
|-------------|-----------|-------|------------|
| Li670 | 0.800 | 1.050 | 1.200 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_CCX_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 10:58:34 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|---------|---------|--------|--------|
| # 1 | 1585.5 | 11987.5 | 12745.0 | 4142.0 | 4142.0 |
| # 2 | 1560.5 | 11849.5 | 12539.0 | 4077.0 | 4077.0 |
| Mean | 1573.0 | 11918.5 | 12642.0 | 4109.5 | 4109.5 |
| SD | 17.7 | 97.6 | 145.7 | 46.0 | 46.0 |
| %RSD | 1.1 | 0.8 | 1.2 | 1.1 | 1.1 |

APPARENT CONCENTRATIONS

Identity 1 : CLP_CCX_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 10:58:34 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|---------|--------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 19.8417 | 4.9773 | 30.0399 | 4142.000 H | 109.7823 |
| # 2 | 19.8401 | 4.9985 | 30.0254 | 4077.000 H | 108.0568 |
| Mean | 19.8409 | 4.9879 | 30.0327 | 4109.500 H | 108.9196 |
| SD | 0.0011 | 0.0149 | 0.0102 | 45.962 | 1.2201 |
| %RSD | 0.0055 | 0.2993 | 0.0340 | 1.118 | 1.1202 |

Checking calibration verification ...

| Report name | Low limit | Value | High limit |
|-------------|-----------|--------|------------|
| K_766 | 18.000 | 19.841 | 22.000 |
| Li670 | 4.500 | 4.988 | 5.500 |
| Na589 | 27.000 | 30.033 | 33.000 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 11:02:26 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|-------|--------|--------|
| # 1 | 24.5 | -18.0 | 51.0 | 3873.5 | 3873.5 |
| # 2 | 24.5 | -13.0 | 51.0 | 3812.5 | 3812.5 |
| Mean | 24.5 | -15.5 | 51.0 | 3843.0 | 3843.0 |
| SD | 0.0 | 3.5 | 0.0 | 43.1 | 43.1 |
| %RSD | 0.0 | 22.8 | 0.0 | 1.1 | 1.1 |

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 11:02:26 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|-------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 24.5 | -18.0 | 51.0 | 3873.500 H | 3873.500 |
| # 2 | 24.5 | -13.0 | 51.0 | 3812.500 H | 3812.500 |
| Mean | 24.5 | -15.5 | 51.0 | 3843.000 H | 3843.000 |
| SD | 0.0 | 3.5 | 0.0 | 43.1 | 43.1 |
| %RSD | 0.0 | 22.8 | 0.0 | 1.1 | 1.1 |

2 L -0.1726 0.0003 L -0.0652 3812.500 H 101.0353
 Mean L -0.1753 L -0.0008 L -0.0662 3843.000 H 101.8450
 SD 0.0038 0.0015 0.0015 43.134 1.1450
 EVOLUTION by Micro-Active Australia Pty Ltd 11:10:46 AM October 12, 2005
 %RSD 2.1704 194.0427 2.2113 1.122 1.1243

010046

Checking calibration blank ...

Identity 1 : Calibration blank Identity 2 :
 Report name CRDL Value
 K_766 0.100 -0.175 Contaminated
 Li670 0.010 -0.001
 Na589 0.050 -0.066 Contaminated
 Sc361 0.000 101.845

BACKGROUND CORRECTED INTENSITIES

Identity 1 : pbw-K12E2 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:05:20 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|-------|--------|--------|
| # 1 | 20.0 | -17.0 | 46.0 | 3872.0 | 3872.0 |
| # 2 | 18.0 | -17.0 | 84.0 | 3890.0 | 3890.0 |
| Mean | 19.0 | -17.0 | 65.0 | 3881.0 | 3881.0 |
| SD | 1.4 | 0.0 | 26.9 | 12.7 | 12.7 |
| %RSD | 7.4 | 0.0 | 41.3 | 0.3 | 0.3 |

APPARENT CONCENTRATIONS

Identity 1 : pbw-K12E2 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:05:20 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--------|-----------|-----------|----------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 L | -0.2397 L | -0.0014 L | -0.0799 | 3872.000 H | 102.6148 |
| # 2 L | -0.2683 L | -0.0014 | 0.0156 | 3890.000 H | 103.0926 |
| Mean L | -0.2540 L | -0.0014 L | -0.0321 | 3881.000 H | 102.8537 |
| SD | 0.0202 | 0.0000 | 0.0675 | 12.728 | 0.3379 |
| %RSD | 7.9652 | 1.7895 | 209.9877 | 0.328 | 0.3285 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : lcsv-K12E2 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:07:18 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|--------|--------|--------|--------|
| # 1 | 1441.0 | 8620.5 | 7769.5 | 3908.5 | 3908.5 |
| # 2 | 1435.0 | 8571.5 | 7656.5 | 3909.5 | 3909.5 |
| Mean | 1438.0 | 8596.0 | 7713.0 | 3909.0 | 3909.0 |
| SD | 4.2 | 34.6 | 79.9 | 0.7 | 0.7 |
| %RSD | 0.3 | 0.4 | 1.0 | 0.0 | 0.0 |

APPARENT CONCENTRATIONS

Identity 1 : lcsv-K12E2 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:07:18 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|---------|--------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 19.0917 | 3.7946 | 19.3371 | 3908.500 H | 103.5838 |
| # 2 | 19.0051 | 3.7721 | 19.0481 | 3909.500 H | 103.6103 |
| Mean | 19.0484 | 3.7834 | 19.1926 | 3909.000 H | 103.5970 |
| SD | 0.0613 | 0.0159 | 0.2044 | 0.707 | 0.0188 |
| %RSD | 0.3216 | 0.4205 | 1.0648 | 0.018 | 0.0181 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268259 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:10:36 AM October 12, 2005

EVOLUTION by Micro-Active Australia Pty Ltd 11:15:44 AM October 12, 2005

010047

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|---------|--------|--------|
| # 1 | 285.5 | 222.0 | 44628.5 | 4320.5 | 4320.5 |
| # 2 | 279.5 | 213.0 | 44394.5 | 4285.5 | 4285.5 |
| Mean | 282.5 | 217.5 | 44511.5 | 4303.0 | 4303.0 |
| SD | 4.2 | 6.4 | 165.5 | 24.7 | 24.7 |
| %RSD | 1.5 | 2.9 | 0.4 | 0.6 | 0.6 |

APPARENT CONCENTRATIONS

Identity 1 : 268259 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:10:36 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|----------|----------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 2.9997 | 0.0944 H | 101.3066 | 4320.500 H | 114.5208 |
| # 2 | 2.9539 | 0.0915 H | 101.5990 | 4285.500 H | 113.5917 |
| Mean | 2.9768 | 0.0930 H | 101.4528 | 4303.000 H | 114.0563 |
| SD | 0.0324 | 0.0020 | 0.2068 | 24.749 | 0.6570 |
| %RSD | 1.0868 | 2.1956 | 0.2038 | 0.575 | 0.5760 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268259d Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:12:30 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|---------|--------|--------|
| # 1 | 279.5 | 206.5 | 43191.0 | 4174.0 | 4174.0 |
| # 2 | 287.5 | 195.5 | 42955.0 | 4152.0 | 4152.0 |
| Mean | 283.5 | 201.0 | 43073.0 | 4163.0 | 4163.0 |
| SD | 5.7 | 7.8 | 166.9 | 15.6 | 15.6 |
| %RSD | 2.0 | 3.9 | 0.4 | 0.4 | 0.4 |

APPARENT CONCENTRATIONS

Identity 1 : 268259d Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:12:30 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|----------|----------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 3.0466 | 0.0911 H | 101.4850 | 4174.000 H | 110.6318 |
| # 2 | 3.1679 | 0.0870 H | 101.4652 | 4152.000 H | 110.0478 |
| Mean | 3.1072 | 0.0891 H | 101.4751 | 4163.000 H | 110.3398 |
| SD | 0.0858 | 0.0029 | 0.0140 | 15.556 | 0.4130 |
| %RSD | 2.7611 | 3.2551 | 0.0138 | 0.374 | 0.3743 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268259L df5 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:15:34 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|--------|--------|--------|
| # 1 | 54.0 | 21.0 | 8034.5 | 3848.0 | 3848.0 |
| # 2 | 63.0 | 29.0 | 8075.5 | 3827.0 | 3827.0 |
| Mean | 58.5 | 25.0 | 8055.0 | 3837.5 | 3837.5 |
| SD | 6.4 | 5.7 | 29.0 | 14.8 | 14.8 |
| %RSD | 10.9 | 22.6 | 0.4 | 0.4 | 0.4 |

APPARENT CONCENTRATIONS

Identity 1 : 268259L df5 Identity 2 : Type : SAMPLE

EVOLUTION by Micro-Active Australia Pty Ltd 11:23:48 AM October 12, 2005

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| | K_766 ppm | Li670 ppm | Na589 ppm | Sc | Sc361 ppm |
|------|--------------|--------------|--------------|------------|--------------|
| # 1 | 0.2319 | 0.0155 | 20.3209 | 3848.000 H | 101.9777 |
| # 2 | 0.3610 | 0.0192 | 20.5388 | 3827.000 H | 101.4202 |
| Mean | 0.2965 | 0.0173 | 20.4299 | 3837.500 H | 101.6990 |
| SD | 0.0913 | 0.0026 | 0.1541 | 14.849 | 0.3942 |
| %RSD | 30.8052 | 14.8519 | 0.7541 | 0.387 | 0.3876 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268259a Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:17:28 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|--------|---------|--------|--------|
| # 1 | 1836.5 | 9314.5 | 50204.0 | 4173.0 | 4173.0 |
| # 2 | 1816.5 | 9300.5 | 50335.0 | 4201.0 | 4201.0 |
| Mean | 1826.5 | 9307.5 | 50269.5 | 4187.0 | 4187.0 |
| SD | 14.1 | 9.9 | 92.6 | 19.8 | 19.8 |
| %RSD | 0.8 | 0.1 | 0.2 | 0.5 | 0.5 |

APPARENT CONCENTRATIONS

Identity 1 : 268259a Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:17:28 AM October 12, 2005

| | K_766 ppm | Li670 ppm | Na589 ppm | Sc | Sc361 ppm |
|------|--------------|--------------|--------------|------------|--------------|
| # 1 | 22.8891 | 3.8402 H | 118.0235 | 4173.000 H | 110.6053 |
| # 2 | 22.4799 | 3.8089 H | 117.5420 | 4201.000 H | 111.3486 |
| Mean | 22.6845 | 3.8245 H | 117.7828 | 4187.000 H | 110.9769 |
| SD | 0.2893 | 0.0221 | 0.3405 | 19.799 | 0.5256 |
| %RSD | 1.2754 | 0.5783 | 0.2891 | 0.473 | 0.4736 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268260 Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:20:32 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|---------|--------|--------|
| # 1 | 207.5 | 179.0 | 45175.0 | 4183.5 | 4183.5 |
| # 2 | 222.5 | 167.0 | 45066.0 | 4161.5 | 4161.5 |
| Mean | 215.0 | 173.0 | 45120.5 | 4172.5 | 4172.5 |
| SD | 10.6 | 8.5 | 77.1 | 15.6 | 15.6 |
| %RSD | 4.9 | 4.9 | 0.2 | 0.4 | 0.4 |

APPARENT CONCENTRATIONS

Identity 1 : 268260 Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:20:32 AM October 12, 2005

| | K_766 ppm | Li670 ppm | Na589 ppm | Sc | Sc361 ppm |
|------|--------------|--------------|--------------|------------|--------------|
| # 1 | 2.1233 | 0.0796 H | 105.9143 | 4183.500 H | 110.8840 |
| # 2 | 2.3289 | 0.0751 H | 106.2179 | 4161.500 H | 110.3000 |
| Mean | 2.2261 | 0.0774 H | 106.0661 | 4172.500 H | 110.5920 |
| SD | 0.1454 | 0.0032 | 0.2147 | 15.556 | 0.4130 |
| %RSD | 6.5316 | 4.1723 | 0.2024 | 0.373 | 0.3734 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268261 Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:23:28 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|-----|-------|-------|---------|--------|--------|
| # 1 | 311.5 | 123.0 | 41441.0 | 4179.5 | 4179.5 |
| # 2 | 320.5 | 112.0 | 41226.0 | 4143.5 | 4143.5 |

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| | | | | | |
|------|-------|-------|---------|--------|--------|
| Mean | 316.0 | 117.5 | 41333.5 | 4161.5 | 4161.5 |
| SD | 6.4 | 7.8 | 152.0 | 25.5 | 25.5 |
| %RSD | 2.0 | 6.6 | 0.4 | 0.6 | 0.6 |

APPARENT CONCENTRATIONS

Identity 1 : 268261 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:23:38 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|----------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 3.4490 | 0.0567 H | 97.2367 | 4179.500 H | 110.7778 |
| # 2 | 3.5990 | 0.0526 H | 97.5733 | 4143.500 H | 109.8221 |
| Mean | 3.5240 | 0.0546 H | 97.4050 | 4161.500 H | 110.3000 |
| SD | 0.1060 | 0.0029 | 0.2380 | 25.456 | 0.6758 |
| %RSD | 3.0087 | 5.3333 | 0.2444 | 0.612 | 0.6127 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268262 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:26:42 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|---------|--------|--------|
| # 1 | 270.0 | 100.0 | 22768.5 | 4192.5 | 4192.5 |
| # 2 | 267.0 | 102.0 | 22467.5 | 4146.5 | 4146.5 |
| Mean | 268.5 | 101.0 | 22618.0 | 4169.5 | 4169.5 |
| SD | 2.1 | 1.4 | 212.8 | 32.5 | 32.5 |
| %RSD | 0.8 | 1.4 | 0.9 | 0.8 | 0.8 |

APPARENT CONCENTRATIONS

Identity 1 : 268262 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:26:42 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|----------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 2.9104 | 0.0471 H | 53.1692 | 4192.500 H | 111.1229 |
| # 2 | 2.9099 | 0.0484 H | 53.0479 | 4146.500 H | 109.9018 |
| Mean | 2.9101 | 0.0478 H | 53.1085 | 4169.500 H | 110.5123 |
| SD | 0.0003 | 0.0009 | 0.0858 | 32.527 | 0.8635 |
| %RSD | 0.0117 | 1.8997 | 0.1615 | 0.780 | 0.7813 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268263 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:29:44 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|---------|--------|--------|
| # 1 | 348.5 | 78.0 | 20855.0 | 4187.5 | 4187.5 |
| # 2 | 353.5 | 87.0 | 20854.0 | 4180.5 | 4180.5 |
| Mean | 351.0 | 82.5 | 20854.5 | 4184.0 | 4184.0 |
| SD | 3.5 | 6.4 | 0.7 | 4.9 | 4.9 |
| %RSD | 1.0 | 7.7 | 0.0 | 0.1 | 0.1 |

APPARENT CONCENTRATIONS

Identity 1 : 268263 Identity 2 : Type : SAMPLE
 Weight : 1.0000 Volume : 1.00 Printed : 11:29:44 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--|-------|-------|-------|----|-------|
|--|-------|-------|-------|----|-------|

| | ppm | ppm | ppm | | ppm |
|-----|--------|--------|---------|------------|----------|
| # 1 | 3.9114 | 0.0381 | 48.7426 | 4187.500 H | 110.9902 |
| # 2 | 3.9824 | 0.0419 | 48.8222 | 4180.500 H | 110.8044 |

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| | | | | | |
|------|--------|--------|---------|------------|----------|
| Mean | 3.9469 | 0.0400 | 48.7824 | 4184.000 H | 110.8973 |
| SD | 0.0502 | 0.0027 | 0.0563 | 4.950 | 0.1314 |
| %RSD | 1.2723 | 6.6291 | 0.1154 | 0.118 | 0.1185 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 11:33:18 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|---------|---------|--------|--------|
| # 1 | 1545.5 | 11649.0 | 12539.0 | 4093.5 | 4093.5 |
| # 2 | 1513.5 | 11379.0 | 12251.0 | 3982.5 | 3982.5 |
| Mean | 1529.5 | 11514.0 | 12395.0 | 4038.0 | 4038.0 |
| SD | 22.6 | 190.9 | 203.6 | 78.5 | 78.5 |
| %RSD | 1.5 | 1.7 | 1.6 | 1.9 | 1.9 |

APPARENT CONCENTRATIONS

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 11:33:18 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|---------|--------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 19.5632 | 4.8942 | 29.9036 | 4093.500 H | 108.4948 |
| # 2 | 19.6955 | 4.9140 | 30.0319 | 3982.500 H | 105.5482 |
| Mean | 19.6294 | 4.9041 | 29.9678 | 4038.000 H | 107.0215 |
| SD | 0.0936 | 0.0140 | 0.0907 | 78.489 | 2.0836 |
| %RSD | 0.4766 | 0.2853 | 0.3028 | 1.944 | 1.9469 |

Checking calibration verification ...

| Report name | Low limit | Value | High limit |
|-------------|-----------|--------|------------|
| K_766 | 18.000 | 19.629 | 22.000 |
| Li670 | 4.500 | 4.904 | 5.500 |
| Na589 | 27.000 | 29.968 | 33.000 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 11:37:16 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|-------|--------|--------|
| # 1 | 7.5 | -14.0 | 58.0 | 3889.0 | 3889.0 |
| # 2 | 24.5 | -13.0 | 41.0 | 3819.0 | 3819.0 |
| Mean | 16.0 | -13.5 | 49.5 | 3854.0 | 3854.0 |
| SD | 12.0 | 0.7 | 12.0 | 49.5 | 49.5 |
| %RSD | 75.1 | 5.2 | 24.3 | 1.3 | 1.3 |

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 11:37:16 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--------|-----------|-----------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 L | -0.4118 L | -0.0000 L | -0.0501 | 3889.000 H | 103.0661 |
| # 2 L | -0.1732 | 0.0003 L | -0.0911 | 3819.000 H | 101.2079 |
| Mean L | -0.2925 | 0.0001 L | -0.0706 | 3854.000 H | 102.1370 |
| SD | 0.1687 | 0.0002 | 0.0290 | 49.497 | 1.3140 |
| %RSD | 57.6756 | 193.1594 | 41.1280 | 1.284 | 1.3065 |

Checking calibration blank ...

Identity 1 : Calibration blank Identity 2 :
EVOLUTION by Micro-Active Australia Pty Ltd 11:47:10 AM October 12, 2005

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| Report name | CRDL | Value | |
|-------------|-------|---------|--------------|
| K_766 | 0.100 | -0.293 | Contaminated |
| Li670 | 0.010 | 0.000 | |
| Na589 | 0.050 | -0.071 | Contaminated |
| Sc361 | 0.000 | 102.137 | |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268264 Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:40:10 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|---------|--------|--------|
| # 1 | 237.0 | 170.0 | 47085.0 | 4282.0 | 4282.0 |
| # 2 | 232.0 | 182.0 | 46382.0 | 4219.0 | 4219.0 |
| Mean | 234.5 | 176.0 | 46733.5 | 4250.5 | 4250.5 |
| SD | 3.5 | 8.5 | 497.1 | 44.5 | 44.5 |
| %RSD | 1.5 | 4.8 | 1.1 | 1.0 | 1.0 |

APPARENT CONCENTRATIONS

Identity 1 : 268264 Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:40:10 AM October 12, 2005

| | K_766 ppm | Li670 ppm | Na589 ppm | Sc | Sc361 ppm |
|------|--------------|--------------|--------------|------------|--------------|
| # 1 | 2.4289 | 0.0743 H | 107.8566 | 4282.000 H | 113.4988 |
| # 2 | 2.4099 | 0.0802 H | 107.8327 | 4219.000 H | 111.8264 |
| Mean | 2.4194 | 0.0773 H | 107.8446 | 4250.500 H | 112.6626 |
| SD | 0.0135 | 0.0042 | 0.0169 | 44.548 | 1.1826 |
| %RSD | 0.5574 | 5.4012 | 0.0157 | 1.048 | 1.0497 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : 268265 Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:43:12 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|--------|--------|--------|
| # 1 | 791.5 | -28.0 | 4468.0 | 4214.5 | 4214.5 |
| # 2 | 799.5 | -35.0 | 4491.0 | 4229.5 | 4229.5 |
| Mean | 795.5 | -31.5 | 4479.5 | 4222.0 | 4222.0 |
| SD | 5.7 | 4.9 | 16.3 | 10.6 | 10.6 |
| %RSD | 0.7 | 15.7 | 0.4 | 0.3 | 0.3 |

APPARENT CONCENTRATIONS

Identity 1 : 268265 Identity 2 : Type : SAMPLE
Weight : 1.0000 Volume : 1.00 Printed : 11:43:12 AM October 12, 2005

| | K_766 ppm | Li670 ppm | Na589 ppm | Sc | Sc361 ppm |
|------|--------------|--------------|--------------|------------|--------------|
| # 1 | 9.4728 L | -0.0053 | 10.2210 | 4214.500 H | 111.7069 |
| # 2 | 9.5380 L | -0.0081 | 10.2375 | 4229.500 H | 112.1051 |
| Mean | 9.5054 L | -0.0067 | 10.2293 | 4222.000 H | 111.9060 |
| SD | 0.0461 | 0.0020 | 0.0117 | 10.607 | 0.2816 |
| %RSD | 0.4848 | 29.7183 | 0.1140 | 0.251 | 0.2516 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CRI Identity 2 : Type : CV
Weight : 1.0000 Volume : 1.00 Printed : 11:46:46 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--|-------|-------|-------|----|-------|
|--|-------|-------|-------|----|-------|

| | | | | | |
|------|------|-------|------|--------|--------|
| # 1 | 40.0 | 208.0 | 65.0 | 3927.0 | 3927.0 |
| # 2 | 39.0 | 224.0 | 59.0 | 3873.0 | 3873.0 |
| Mean | 39.5 | 216.0 | 62.0 | 3900.0 | 3900.0 |

EVOLUTION by Micro-Active Australia Pty Ltd 11:52:44 AM October 12, 2005

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| | | | | | |
|------|-----|------|-----|------|------|
| SD | 0.7 | 11.3 | 4.2 | 38.2 | 38.2 |
| %RSD | 1.8 | 5.2 | 6.8 | 1.0 | 1.0 |

APPARENT CONCENTRATIONS

Identity 1 : CRI Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 11:46:46 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|---------|----------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 | 0.0273 | 0.0971 L | -0.0340 | 3927.000 H | 104.0749 |
| # 2 | 0.0211 | 0.1055 L | -0.0469 | 3873.000 H | 102.6414 |
| Mean | 0.0242 | 0.1013 L | -0.0404 | 3900.000 H | 103.3581 |
| SD | 0.0044 | 0.0059 | 0.0092 | 38.184 | 1.0136 |
| %RSD | 18.0518 | 5.8383 | 22.6546 | 0.979 | 0.9807 |

Checking calibration verification ...

Identity 1 : CRI Identity 2 :
 Report name Low limit Value High limit
 Li670 0.090 0.101 0.110

BACKGROUND CORRECTED INTENSITIES

Identity 1 : ICSA Identity 2 : Type : INTRF
 Weight : 1.0000 Volume : 1.00 Printed : 11:49:40 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|-------|--------|--------|
| # 1 | 17.0 | -35.0 | 69.0 | 3760.0 | 3760.0 |
| # 2 | 5.0 | -27.0 | 77.0 | 3726.0 | 3726.0 |
| Mean | 11.0 | -31.0 | 73.0 | 3743.0 | 3743.0 |
| SD | 8.5 | 5.7 | 5.7 | 24.0 | 24.0 |
| %RSD | 77.1 | 18.2 | 7.7 | 0.6 | 0.6 |

APPARENT CONCENTRATIONS

Identity 1 : ICSA Identity 2 : Type : INTRF
 Weight : 1.0000 Volume : 1.00 Printed : 11:49:40 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|--------|-----------|-----------|----------|----------|---------|
| | ppm | ppm | ppm | | ppm |
| # 1 L | -0.2739 L | -0.0098 L | -0.0163 | 3760.000 | 99.6416 |
| # 2 L | -0.4430 L | -0.0063 | 0.0065 | 3726.000 | 98.7390 |
| Mean L | -0.3585 L | -0.0081 L | -0.0049 | 3743.000 | 99.1903 |
| SD | 0.1196 | 0.0025 | 0.0161 | 24.042 | 0.6382 |
| %RSD | 33.3497 | 31.0253 | 327.5717 | 0.642 | 0.6434 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : ICSAB Identity 2 : Type : ICSAB
 Weight : 1.0000 Volume : 1.00 Printed : 11:52:32 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|--------|-------|--------|--------|
| # 1 | 20.5 | 2297.0 | 77.0 | 3809.5 | 3809.5 |
| # 2 | 18.5 | 2247.0 | 85.0 | 3782.5 | 3782.5 |
| Mean | 19.5 | 2272.0 | 81.0 | 3796.0 | 3796.0 |
| SD | 1.4 | 35.4 | 5.7 | 19.1 | 19.1 |
| %RSD | 7.3 | 1.6 | 7.0 | 0.5 | 0.5 |

APPARENT CONCENTRATIONS

Identity 1 : ICSAB Identity 2 : Type : ICSAB

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| | K_766 ppm | Li670 ppm | Na589 ppm | Sc | Sc361 ppm |
|--|--------------|--------------|--------------|------------|--------------|
| EVOLUTION by Micro-Active Australia Pty Ltd 12:01:10 PM October 12, 2005 | | | | | |
| # 1 L | -0.2282 | 1.0418 | 0.0020 | 3809.500 H | 100.9557 |
| # 2 L | -0.2543 | 1.0265 | 0.0242 | 3782.500 H | 100.2389 |
| Mean L | -0.2413 | 1.0342 | 0.0131 | 3796.000 H | 100.5973 |
| SD | 0.0184 | 0.0108 | 0.0157 | 19.092 | 0.5068 |
| %RSD | 7.6428 | 1.0470 | 119.7282 | 0.503 | 0.5038 |

Checking interference check standard ...

Identity 1 : ICSAB Identity 2 :

| Report name | Low limit | Value | High limit |
|-------------|-----------|-------|------------|
| Li670 | 0.800 | 1.034 | 1.200 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 11:56:56 AM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|--------|---------|---------|--------|--------|
| # 1 | 1577.5 | 11883.0 | 12766.5 | 4176.5 | 4176.5 |
| # 2 | 1533.5 | 11630.0 | 12518.5 | 4071.5 | 4071.5 |
| Mean | 1555.5 | 11756.5 | 12642.5 | 4124.0 | 4124.0 |
| SD | 31.1 | 178.9 | 175.4 | 74.2 | 74.2 |
| %RSD | 2.0 | 1.5 | 1.4 | 1.8 | 1.8 |

APPARENT CONCENTRATIONS

Identity 1 : CLP_CCV_SC Identity 2 : Type : CV
 Weight : 1.0000 Volume : 1.00 Printed : 11:56:56 AM October 12, 2005

| | K_766 ppm | Li670 ppm | Na589 ppm | Sc | Sc361 ppm |
|------|--------------|--------------|--------------|------------|--------------|
| # 1 | 19.5717 | 4.8933 | 29.8407 | 4176.500 H | 110.6982 |
| # 2 | 19.5150 | 4.9126 | 30.0168 | 4071.500 H | 107.9108 |
| Mean | 19.5433 | 4.9029 | 29.9287 | 4124.000 H | 109.3045 |
| SD | 0.0401 | 0.0136 | 0.1245 | 74.246 | 1.9710 |
| %RSD | 0.2051 | 0.2783 | 0.4160 | 1.800 | 1.8032 |

Checking calibration verification ...

Identity 1 : CLP_CCV_SC Identity 2 :

| Report name | Low limit | Value | High limit |
|-------------|-----------|--------|------------|
| K_766 | 18.000 | 19.543 | 22.000 |
| Li670 | 4.500 | 4.903 | 5.500 |
| Na589 | 27.000 | 29.929 | 33.000 |

BACKGROUND CORRECTED INTENSITIES

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 12:00:50 PM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|------|-------|-------|-------|--------|--------|
| # 1 | 19.0 | -28.5 | 103.0 | 3908.5 | 3908.5 |
| # 2 | 22.0 | -5.5 | 70.0 | 3866.5 | 3866.5 |
| Mean | 20.5 | -17.0 | 86.5 | 3887.5 | 3887.5 |
| SD | 2.1 | 16.3 | 23.3 | 29.7 | 29.7 |
| %RSD | 10.3 | 95.7 | 27.0 | 0.8 | 0.8 |

APPARENT CONCENTRATIONS

Identity 1 : Calibration blank Identity 2 : Type : CB
 Weight : 1.0000 Volume : 1.00 Printed : 12:00:50 PM October 12, 2005

| | K_766 | Li670 | Na589 | Sc | Sc361 |
|-------|-----------|----------|---------|------------|----------|
| | ppm | ppm | ppm | | ppm |
| # 1 L | -0.2559 L | -0.0064 | 0.0623 | 3908.500 H | 103.5838 |
| # 2 L | -0.2118 | 0.0037 L | -0.0187 | 3866.500 H | 102.4688 |

EVOLUTION by Micro-Active Australia Pty Ltd 12:11:40 PM October 12, 2005

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| | | | | | |
|--------|-----------|----------|----------|------------|----------|
| Mean L | -0.2338 L | -0.0013 | 0.0218 | 3887.500 H | 103.0263 |
| SD | 0.0312 | 0.0071 | 0.0573 | 29.698 | 0.7884 |
| %RSD | 13.3263 | 532.3843 | 262.6633 | 0.764 | 0.7652 |

Checking calibration blank ...

| Report name | CRDL | Value | |
|-------------|-------|---------|--------------|
| K_766 | 0.100 | -0.234 | Contaminated |
| Li670 | 0.010 | -0.001 | |
| Na589 | 0.050 | 0.022 | |
| Sc361 | 0.000 | 103.026 | |

DL 10-25-25

268259 for Ca
 $5.271 \text{ mg/L} \times \frac{\text{Sml}}{\text{Sml}} = 5.27 \frac{\text{mg}}{\text{L}}$

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | rl | mg/L | Sml | Dilution | Calc RL | ug/ml | Date | Time |
|------------|---------|---------|----------|----------|-------|-------|------|-----------|------|-------|----------|----------|----------|---------|----------|----------|-------|
| pbw-K12H1 | Ag3280 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00054 | 0.00054 | 1 | 0.005 | 0.00054 | 10/12/05 | 11:34 |
| pbw-K12H1 | Al3082 | 0.0600 | U | | mg/L | 0.06 | | | | 0.06 | 0.00514 | 0.00514 | 1 | 0.06 | 0.00514 | 10/12/05 | 11:34 |
| pbw-K12H1 | As1890 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00055 | -0.00055 | 1 | 0.005 | -0.00055 | 10/12/05 | 11:34 |
| pbw-K12H1 | B_2496 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | 0.00367 | 0.00367 | 1 | 0.02 | 0.00367 | 10/12/05 | 11:34 |
| pbw-K12H1 | Ba4934 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00002 | -0.00002 | 1 | 0.005 | -0.00002 | 10/12/05 | 11:34 |
| pbw-K12H1 | Be3130 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00001 | 0.00001 | 1 | 0.005 | 0.00001 | 10/12/05 | 11:34 |
| pbw-K12H1 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00222 | 0.00222 | 1 | 0.01 | 0.00222 | 10/12/05 | 11:34 |
| pbw-K12H1 | Ca3179 | 0.0500 | U | | mg/L | 0.05 | | | | 0.05 | 0.00155 | 0.00155 | 1 | 0.05 | 0.00155 | 10/12/05 | 11:34 |
| pbw-K12H1 | Cd2265 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00031 | 0.00031 | 1 | 0.005 | 0.00031 | 10/12/05 | 11:34 |
| pbw-K12H1 | Co2286 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00032 | 0.00032 | 1 | 0.005 | 0.00032 | 10/12/05 | 11:34 |
| pbw-K12H1 | Cr2677 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00028 | 0.00028 | 1 | 0.005 | 0.00028 | 10/12/05 | 11:34 |
| pbw-K12H1 | Cu3247 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00007 | 0.00007 | 1 | 0.005 | 0.00007 | 10/12/05 | 11:34 |
| pbw-K12H1 | Fe2714 | 0.0500 | U | | mg/L | 0.05 | | | | 0.05 | 0.01271 | 0.0127 | 1 | 0.05 | 0.01271 | 10/12/05 | 11:34 |
| pbw-K12H1 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00013 | 0.00013 | 1 | 0.005 | 0.00013 | 10/12/05 | 11:34 |
| pbw-K12H1 | Mg2790 | 0.0500 | U | | mg/L | 0.05 | | | | 0.05 | 0.00238 | 0.00238 | 1 | 0.05 | 0.00238 | 10/12/05 | 11:34 |
| pbw-K12H1 | Mn2576 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0 | 0 | 1 | 0.005 | 0 | 10/12/05 | 11:34 |
| pbw-K12H1 | Mo2020 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00178 | 0.00178 | 1 | 0.005 | 0.00178 | 10/12/05 | 11:34 |
| pbw-K12H1 | Ni2316 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.0003 | 0.0003 | 1 | 0.005 | 0.0003 | 10/12/05 | 11:34 |
| pbw-K12H1 | P_1782 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | 0.00096 | 0.00096 | 1 | 0.02 | 0.00096 | 10/12/05 | 11:34 |
| pbw-K12H1 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.002 | 0.002 | 1 | 0.005 | 0.002 | 10/12/05 | 11:34 |
| pbw-K12H1 | S_1820 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | 0.00476 | 0.00476 | 1 | 0.02 | 0.00476 | 10/12/05 | 11:34 |
| pbw-K12H1 | Sb2068 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00363 | 0.00363 | 1 | 0.01 | 0.00363 | 10/12/05 | 11:34 |
| pbw-K12H1 | Si2881 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | -0.0001 | -0.0001 | 1 | 0.02 | -0.0001 | 10/12/05 | 11:34 |
| pbw-K12H1 | Pb220 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00035 | -0.00035 | 1 | 0.005 | -0.00035 | 10/12/05 | 11:34 |
| pbw-K12H1 | Se196 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00003 | 0.00003 | 1 | 0.01 | 0.00003 | 10/12/05 | 11:34 |
| pbw-K12H1 | Sn1899 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00185 | 0.00185 | 1 | 0.005 | 0.00185 | 10/12/05 | 11:34 |
| pbw-K12H1 | Sr4215 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00002 | 0.00002 | 1 | 0.005 | 0.00002 | 10/12/05 | 11:34 |
| pbw-K12H1 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | | 0.025 | -0.0003 | -0.0003 | 1 | 0.025 | -0.0003 | 10/12/05 | 11:34 |
| pbw-K12H1 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00001 | 0.00001 | 1 | 0.005 | 0.00001 | 10/12/05 | 11:34 |
| pbw-K12H1 | Ti1908 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00205 | 0.00205 | 1 | 0.01 | 0.00205 | 10/12/05 | 11:34 |
| pbw-K12H1 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | | 0.1 | 0.02178 | 0.0218 | 1 | 0.1 | 0.02178 | 10/12/05 | 11:34 |
| pbw-K12H1 | V_2924 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.0007 | -0.0007 | 1 | 0.005 | -0.0007 | 10/12/05 | 11:34 |
| pbw-K12H1 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00201 | 0.00201 | 1 | 0.01 | 0.00201 | 10/12/05 | 11:34 |
| pbw-K12H1 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00009 | 0.00009 | 1 | 0.005 | 0.00009 | 10/12/05 | 11:34 |
| pbw-K12H1 | Zn2062 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00009 | 0.00009 | 1 | 0.005 | 0.00009 | 10/12/05 | 11:34 |
| pbw-K12H1 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00017 | 0.00017 | 1 | 0.005 | 0.00017 | 10/12/05 | 11:34 |
| lcsW-K12H1 | Ag3280 | 0.0509 | | | mg/L | 0.005 | | 101.8% | 0.05 | 0.005 | 0.05087 | 0.0509 | 1 | 0.005 | 0.05087 | 10/12/05 | 11:38 |
| lcsW-K12H1 | Al3082 | 1.95 | | | mg/L | 0.06 | | 97.5% | 2 | 0.06 | 1.94581 | 1.95 | 1 | 0.06 | 1.94581 | 10/12/05 | 11:38 |
| lcsW-K12H1 | As1890 | 2.04 | | | mg/L | 0.005 | | 102.0% | 2 | 0.005 | 2.0432 | 2.04 | 1 | 0.005 | 2.0432 | 10/12/05 | 11:38 |
| lcsW-K12H1 | B_2496 | 0.0200 | U | | mg/L | 0.02 | | | 0 | 0.02 | 0.00305 | 0.00305 | 1 | 0.02 | 0.00305 | 10/12/05 | 11:38 |
| lcsW-K12H1 | Ba4934 | 2.00 | | | mg/L | 0.005 | | 100.0% | 2 | 0.005 | 2.00097 | 2 | 1 | 0.005 | 2.00097 | 10/12/05 | 11:38 |
| lcsW-K12H1 | Be3130 | 0.0494 | | | mg/L | 0.005 | | 98.8% | 0.05 | 0.005 | 0.04941 | 0.0494 | 1 | 0.005 | 0.04941 | 10/12/05 | 11:38 |
| lcsW-K12H1 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | 0 | 0.01 | 0.00039 | 0.00039 | 1 | 0.01 | 0.00039 | 10/12/05 | 11:38 |

010055

AKR
10/20/05

DIV. 20
 TO#051011-4
 Project No. 06002.01.242
 Prep. Page 62-154

| 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-K12H1 | Ca3179 | 20.0 | | | mg/L | 0.05 | | 100.0% | 20 | 0.05 | 20.00494 | 20 | 1 | 0.05 | 20.00494 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Cd2265 | 0.0508 | | | mg/L | 0.005 | | 101.6% | 0.05 | 0.005 | 0.05083 | 0.0508 | 1 | 0.005 | 0.05083 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Co2286 | 0.499 | | | mg/L | 0.005 | | 99.8% | 0.5 | 0.005 | 0.49868 | 0.499 | 1 | 0.005 | 0.49868 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Cr2677 | 0.197 | | | mg/L | 0.005 | | 98.5% | 0.2 | 0.005 | 0.1973 | 0.197 | 1 | 0.005 | 0.1973 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Cu3247 | 0.250 | | | mg/L | 0.005 | | 100.0% | 0.25 | 0.005 | 0.25047 | 0.25 | 1 | 0.005 | 0.25047 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Fe2714 | 1.09 | | | mg/L | 0.05 | | 109.0% | 1 | 0.05 | 1.09142 | 1.09 | 1 | 0.05 | 1.09142 | 10/12/05 | 11:38 |
| lcsw-K12H1 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | 0 | 0.005 | 0 | 0 | 1 | 0.005 | 0 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Mg2790 | 20.0 | | | mg/L | 0.05 | | 100.0% | 20 | 0.05 | 20.02658 | 20 | 1 | 0.05 | 20.02658 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Mn2576 | 0.504 | | | mg/L | 0.005 | | 100.8% | 0.5 | 0.005 | 0.50406 | 0.504 | 1 | 0.005 | 0.50406 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Mo2020 | 0.00500 | U | | mg/L | 0.005 | | | 0 | 0.005 | 0.00033 | 0.00033 | 1 | 0.005 | 0.00033 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Ni2316 | 0.494 | | | mg/L | 0.005 | | 98.8% | 0.5 | 0.005 | 0.49376 | 0.494 | 1 | 0.005 | 0.49376 | 10/12/05 | 11:38 |
| lcsw-K12H1 | P_1782 | 0.0200 | U | | mg/L | 0.02 | | | 0 | 0.02 | 0.00193 | 0.00193 | 1 | 0.02 | 0.00193 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | 0 | 0.005 | 0.00232 | 0.00232 | 1 | 0.005 | 0.00232 | 10/12/05 | 11:38 |
| lcsw-K12H1 | S_1820 | 4.14 | | | mg/L | 0.02 | | 103.5% | 4 | 0.02 | 4.13981 | 4.14 | 1 | 0.02 | 4.13981 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Sb2068 | 0.503 | | | mg/L | 0.01 | | 100.6% | 0.5 | 0.01 | 0.50337 | 0.503 | 1 | 0.01 | 0.50337 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Si2881 | 4.03 | | | mg/L | 0.02 | | 100.8% | 4 | 0.02 | 4.02803 | 4.03 | 1 | 0.02 | 4.02803 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Pb220 | 0.498 | | | mg/L | 0.005 | | 99.6% | 0.5 | 0.005 | 0.4982 | 0.498 | 1 | 0.005 | 0.4982 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Se196 | 2.11 | | | mg/L | 0.01 | | 105.5% | 2 | 0.01 | 2.10661 | 2.11 | 1 | 0.01 | 2.10661 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Sn1899 | 0.00500 | U | | mg/L | 0.005 | | | 0 | 0.005 | 0.00047 | 0.00047 | 1 | 0.005 | 0.00047 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Sr4215 | 0.00500 | U | | mg/L | 0.005 | | | 0 | 0.005 | 0.00067 | 0.00067 | 1 | 0.005 | 0.00067 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | 0 | 0.025 | -0.01896 | -0.019 | 1 | 0.025 | -0.01896 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | 0 | 0.005 | 0.00003 | 0.00003 | 1 | 0.005 | 0.00003 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Ti1908 | 2.07 | | | mg/L | 0.01 | | 103.5% | 2 | 0.01 | 2.0747 | 2.07 | 1 | 0.01 | 2.0747 | 10/12/05 | 11:38 |
| lcsw-K12H1 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | 0 | 0.1 | 0.02065 | 0.0207 | 1 | 0.1 | 0.02065 | 10/12/05 | 11:38 |
| lcsw-K12H1 | V_2924 | 0.493 | | | mg/L | 0.005 | | 98.6% | 0.5 | 0.005 | 0.49335 | 0.493 | 1 | 0.005 | 0.49335 | 10/12/05 | 11:38 |
| lcsw-K12H1 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | 0 | 0.01 | 0.00189 | 0.00189 | 1 | 0.01 | 0.00189 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | 0 | 0.005 | -0.00008 | -0.00008 | 1 | 0.005 | -0.00008 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Zn2062 | 0.502 | | | mg/L | 0.005 | | 100.4% | 0.5 | 0.005 | 0.50246 | 0.502 | 1 | 0.005 | 0.50246 | 10/12/05 | 11:38 |
| lcsw-K12H1 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | 0 | 0.005 | 0.00034 | 0.00034 | 1 | 0.005 | 0.00034 | 10/12/05 | 11:38 |
| 268259 | Ag3280 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00026 | -0.00026 | 1 | 0.005 | -0.00026 | 10/12/05 | 11:43 |
| 268259 | Al3082 | 0.0600 | U | | mg/L | 0.06 | | | | 0.06 | 0.0269 | 0.0269 | 1 | 0.06 | 0.0269 | 10/12/05 | 11:43 |
| 268259 | As1890 | 0.0152 | | | mg/L | 0.005 | | | | 0.005 | 0.01518 | 0.0152 | 1 | 0.005 | 0.01518 | 10/12/05 | 11:43 |
| 268259 | B_2496 | 0.224 | | | mg/L | 0.02 | | | | 0.02 | 0.22438 | 0.224 | 1 | 0.02 | 0.22438 | 10/12/05 | 11:43 |
| 268259 | Ba4934 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00318 | 0.00318 | 1 | 0.005 | 0.00318 | 10/12/05 | 11:43 |
| 268259 | Be3130 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0 | 0 | 1 | 0.005 | 0 | 10/12/05 | 11:43 |
| 268259 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00343 | 0.00343 | 1 | 0.01 | 0.00343 | 10/12/05 | 11:43 |
| 268259 | Ca3179 | 5.27 | | ✓ | mg/L | 0.05 | | | | 0.05 | 5.2711 | 5.27 | 1 | 0.05 | 5.2711 | 10/12/05 | 11:43 |
| 268259 | Cd2265 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00003 | 0.00003 | 1 | 0.005 | 0.00003 | 10/12/05 | 11:43 |
| 268259 | Co2286 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00028 | 0.00028 | 1 | 0.005 | 0.00028 | 10/12/05 | 11:43 |
| 268259 | Cr2677 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00095 | 0.00095 | 1 | 0.005 | 0.00095 | 10/12/05 | 11:43 |
| 268259 | Cu3247 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00002 | -0.00002 | 1 | 0.005 | -0.00002 | 10/12/05 | 11:43 |
| 268259 | Fe2714 | 0.0500 | U | | mg/L | 0.05 | | | | 0.05 | 0.0157 | 0.0157 | 1 | 0.05 | 0.0157 | 10/12/05 | 11:43 |
| 268259 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00111 | -0.00111 | 1 | 0.005 | -0.00111 | 10/12/05 | 11:43 |

010056

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | rl | mg/L | sigwt | Dilution | Calc RL | ug/ml | Date | Time |
|-----------|---------|---------|----------|----------|-------|-------|-------|-----------|----|-------|----------|----------|----------|---------|----------|----------|-------|
| 268259 | Mg2790 | 1.01 | | | mg/L | 0.05 | | | | 0.05 | 1.01297 | 1.01 | 1 | 0.05 | 1.01297 | 10/12/05 | 11:43 |
| 268259 | Mn2576 | 0.00542 | | | mg/L | 0.005 | | | | 0.005 | 0.00542 | 0.00542 | 1 | 0.005 | 0.00542 | 10/12/05 | 11:43 |
| 268259 | Mo2020 | 0.0442 | | | mg/L | 0.005 | | | | 0.005 | 0.0442 | 0.0442 | 1 | 0.005 | 0.0442 | 10/12/05 | 11:43 |
| 268259 | Ni2316 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00057 | 0.00057 | 1 | 0.005 | 0.00057 | 10/12/05 | 11:43 |
| 268259 | P_1782 | 0.0345 | | | mg/L | 0.02 | | | | 0.02 | 0.03453 | 0.0345 | 1 | 0.02 | 0.03453 | 10/12/05 | 11:43 |
| 268259 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00319 | -0.00319 | 1 | 0.005 | -0.00319 | 10/12/05 | 11:43 |
| 268259 | S_1820 | 13.6 | | | mg/L | 0.02 | | | | 0.02 | 13.60101 | 13.6 | 1 | 0.02 | 13.60101 | 10/12/05 | 11:43 |
| 268259 | Sb2068 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00279 | 0.00279 | 1 | 0.01 | 0.00279 | 10/12/05 | 11:43 |
| 268259 | Si2881 | 21.6 | | | mg/L | 0.02 | | | | 0.02 | 21.62056 | 21.6 | 1 | 0.02 | 21.62056 | 10/12/05 | 11:43 |
| 268259 | Pb220 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00075 | 0.00075 | 1 | 0.005 | 0.00075 | 10/12/05 | 11:43 |
| 268259 | Se196 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00621 | 0.00621 | 1 | 0.01 | 0.00621 | 10/12/05 | 11:43 |
| 268259 | Sn1899 | 0.0136 | | | mg/L | 0.005 | | | | 0.005 | 0.01356 | 0.0136 | 1 | 0.005 | 0.01356 | 10/12/05 | 11:43 |
| 268259 | Sr4215 | 0.0397 | | | mg/L | 0.005 | | | | 0.005 | 0.03967 | 0.0397 | 1 | 0.005 | 0.03967 | 10/12/05 | 11:43 |
| 268259 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | | 0.025 | -0.00156 | -0.00156 | 1 | 0.025 | -0.00156 | 10/12/05 | 11:43 |
| 268259 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00024 | -0.00024 | 1 | 0.005 | -0.00024 | 10/12/05 | 11:43 |
| 268259 | Tl1908 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00765 | -0.00765 | 1 | 0.01 | -0.00765 | 10/12/05 | 11:43 |
| 268259 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | | 0.1 | -0.01852 | -0.0185 | 1 | 0.1 | -0.01852 | 10/12/05 | 11:43 |
| 268259 | V_2924 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00157 | 0.00157 | 1 | 0.005 | 0.00157 | 10/12/05 | 11:43 |
| 268259 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00658 | 0.00658 | 1 | 0.01 | 0.00658 | 10/12/05 | 11:43 |
| 268259 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00002 | -0.00002 | 1 | 0.005 | -0.00002 | 10/12/05 | 11:43 |
| 268259 | Zn2062 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00247 | 0.00247 | 1 | 0.005 | 0.00247 | 10/12/05 | 11:43 |
| 268259 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00024 | -0.00024 | 1 | 0.005 | -0.00024 | 10/12/05 | 11:43 |
| 268259d | Ag3280 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | -0.00054 | -0.00054 | 1 | 0.005 | -0.00054 | 10/12/05 | 11:48 |
| 268259d | Al3082 | 0.0600 | U | | mg/L | 0.06 | 0.0% | | | 0.06 | 0.05016 | 0.0502 | 1 | 0.06 | 0.05016 | 10/12/05 | 11:48 |
| 268259d | As1890 | 0.0127 | | | mg/L | 0.005 | 17.9% | | | 0.005 | 0.0127 | 0.0127 | 1 | 0.005 | 0.0127 | 10/12/05 | 11:48 |
| 268259d | B_2496 | 0.226 | | | mg/L | 0.02 | 0.9% | | | 0.02 | 0.22605 | 0.226 | 1 | 0.02 | 0.22605 | 10/12/05 | 11:48 |
| 268259d | Ba4934 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | 0.00309 | 0.00309 | 1 | 0.005 | 0.00309 | 10/12/05 | 11:48 |
| 268259d | Be3130 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | -0.00001 | -0.00001 | 1 | 0.005 | -0.00001 | 10/12/05 | 11:48 |
| 268259d | Bi2230 | 0.0100 | U | | mg/L | 0.01 | 0.0% | | | 0.01 | -0.00172 | -0.00172 | 1 | 0.01 | -0.00172 | 10/12/05 | 11:48 |
| 268259d | Ca3179 | 5.26 | | | mg/L | 0.05 | 0.2% | | | 0.05 | 5.26148 | 5.26 | 1 | 0.05 | 5.26148 | 10/12/05 | 11:48 |
| 268259d | Cd2265 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | 0.0001 | 0.0001 | 1 | 0.005 | 0.0001 | 10/12/05 | 11:48 |
| 268259d | Co2286 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | 0.00019 | 0.00019 | 1 | 0.005 | 0.00019 | 10/12/05 | 11:48 |
| 268259d | Cr2677 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | 0.00032 | 0.00032 | 1 | 0.005 | 0.00032 | 10/12/05 | 11:48 |
| 268259d | Cu3247 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | -0.00018 | -0.00018 | 1 | 0.005 | -0.00018 | 10/12/05 | 11:48 |
| 268259d | Fe2714 | 0.0500 | U | | mg/L | 0.05 | 0.0% | | | 0.05 | 0.01208 | 0.0121 | 1 | 0.05 | 0.01208 | 10/12/05 | 11:48 |
| 268259d | La3988 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | -0.00097 | -0.00097 | 1 | 0.005 | -0.00097 | 10/12/05 | 11:48 |
| 268259d | Mg2790 | 1.01 | | | mg/L | 0.05 | 0.0% | | | 0.05 | 1.01341 | 1.01 | 1 | 0.05 | 1.01341 | 10/12/05 | 11:48 |
| 268259d | Mn2576 | 0.00545 | | | mg/L | 0.005 | 0.6% | | | 0.005 | 0.00545 | 0.00545 | 1 | 0.005 | 0.00545 | 10/12/05 | 11:48 |
| 268259d | Mo2020 | 0.0444 | | | mg/L | 0.005 | 0.5% | | | 0.005 | 0.04444 | 0.0444 | 1 | 0.005 | 0.04444 | 10/12/05 | 11:48 |
| 268259d | Ni2316 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | -0.0001 | -0.0001 | 1 | 0.005 | -0.0001 | 10/12/05 | 11:48 |
| 268259d | P_1782 | 0.0279 | | * | mg/L | 0.02 | 21.2% | | | 0.02 | 0.02794 | 0.0279 | 1 | 0.02 | 0.02794 | 10/12/05 | 11:48 |
| 268259d | Pd3404 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | -0.00415 | -0.00415 | 1 | 0.005 | -0.00415 | 10/12/05 | 11:48 |
| 268259d | S_1820 | 13.6 | | | mg/L | 0.02 | 0.0% | | | 0.02 | 13.60817 | 13.6 | 1 | 0.02 | 13.60817 | 10/12/05 | 11:48 |

010057

DIV. 20
 TO#051011-4
 Project No. 06002.01.242
 Prep. Page 62-154

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | rl | mg/L | sigwt | Dilution | Calc RL | ug/ml | Date | Time |
|-----------|---------|---------|----------|----------|-------|-------|------|-----------|------|-------|----------|----------|----------|---------|----------|----------|-------|
| 268259d | Sb2068 | 0.0100 | U | | mg/L | 0.01 | 0.0% | | | 0.01 | 0.0041 | 0.0041 | 1 | 0.01 | 0.0041 | 10/12/05 | 11:48 |
| 268259d | Si2881 | 21.6 | | | mg/L | 0.02 | 0.0% | | | 0.02 | 21.64293 | 21.6 | 1 | 0.02 | 21.64293 | 10/12/05 | 11:48 |
| 268259d | Pb220 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | 0.00166 | 0.00166 | 1 | 0.005 | 0.00166 | 10/12/05 | 11:48 |
| 268259d | Se196 | 0.0100 | U | | mg/L | 0.01 | 0.0% | | | 0.01 | 0.00739 | 0.00739 | 1 | 0.01 | 0.00739 | 10/12/05 | 11:48 |
| 268259d | Sn1899 | 0.0137 | | | mg/L | 0.005 | 0.7% | | | 0.005 | 0.01368 | 0.0137 | 1 | 0.005 | 0.01368 | 10/12/05 | 11:48 |
| 268259d | Sr4215 | 0.0397 | | | mg/L | 0.005 | 0.0% | | | 0.005 | 0.03971 | 0.0397 | 1 | 0.005 | 0.03971 | 10/12/05 | 11:48 |
| 268259d | Th2837 | 0.0250 | U | | mg/L | 0.025 | 0.0% | | | 0.025 | -0.00206 | -0.00206 | 1 | 0.025 | -0.00206 | 10/12/05 | 11:48 |
| 268259d | Ti3349 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | -0.00016 | -0.00016 | 1 | 0.005 | -0.00016 | 10/12/05 | 11:48 |
| 268259d | Tl1908 | 0.0100 | U | | mg/L | 0.01 | 0.0% | | | 0.01 | -0.00765 | -0.00765 | 1 | 0.01 | -0.00765 | 10/12/05 | 11:48 |
| 268259d | U_4090 | 0.100 | U | | mg/L | 0.1 | 0.0% | | | 0.1 | -0.01103 | -0.011 | 1 | 0.1 | -0.01103 | 10/12/05 | 11:48 |
| 268259d | V_2924 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | 0.00154 | 0.00154 | 1 | 0.005 | 0.00154 | 10/12/05 | 11:48 |
| 268259d | W_2079 | 0.0100 | U | | mg/L | 0.01 | 0.0% | | | 0.01 | 0.00535 | 0.00535 | 1 | 0.01 | 0.00535 | 10/12/05 | 11:48 |
| 268259d | Y_3710 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | 0 | 0 | 1 | 0.005 | 0 | 10/12/05 | 11:48 |
| 268259d | Zn2062 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | 0.00272 | 0.00272 | 1 | 0.005 | 0.00272 | 10/12/05 | 11:48 |
| 268259d | Zr3496 | 0.00500 | U | | mg/L | 0.005 | 0.0% | | | 0.005 | -0.00029 | -0.00029 | 1 | 0.005 | -0.00029 | 10/12/05 | 11:48 |
| 268259s | Ag3280 | 0.0481 | | | mg/L | 0.005 | | 96.2% | 0.05 | 0.005 | 0.04806 | 0.0481 | 1 | 0.005 | 0.04806 | 10/12/05 | 11:58 |
| 268259s | Al3082 | 2.05 | | | mg/L | 0.06 | | 102.5% | 2 | 0.06 | 2.04703 | 2.05 | 1 | 0.06 | 2.04703 | 10/12/05 | 11:58 |
| 268259s | As1890 | 2.11 | | | mg/L | 0.005 | | 104.7% | 2 | 0.005 | 2.11213 | 2.11 | 1 | 0.005 | 2.11213 | 10/12/05 | 11:58 |
| 268259s | B_2496 | 0.222 | | #DIV/0! | mg/L | 0.02 | | #DIV/0! | 0 | 0.02 | 0.22179 | 0.222 | 1 | 0.02 | 0.22179 | 10/12/05 | 11:58 |
| 268259s | Ba4934 | 2.01 | | | mg/L | 0.005 | | 100.5% | 2 | 0.005 | 2.00716 | 2.01 | 1 | 0.005 | 2.00716 | 10/12/05 | 11:58 |
| 268259s | Be3130 | 0.0490 | | | mg/L | 0.005 | | 98.0% | 0.05 | 0.005 | 0.04896 | 0.049 | 1 | 0.005 | 0.04896 | 10/12/05 | 11:58 |
| 268259s | Bi2230 | 0.0100 | U | #DIV/0! | mg/L | 0.01 | | #DIV/0! | 0 | 0.01 | -0.00109 | -0.00109 | 1 | 0.01 | -0.00109 | 10/12/05 | 11:58 |
| 268259s | Ca3179 | 25.0 | | | mg/L | 0.05 | | 98.7% | 20 | 0.05 | 25.02593 | 25 | 1 | 0.05 | 25.02593 | 10/12/05 | 11:58 |
| 268259s | Cd2265 | 0.0511 | | | mg/L | 0.005 | | 102.2% | 0.05 | 0.005 | 0.05108 | 0.0511 | 1 | 0.005 | 0.05108 | 10/12/05 | 11:58 |
| 268259s | Co2286 | 0.505 | | | mg/L | 0.005 | | 101.0% | 0.5 | 0.005 | 0.50526 | 0.505 | 1 | 0.005 | 0.50526 | 10/12/05 | 11:58 |
| 268259s | Cr2677 | 0.198 | | | mg/L | 0.005 | | 99.0% | 0.2 | 0.005 | 0.19758 | 0.198 | 1 | 0.005 | 0.19758 | 10/12/05 | 11:58 |
| 268259s | Cu3247 | 0.258 | | | mg/L | 0.005 | | 103.2% | 0.25 | 0.005 | 0.25817 | 0.258 | 1 | 0.005 | 0.25817 | 10/12/05 | 11:58 |
| 268259s | Fe2714 | 1.10 | | | mg/L | 0.05 | | 110.0% | 1 | 0.05 | 1.10088 | 1.1 | 1 | 0.05 | 1.10088 | 10/12/05 | 11:58 |
| 268259s | La3988 | 0.00500 | U | #DIV/0! | mg/L | 0.005 | | #DIV/0! | 0 | 0.005 | -0.00049 | -0.00049 | 1 | 0.005 | -0.00049 | 10/12/05 | 11:58 |
| 268259s | Mg2790 | 21.0 | | | mg/L | 0.05 | | 100.0% | 20 | 0.05 | 20.98173 | 21 | 1 | 0.05 | 20.98173 | 10/12/05 | 11:58 |
| 268259s | Mn2576 | 0.510 | | | mg/L | 0.005 | | 100.9% | 0.5 | 0.005 | 0.50954 | 0.51 | 1 | 0.005 | 0.50954 | 10/12/05 | 11:58 |
| 268259s | Mo2020 | 0.0428 | | #DIV/0! | mg/L | 0.005 | | #DIV/0! | 0 | 0.005 | 0.04284 | 0.0428 | 1 | 0.005 | 0.04284 | 10/12/05 | 11:58 |
| 268259s | Ni2316 | 0.498 | | | mg/L | 0.005 | | 99.6% | 0.5 | 0.005 | 0.4978 | 0.498 | 1 | 0.005 | 0.4978 | 10/12/05 | 11:58 |
| 268259s | P_1782 | 0.0313 | | #DIV/0! | mg/L | 0.02 | | #DIV/0! | 0 | 0.02 | 0.03127 | 0.0313 | 1 | 0.02 | 0.03127 | 10/12/05 | 11:58 |
| 268259s | Pd3404 | 0.00500 | U | #DIV/0! | mg/L | 0.005 | | #DIV/0! | 0 | 0.005 | -0.00206 | -0.00206 | 1 | 0.005 | -0.00206 | 10/12/05 | 11:58 |
| 268259s | S_1820 | 17.7 | | | mg/L | 0.02 | | 102.5% | 4 | 0.02 | 17.68013 | 17.7 | 1 | 0.02 | 17.68013 | 10/12/05 | 11:58 |
| 268259s | Sb2068 | 0.520 | | | mg/L | 0.01 | | 104.0% | 0.5 | 0.01 | 0.51977 | 0.52 | 1 | 0.01 | 0.51977 | 10/12/05 | 11:58 |
| 268259s | Si2881 | 25.6 | | | mg/L | 0.02 | | 100.0% | 4 | 0.02 | 25.62401 | 25.6 | 1 | 0.02 | 25.62401 | 10/12/05 | 11:58 |
| 268259s | Pb220 | 0.504 | | | mg/L | 0.005 | | 100.8% | 0.5 | 0.005 | 0.50448 | 0.504 | 1 | 0.005 | 0.50448 | 10/12/05 | 11:58 |
| 268259s | Se196 | 2.30 | | | mg/L | 0.01 | | 115.0% | 2 | 0.01 | 2.29699 | 2.3 | 1 | 0.01 | 2.29699 | 10/12/05 | 11:58 |
| 268259s | Sn1899 | 0.0128 | | #DIV/0! | mg/L | 0.005 | | #DIV/0! | 0 | 0.005 | 0.01281 | 0.0128 | 1 | 0.005 | 0.01281 | 10/12/05 | 11:58 |
| 268259s | Sr4215 | 0.0396 | | #DIV/0! | mg/L | 0.005 | | #DIV/0! | 0 | 0.005 | 0.03955 | 0.0396 | 1 | 0.005 | 0.03955 | 10/12/05 | 11:58 |
| 268259s | Th2837 | 0.0250 | U | #DIV/0! | mg/L | 0.025 | | #DIV/0! | 0 | 0.025 | -0.02199 | -0.022 | 1 | 0.025 | -0.02199 | 10/12/05 | 11:58 |

010058

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | ri | mg/L | sigwt | Dilution | Calc RL | ug/ml | Date | Time |
|-----------|---------|---------|----------|----------|-------|-------|------|-----------|-----|-------|----------|----------|----------|---------|----------|----------|-------|
| 268259s | Ti3349 | 0.00500 | U | #DIV/0! | mg/L | 0.005 | | #DIV/0! | 0 | 0.005 | -0.00028 | -0.00028 | 1 | 0.005 | -0.00028 | 10/12/05 | 11:58 |
| 268259s | Ti1908 | 2.10 | | | mg/L | 0.01 | | 105.0% | 2 | 0.01 | 2.10167 | 2.1 | 1 | 0.01 | 2.10167 | 10/12/05 | 11:58 |
| 268259s | U_4090 | 0.100 | U | #DIV/0! | mg/L | 0.1 | | #DIV/0! | 0 | 0.1 | 0.00422 | 0.00422 | 1 | 0.1 | 0.00422 | 10/12/05 | 11:58 |
| 268259s | V_2924 | 0.499 | | | mg/L | 0.005 | | 99.8% | 0.5 | 0.005 | 0.49909 | 0.499 | 1 | 0.005 | 0.49909 | 10/12/05 | 11:58 |
| 268259s | W_2079 | 0.0100 | U | #DIV/0! | mg/L | 0.01 | | #DIV/0! | 0 | 0.01 | 0.00633 | 0.00633 | 1 | 0.01 | 0.00633 | 10/12/05 | 11:58 |
| 268259s | Y_3710 | 0.00500 | U | #DIV/0! | mg/L | 0.005 | | #DIV/0! | 0 | 0.005 | -0.00011 | -0.00011 | 1 | 0.005 | -0.00011 | 10/12/05 | 11:58 |
| 268259s | Zn2062 | 0.518 | | | mg/L | 0.005 | | 103.6% | 0.5 | 0.005 | 0.5175 | 0.518 | 1 | 0.005 | 0.5175 | 10/12/05 | 11:58 |
| 268259s | Zr3496 | 0.00500 | U | #DIV/0! | mg/L | 0.005 | | #DIV/0! | 0 | 0.005 | -0.00025 | -0.00025 | 1 | 0.005 | -0.00025 | 10/12/05 | 11:58 |
| 268260 | Ag3280 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00021 | 0.00021 | 1 | 0.005 | 0.00021 | 10/12/05 | 12:02 |
| 268260 | Al3082 | 0.349 | | | mg/L | 0.06 | | | | 0.06 | 0.34858 | 0.349 | 1 | 0.06 | 0.34858 | 10/12/05 | 12:02 |
| 268260 | As1890 | 0.0137 | | | mg/L | 0.005 | | | | 0.005 | 0.01374 | 0.0137 | 1 | 0.005 | 0.01374 | 10/12/05 | 12:02 |
| 268260 | B_2496 | 0.177 | | | mg/L | 0.02 | | | | 0.02 | 0.17666 | 0.177 | 1 | 0.02 | 0.17666 | 10/12/05 | 12:02 |
| 268260 | Ba4934 | 0.0116 | | | mg/L | 0.005 | | | | 0.005 | 0.01161 | 0.0116 | 1 | 0.005 | 0.01161 | 10/12/05 | 12:02 |
| 268260 | Be3130 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00019 | 0.00019 | 1 | 0.005 | 0.00019 | 10/12/05 | 12:02 |
| 268260 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00213 | -0.00213 | 1 | 0.01 | -0.00213 | 10/12/05 | 12:02 |
| 268260 | Ca3179 | 3.84 | | | mg/L | 0.05 | | | | 0.05 | 3.83705 | 3.84 | 1 | 0.05 | 3.83705 | 10/12/05 | 12:02 |
| 268260 | Cd2265 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00011 | -0.00011 | 1 | 0.005 | -0.00011 | 10/12/05 | 12:02 |
| 268260 | Co2286 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00057 | 0.00057 | 1 | 0.005 | 0.00057 | 10/12/05 | 12:02 |
| 268260 | Cr2677 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00259 | 0.00259 | 1 | 0.005 | 0.00259 | 10/12/05 | 12:02 |
| 268260 | Cu3247 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.0011 | 0.0011 | 1 | 0.005 | 0.0011 | 10/12/05 | 12:02 |
| 268260 | Fe2714 | 0.563 | | | mg/L | 0.05 | | | | 0.05 | 0.5633 | 0.563 | 1 | 0.05 | 0.5633 | 10/12/05 | 12:02 |
| 268260 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00016 | -0.00016 | 1 | 0.005 | -0.00016 | 10/12/05 | 12:02 |
| 268260 | Mg2790 | 0.413 | | | mg/L | 0.05 | | | | 0.05 | 0.41323 | 0.413 | 1 | 0.05 | 0.41323 | 10/12/05 | 12:02 |
| 268260 | Mn2576 | 0.0115 | | | mg/L | 0.005 | | | | 0.005 | 0.01148 | 0.0115 | 1 | 0.005 | 0.01148 | 10/12/05 | 12:02 |
| 268260 | Mo2020 | 0.0450 | | | mg/L | 0.005 | | | | 0.005 | 0.04503 | 0.045 | 1 | 0.005 | 0.04503 | 10/12/05 | 12:02 |
| 268260 | Ni2316 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00086 | 0.00086 | 1 | 0.005 | 0.00086 | 10/12/05 | 12:02 |
| 268260 | P_1782 | 0.0580 | | | mg/L | 0.02 | | | | 0.02 | 0.05797 | 0.058 | 1 | 0.02 | 0.05797 | 10/12/05 | 12:02 |
| 268260 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00256 | -0.00256 | 1 | 0.005 | -0.00256 | 10/12/05 | 12:02 |
| 268260 | S_1820 | 15.7 | | | mg/L | 0.02 | | | | 0.02 | 15.65277 | 15.7 | 1 | 0.02 | 15.65277 | 10/12/05 | 12:02 |
| 268260 | Sb2068 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00442 | 0.00442 | 1 | 0.01 | 0.00442 | 10/12/05 | 12:02 |
| 268260 | Si2881 | 19.9 | | | mg/L | 0.02 | | | | 0.02 | 19.9139 | 19.9 | 1 | 0.02 | 19.9139 | 10/12/05 | 12:02 |
| 268260 | Pb220 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00321 | 0.00321 | 1 | 0.005 | 0.00321 | 10/12/05 | 12:02 |
| 268260 | Se196 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00505 | 0.00505 | 1 | 0.01 | 0.00505 | 10/12/05 | 12:02 |
| 268260 | Sn1899 | 0.0129 | | | mg/L | 0.005 | | | | 0.005 | 0.01291 | 0.0129 | 1 | 0.005 | 0.01291 | 10/12/05 | 12:02 |
| 268260 | Sr4215 | 0.0275 | | | mg/L | 0.005 | | | | 0.005 | 0.02754 | 0.0275 | 1 | 0.005 | 0.02754 | 10/12/05 | 12:02 |
| 268260 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | | 0.025 | -0.00096 | -0.00096 | 1 | 0.025 | -0.00096 | 10/12/05 | 12:02 |
| 268260 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00096 | 0.00096 | 1 | 0.005 | 0.00096 | 10/12/05 | 12:02 |
| 268260 | Ti1908 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00842 | -0.00842 | 1 | 0.01 | -0.00842 | 10/12/05 | 12:02 |
| 268260 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | | 0.1 | -0.00143 | -0.00143 | 1 | 0.1 | -0.00143 | 10/12/05 | 12:02 |
| 268260 | V_2924 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00175 | 0.00175 | 1 | 0.005 | 0.00175 | 10/12/05 | 12:02 |
| 268260 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00198 | -0.00198 | 1 | 0.01 | -0.00198 | 10/12/05 | 12:02 |
| 268260 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00014 | 0.00014 | 1 | 0.005 | 0.00014 | 10/12/05 | 12:02 |
| 268260 | Zn2062 | 0.0153 | | | mg/L | 0.005 | | | | 0.005 | 0.01527 | 0.0153 | 1 | 0.005 | 0.01527 | 10/12/05 | 12:02 |

010059

DIV. 20
 TO#051011-4
 Project No. 06002.01.242
 Prep. Page 62-154

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | rl | mg/L | sigwt | Dilution | Calc RL | ug/ml | Date | Time |
|-----------|---------|---------|----------|----------|-------|-------|------|-----------|----|-------|----------|----------|----------|---------|----------|----------|-------|
| 268260 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00004 | -0.00004 | 1 | 0.005 | -0.00004 | 10/12/05 | 12:02 |
| 268261 | Ag3280 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00005 | -0.00005 | 1 | 0.005 | -0.00005 | 10/12/05 | 12:07 |
| 268261 | Al3082 | 0.204 | | | mg/L | 0.06 | | | | 0.06 | 0.20421 | 0.204 | 1 | 0.06 | 0.20421 | 10/12/05 | 12:07 |
| 268261 | As1890 | 0.0169 | | | mg/L | 0.005 | | | | 0.005 | 0.0169 | 0.0169 | 1 | 0.005 | 0.0169 | 10/12/05 | 12:07 |
| 268261 | B_2496 | 0.198 | | | mg/L | 0.02 | | | | 0.02 | 0.19784 | 0.198 | 1 | 0.02 | 0.19784 | 10/12/05 | 12:07 |
| 268261 | Ba4934 | 0.00803 | | | mg/L | 0.005 | | | | 0.005 | 0.00803 | 0.00803 | 1 | 0.005 | 0.00803 | 10/12/05 | 12:07 |
| 268261 | Be3130 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00012 | 0.00012 | 1 | 0.005 | 0.00012 | 10/12/05 | 12:07 |
| 268261 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00189 | 0.00189 | 1 | 0.01 | 0.00189 | 10/12/05 | 12:07 |
| 268261 | Ca3179 | 4.15 | | | mg/L | 0.05 | | | | 0.05 | 4.14834 | 4.15 | 1 | 0.05 | 4.14834 | 10/12/05 | 12:07 |
| 268261 | Cd2265 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0 | 0 | 1 | 0.005 | 0 | 10/12/05 | 12:07 |
| 268261 | Co2286 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00051 | 0.00051 | 1 | 0.005 | 0.00051 | 10/12/05 | 12:07 |
| 268261 | Cr2677 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00009 | -0.00009 | 1 | 0.005 | -0.00009 | 10/12/05 | 12:07 |
| 268261 | Cu3247 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00025 | 0.00025 | 1 | 0.005 | 0.00025 | 10/12/05 | 12:07 |
| 268261 | Fe2714 | 0.273 | | | mg/L | 0.05 | | | | 0.05 | 0.27301 | 0.273 | 1 | 0.05 | 0.27301 | 10/12/05 | 12:07 |
| 268261 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00052 | -0.00052 | 1 | 0.005 | -0.00052 | 10/12/05 | 12:07 |
| 268261 | Mg2790 | 0.286 | | | mg/L | 0.05 | | | | 0.05 | 0.28612 | 0.286 | 1 | 0.05 | 0.28612 | 10/12/05 | 12:07 |
| 268261 | Mn2576 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00325 | 0.00325 | 1 | 0.005 | 0.00325 | 10/12/05 | 12:07 |
| 268261 | Mo2020 | 0.00564 | | | mg/L | 0.005 | | | | 0.005 | 0.00564 | 0.00564 | 1 | 0.005 | 0.00564 | 10/12/05 | 12:07 |
| 268261 | Ni2316 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00112 | 0.00112 | 1 | 0.005 | 0.00112 | 10/12/05 | 12:07 |
| 268261 | P_1782 | 0.0783 | | | mg/L | 0.02 | | | | 0.02 | 0.07829 | 0.0783 | 1 | 0.02 | 0.07829 | 10/12/05 | 12:07 |
| 268261 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.0036 | -0.0036 | 1 | 0.005 | -0.0036 | 10/12/05 | 12:07 |
| 268261 | S_1820 | 9.66 | | | mg/L | 0.02 | | | | 0.02 | 9.66214 | 9.66 | 1 | 0.02 | 9.66214 | 10/12/05 | 12:07 |
| 268261 | Sb2068 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00503 | 0.00503 | 1 | 0.01 | 0.00503 | 10/12/05 | 12:07 |
| 268261 | Si2881 | 33.7 | | | mg/L | 0.02 | | | | 0.02 | 33.74269 | 33.7 | 1 | 0.02 | 33.74269 | 10/12/05 | 12:07 |
| 268261 | Pb220 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00222 | 0.00222 | 1 | 0.005 | 0.00222 | 10/12/05 | 12:07 |
| 268261 | Se196 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00623 | 0.00623 | 1 | 0.01 | 0.00623 | 10/12/05 | 12:07 |
| 268261 | Sn1899 | 0.0112 | | | mg/L | 0.005 | | | | 0.005 | 0.01122 | 0.0112 | 1 | 0.005 | 0.01122 | 10/12/05 | 12:07 |
| 268261 | Sr4215 | 0.0303 | | | mg/L | 0.005 | | | | 0.005 | 0.03025 | 0.0303 | 1 | 0.005 | 0.03025 | 10/12/05 | 12:07 |
| 268261 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | | 0.025 | -0.00317 | -0.00317 | 1 | 0.025 | -0.00317 | 10/12/05 | 12:07 |
| 268261 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00047 | 0.00047 | 1 | 0.005 | 0.00047 | 10/12/05 | 12:07 |
| 268261 | Tl1908 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.008 | -0.008 | 1 | 0.01 | -0.008 | 10/12/05 | 12:07 |
| 268261 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | | 0.1 | 0.00998 | 0.00998 | 1 | 0.1 | 0.00998 | 10/12/05 | 12:07 |
| 268261 | V_2924 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00495 | 0.00495 | 1 | 0.005 | 0.00495 | 10/12/05 | 12:07 |
| 268261 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00067 | -0.00067 | 1 | 0.01 | -0.00067 | 10/12/05 | 12:07 |
| 268261 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00062 | 0.00062 | 1 | 0.005 | 0.00062 | 10/12/05 | 12:07 |
| 268261 | Zn2062 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00451 | 0.00451 | 1 | 0.005 | 0.00451 | 10/12/05 | 12:07 |
| 268261 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00042 | -0.00042 | 1 | 0.005 | -0.00042 | 10/12/05 | 12:07 |
| 268262 | Ag3280 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00002 | 0.00002 | 1 | 0.005 | 0.00002 | 10/12/05 | 12:12 |
| 268262 | Al3082 | 0.0600 | U | | mg/L | 0.06 | | | | 0.06 | 0.00134 | 0.00134 | 1 | 0.06 | 0.00134 | 10/12/05 | 12:12 |
| 268262 | As1890 | 0.00841 | | | mg/L | 0.005 | | | | 0.005 | 0.00841 | 0.00841 | 1 | 0.005 | 0.00841 | 10/12/05 | 12:12 |
| 268262 | B_2496 | 0.161 | | | mg/L | 0.02 | | | | 0.02 | 0.16067 | 0.161 | 1 | 0.02 | 0.16067 | 10/12/05 | 12:12 |
| 268262 | Ba4934 | 0.00678 | | | mg/L | 0.005 | | | | 0.005 | 0.00678 | 0.00678 | 1 | 0.005 | 0.00678 | 10/12/05 | 12:12 |
| 268262 | Be3130 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00001 | -0.00001 | 1 | 0.005 | -0.00001 | 10/12/05 | 12:12 |

010060

DIV. 20
 TO#051011-4
 Project No. 06002.01.242
 Prep. Page 62-154

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | rl | mg/L | sigwt | Dilution | Calc RL | ug/ml | Date | Time |
|-----------|---------|---------|----------|----------|-------|-------|------|-----------|----|-------|----------|----------|----------|---------|----------|----------|-------|
| 268262 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00155 | -0.00155 | 1 | 0.01 | -0.00155 | 10/12/05 | 12:12 |
| 268262 | Ca3179 | 15.8 | | | mg/L | 0.05 | | | | 0.05 | 15.84668 | 15.8 | 1 | 0.05 | 15.84668 | 10/12/05 | 12:12 |
| 268262 | Cd2265 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00008 | 0.00008 | 1 | 0.005 | 0.00008 | 10/12/05 | 12:12 |
| 268262 | Co2286 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00053 | 0.00053 | 1 | 0.005 | 0.00053 | 10/12/05 | 12:12 |
| 268262 | Cr2677 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00154 | 0.00154 | 1 | 0.005 | 0.00154 | 10/12/05 | 12:12 |
| 268262 | Cu3247 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00011 | -0.00011 | 1 | 0.005 | -0.00011 | 10/12/05 | 12:12 |
| 268262 | Fe2714 | 0.0500 | U | | mg/L | 0.05 | | | | 0.05 | -0.0025 | -0.0025 | 1 | 0.05 | -0.0025 | 10/12/05 | 12:12 |
| 268262 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00066 | -0.00066 | 1 | 0.005 | -0.00066 | 10/12/05 | 12:12 |
| 268262 | Mg2790 | 1.10 | | | mg/L | 0.05 | | | | 0.05 | 1.10085 | 1.1 | 1 | 0.05 | 1.10085 | 10/12/05 | 12:12 |
| 268262 | Mn2576 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00027 | 0.00027 | 1 | 0.005 | 0.00027 | 10/12/05 | 12:12 |
| 268262 | Mo2020 | 0.00681 | | | mg/L | 0.005 | | | | 0.005 | 0.00681 | 0.00681 | 1 | 0.005 | 0.00681 | 10/12/05 | 12:12 |
| 268262 | Ni2316 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00028 | -0.00028 | 1 | 0.005 | -0.00028 | 10/12/05 | 12:12 |
| 268262 | P_1782 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | 0.01578 | 0.0158 | 1 | 0.02 | 0.01578 | 10/12/05 | 12:12 |
| 268262 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00253 | -0.00253 | 1 | 0.005 | -0.00253 | 10/12/05 | 12:12 |
| 268262 | S_1820 | 8.54 | | | mg/L | 0.02 | | | | 0.02 | 8.53542 | 8.54 | 1 | 0.02 | 8.53542 | 10/12/05 | 12:12 |
| 268262 | Sb2068 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00517 | 0.00517 | 1 | 0.01 | 0.00517 | 10/12/05 | 12:12 |
| 268262 | Si2881 | 24.5 | | | mg/L | 0.02 | | | | 0.02 | 24.46489 | 24.5 | 1 | 0.02 | 24.46489 | 10/12/05 | 12:12 |
| 268262 | Pb220 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00123 | 0.00123 | 1 | 0.005 | 0.00123 | 10/12/05 | 12:12 |
| 268262 | Se196 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00592 | 0.00592 | 1 | 0.01 | 0.00592 | 10/12/05 | 12:12 |
| 268262 | Sn1899 | 0.00911 | | | mg/L | 0.005 | | | | 0.005 | 0.00911 | 0.00911 | 1 | 0.005 | 0.00911 | 10/12/05 | 12:12 |
| 268262 | Sr4215 | 0.0440 | | | mg/L | 0.005 | | | | 0.005 | 0.04397 | 0.044 | 1 | 0.005 | 0.04397 | 10/12/05 | 12:12 |
| 268262 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | | 0.025 | -0.00211 | -0.00211 | 1 | 0.025 | -0.00211 | 10/12/05 | 12:12 |
| 268262 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00042 | -0.00042 | 1 | 0.005 | -0.00042 | 10/12/05 | 12:12 |
| 268262 | Ti1908 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00143 | -0.00143 | 1 | 0.01 | -0.00143 | 10/12/05 | 12:12 |
| 268262 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | | 0.1 | -0.00036 | -0.00036 | 1 | 0.1 | -0.00036 | 10/12/05 | 12:12 |
| 268262 | V_2924 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.0031 | 0.0031 | 1 | 0.005 | 0.0031 | 10/12/05 | 12:12 |
| 268262 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00329 | -0.00329 | 1 | 0.01 | -0.00329 | 10/12/05 | 12:12 |
| 268262 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00011 | -0.00011 | 1 | 0.005 | -0.00011 | 10/12/05 | 12:12 |
| 268262 | Zn2062 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00182 | 0.00182 | 1 | 0.005 | 0.00182 | 10/12/05 | 12:12 |
| 268262 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00044 | -0.00044 | 1 | 0.005 | -0.00044 | 10/12/05 | 12:12 |
| 268263 | Ag3280 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00058 | -0.00058 | 1 | 0.005 | -0.00058 | 10/12/05 | 12:17 |
| 268263 | Al3082 | 0.0600 | U | | mg/L | 0.06 | | | | 0.06 | -0.00008 | -0.00008 | 1 | 0.06 | -0.00008 | 10/12/05 | 12:17 |
| 268263 | As1890 | 0.0109 | | | mg/L | 0.005 | | | | 0.005 | 0.01088 | 0.0109 | 1 | 0.005 | 0.01088 | 10/12/05 | 12:17 |
| 268263 | B_2496 | 0.150 | | | mg/L | 0.02 | | | | 0.02 | 0.1498 | 0.15 | 1 | 0.02 | 0.1498 | 10/12/05 | 12:17 |
| 268263 | Ba4934 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00415 | 0.00415 | 1 | 0.005 | 0.00415 | 10/12/05 | 12:17 |
| 268263 | Be3130 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0 | 0 | 1 | 0.005 | 0 | 10/12/05 | 12:17 |
| 268263 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00269 | -0.00269 | 1 | 0.01 | -0.00269 | 10/12/05 | 12:17 |
| 268263 | Ca3179 | 15.4 | | | mg/L | 0.05 | | | | 0.05 | 15.44831 | 15.4 | 1 | 0.05 | 15.44831 | 10/12/05 | 12:17 |
| 268263 | Cd2265 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00026 | -0.00026 | 1 | 0.005 | -0.00026 | 10/12/05 | 12:17 |
| 268263 | Co2286 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.0002 | 0.0002 | 1 | 0.005 | 0.0002 | 10/12/05 | 12:17 |
| 268263 | Cr2677 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00072 | 0.00072 | 1 | 0.005 | 0.00072 | 10/12/05 | 12:17 |
| 268263 | Cu3247 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0 | 0 | 1 | 0.005 | 0 | 10/12/05 | 12:17 |
| 268263 | Fe2714 | 0.0500 | U | | mg/L | 0.05 | | | | 0.05 | -0.00723 | -0.00723 | 1 | 0.05 | -0.00723 | 10/12/05 | 12:17 |

010061

DIV. 20
 TO#051011-4
 Project No. 06002.01.242
 Prep. Page 62-154

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | rl | mg/L | sigwt | Dilution | Calc RL | ug/ml | Date | Time |
|-----------|---------|---------|----------|----------|-------|-------|------|-----------|----|-------|----------|----------|----------|---------|----------|----------|-------|
| 268263 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00154 | -0.00154 | 1 | 0.005 | -0.00154 | 10/12/05 | 12:17 |
| 268263 | Mg2790 | 1.28 | | | mg/L | 0.05 | | | | 0.05 | 1.27552 | 1.28 | 1 | 0.05 | 1.27552 | 10/12/05 | 12:17 |
| 268263 | Mn2576 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00007 | 0.00007 | 1 | 0.005 | 0.00007 | 10/12/05 | 12:17 |
| 268263 | Mo2020 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00223 | 0.00223 | 1 | 0.005 | 0.00223 | 10/12/05 | 12:17 |
| 268263 | Ni2316 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00041 | 0.00041 | 1 | 0.005 | 0.00041 | 10/12/05 | 12:17 |
| 268263 | P_1782 | 0.0234 | | | mg/L | 0.02 | | | | 0.02 | 0.02343 | 0.0234 | 1 | 0.02 | 0.02343 | 10/12/05 | 12:17 |
| 268263 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00436 | -0.00436 | 1 | 0.005 | -0.00436 | 10/12/05 | 12:17 |
| 268263 | S_1820 | 7.47 | | | mg/L | 0.02 | | | | 0.02 | 7.47294 | 7.47 | 1 | 0.02 | 7.47294 | 10/12/05 | 12:17 |
| 268263 | Sb2068 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00109 | 0.00109 | 1 | 0.01 | 0.00109 | 10/12/05 | 12:17 |
| 268263 | Si2881 | 27.4 | | | mg/L | 0.02 | | | | 0.02 | 27.38354 | 27.4 | 1 | 0.02 | 27.38354 | 10/12/05 | 12:17 |
| 268263 | Pb220 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00143 | 0.00143 | 1 | 0.005 | 0.00143 | 10/12/05 | 12:17 |
| 268263 | Se196 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00259 | 0.00259 | 1 | 0.01 | 0.00259 | 10/12/05 | 12:17 |
| 268263 | Sn1899 | 0.00824 | | | mg/L | 0.005 | | | | 0.005 | 0.00824 | 0.00824 | 1 | 0.005 | 0.00824 | 10/12/05 | 12:17 |
| 268263 | Sr4215 | 0.0639 | | | mg/L | 0.005 | | | | 0.005 | 0.06388 | 0.0639 | 1 | 0.005 | 0.06388 | 10/12/05 | 12:17 |
| 268263 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | | 0.025 | -0.00396 | -0.00396 | 1 | 0.025 | -0.00396 | 10/12/05 | 12:17 |
| 268263 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00045 | -0.00045 | 1 | 0.005 | -0.00045 | 10/12/05 | 12:17 |
| 268263 | Tl1908 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00463 | -0.00463 | 1 | 0.01 | -0.00463 | 10/12/05 | 12:17 |
| 268263 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | | 0.1 | -0.01831 | -0.0183 | 1 | 0.1 | -0.01831 | 10/12/05 | 12:17 |
| 268263 | V_2924 | 0.00535 | | | mg/L | 0.005 | | | | 0.005 | 0.00535 | 0.00535 | 1 | 0.005 | 0.00535 | 10/12/05 | 12:17 |
| 268263 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00236 | -0.00236 | 1 | 0.01 | -0.00236 | 10/12/05 | 12:17 |
| 268263 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00011 | -0.00011 | 1 | 0.005 | -0.00011 | 10/12/05 | 12:17 |
| 268263 | Zn2062 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00168 | 0.00168 | 1 | 0.005 | 0.00168 | 10/12/05 | 12:17 |
| 268263 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00032 | -0.00032 | 1 | 0.005 | -0.00032 | 10/12/05 | 12:17 |
| 268264 | Ag3280 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00032 | -0.00032 | 1 | 0.005 | -0.00032 | 10/12/05 | 12:37 |
| 268264 | Al3082 | 1.33 | | | mg/L | 0.06 | | | | 0.06 | 1.32745 | 1.33 | 1 | 0.06 | 1.32745 | 10/12/05 | 12:37 |
| 268264 | As1890 | 0.00993 | | | mg/L | 0.005 | | | | 0.005 | 0.00993 | 0.00993 | 1 | 0.005 | 0.00993 | 10/12/05 | 12:37 |
| 268264 | B_2496 | 0.178 | | | mg/L | 0.02 | | | | 0.02 | 0.17844 | 0.178 | 1 | 0.02 | 0.17844 | 10/12/05 | 12:37 |
| 268264 | Ba4934 | 0.0499 | | | mg/L | 0.005 | | | | 0.005 | 0.04994 | 0.0499 | 1 | 0.005 | 0.04994 | 10/12/05 | 12:37 |
| 268264 | Be3130 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00138 | 0.00138 | 1 | 0.005 | 0.00138 | 10/12/05 | 12:37 |
| 268264 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00028 | 0.00028 | 1 | 0.01 | 0.00028 | 10/12/05 | 12:37 |
| 268264 | Ca3179 | 9.63 | | | mg/L | 0.05 | | | | 0.05 | 9.62627 | 9.63 | 1 | 0.05 | 9.62627 | 10/12/05 | 12:37 |
| 268264 | Cd2265 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00025 | 0.00025 | 1 | 0.005 | 0.00025 | 10/12/05 | 12:37 |
| 268264 | Co2286 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00091 | 0.00091 | 1 | 0.005 | 0.00091 | 10/12/05 | 12:37 |
| 268264 | Cr2677 | 0.00633 | | | mg/L | 0.005 | | | | 0.005 | 0.00633 | 0.00633 | 1 | 0.005 | 0.00633 | 10/12/05 | 12:37 |
| 268264 | Cu3247 | 0.00665 | | | mg/L | 0.005 | | | | 0.005 | 0.00665 | 0.00665 | 1 | 0.005 | 0.00665 | 10/12/05 | 12:37 |
| 268264 | Fe2714 | 1.71 | | | mg/L | 0.05 | | | | 0.05 | 1.70892 | 1.71 | 1 | 0.05 | 1.70892 | 10/12/05 | 12:37 |
| 268264 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00084 | 0.00084 | 1 | 0.005 | 0.00084 | 10/12/05 | 12:37 |
| 268264 | Mg2790 | 1.27 | | | mg/L | 0.05 | | | | 0.05 | 1.27262 | 1.27 | 1 | 0.05 | 1.27262 | 10/12/05 | 12:37 |
| 268264 | Mn2576 | 0.0703 | | | mg/L | 0.005 | | | | 0.005 | 0.07029 | 0.0703 | 1 | 0.005 | 0.07029 | 10/12/05 | 12:37 |
| 268264 | Mo2020 | 0.0244 | | | mg/L | 0.005 | | | | 0.005 | 0.02441 | 0.0244 | 1 | 0.005 | 0.02441 | 10/12/05 | 12:37 |
| 268264 | Ni2316 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00455 | 0.00455 | 1 | 0.005 | 0.00455 | 10/12/05 | 12:37 |
| 268264 | P_1782 | 0.0671 | | | mg/L | 0.02 | | | | 0.02 | 0.06709 | 0.0671 | 1 | 0.02 | 0.06709 | 10/12/05 | 12:37 |
| 268264 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00283 | -0.00283 | 1 | 0.005 | -0.00283 | 10/12/05 | 12:37 |

010062

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | rl | mg/L | sigwt | Dilution | Calc RL | ug/ml | Date | Time |
|-----------|---------|---------|----------|----------|-------|-------|------|-----------|----|-------|----------|----------|----------|---------|----------|----------|-------|
| 268264 | S_1820 | 15.7 | | | mg/L | 0.02 | | | | 0.02 | 15.65758 | 15.7 | 1 | 0.02 | 15.65758 | 10/12/05 | 12:37 |
| 268264 | Sb2068 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00581 | 0.00581 | 1 | 0.01 | 0.00581 | 10/12/05 | 12:37 |
| 268264 | Si2881 | 24.2 | | | mg/L | 0.02 | | | | 0.02 | 24.20908 | 24.2 | 1 | 0.02 | 24.20908 | 10/12/05 | 12:37 |
| 268264 | Pb220 | 0.0158 | | | mg/L | 0.005 | | | | 0.005 | 0.01584 | 0.0158 | 1 | 0.005 | 0.01584 | 10/12/05 | 12:37 |
| 268264 | Se196 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.00481 | 0.00481 | 1 | 0.01 | 0.00481 | 10/12/05 | 12:37 |
| 268264 | Sn1899 | 0.0122 | | | mg/L | 0.005 | | | | 0.005 | 0.0122 | 0.0122 | 1 | 0.005 | 0.0122 | 10/12/05 | 12:37 |
| 268264 | Sr4215 | 0.0760 | | | mg/L | 0.005 | | | | 0.005 | 0.076 | 0.076 | 1 | 0.005 | 0.076 | 10/12/05 | 12:37 |
| 268264 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | | 0.025 | 0.00216 | 0.00216 | 1 | 0.025 | 0.00216 | 10/12/05 | 12:37 |
| 268264 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.0031 | 0.0031 | 1 | 0.005 | 0.0031 | 10/12/05 | 12:37 |
| 268264 | Ti1908 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00395 | -0.00395 | 1 | 0.01 | -0.00395 | 10/12/05 | 12:37 |
| 268264 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | | 0.1 | 0.00153 | 0.00153 | 1 | 0.1 | 0.00153 | 10/12/05 | 12:37 |
| 268264 | V_2924 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00272 | 0.00272 | 1 | 0.005 | 0.00272 | 10/12/05 | 12:37 |
| 268264 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00246 | -0.00246 | 1 | 0.01 | -0.00246 | 10/12/05 | 12:37 |
| 268264 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00043 | 0.00043 | 1 | 0.005 | 0.00043 | 10/12/05 | 12:37 |
| 268264 | Zn2062 | 0.0478 | | | mg/L | 0.005 | | | | 0.005 | 0.04779 | 0.0478 | 1 | 0.005 | 0.04779 | 10/12/05 | 12:37 |
| 268264 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00065 | 0.00065 | 1 | 0.005 | 0.00065 | 10/12/05 | 12:37 |
| 268265 | Ag3280 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00011 | -0.00011 | 1 | 0.005 | -0.00011 | 10/12/05 | 12:42 |
| 268265 | Al3082 | 0.0600 | U | | mg/L | 0.06 | | | | 0.06 | 0.00241 | 0.00241 | 1 | 0.06 | 0.00241 | 10/12/05 | 12:42 |
| 268265 | As1890 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00112 | 0.00112 | 1 | 0.005 | 0.00112 | 10/12/05 | 12:42 |
| 268265 | B_2496 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | 0.00003 | 0.00003 | 1 | 0.02 | 0.00003 | 10/12/05 | 12:42 |
| 268265 | Ba4934 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.0001 | -0.0001 | 1 | 0.005 | -0.0001 | 10/12/05 | 12:42 |
| 268265 | Be3130 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0 | 0 | 1 | 0.005 | 0 | 10/12/05 | 12:42 |
| 268265 | Bi2230 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00419 | -0.00419 | 1 | 0.01 | -0.00419 | 10/12/05 | 12:42 |
| 268265 | Ca3179 | 9.86 | | | mg/L | 0.05 | | | | 0.05 | 9.86038 | 9.86 | 1 | 0.05 | 9.86038 | 10/12/05 | 12:42 |
| 268265 | Cd2265 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00002 | 0.00002 | 1 | 0.005 | 0.00002 | 10/12/05 | 12:42 |
| 268265 | Co2286 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00019 | -0.00019 | 1 | 0.005 | -0.00019 | 10/12/05 | 12:42 |
| 268265 | Cr2677 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00038 | -0.00038 | 1 | 0.005 | -0.00038 | 10/12/05 | 12:42 |
| 268265 | Cu3247 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00056 | -0.00056 | 1 | 0.005 | -0.00056 | 10/12/05 | 12:42 |
| 268265 | Fe2714 | 9.90 | | | mg/L | 0.05 | | | | 0.05 | 9.90141 | 9.9 | 1 | 0.05 | 9.90141 | 10/12/05 | 12:42 |
| 268265 | La3988 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.0008 | -0.0008 | 1 | 0.005 | -0.0008 | 10/12/05 | 12:42 |
| 268265 | Mg2790 | 9.70 | | | mg/L | 0.05 | | | | 0.05 | 9.70316 | 9.7 | 1 | 0.05 | 9.70316 | 10/12/05 | 12:42 |
| 268265 | Mn2576 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00018 | -0.00018 | 1 | 0.005 | -0.00018 | 10/12/05 | 12:42 |
| 268265 | Mo2020 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00072 | 0.00072 | 1 | 0.005 | 0.00072 | 10/12/05 | 12:42 |
| 268265 | Ni2316 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00039 | 0.00039 | 1 | 0.005 | 0.00039 | 10/12/05 | 12:42 |
| 268265 | P_1782 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | -0.00215 | -0.00215 | 1 | 0.02 | -0.00215 | 10/12/05 | 12:42 |
| 268265 | Pd3404 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00463 | -0.00463 | 1 | 0.005 | -0.00463 | 10/12/05 | 12:42 |
| 268265 | S_1820 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | -0.00025 | -0.00025 | 1 | 0.02 | -0.00025 | 10/12/05 | 12:42 |
| 268265 | Sb2068 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00292 | -0.00292 | 1 | 0.01 | -0.00292 | 10/12/05 | 12:42 |
| 268265 | Si2881 | 0.0200 | U | | mg/L | 0.02 | | | | 0.02 | 0.0006 | 0.0006 | 1 | 0.02 | 0.0006 | 10/12/05 | 12:42 |
| 268265 | Pb220 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00094 | 0.00094 | 1 | 0.005 | 0.00094 | 10/12/05 | 12:42 |
| 268265 | Se196 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00007 | -0.00007 | 1 | 0.01 | -0.00007 | 10/12/05 | 12:42 |
| 268265 | Sn1899 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00078 | 0.00078 | 1 | 0.005 | 0.00078 | 10/12/05 | 12:42 |
| 268265 | Sr4215 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00033 | 0.00033 | 1 | 0.005 | 0.00033 | 10/12/05 | 12:42 |

010063

DIV. 20
 TO#051011-4
 Project No. 06002.01.242
 Prep. Page 62-154

| Sample ID | Element | Result | Qual (C) | Qual (Q) | Units | RL | %RPD | %Recovery | TV | rl | mg/L | sigwt | Dilution | Calc RL | ug/ml | Date | Time |
|-----------|---------|---------|----------|----------|-------|-------|------|-----------|----|-------|----------|----------|----------|---------|----------|----------|-------|
| 268265 | Th2837 | 0.0250 | U | | mg/L | 0.025 | | | | 0.025 | -0.00914 | -0.00914 | 1 | 0.025 | -0.00914 | 10/12/05 | 12:42 |
| 268265 | Ti3349 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00016 | -0.00016 | 1 | 0.005 | -0.00016 | 10/12/05 | 12:42 |
| 268265 | Ti1908 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | 0.0023 | 0.0023 | 1 | 0.01 | 0.0023 | 10/12/05 | 12:42 |
| 268265 | U_4090 | 0.100 | U | | mg/L | 0.1 | | | | 0.1 | -0.0183 | -0.0183 | 1 | 0.1 | -0.0183 | 10/12/05 | 12:42 |
| 268265 | V_2924 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00103 | -0.00103 | 1 | 0.005 | -0.00103 | 10/12/05 | 12:42 |
| 268265 | W_2079 | 0.0100 | U | | mg/L | 0.01 | | | | 0.01 | -0.00125 | -0.00125 | 1 | 0.01 | -0.00125 | 10/12/05 | 12:42 |
| 268265 | Y_3710 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00016 | -0.00016 | 1 | 0.005 | -0.00016 | 10/12/05 | 12:42 |
| 268265 | Zn2062 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | 0.00374 | 0.00374 | 1 | 0.005 | 0.00374 | 10/12/05 | 12:42 |
| 268265 | Zr3496 | 0.00500 | U | | mg/L | 0.005 | | | | 0.005 | -0.00073 | -0.00073 | 1 | 0.005 | -0.00073 | 10/12/05 | 12:42 |

010064

200.7 TAP No. 01-0406-028 Rev2/Mar02

6010B TAP No. 01-0406-130 Rev3/Mar05

Other _____

| |
|--------------------|
| QC STD. ID's |
| CCV <u>05403</u> |
| CRI _____ |
| ICSA _____ |
| ICSAB <u>05403</u> |

| |
|-------------------|
| ICP CAL.STD. |
| ID's |
| Std0 <u>05403</u> |
| Std1 _____ |
| Std2 _____ |
| Std3 _____ |
| Std4 _____ |
| Std5 _____ |
| Std6 <u>05403</u> |

010065

PROJ. NO. PROJECT TO# DATE MATRIX LOGBK PG

06002.01.24Z Div 20 051011-A 10-12-05 Water 6Z-153

INSTRUMENT: TRACEZ FILENAME: B510114

File converted to wsl?

Method: DAILY2 Standard: blk

Run Time: 10/12/05 10:24:03

010066

| | | | | | | | |
|------|--------|--------|--------|--------|--------|--------|---------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Avg | -.0000 | .0004 | -.0000 | .0000 | .0000 | -.0001 | .0000 |
| SDev | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 |
| %RSD | 45.05 | 3.891 | 11.62 | 6.483 | 141.4 | 3.306 | 362000. |
| #1 | -.0000 | .0004 | -.0001 | .0000 | .0000 | -.0001 | -.0000 |
| #2 | -.0000 | .0004 | -.0000 | .0000 | .0000 | -.0001 | .0000 |
| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
| Avg | .0000 | -.0000 | -.0000 | .0000 | .0003 | .0000 | .0002 |
| SDev | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 |
| %RSD | 10.82 | 28.23 | 33.72 | 70.75 | 3.816 | 29.21 | 3.111 |
| #1 | .0000 | -.0000 | -.0000 | .0000 | .0003 | .0000 | .0002 |
| #2 | .0000 | -.0000 | -.0000 | .0000 | .0003 | .0000 | .0002 |
| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
| Avg | .0000 | .0000 | .0000 | .0000 | -.0000 | -.0001 | -.0102 |
| SDev | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 |
| %RSD | .0553 | 4.475 | 141.4 | 50.56 | 55.61 | 1.292 | .2951 |
| #1 | .0000 | .0000 | .0000 | .0000 | -.0000 | -.0001 | -.0101 |
| #2 | .0000 | .0000 | .0000 | .0000 | -.0000 | -.0001 | -.0102 |
| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
| Avg | -.0000 | .0000 | .0000 | .0000 | .0001 | .0002 | -.0011 |
| SDev | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 |
| %RSD | 270.9 | 17.09 | 90.32 | 309.2 | 17.37 | 6.116 | .3356 |
| #1 | -.0000 | .0000 | .0001 | .0000 | .0001 | .0002 | -.0011 |
| #2 | .0000 | .0000 | .0000 | -.0000 | .0001 | .0003 | -.0011 |
| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Sn1899 | Sr4215 | Th2837 |
| Avg | 116.1 | -.0002 | .0001 | .0017 | -.0000 | .0000 | .0001 |
| SDev | .1 | .0001 | .0000 | .0000 | .0000 | .0000 | .0000 |
| %RSD | .0515 | 32.05 | 56.81 | 2.137 | 35.41 | 708.4 | 10.82 |
| #1 | 116.1 | -.0001 | .0000 | .0017 | -.0000 | .0000 | .0001 |
| #2 | 116.0 | -.0002 | .0001 | .0016 | -.0000 | -.0000 | .0000 |
| Elem | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 | Y_3710 | Zn2062 |
| Avg | -.0001 | -.0001 | -.0002 | -.0000 | .0002 | .0000 | .0000 |
| SDev | .0000 | .0000 | .0001 | .0000 | .0001 | .0000 | .0000 |
| %RSD | 34.56 | 3.793 | 33.07 | 6.387 | 85.54 | 222.2 | 282.7 |
| #1 | -.0001 | -.0001 | -.0002 | -.0000 | .0001 | -.0000 | -.0000 |
| #2 | -.0000 | -.0001 | -.0003 | -.0000 | .0002 | .0000 | .0000 |
| Elem | Zr3496 | | | | | | |
| Avg | .0002 | | | | | | |
| SDev | .0000 | | | | | | |
| %RSD | 2.083 | | | | | | |
| #1 | .0002 | | | | | | |
| #2 | .0002 | | | | | | |

DQ 10-12-05



Handwritten signature and date: 10/21/05

010067

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1160596 | 10000 | -- | -- | -- | -- | -- |
| SDev | 641.3458 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .0552601 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1161049 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1160142 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Standard: clp_std4
 Run Time: 10/12/05 10:28:48

010068

| | | | | | | | |
|------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | As1890 | 2203/1 | 2203/2 | Sb2068 | 1960/1 | 1960/2 |
| Avge | .0803 | .1083 | .3096 | .2692 | .1533 | .2248 | .2198 |
| SDev | .0000 | .0001 | .0015 | .0002 | .0004 | .0013 | .0005 |
| %RSD | .0034 | .0811 | .4700 | .0597 | .2324 | .5843 | .2139 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | .0803 | .1082 | .3106 | .2693 | .1530 | .2257 | .2195 |
| #2 | .0803 | .1084 | .3086 | .2690 | .1535 | .2238 | .2202 |

| | |
|------|--------|
| Elem | Tl1908 |
| Avge | .2022 |
| SDev | .0000 |
| %RSD | .0168 |

| | |
|----|-------|
| #1 | .2022 |
| #2 | .2022 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1153036 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1042.983 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .0904553 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1152299 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1153774 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Standard: clp_std1
 Run Time: 10/12/05 10:33:11

010069

| | | | | | | | |
|------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Al3082 | Ca3179 | Fe2714 | K_7664 | Li6707 | Mg2790 | Na3302 |
| Avge | .1076 | .2283 | .1046 | .1568 | 2.634 | .0955 | .0082 |
| SDev | .0000 | .0006 | .0000 | .0002 | .009 | .0001 | .0000 |
| %RSD | .0402 | .2559 | .0167 | .1428 | .3348 | .1228 | .2233 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | .1076 | .2288 | .1046 | .1569 | 2.640 | .0955 | .0082 |
| #2 | .1076 | .2279 | .1046 | .1566 | 2.628 | .0954 | .0082 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1153375 | 10000 | -- | -- | -- | -- | -- |
| SDev | 3527.049 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .3058024 | .0000000 | -- | -- | -- | -- | -- |

| | | | | | | | |
|----|---------|-------|----|----|----|----|----|
| #1 | 1150881 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1155869 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Standard: clp_std5

Run Time: 10/12/05 10:36:52

010070

| | | | | | | | |
|------|--------|--------|--------|--------|--------|--------|--------|
| Elem | B_2496 | Bi2230 | Mo2020 | P_1782 | Si2881 | Sn1899 | Sr4215 |
| Avge | .1740 | .0313 | .3255 | .0187 | .1736 | .1580 | 2.356 |
| SDev | .0012 | .0002 | .0010 | .0001 | .0004 | .0001 | .005 |
| %RSD | .6673 | .5460 | .3079 | .3582 | .2213 | .0882 | .2161 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | .1732 | .0312 | .3248 | .0186 | .1733 | .1581 | 2.352 |
| #2 | .1748 | .0314 | .3262 | .0187 | .1739 | .1579 | 2.359 |

| | |
|------|--------|
| Elem | Ti3349 |
| Avge | 2.892 |
| SDev | .005 |
| %RSD | .1587 |

| | |
|----|-------|
| #1 | 2.889 |
| #2 | 2.895 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1162783 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1854.034 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1594480 | .0000000 | -- | -- | -- | -- | -- |

| | | | | | | | |
|----|---------|-------|----|----|----|----|----|
| #1 | 1161472 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1164094 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Standard: clp_std2
Run Time: 10/12/05 10:40:34

010071

| Elem | Ba4934 | Be3130 | Cr2677 | Cu3247 | Ni2316 |
|------|--------|--------|--------|--------|--------|
| Avge | .9699 | 1.526 | .4518 | .3079 | .3383 |
| SDev | .0006 | .001 | .0006 | .0001 | .0009 |
| %RSD | .0614 | .0433 | .1286 | .0306 | .2786 |

| | | | | | |
|----|-------|-------|-------|-------|-------|
| #1 | .9703 | 1.527 | .4522 | .3080 | .3390 |
| #2 | .9695 | 1.526 | .4514 | .3079 | .3376 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1161668 | 10000 | -- | -- | -- | -- | -- |
| SDev | 2895.602 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .2492626 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1159620 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1163715 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Standard: clp_std3

Run Time: 10/12/05 10:43:52

010072

| | | | | | |
|------|--------|--------|--------|--------|--------|
| Elem | Cd2265 | Co2286 | Mn2576 | V_2924 | Zn2062 |
| Avge | 1.023 | .2142 | .9972 | .2078 | .2986 |
| SDev | .001 | .0001 | .0001 | .0001 | .0005 |
| %RSD | .1438 | .0587 | .0078 | .0488 | .1817 |

| | | | | | |
|----|-------|-------|-------|-------|-------|
| #1 | 1.024 | .2143 | .9972 | .2079 | .2989 |
| #2 | 1.022 | .2141 | .9971 | .2078 | .2982 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1177142 | 10000 | -- | -- | -- | -- | -- |
| SDev | 5262.996 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .4470997 | .0000000 | -- | -- | -- | -- | -- |

| | | | | | | | |
|----|---------|-------|----|----|----|----|----|
| #1 | 1173420 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1180863 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Standard: clp_std6
 Run Time: 10/12/05 10:47:32

010073

| | | | | | | | |
|------|--------|--------|--------|--------|--------|--------|--------|
| Elem | La3988 | Na5889 | Pd3404 | S_1820 | Th2837 | U_4090 | W_2079 |
| Avge | .4638 | .0353 | .2091 | .0329 | .1163 | .0678 | .1595 |
| SDev | .0007 | .0002 | .0001 | .0000 | .0001 | .0000 | .0001 |
| %RSD | .1569 | .6297 | .0498 | .0451 | .1008 | .0254 | .0418 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | .4633 | .0354 | .2090 | .0329 | .1164 | .0678 | .1596 |
| #2 | .4644 | .0351 | .2092 | .0329 | .1162 | .0678 | .1595 |

| | | |
|------|--------|--------|
| Elem | Y_3710 | Zr3496 |
| Avge | .7649 | 2.065 |
| SDev | .0006 | .003 |
| %RSD | .0779 | .1353 |

| | | |
|----|-------|-------|
| #1 | .7644 | 2.063 |
| #2 | .7653 | 2.067 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1169047 | 10000 | -- | -- | -- | -- | -- |
| SDev | 7922.424 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .6776823 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1163445 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1174649 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2

Slope = Conc(SIR)/IR

010074

| Element | Wavelen | High std | Low std | Slope | Y-intercept | Date Standardized |
|---------|---------|----------|---------|---------|-------------|-------------------|
| Ag3280 | 328.068 | clp_std4 | blk | 24.8927 | .000472 | 10/12/05 10:47:32 |
| Al3082 | 308.215 | clp_std1 | blk | 466.369 | -.172788 | 10/12/05 10:47:32 |
| As1890 | 189.042 | clp_std4 | blk | 92.2869 | .004334 | 10/12/05 10:47:32 |
| B_2496 | 249.678 | clp_std5 | blk | 57.4759 | -.002179 | 10/12/05 10:47:32 |
| Ba4934 | 493.409 | clp_std2 | blk | 10.3107 | -.000027 | 10/12/05 10:47:32 |
| Be3130 | 313.042 | clp_std2 | blk | 3.27596 | .000246 | 10/12/05 10:47:32 |
| Bi2230 | 223.061 | clp_std5 | blk | 158.418 | -.000000 | 10/12/05 10:47:32 |
| Ca3179 | 317.933 | clp_std1 | blk | 219.013 | -.002453 | 10/12/05 10:47:32 |
| Cd2265 | 226.502 | clp_std3 | blk | 9.77515 | .000063 | 10/12/05 10:47:32 |
| Co2286 | 228.616 | clp_std3 | blk | 46.6820 | .000422 | 10/12/05 10:47:32 |
| Cr2677 | 267.716 | clp_std2 | blk | 22.1330 | -.000114 | 10/12/05 10:47:32 |
| Cu3247 | 324.753 | clp_std2 | blk | 32.5101 | -.010532 | 10/12/05 10:47:32 |
| Fe2714 | 271.441 | clp_std1 | blk | 478.534 | -.011956 | 10/12/05 10:47:32 |
| K_7664 | 766.491 | clp_std1 | blk | 319.366 | -.073746 | 10/12/05 10:47:32 |
| La3988 | 398.853 | clp_std6 | blk | 21.5801 | -.000744 | 10/12/05 10:47:32 |
| Li6707 | 670.784 | clp_std1 | blk | 3.79690 | -.000105 | 10/12/05 10:47:32 |
| Mg2790 | 279.078 | clp_std1 | blk | 261.830 | -.001240 | 10/12/05 10:47:32 |
| Mn2576 | 257.610 | clp_std3 | blk | 10.0291 | -.000121 | 10/12/05 10:47:32 |
| Mo2020 | 202.030 | clp_std5 | blk | 30.7277 | .000741 | 10/12/05 10:47:32 |
| Na3302 | 330.232 | clp_std1 | blk | 6012.49 | .815929 | 10/12/05 10:47:32 |
| Na5889 | 588.991 | clp_std6 | blk | 22.1325 | .224892 | 10/12/05 10:47:32 |
| Ni2316 | 231.604 | clp_std2 | blk | 29.5596 | .000445 | 10/12/05 10:47:32 |
| P_1782 | 178.287 | clp_std5 | blk | 536.206 | -.015246 | 10/12/05 10:47:32 |
| 2203/1 | 220.351 | clp_std4 | blk | 32.3026 | -.001002 | 10/12/05 10:47:32 |
| 2203/2 | 220.352 | clp_std4 | blk | 37.1555 | -.000432 | 10/12/05 10:47:32 |
| Pd3404 | 340.458 | clp_std6 | blk | 49.1178 | -.004148 | 10/12/05 10:47:32 |
| S_1820 | 182.040 | clp_std6 | blk | 305.957 | -.073815 | 10/12/05 10:47:32 |
| Sb2068 | 206.838 | clp_std4 | blk | 64.7728 | .070683 | 10/12/05 10:47:32 |
| Sc3613 | 361.384 | blk | dark | .861566 | .000000 | 10/12/05 10:47:32 |
| 1960/1 | 196.021 | clp_std4 | blk | 44.4618 | .007873 | 10/12/05 10:47:32 |
| 1960/2 | 196.022 | clp_std4 | blk | 45.5023 | -.002882 | 10/12/05 10:47:32 |
| Si2881 | 288.158 | clp_std5 | blk | 57.9422 | -.096603 | 10/12/05 10:47:32 |
| 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 | 63.3257 | .001091 | 10/12/05 10:47:32 |
| Sr4215 | 421.552 | clp_std5 | blk | 4.24529 | -.000004 | 10/12/05 10:47:32 |
| Th2837 | 283.730 | clp_std6 | blk | 89.8080 | -.004527 | 10/12/05 10:47:32 |
| Ti3349 | 334.941 | clp_std5 | blk | 3.45789 | .000213 | 10/12/05 10:47:32 |
| Tl1908 | 190.864 | clp_std4 | blk | 49.4149 | .006259 | 10/12/05 10:47:32 |
| U_4090 | 409.014 | clp_std6 | blk | 146.902 | .032533 | 10/12/05 10:47:32 |
| V_2924 | 292.402 | clp_std3 | blk | 48.1084 | .001389 | 10/12/05 10:47:32 |
| W_2079 | 207.914 | clp_std6 | blk | 31.3641 | -.004717 | 10/12/05 10:47:32 |
| Y_3710 | 371.030 | clp_std6 | blk | 13.0720 | -.000039 | 10/12/05 10:47:32 |
| Zn2062 | 206.200 | clp_std3 | blk | 33.4962 | -.000087 | 10/12/05 10:47:32 |
| Zr3496 | 349.621 | clp_std6 | blk | 5.29339 | -.001056 | 10/12/05 10:47:32 |

Method: DAILY2 Sample Name: icv/ccv

Operator:

Run Time: 10/12/05 10:53:27

010075

Comment:

Mode: CONC Corr. Factor: 1

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | .9958 | 9.818 | 5.119 | 4.819 | 10.03 | .9759 | 5.004 |
| SDev | .0011 | .010 | .008 | .018 | .01 | .0011 | .011 |
| %RSD | .1092 | .0975 | .1514 | .3802 | .0646 | .1124 | .2193 |
| #1 | .9966 | 9.824 | 5.113 | 4.806 | 10.04 | .9752 | 5.012 |
| #2 | .9951 | 9.811 | 5.124 | 4.831 | 10.03 | .9767 | 4.997 |
| Errors | 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 |
| Avge | 20.04 | 1.009 | 5.070 | 1.956 | 2.022 | 9.842 | 18.77 |
| SDev | .02 | .004 | .004 | .002 | .000 | .009 | .02 |
| %RSD | .1057 | .3942 | .0728 | .0768 | .0206 | .0888 | .0914 |
| #1 | 20.02 | 1.006 | 5.072 | 1.955 | 2.022 | 9.836 | 18.76 |
| #2 | 20.05 | 1.012 | 5.067 | 1.957 | 2.022 | 9.848 | 18.78 |
| Errors | 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 |
| Avge | 4.908 | 4.818 | 20.06 | 1.012 | 5.025 | 28.50 | Q42.02 |
| SDev | .004 | .001 | .00 | .001 | .017 | .09 | .02 |
| %RSD | .0746 | .0280 | .0225 | .0673 | .3479 | .3273 | .0463 |
| #1 | 4.911 | 4.817 | 20.06 | 1.013 | 5.013 | 28.43 | Q42.03 |
| #2 | 4.906 | 4.819 | 20.05 | 1.012 | 5.038 | 28.56 | Q42.00 |
| Errors | 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 |
| Avge | 4.970 | 5.093 | 4.966 | 4.965 | 1.003 | .9997 | 1.005 |
| SDev | .005 | .035 | .024 | .029 | .000 | .0059 | .002 |
| %RSD | .1025 | .6846 | .4812 | .5793 | .0444 | .5904 | .2390 |
| #1 | 4.974 | 5.117 | 4.949 | 4.986 | 1.003 | .9956 | 1.006 |
| #2 | 4.967 | 5.068 | 4.983 | 4.945 | 1.003 | 1.004 | 1.003 |
| 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 |

010076

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 100.7 | 5.239 | 5.256 | 4.991 | 4.966 | 5.250 | 4.907 |
| SDev | .2 | .046 | .040 | .008 | .011 | .011 | .004 |
| %RSD | .1529 | .8717 | .7599 | .1562 | .2258 | .2172 | .0808 |
| #1 | 100.8 | 5.207 | 5.284 | 4.997 | 4.973 | 5.258 | 4.904 |
| #2 | 100.6 | 5.271 | 5.227 | 4.986 | 4.958 | 5.242 | 4.910 |
| 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 |
| Avge | 5.061 | .9681 | 4.785 | 5.207 | Q1.112 | 4.956 | Q1.116 |
| SDev | .002 | .0011 | .004 | .007 | .012 | .003 | .009 |
| %RSD | .0435 | .1093 | .0833 | .1321 | 1.121 | .0694 | .8323 |
| #1 | 5.060 | .9688 | 4.782 | 5.202 | Q1.121 | 4.953 | Q1.109 |
| #2 | 5.063 | .9673 | 4.788 | 5.212 | Q1.103 | 4.958 | Q1.122 |
| Errors | QC Pass | QC Pass | QC Pass | QC Pass | QC Fail | QC Pass | QC Fail |
| 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 | 5.014 | 1.017 | 4.881 | | | | |
| SDev | .003 | .001 | .007 | | | | |
| %RSD | .0644 | .1270 | .1459 | | | | |
| #1 | 5.012 | 1.016 | 4.876 | | | | |
| #2 | 5.017 | 1.018 | 4.886 | | | | |
| Errors | QC Pass | QC Pass | QC Pass | | | | |
| Value | 5.000 | 1.000 | 5.000 | | | | |
| Range | 10.00 | 10.00 | 10.00 | | | | |

010077

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1168359 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1746.554 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1494878 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1169594 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1167124 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: icb/ccb

Operator:

Run Time: 10/12/05 11:00:04

Comment:

010078

Mode: CONC Corr. Factor: 1

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0000 | .0039 | .0002 | .0068 | -.0000 | -.0000 | -.0008 |
| SDev | .0010 | .0000 | .0015 | .0009 | .0000 | .0000 | .0005 |
| %RSD | 3701. | .9708 | 676.8 | 12.83 | 12.35 | 530.2 | 67.12 |

| | | | | | | | |
|----|--------|-------|--------|-------|--------|--------|--------|
| #1 | -.0007 | .0039 | .0013 | .0074 | -.0000 | -.0000 | -.0004 |
| #2 | .0006 | .0040 | -.0009 | .0061 | -.0001 | .0000 | -.0012 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avge | .0002 | .0001 | -.0001 | -.0004 | -.0001 | .0006 | -.0011 |
| SDev | .0013 | .0001 | .0009 | .0002 | .0002 | .0203 | .0159 |
| %RSD | 571.4 | 104.5 | 617.8 | 49.70 | 228.6 | 3595. | 1433. |

| | | | | | | | |
|----|--------|-------|--------|--------|--------|--------|--------|
| #1 | -.0007 | .0000 | -.0008 | -.0005 | -.0002 | -.0138 | -.0124 |
| #2 | .0011 | .0002 | .0005 | -.0003 | .0001 | .0149 | .0101 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avge | -.0008 | .0002 | .0008 | -.0000 | .0031 | -.0333 | .0185 |
| SDev | .0015 | .0000 | .0041 | .0000 | .0011 | .1748 | .0017 |
| %RSD | 175.7 | 3.171 | 493.0 | 137.7 | 36.08 | 525.4 | 9.163 |

| | | | | | | | |
|----|--------|-------|--------|--------|-------|---------|-------|
| #1 | -.0019 | .0002 | -.0021 | -.0000 | .0039 | L-.1569 | .0173 |
| #2 | .0002 | .0002 | .0038 | -.0000 | .0023 | H.0903 | .0197 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avge | .0000 | .0048 | .0020 | -.0016 | .0009 | -.0004 | .0026 |
| SDev | .0009 | .0016 | .0017 | .0001 | .0033 | .0008 | .0005 |
| %RSD | 8691. | 32.65 | 85.10 | 4.583 | 376.3 | 192.6 | 18.79 |

| | | | | | | | |
|----|--------|-------|-------|--------|--------|--------|-------|
| #1 | -.0006 | .0059 | .0032 | -.0016 | -.0015 | .0001 | .0030 |
| #2 | .0006 | .0037 | .0008 | -.0017 | .0033 | -.0009 | .0023 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
|------|--------|--------|--------|--------|-------|-------|--------|

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| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.5 | .0043 | .0000 | .0013 | -.0004 | .0014 | .0011 |
| SDev | .2 | .0013 | .0001 | .0042 | .0006 | .0004 | .0002 |
| %RSD | .2231 | 30.14 | 345.3 | 315.9 | 155.5 | 25.24 | 13.98 |
| #1 | 102.7 | .0052 | -.0000 | -.0016 | .0000 | .0017 | .0013 |
| #2 | 102.3 | .0034 | .0001 | .0043 | -.0008 | .0012 | .0010 |
| 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 |
| Avge | .0000 | -.0017 | -.0001 | .0031 | .0077 | -.0008 | .0028 |
| SDev | .0000 | .0007 | .0000 | .0001 | .0343 | .0005 | .0006 |
| %RSD | 45.11 | 42.36 | 19.31 | 1.602 | 446.1 | 64.40 | 21.51 |
| #1 | .0000 | -.0012 | -.0002 | .0031 | -.0165 | -.0012 | .0033 |
| #2 | .0000 | -.0023 | -.0001 | .0031 | .0319 | -.0004 | .0024 |
| Errors | 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 | .0001 | -.0003 | | | | |
| SDev | .0000 | .0001 | .0001 | | | | |
| %RSD | 92.02 | 153.9 | 41.95 | | | | |
| #1 | -.0001 | -.0000 | -.0004 | | | | |
| #2 | -.0000 | .0001 | -.0002 | | | | |
| Errors | LC Pass | LC Pass | LC Pass | | | | |
| High | .0050 | .0050 | .0050 | | | | |
| Low | -.0050 | -.0050 | -.0050 | | | | |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 010080 |
|--------|----------|----------|---------|---------|---------|---------|---------------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1189617 | 10000 | -- | -- | -- | -- | -- |
| SDev | 2542.756 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .2137458 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1191415 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1187819 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: cri

Operator: **010081**

Run Time: 10/12/05 11:04:49

Comment:

Mode: CONC Corr. Factor: 1

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | .0206 | .1061 | .0225 | .1035 | .0205 | .0098 | .0001 |
| SDev | .0006 | .0033 | .0008 | .0011 | .0001 | .0000 | .0007 |
| %RSD | 3.089 | 3.101 | 3.354 | 1.039 | .2932 | .2378 | 668.1 |
| #1 | .0201 | .1038 | .0230 | .1027 | .0205 | .0098 | .0006 |
| #2 | .0210 | .1084 | .0220 | .1042 | .0206 | .0098 | -.0004 |
| Errors | 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 |
| Avge | .0041 | .0105 | .1001 | .0196 | .0493 | .0809 | -.0087 |
| SDev | .0010 | .0003 | .0006 | .0004 | .0004 | .0071 | .0233 |
| %RSD | 24.74 | 2.361 | .5543 | 2.047 | .7341 | 8.792 | 268.2 |
| #1 | .0033 | .0103 | .1005 | .0193 | .0490 | .0758 | -.0251 |
| #2 | .0048 | .0107 | .0997 | .0199 | .0495 | .0859 | .0078 |
| Errors | NOCHECK | 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 |
| Avge | -.0005 | .0714 | -.0013 | .0305 | .0216 | -.1854 | .0157 |
| SDev | .0001 | .0000 | .0015 | .0000 | .0002 | .3348 | .0070 |
| %RSD | 17.80 | .0581 | 114.9 | .1149 | .8247 | 180.6 | 44.31 |
| #1 | -.0005 | .0714 | -.0003 | .0305 | .0215 | -.4222 | .0108 |
| #2 | -.0004 | .0714 | -.0024 | .0305 | .0217 | .0514 | .0206 |
| 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 |
| Avge | .0826 | .0953 | .0077 | .0038 | -.0003 | .0082 | .1245 |
| SDev | .0003 | .0099 | .0024 | .0023 | .0044 | .0027 | .0018 |
| %RSD | .3774 | 10.41 | 30.59 | 61.65 | 1470. | 32.57 | 1.480 |
| #1 | .0829 | .1023 | .0060 | .0054 | -.0034 | .0063 | .1258 |
| #2 | .0824 | .0883 | .0093 | .0021 | .0028 | .0101 | .1232 |
| 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 |

010082

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.0 | .0102 | .0109 | .1049 | .0051 | .0106 | .1032 |
| SDev | .6 | .0024 | .0022 | .0012 | .0008 | .0006 | .0005 |
| %RSD | .5988 | 24.04 | 19.92 | 1.109 | 15.13 | 5.910 | .4456 |
| #1 | 102.4 | .0084 | .0124 | .1040 | .0056 | .0111 | .1035 |
| #2 | 101.6 | .0119 | .0093 | .1057 | .0045 | .0102 | .1029 |
| 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 |
| Avge | .0211 | -.0014 | .0188 | .0222 | .1981 | .0986 | .0006 |
| SDev | .0000 | .0004 | .0001 | .0026 | .0178 | .0002 | .0013 |
| %RSD | .0219 | 25.65 | .4785 | 11.93 | 8.996 | .1672 | 232.0 |
| #1 | .0211 | -.0017 | .0188 | .0240 | .1855 | .0987 | .0015 |
| #2 | .0211 | -.0012 | .0189 | .0203 | .2107 | .0985 | -.0004 |
| 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 | .0405 | .0941 | | | | |
| SDev | .0001 | .0000 | .0005 | | | | |
| %RSD | 157.2 | .1011 | .5471 | | | | |
| #1 | -.0000 | .0405 | .0937 | | | | |
| #2 | .0001 | .0406 | .0945 | | | | |
| Errors | NOCHECK | QC Pass | QC Pass | | | | |
| Value | | .0400 | .1000 | | | | |
| Range | | 50.00 | 50.00 | | | | |

010083

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1183866 | 10000 | -- | -- | -- | -- | -- |
| SDev | 7009.549 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .5920895 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1188823 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1178910 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: icsa

Operator:

Run Time: 10/12/05 11:09:36

010084

Comment:

Mode: CONC Corr. Factor: 1

| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | -.0004 | 512.1 | .0033 | -.0146 | .0023 | -.0001 | .0011 |
| SDev | .0000 | .6 | .0006 | .0001 | .0000 | .0000 | .0001 |
| %RSD | .5085 | .1185 | 17.06 | .6600 | .8549 | 50.12 | 12.22 |

| | | | | | | | |
|----|--------|-------|-------|--------|-------|--------|-------|
| #1 | -.0004 | 512.6 | .0037 | -.0147 | .0023 | -.0001 | .0012 |
| #2 | -.0004 | 511.7 | .0029 | -.0146 | .0022 | -.0000 | .0010 |

| | | | | | | | |
|--------------|---------|---------|---------|---------|---------|---------|---------|
| Errors Value | NOCHECK | QC Pass | NOCHECK | NOCHECK | NOCHECK | NOCHECK | NOCHECK |
| Range | | 500.0 | | | | | |
| | | 20.00 | | | | | |

| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | 460.0 | -.0006 | .0005 | -.0003 | .0023 | 191.8 | .0175 |
| SDev | 1.0 | .0000 | .0006 | .0003 | .0007 | .4 | .0156 |
| %RSD | .2193 | 6.335 | 133.4 | 75.25 | 28.81 | .1855 | 89.35 |

| | | | | | | | |
|----|-------|--------|-------|--------|-------|-------|-------|
| #1 | 460.7 | -.0006 | .0000 | -.0005 | .0018 | 192.0 | .0285 |
| #2 | 459.2 | -.0006 | .0009 | -.0002 | .0028 | 191.5 | .0064 |

| | | | | | | | |
|--------------|---------|---------|---------|---------|---------|---------|---------|
| Errors Value | QC Pass | NOCHECK | NOCHECK | NOCHECK | NOCHECK | QC Pass | NOCHECK |
| Range | 500.0 | | | | | 200.0 | |
| | 20.00 | | | | | 20.00 | |

| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0036 | .0005 | 544.4 | -.0035 | -.0006 | .2348 | .0147 |
| SDev | .0002 | .0001 | 1.0 | .0000 | .0017 | .2106 | .0002 |
| %RSD | 6.526 | 12.92 | .1871 | 1.190 | 280.5 | 89.67 | 1.236 |

| | | | | | | | |
|----|-------|-------|-------|--------|--------|-------|-------|
| #1 | .0038 | .0005 | 545.1 | -.0036 | -.0018 | .3837 | .0148 |
| #2 | .0035 | .0004 | 543.7 | -.0035 | .0006 | .0859 | .0146 |

| | | | | | | | |
|--------------|---------|---------|---------|---------|---------|---------|---------|
| Errors Value | NOCHECK | NOCHECK | QC Pass | NOCHECK | NOCHECK | NOCHECK | NOCHECK |
| Range | | | 500.0 | | | | |
| | | | 20.00 | | | | |

| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0020 | -.0048 | .0284 | -.0276 | .0091 | .0055 | .0083 |
| SDev | .0005 | .0073 | .0024 | .0003 | .0012 | .0041 | .0023 |
| %RSD | 24.89 | 150.7 | 8.348 | 1.218 | 13.28 | 73.69 | 27.96 |

| | | | | | | | |
|----|-------|--------|-------|--------|-------|-------|-------|
| #1 | .0017 | .0003 | .0267 | -.0274 | .0099 | .0026 | .0066 |
| #2 | .0024 | -.0100 | .0301 | -.0279 | .0082 | .0084 | .0099 |

| | | | | | | | |
|--------------|---------|---------|---------|---------|---------|---------|---------|
| Errors Value | NOCHECK |
| Range | | | | | | | |

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

010085

| | | | | | | | |
|--------------------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 92.35 | .0080 | .0005 | -.0067 | -.0089 | .0030 | -.0035 |
| SDev | .44 | .0022 | .0042 | .0018 | .0006 | .0021 | .0008 |
| %RSD | .4744 | 27.84 | 813.6 | 26.02 | 6.325 | 69.04 | 23.30 |
| #1 | 92.04 | .0096 | -.0025 | -.0055 | -.0093 | .0015 | -.0029 |
| #2 | 92.66 | .0064 | .0035 | -.0080 | -.0085 | .0045 | -.0041 |
| Errors Value Range | NOCHECK |
| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
| Units | ppm |
| Avge | .0165 | .0273 | -.0011 | .0035 | .0195 | .0001 | .0013 |
| SDev | .0000 | .0006 | .0001 | .0026 | .0058 | .0004 | .0033 |
| %RSD | .0314 | 2.323 | 10.53 | 74.91 | 29.89 | 376.4 | 252.2 |
| #1 | .0165 | .0268 | -.0012 | .0016 | .0236 | -.0002 | .0036 |
| #2 | .0165 | .0277 | -.0010 | .0053 | .0154 | .0004 | -.0010 |
| Errors Value Range | NOCHECK |
| Elem | Y_3710 | Zn2062 | Zr3496 | | | | |
| Units | ppm | ppm | ppm | | | | |
| Avge | .0000 | .0070 | -.0000 | | | | |
| SDev | .0001 | .0003 | .0002 | | | | |
| %RSD | 1448. | 3.579 | 2002. | | | | |
| #1 | -.0001 | .0069 | .0001 | | | | |
| #2 | .0001 | .0072 | -.0001 | | | | |
| Errors Value Range | NOCHECK | NOCHECK | NOCHECK | | | | |

010086

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1071908 | 10000 | -- | -- | -- | -- | -- |
| SDev | 5072.784 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .4732481 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1068321 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1075495 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: icsab
 Run Time: 10/12/05 11:14:21
 Comment:
 Mode: CONC Corr. Factor: 1

Operator:

010087

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | 1.109 | 502.3 | 1.046 | 1.031 | .5346 | .4810 | .0018 |
| SDev | .002 | .9 | .001 | .002 | .0008 | .0002 | .0006 |
| %RSD | .1843 | .1846 | .0486 | .2128 | .1545 | .0363 | 34.48 |
| #1 | 1.110 | 503.0 | 1.046 | 1.029 | .5351 | .4809 | .0023 |
| #2 | 1.108 | 501.7 | 1.046 | 1.032 | .5340 | .4812 | .0014 |
| Errors | 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 |
| Avge | 448.8 | .9588 | .4841 | .4766 | .5586 | 187.5 | -.0292 |
| SDev | .0 | .0000 | .0008 | .0005 | .0000 | .1 | .0087 |
| %RSD | .0036 | .0027 | .1673 | .1098 | .0014 | .0312 | 29.68 |
| #1 | 448.8 | .9589 | .4847 | .4762 | .5586 | 187.5 | -.0353 |
| #2 | 448.8 | .9588 | .4835 | .4769 | .5586 | 187.6 | -.0231 |
| Errors | 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 |
| Avge | .0031 | 1.223 | 533.3 | .4897 | 1.016 | .2668 | .0001 |
| SDev | .0002 | .001 | .4 | .0006 | .002 | .0051 | .0000 |
| %RSD | 6.820 | .0946 | .0710 | .1125 | .1990 | 1.908 | 61.18 |
| #1 | .0029 | 1.223 | 533.1 | .4893 | 1.015 | .2704 | .0001 |
| #2 | .0032 | 1.222 | 533.6 | .4901 | 1.018 | .2632 | .0000 |
| 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 |
| Avge | .9434 | 1.019 | 1.004 | .9552 | .0049 | .0129 | 1.057 |
| SDev | .0007 | .011 | .006 | .0051 | .0008 | .0160 | .001 |
| %RSD | .0704 | 1.036 | .5626 | .5341 | 16.25 | 123.9 | .1045 |
| #1 | .9429 | 1.011 | 1.000 | .9588 | .0043 | .0242 | 1.058 |
| #2 | .9439 | 1.026 | 1.008 | .9516 | .0054 | .0016 | 1.056 |
| 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 |

010088

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 95.03 | 1.023 | 1.018 | 1.038 | .9716 | 1.020 | .9990 |
| SDev | .14 | .015 | .012 | .001 | .0015 | .003 | .0010 |
| %RSD | .1472 | 1.494 | 1.161 | .0615 | .1562 | .2733 | .1008 |
| #1 | 95.13 | 1.012 | 1.026 | 1.038 | .9727 | 1.022 | .9983 |
| #2 | 94.93 | 1.034 | 1.010 | 1.039 | .9705 | 1.018 | .9997 |
| 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 |
| Avge | 1.058 | .0258 | .9548 | .9968 | .9583 | .4989 | .0051 |
| SDev | .000 | .0018 | .0006 | .0060 | .0105 | .0001 | .0030 |
| %RSD | .0460 | 6.778 | .0605 | .5965 | 1.100 | .0184 | 58.13 |
| #1 | 1.059 | .0270 | .9552 | .9926 | .9658 | .4990 | .0030 |
| #2 | 1.058 | .0245 | .9544 | 1.001 | .9509 | .4988 | .0072 |
| 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 | -.0001 | .9644 | .9459 | | | | |
| SDev | .0001 | .0020 | .0019 | | | | |
| %RSD | 70.14 | .2100 | .1989 | | | | |
| #1 | -.0002 | .9630 | .9446 | | | | |
| #2 | -.0001 | .9659 | .9473 | | | | |
| Errors | NOCHECK | QC Pass | QC Pass | | | | |
| Value | | 1.000 | 1.000 | | | | |
| Range | | 20.00 | 20.00 | | | | |

010089

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1102906 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1554.221 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1409205 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1104005 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1101807 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: icv/ccv

Operator:

010090

Run Time: 10/12/05 11:22:49

Comment:

Mode: CONC Corr. Factor: 1

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | .9978 | 9.776 | 5.118 | 4.825 | 10.04 | .9748 | 4.996 |
| SDev | .0004 | .010 | .009 | .011 | .01 | .0008 | .013 |
| %RSD | .0405 | .1042 | .1833 | .2242 | .0506 | .0813 | .2520 |
| #1 | .9981 | 9.783 | 5.111 | 4.818 | 10.03 | .9754 | 5.005 |
| #2 | .9975 | 9.768 | 5.125 | 4.833 | 10.04 | .9742 | 4.988 |
| Errors | 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 |
| Avge | 19.87 | 1.007 | 5.059 | 1.952 | 2.032 | 9.770 | 18.85 |
| SDev | .01 | .001 | .002 | .000 | .004 | .000 | .06 |
| %RSD | .0715 | .0613 | .0486 | .0067 | .1942 | .0023 | .3116 |
| #1 | 19.86 | 1.006 | 5.061 | 1.952 | 2.035 | 9.770 | 18.81 |
| #2 | 19.88 | 1.007 | 5.057 | 1.952 | 2.029 | 9.771 | 18.89 |
| Errors | 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 |
| Avge | 4.910 | 4.806 | 20.01 | 1.012 | 5.031 | 28.55 | Q42.05 |
| SDev | .001 | .018 | .02 | .001 | .008 | .05 | .15 |
| %RSD | .0223 | .3790 | .1227 | .0649 | .1551 | .1831 | .3496 |
| #1 | 4.911 | 4.793 | 20.03 | 1.012 | 5.026 | 28.58 | Q41.95 |
| #2 | 4.909 | 4.819 | 19.99 | 1.011 | 5.037 | 28.51 | Q42.16 |
| Errors | 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 |
| Avge | 4.946 | 5.077 | 4.943 | 4.933 | 1.003 | 1.001 | 1.004 |
| SDev | .008 | .054 | .018 | .008 | .001 | .015 | .001 |
| %RSD | .1567 | 1.062 | .3696 | .1605 | .1275 | 1.464 | .1398 |
| #1 | 4.951 | 5.039 | 4.956 | 4.928 | 1.004 | .9902 | 1.005 |
| #2 | 4.940 | 5.115 | 4.930 | 4.939 | 1.002 | 1.011 | 1.003 |
| 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 |

010091

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 101.7 | 5.255 | 5.234 | 5.006 | 4.936 | 5.241 | 4.904 |
| SDev | .1 | .009 | .005 | .007 | .001 | .000 | .003 |
| %RSD | .0906 | .1712 | .0941 | .1446 | .0163 | .0054 | .0515 |
| #1 | 101.7 | 5.261 | 5.230 | 5.011 | 4.937 | 5.241 | 4.906 |
| #2 | 101.8 | 5.249 | 5.237 | 5.001 | 4.936 | 5.241 | 4.902 |
| 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 |
| Avge | 5.058 | .9681 | 4.787 | 5.194 | 1.096 | 4.955 | Q1.114 |
| SDev | .004 | .0009 | .000 | .018 | .015 | .004 | .001 |
| %RSD | .0740 | .0895 | .0006 | .3450 | 1.372 | .0841 | .0799 |
| #1 | 5.061 | .9687 | 4.787 | 5.182 | 1.085 | 4.958 | Q1.114 |
| #2 | 5.056 | .9675 | 4.787 | 5.207 | Q1.106 | 4.952 | Q1.115 |
| Errors | QC Pass | QC Fail |
| 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 | 5.016 | 1.012 | 4.878 | | | | |
| SDev | .001 | .002 | .008 | | | | |
| %RSD | .0166 | .1960 | .1573 | | | | |
| #1 | 5.016 | 1.011 | 4.884 | | | | |
| #2 | 5.017 | 1.014 | 4.873 | | | | |
| Errors | QC Pass | QC Pass | QC Pass | | | | |
| Value | 5.000 | 1.000 | 5.000 | | | | |
| Range | 10.00 | 10.00 | 10.00 | | | | |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1180768 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1191.475 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1009068 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1179925 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1181610 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: icb/ccb

Operator:

Run Time: 10/12/05 11:29:26

010093

Comment:

Mode: CONC Corr. Factor: 1

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0000 | .0018 | .0019 | .0077 | .0000 | -.0000 | .0056 |
| SDev | .0004 | .0016 | .0016 | .0000 | .0000 | .0000 | .0008 |
| %RSD | 852.0 | 89.65 | 85.99 | .2824 | 28.38 | 149.9 | 13.61 |
| #1 | -.0003 | .0030 | .0030 | .0077 | .0000 | .0000 | .0062 |
| #2 | .0002 | .0007 | .0007 | .0077 | .0001 | -.0000 | .0051 |
| Errors | 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 |
| Avge | .0008 | .0002 | .0006 | .0004 | .0002 | .0053 | -.0008 |
| SDev | .0004 | .0001 | .0001 | .0004 | .0001 | .0045 | .0085 |
| %RSD | 49.34 | 57.69 | 8.907 | 121.4 | 63.57 | 84.75 | 1082. |
| #1 | .0005 | .0003 | .0007 | .0001 | .0001 | .0021 | -.0068 |
| #2 | .0011 | .0001 | .0006 | .0007 | .0003 | .0085 | .0052 |
| Errors | 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 |
| Avge | -.0004 | .0001 | -.0023 | .0000 | .0031 | L-.1691 | .0161 |
| SDev | .0007 | .0000 | .0001 | .0000 | .0003 | .1772 | .0060 |
| %RSD | 191.9 | 17.10 | 2.139 | 101.6 | 10.64 | 104.8 | 37.34 |
| #1 | .0001 | .0001 | -.0023 | .0000 | .0034 | L-.2944 | .0118 |
| #2 | -.0009 | .0001 | -.0023 | .0000 | .0029 | -.0439 | .0204 |
| Errors | LC Pass | LC Low | 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 |
| Avge | .0008 | -.0051 | .0010 | .0001 | .0003 | H.0101 | .0049 |
| SDev | .0008 | .0080 | .0036 | .0009 | .0029 | .0017 | .0004 |
| %RSD | 100.1 | 156.7 | 366.6 | 1077. | 879.5 | 17.03 | 8.256 |
| #1 | .0013 | .0006 | -.0016 | .0007 | -.0017 | .0089 | .0046 |
| #2 | .0002 | L-.0107 | .0035 | -.0006 | .0024 | H.0113 | .0052 |
| Errors | LC Pass | LC Pass | NOCHECK | NOCHECK | LC Pass | LC High | LC Pass |
| High | .0050 | .0100 | | | .0050 | .0100 | .0100 |
| Low | -.0050 | -.0100 | | | -.0050 | -.0100 | -.0100 |
| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |

010094

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.4 | .0028 | -.0010 | -.0015 | .0004 | .0003 | .0022 |
| SDev | .1 | .0042 | .0016 | .0002 | .0006 | .0003 | .0004 |
| %RSD | .1251 | 150.0 | 159.3 | 12.09 | 144.3 | 122.9 | 20.43 |
| #1 | 102.3 | -.0002 | .0001 | -.0016 | -.0000 | .0000 | .0019 |
| #2 | 102.5 | .0057 | -.0021 | -.0013 | .0008 | .0005 | .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 |
| Avge | .0000 | -.0019 | .0001 | .0005 | .0136 | .0003 | .0020 |
| SDev | .0000 | .0006 | .0000 | .0008 | .0026 | .0007 | .0017 |
| %RSD | 39.94 | 32.92 | 20.24 | 154.8 | 19.08 | 266.6 | 87.50 |
| #1 | .0001 | -.0023 | .0001 | .0011 | .0155 | -.0002 | .0032 |
| #2 | .0000 | -.0014 | .0001 | -.0000 | .0118 | .0007 | .0007 |
| Errors | 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 | -.0000 | .0003 | | | | |
| SDev | .0000 | .0001 | .0001 | | | | |
| %RSD | 32.32 | 132.9 | 47.63 | | | | |
| #1 | .0001 | -.0001 | .0004 | | | | |
| #2 | .0001 | -.0000 | .0002 | | | | |
| Errors | LC Pass | LC Pass | LC Pass | | | | |
| High | .0050 | .0050 | .0050 | | | | |
| Low | -.0050 | -.0050 | -.0050 | | | | |

010095

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1188290 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1436.841 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1209167 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1187274 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1189306 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: pbw-K12H1

Operator:

010096

Run Time: 10/12/05 11:34:11

Comment:

Mode: CONC Corr. Factor: 1

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | .0005 | .0051 | -.0006 | .0037 | -.0000 | .0000 | .0022 |
| SDev | .0000 | .0011 | .0005 | .0006 | .0000 | .0000 | .0016 |
| %RSD | 7.452 | 21.83 | 85.78 | 17.21 | 139.0 | 48.66 | 72.41 |
| #1 | .0005 | .0043 | -.0002 | .0041 | -.0000 | .0000 | .0034 |
| #2 | .0006 | .0059 | -.0009 | .0032 | -.0001 | .0000 | .0011 |
| Errors | 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 |
| Avge | .0016 | .0003 | .0003 | .0003 | .0001 | .0127 | .0098 |
| SDev | .0001 | .0000 | .0001 | .0007 | .0002 | .0000 | .0063 |
| %RSD | 8.706 | 9.519 | 43.85 | 228.0 | 239.5 | .2342 | 64.63 |
| #1 | .0016 | .0003 | .0002 | .0008 | .0002 | .0127 | .0142 |
| #2 | .0015 | .0003 | .0004 | -.0002 | -.0000 | .0127 | .0053 |
| Errors | 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 |
| Avge | .0001 | .0001 | .0024 | .0000 | .0018 | H.1197 | .0215 |
| SDev | .0003 | .0000 | .0035 | .0001 | .0005 | .1487 | .0026 |
| %RSD | 202.3 | 3.816 | 144.9 | 4409. | 25.71 | 124.2 | 11.93 |
| #1 | -.0001 | .0001 | -.0001 | .0001 | .0021 | .0146 | .0197 |
| #2 | .0003 | .0001 | .0048 | -.0001 | .0015 | H.2249 | .0233 |
| Errors | 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 |
| Avge | .0003 | .0010 | -.0013 | .0001 | .0020 | .0048 | .0036 |
| SDev | .0005 | .0012 | .0022 | .0006 | .0007 | .0014 | .0005 |
| %RSD | 165.8 | 127.0 | 171.4 | 830.9 | 33.79 | 29.68 | 13.59 |
| #1 | .0007 | .0001 | .0003 | .0005 | .0025 | .0038 | .0040 |
| #2 | -.0001 | .0018 | -.0028 | -.0004 | .0015 | .0058 | .0033 |
| 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 |

010097

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.5 | .0009 | -.0004 | -.0001 | -.0004 | .0000 | .0019 |
| SDev | .3 | .0033 | .0016 | .0000 | .0011 | .0000 | .0006 |
| %RSD | .2888 | 370.6 | 401.1 | 33.59 | 318.4 | 32.31 | 30.32 |
| #1 | 102.3 | .0032 | -.0016 | -.0001 | .0004 | .0000 | .0015 |
| #2 | 102.7 | -.0014 | .0007 | -.0001 | -.0012 | .0000 | .0023 |
| 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 |
| Avge | .0000 | -.0003 | .0000 | .0021 | .0218 | -.0007 | .0020 |
| SDev | .0000 | .0009 | .0001 | .0027 | .0026 | .0004 | .0030 |
| %RSD | 83.03 | 307.4 | 471.0 | 132.6 | 11.88 | 52.83 | 149.0 |
| #1 | .0000 | -.0010 | .0001 | .0040 | .0236 | -.0004 | .0041 |
| #2 | .0000 | .0004 | -.0000 | .0001 | .0200 | -.0010 | -.0001 |
| Errors | 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 | .0001 | .0002 | | | | |
| SDev | .0001 | .0001 | .0004 | | | | |
| %RSD | 55.78 | 104.0 | 203.5 | | | | |
| #1 | .0001 | .0002 | .0004 | | | | |
| #2 | .0001 | .0000 | -.0001 | | | | |
| Errors | LC Pass | LC Pass | LC Pass | | | | |
| High | .0050 | .0050 | .0050 | | | | |
| Low | -.0050 | -.0050 | -.0050 | | | | |

010098

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1189404 | 10000 | -- | -- | -- | -- | -- |
| SDev | 3392.698 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .2852436 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1187005 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1191803 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: lcsw-K12H1

Operator:

Run Time: 10/12/05 11:38:57

010099

Comment:

Mode: CONC Corr. Factor: 1

| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0509 | 1.946 | 2.043 | .0031 | 2.001 | .0494 | .0004 |
| SDev | .0005 | .008 | .005 | .0002 | .002 | .0001 | .0024 |
| %RSD | .9969 | .4303 | .2237 | 6.963 | .0838 | .1381 | 612.2 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | .0505 | 1.940 | 2.046 | .0029 | 2.000 | .0494 | -.0013 |
| #2 | .0512 | 1.952 | 2.040 | .0032 | 2.002 | .0495 | .0021 |

| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | 20.00 | .0508 | .4987 | .1973 | .2505 | 1.091 | 17.69 |
| SDev | .01 | .0004 | .0016 | .0001 | .0003 | .016 | .03 |
| %RSD | .0556 | .7254 | .3143 | .0660 | .1232 | 1.469 | .1625 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 20.00 | .0506 | .4976 | .1972 | .2503 | 1.080 | 17.67 |
| #2 | 20.01 | .0511 | .4998 | .1974 | .2507 | 1.103 | 17.71 |

| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0000 | 3.651 | 20.03 | .5041 | .0003 | 18.08 | 27.11 |
| SDev | .0001 | .005 | .03 | .0006 | .0003 | .27 | .08 |
| %RSD | 615.7 | .1439 | .1526 | .1083 | 73.78 | 1.467 | .2859 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | .0000 | 3.648 | 20.00 | .5037 | .0002 | 17.89 | 27.06 |
| #2 | -.0000 | 3.655 | 20.05 | .5044 | .0005 | 18.27 | 27.17 |

| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .4938 | .0019 | .4993 | .4976 | .0023 | 4.140 | .5034 |
| SDev | .0029 | .0029 | .0073 | .0008 | .0010 | .001 | .0009 |
| %RSD | .5910 | 148.7 | 1.467 | .1632 | 41.15 | .0325 | .1854 |

| | | | | | | | |
|----|-------|--------|-------|-------|-------|-------|-------|
| #1 | .4917 | .0040 | .4941 | .4971 | .0030 | 4.139 | .5040 |
| #2 | .4958 | -.0001 | .5045 | .4982 | .0017 | 4.141 | .5027 |

| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 98.70 | 2.127 | 2.097 | 4.028 | .4982 | 2.107 | .0005 |
| SDev | .60 | .005 | .021 | .004 | .0030 | .012 | .0012 |
| %RSD | .6055 | .2489 | .9850 | .0875 | .5992 | .5698 | 257.0 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | 99.12 | 2.130 | 2.082 | 4.026 | .4961 | 2.098 | -.0004 |
| #2 | 98.28 | 2.123 | 2.111 | 4.031 | .5003 | 2.115 | .0013 |

| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0007 | -.0190 | .0000 | 2.075 | .0207 | .4934 | .0019 |
| SDev | .0000 | .0002 | .0001 | .001 | .0011 | .0009 | .0000 |
| %RSD | 4.099 | 1.046 | 290.0 | .0299 | 5.270 | .1755 | .9814 |

| | | | | | | | |
|----|-------|--------|--------|-------|-------|-------|-------|
| #1 | .0007 | -.0188 | .0001 | 2.075 | .0199 | .4927 | .0019 |
| #2 | .0007 | -.0191 | -.0000 | 2.074 | .0214 | .4940 | .0019 |

010100

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | -.0001 | .5025 | .0003 |
| SDev | .0001 | .0014 | .0001 |
| %RSD | 110.8 | .2811 | 29.66 |

| | | | |
|----|--------|-------|-------|
| #1 | -.0000 | .5015 | .0004 |
| #2 | -.0002 | .5035 | .0003 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1145520 | 10000 | -- | -- | -- | -- | -- |
| SDev | 6989.751 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .6101811 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1150463 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1140578 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268259
 Run Time: 10/12/05 11:43:45
 Comment:
 Mode: CONC Corr. Factor: 1

Operator:

010101

| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | -.0003 | .0269 | .0152 | .2244 | .0032 | -.0000 | .0034 |
| SDev | .0008 | .0026 | .0011 | .0009 | .0000 | .0000 | .0048 |
| %RSD | 314.4 | 9.738 | 7.508 | .4163 | .8306 | 2350. | 139.4 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|--------|-------|
| #1 | -.0009 | .0251 | .0160 | .2251 | .0032 | .0000 | .0000 |
| #2 | .0003 | .0288 | .0144 | .2237 | .0032 | -.0000 | .0068 |

| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | 5.271 | .0000 | .0003 | .0010 | -.0000 | .0157 | 3.954 |
| SDev | .011 | .0003 | .0003 | .0002 | .0005 | .0343 | .010 |
| %RSD | .2094 | 920.1 | 102.1 | 17.10 | 2228. | 218.2 | .2525 |

| | | | | | | | |
|----|-------|--------|-------|-------|--------|--------|-------|
| #1 | 5.263 | -.0002 | .0001 | .0011 | -.0004 | -.0085 | 3.947 |
| #2 | 5.279 | .0002 | .0005 | .0008 | .0003 | .0399 | 3.961 |

| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | -.0011 | .0929 | 1.013 | .0054 | .0442 | 102.9 | 133.9 |
| SDev | .0004 | .0006 | .012 | .0001 | .0005 | .2 | .8 |
| %RSD | 37.86 | .6083 | 1.178 | 1.087 | 1.134 | .1470 | .5763 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | -.0014 | .0933 | 1.005 | .0054 | .0439 | 103.0 | 134.4 |
| #2 | -.0008 | .0925 | 1.021 | .0055 | .0446 | 102.7 | 133.3 |

| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0006 | .0345 | .0026 | -.0002 | -.0032 | 13.60 | .0028 |
| SDev | .0006 | .0074 | .0023 | .0029 | .0081 | .10 | .0001 |
| %RSD | 111.8 | 21.35 | 87.34 | 1672. | 252.4 | .7344 | 4.854 |

| | | | | | | | |
|----|-------|-------|-------|--------|--------|-------|-------|
| #1 | .0010 | .0293 | .0010 | .0019 | -.0089 | 13.67 | .0027 |
| #2 | .0001 | .0397 | .0042 | -.0022 | .0025 | 13.53 | .0029 |

| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.2 | .0173 | .0006 | 21.62 | .0008 | .0062 | .0136 |
| SDev | .7 | .0034 | .0004 | .11 | .0012 | .0009 | .0006 |
| %RSD | .7057 | 19.84 | 61.04 | .5165 | 155.8 | 14.21 | 4.138 |

| | | | | | | | |
|----|-------|-------|-------|-------|--------|-------|-------|
| #1 | 102.7 | .0149 | .0009 | 21.70 | .0016 | .0056 | .0140 |
| #2 | 101.6 | .0198 | .0004 | 21.54 | -.0001 | .0068 | .0132 |

| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0397 | -.0016 | -.0002 | -.0077 | -.0185 | .0016 | .0066 |
| SDev | .0000 | .0008 | .0000 | .0009 | .0238 | .0001 | .0001 |
| %RSD | .0032 | 53.99 | 4.999 | 12.31 | 128.5 | 6.411 | 1.278 |

| | | | | | | | |
|----|-------|--------|--------|--------|--------|-------|-------|
| #1 | .0397 | -.0010 | -.0003 | -.0070 | -.0354 | .0017 | .0066 |
| #2 | .0397 | -.0022 | -.0002 | -.0083 | -.0017 | .0015 | .0065 |

010102

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | -.0000 | .0025 | -.0002 |
| SDev | .0000 | .0000 | .0001 |
| %RSD | 169.4 | .8331 | 37.46 |

| | | | |
|----|--------|-------|--------|
| #1 | -.0001 | .0025 | -.0003 |
| #2 | .0000 | .0025 | -.0002 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1185671 | 10000 | -- | -- | -- | -- | -- |
| SDev | 8377.801 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .7065873 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1191595 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1179747 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268259d
Run Time: 10/12/05 11:48:30
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010103

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0005 | .0502 | .0127 | .2261 | .0031 | -.0000 | -.0017 |
| SDev | .0005 | .0050 | .0029 | .0000 | .0001 | .0000 | .0015 |
| %RSD | 97.15 | 9.865 | 22.71 | .0115 | 2.425 | 64.58 | 84.30 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|--------|--------|
| #1 | -.0009 | .0467 | .0147 | .2261 | .0030 | -.0000 | -.0027 |
| #2 | -.0002 | .0537 | .0107 | .2260 | .0032 | -.0000 | -.0007 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
| Units | ppm |
| Avge | 5.261 | .0001 | .0002 | .0003 | -.0002 | .0121 | 3.968 |
| SDev | .014 | .0004 | .0009 | .0006 | .0004 | .0216 | .025 |
| %RSD | .2628 | 358.2 | 487.1 | 198.1 | 233.4 | 179.1 | .6288 |

| | | | | | | | |
|----|-------|--------|--------|--------|--------|--------|-------|
| #1 | 5.252 | -.0002 | -.0005 | -.0001 | -.0005 | -.0032 | 3.950 |
| #2 | 5.271 | .0004 | .0009 | .0008 | .0001 | .0274 | 3.986 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
| Units | ppm |
| Avge | -.0010 | .0932 | 1.013 | .0055 | .0444 | 103.2 | 133.8 |
| SDev | .0010 | .0001 | .009 | .0000 | .0004 | .2 | .3 |
| %RSD | 100.8 | .0599 | .9092 | .1708 | .8869 | .1568 | .1998 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | -.0017 | .0932 | 1.007 | .0055 | .0442 | 103.0 | 134.0 |
| #2 | -.0003 | .0932 | 1.020 | .0054 | .0447 | 103.3 | 133.6 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
| Units | ppm |
| Avge | -.0001 | .0279 | .0039 | .0005 | -.0042 | 13.61 | .0041 |
| SDev | .0003 | .0147 | .0013 | .0003 | .0057 | .11 | .0022 |
| %RSD | 324.1 | 52.66 | 33.76 | 53.64 | 136.6 | .8210 | 54.86 |

| | | | | | | | |
|----|--------|-------|-------|-------|--------|-------|-------|
| #1 | -.0004 | .0384 | .0049 | .0003 | -.0082 | 13.69 | .0025 |
| #2 | .0001 | .0175 | .0030 | .0007 | -.0001 | 13.53 | .0057 |

| | | | | | | | |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.7 | .0186 | .0018 | 21.64 | .0017 | .0074 | .0137 |
| SDev | .1 | .0005 | .0029 | .06 | .0003 | .0021 | .0008 |
| %RSD | .1384 | 2.658 | 160.7 | .2888 | 15.45 | 28.20 | 5.824 |

| | | | | | | | |
|----|-------|-------|--------|-------|-------|-------|-------|
| #1 | 102.6 | .0182 | -.0002 | 21.69 | .0018 | .0059 | .0131 |
| #2 | 102.8 | .0189 | .0038 | 21.60 | .0015 | .0089 | .0143 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
| Units | ppm |
| Avge | .0397 | -.0021 | -.0002 | -.0077 | -.0110 | .0015 | .0054 |
| SDev | .0001 | .0017 | .0000 | .0001 | .0397 | .0000 | .0010 |
| %RSD | .1487 | 83.36 | 10.37 | .8618 | 359.9 | 1.488 | 19.25 |

| | | | | | | | |
|----|-------|--------|--------|--------|--------|-------|-------|
| #1 | .0397 | -.0008 | -.0002 | -.0077 | -.0391 | .0015 | .0046 |
| #2 | .0398 | -.0033 | -.0002 | -.0076 | .0170 | .0016 | .0061 |

010104

| Elem | Y_3710 | Zn2062 | Zr3496 |
|-------|--------|--------|--------|
| Units | ppm | ppm | ppm |
| Avge | .0000 | .0027 | -.0003 |
| SDev | .0000 | .0002 | .0003 |
| %RSD | 240.9 | 7.867 | 95.40 |

| | | | |
|----|--------|-------|--------|
| #1 | -.0000 | .0026 | -.0005 |
| #2 | .0000 | .0029 | -.0001 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1192042 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1749.382 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1467551 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1190805 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1193279 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268259L df5
Run Time: 10/12/05 11:53:16
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010105

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0002 | .0200 | .0033 | .0465 | .0006 | -.0000 | .0008 |
| SDev | .0010 | .0119 | .0017 | .0017 | .0001 | .0000 | .0059 |
| %RSD | 550.9 | 59.53 | 52.12 | 3.584 | 24.39 | 77.00 | 762.5 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|--------|--------|
| #1 | -.0009 | .0116 | .0021 | .0476 | .0007 | -.0000 | -.0034 |
| #2 | .0005 | .0285 | .0045 | .0453 | .0005 | -.0000 | .0050 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
| Units | ppm |
| Avge | 1.048 | .0001 | .0001 | .0004 | .0004 | .0042 | .5168 |
| SDev | .004 | .0002 | .0010 | .0012 | .0010 | .0220 | .0232 |
| %RSD | .4231 | 222.3 | 1710. | 270.1 | 240.8 | 520.8 | 4.498 |

| | | | | | | | |
|----|-------|--------|--------|--------|--------|--------|-------|
| #1 | 1.044 | -.0001 | -.0006 | .0013 | .0011 | -.0113 | .5004 |
| #2 | 1.051 | .0003 | .0007 | -.0004 | -.0003 | .0197 | .5332 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
| Units | ppm |
| Avge | -.0008 | .0165 | .1993 | .0010 | .0099 | 17.07 | 23.50 |
| SDev | .0016 | .0000 | .0130 | .0002 | .0017 | .21 | .04 |
| %RSD | 199.0 | .0538 | 6.522 | 15.68 | 17.57 | 1.246 | .1741 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | -.0019 | .0165 | .1901 | .0011 | .0111 | 16.92 | 23.52 |
| #2 | .0003 | .0165 | .2085 | .0009 | .0086 | 17.22 | 23.47 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
| Units | ppm |
| Avge | .0004 | .0077 | -.0003 | -.0007 | -.0021 | 2.691 | .0021 |
| SDev | .0000 | .0028 | .0080 | .0064 | .0062 | .002 | .0042 |
| %RSD | 6.488 | 36.61 | 2879. | 869.7 | 295.9 | .0616 | 202.9 |

| | | | | | | | |
|----|-------|-------|--------|--------|--------|-------|--------|
| #1 | .0004 | .0097 | -.0059 | .0038 | -.0065 | 2.692 | .0050 |
| #2 | .0003 | .0057 | .0054 | -.0052 | .0023 | 2.690 | -.0009 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|-------|--------|
| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 101.5 | .0074 | .0029 | 4.375 | -.0006 | .0044 | .0029 |
| SDev | .4 | .0043 | .0018 | .008 | .0016 | .0003 | .0013 |
| %RSD | .3918 | 58.18 | 61.28 | .1732 | 280.2 | 5.819 | 44.90 |

| | | | | | | | |
|----|-------|-------|-------|-------|--------|-------|-------|
| #1 | 101.8 | .0044 | .0041 | 4.370 | .0006 | .0042 | .0020 |
| #2 | 101.2 | .0105 | .0016 | 4.380 | -.0017 | .0046 | .0038 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
| Units | ppm |
| Avge | .0080 | -.0012 | -.0002 | -.0019 | .0001 | -.0001 | .0008 |
| SDev | .0001 | .0053 | .0003 | .0016 | .0513 | .0010 | .0041 |
| %RSD | .7980 | 438.6 | 151.5 | 81.94 | 53930. | 712.4 | 543.7 |

| | | | | | | | |
|----|-------|--------|--------|--------|--------|--------|--------|
| #1 | .0079 | .0026 | .0000 | -.0030 | -.0362 | .0006 | -.0022 |
| #2 | .0080 | -.0050 | -.0004 | -.0008 | .0364 | -.0008 | .0037 |

010106

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | .0000 | .0005 | -.0003 |
| SDev | .0002 | .0002 | .0009 |
| %RSD | 386.7 | 42.06 | 301.4 |

| | | | |
|----|--------|-------|--------|
| #1 | .0002 | .0004 | .0003 |
| #2 | -.0001 | .0007 | -.0009 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1178204 | 10000 | -- | -- | -- | -- | -- |
| SDev | 4700.846 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .3989840 | .0000000 | -- | -- | -- | -- | -- |

| | | | | | | | |
|----|---------|-------|----|----|----|----|----|
| #1 | 1181528 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1174880 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268259s

Operator: **010107**

Run Time: 10/12/05 11:58:03

Comment:

Mode: CONC Corr. Factor: 1

| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0481 | 2.047 | 2.112 | .2218 | 2.007 | .0490 | -.0011 |
| SDev | .0011 | .004 | .000 | .0008 | .010 | .0002 | .0026 |
| %RSD | 2.208 | .2040 | .0109 | .3558 | .5116 | .3610 | 236.2 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | .0488 | 2.050 | 2.112 | .2224 | 2.000 | .0491 | .0007 |
| #2 | .0473 | 2.044 | 2.112 | .2212 | 2.014 | .0488 | -.0029 |

| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | 25.03 | .0511 | .5053 | .1976 | .2582 | 1.101 | 28.27 |
| SDev | .07 | .0002 | .0015 | .0011 | .0008 | .008 | .16 |
| %RSD | .2709 | .4021 | .2983 | .5723 | .3059 | .7679 | .5819 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 25.07 | .0512 | .5063 | .1984 | .2576 | 1.107 | 28.15 |
| #2 | 24.98 | .0509 | .5042 | .1968 | .2587 | 1.095 | 28.38 |

| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | -.0005 | 4.029 | 20.98 | .5095 | .0428 | 128.0 | 167.0 |
| SDev | .0010 | .016 | .05 | .0009 | .0008 | .1 | .0 |
| %RSD | 192.1 | .3974 | .2422 | .1782 | 1.848 | .0541 | .0210 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | .0002 | 4.018 | 21.02 | .5102 | .0434 | 128.0 | 167.0 |
| #2 | -.0012 | 4.040 | 20.95 | .5089 | .0423 | 128.1 | 167.1 |

| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .4978 | .0313 | .5064 | .5035 | -.0021 | 17.68 | .5198 |
| SDev | .0006 | .0064 | .0023 | .0036 | .0020 | .01 | .0004 |
| %RSD | .1110 | 20.39 | .4592 | .7205 | 95.40 | .0337 | .0743 |

| | | | | | | | |
|----|-------|-------|-------|-------|--------|-------|-------|
| #1 | .4982 | .0268 | .5081 | .5061 | -.0007 | 17.68 | .5195 |
| #2 | .4974 | .0358 | .5048 | .5009 | -.0035 | 17.68 | .5200 |

| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 101.9 | 2.303 | 2.294 | 25.62 | .5045 | 2.297 | .0128 |
| SDev | .8 | .020 | .008 | .05 | .0032 | .012 | .0015 |
| %RSD | .7891 | .8779 | .3684 | .2017 | .6326 | .5387 | 11.57 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 101.4 | 2.317 | 2.300 | 25.66 | .5067 | 2.306 | .0139 |
| #2 | 102.5 | 2.289 | 2.288 | 25.59 | .5022 | 2.288 | .0118 |

| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0396 | -.0220 | -.0003 | 2.102 | .0042 | .4991 | .0063 |
| SDev | .0001 | .0015 | .0002 | .000 | .0319 | .0019 | .0034 |
| %RSD | .1321 | 6.945 | 71.86 | .0022 | 755.5 | .3737 | 53.59 |

| | | | | | | | |
|----|-------|--------|--------|-------|--------|-------|-------|
| #1 | .0395 | -.0209 | -.0001 | 2.102 | .0268 | .5004 | .0087 |
| #2 | .0396 | -.0231 | -.0004 | 2.102 | -.0183 | .4978 | .0039 |

010108

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | -.0001 | .5175 | -.0003 |
| SDev | .0001 | .0022 | .0008 |
| %RSD | 104.8 | .4304 | 298.7 |

| | | | |
|----|--------|-------|--------|
| #1 | -.0000 | .5191 | .0003 |
| #2 | -.0002 | .5159 | -.0008 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1182874 | 10000 | -- | -- | -- | -- | -- |
| SDev | 9389.671 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .7938011 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1176235 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1189514 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268260
Run Time: 10/12/05 12:02:50
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010109

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | .0002 | .3486 | .0137 | .1767 | .0116 | .0002 | -.0021 |
| SDev | .0002 | .0012 | .0006 | .0008 | .0001 | .0000 | .0058 |
| %RSD | 106.9 | .3359 | 4.413 | .4624 | .6054 | 9.471 | 273.4 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | .0001 | .3478 | .0142 | .1772 | .0117 | .0002 | -.0063 |
| #2 | .0004 | .3494 | .0133 | .1761 | .0116 | .0002 | .0020 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
| Units | ppm |
| Avge | 3.837 | -.0001 | .0006 | .0026 | .0011 | .5633 | 2.862 |
| SDev | .000 | .0000 | .0006 | .0001 | .0001 | .0067 | .039 |
| %RSD | .0113 | 25.90 | 95.29 | 5.344 | 8.769 | 1.182 | 1.375 |

| | | | | | | | |
|----|-------|--------|-------|-------|-------|-------|-------|
| #1 | 3.837 | -.0001 | .0002 | .0027 | .0010 | .5586 | 2.834 |
| #2 | 3.837 | -.0001 | .0010 | .0025 | .0012 | .5680 | 2.890 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
| Units | ppm |
| Avge | -.0002 | .0776 | .4132 | .0115 | .0450 | 108.1 | 139.3 |
| SDev | .0009 | .0001 | .0018 | .0001 | .0014 | .3 | .1 |
| %RSD | 512.8 | .1582 | .4296 | .8355 | 3.005 | .2942 | .0828 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | -.0008 | .0775 | .4120 | .0114 | .0441 | 107.9 | 139.2 |
| #2 | .0004 | .0777 | .4145 | .0116 | .0460 | 108.3 | 139.4 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
| Units | ppm |
| Avge | .0009 | .0580 | .0044 | .0026 | -.0026 | 15.65 | .0044 |
| SDev | .0006 | .0083 | .0008 | .0022 | .0031 | .00 | .0020 |
| %RSD | 63.07 | 14.29 | 17.06 | 87.11 | 120.0 | .0065 | 45.69 |

| | | | | | | | |
|----|-------|-------|-------|-------|--------|-------|-------|
| #1 | .0013 | .0521 | .0039 | .0042 | -.0047 | 15.65 | .0058 |
| #2 | .0005 | .0638 | .0050 | .0010 | -.0004 | 15.65 | .0030 |

| | | | | | | | |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 103.1 | .0156 | -.0002 | 19.91 | .0032 | .0051 | .0129 |
| SDev | .3 | .0018 | .0033 | .06 | .0013 | .0016 | .0005 |
| %RSD | .3379 | 11.65 | 1459. | .3188 | 38.81 | 32.10 | 4.149 |

| | | | | | | | |
|----|-------|-------|--------|-------|-------|-------|-------|
| #1 | 102.9 | .0143 | .0021 | 19.96 | .0041 | .0062 | .0133 |
| #2 | 103.3 | .0169 | -.0026 | 19.87 | .0023 | .0039 | .0125 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
| Units | ppm |
| Avge | .0275 | -.0010 | .0010 | -.0084 | -.0014 | .0018 | -.0020 |
| SDev | .0001 | .0022 | .0001 | .0032 | .0341 | .0002 | .0000 |
| %RSD | .2900 | 226.7 | 13.89 | 38.19 | 2375. | 9.489 | 1.650 |

| | | | | | | | |
|----|-------|--------|-------|--------|--------|-------|--------|
| #1 | .0275 | .0006 | .0011 | -.0107 | -.0256 | .0019 | -.0020 |
| #2 | .0276 | -.0025 | .0009 | -.0061 | .0227 | .0016 | -.0020 |

010110

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | .0001 | .0153 | -.0000 |
| SDev | .0001 | .0000 | .0002 |
| %RSD | 42.83 | .0889 | 437.1 |

| | | | |
|----|-------|-------|--------|
| #1 | .0002 | .0153 | -.0002 |
| #2 | .0001 | .0153 | .0001 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1196510 | 10000 | -- | -- | -- | -- | -- |
| SDev | 4121.019 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .3444199 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1193596 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1199424 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268261

Operator:

Run Time: 10/12/05 12:07:36

Comment:

010111

Mode: CONC Corr. Factor: 1

| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | -.0001 | .2042 | .0169 | .1978 | .0080 | .0001 | .0019 |
| SDev | .0004 | .0060 | .0005 | .0009 | .0000 | .0000 | .0007 |
| %RSD | 760.7 | 2.938 | 2.842 | .4698 | .0952 | 2.071 | 36.57 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | -.0003 | .2085 | .0166 | .1985 | .0080 | .0001 | .0014 |
| #2 | .0002 | .2000 | .0172 | .1972 | .0080 | .0001 | .0024 |

| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | 4.148 | -.0000 | .0005 | -.0001 | .0003 | .2730 | 4.571 |
| SDev | .018 | .0000 | .0002 | .0004 | .0003 | .0355 | .032 |
| %RSD | .4333 | 4494. | 34.65 | 388.8 | 120.1 | 13.01 | .6910 |

| | | | | | | | |
|----|-------|--------|-------|--------|-------|-------|-------|
| #1 | 4.136 | .0000 | .0006 | .0002 | .0000 | .2479 | 4.549 |
| #2 | 4.161 | -.0000 | .0004 | -.0004 | .0005 | .2981 | 4.594 |

| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | -.0005 | .0618 | .2861 | .0033 | .0056 | 97.80 | 127.0 |
| SDev | .0001 | .0001 | .0000 | .0000 | .0007 | .38 | .2 |
| %RSD | 21.72 | .0740 | .0027 | 1.067 | 12.36 | .3851 | .1948 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | -.0006 | .0618 | .2861 | .0033 | .0061 | 97.53 | 126.8 |
| #2 | -.0004 | .0619 | .2861 | .0032 | .0052 | 98.06 | 127.2 |

| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0011 | .0783 | .0027 | .0020 | -.0036 | 9.662 | .0050 |
| SDev | .0008 | .0048 | .0007 | .0007 | .0052 | .063 | .0032 |
| %RSD | 72.79 | 6.171 | 24.95 | 37.68 | 143.9 | .6527 | 64.55 |

| | | | | | | | |
|----|-------|-------|-------|-------|--------|-------|-------|
| #1 | .0005 | .0817 | .0022 | .0014 | -.0073 | 9.707 | .0073 |
| #2 | .0017 | .0749 | .0032 | .0025 | .0001 | 9.618 | .0027 |

| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 103.9 | .0165 | .0011 | 33.74 | .0022 | .0062 | .0112 |
| SDev | 1.3 | .0048 | .0005 | .05 | .0007 | .0013 | .0006 |
| %RSD | 1.217 | 29.40 | 45.08 | .1557 | 32.37 | 20.52 | 5.718 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 104.8 | .0130 | .0015 | 33.78 | .0017 | .0053 | .0108 |
| #2 | 103.0 | .0199 | .0008 | 33.71 | .0027 | .0071 | .0117 |

| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0303 | -.0032 | .0005 | -.0080 | .0100 | .0050 | -.0007 |
| SDev | .0000 | .0013 | .0001 | .0002 | .0004 | .0005 | .0008 |
| %RSD | .0054 | 41.00 | 12.11 | 2.164 | 4.110 | 9.593 | 116.6 |

| | | | | | | | |
|----|-------|--------|-------|--------|-------|-------|--------|
| #1 | .0303 | -.0041 | .0005 | -.0081 | .0097 | .0053 | -.0012 |
| #2 | .0303 | -.0023 | .0004 | -.0079 | .0103 | .0046 | -.0001 |

010112

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | .0006 | .0045 | -.0004 |
| SDev | .0000 | .0001 | .0000 |
| %RSD | 4.992 | 2.157 | 4.241 |

| | | | |
|----|-------|-------|--------|
| #1 | .0006 | .0044 | -.0004 |
| #2 | .0006 | .0046 | -.0004 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1205954 | 10000 | -- | -- | -- | -- | -- |
| SDev | 14715.60 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | 1.220246 | .0000000 | -- | -- | -- | -- | -- |

| | | | | | | | |
|----|---------|-------|----|----|----|----|----|
| #1 | 1216359 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1195548 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268262
Run Time: 10/12/05 12:12:22
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010113

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avg | .0000 | .0013 | .0084 | .1607 | .0068 | -.0000 | -.0016 |
| SDev | .0000 | .0022 | .0002 | .0015 | .0001 | .0000 | .0025 |
| %RSD | 132.5 | 160.9 | 2.586 | .9219 | 1.384 | 96.32 | 163.5 |

| | | | | | | | |
|----|-------|--------|-------|-------|-------|--------|--------|
| #1 | .0001 | -.0002 | .0086 | .1617 | .0069 | -.0000 | -.0034 |
| #2 | .0000 | .0029 | .0083 | .1596 | .0067 | -.0000 | .0002 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
| Units | ppm |
| Avg | 15.85 | .0001 | .0005 | .0015 | -.0001 | -.0025 | 3.217 |
| SDev | .00 | .0001 | .0001 | .0004 | .0001 | .0022 | .018 |
| %RSD | .0150 | 104.8 | 14.47 | 24.40 | 93.29 | 85.81 | .5729 |

| | | | | | | | |
|----|-------|-------|-------|-------|--------|--------|-------|
| #1 | 15.85 | .0002 | .0005 | .0018 | -.0000 | -.0010 | 3.204 |
| #2 | 15.85 | .0000 | .0006 | .0013 | -.0002 | -.0040 | 3.230 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
| Units | ppm |
| Avg | -.0007 | .0450 | 1.101 | .0003 | .0068 | 49.87 | 67.25 |
| SDev | .0006 | .0000 | .003 | .0001 | .0006 | .06 | .04 |
| %RSD | 90.42 | .0704 | .3154 | 17.13 | 8.012 | .1250 | .0572 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | -.0002 | .0450 | 1.098 | .0002 | .0064 | 49.82 | 67.22 |
| #2 | -.0011 | .0450 | 1.103 | .0003 | .0072 | 49.91 | 67.27 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
| Units | ppm |
| Avg | -.0003 | .0158 | .0008 | .0014 | -.0025 | 8.535 | .0052 |
| SDev | .0005 | .0052 | .0008 | .0024 | .0016 | .060 | .0041 |
| %RSD | 157.9 | 32.81 | 100.4 | 172.9 | 63.37 | .7037 | 79.44 |

| | | | | | | | |
|----|--------|-------|-------|--------|--------|-------|-------|
| #1 | .0000 | .0121 | .0002 | .0032 | -.0037 | 8.578 | .0023 |
| #2 | -.0006 | .0194 | .0014 | -.0003 | -.0014 | 8.493 | .0081 |

| | | | | | | | |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avg | 102.8 | .0165 | .0006 | 24.46 | .0012 | .0059 | .0091 |
| SDev | .3 | .0023 | .0002 | .06 | .0014 | .0009 | .0007 |
| %RSD | .3181 | 13.72 | 31.08 | .2619 | 110.9 | 14.87 | 7.669 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 103.0 | .0149 | .0005 | 24.51 | .0022 | .0053 | .0086 |
| #2 | 102.5 | .0181 | .0007 | 24.42 | .0003 | .0065 | .0096 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
| Units | ppm |
| Avg | .0440 | -.0021 | -.0004 | -.0014 | -.0004 | .0031 | -.0033 |
| SDev | .0000 | .0015 | .0002 | .0034 | .0137 | .0002 | .0026 |
| %RSD | .0830 | 72.62 | 36.91 | 235.8 | 3800. | 7.058 | 79.75 |

| | | | | | | | |
|----|-------|--------|--------|--------|--------|-------|--------|
| #1 | .0440 | -.0010 | -.0003 | -.0038 | -.0101 | .0030 | -.0052 |
| #2 | .0439 | -.0032 | -.0005 | .0010 | .0094 | .0033 | -.0014 |

010114

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | -.0001 | .0018 | -.0004 |
| SDev | .0001 | .0001 | .0000 |
| %RSD | 49.25 | 7.303 | 4.091 |

| | | | |
|----|--------|-------|--------|
| #1 | -.0001 | .0019 | -.0004 |
| #2 | -.0001 | .0017 | -.0005 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1192726 | 10000 | -- | -- | -- | -- | -- |
| SDev | 3866.460 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .3241700 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1195460 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1189992 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268263

Operator:

Run Time: 10/12/05 12:17:16

Comment:

010115

Mode: CONC Corr. Factor: 1

| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | -.0006 | -.0001 | .0109 | .1498 | .0042 | .0000 | -.0027 |
| SDev | .0003 | .0033 | .0005 | .0014 | .0001 | .0000 | .0013 |
| %RSD | 56.15 | 3848. | 4.872 | .9239 | 1.249 | 1629. | 48.33 |

| | | | | | | | |
|----|--------|--------|-------|-------|-------|--------|--------|
| #1 | -.0004 | .0023 | .0105 | .1508 | .0042 | -.0000 | -.0036 |
| #2 | -.0008 | -.0025 | .0113 | .1488 | .0041 | .0000 | -.0018 |

| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | 15.45 | -.0003 | .0002 | .0007 | .0000 | -.0072 | 4.107 |
| SDev | .00 | .0004 | .0001 | .0010 | .0005 | .0117 | .019 |
| %RSD | .0095 | 167.1 | 29.53 | 135.9 | 5458. | 161.5 | .4637 |

| | | | | | | | |
|----|-------|--------|-------|-------|--------|--------|-------|
| #1 | 15.45 | .0000 | .0002 | .0014 | .0004 | -.0155 | 4.093 |
| #2 | 15.45 | -.0006 | .0002 | .0000 | -.0003 | .0010 | 4.120 |

| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | -.0015 | .0412 | 1.276 | .0001 | .0022 | 45.20 | 61.65 |
| SDev | .0006 | .0000 | .001 | .0001 | .0000 | .05 | .25 |
| %RSD | 40.10 | .1073 | .1037 | 122.6 | .3876 | .1214 | .3999 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|-------|
| #1 | -.0011 | .0412 | 1.275 | .0001 | .0022 | 45.16 | 61.82 |
| #2 | -.0020 | .0412 | 1.276 | .0000 | .0022 | 45.24 | 61.47 |

| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0004 | .0234 | .0022 | .0011 | -.0044 | 7.473 | .0011 |
| SDev | .0001 | .0055 | .0024 | .0015 | .0054 | .046 | .0001 |
| %RSD | 21.87 | 23.64 | 109.9 | 143.5 | 124.8 | .6122 | 5.413 |

| | | | | | | | |
|----|-------|-------|-------|--------|--------|-------|-------|
| #1 | .0003 | .0195 | .0039 | -.0000 | -.0082 | 7.505 | .0011 |
| #2 | .0005 | .0274 | .0005 | .0021 | -.0005 | 7.441 | .0011 |

| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.7 | .0128 | -.0025 | 27.38 | .0014 | .0026 | .0082 |
| SDev | .5 | .0073 | .0040 | .12 | .0002 | .0002 | .0001 |
| %RSD | .5074 | 56.81 | 158.0 | .4553 | 14.76 | 8.844 | .8391 |

| | | | | | | | |
|----|-------|-------|--------|-------|-------|-------|-------|
| #1 | 102.3 | .0179 | -.0053 | 27.47 | .0013 | .0024 | .0083 |
| #2 | 103.1 | .0077 | .0003 | 27.30 | .0016 | .0028 | .0082 |

| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .0639 | -.0040 | -.0005 | -.0046 | -.0183 | .0054 | -.0024 |
| SDev | .0001 | .0007 | .0001 | .0014 | .0192 | .0008 | .0015 |
| %RSD | .1538 | 17.33 | 28.93 | 29.45 | 104.7 | 15.94 | 65.12 |

| | | | | | | | |
|----|-------|--------|--------|--------|--------|-------|--------|
| #1 | .0638 | -.0035 | -.0004 | -.0037 | -.0048 | .0060 | -.0013 |
| #2 | .0640 | -.0044 | -.0005 | -.0056 | -.0319 | .0048 | -.0035 |

010116

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | -.0001 | .0017 | -.0003 |
| SDev | .0001 | .0001 | .0005 |
| %RSD | 76.57 | 2.892 | 150.3 |

| | | | |
|----|--------|-------|--------|
| #1 | -.0001 | .0017 | .0000 |
| #2 | -.0002 | .0017 | -.0007 |

| | | | | | | | |
|--------|----------|----------|---------|---------|---------|---------|---------|
| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1192050 | 10000 | -- | -- | -- | -- | -- |
| SDev | 6022.428 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .5052163 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1187791 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1196308 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: ccv2
Run Time: 10/12/05 12:26:12
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010117

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avg | .9946 | 9.767 | 5.118 | 4.825 | 10.01 | .9705 | 4.993 |
| SDev | .0012 | .033 | .021 | .026 | .02 | .0003 | .014 |
| %RSD | .1218 | .3386 | .4160 | .5483 | .2061 | .0315 | .2787 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | .9937 | 9.743 | 5.103 | 4.806 | 9.992 | .9702 | 4.983 |
| #2 | .9954 | 9.790 | 5.133 | 4.844 | 10.02 | .9707 | 5.003 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avg | 19.76 | 1.002 | 5.031 | 1.945 | 2.035 | 9.735 | 18.92 |
| SDev | .02 | .004 | .006 | .004 | .006 | .006 | .09 |
| %RSD | .1072 | .4129 | .1155 | .1943 | .3054 | .0625 | .4522 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 19.77 | 1.005 | 5.035 | 1.948 | 2.030 | 9.740 | 18.86 |
| #2 | 19.74 | .9987 | 5.027 | 1.943 | 2.039 | 9.731 | 18.98 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avg | 4.905 | 4.790 | 19.87 | 1.008 | 5.019 | 28.47 | H41.90 |
| SDev | .009 | .002 | .00 | .001 | .011 | .11 | .13 |
| %RSD | .1817 | .0410 | .0176 | .1012 | .2139 | .3733 | .2991 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | 4.899 | 4.788 | 19.87 | 1.009 | 5.011 | 28.54 | H41.81 |
| #2 | 4.912 | 4.791 | 19.87 | 1.008 | 5.026 | 28.39 | H41.99 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avg | 4.927 | 5.111 | 4.916 | 4.907 | 1.001 | 1.014 | 1.004 |
| SDev | .020 | .070 | .039 | .025 | .002 | .001 | .004 |
| %RSD | .4061 | 1.365 | .7882 | .5101 | .1770 | .1260 | .3753 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 4.942 | 5.061 | 4.943 | 4.925 | .9998 | 1.013 | 1.007 |
| #2 | 4.913 | 5.160 | 4.888 | 4.889 | 1.002 | 1.015 | 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 |
|------|--------|--------|--------|--------|-------|-------|--------|

010118

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 101.8 | 5.232 | 5.219 | 4.981 | 4.910 | 5.224 | 4.896 |
| SDev | .3 | .030 | .031 | .005 | .030 | .030 | .005 |
| %RSD | .2886 | .5728 | .5891 | .1016 | .6028 | .5837 | .0922 |
| #1 | 101.6 | 5.254 | 5.241 | 4.978 | 4.931 | 5.245 | 4.899 |
| #2 | 102.0 | 5.211 | 5.198 | 4.985 | 4.889 | 5.202 | 4.893 |
| 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 |
| Avge | 5.049 | .9656 | 4.780 | 5.184 | 1.077 | 4.931 | H1.110 |
| SDev | .010 | .0015 | .004 | .009 | .016 | .002 | .003 |
| %RSD | .2031 | .1522 | .0937 | .1831 | 1.495 | .0487 | .2817 |
| #1 | 5.042 | .9666 | 4.777 | 5.177 | 1.088 | 4.929 | H1.112 |
| #2 | 5.056 | .9645 | 4.783 | 5.190 | 1.066 | 4.932 | H1.108 |
| Errors | LC Pass | LC High |
| 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 | 5.006 | 1.006 | 4.884 | | | | |
| SDev | .007 | .003 | .012 | | | | |
| %RSD | .1389 | .2659 | .2533 | | | | |
| #1 | 5.001 | 1.008 | 4.875 | | | | |
| #2 | 5.011 | 1.004 | 4.892 | | | | |
| Errors | LC Pass | LC Pass | LC Pass | | | | |
| High | 5.500 | 1.100 | 5.500 | | | | |
| Low | 4.500 | .9000 | 4.500 | | | | |

010119
7

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1181816 | 10000 | -- | -- | -- | -- | -- |
| SDev | 3368.657 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .2850407 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1179434 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1184198 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: ccb2
Run Time: 10/12/05 12:33:01
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010120

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0004 | -.0001 | -.0015 | .0055 | -.0000 | .0000 | .0001 |
| SDev | .0005 | .0002 | .0006 | .0013 | .0000 | .0000 | .0004 |
| %RSD | 148.0 | 169.2 | 40.31 | 23.10 | 45.89 | 125.9 | 361.2 |

| | | | | | | | |
|----|--------|--------|--------|-------|--------|-------|--------|
| #1 | .0000 | -.0002 | -.0019 | .0064 | -.0000 | .0000 | .0004 |
| #2 | -.0007 | .0000 | -.0011 | .0046 | -.0000 | .0000 | -.0002 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avge | .0007 | .0001 | .0001 | -.0004 | -.0004 | .0004 | -.0016 |
| SDev | .0007 | .0001 | .0006 | .0002 | .0004 | .0002 | .0050 |
| %RSD | 99.60 | 57.52 | 741.6 | 50.72 | 97.75 | 54.22 | 322.4 |

| | | | | | | | |
|----|-------|-------|--------|--------|--------|-------|--------|
| #1 | .0012 | .0001 | .0005 | -.0002 | -.0001 | .0006 | .0020 |
| #2 | .0002 | .0002 | -.0003 | -.0005 | -.0007 | .0003 | -.0051 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 | .0004 | -.0053 | -.0001 | .0030 | L-.1192 | .0302 |
| SDev | .0000 | .0000 | .0011 | .0000 | .0005 | .2409 | .0026 |
| %RSD | 3.302 | 9.813 | 20.45 | 1.853 | 15.15 | 202.1 | 8.704 |

| | | | | | | | |
|----|--------|-------|--------|--------|-------|---------|-------|
| #1 | -.0012 | .0004 | -.0046 | -.0001 | .0033 | H.0511 | .0321 |
| #2 | -.0013 | .0004 | -.0061 | -.0001 | .0027 | L-.2895 | .0283 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|--------|---------|
| Errors | LC Pass | LC Low | 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 |
| Avge | .0003 | -.0040 | .0018 | -.0005 | -.0017 | .0064 | .0015 |
| SDev | .0000 | .0019 | .0021 | .0007 | .0020 | .0023 | .0010 |
| %RSD | .5210 | 47.29 | 115.6 | 154.9 | 116.0 | 35.81 | 65.40 |

| | | | | | | | |
|----|-------|--------|-------|--------|--------|-------|-------|
| #1 | .0002 | -.0054 | .0003 | -.0010 | -.0003 | .0080 | .0023 |
| #2 | .0003 | -.0027 | .0033 | .0000 | -.0031 | .0048 | .0008 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
|------|--------|--------|--------|--------|-------|-------|--------|

010121

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.9 | .0059 | -.0016 | .0012 | .0003 | .0009 | .0019 |
| SDev | .1 | .0002 | .0030 | .0000 | .0012 | .0019 | .0008 |
| %RSD | .1222 | 2.999 | 185.4 | 3.494 | 375.7 | 216.0 | 42.20 |
| #1 | 102.8 | .0058 | .0005 | .0012 | -.0005 | .0023 | .0025 |
| #2 | 103.0 | .0060 | -.0037 | .0012 | .0012 | -.0005 | .0014 |
| 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 |
| Avge | .0000 | -.0016 | -.0001 | .0021 | -.0197 | -.0008 | .0016 |
| SDev | .0000 | .0017 | .0001 | .0030 | .0116 | .0004 | .0005 |
| %RSD | 186.5 | 105.8 | 38.10 | 147.1 | 58.73 | 45.65 | 32.91 |
| #1 | .0000 | -.0004 | -.0001 | .0042 | -.0115 | -.0006 | .0020 |
| #2 | -.0000 | -.0028 | -.0002 | -.0001 | -.0279 | -.0011 | .0012 |
| Errors | 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 | -.0000 | -.0001 | -.0007 | | | | |
| SDev | .0000 | .0000 | .0002 | | | | |
| %RSD | 315.5 | 15.00 | 32.44 | | | | |
| #1 | .0000 | -.0001 | -.0005 | | | | |
| #2 | -.0000 | -.0001 | -.0008 | | | | |
| Errors | LC Pass | LC Pass | LC Pass | | | | |
| High | .0050 | .0050 | .0050 | | | | |
| Low | -.0050 | -.0050 | -.0050 | | | | |

010122

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1194490 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1542.200 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1291094 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1193400 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1195581 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268264
Run Time: 10/12/05 12:37:46
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010123

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0003 | 1.327 | .0099 | .1784 | .0499 | .0014 | .0003 |
| SDev | .0005 | .015 | .0005 | .0008 | .0000 | .0000 | .0016 |
| %RSD | 154.0 | 1.106 | 5.174 | .4686 | .0805 | .2063 | 575.1 |

| | | | | | | | |
|----|--------|-------|-------|-------|-------|-------|--------|
| #1 | -.0007 | 1.338 | .0096 | .1790 | .0499 | .0014 | .0014 |
| #2 | .0000 | 1.317 | .0103 | .1779 | .0500 | .0014 | -.0009 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
| Units | ppm |
| Avge | 9.626 | .0003 | .0009 | .0063 | .0067 | 1.709 | 3.147 |
| SDev | .003 | .0001 | .0000 | .0002 | .0002 | .000 | .003 |
| %RSD | .0359 | 50.13 | 3.366 | 2.661 | 2.570 | .0237 | .0934 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 9.624 | .0002 | .0009 | .0062 | .0065 | 1.709 | 3.145 |
| #2 | 9.629 | .0003 | .0009 | .0065 | .0068 | 1.709 | 3.149 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
| Units | ppm |
| Avge | .0008 | .0829 | 1.273 | .0703 | .0244 | 110.9 | 143.1 |
| SDev | .0005 | .0001 | .002 | .0001 | .0004 | .3 | .4 |
| %RSD | 54.72 | .1822 | .1343 | .1257 | 1.818 | .2970 | .3018 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | .0005 | .0830 | 1.271 | .0704 | .0241 | 111.1 | 143.4 |
| #2 | .0012 | .0828 | 1.274 | .0702 | .0247 | 110.7 | 142.8 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
| Units | ppm |
| Avge | .0046 | .0671 | .0166 | .0154 | -.0028 | 15.66 | .0058 |
| SDev | .0000 | .0102 | .0021 | .0010 | .0006 | .03 | .0031 |
| %RSD | .5737 | 15.15 | 12.31 | 6.512 | 22.67 | .1905 | 53.59 |

| | | | | | | | |
|----|-------|-------|-------|-------|--------|-------|-------|
| #1 | .0045 | .0743 | .0152 | .0147 | -.0033 | 15.64 | .0036 |
| #2 | .0046 | .0599 | .0181 | .0161 | -.0024 | 15.68 | .0080 |

| | | | | | | | |
|-------|--------|--------|--------|--------|-------|-------|--------|
| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 101.7 | .0150 | -.0003 | 24.21 | .0158 | .0048 | .0122 |
| SDev | .3 | .0006 | .0026 | .12 | .0014 | .0015 | .0010 |
| %RSD | .2534 | 4.098 | 926.8 | .4953 | 8.536 | 32.21 | 8.000 |

| | | | | | | | |
|----|-------|-------|--------|-------|-------|-------|-------|
| #1 | 101.5 | .0145 | .0016 | 24.29 | .0149 | .0059 | .0129 |
| #2 | 101.9 | .0154 | -.0021 | 24.12 | .0168 | .0037 | .0115 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
| Units | ppm |
| Avge | .0760 | .0022 | .0031 | -.0040 | .0015 | .0027 | -.0025 |
| SDev | .0001 | .0001 | .0002 | .0033 | .0008 | .0000 | .0012 |
| %RSD | .0914 | 2.145 | 7.685 | 83.79 | 51.07 | 1.141 | 46.93 |

| | | | | | | | |
|----|-------|-------|-------|--------|-------|-------|--------|
| #1 | .0760 | .0022 | .0033 | -.0063 | .0010 | .0027 | -.0033 |
| #2 | .0761 | .0021 | .0029 | -.0016 | .0021 | .0027 | -.0016 |

| | | | |
|-------|--------|--------|--------|
| Elem | Y_3710 | Zn2062 | Zr3496 |
| Units | ppm | ppm | ppm |
| Avge | .0004 | .0478 | .0007 |
| SDev | .0000 | .0002 | .0002 |
| %RSD | 6.897 | .3336 | 29.69 |

010124

| | | | |
|----|-------|-------|-------|
| #1 | .0004 | .0477 | .0005 |
| #2 | .0005 | .0479 | .0008 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1180370 | 10000 | -- | -- | -- | -- | -- |
| SDev | 2988.940 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .2532205 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1178257 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1182484 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: 268265
Run Time: 10/12/05 12:42:33
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010125

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0001 | .0024 | .0011 | .0000 | -.0001 | -.0000 | -.0042 |
| SDev | .0001 | .0045 | .0002 | .0004 | .0001 | .0000 | .0028 |
| %RSD | 100.2 | 185.0 | 15.63 | 971.8 | 78.17 | 102.4 | 65.57 |

| | | | | | | | |
|----|--------|--------|-------|--------|--------|--------|--------|
| #1 | -.0002 | -.0007 | .0012 | .0003 | -.0000 | -.0000 | -.0023 |
| #2 | -.0000 | .0056 | .0010 | -.0002 | -.0002 | -.0000 | -.0061 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ca3179 | Cd2265 | Co2286 | Cr2677 | Cu3247 | Fe2714 | K_7664 |
| Units | ppm |
| Avge | 9.860 | .0000 | -.0002 | -.0004 | -.0006 | 9.901 | 8.062 |
| SDev | .007 | .0000 | .0001 | .0006 | .0001 | .006 | .018 |
| %RSD | .0699 | 78.97 | 66.69 | 161.1 | 16.91 | .0646 | .2243 |

| | | | | | | | |
|----|-------|-------|--------|--------|--------|-------|-------|
| #1 | 9.856 | .0000 | -.0001 | .0001 | -.0005 | 9.897 | 8.049 |
| #2 | 9.865 | .0000 | -.0003 | -.0008 | -.0006 | 9.906 | 8.074 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | La3988 | Li6707 | Mg2790 | Mn2576 | Mo2020 | Na3302 | Na5889 |
| Units | ppm |
| Avge | -.0008 | -.0002 | 9.703 | -.0002 | .0007 | 7.992 | 11.80 |
| SDev | .0003 | .0000 | .002 | .0000 | .0011 | .009 | .00 |
| %RSD | 30.86 | 14.23 | .0221 | 26.09 | 157.5 | .1089 | .0371 |

| | | | | | | | |
|----|--------|--------|-------|--------|--------|-------|-------|
| #1 | -.0006 | -.0002 | 9.702 | -.0002 | .0015 | 7.998 | 11.80 |
| #2 | -.0010 | -.0002 | 9.705 | -.0001 | -.0001 | 7.986 | 11.80 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ni2316 | P_1782 | 2203/1 | 2203/2 | Pd3404 | S_1820 | Sb2068 |
| Units | ppm |
| Avge | .0004 | -.0022 | .0028 | .0000 | -.0046 | -.0003 | -.0029 |
| SDev | .0014 | .0087 | .0040 | .0018 | .0009 | .0103 | .0018 |
| %RSD | 349.2 | 401.2 | 142.6 | 14650. | 20.47 | 4093. | 61.93 |

| | | | | | | | |
|----|--------|--------|--------|--------|--------|--------|--------|
| #1 | .0014 | -.0083 | -.0000 | .0013 | -.0053 | -.0075 | -.0042 |
| #2 | -.0006 | .0040 | .0056 | -.0012 | -.0040 | .0070 | -.0016 |

| | | | | | | | |
|-------|--------|--------|--------|--------|-------|--------|--------|
| Elem | Sc3613 | 1960/1 | 1960/2 | Si2881 | Pb220 | Se196 | Sn1899 |
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 106.1 | .0071 | -.0037 | .0006 | .0009 | -.0001 | .0008 |
| SDev | .2 | .0042 | .0010 | .0015 | .0001 | .0021 | .0007 |
| %RSD | .1733 | 59.15 | 26.73 | 249.9 | 15.50 | 2710. | 92.17 |

| | | | | | | | |
|----|-------|-------|--------|--------|-------|--------|-------|
| #1 | 106.2 | .0041 | -.0044 | -.0005 | .0008 | -.0015 | .0013 |
| #2 | 106.0 | .0101 | -.0030 | .0017 | .0011 | .0014 | .0003 |

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
| Units | ppm |
| Avge | .0003 | -.0091 | -.0002 | .0023 | -.0183 | -.0010 | -.0013 |
| SDev | .0000 | .0020 | .0001 | .0011 | .0103 | .0005 | .0010 |
| %RSD | .4759 | 21.94 | 67.25 | 48.63 | 56.24 | 44.46 | 79.37 |

| | | | | | | | |
|----|-------|--------|--------|-------|--------|--------|--------|
| #1 | .0003 | -.0077 | -.0001 | .0031 | -.0110 | -.0007 | -.0020 |
| #2 | .0003 | -.0106 | -.0002 | .0015 | -.0256 | -.0014 | -.0006 |

010126

| Elem | Y_3710 | Zn2062 | Zr3496 |
|-------|--------|--------|--------|
| Units | ppm | ppm | ppm |
| Avge | -.0002 | .0037 | -.0007 |
| SDev | .0001 | .0001 | .0004 |
| %RSD | 69.46 | 1.385 | 48.70 |

| | | | |
|----|--------|-------|--------|
| #1 | -.0001 | .0038 | -.0005 |
| #2 | -.0002 | .0037 | -.0010 |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1231162 | 10000 | -- | -- | -- | -- | -- |
| SDev | 2042.832 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1659270 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1232607 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1229718 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: cri
Run Time: 10/12/05 12:50:58
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010127

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | .0194 | .0984 | .0212 | .0999 | .0202 | .0098 | -.0030 |
| SDev | .0007 | .0025 | .0004 | .0004 | .0000 | .0000 | .0004 |
| %RSD | 3.708 | 2.563 | 1.798 | .4380 | .2170 | .1204 | 12.67 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | .0189 | .0966 | .0210 | .1002 | .0202 | .0098 | -.0033 |
| #2 | .0200 | .1002 | .0215 | .0996 | .0202 | .0098 | -.0027 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
| Avge | .0034 | .0105 | .0999 | .0190 | .0491 | .0818 | -.0180 |
| SDev | .0011 | .0001 | .0004 | .0001 | .0001 | .0043 | .0008 |
| %RSD | 32.75 | .4332 | .4083 | .5030 | .2763 | 5.270 | 4.699 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | .0026 | .0104 | .0996 | .0191 | .0492 | .0787 | -.0174 |
| #2 | .0042 | .0105 | .1002 | .0190 | .0490 | .0848 | -.0186 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | NOCHECK | 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 |
| Avge | -.0011 | .0714 | -.0016 | .0305 | .0203 | -.3096 | .0242 |
| SDev | .0008 | .0001 | .0021 | .0001 | .0007 | .0368 | .0002 |
| %RSD | 72.32 | .1887 | 131.4 | .3720 | 3.633 | 11.87 | .7917 |

| | | | | | | | |
|----|--------|-------|--------|-------|-------|--------|-------|
| #1 | -.0017 | .0715 | -.0031 | .0304 | .0198 | -.3356 | .0241 |
| #2 | -.0006 | .0713 | -.0001 | .0305 | .0208 | -.2836 | .0244 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
| Avge | .0801 | .0979 | .0075 | .0049 | -.0031 | .0075 | .1237 |
| SDev | .0003 | .0013 | .0007 | .0003 | .0012 | .0027 | .0032 |
| %RSD | .4305 | 1.293 | 8.839 | 7.232 | 39.68 | 35.83 | 2.568 |

| | | | | | | | |
|----|-------|-------|-------|-------|--------|-------|-------|
| #1 | .0803 | .0970 | .0071 | .0046 | -.0040 | .0094 | .1260 |
| #2 | .0798 | .0988 | .0080 | .0051 | -.0022 | .0056 | .1215 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
|------|--------|--------|--------|--------|-------|-------|--------|

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | 010128 |
| Avge | 101.2 | .0130 | .0094 | .1051 | .0058 | .0106 | .1052 |
| SDev | .6 | .0009 | .0022 | .0003 | .0005 | .0012 | .0013 |
| %RSD | .5533 | 6.693 | 23.57 | .3309 | 7.924 | 11.17 | 1.233 |
| #1 | 101.6 | .0124 | .0110 | .1053 | .0054 | .0115 | .1061 |
| #2 | 100.8 | .0137 | .0078 | .1048 | .0061 | .0098 | .1042 |
| 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 |
| Avge | .0210 | -.0027 | .0187 | .0173 | .1855 | .0980 | -.0008 |
| SDev | .0000 | .0009 | .0001 | .0033 | .0138 | .0002 | .0018 |
| %RSD | .1993 | 31.29 | .5490 | 18.95 | 7.420 | .1715 | 227.1 |
| #1 | .0210 | -.0033 | .0187 | .0150 | .1758 | .0978 | -.0020 |
| #2 | .0210 | -.0021 | .0188 | .0196 | .1952 | .0981 | .0005 |
| 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 | .0408 | .0942 | | | | |
| SDev | .0000 | .0001 | .0008 | | | | |
| %RSD | 5.584 | .1385 | .8328 | | | | |
| #1 | -.0001 | .0409 | .0937 | | | | |
| #2 | -.0001 | .0408 | .0948 | | | | |
| Errors | NOCHECK | LC Pass | NOCHECK | | | | |
| High | | .0600 | | | | | |
| Low | | .0200 | | | | | |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 010129 |
|--------|----------|----------|---------|---------|---------|---------|---------------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1173959 | 10000 | -- | -- | -- | -- | -- |
| SDev | 6501.140 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .5537791 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1178556 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1169362 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: icsa
Run Time: 10/12/05 12:55:44
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010130

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0005 | 510.6 | .0036 | -.0169 | .0022 | .0000 | .0009 |
| SDev | .0002 | .4 | .0001 | .0000 | .0001 | .0000 | .0036 |
| %RSD | 44.84 | .0781 | 1.756 | .1713 | 4.004 | 112.5 | 410.9 |

| | | | | | | | |
|----|--------|-------|-------|--------|-------|-------|--------|
| #1 | -.0006 | 510.8 | .0036 | -.0168 | .0021 | .0000 | .0034 |
| #2 | -.0003 | 510.3 | .0037 | -.0169 | .0023 | .0000 | -.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 |
| Avge | 456.5 | -.0006 | .0006 | -.0008 | .0014 | 190.7 | -.0119 |
| SDev | .7 | .0002 | .0005 | .0005 | .0010 | .0 | .0078 |
| %RSD | .1508 | 32.81 | 83.27 | 65.05 | 67.04 | .0258 | 65.17 |

| | | | | | | | |
|----|-------|--------|-------|--------|-------|-------|--------|
| #1 | 456.0 | -.0005 | .0002 | -.0011 | .0008 | 190.7 | -.0064 |
| #2 | 457.0 | -.0008 | .0010 | -.0004 | .0021 | 190.7 | -.0174 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
| Avge | .0035 | .0008 | 540.8 | -.0034 | -.0007 | -.0350 | .0230 |
| SDev | .0003 | .0001 | .8 | .0001 | .0022 | .0896 | .0046 |
| %RSD | 9.251 | 9.049 | .1397 | 1.790 | 295.0 | 255.9 | 19.95 |

| | | | | | | | |
|----|-------|-------|-------|--------|--------|--------|-------|
| #1 | .0038 | .0008 | 540.2 | -.0034 | .0008 | .0284 | .0262 |
| #2 | .0033 | .0007 | 541.3 | -.0033 | -.0023 | -.0984 | .0197 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
| Avge | .0013 | -.0127 | .0307 | -.0278 | .0057 | .0200 | .0114 |
| SDev | .0013 | .0030 | .0043 | .0013 | .0002 | .0021 | .0006 |
| %RSD | 104.8 | 23.56 | 14.13 | 4.799 | 3.647 | 10.33 | 5.640 |

| | | | | | | | |
|----|-------|--------|-------|--------|-------|-------|-------|
| #1 | .0003 | -.0148 | .0277 | -.0288 | .0059 | .0215 | .0119 |
| #2 | .0022 | -.0106 | .0338 | -.0269 | .0056 | .0186 | .0110 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | NOCHECK |
| High | | | | | | | |
| Low | | | | | | | |

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

010131

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 91.42 | .0073 | -.0050 | -.0046 | -.0083 | -.0009 | -.0032 |
| SDev | .17 | .0019 | .0019 | .0018 | .0023 | .0019 | .0021 |
| %RSD | .1911 | 25.83 | 38.71 | 39.13 | 28.21 | 223.7 | 65.45 |
| #1 | 91.55 | .0060 | -.0063 | -.0033 | -.0099 | -.0022 | -.0047 |
| #2 | 91.30 | .0087 | -.0036 | -.0058 | -.0066 | .0005 | -.0017 |
| Errors | NOCHECK |
| High | | | | | | | |
| Low | | | | | | | |
| Elem | Sr4215 | Th2837 | Ti3349 | Tl1908 | U_4090 | V_2924 | W_2079 |
| Units | ppm |
| Avge | .0165 | .0269 | -.0012 | .0012 | .0049 | -.0006 | -.0004 |
| SDev | .0000 | .0001 | .0002 | .0005 | .0115 | .0006 | .0009 |
| %RSD | .0873 | .2168 | 17.36 | 38.46 | 235.5 | 98.75 | 195.6 |
| #1 | .0164 | .0269 | -.0013 | .0016 | .0130 | -.0010 | .0002 |
| #2 | .0165 | .0268 | -.0010 | .0009 | -.0032 | -.0002 | -.0011 |
| Errors | NOCHECK |
| High | | | | | | | |
| Low | | | | | | | |
| Elem | Y_3710 | Zn2062 | Zr3496 | | | | |
| Units | ppm | ppm | ppm | | | | |
| Avge | -.0001 | .0073 | -.0005 | | | | |
| SDev | .0001 | .0000 | .0007 | | | | |
| %RSD | 52.42 | .3815 | 136.6 | | | | |
| #1 | -.0002 | .0073 | -.0010 | | | | |
| #2 | -.0001 | .0073 | -.0000 | | | | |
| Errors | NOCHECK | NOCHECK | NOCHECK | | | | |
| High | | | | | | | |
| Low | | | | | | | |

010132

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1061107 | 10000 | -- | -- | -- | -- | -- |
| SDev | 2001.112 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1885872 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1062522 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1059692 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: icsab
 Run Time: 10/12/05 13:00:30
 Comment:
 Mode: CONC Corr. Factor: 1

Operator:

010133

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | 1.098 | 499.1 | 1.038 | 1.018 | .5251 | .4795 | -.0007 |
| SDev | .001 | .0 | .003 | .000 | .0009 | .0005 | .0006 |
| %RSD | .1019 | .0014 | .2928 | .0183 | .1697 | .1015 | 83.34 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | 1.098 | 499.1 | 1.040 | 1.018 | .5245 | .4791 | -.0012 |
| #2 | 1.097 | 499.1 | 1.036 | 1.018 | .5258 | .4798 | -.0003 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avge | 450.0 | .9560 | .4840 | .4763 | .5504 | 186.9 | -.0174 |
| SDev | .6 | .0011 | .0006 | .0016 | .0013 | .2 | .0112 |
| %RSD | .1343 | .1208 | .1137 | .3359 | .2333 | .0838 | 64.21 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | 449.6 | .9552 | .4843 | .4752 | .5513 | 186.8 | -.0254 |
| #2 | 450.4 | .9568 | .4836 | .4774 | .5495 | 187.0 | -.0095 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avge | .0036 | H1.212 | 531.5 | .4906 | 1.019 | .3315 | -.0002 |
| SDev | .0005 | .002 | .7 | .0004 | .005 | .0522 | .0005 |
| %RSD | 13.80 | .1600 | .1256 | .0865 | .4548 | 15.73 | 215.6 |

| | | | | | | | |
|----|-------|--------|-------|-------|-------|-------|--------|
| #1 | .0032 | H1.213 | 531.1 | .4903 | 1.016 | .2946 | -.0005 |
| #2 | .0039 | H1.211 | 532.0 | .4909 | 1.023 | .3683 | .0001 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | NOCHECK | LC High | 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 |
| Avge | .9348 | 1.019 | 1.006 | .9590 | .0064 | .0216 | 1.050 |
| SDev | .0003 | .033 | .002 | .0061 | .0003 | .0014 | .001 |
| %RSD | .0357 | 3.268 | .1980 | .6347 | 3.961 | 6.393 | .0604 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | .9346 | 1.043 | 1.005 | .9547 | .0066 | .0226 | 1.050 |
| #2 | .9350 | .9959 | 1.008 | .9633 | .0062 | .0206 | 1.050 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
|------|--------|--------|--------|--------|-------|-------|--------|

010134

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 91.36 | 1.023 | 1.021 | 1.032 | .9748 | 1.022 | .9990 |
| SDev | .21 | .001 | .004 | .000 | .0047 | .003 | .0003 |
| %RSD | .2262 | .0734 | .4198 | .0122 | .4844 | .2551 | .0317 |
| #1 | 91.51 | 1.024 | 1.018 | 1.032 | .9715 | 1.020 | .9992 |
| #2 | 91.22 | 1.023 | 1.024 | 1.032 | .9781 | 1.024 | .9988 |
| 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 |
| Avge | 1.050 | .0244 | .9513 | .9914 | .9546 | .4952 | .0010 |
| SDev | .000 | .0037 | .0007 | .0026 | .0062 | .0001 | .0022 |
| %RSD | .0228 | 15.29 | .0692 | .2574 | .6504 | .0286 | 210.5 |
| #1 | 1.050 | .0218 | .9518 | .9896 | .9590 | .4951 | .0025 |
| #2 | 1.050 | .0271 | .9509 | .9932 | .9502 | .4953 | -.0005 |
| 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 | -.0001 | .9710 | .9449 | | | | |
| SDev | .0000 | .0006 | .0009 | | | | |
| %RSD | .2350 | .0581 | .0955 | | | | |
| #1 | -.0001 | .9706 | .9443 | | | | |
| #2 | -.0001 | .9714 | .9455 | | | | |
| Errors | NOCHECK | LC Pass | NOCHECK | | | | |
| High | | 1.200 | | | | | |
| Low | | .8000 | | | | | |

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1060293 | 10000 | -- | -- | -- | -- | -- |
| SDev | 2394.264 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .2258115 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1061986 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1058600 | 10000 | -- | -- | -- | -- | -- |

010135

Method: DAILY2 Sample Name: ccv3
 Run Time: 10/12/05 13:08:56
 Comment:
 Mode: CONC Corr. Factor: 1

Operator:

010136

| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Units | ppm |
| Avge | .9938 | 9.715 | 5.105 | 4.797 | 9.891 | .9745 | 4.991 |
| SDev | .0012 | .011 | .014 | .017 | .014 | .0008 | .014 |
| %RSD | .1224 | .1093 | .2802 | .3529 | .1402 | .0875 | .2838 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | .9930 | 9.708 | 5.115 | 4.785 | 9.881 | .9739 | 4.981 |
| #2 | .9947 | 9.723 | 5.095 | 4.809 | 9.901 | .9751 | 5.001 |

| Errors | 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 |
| Avge | 19.88 | 1.006 | 5.053 | 1.953 | 2.022 | 9.748 | 18.83 |
| SDev | .02 | .000 | .004 | .001 | .002 | .024 | .02 |
| %RSD | .0872 | .0363 | .0862 | .0477 | .0982 | .2451 | .1240 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 19.87 | 1.005 | 5.050 | 1.953 | 2.021 | 9.732 | 18.81 |
| #2 | 19.90 | 1.006 | 5.056 | 1.954 | 2.023 | 9.765 | 18.85 |

| Errors | 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 |
| Avge | 4.896 | 4.800 | 19.94 | 1.012 | 5.043 | 28.54 | H41.99 |
| SDev | .003 | .005 | .01 | .001 | .004 | .05 | .04 |
| %RSD | .0685 | .0965 | .0611 | .1218 | .0789 | .1820 | .0959 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|--------|
| #1 | 4.894 | 4.797 | 19.93 | 1.012 | 5.040 | 28.50 | H41.96 |
| #2 | 4.898 | 4.803 | 19.95 | 1.013 | 5.046 | 28.57 | H42.01 |

| Errors | 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 |
| Avge | 4.912 | 5.124 | 4.955 | 4.941 | 1.001 | 1.019 | 1.007 |
| SDev | .025 | .044 | .006 | .014 | .003 | .008 | .000 |
| %RSD | .5075 | .8623 | .1221 | .2766 | .2913 | .7538 | .0366 |

| | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|
| #1 | 4.894 | 5.155 | 4.950 | 4.931 | .9989 | 1.014 | 1.007 |
| #2 | 4.929 | 5.093 | 4.959 | 4.951 | 1.003 | 1.025 | 1.007 |

| 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 |
|------|--------|--------|--------|--------|-------|-------|--------|

010137

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 100.4 | 5.261 | 5.251 | 4.968 | 4.946 | 5.254 | 4.921 |
| SDev | .5 | .002 | .011 | .002 | .011 | .007 | .002 |
| %RSD | .4970 | .0316 | .2170 | .0442 | .2249 | .1340 | .0369 |
| #1 | 100.7 | 5.260 | 5.259 | 4.970 | 4.938 | 5.259 | 4.920 |
| #2 | 100.0 | 5.263 | 5.243 | 4.967 | 4.953 | 5.249 | 4.922 |
| 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 |
| Avge | 5.020 | .9712 | 4.781 | 5.199 | H1.101 | 4.926 | H1.112 |
| SDev | .001 | .0016 | .007 | .014 | .022 | .002 | .005 |
| %RSD | .0102 | .1692 | .1456 | .2704 | 1.973 | .0380 | .4150 |
| #1 | 5.020 | .9701 | 4.776 | 5.189 | 1.085 | 4.924 | H1.108 |
| #2 | 5.020 | .9724 | 4.786 | 5.209 | H1.116 | 4.927 | H1.115 |
| Errors | LC Pass | LC Pass | LC Pass | LC Pass | LC High | LC Pass | LC High |
| 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 | 4.991 | 1.017 | 4.892 | | | | |
| SDev | .003 | .001 | .004 | | | | |
| %RSD | .0612 | .0545 | .0730 | | | | |
| #1 | 4.989 | 1.017 | 4.894 | | | | |
| #2 | 4.993 | 1.018 | 4.889 | | | | |
| Errors | LC Pass | LC Pass | LC Pass | | | | |
| High | 5.500 | 1.100 | 5.500 | | | | |
| Low | 4.500 | .9000 | 4.500 | | | | |

010138

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1164648 | 10000 | -- | -- | -- | -- | -- |
| SDev | 5774.941 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .4958531 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1168731 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1160564 | 10000 | -- | -- | -- | -- | -- |

Method: DAILY2 Sample Name: ccb3
Run Time: 10/12/05 13:15:36
Comment:
Mode: CONC Corr. Factor: 1

Operator:

010139

| | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|
| Elem | Ag3280 | Al3082 | As1890 | B_2496 | Ba4934 | Be3130 | Bi2230 |
| Units | ppm |
| Avge | -.0002 | -.0014 | .0024 | .0062 | .0000 | .0000 | .0017 |
| SDev | .0001 | .0015 | .0011 | .0016 | .0001 | .0000 | .0003 |
| %RSD | 75.34 | 111.6 | 44.95 | 26.52 | 575.3 | 27.69 | 17.29 |

| | | | | | | | |
|----|--------|--------|-------|-------|--------|-------|-------|
| #1 | -.0002 | -.0003 | .0016 | .0073 | -.0001 | .0000 | .0019 |
| #2 | -.0001 | -.0024 | .0031 | .0050 | .0001 | .0001 | .0015 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 |
| Avge | .0019 | .0003 | -.0001 | -.0003 | -.0002 | .0023 | -.0137 |
| SDev | .0017 | .0001 | .0004 | .0004 | .0001 | .0036 | .0024 |
| %RSD | 90.31 | 53.38 | 431.7 | 161.4 | 45.09 | 157.6 | 17.45 |

| | | | | | | | |
|----|-------|-------|--------|--------|--------|--------|--------|
| #1 | .0007 | .0004 | -.0004 | -.0006 | -.0002 | .0048 | -.0120 |
| #2 | .0031 | .0002 | .0002 | .0000 | -.0001 | -.0003 | -.0154 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Errors | 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 | -.0008 | .0002 | .0011 | -.0000 | .0027 | L-.2184 | .0228 |
| SDev | .0000 | .0000 | .0038 | .0000 | .0002 | .2423 | .0053 |
| %RSD | 3.591 | 5.982 | 344.0 | 81.89 | 7.012 | 110.9 | 23.30 |

| | | | | | | | |
|----|--------|-------|--------|--------|-------|---------|-------|
| #1 | -.0008 | .0002 | -.0016 | -.0001 | .0025 | -.0471 | .0265 |
| #2 | -.0008 | .0002 | .0038 | -.0000 | .0028 | L-.3897 | .0190 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|--------|---------|
| Errors | LC Pass | LC Low | 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 |
| Avge | .0001 | .0027 | .0011 | -.0007 | -.0013 | .0054 | .0022 |
| SDev | .0003 | .0003 | .0026 | .0006 | .0035 | .0048 | .0034 |
| %RSD | 243.6 | 13.21 | 242.7 | 84.01 | 275.7 | 88.76 | 157.1 |

| | | | | | | | |
|----|--------|-------|--------|--------|--------|-------|--------|
| #1 | -.0001 | .0024 | .0030 | -.0012 | .0012 | .0088 | -.0002 |
| #2 | .0004 | .0029 | -.0008 | -.0003 | -.0037 | .0020 | .0046 |

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| 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 |
|------|--------|--------|--------|--------|-------|-------|--------|

010140

| | | | | | | | |
|--------|---------|---------|---------|---------|---------|---------|---------|
| Units | %R | ppm | ppm | ppm | ppm | ppm | ppm |
| Avge | 102.0 | .0029 | -.0010 | -.0010 | -.0001 | .0003 | .0008 |
| SDev | .2 | .0022 | .0033 | .0010 | .0005 | .0014 | .0017 |
| %RSD | .1554 | 75.14 | 333.2 | 100.4 | 442.3 | 454.1 | 201.7 |
| #1 | 102.1 | .0014 | .0013 | -.0003 | .0002 | .0013 | -.0004 |
| #2 | 101.8 | .0044 | -.0033 | -.0017 | -.0004 | -.0007 | .0020 |
| 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 |
| Avge | .0000 | -.0021 | -.0001 | .0037 | -.0003 | -.0003 | .0028 |
| SDev | .0000 | .0003 | .0001 | .0001 | .0068 | .0003 | .0006 |
| %RSD | 68.68 | 13.11 | 100.8 | 1.787 | 2164. | 104.6 | 19.88 |
| #1 | .0000 | -.0019 | -.0002 | .0037 | .0045 | -.0006 | .0032 |
| #2 | .0001 | -.0022 | -.0000 | .0036 | -.0051 | -.0001 | .0024 |
| Errors | 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 | .0000 | -.0000 | -.0001 | | | | |
| SDev | .0001 | .0001 | .0002 | | | | |
| %RSD | 219.4 | 3575. | 246.6 | | | | |
| #1 | .0001 | -.0001 | -.0003 | | | | |
| #2 | -.0000 | .0001 | .0001 | | | | |
| Errors | LC Pass | LC Pass | LC Pass | | | | |
| High | .0050 | .0050 | .0050 | | | | |
| Low | -.0050 | -.0050 | -.0050 | | | | |

010141

| IntStd | 1 | 2 | 3 | 4 | 5 | 6 | |
|--------|----------|----------|---------|---------|---------|---------|---------|
| Mode | *Counts | Time | NOTUSED | NOTUSED | NOTUSED | NOTUSED | NOTUSED |
| Elem | Sc | -- | -- | -- | -- | -- | -- |
| Wavlen | 361.384 | -- | -- | -- | -- | -- | -- |
| Avge | 1183335 | 10000 | -- | -- | -- | -- | -- |
| SDev | 1790.394 | .0000000 | -- | -- | -- | -- | -- |
| %RSD | .1513007 | .0000000 | -- | -- | -- | -- | -- |
| #1 | 1184601 | 10000 | -- | -- | -- | -- | -- |
| #2 | 1182069 | 10000 | -- | -- | -- | -- | -- |

010142

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 051011-4

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

Certificates of Analysis

SPEXertificate™

Certificate of Reference Material

010143

Catalog Number: INT-B1 Lot No.: 27-94AS
Description: Analytes B
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 |
|---------|----------------|-----------------|----------|
| Ag | 100 | 99.77 | 3151 |
| Cd | 100 | 99.56 | 3108 |
| Ni | 100 | 99.90 | 3136 |
| Pb | 100 | 99.96 | 3128 |
| Zn | 100 | 100.13 | 3168a |
| Ba | 50 | 49.86 | 3104a |
| Be | 50 | 49.83 | 3105a |
| Co | 50 | 49.74 | 3113 |
| Cr | 50 | 49.89 | 3112a |
| Cu | 50 | 49.93 | 3114 |
| Mn | 50 | 49.98 | 3132 |
| V | 50 | 49.92 | 3165 |

Spex Reference Multi: Lot # 16-127AS, 1-65GM, 22-67ASREF

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 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.

OCT - - 2004

Date of Certification: _____ Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 10/18/04
DATE EXPIRED: 10/15/2005
DATE OPENED: 10/11/04
INORG: 4611
PO: F39760
DR

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

010144

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

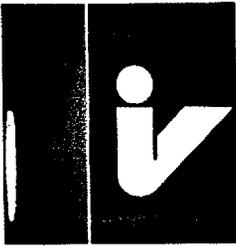
Certification Traveler Report:

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

Legal Notice:

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





certificate of analysis ⁰¹⁰¹⁴⁵

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Thorium in 3% (abs) HNO₃

Catalog Number: CGTH1-1, CGTH1-2, and CGTH1-5

Lot Number: X-TH01064

Starting Material: Th(NO₃)₄·4H₂O

Starting Material Purity (%): 99.998809

Starting Material Lot No X-25828-7

Matrix: 3% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 11/02/04
DATE EXPIRED: 12/01/2005
DATE OPENED: 11/02/04
INORG: 4844 PO: F54766

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 998 ± 3 µg/mL

Certified Density: 1.022 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:

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

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

(\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 #1 998 ± 3 µg/mL

ICP Assay NIST SRM 3159 Lot Number: 992912

Assay Method #2 999 ± 3 µg/mL

EDTA NIST SRM 928 Lot Number: 880710

4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98. 010146

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>M</u> Al < 0.00998 | <u>M</u> Dy < 0.00599 | <u>Q</u> Li < 0.05000 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.02995 |
| <u>M</u> Sb < 0.00050 | <u>M</u> Er < 0.00499 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00100 | <u>M</u> Tb < 0.00030 |
| <u>M</u> As < 0.00998 | <u>M</u> Eu < 0.00300 | <u>Q</u> Mg < 0.02000 | <u>M</u> Rh < 0.00100 | <u>M</u> Tl < 0.00100 |
| <u>M</u> Ba < 0.00998 | <u>M</u> Gd < 0.00100 | <u>M</u> Mn 0.00049 | <u>M</u> Rb < 0.00100 | <u>s</u> Th |
| <u>M</u> Be < 0.00050 | <u>M</u> Ga < 0.00100 | <u>i</u> Hg | <u>M</u> Ru < 0.00200 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi < 0.00040 | <u>M</u> Ge < 0.00599 | <u>M</u> Mo < 0.00200 | <u>M</u> Sm < 0.00100 | <u>M</u> Sn < 0.00499 |
| <u>M</u> B < 0.06987 | <u>M</u> Au < 0.00300 | <u>M</u> Nd 0.00044 | <u>M</u> Sc < 0.00998 | <u>M</u> Tl < 0.04991 |
| <u>M</u> Cd < 0.00300 | <u>M</u> Hf < 0.00200 | <u>M</u> Ni < 0.00799 | <u>M</u> Se < 0.00799 | <u>M</u> W < 0.00998 |
| <u>Q</u> Ca < 0.10000 | <u>M</u> Ho < 0.00050 | <u>M</u> Nb < 0.00050 | <u>i</u> Si | <u>M</u> U 0.00406 |
| <u>M</u> Ce 0.00267 | <u>M</u> In < 0.00998 | <u>n</u> Os | <u>M</u> Ag < 0.00200 | <u>M</u> V < 0.00200 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00499 | <u>M</u> Pd < 0.00499 | <u>Q</u> Na < 0.05000 | <u>M</u> Yb < 0.00100 |
| <u>M</u> Cr < 0.00499 | <u>Q</u> Fe < 0.05000 | <u>i</u> P | <u>M</u> Sr < 0.00050 | <u>M</u> Y < 0.03993 |
| <u>M</u> Co < 0.00300 | <u>M</u> La 0.00076 | <u>M</u> Pt < 0.00200 | <u>i</u> S | <u>M</u> Zn 0.00425 |
| <u>M</u> Cu < 0.00599 | <u>M</u> Pb < 0.00300 | <u>Q</u> K < 0.03000 | <u>M</u> Ta < 0.00699 | <u>M</u> 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

010147

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 - 232.0361; +4; 8; Th(OH)⁴⁺ and Th(OH)₈⁴⁺

Chemical Compatibility - Soluble in HCl, and HNO₃. Avoid H₃PO₄, H₂SO₄, and HF although solubilities may not be a problem depending upon pH and matrix (For example: ThF₄ is soluble in acids). Avoid neutral to basic media. Th⁴⁺ 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% HNO₃ / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO₃ / 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. H₂SO₄); Ores (Na₂O, 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 Pt⁴ crucible and the ash treated with H₂SO₄ / 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 at = concs.) |
|--------------------|--------------------|-------|-------------------|---|
| 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, Es, V | |
| ICP-MS 232 amu | 1 ppt | n/a | M ⁺ | |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2

DATE RECEIVED: 11/02/04
 DATE EXPIRED: 12/01/2005 V03
 DATE OPENED: 11/02/04
 INORG: 4844 PD: F54766



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: June 24, 2004

Expiration Date:

EXPIRES
1 1 2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

JoAnn Struthers

Certificate Approved By: Katalin Le, QC Manager

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines



inorganic ventures / iv labs

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certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Chromium (+3) In 1.4% (abs) HNO₃

Catalog Number: CGCR(3)1-1, CGCR(3)1-2, and CGCR(3)1-5
Lot Number: X-CR02137
Starting Material: Cr pieces
Starting Material Purity (%): 99.997404
Starting Material Lot No: F02N38
Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 1 of 2
DATE RECEIVED: 12/02/04
DATE EXPIRED: 12/01/2005 WJ
DATE OPENED: 12/02/04
INORG: 4906 PO: F55102

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1002 ± 2 µg/mL

Certified Density: 1.011 g/mL (measured at 22° C)

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

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

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

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 1002 ± 2 µg/mL (Avg 2 runs)

ICP Assay NIST SRM 3112a Lot Number: 990607

Assay Method #2 1004 µg/mL

Gravimetric NIST SRM Lot Number: See Sec. 4.2

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

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

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

| | | | | | | | | | |
|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|
| Q Al | 0.00120 | M Dy | < 0.02432 | Q Li | < 0.00002 | M Pr | < 0.00122 | M Ta | < 0.12159 |
| M Sb | < 0.00203 | M Er | < 0.02027 | M Lu | < 0.00162 | M Re | < 0.00405 | M Tb | < 0.00122 |
| M As | < 0.04053 | M Eu | < 0.01216 | Q Mg | < 0.00030 | M Rh | < 0.00405 | M Tl | < 0.00405 |
| M Ba | < 0.04053 | M Gd | < 0.00405 | M Mn | < 0.01621 | M Rb | < 0.00405 | M Th | < 0.00405 |
| M Be | < 0.00203 | M Ga | < 0.00405 | Q Hg | < 0.01500 | M Ru | < 0.00811 | M Tm | < 0.00162 |
| M Bi | < 0.00162 | M Ge | < 0.02432 | M Mo | < 0.00811 | M Sm | < 0.00405 | M Sn | < 0.02027 |
| Q B | < 0.01000 | M Au | < 0.01216 | M Nd | < 0.00811 | M Sc | < 0.04053 | Q Ti | < 0.00100 |
| M Cd | < 0.01216 | M Hf | < 0.00811 | Q Ni | < 0.02000 | M Se | < 0.03242 | M W | < 0.04053 |
| Q Ca | 0.01818 | M Ho | < 0.00203 | M Nb | < 0.00203 | Q Si | < 0.20000 | M U | < 0.00811 |
| M Ce | < 0.02027 | M In | < 0.04053 | n Os | | M Ag | < 0.00811 | Q V | < 0.02000 |
| M Cs | < 0.00122 | M Ir | < 0.02027 | M Pd | < 0.02027 | Q Na | 0.00647 | M Yb | < 0.00405 |
| s Cr | | Q Fe | < 0.01000 | Q P | < 0.04000 | M Sr | < 0.00203 | M Y | < 0.16212 |
| M Co | < 0.01216 | M La | < 0.00203 | M Pt | < 0.00811 | i S | | Q Zn | < 0.00400 |
| M Cu | < 0.02432 | M Pb | 0.00089 | Q K | < 0.00180 | M Ta | < 0.02837 | M Zr | < 0.02027 |

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

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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 - 51.9961; +3; 6; Cr(H₂O)₆³⁺

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.

Cr Containing Samples (Preparation and Solution) - Metal (soluble in HCl); Oxides/Ores (Chrome ore/oxides are very difficult to dissolve. The following procedures [A-D] are commonly used:

A. Fusion with KHSO₅ and extraction with hot KCl. The residue fused with Na₂CO₃ and KClO₄, 3:1.

B. Fusion with Na₂SO₄ and NaF, 2:1.

C. Fusion with magnesia or lime and sodium or potassium carbonates, 4:1.

D. Fusion with Na₂O₂ or NaOH and KNO₃ or NaOH and Na₂O₂.

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 digestions may be 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 at = concs.) |
|--------------------|----------------------|-------|----------------|---|
| 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, Y |
| ICP-MS 52 amu | 40 ppt | n/a | M ⁺ | ⁴⁵ Sc, ⁴⁰ Ar, ⁴⁰ Ar - The ⁵² Cr, ⁵³ Cr, ⁵⁴ Cr lines suffer from many more potential interferences from sulfur, chlorine and argon compounds of 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)

INORGANIC LABS/RADCHEM LABS ¹³ of ²
 DATE RECEIVED: 12/02/04
 DATE EXPIRED: 12/01/2005 ^{ves}
 DATE OPENED: 12/02/04
 INDRG: 4906 PD: F55102

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
12/2005

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, Chemist, Senior Technical Director



inorganic ventures / iv labs

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

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certificate of analysis

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

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

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

Lot Number: X-K02116

Starting Material: KNO₃

Starting Material Purity (%): 99.996753

Starting Material Lot No K18J19

Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 1 of 3

DATE RECEIVED: 12/02/04

DATE EXPIRED: 12/01/2005

DATE OPENED: 12/02/04

INORG: 4907 PO: F55102

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 9957 ± 28 µg/mL

Certified Density: 1.023 g/mL (measured at 22° C)

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

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

$\sum S$ = The summation of all significant estimated errors

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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 10,011 ± 16 µg/mL

Gravimetric NIST SRM Lot Number: See Sec. 4.2

Assay Method #2 9957 ± 28 µg/mL

ICP Assay NIST SRM 3141a Lot Number: 891312

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.

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>O</u> Al < 0.00090 | <u>M</u> Dy < 0.02426 | <u>O</u> Li < 0.00003 | <u>M</u> Pr < 0.00121 | <u>M</u> Te < 0.12131 |
| <u>M</u> Sb < 0.00202 | <u>M</u> Er < 0.02022 | <u>M</u> Lu < 0.00162 | <u>M</u> Re < 0.00404 | <u>M</u> Tb < 0.00121 |
| <u>M</u> As < 0.04044 | <u>M</u> Eu < 0.01213 | <u>O</u> Mg 0.00109 | <u>M</u> Rh < 0.00404 | <u>M</u> Tl < 0.00404 |
| <u>M</u> Ba < 0.04044 | <u>M</u> Gd < 0.00404 | <u>O</u> Mn < 0.00003 | <u>M</u> Rb 0.63001 | <u>M</u> Th < 0.00404 |
| <u>O</u> Be < 0.00020 | <u>M</u> Ga < 0.00404 | <u>O</u> Hg < 0.01500 | <u>M</u> Ru < 0.00809 | <u>M</u> Tm < 0.00162 |
| <u>M</u> Bi < 0.00162 | <u>O</u> Ge < 0.00150 | <u>M</u> Mo < 0.00809 | <u>M</u> Sm < 0.00404 | <u>M</u> Sn < 0.02022 |
| <u>O</u> B < 0.00060 | <u>O</u> Au < 0.00300 | <u>M</u> Nd < 0.00809 | <u>O</u> Sc < 0.00002 | <u>O</u> Ti < 0.00070 |
| <u>M</u> Cd < 0.01213 | <u>M</u> Hf < 0.00809 | <u>O</u> Ni < 0.00230 | <u>O</u> Se < 0.05000 | <u>M</u> W < 0.04044 |
| <u>O</u> Ca 0.01360 | <u>M</u> Ho < 0.00202 | <u>M</u> Nb < 0.00202 | <u>O</u> Si < 0.00340 | <u>M</u> U < 0.00809 |
| <u>M</u> Ce < 0.02022 | <u>M</u> In < 0.04044 | <u>i</u> Os | <u>M</u> Ag < 0.00809 | <u>O</u> V < 0.00090 |
| <u>M</u> Cs 0.00050 | <u>M</u> Ir < 0.02022 | <u>M</u> Pd < 0.02022 | <u>O</u> Na 0.19537 | <u>M</u> Yb < 0.00404 |
| <u>M</u> Cr < 0.02022 | <u>O</u> Fe 0.00297 | <u>O</u> P < 0.00250 | <u>M</u> Sr < 0.00202 | <u>M</u> Y < 0.16175 |
| <u>M</u> Co < 0.01213 | <u>M</u> La < 0.00202 | <u>M</u> Pt < 0.00809 | <u>O</u> S < 0.07200 | <u>O</u> Zn < 0.00020 |
| <u>M</u> Cu < 0.02426 | <u>M</u> Pb < 0.01213 | <u>S</u> K | <u>M</u> Ta < 0.02831 | <u>M</u> Zr < 0.02022 |

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

Stability - 2-100 ppb levels stable for months in 1% HNO₃ / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1.5% HNO₃ / LDPE container.

K Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water), Ores (Sodium carbonate fusion in P¹⁸ followed by HCl dissolution-blink levels of K in sodium carbonate critical), Organic Matrices (Sulfuric/peroxide digestion)

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

| Technique | Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at = concs.) |
|-----------|------------|-------------------|-------|----------------|---|
| ICP-OES | 766.490 nm | 0.4 / 0.001 µg/mL | 1 | atom | 2 nd order radiation from R.E.s on some optical designs |
| ICP-OES | 771.531 nm | 1.0 / 0.03 µg/mL | 1 | atom | 2 nd order radiation from R.E.s on some optical designs |
| ICP-OES | 404.721 nm | 1.1 / 0.05 µg/mL | 1 | atom | <u>U, Ce</u> |
| ICP-MS | 39 amu | 10 ppt | n/a | M ⁺ | ³⁹ Ar ⁺ , ⁴⁰ Na ⁺ , 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

010155

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 30, 2004

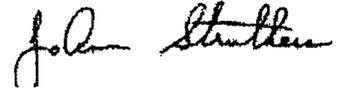
Expiration Date:

INORGANIC LABS/RADCHEM LABS 79-2092
DATE RECEIVED: 12/02/04
DATE EXPIRED: 12/01/2005 v05
DATE OPENED: 12/02/04
INORG: 4907 PD: F55102

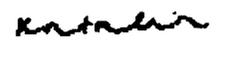
EXPIRES
12/2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

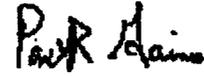
Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant



Certificate Approved By: Katalin Le, QC Manager

 010156

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director





inorganic ventures / iv labs

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

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certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Titanium in 1.4% (abs) HNO₃ tr. HF

Catalog Number: CGT11-1, CGT11-2, and CGT11-5
Lot Number: X-QTI01116
Starting Material: Ti granules
Starting Material Purity (%): 99.960814
Starting Material Lot No: K27M07
Matrix: 1.4% (abs) HNO₃ tr. HF

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 998 ± 4 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:

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

$$\text{Uncertainty } (s) = \frac{2(\sum s_i)P_{95}}{n^{0.5}}$$

(\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 CRM 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 ± 4 µg/mL (Avg 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 Pg. 1 of 2

DATE RECEIVED: 12/02/04

DATE EXPIRED: 12/01/2005

DATE OPENED: 12/02/04

INORG: 4908 PO: F55102

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.

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

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

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

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

| | | | | |
|----------------|----------------|----------------|----------------|----------------|
| Q Al < 0.01201 | M Dy < 0.01190 | Q 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 | Q Mg < 0.00040 | M Rh < 0.00198 | M Tl < 0.00198 |
| M Ba < 0.01984 | M Gd < 0.00198 | Q Mn 0.00161 | M Rb < 0.00198 | M Th < 0.00198 |
| M Be < 0.00099 | M Ga < 0.00198 | Q 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 |
| Q B < 0.00801 | M Au < 0.00595 | M Nd < 0.00397 | Q 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 |
| Q Ca < 0.00024 | M Ho < 0.00099 | M Nb < 0.00099 | Q Si < 0.01601 | M U < 0.00397 |
| M Ce < 0.00992 | M In < 0.01984 | n Os | M Ag < 0.00397 | Q V < 0.00801 |
| M Cs < 0.00060 | M Ir < 0.00992 | M Pd < 0.00992 | Q Na 0.14051 | M Yb < 0.00198 |
| M Cr < 0.00992 | Q Fe < 0.00400 | Q 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 | Q Zn < 0.00060 |
| Q Cu < 0.01201 | M Pb < 0.00595 | Q 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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 47.867; +4; 6; $\text{Tl}(\text{F})_3$.

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 $\text{Tl}(\text{F})_3$ for months in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $\text{Tl}(\text{F})_3$ chemically stable for years in 2-5% HNO_3 / trace HF in an LDPE container.

Tl Containing Samples (Preparation and Solution) - Metal (Soluble in H_2O / HF - powder reacts violently); Oxide - low temperature history anatase or rutile (Dissolved by heating in 1:1:1 H_2O / HF / H_2SO_4); Oxide - high temperature history ($\sim 800^\circ\text{C}$) brookite (use in Pt^* with $\text{K}_2\text{S}_2\text{O}_8$); Ores (use in Pt^* with $\text{KF} + \text{K}_2\text{S}_2\text{O}_8$ - no KF if silica not present); Organic Matrices (Dry ash at 450°C in Pt^* and dissolve by heating with 1:1:1 H_2O / HF / H_2SO_4 or use ash with pyrosulfate if ash 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 at = concs.) |
|--------------------|---|-------|------|---|--|
| ICP-OES 334.941 nm | 0.0038 / 0.000028 $\mu\text{g}/\text{mL}$ | 1 | ion | <u>No</u> , <u>Ta</u> , <u>Cr</u> , <u>U</u> | |
| ICP-OES 336.121 nm | 0.0053 / 0.000034 $\mu\text{g}/\text{mL}$ | 1 | ion | <u>W</u> , <u>Mo</u> , <u>Co</u> | |
| ICP-OES 323.452 nm | 0.0054 / 0.00082 $\mu\text{g}/\text{mL}$ | 1 | ion | <u>Ce</u> , <u>Ar</u> , <u>Ni</u> | |
| ICP-MS 48 amu | 1.4 ppt | n/a | M | <u>$^{13}\text{S}^{16}\text{O}$</u> , <u>$^{15}\text{S}^{16}\text{O}$</u> , <u>$^{14}\text{N}^{16}\text{O}^{16}\text{O}$</u> , <u>$^{14}\text{N}^{14}\text{N}$</u> , <u>$^{40}\text{Ar}^{16}\text{O}$</u> , <u>$^{40}\text{Ca}$</u> , <u>[**X**]</u> (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 Safety Data sheet for information regarding this CRM.

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2
 DATE RECEIVED: 12/02/04
 DATE EXPIRED: 12/01/2005 v03
 DATE OPENED: 12/02/04
 INORG: 4908 PO: F55102

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010160



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: September 28, 2004

Expiration Date:

EXPIRES
12 2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Makda, QA Administrator

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

SPEX Certificate™

010161

Certificate of Reference Material

Catalog Number: ICV-2A Lot No.: 6-114MS
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

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: NOV 04 Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 12/02/04
DATE EXPIRED: 11/30/2005
DATE OPENED: 12/02/04
INDRG: 4909 PO: F55102

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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

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SPX Certificate™

Certificate of Reference Material

Catalog Number: ICV-2C Lot No.: 6-146MS
 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 #9-34AS, 11-173AS, 1-57GM, 15-39AS REF.

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

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

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 12/02/04
 DATE EXPIRED: 11/30/2005
 DATE OPENED: 12/02/04
 INORG: 4910 PO: F55103

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

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

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

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

Certification Traveler Report:

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

Legal Notice:

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

010164



SPEXTM Certificate

Certificate of Reference Material

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INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 12/02/04
 DATE EXPIRED: 11/20/05 MS
 DATE OPENED: 12/02/04
 INORG: 4911 PO: F55102

Catalog Number: PLSB7-2X/2Y/2T **Lot No.** 10-43SB
Description: 1000 mg/L Antimony
Matrix: H2O/0.6Tart.Acid/tr.HNO3

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

Certified Value: 1004 mg/L
Uncertainty Associated with Measurement: +/-3.0mg/L
Certified Value is Traceable to: NIST SRM 3102a

The CRM is prepared gravimetrically using high purity Antimony Metal Lot# 04021A. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis. Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1005 mg/L

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

Instrumental Analysis by ICP spectrometer: 1002 mg/L

Uncertified Properties:

Density: 1.046 @ 25.5 Degrees Celsius

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

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

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

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

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

010166

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



203 Norcross Avenue • Metuchen, NJ 08840 USA

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

SPEXTM Certificate

Certificate of Reference Material

010167

INORGANIC LABS/INSTRUMENTATION
 DATE RECEIVED: 12/02/04
 DATE EXPIRED: 11/30/05
 DATE OPENED: 12/02/04
 INORG: 4912 PO: 555103

Catalog Number: PLBI4-2X/2Y **Lot No.** 10-173BI
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: 1002.5 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# 04941B. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 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 @ 24.0 Degrees Celsius

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

| Element | mg/L | Element | mg/L | Element | mg/L |
|---------|--------|---------|--------|---------|--------|
| Al | 0.02 | Cu | <0.001 | Pb | 0.006 |
| As | <0.001 | Fe | 0.001 | Re | <0.001 |
| Ag | 0.002 | Ga | <0.001 | Rb | <0.001 |
| B | <0.002 | In | <0.001 | Sr | <0.001 |
| Ba | 0.002 | K | 0.010 | Sb | <0.001 |
| Be | <0.002 | Li | <0.001 | Si | 0.005 |
| Cd | <0.001 | Mn | <0.001 | Ti | <0.002 |
| Co | <0.001 | Mo | <0.001 | Tl | <0.001 |
| Ca | 0.125 | Mg | <0.001 | V | <0.001 |
| Cr | <0.001 | Na | 0.006 | Zr | <0.001 |
| | | Ni | 0.002 | Zn | 0.08 |

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. Kocherakota

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

010168

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



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SPEXcertificate™

010169

Certificate of Reference Material

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

Lot No. 10-121Y

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: 1000 mg/L

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

Certified Value is Traceable to: NIST SRM 3167a

The CRM is prepared gravimetrically using high purity Yttrium Oxide Lot# 01031B. 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: 1.011 @ 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 | <0.001 | La | <0.001 | Tb | <0.001 |
| Ca | 0.007 | Lu | <0.001 | Tm | <0.001 |
| Dy | <0.001 | Mn | <0.001 | Tl | <0.001 |
| Er | <0.001 | Mo | <0.001 | Th | <0.001 |
| Eu | <0.001 | Nd | <0.001 | Ta | <0.001 |
| Fe | 0.015 | Ni | <0.001 | Ti | <0.001 |
| Gd | <0.001 | Na | 0.006 | V | <0.001 |
| Ga | <0.001 | Pr | <0.001 | W | <0.001 |
| Hf | <0.001 | Rb | <0.001 | Yb | <0.001 |
| Ho | <0.001 | Sc | <0.001 | Zr | <0.001 |
| In | <0.001 | Sm | <0.001 | | |

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

Date of Certification: NOV 04

Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 12/03/04
DATE EXPIRED: 11/30/2005
DATE OPENED: 12/02/04
INORG: 4913
PO: F55102

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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





inorganic ventures / iv labs

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

010171 certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Zinc in 1.4% (abs) HNO₃

Catalog Number: CGZN1-1, CGZN1-2, and CGZN1-5
Lot Number: X-ZN02020
Starting Material: Zn shot
Starting Material Purity (%): 99.999889
Starting Material Lot No: J17L26
Matrix: 1.4% (abs) HNO₃

INDORGANIC LABS/RADCHEM LABS 83-1 of 1
DATE RECEIVED: 12/03/04
DATE EXPIRED: 01/01/2006 WJ
DATE OPENED: 12/07/04
INORG: 4915 PO: F55106

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1002 ± 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:

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

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

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

($\sum e_i^2$) = The summation of all significant estimated errors
(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 1005 ± 4 µg/mL
ICP Assay NIST SRM 3168a Lot Number: 001402
Assay Method #2 1002 ± 2 µg/mL
EDTA NIST SRM 928 Lot Number: 880710

4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

010172

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00200 | <u>M</u> Dy < 0.02440 | <u>Q</u> Li 0.00001 | <u>M</u> Pr < 0.00122 | <u>M</u> Te < 0.12198 |
| <u>M</u> Sb < 0.00203 | <u>M</u> Er < 0.02033 | <u>M</u> Lu < 0.00163 | <u>M</u> Re < 0.00407 | <u>M</u> Tb < 0.00122 |
| <u>M</u> As < 0.04066 | <u>M</u> Eu < 0.01220 | <u>Q</u> Mg 0.00011 | <u>M</u> Rh < 0.00407 | <u>M</u> Tl < 0.00407 |
| <u>M</u> Ba < 0.04066 | <u>M</u> Gd < 0.00407 | <u>M</u> Mn < 0.01626 | <u>M</u> Rb < 0.00407 | <u>M</u> Th < 0.00407 |
| <u>M</u> Be < 0.00203 | <u>M</u> Ga < 0.00407 | <u>Q</u> Hg < 0.01000 | <u>M</u> Ru < 0.00813 | <u>M</u> Tm < 0.00163 |
| <u>M</u> Bi < 0.00163 | <u>M</u> Ge < 0.02440 | <u>M</u> Mo < 0.00813 | <u>M</u> Sm < 0.00407 | <u>M</u> Sn < 0.02033 |
| <u>Q</u> B 0.00015 | <u>M</u> Au < 0.01220 | <u>M</u> Nd < 0.00813 | <u>M</u> Sc < 0.04066 | <u>M</u> Ti < 0.20331 |
| <u>M</u> Cd < 0.01220 | <u>M</u> Hf < 0.00813 | <u>Q</u> Ni 0.00009 | <u>M</u> Se < 0.03253 | <u>M</u> W < 0.04066 |
| <u>Q</u> Ca 0.00022 | <u>M</u> Ho < 0.00203 | <u>M</u> Nb < 0.00203 | <u>Q</u> Si < 0.00400 | <u>M</u> U < 0.00813 |
| <u>M</u> Ce < 0.02033 | <u>M</u> In < 0.04066 | <u>n</u> Os | <u>M</u> Ag < 0.00813 | <u>M</u> V < 0.00813 |
| <u>M</u> Cs < 0.00122 | <u>M</u> Ir < 0.02033 | <u>M</u> Pd < 0.02033 | <u>Q</u> Na 0.00055 | <u>M</u> Yb < 0.00407 |
| <u>Q</u> Cr < 0.00100 | <u>Q</u> Fe 0.00005 | <u>Q</u> P < 0.00300 | <u>M</u> Sr < 0.00203 | <u>M</u> Y < 0.16264 |
| <u>M</u> Co < 0.01220 | <u>M</u> La < 0.00203 | <u>M</u> Pt < 0.00813 | <u>Q</u> S < 0.02000 | <u>s</u> Zn |
| <u>Q</u> Cu < 0.00050 | <u>M</u> Pb < 0.01220 | <u>Q</u> K 0.00018 | <u>M</u> Ta < 0.02846 | <u>M</u> Zr < 0.02033 |

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 - 65.39; +2; 4; Zn(OH)(aq)²⁺

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 450°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 at concs.) |
|--------------------|----------------------|--------|----------------|--|
| 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 | ⁴⁴ Ti, ⁵⁰ Cr, ⁵⁴ Fe, ⁵⁶ Fe, ⁵⁸ Fe, ⁶⁰ Fe, ⁶² Ni, ⁶⁴ Ni, ⁶⁶ Ni, ⁶⁸ Zn, ⁷⁰ Zn, ⁷² Zn, ⁷⁴ Zn, ⁷⁶ Zn, ⁷⁸ Zn, ⁸⁰ Zn, ⁸² Zn, ⁸⁴ Zn, ⁸⁶ Zn, ⁸⁸ Zn, ⁹⁰ Zn, ⁹² Zn, ⁹⁴ Zn, ⁹⁶ Zn, ⁹⁸ Zn, ¹⁰⁰ Zn, ¹⁰² Zn, ¹⁰⁴ Zn, ¹⁰⁶ Zn, ¹⁰⁸ Zn, ¹¹⁰ Zn, ¹¹² Zn, ¹¹⁴ Zn, ¹¹⁶ Zn, ¹¹⁸ Zn, ¹²⁰ Zn, ¹²² Zn, ¹²⁴ Zn, ¹²⁶ Zn, ¹²⁸ Zn, ¹³⁰ Zn, ¹³² Zn, ¹³⁴ Zn, ¹³⁶ Zn, ¹³⁸ Zn, ¹⁴⁰ Zn, ¹⁴² Zn, ¹⁴⁴ Zn, ¹⁴⁶ Zn, ¹⁴⁸ Zn, ¹⁵⁰ Zn, ¹⁵² Zn, ¹⁵⁴ Zn, ¹⁵⁶ Zn, ¹⁵⁸ Zn, ¹⁶⁰ Zn, ¹⁶² Zn, ¹⁶⁴ Zn, ¹⁶⁶ Zn, ¹⁶⁸ Zn, ¹⁷⁰ Zn, ¹⁷² Zn, ¹⁷⁴ Zn, ¹⁷⁶ Zn, ¹⁷⁸ Zn, ¹⁸⁰ Zn, ¹⁸² Zn, ¹⁸⁴ Zn, ¹⁸⁶ Zn, ¹⁸⁸ Zn, ¹⁹⁰ Zn, ¹⁹² Zn, ¹⁹⁴ Zn, ¹⁹⁶ Zn, ¹⁹⁸ Zn, ²⁰⁰ Zn, ²⁰² Zn, ²⁰⁴ Zn, ²⁰⁶ Zn, ²⁰⁸ Zn, ²¹⁰ Zn, ²¹² Zn, ²¹⁴ Zn, ²¹⁶ Zn, ²¹⁸ Zn, ²²⁰ Zn, ²²² Zn, ²²⁴ Zn, ²²⁶ Zn, ²²⁸ Zn, ²³⁰ Zn, ²³² Zn, ²³⁴ Zn, ²³⁶ Zn, ²³⁸ Zn, ²⁴⁰ Zn, ²⁴² Zn, ²⁴⁴ Zn, ²⁴⁶ Zn, ²⁴⁸ Zn, ²⁵⁰ Zn, ²⁵² Zn, ²⁵⁴ Zn, ²⁵⁶ Zn, ²⁵⁸ Zn, ²⁶⁰ Zn, ²⁶² Zn, ²⁶⁴ Zn, ²⁶⁶ Zn, ²⁶⁸ Zn, ²⁷⁰ Zn, ²⁷² Zn, ²⁷⁴ Zn, ²⁷⁶ Zn, ²⁷⁸ Zn, ²⁸⁰ Zn, ²⁸² Zn, ²⁸⁴ Zn, ²⁸⁶ Zn, ²⁸⁸ Zn, ²⁹⁰ Zn, ²⁹² Zn, ²⁹⁴ Zn, ²⁹⁶ Zn, ²⁹⁸ Zn, ³⁰⁰ Zn, ³⁰² Zn, ³⁰⁴ Zn, ³⁰⁶ Zn, ³⁰⁸ Zn, ³¹⁰ Zn, ³¹² Zn, ³¹⁴ Zn, ³¹⁶ Zn, ³¹⁸ Zn, ³²⁰ Zn, ³²² Zn, ³²⁴ Zn, ³²⁶ Zn, ³²⁸ Zn, ³³⁰ Zn, ³³² Zn, ³³⁴ Zn, ³³⁶ Zn, ³³⁸ Zn, ³⁴⁰ Zn, ³⁴² Zn, ³⁴⁴ Zn, ³⁴⁶ Zn, ³⁴⁸ Zn, ³⁵⁰ Zn, ³⁵² Zn, ³⁵⁴ Zn, ³⁵⁶ Zn, ³⁵⁸ Zn, ³⁶⁰ Zn, ³⁶² Zn, ³⁶⁴ Zn, ³⁶⁶ Zn, ³⁶⁸ Zn, ³⁷⁰ Zn, ³⁷² Zn, ³⁷⁴ Zn, ³⁷⁶ Zn, ³⁷⁸ Zn, ³⁸⁰ Zn, ³⁸² Zn, ³⁸⁴ Zn, ³⁸⁶ Zn, ³⁸⁸ Zn, ³⁹⁰ Zn, ³⁹² Zn, ³⁹⁴ Zn, ³⁹⁶ Zn, ³⁹⁸ Zn, ⁴⁰⁰ Zn, ⁴⁰² Zn, ⁴⁰⁴ Zn, ⁴⁰⁶ Zn, ⁴⁰⁸ Zn, ⁴¹⁰ Zn, ⁴¹² Zn, ⁴¹⁴ Zn, ⁴¹⁶ Zn, ⁴¹⁸ Zn, ⁴²⁰ Zn, ⁴²² Zn, ⁴²⁴ Zn, ⁴²⁶ Zn, ⁴²⁸ Zn, ⁴³⁰ Zn, ⁴³² Zn, ⁴³⁴ Zn, ⁴³⁶ Zn, ⁴³⁸ Zn, ⁴⁴⁰ Zn, ⁴⁴² Zn, ⁴⁴⁴ Zn, ⁴⁴⁶ Zn, ⁴⁴⁸ Zn, ⁴⁵⁰ Zn, ⁴⁵² Zn, ⁴⁵⁴ Zn, ⁴⁵⁶ Zn, ⁴⁵⁸ Zn, ⁴⁶⁰ Zn, ⁴⁶² Zn, ⁴⁶⁴ Zn, ⁴⁶⁶ Zn, ⁴⁶⁸ Zn, ⁴⁷⁰ Zn, ⁴⁷² Zn, ⁴⁷⁴ Zn, ⁴⁷⁶ Zn, ⁴⁷⁸ Zn, ⁴⁸⁰ Zn, ⁴⁸² Zn, ⁴⁸⁴ Zn, ⁴⁸⁶ Zn, ⁴⁸⁸ Zn, ⁴⁹⁰ Zn, ⁴⁹² Zn, ⁴⁹⁴ Zn, ⁴⁹⁶ Zn, ⁴⁹⁸ Zn, ⁵⁰⁰ Zn, ⁵⁰² Zn, ⁵⁰⁴ Zn, ⁵⁰⁶ Zn, ⁵⁰⁸ Zn, ⁵¹⁰ Zn, ⁵¹² Zn, ⁵¹⁴ Zn, ⁵¹⁶ Zn, ⁵¹⁸ Zn, ⁵²⁰ Zn, ⁵²² Zn, ⁵²⁴ Zn, ⁵²⁶ Zn, ⁵²⁸ Zn, ⁵³⁰ Zn, ⁵³² Zn, ⁵³⁴ Zn, ⁵³⁶ Zn, ⁵³⁸ Zn, ⁵⁴⁰ Zn, ⁵⁴² Zn, ⁵⁴⁴ Zn, ⁵⁴⁶ Zn, ⁵⁴⁸ Zn, ⁵⁵⁰ Zn, ⁵⁵² Zn, ⁵⁵⁴ Zn, ⁵⁵⁶ Zn, ⁵⁵⁸ Zn, ⁵⁶⁰ Zn, ⁵⁶² Zn, ⁵⁶⁴ Zn, ⁵⁶⁶ Zn, ⁵⁶⁸ Zn, ⁵⁷⁰ Zn, ⁵⁷² Zn, ⁵⁷⁴ Zn, ⁵⁷⁶ Zn, ⁵⁷⁸ Zn, ⁵⁸⁰ Zn, ⁵⁸² Zn, ⁵⁸⁴ Zn, ⁵⁸⁶ Zn, ⁵⁸⁸ Zn, ⁵⁹⁰ Zn, ⁵⁹² Zn, ⁵⁹⁴ Zn, ⁵⁹⁶ Zn, ⁵⁹⁸ Zn, ⁶⁰⁰ Zn, ⁶⁰² Zn, ⁶⁰⁴ Zn, ⁶⁰⁶ Zn, ⁶⁰⁸ Zn, ⁶¹⁰ Zn, ⁶¹² Zn, ⁶¹⁴ Zn, ⁶¹⁶ Zn, ⁶¹⁸ Zn, ⁶²⁰ Zn, ⁶²² Zn, ⁶²⁴ Zn, ⁶²⁶ Zn, ⁶²⁸ Zn, ⁶³⁰ Zn, ⁶³² Zn, ⁶³⁴ Zn, ⁶³⁶ Zn, ⁶³⁸ Zn, ⁶⁴⁰ Zn, ⁶⁴² Zn, ⁶⁴⁴ Zn, ⁶⁴⁶ Zn, ⁶⁴⁸ Zn, ⁶⁵⁰ Zn, ⁶⁵² Zn, ⁶⁵⁴ Zn, ⁶⁵⁶ Zn, ⁶⁵⁸ Zn, ⁶⁶⁰ Zn, ⁶⁶² Zn, ⁶⁶⁴ Zn, ⁶⁶⁶ Zn, ⁶⁶⁸ Zn, ⁶⁷⁰ Zn, ⁶⁷² Zn, ⁶⁷⁴ Zn, ⁶⁷⁶ Zn, ⁶⁷⁸ Zn, ⁶⁸⁰ Zn, ⁶⁸² Zn, ⁶⁸⁴ Zn, ⁶⁸⁶ Zn, ⁶⁸⁸ Zn, ⁶⁹⁰ Zn, ⁶⁹² Zn, ⁶⁹⁴ Zn, ⁶⁹⁶ Zn, ⁶⁹⁸ Zn, ⁷⁰⁰ Zn, ⁷⁰² Zn, ⁷⁰⁴ Zn, ⁷⁰⁶ Zn, ⁷⁰⁸ Zn, ⁷¹⁰ Zn, ⁷¹² Zn, ⁷¹⁴ Zn, ⁷¹⁶ Zn, ⁷¹⁸ Zn, ⁷²⁰ Zn, ⁷²² Zn, ⁷²⁴ Zn, ⁷²⁶ Zn, ⁷²⁸ Zn, ⁷³⁰ Zn, ⁷³² Zn, ⁷³⁴ Zn, ⁷³⁶ Zn, ⁷³⁸ Zn, ⁷⁴⁰ Zn, ⁷⁴² Zn, ⁷⁴⁴ Zn, ⁷⁴⁶ Zn, ⁷⁴⁸ Zn, ⁷⁵⁰ Zn, ⁷⁵² Zn, ⁷⁵⁴ Zn, ⁷⁵⁶ Zn, ⁷⁵⁸ Zn, ⁷⁶⁰ Zn, ⁷⁶² Zn, ⁷⁶⁴ Zn, ⁷⁶⁶ Zn, ⁷⁶⁸ Zn, ⁷⁷⁰ Zn, ⁷⁷² Zn, ⁷⁷⁴ Zn, ⁷⁷⁶ Zn, ⁷⁷⁸ Zn, ⁷⁸⁰ Zn, ⁷⁸² Zn, ⁷⁸⁴ Zn, ⁷⁸⁶ Zn, ⁷⁸⁸ Zn, ⁷⁹⁰ Zn, ⁷⁹² Zn, ⁷⁹⁴ Zn, ⁷⁹⁶ Zn, ⁷⁹⁸ Zn, ⁸⁰⁰ Zn, ⁸⁰² Zn, ⁸⁰⁴ Zn, ⁸⁰⁶ Zn, ⁸⁰⁸ Zn, ⁸¹⁰ Zn, ⁸¹² Zn, ⁸¹⁴ Zn, ⁸¹⁶ Zn, ⁸¹⁸ Zn, ⁸²⁰ Zn, ⁸²² Zn, ⁸²⁴ Zn, ⁸²⁶ Zn, ⁸²⁸ Zn, ⁸³⁰ Zn, ⁸³² Zn, ⁸³⁴ Zn, ⁸³⁶ Zn, ⁸³⁸ Zn, ⁸⁴⁰ Zn, ⁸⁴² Zn, ⁸⁴⁴ Zn, ⁸⁴⁶ Zn, ⁸⁴⁸ Zn, ⁸⁵⁰ Zn, ⁸⁵² Zn, ⁸⁵⁴ Zn, ⁸⁵⁶ Zn, ⁸⁵⁸ Zn, ⁸⁶⁰ Zn, ⁸⁶² Zn, ⁸⁶⁴ Zn, ⁸⁶⁶ Zn, ⁸⁶⁸ Zn, ⁸⁷⁰ Zn, ⁸⁷² Zn, ⁸⁷⁴ Zn, ⁸⁷⁶ Zn, ⁸⁷⁸ Zn, ⁸⁸⁰ Zn, ⁸⁸² Zn, ⁸⁸⁴ Zn, ⁸⁸⁶ Zn, ⁸⁸⁸ Zn, ⁸⁹⁰ Zn, ⁸⁹² Zn, ⁸⁹⁴ Zn, ⁸⁹⁶ Zn, ⁸⁹⁸ Zn, ⁹⁰⁰ Zn, ⁹⁰² Zn, ⁹⁰⁴ Zn, ⁹⁰⁶ Zn, ⁹⁰⁸ Zn, ⁹¹⁰ Zn, ⁹¹² Zn, ⁹¹⁴ Zn, ⁹¹⁶ Zn, ⁹¹⁸ Zn, ⁹²⁰ Zn, ⁹²² Zn, ⁹²⁴ Zn, ⁹²⁶ Zn, ⁹²⁸ Zn, ⁹³⁰ Zn, ⁹³² Zn, ⁹³⁴ Zn, ⁹³⁶ Zn, ⁹³⁸ Zn, ⁹⁴⁰ Zn, ⁹⁴² Zn, ⁹⁴⁴ Zn, ⁹⁴⁶ Zn, ⁹⁴⁸ Zn, ⁹⁵⁰ Zn, ⁹⁵² Zn, ⁹⁵⁴ Zn, ⁹⁵⁶ Zn, ⁹⁵⁸ Zn, ⁹⁶⁰ Zn, ⁹⁶² Zn, ⁹⁶⁴ Zn, ⁹⁶⁶ Zn, ⁹⁶⁸ Zn, ⁹⁷⁰ Zn, ⁹⁷² Zn, ⁹⁷⁴ Zn, ⁹⁷⁶ Zn, ⁹⁷⁸ Zn, ⁹⁸⁰ Zn, ⁹⁸² Zn, ⁹⁸⁴ Zn, ⁹⁸⁶ Zn, ⁹⁸⁸ Zn, ⁹⁹⁰ Zn, ⁹⁹² Zn, ⁹⁹⁴ Zn, ⁹⁹⁶ Zn, ⁹⁹⁸ Zn, ¹⁰⁰⁰ Zn |

010173

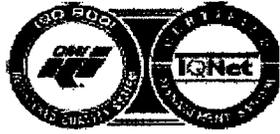
8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety Data sheet for information regarding this CRM.

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

10.0 QUALITY STANDARD DOCUMENTATION

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

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



Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

INORGANIC LABS/RADCHEM LABS Page 2 of 2
 DATE RECEIVED: 12/03/04
 DATE EXPIRED: 01/01/2006
 DATE OPENED: 12/07/04
 INDRG: 4915 PO: F55106

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010174



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

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

Certification Date: February 19, 2004

Expiration Date:

EXPIRES
1/1/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

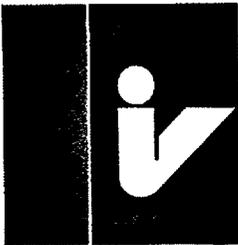
JoAnn Struthers

Certificate Approved By: Katalin Le, QC Manager

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines



inorganic ventures / iv labs

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

certificate of analysis ⁰¹⁰¹⁷⁵

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Vanadium in 1.4% (abs) HNO₃

Catalog Number: CGV1-1, CGV1-2, and CGV1-5
Lot Number: X-QV01102
Starting Material: V2O5
Starting Material Purity (%): 99.986532
Starting Material Lot No Stractor 46
Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS Pg. 1 of 1
DATE RECEIVED: 12/9/2004
DATE EXPIRED: 01/01/2006
DATE OPENED: 12/19/04
INORG: 4916 PD: F55102 v03 12/1

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 999 ± 3 µg/mL

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

$\sum s_i$ = 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

ICP Assay NIST SRM 3165 Lot Number: 992706

Assay Method #2 1007 ± 3 µg/mL

EDTA NIST SRM 928 Lot Number: 880710

4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00600 | <u>M</u> Dy < 0.00597 | <u>Q</u> Li < 0.00002 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.02984 |
| <u>M</u> Sb 0.04543 | <u>M</u> Er < 0.00497 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00100 | <u>M</u> Tb < 0.00030 |
| <u>M</u> As < 0.00995 | <u>M</u> Eu < 0.00298 | <u>Q</u> Mg < 0.10000 | <u>M</u> Rh < 0.00100 | <u>M</u> Tl < 0.00100 |
| <u>M</u> Ba < 0.00995 | <u>M</u> Gd < 0.00100 | <u>M</u> Mn 0.00069 | <u>M</u> Rb < 0.00100 | <u>M</u> Th < 0.00100 |
| <u>M</u> Be < 0.00050 | <u>M</u> Ga < 0.00100 | <u>Q</u> Hg < 0.01200 | <u>M</u> Ru < 0.00199 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi < 0.00040 | <u>M</u> Ge < 0.00597 | <u>M</u> Mo 0.01481 | <u>M</u> Sm < 0.00100 | <u>M</u> Sn < 0.00497 |
| <u>Q</u> B < 0.04000 | <u>M</u> Au < 0.00298 | <u>M</u> Nd < 0.00199 | <u>M</u> Sc < 0.00995 | <u>M</u> Ti < 0.04973 |
| <u>M</u> Cd < 0.00298 | <u>M</u> Hf < 0.00199 | <u>M</u> Ni < 0.07957 | <u>M</u> Se < 0.00796 | <u>M</u> W < 0.00995 |
| <u>Q</u> Ca 0.00596 | <u>M</u> Ho < 0.00050 | <u>M</u> Nb < 0.00050 | <u>Q</u> Si 0.04964 | <u>M</u> U < 0.00199 |
| <u>M</u> Ce < 0.00497 | <u>M</u> In < 0.00995 | <u>n</u> Os | <u>M</u> Ag < 0.00199 | <u>s</u> V |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00497 | <u>M</u> Pd < 0.00497 | <u>Q</u> Na < 0.01000 | <u>M</u> Yb < 0.00100 |
| <u>Q</u> Cr < 0.10000 | <u>Q</u> Fe 0.08936 | <u>Q</u> P < 0.10000 | <u>M</u> Sr < 0.00050 | <u>M</u> Y < 0.03979 |
| <u>Q</u> Co < 0.00200 | <u>M</u> La < 0.00050 | <u>M</u> Pt < 0.00199 | <u>n</u> S | <u>M</u> Zn < 0.01989 |
| <u>M</u> Cu < 0.00597 | <u>M</u> Pb < 0.00298 | <u>Q</u> K 0.03276 | <u>M</u> Ta < 0.00696 | <u>M</u> 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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 50.9415; +5; 6; $\text{H}_2\text{V}_2\text{O}_7$.

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^{2+} or Na_2CO_3 / KNO_3), Oxides (V_2O_5 - use HCl , V_2O_5 - use HCl or HNO_3 , V_2O_5 - use concentrated acids); Ores (Na_2CO_3 / KNO_3 in Pt^{2+} *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 at = concs.) |
|--------------------|--|-------|------|--|
| ICP-OES 309.311 nm | 0.005 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | ion | Mg, U, Th |
| ICP-OES 292.402 nm | 0.006 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | ion | Th |
| ICP-OES 290.882 nm | 0.008 / 0.0008 $\mu\text{g}/\text{mL}$ | 1 | atom | Hf, Nb |
| ICP-MS 51 amu | 4 ppt | n/a | M | $^{34}\text{S}^{16}\text{O}^+$, $^{35}\text{Cl}^{16}\text{O}^+$, $^{40}\text{Ar}^{12}\text{C}^+$, $^{40}\text{Ar}^{14}\text{N}^+$, $^{40}\text{Ar}^{16}\text{N}^+$, $^{40}\text{Ar}^{18}\text{H}^+$, $^{13}\text{C}^{14}\text{N}^+$, $^{32}\text{S}^{14}\text{N}^+$, $^{32}\text{S}^{16}\text{O}^+$, $^{32}\text{S}^{18}\text{O}^+$, $^{86}\text{Ru}^{2+}$, $^{88}\text{Pd}^{2+}$ |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

INORGANIC LABS/RADCHEM LABS Pg. 2 of 2

DATE RECEIVED: 12/9/2004
 DATE EXPIRED: 01/01/2006 vs for KE
 DATE OPENED: 12/9/04
 INORG: 4916 PD: F55102



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 26, 2004

Expiration Date:

EXPIRES
01 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Nicholas Maida
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines



inorganic ventures / iv labs

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

certificate of analysis ⁰¹⁰¹⁷⁹

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Sulfur in H₂O

Catalog Number: CGS1-1, CGS1-2, and CGS1-5
Lot Number: X-S01069
Starting Material: H₂SO₄
Starting Material Purity (%): 99.999965
Starting Material Lot No: N38818
Matrix: H₂O

INORGANIC LABS/RADCHEM LABS 75-1 of 2
DATE RECEIVED: 12/9/04
DATE EXPIRED: 01/01/2006 KE
DATE OPENED: 12/9/04
INDRG: 4917 PD: F5510a WOS 12/24/04

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1007 ± 7 µg/mL
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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

$\sum S$ = The summation of all significant estimated errors

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 1012 ± 2 µg/mL
Acidimetric NIST SRM 84k Lot Number: 84k
Assay Method #2 1007 ± 7 µg/mL
ICP Assay NIST SRM 3154 Lot Number: 892205

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. 010180

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.00025 | <u>M</u> Dy < 0.01197 | <u>Q</u> Li < 0.00016 | <u>M</u> Pr < 0.00060 | <u>M</u> Te < 0.05984 |
| <u>M</u> Sb < 0.00100 | <u>M</u> Er < 0.00997 | <u>M</u> Lu < 0.00080 | <u>M</u> Re < 0.00200 | <u>M</u> Tb < 0.00060 |
| <u>M</u> As < 0.01995 | <u>M</u> Eu < 0.00598 | <u>Q</u> Mg < 0.00004 | <u>M</u> Rh < 0.00200 | <u>M</u> Tl < 0.00200 |
| <u>M</u> Ba < 0.01995 | <u>M</u> Gd < 0.00200 | <u>M</u> Mn < 0.00798 | <u>M</u> Rb < 0.00200 | <u>M</u> Th < 0.00200 |
| <u>Q</u> Be < 0.00200 | <u>M</u> Ga < 0.00200 | <u>Q</u> Hg < 0.01100 | <u>M</u> Ru < 0.00399 | <u>M</u> Tm < 0.00080 |
| <u>M</u> Bi < 0.00080 | <u>M</u> Ge < 0.01197 | <u>M</u> Mo < 0.00399 | <u>M</u> Sm < 0.00200 | <u>M</u> Sn < 0.00997 |
| <u>Q</u> B < 0.00990 | <u>M</u> Au < 0.00598 | <u>M</u> Nd < 0.00399 | <u>M</u> Sc < 0.01995 | <u>M</u> Tl < 0.09974 |
| <u>M</u> Cd < 0.00598 | <u>M</u> Hf < 0.00399 | <u>Q</u> Ni < 0.00230 | <u>Q</u> Se < 0.00620 | <u>M</u> W < 0.01995 |
| <u>Q</u> Ca 0.00020 | <u>M</u> Ho < 0.00100 | <u>M</u> Nb < 0.00100 | <u>Q</u> Si < 0.00410 | <u>M</u> U < 0.00399 |
| <u>M</u> Ce < 0.00997 | <u>M</u> In < 0.01995 | <u>n</u> Os | <u>M</u> Ag < 0.00399 | <u>M</u> V < 0.00399 |
| <u>M</u> Cs < 0.00060 | <u>M</u> Ir < 0.00997 | <u>M</u> Pd < 0.00997 | <u>Q</u> Na < 0.00010 | <u>M</u> Yb < 0.00200 |
| <u>M</u> Cr < 0.00997 | <u>Q</u> Fe 0.00015 | <u>Q</u> P < 0.00480 | <u>M</u> Sr < 0.00100 | <u>M</u> Y < 0.07979 |
| <u>M</u> Co < 0.00598 | <u>M</u> La < 0.00100 | <u>M</u> Pt < 0.00399 | <u>s</u> S | <u>Q</u> Zn 0.00125 |
| <u>M</u> Cu < 0.01197 | <u>M</u> Pb < 0.00598 | <u>Q</u> K < 0.00170 | <u>M</u> Ta < 0.01396 | <u>M</u> Zr < 0.00997 |

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

6.0 INTENDED USE

- For the calibration of analytical instruments including but not limited to the following: ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 32.066; +6; 6; (O=), S(OH)

Chemical Compatibility - Soluble in HCl, HNO₃, H₂PO₄ and HF aqueous matrices water and NH₄OH. 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% HNO₃ / 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 powdered sample is fused in a Pt⁺ crucible with 6 times its weight of Na₂CO₃ + 0.5 grams KNO₃. The fuseate is extracted with water. Any BaSO₄ present in the sample is transposed by the carbonate fusion to the BaCO₃, which is left behind in the water-insoluble residue. If PbSO₄ is present the fuseate should be boiled with a sodium carbonate saturated with CO₂ solution for 1 hour or more where the PbSO₄ 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 at = concs.) |
|--------------------|-------------------|-------|------|---|
| ICP-OES 166.669nm | 0.27/0.19 µg/mL | 1 | atom | <u>Si</u> , <u>B</u> |
| 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, ¹⁴ N ¹⁶ O, ¹⁴ N ¹⁸ O, ¹⁴ N ¹⁶ O ¹⁸ H, ¹⁴ N ¹⁶ O ¹⁶ H |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

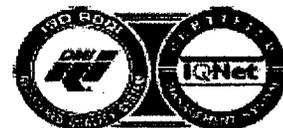
Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

INORGANIC LABS/RADCHEM LABS Ps-2 of 2
 DATE RECEIVED: 12/9/2004
 DATE EXPIRED: 01/01/2006 vs for KE
 DATE OPENED: 12/9/04
 INORG: 4917 PD: F55102

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 30, 2004

Expiration Date:

EXPIRES
01/2006

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

JoAnn Struthers

Katalin Le

Paul Gaines

SPEXcertificate™

Certificate of Reference Material

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

Lot No. 10-119B

Description: 1000 mg/L Boron

Matrix: H₂O

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

Certified Value: 1001 mg/L

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

Certified Value is Traceable to: NIST SRM 3107

The CRM is prepared gravimetrically using high purity (NH₄)₂B₄O₇·4H₂O Lot# 08001E. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis

Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 1001 mg/L

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

Instrumental Analysis by ICP spectrometer: 1001 mg/L

Uncertified Properties:

Density: 1.001 @ 22.3 Degrees Celsius

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

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

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

Date of Certification: 1/11/05 Certifying Officer: N. Kocherakota

DATE RECEIVED: 01/17/05
 DATE EXPIRED: 01/15/2006
 DATE OPENED: 01/19/05
 INORG: 4966
 PD: F55130
 W03

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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

010184



SPEXTM Certificate

010185

Certificate of Reference Material

Catalog Number: PLPD3-2X/2Y

Lot No. 9-99PD

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: 999 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# 06021C. 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 Dimethyl Glyoxime. Filter, dry, and weigh as Pd(C₄H₇O₂N₂)₂.

Instrumental Analysis by ICP spectrometer: 1000 mg/L

Uncertified Properties:

Density: 1.017 @ 24.2 Degrees Celsius

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

| Element | mg/L | Element | mg/L | Element | mg/L |
|---------|--------|---------|--------|---------|--------|
| Al | 0.002 | Fe | 0.033 | Re | <0.001 |
| Au | 0.002 | Ga | <0.001 | Rh | <0.001 |
| Ag | <0.001 | Ir | <0.001 | Rb | <0.001 |
| B | <0.001 | In | <0.001 | Ru | <0.001 |
| Be | <0.001 | Mg | 0.001 | Sn | <0.001 |
| Bi | <0.001 | Mn | <0.001 | Te | <0.001 |
| Ca | 0.006 | Na | 0.005 | Ti | <0.001 |
| Cd | <0.001 | Ni | 0.001 | W | <0.001 |
| Co | <0.001 | Pb | 0.002 | Zr | <0.001 |
| Cr | <0.002 | Pt | 0.008 | Zn | 0.06 |
| Cu | 0.002 | | | | |

Balances are calibrated regularly with weight sets traceable to NIST #32856, #32857 and others. This CRM is guaranteed stable to $\pm 0.5\%$ 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 '05

Certifying Officer: N. Koderaoka

DATE RECEIVED: 01/17/05
DATE EXP. 01/15/2006
DATE OPENED: 01/19/05
INORG: 4967
PO: F55130

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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

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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 #383-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s)), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Arsenic in 1.4% (abs) HNO₃

Catalog Number: CGAS1-1, CGAS1-2, and CGAS1-5

Lot Number: X-AS02026

Starting Material: As Polycrystalline lump

Starting Material Purity (%): 99.998994

Starting Material Lot No 23115

Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 11/27/05

DATE EXPIRED: 2/1/06 DR

DATE OPENED: 11/28/05

INORG: 4987 PO: F55132

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 997 ± 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

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

$\sum s_i$ = 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 #1 997 ± 3 µg/mL (Avg 2 runs)

ICP Assay NIST SRM 3103a Lot Number: 010713

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 UHPA-Filtered Clean Room. An UHPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | | | | | | |
|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|
| Q Al | 0.00038 | M Dy | < 0.01596 | Q Li | 0.00009 | M Pr | < 0.00080 | M Te | < 0.07978 |
| Q Sb | < 0.01000 | M Er | < 0.01330 | M Lu | < 0.00106 | Q Re | < 0.01000 | M Tb | < 0.00080 |
| s As | | M Eu | < 0.00798 | Q Mg | 0.00009 | M Rh | < 0.00266 | M Tl | < 0.00266 |
| M Ba | < 0.02660 | M Gd | < 0.00266 | Q Mn | < 0.00003 | M Rb | < 0.00266 | M Th | < 0.00266 |
| M Be | < 0.00133 | M Ga | < 0.00266 | Q Hg | < 0.01200 | M Ru | < 0.00532 | M Tm | < 0.00106 |
| M Bi | < 0.00106 | M Ge | < 0.01596 | M Mo | < 0.00532 | M Sm | < 0.00266 | Q Sn | 0.00049 |
| Q B | < 0.01200 | M Au | < 0.00798 | M Nd | < 0.00532 | M Sc | < 0.02660 | M Ti | < 0.13297 |
| M Cd | < 0.00798 | M Hf | < 0.00532 | M Ni | < 0.02128 | M Se | < 0.02128 | M W | < 0.02660 |
| Q Ca | 0.00189 | M Ho | < 0.00133 | Q Nb | < 0.00200 | Q Si | 0.00415 | M U | < 0.00532 |
| M Ce | < 0.01330 | M In | < 0.02660 | n Os | | M Ag | < 0.00532 | M V | < 0.00532 |
| M Cs | < 0.00080 | M Ir | < 0.01330 | M Pd | < 0.01330 | Q Na | 0.00159 | M Yb | < 0.00266 |
| M Cr | < 0.01330 | Q Fe | < 0.00110 | Q P | < 0.00260 | M Sr | < 0.00133 | M Y | < 0.10638 |
| M Co | < 0.00798 | M La | < 0.00133 | M Pt | < 0.00532 | Q S | < 0.02500 | Q Zn | 0.00057 |
| M Cu | < 0.01596 | M Pb | < 0.00798 | Q K | 0.00132 | M Ta | < 0.01862 | M Zr | < 0.01330 |

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 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_2PO_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) - As^0 (soluble in 1:1 H_2O / HNO_3) Oxides (the oxide exists in crystalline and amorphous forms where the amorphous form is more water soluble. The oxides typically dissolve in dilute acidic solutions when boiled); Minerals (One gram of powdered sample is fused in a Ni^0 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 Ni^0 crucible. The fusate 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 at = concs.) |
|--------------------|-------------------------------|-------|------|---|
| ICP-OES 189.042 nm | 0.05 / 0.005 $\mu\text{g/mL}$ | 1 | atom | Cr |
| ICP-OES 193.696 nm | 0.1 / 0.01 $\mu\text{g/mL}$ | 1 | atom | V, Ge |
| ICP-OES 228.812 nm | 0.1 / 0.01 $\mu\text{g/mL}$ | 1 | atom | Cd, Pt, Ir, Co |
| ICP-MS 75 amu | 20 ppt | n/a | M | $^{37}\text{Ar}^{35}\text{Cl}$, $^{54}\text{Co}^{54}\text{O}$, $^{39}\text{Ar}^{39}\text{H}$, $^{39}\text{Ar}^{39}\text{Cl}$, $^{39}\text{Ar}^{39}\text{K}$, $^{142}\text{Nd}^{142}$, $^{152}\text{Sm}^{152}$ |

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 / 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 17, 2004

Expiration Date: **EXPIRES**
18 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

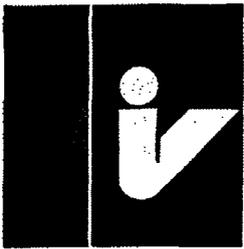
Nicholas Maida
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

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 Statistical Principles."

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

Catalog Number: CGCA10-1, CGCA10-2, and CGCA10-5
Lot Number: X-CA03030
Starting Material: CaO
Starting Material Purity (%): 99.999155
Starting Material Lot No: C27L01
Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/27/05
DATE EXPIRED: 3/1/06 DR
DATE OPENED: 11/28/05
INORG: 4988 PO: F55133

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 10,035 ± 24 µg/mL

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

$\sum S$ = The summation of all significant estimated errors

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

- 4.1 Assay Method #1 10,035 ± 24 µg/mL
EDTA NIST SRM 928 Lot Number: 392110
- Assay Method #2 10,046 ± 65 µg/mL
ICP Assay NIST SRM 3109a Lot Number: 000622

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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.

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

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

| | | | | |
|----------------|----------------|----------------|----------------|----------------|
| Q Al 0.00069 | M Dy < 0.04098 | Q Li < 0.00002 | M Pr < 0.00205 | M Te < 0.20492 |
| M Sb < 0.00342 | M Er < 0.03415 | M Lu < 0.00273 | M Re < 0.00683 | M Tb < 0.00205 |
| M As < 0.06831 | M Eu < 0.02049 | Q Mg 0.05295 | M Rh < 0.00683 | M Tl < 0.00683 |
| Q Ba 0.00065 | M Gd < 0.00683 | Q Mn 0.00038 | M Rb < 0.00683 | M Th < 0.00683 |
| Q Be < 0.00009 | M Ga < 0.00683 | Q Hg < 0.01100 | M Ru < 0.01366 | M Tm < 0.00273 |
| M Bi < 0.00273 | M Ge < 0.04098 | M Mo < 0.01366 | M Sm < 0.00683 | M Sn < 0.03415 |
| Q B < 0.00054 | M Au < 0.02049 | M Nd < 0.01366 | Q Sc < 0.00002 | M Tl < 0.34153 |
| Q Cd < 0.00450 | M Hf < 0.01366 | Q Ni < 0.00230 | Q Se < 0.00620 | M W < 0.06831 |
| s Ca | M Ho < 0.00342 | M Nb < 0.00342 | Q Si 0.00132 | M U < 0.01366 |
| M Ce < 0.03415 | Q In < 0.00200 | n Os | M Ag < 0.01366 | Q V < 0.00090 |
| M Cs < 0.00205 | M Ir < 0.03415 | M Pd < 0.03415 | Q Na 0.01000 | M Yb < 0.00683 |
| Q Cr 0.00103 | Q Fe < 0.00110 | Q P < 0.00480 | Q Sr 0.03530 | M Y < 0.27323 |
| Q Co < 0.00120 | M La < 0.00342 | M Pt < 0.01366 | Q S 0.00412 | Q Zn 0.02353 |
| Q Cu < 0.00400 | M Pb < 0.02049 | Q K < 0.00170 | M Ta < 0.04782 | M Zr < 0.03415 |

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

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

Chemical Compatibility - Soluble in HCl and HNO_3 . Avoid H_2SO_4 , HF, H_3PO_4 , and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate and tungstate in neutral aqueous media.

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

Ca Containing Samples (Preparation and Solution) - Metal (best dissolved in diluted HNO_3) Ores (Carbonate fusion in P^{10} followed by HCl dissolution); Organic Matrices (dry ash and dissolution in dilute HCl. Do not heat when dissolving to avoid precipitation of SiO_2). The oxide, hydroxide, carbonate, phosphate, and fluoride of calcium are soluble in % levels of HCl or HNO_3 . The sulfates (gypsum, anhydrite, etc.), certain silicates and complex compounds require fusion with Na_2CO_3 followed by HCl / water dissolution. Contamination is a very real problem when analyzing for trace levels.

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

| Technique/Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at concs.) |
|--------------------|--|-------|------|--|
| ICP-OES 393.366 nm | 0.0002 / 0.00004 $\mu\text{g}/\text{mL}$ | 1 | ion | U, Ce |
| ICP-OES 396.847 nm | 0.0005 / 0.00006 $\mu\text{g}/\text{mL}$ | 1 | ion | Th |
| ICP-OES 422.673 nm | 0.01 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | atom | Ge |
| ICP-MS 44 amu | 1200 ppt | n/a | M | ^{40}O , ^{42}C , $^{44}\text{Si}^{16}\text{O}$, $^{88}\text{Sr}^{2}$ |

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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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4968

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010194



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: September 20, 2004

Expiration Date: **EXPIRES**
11 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Malda, QA Administrator

Nicholas Malda
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

4064
4988



inorganic ventures / iv labs

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phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Manganese In 2% (abs) HNO₃ 010195

Catalog Number: CGMN1-1, CGMN1-2, and CGMN1-5

Lot Number: X-MN02037

Starting Material: Mn pieces

Starting Material Purity (%): 99.995300

Starting Material Lot No 21563

Matrix: 2% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/27/05
DATE EXPIRED: 2/1/06 DR
DATE OPENED: 1/28/05
INORG: 4989 PO: F55133

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 1006 ± 2 µg/mL

Certified Density: 1.014 g/mL (measured at 22° C)

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

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

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

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

$\sum s_i$ = 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 1006 ± 2 µg/mL
ICP Assay NIST SRM 3132 Lot Number: 890903

Assay Method #2 1008 ± 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.

| | | | | |
|----------------|----------------|----------------|----------------|----------------|
| Q Al 0.00221 | M Dy < 0.02471 | Q Li 0.00020 | M Pr < 0.00124 | M Te < 0.12355 |
| M Sb < 0.00206 | M Er < 0.02059 | M Lu < 0.00165 | M Re < 0.00412 | M Tb < 0.00124 |
| M As < 0.04118 | M Eu < 0.01236 | Q Mg 0.03350 | M Rh < 0.00412 | M Ti < 0.00412 |
| M Ba < 0.04118 | M Gd < 0.00412 | s Mn | M Rb < 0.00412 | M Th < 0.00412 |
| M Be < 0.00206 | Q Ga < 0.05000 | i Hg | M Ru < 0.00824 | M Tm < 0.00165 |
| M Bi < 0.00165 | Q Ge < 0.00300 | M Mo < 0.00824 | M Sm < 0.00412 | M Sn < 0.02059 |
| Q B 0.00295 | M Au < 0.01236 | M Nd < 0.00824 | M Sc < 0.04118 | M Tl < 0.20592 |
| M Cd < 0.01236 | M Hf < 0.00824 | M Ni < 0.03295 | M Se < 0.03295 | M W < 0.04118 |
| Q Ca 0.00340 | M Ho < 0.00206 | M Nb < 0.00206 | Q Si 0.00275 | M U < 0.00824 |
| M Ce < 0.02059 | M In < 0.04118 | n Os | M Ag < 0.00824 | M V < 0.00824 |
| M Cs < 0.00124 | M Ir < 0.02059 | M Pd < 0.02059 | Q Na 0.00225 | M Yb < 0.00412 |
| M Cr < 0.02059 | Q Fe < 0.01000 | i P | M Sr < 0.00206 | M Y < 0.16474 |
| M Co < 0.01236 | M La < 0.00206 | M Pt < 0.00824 | i S | Q Zn 0.00250 |
| M Cu < 0.02471 | M Pb < 0.01236 | Q K 0.00105 | M Ta < 0.02883 | M Zr < 0.02059 |

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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4989

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

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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)²⁺

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

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

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 SO₂ fumes - dense white fumes).

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

| Technique/Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe) |
|--------------------|------------------------|-------|----------------|--|
| ICP-OES 257.610nm | 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 ⁺ | ⁴⁰ Ar ¹⁴ N ¹⁴ H ¹ , ³⁹ K ¹⁶ O ² , ³⁷ Cl ¹⁶ O ² , ⁴⁰ Ar ¹⁴ N ¹⁴ , ³⁹ Ar ¹⁶ O ² , ³⁷ Ar ¹⁶ O ² , ³⁵ Cl ¹⁶ O ² , ³⁷ Cl ¹⁶ O ² , ²³ Na ³² S |

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

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

10.0 **QUALITY STANDARD DOCUMENTATION**

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of **IQ Net International Certification Network**:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

3084
4969

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**
12 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 Gaines

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4989



certificate of analysis

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

010199

- 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: X-TL01091
Starting Material: TINO3
Starting Material Purity (%): 99.999824
Starting Material Lot No: G09P28
Matrix: 0.5% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 11/27/05
DATE EXPIRED: 2/1/06
DATE OPENED: 1/28/05 DR
INORG: 4990 PD: F55133

- 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 999 ± 3 µg/mL

Certified Density: 1.001 g/mL (measured at 22° C)

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

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

$\sum S$ = The summation of all significant estimated errors

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

- 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 of 2 runs)
ICP Assay NIST SRM 3158 Lot Number: 993012
Assay Method #2 1000 µg/mL
Gravimetric NIST SRM Lot Number: See Sec. 4.2

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4990

- 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 892476 - Class 1 and 892476A - 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, 178240. 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.

010200

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 | Q 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 | Q 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 | Q 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 |
| Q B < 0.00140 | M Au < 0.00606 | M Nd < 0.00404 | M Sc < 0.02018 | M Ti < 0.10091 |
| Q Cd < 0.00540 | M Hf < 0.00404 | Q Ni < 0.00090 | M Se < 0.01615 | M W < 0.02018 |
| Q Ca 0.00015 | M Ho < 0.00101 | M Nb < 0.00101 | Q 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 | Q Na 0.00124 | M Yb < 0.00202 |
| M Cr < 0.01009 | Q Fe < 0.00100 | Q P < 0.00260 | M Sr < 0.00101 | M Y < 0.08073 |
| M Co < 0.00606 | M La < 0.00101 | M Pt < 0.00404 | Q S < 0.03000 | Q Zn 0.00154 |
| M Cu < 0.01211 | M Pb < 0.00606 | Q 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

2084
4990

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 204.383; +1; 6; $\text{Ti}(\text{H}_2\text{O})_6^{3+}$

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.

Ti Containing Samples (Preparation and Solution) - Metal (Best dissolved in HNO_3 , which forms chiefly the Ti^{3+} ion), Oxide (The thalious oxide is readily soluble in water. The thallic oxide requires high levels of acid), Ores (Carbonate fusion in Pt 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 indicates severe at = concs.) |
|--------------------|-------------------------------|-------|------|---|
| ICP-OES 190.864 nm | 0.04 / 0.004 $\mu\text{g/mL}$ | 1 | ion | V, Ti |
| ICP-OES 276.787 nm | 0.1 / 0.01 $\mu\text{g/mL}$ | 1 | atom | Ta, V, Fe, Cr |
| ICP-OES 351.924 nm | 0.2 / 0.02 $\mu\text{g/mL}$ | 1 | atom | Th, Ce, Zr |
| ICP-MS 205 amu | 2 ppt | n/a | M | ¹⁸⁰ Os ¹⁶ O |

010201

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)

3004
4990

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 05, 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

Nicholas Maida

Katalin Le

Paul Gaines

4084
4990

SPEXTM Certificate

Certificate of Reference Material

010203

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 1/31/05
 DATE EXPIRED: 1/30/2006
 DATE OPENED: 1/31/05
 INDRG: 4998
 PO: F55137

Catalog Number: PLNA2-3X/3Y **Lot No.** V9-56NA
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: 9984 mg/L
Uncertainty Associated with Measurement: +/- 30.0 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: 9983 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: 1.048 @ 23.1 Degrees Celsius

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

| Element | mg/L | Element | mg/L | Element | mg/L |
|---------|--------|---------|--------|---------|--------|
| Al | <0.001 | Cu | 0.01 | Pb | 0.009 |
| As | <0.01 | Fe | 0.02 | Re | <0.001 |
| Ag | <0.02 | Ga | <0.001 | Rb | <0.001 |
| B | <0.05 | In | <0.001 | Sr | <0.002 |
| Ba | 0.01 | K | 2.50 | Sb | <0.001 |
| Be | <0.009 | Li | <0.002 | Si | 0.14 |
| Bi | 0.001 | Mg | 0.20 | Ti | <0.02 |
| Ca | 0.75 | Mn | 0.001 | Tl | <0.001 |
| Cr | <0.02 | Mo | <0.001 | V | 0.002 |
| Cd | <0.001 | Ni | <0.006 | Zr | <0.01 |
| Co | <0.001 | | | Zn | 0.02 |

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 - - 2005 **Certifying Officer:** N. Kocherakota

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

010204

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

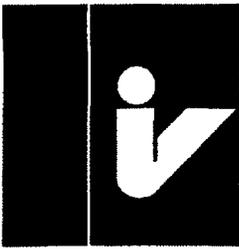
Certification Traveler Report:

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

Legal Notice:

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





inorganic ventures / iv labs

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certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Silicon in H₂O tr. HNO₃ tr. HF **010205**

Catalog Number: CGSI1-1, CGSI1-2, and CGSI1-5
Lot Number: X-SI02087
Starting Material: SiO₂
Starting Material Purity (%): 99.996367
Starting Material Lot No: C05310C
Matrix: H₂O tr. HNO₃ tr. HF

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/31/05
DATE EXPIRED: 3/1/2006
DATE OPENED: 1/31/05
INDRG: 4999 PO: F55139

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

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

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 996 ± 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 $\mu\text{g/mL}$ 010206

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.02730 | <u>M</u> Dy < 0.01358 | <u>Q</u> Li < 0.00009 | <u>M</u> Pr < 0.00068 | <u>M</u> Te < 0.06791 |
| <u>M</u> Sb < 0.00113 | <u>M</u> Er < 0.01132 | <u>M</u> Lu < 0.00091 | <u>M</u> Re < 0.00226 | <u>M</u> Tb < 0.00068 |
| <u>M</u> As < 0.02264 | <u>M</u> Eu < 0.00679 | <u>Q</u> Mg < 0.04991 | <u>M</u> Rh < 0.00226 | <u>M</u> Tl < 0.00226 |
| <u>M</u> Ba < 0.02264 | <u>M</u> Gd < 0.00226 | <u>M</u> Mn < 0.00906 | <u>M</u> Rb < 0.00226 | <u>M</u> Th < 0.00226 |
| <u>Q</u> Be < 0.00091 | <u>M</u> Ga < 0.00226 | <u>Q</u> Hg < 0.04991 | <u>M</u> Ru < 0.00453 | <u>M</u> Tm < 0.00091 |
| <u>M</u> Bi < 0.00091 | <u>M</u> Ge < 0.01358 | <u>M</u> Mo < 0.00453 | <u>M</u> Sm < 0.00226 | <u>M</u> Sn < 0.01132 |
| <u>Q</u> B 0.02409 | <u>M</u> Au < 0.00679 | <u>M</u> Nd < 0.00453 | <u>Q</u> Sc < 0.00091 | <u>Q</u> Ti 0.01325 |
| <u>M</u> Cd < 0.00679 | <u>M</u> Hf < 0.00453 | <u>Q</u> Ni < 0.01044 | <u>M</u> Se < 0.01811 | <u>M</u> W < 0.02264 |
| <u>Q</u> Ca 0.00135 | <u>M</u> Ho < 0.00113 | <u>M</u> Nb < 0.00113 | <u>s</u> Si | <u>M</u> U < 0.00453 |
| <u>M</u> Ce < 0.01132 | <u>M</u> In < 0.02264 | <u>n</u> Os | <u>M</u> Ag < 0.00453 | <u>Q</u> V < 0.00408 |
| <u>M</u> Cs < 0.00068 | <u>M</u> Ir < 0.01132 | <u>M</u> Pd < 0.01132 | <u>Q</u> Na 0.02008 | <u>M</u> Yb < 0.00226 |
| <u>Q</u> Cr < 0.00681 | <u>Q</u> Fe < 0.00499 | <u>Q</u> P < 0.02269 | <u>Q</u> Sr < 0.00032 | <u>M</u> Y < 0.09055 |
| <u>M</u> Co < 0.00679 | <u>M</u> La < 0.00113 | <u>M</u> Pt < 0.00453 | <u>Q</u> S < 0.11342 | <u>M</u> Zn < 0.04528 |
| <u>Q</u> Cu < 0.00454 | <u>M</u> Pb < 0.00679 | <u>Q</u> K < 0.00771 | <u>M</u> Ta 0.00200 | <u>M</u> Zr < 0.01132 |

M - Checked by ICP-MS O - Checked by ICP-OES 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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 28.0855; +4; 6; $\text{Si}(\text{OH})_4(\text{F})_2^2$

Chemical Compatibility - Soluble in HCl, HF, H_3PO_4 , H_2SO_4 and HNO_3 as the $\text{Si}(\text{OH})_4(\text{F})_2^2$. Avoid neutral to basic media. Unstable at ppm levels with metals that would pull F^- away (i.e. Do not mix with Alkaline or Rare Earths, or high levels of transition elements unless they are fluorinated). Stable with most inorganic anions with a tendency to hydrolyze forming silicic acid (silicic acid is soluble up to ~100 ppm in water) in all dilute acids except HF.

Stability - 2-100 ppb levels - stability unknown - (alone or mixed with all other metals) as the $\text{Si}(\text{OH})_4(\text{F})_2^2$. 1-10,000 ppm single element solutions as the $\text{Si}(\text{OH})_4(\text{F})_2^2$ chemically stable for years in 2-5% HNO_3 / trace HF in a LDPE container.

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

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

| Technique/Line | Estimated D.L. | Order | Type | Interferences |
|--------------------|---------------------------------------|-------|------|--|
| ICP-OES 251.611 nm | 0.012 / 0.003 $\mu\text{g}/\text{mL}$ | 1 | ion | Ta, U, Zn, Th |
| ICP-OES 212.412 nm | 0.02 / 0.01 $\mu\text{g}/\text{mL}$ | 1 | ion | Hf, Os, Mo, Ta |
| ICP-OES 288.158 nm | 0.03 / 0.004 $\mu\text{g}/\text{mL}$ | 1 | ion | Ta, Ce, Cr, Cd, Th |
| ICP-MS 28 amu | 4000 - 8000 ppt | n/a | M | $^{14}\text{N}_2$, $^{12}\text{C}^{16}\text{O}$ |

010207

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

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

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4999

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010208



- 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**
01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: JoAnn Struthers, QA Administrative Assistant

Certificate Approved By: Katalin Le, QC Manager

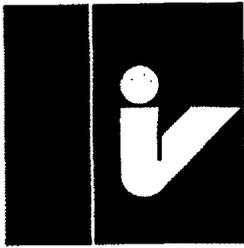
Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

JoAnn Struthers

Katalin Le

Paul Gaines

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4999



inorganic ventures / iv labs

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phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

certificate of analysis

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

010209

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-QY01107
Starting Material: Y2O₃
Starting Material Purity (%): 99.999896
Starting Material Lot No: 9918901OYL
Matrix: 1.4% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 1/31/05
DATE EXPIRED: 3/1/2006 DR
DATE OPENED: 1/31/05
INORG: 5000 PO: F55139

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 998 ± 2 µg/mL

Certified Density: 1.011 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:

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

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

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

$\sum \sigma_i^2$ = The summation of all significant estimated errors.
(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 996 ± 2 µg/mL
ICP Assay NIST SRM 3167a Lot Number: 790412
Assay Method #2 998 ± 2 µg/mL
EDTA NIST SRM 928 Lot Number: 880710

1 of 4
5000

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00090 | <u>M</u> Dy 0.00030 | <u>Q</u> Li < 0.00002 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.02985 |
| <u>M</u> Sb < 0.00050 | <u>M</u> Er < 0.00498 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00100 | <u>M</u> Tb 0.00099 |
| <u>M</u> As < 0.00995 | <u>M</u> Eu 0.00027 | <u>Q</u> Mg 0.00001 | <u>M</u> Rh < 0.00100 | <u>M</u> Tl < 0.00100 |
| <u>M</u> Ba < 0.00995 | <u>M</u> Gd < 0.00100 | <u>Q</u> Mn < 0.00002 | <u>M</u> Rb < 0.00100 | <u>M</u> Th < 0.00100 |
| <u>M</u> Be < 0.00050 | <u>M</u> Ga < 0.00100 | <u>Q</u> Hg < 0.02000 | <u>M</u> Ru < 0.00199 | <u>M</u> Tm 0.00007 |
| <u>M</u> Bi < 0.00040 | <u>M</u> Ge < 0.00597 | <u>M</u> Mo < 0.00199 | <u>M</u> Sm 0.00014 | <u>M</u> Sn < 0.00498 |
| <u>Q</u> B < 0.00100 | <u>M</u> Au < 0.00299 | <u>M</u> Nd 0.00008 | <u>Q</u> Sc < 0.00003 | <u>M</u> Tl < 0.04976 |
| <u>M</u> Cd < 0.00299 | <u>M</u> Hf < 0.00199 | <u>M</u> Ni < 0.00796 | <u>M</u> Se < 0.00796 | <u>M</u> W < 0.00995 |
| <u>Q</u> Ca 0.00026 | <u>M</u> Ho 0.00006 | <u>M</u> Nb < 0.00050 | <u>Q</u> Si 0.00016 | <u>M</u> U < 0.00199 |
| <u>M</u> Ce 0.00010 | <u>M</u> In < 0.00995 | <u>n</u> Os | <u>Q</u> Ag < 0.02000 | <u>Q</u> V < 0.00080 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00498 | <u>Q</u> Pd < 0.10000 | <u>Q</u> Na < 0.05000 | <u>M</u> Yb 0.00028 |
| <u>M</u> Cr < 0.00498 | <u>Q</u> Fe 0.00079 | <u>Q</u> P < 0.07000 | <u>Q</u> Sr < 0.00004 | <u>s</u> Y |
| <u>M</u> Co < 0.00299 | <u>M</u> La 0.00025 | <u>M</u> Pt < 0.00199 | <u>Q</u> S < 0.04300 | <u>Q</u> Zn < 0.00040 |
| <u>M</u> Cu < 0.00597 | <u>M</u> Pb < 0.00299 | <u>Q</u> K < 0.10000 | <u>M</u> Ta < 0.00697 | <u>Q</u> 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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5000

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 88.9059; +3, 6; $\text{Y}(\text{OH})(\text{H}_2\text{O})_2^{+2}$

Chemical Compatibility - Soluble in HCl, H_2SO_4 , and HNO_3 . Avoid HF, H_2PO_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.

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.

Y 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).

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 $\mu\text{g}/\text{mL}$ | 1 | ion | Ce, Th |
| ICP-OES 371.030 nm | 0.004 / 0.00007 $\mu\text{g}/\text{mL}$ | 1 | ion | Ce |
| ICP-OES 377.433 nm | 0.005 / 0.0009 $\mu\text{g}/\text{mL}$ | 1 | ion | Ta, Th, <u>Ge</u> , <u>O</u> , <u>Hf</u> |
| ICP-MS 89 amu | 0.8 ppt | n/a | M | |

010211

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)

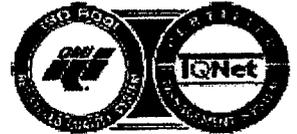
Entidad Mexicana de Acreditacion, a.c.(EMA)

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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5000



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**
01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Debbie Newman, Production Manager

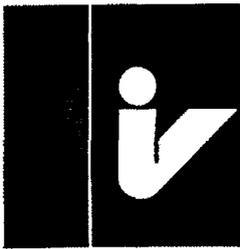
Debbie Newman
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

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5000



inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Barium in 0.1% (abs) HNO₃ 010213

Catalog Number: CGBA1-1, CGBA1-2, and CGBA1-5
Lot Number: X-BA02027
Starting Material: Ba(NO₃)₂ INORGANIC LABS/RADCHEM LABS
Starting Material Purity (%): 99.999730 DATE RECEIVED: 2/18/05
Starting Material Lot No 21879 DATE EXPIRED: 3/11/2006 DR
Matrix: 0.1% (abs) HNO₃ 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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

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

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 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.

010214

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

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

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

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

6.0 **INTENDED USE**

- For the calibration of analytical instruments including but not limited to the following: ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

010215

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - $137.33 \pm 2; 6; \text{Ba}(\text{H}_2\text{O})_6^{+2}$

Chemical Compatibility - Soluble in HCl, and HNO_3 . Avoid H_2SO_4 , HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate, iodate, molybdate, sulfite and tungstate in neutral aqueous media.

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

Ba Containing Samples (Preparation and Solution) - Metal is best dissolved in diluted HNO_3 . Ores (Carbonate fusion in Pt^{II} 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 $\mu\text{g}/\text{mL}$ | 1 | ion | Zr, U |
| ICP-OES 233.527 nm | 0.004 / 0.0003 $\mu\text{g}/\text{mL}$ | 1 | ion | |
| ICP-OES 230.424 nm | 0.004 / 0.0005 $\mu\text{g}/\text{mL}$ | 1 | ion | Mo, Ir, Co |
| ICP-MS 138 amu | 1 ppt | n/a | M' | $^{122}\text{Sn}^{+20}$, $^{127}\text{Te}^{+20}$ |

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

010216



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
12 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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5027

SPEX Certificate TM

Certificate of Reference Material

010217

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. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 2/28/05
 DATE EXP. DATE: 3/28/06
 DATE OPENED: 3/28/05
 INORG: 5037 PO: F5514K

Report of Certification

010218

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



SPEXTM Certificate

Certificate of Reference Material

010219

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.

FEB '05

Date of Certification: _____ Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 2/28/05
 DATE EXPIRED: 3/28/06
 DATE OPENED: 3/28/05
 INORG: 5038
 PO: F55148

Report of Certification

010220

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



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 DATE RECEIVED: 2/28/05
 DATE EXP. DATE: 2/28/06
 DATE OPENED: 2/28/05
 INORG: 5039
 PO: F55148
 DR

SPEXTM Certificate

Certificate of Reference Material

010221

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. Kocherakota

Report of Certification

010222

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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 DATE RECEIVED: 2/25/05
 DATE EXPIRED: 2/25/06
 DATE OPENED: 3/28/05
 INORG: 5040 PO: F55148

SPEXTM Certificate

Certificate of Reference Material

010223

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. Kocherakota

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



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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

010225

certificate of analysis

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

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

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) HNO₃

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 2/28/05
DATE EXPIRED: 3/1/2008
DATE OPENED: 2/28/05
INORG: 5041 PO: F55147

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:

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

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

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

$\sum s_i$ = 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 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.

010226

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00090 | <u>M</u> Dy < 0.01191 | <u>Q</u> Li < 0.00002 | <u>M</u> Pr < 0.00060 | <u>Q</u> Te < 0.00700 |
| <u>M</u> Sb 0.00039 | <u>M</u> Er < 0.00993 | <u>M</u> Lu < 0.00079 | <u>M</u> Re < 0.00199 | <u>M</u> Tb < 0.00060 |
| <u>M</u> As < 0.01985 | <u>M</u> Eu < 0.00596 | <u>Q</u> Mg 0.00002 | <u>M</u> Rh < 0.00199 | <u>M</u> Tl < 0.00199 |
| <u>M</u> Ba < 0.01985 | <u>M</u> Gd < 0.00199 | <u>M</u> Mn < 0.00794 | <u>M</u> Rb < 0.00199 | <u>M</u> Th < 0.00199 |
| <u>M</u> Be < 0.00099 | <u>M</u> Ga < 0.00199 | <u>Q</u> Hg < 0.01200 | <u>M</u> Ru < 0.00397 | <u>M</u> Tm < 0.00079 |
| <u>M</u> Bi < 0.00079 | <u>M</u> Ge < 0.01191 | <u>M</u> Mo < 0.00397 | <u>M</u> Sm < 0.00199 | <u>M</u> Sn < 0.00993 |
| <u>Q</u> B < 0.00900 | <u>M</u> Au < 0.00596 | <u>M</u> Nd < 0.00397 | <u>M</u> Sc < 0.01985 | <u>M</u> Tl < 0.09925 |
| <u>s</u> Cd | <u>M</u> Hf < 0.00397 | <u>Q</u> Ni < 0.00300 | <u>M</u> Se < 0.01588 | <u>M</u> W < 0.01985 |
| <u>Q</u> Ca 0.00378 | <u>M</u> Ho < 0.00099 | <u>M</u> Nb < 0.00099 | <u>Q</u> Si < 0.00340 | <u>M</u> U < 0.00397 |
| <u>M</u> Ce < 0.00993 | <u>Q</u> In < 0.00200 | <u>n</u> Os | <u>M</u> Ag < 0.00397 | <u>M</u> V < 0.00397 |
| <u>M</u> Cs < 0.00060 | <u>M</u> Ir < 0.00993 | <u>M</u> Pd 0.00691 | <u>M</u> Na < 0.19849 | <u>M</u> Yb < 0.00199 |
| <u>M</u> Cr < 0.00993 | <u>Q</u> Fe < 0.00110 | <u>Q</u> P < 0.00300 | <u>M</u> Sr < 0.00099 | <u>M</u> Y < 0.07940 |
| <u>M</u> Co < 0.00596 | <u>M</u> La < 0.00099 | <u>M</u> Pt < 0.00397 | <u>Q</u> S < 0.03000 | <u>Q</u> Zn 0.00040 |
| <u>M</u> Cu < 0.01191 | <u>M</u> Pb < 0.00596 | <u>Q</u> K 0.00015 | <u>M</u> Ta < 0.01389 | <u>M</u> Zr < 0.00993 |

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

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

010227

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 112.41; +2, 4; Cd₂(OH)²⁺ and Cd(C₂O₄)₂²⁻

Chemical Compatibility - Stable in HCl, HNO₃, H₂SO₄, and HF. Avoid basic media forming insoluble carbonate and hydroxide. Most metals and inorganic anions in acidic media. The sulfide, carbonate, oxalate, phosphate, and cyanide are insoluble in HCl, HNO₃ and NH₄OH. The chloride, bromide and iodide are soluble in water. Cd₂ is one of the few iodides soluble in water. Compounds of Cd are soluble in excess NaI, due to the formation of the complex ion, CdI₄²⁻.

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

Cd Containing Samples (Preparation and Solution) - Metal (soluble in HNO₃); Oxides (Soluble in HCl or HNO₃); Ores (HNO₃ then take to fumes with H₂SO₄. The silica and lead sulfate are filtered off after addition of water.); Organic based (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, <u>As</u> , Pt |
| ICP-OES 226.502 nm | 0.003 / 0.0003 µg/mL | 1 | ion | <u>Ir</u> |
| ICP-MS 111 amu | 11 ppt | n/a | M | ⁹⁵ Mo ¹⁶ O |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

Argentina (IRAM), Australia (QAS), Austria (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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11.1 **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 Malda, QA Administrator

Nicholas Malda
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

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4064



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

certificate of analysis ⁰¹⁰²²⁹

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Antimony In 0.7% (abs) HNO₃ / 3% Tartaric Acid

| | | |
|-------------------------------|--|------------------------------------|
| Catalog Number: | CGSB1-1, CGSB1-2 and CGSB1-5 | INORGANIC LABS/RADCHEM LA |
| Lot Number: | X-SB02083 | DATE RECEIVED: <u>2/28/05</u> |
| Starting Material: | Sb shot | DATE EXPIRED: <u>3/1/2006</u> |
| Starting Material Purity (%): | 99.993665 | DATE OPENED: <u>2/28/05</u> |
| Starting Material Lot No | D29N32 | INORG: <u>5042</u> PO: <u>F551</u> |
| Matrix: | 0.7% (abs) HNO ₃ / 3% Tartaric Acid | |

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:

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

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

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

$\sum s_i$ = 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.)

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. **010230**

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.02186 | <u>M</u> Dy < 0.00598 | <u>Q</u> Li < 0.00002 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.02988 |
| <u>s</u> Sb | <u>M</u> Er < 0.00498 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00100 | <u>M</u> Tb < 0.00030 |
| <u>M</u> As < 0.00996 | <u>M</u> Eu < 0.00299 | <u>Q</u> Mg 0.00074 | <u>M</u> Rh < 0.00100 | <u>M</u> Tl 0.00015 |
| <u>Q</u> Ba 0.00011 | <u>M</u> Gd < 0.00100 | <u>Q</u> Mn 0.00139 | <u>M</u> Rb < 0.00100 | <u>M</u> Th < 0.00100 |
| <u>Q</u> Be < 0.00001 | <u>M</u> Ga < 0.00100 | <u>Q</u> Hg < 0.01500 | <u>M</u> Ru < 0.00199 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi 0.00386 | <u>M</u> Ge < 0.00598 | <u>M</u> Mo < 0.00199 | <u>M</u> Sm < 0.00100 | <u>M</u> Sn < 0.00498 |
| <u>Q</u> B 0.00045 | <u>M</u> Au < 0.00299 | <u>M</u> Nd < 0.00199 | <u>Q</u> Sc < 0.00016 | <u>Q</u> Ti 0.00056 |
| <u>M</u> Cd < 0.00299 | <u>M</u> Hf < 0.00199 | <u>Q</u> Ni 0.00219 | <u>M</u> Se < 0.00797 | <u>M</u> W < 0.00996 |
| <u>Q</u> Ca 0.00521 | <u>M</u> Ho < 0.00050 | <u>M</u> Nb < 0.00050 | <u>Q</u> Si 0.00388 | <u>M</u> U < 0.00199 |
| <u>Q</u> Ce < 0.00300 | <u>M</u> In < 0.00996 | <u>n</u> Os | <u>M</u> Ag < 0.00199 | <u>M</u> V < 0.00199 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00498 | <u>M</u> Pd < 0.00498 | <u>Q</u> Na 0.00298 | <u>M</u> Yb < 0.00100 |
| <u>Q</u> Cr 0.00696 | <u>Q</u> Fe 0.00715 | <u>Q</u> P < 0.04000 | <u>M</u> Sr < 0.00050 | <u>M</u> Y < 0.03984 |
| <u>M</u> Co 0.00052 | <u>Q</u> La < 0.00120 | <u>M</u> Pt < 0.00199 | <u>n</u> S | <u>M</u> Zn < 0.01992 |
| <u>Q</u> Cu 0.00239 | <u>M</u> Pb 0.00040 | <u>Q</u> K 0.00497 | <u>M</u> Ta < 0.00697 | <u>M</u> Zr < 0.00498 |

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

6.0 INTENDED USE

- For the calibration of analytical instruments including but not limited to the following: ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 121.75; +3; 6; $\text{Sb}(\text{O})_2 \cdot \text{H}_2\text{O} \cdot \text{H}_2\text{O}_2$

Chemical Compatibility - Stable in concentrated HCl, dilute or concentrated HF. Stable in dilute HNO_3 as the fluoroantimonate complex. Avoid basic media. Stable with most metals and inorganic anions in acidic media as the tartarate complex provided the acidity is not too high or the acid is oxidizing causing loss of the stabilizing tartarate 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 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Ia</u> , Cr, Ge, Hf |
| ICP-OES 217.581 nm | 0.05 / 0.005 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Nb</u> , W, Re, Fe, |
| ICP-OES 231.147 nm | 0.06 / 0.006 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Ni</u> , Co, Pt |
| ICP-MS 121 amu | 5 ppt | n/a | M ⁺ | <u>Pd</u> , O, <u>Y</u> , <u>Os</u> |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

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

10.2 ISO/IEC 17025 - 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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11.1 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
12 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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4864



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

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Nickel in 1.4% (abs) HNO₃ 010233

| | | |
|-------------------------------|-------------------------------|-----------------------------|
| Catalog Number: | CGNI1-1, CGNI1-2, and CGNI1-5 | |
| Lot Number: | X-NI02032 | |
| Starting Material: | Ni pieces | INORGANIC LABS/RADCHEM LABS |
| Starting Material Purity (%): | 99.999371 | DATE RECEIVED: 2/28/05 |
| Starting Material Lot No | L06L02 | DATE EXPIRED: 3/17/2006 DR |
| Matrix: | 1.4% (abs) HNO ₃ | 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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

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

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

| | | |
|-----|-----------------|--|
| 4.1 | Assay Method #1 | 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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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. 010234

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00938 | <u>M</u> Dy < 0.06577 | <u>Q</u> Li < 0.00006 | <u>M</u> Pr < 0.00329 | <u>M</u> Te < 0.32886 |
| <u>M</u> Sb < 0.00548 | <u>M</u> Er < 0.05481 | <u>M</u> Lu < 0.00439 | <u>M</u> Re < 0.01096 | <u>M</u> Tb < 0.00329 |
| <u>Q</u> As < 0.01689 | <u>M</u> Eu < 0.03289 | <u>Q</u> Mg 0.00002 | <u>M</u> Rh < 0.01096 | <u>M</u> Tl < 0.01096 |
| <u>M</u> Ba < 0.10962 | <u>M</u> Gd < 0.01096 | <u>M</u> Mn < 0.04385 | <u>M</u> Rb < 0.01096 | <u>M</u> Th < 0.01096 |
| <u>Q</u> Be < 0.00626 | <u>M</u> Ga < 0.01096 | <u>Q</u> Hg < 0.03441 | <u>M</u> Ru < 0.02192 | <u>M</u> Tm < 0.00439 |
| <u>M</u> Bi < 0.00439 | <u>M</u> Ge < 0.06577 | <u>M</u> Mo < 0.02192 | <u>M</u> Sm < 0.01096 | <u>M</u> Sn < 0.05481 |
| <u>Q</u> B < 0.03097 | <u>M</u> Au < 0.03289 | <u>M</u> Nd < 0.02192 | <u>M</u> Sc < 0.10962 | <u>M</u> Ti < 0.54811 |
| <u>M</u> Cd < 0.03289 | <u>M</u> Hf < 0.02192 | <u>S</u> Ni | <u>Q</u> Se < 0.01877 | <u>M</u> W < 0.10962 |
| <u>Q</u> Ca < 0.01157 | <u>M</u> Ho < 0.00548 | <u>M</u> Nb < 0.00548 | <u>Q</u> Si 0.00188 | <u>M</u> U < 0.02192 |
| <u>M</u> Ce < 0.05481 | <u>M</u> In < 0.10962 | <u>n</u> Os | <u>M</u> Ag < 0.02192 | <u>M</u> V < 0.02192 |
| <u>M</u> Cs < 0.00329 | <u>M</u> Ir < 0.05481 | <u>M</u> Pd < 0.05481 | <u>Q</u> Na 0.00102 | <u>M</u> Yb < 0.01096 |
| <u>M</u> Cr < 0.05481 | <u>Q</u> Fe 0.00156 | <u>Q</u> P < 0.31280 | <u>M</u> Sr < 0.00548 | <u>M</u> Y < 0.43849 |
| <u>Q</u> Co 0.00182 | <u>M</u> La < 0.00548 | <u>M</u> Pt < 0.02192 | <u>Q</u> S < 0.07820 | <u>M</u> Zn 0.00189 |
| <u>M</u> Cu < 0.06577 | <u>M</u> Pb < 0.03289 | <u>Q</u> K 0.00043 | <u>M</u> Ta < 0.07674 | <u>M</u> 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; 8; $Ni(H_2O)_6^{2+}$

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

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

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

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

| Technique/line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at # 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 231.804 nm | 0.02 / 0.002 µg/mL | 1 ion | | Sb, Ta, Co |
| ICP-MS 60 amu | 100 ppt | n/a | M ⁺ | ⁴⁴ Ca ¹⁶ O ⁴ H, ⁴⁴ Ca ¹⁶ O, ²³ Na ³⁷ Cl |

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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

010235

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)

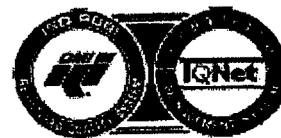
Entidad Mexicana de Acreditacion, a.c.(EMA)

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**
1A 2006

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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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010237

certificate of analysis

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

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

| | | |
|-------------------------------|-------------------------------|-----------------------------|
| Catalog Number: | CGCO1-1, CGCO1-2, and CGCO1-5 | |
| Lot Number: | X-CO01123 | |
| Starting Material: | Co powder | INORGANIC LABS/RADCHEM LABS |
| Starting Material Purity (%): | 99.999403 | DATE RECEIVED: 2/28/05 |
| Starting Material Lot No | 23171 | DATE EXPIRED: 3/1/06 |
| Matrix: | 2% (abs) HNO ₃ | DATE OPENED: 2/28/05 |
| | | INORG: 5044 PQ: 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:

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

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

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

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. 010238

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

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

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

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

| | | | | |
|----------------|----------------|----------------|----------------|----------------|
| Q Al 0.00030 | M Dy < 0.02394 | Q 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 |
| Q As < 0.10000 | M Eu < 0.01197 | Q Mg 0.00128 | M Rh < 0.00399 | M Tl < 0.00399 |
| M Ba < 0.03990 | M Gd < 0.00399 | Q Mn < 0.00400 | M Rb < 0.00399 | M Th < 0.00399 |
| M Be < 0.00200 | M Ga < 0.00399 | Q 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 |
| Q 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 | Q Ni < 0.02000 | M Se < 0.03192 | M W < 0.03990 |
| Q Ca 0.00168 | M Ho < 0.00200 | M Nb < 0.00200 | Q 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 | Q Na 0.00095 | M Yb < 0.00399 |
| M Cr 0.00080 | Q 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 | Q Zn 0.00020 |
| M Cu 0.00023 | M Pb 0.00150 | Q 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(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.

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

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

| Technique/Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at = concs.) |
|--------------------|-----------------|-------|------|---|
| ICP-OES 236.882 nm | 0.01/0.02 µg/mL | 1 | ion | <u>Fe, W, Ta</u> |
| ICP-OES 228.616 nm | 0.01/0.01 µg/mL | 1 | ion | |
| ICP-OES 237.862 nm | 0.01/0.02 µg/mL | 1 | ion | <u>W, Re, Al, Ta</u> |
| ICP-MS 59 amu | 2 ppt | n/a | M | <u>*Ca*O*H, *Ar*O*H, *Ar*Na, *Ca*O, *Mg*Cl</u> |

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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

010239

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 30, 2004

Expiration Date: **EXPIRES**
1st 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

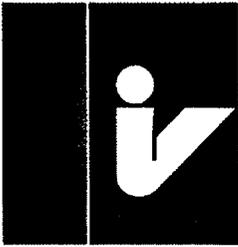
Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

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inorganic ventures / iv labs

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

010241

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL 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
DATE EXPIRED: 3/12/06
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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

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

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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. 010242

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

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

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

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

| | | | | |
|----------------|----------------|----------------|----------------|----------------|
| Q Al 0.00400 | M Dy < 0.00060 | Q Li < 0.04000 | M Pr < 0.00003 | Q Te < 0.01300 |
| Q Sb < 0.00500 | M Er < 0.00050 | M Lu < 0.00004 | M Re < 0.00010 | M Tb < 0.00003 |
| Q As < 0.01400 | M Eu < 0.00030 | Q Mg < 0.01100 | Q Rh < 0.00600 | M Tl < 0.00010 |
| M Ba < 0.00100 | M Gd < 0.00010 | Q Mn < 0.00650 | M Rb < 0.00010 | M Th < 0.00010 |
| Q Be < 0.00009 | M Ga < 0.00010 | Q Hg < 0.01100 | Q Ru < 0.00200 | M Tm < 0.00004 |
| M Bi < 0.00004 | M Ge < 0.00060 | M Mo < 0.00020 | M Sm < 0.00010 | Q Sn < 0.00700 |
| Q B < 0.00090 | Q Au < 0.00300 | M Nd < 0.00020 | Q Sc < 0.00009 | Q Ti < 0.00100 |
| Q Cd < 0.00600 | M Hf < 0.00020 | Q Ni 0.01800 | M Se < 0.00080 | M W < 0.00100 |
| Q Ca 0.00700 | M Ho < 0.00005 | M Nb < 0.00005 | Q Si 0.00600 | M U < 0.00020 |
| M Ce < 0.00050 | Q In < 0.03300 | n Os | Q Ag < 0.00670 | M V < 0.00020 |
| M Cs < 0.00003 | M Ir < 0.00050 | s Pd | Q Na 0.01500 | M Yb < 0.00010 |
| Q Cr 0.00450 | Q Fe 0.04600 | Q P 0.00600 | M Sr < 0.00005 | M Y < 0.00400 |
| M Co < 0.00030 | M La < 0.00005 | Q Pt < 0.00600 | Q S < 0.02500 | Q Zn < 0.00060 |
| Q Cu 0.00360 | M Pb < 0.00030 | Q 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 - 105.42; +2; 6; Pd(H₂O)₆²⁺

Chemical Compatibility - Stable in HCl, HNO₃, H₂SO₄, HF, H₃PO₄. Avoid basic media. Stable with most metals and inorganic anions in acidic media. Avoid contact with water soluble organics such as aldehydes since Pd²⁺ is easily reduced.

Stability - 2-100 ppb levels. 2ppb Pd is stable for 1 day in 1% HNO₃ /LDPE container. 10 ppb is stable for 3 days in 1% HNO₃ /LDPE container. 100 ppb is stable for ± 5 months in 1% HNO₃ /LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO₃ /LDPE container.

Pd Containing Samples (Preparation and Solution) - Metal (Soluble in HNO₃ or Aqua Regia) ; Oxides (Soluble in HCl) ; Ores (Dissolve in HCl / HNO₃).

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

| Technique/Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at = 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' | ⁶⁴ Ar ³⁶ Cu, ⁸⁸ Y ¹⁰⁰ O |

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2 of 4

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

010243

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

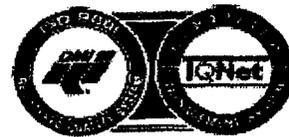
Standards Council of Canada (SCC)

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

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12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Nicholas Maida
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines 010244

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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 Statistical Principles."

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2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Silicon In H₂O tr. HNO₃ tr. HF

| | | |
|-------------------------------|--|-----------------------------|
| Catalog Number: | CGSI1-1, CGSI1-2, and CGSI1-5 | |
| Lot Number: | X-SI02087 | |
| Starting Material: | SiO ₂ | INORGANIC LABS/RADCHEM LABS |
| Starting Material Purity (%): | 99.996367 | DATE RECEIVED: 2/28/05 |
| Starting Material Lot No | C05310C | DATE EXPIRED: 3/1/2006 |
| Matrix: | H ₂ O tr. HNO ₃ tr. HF | DATE OPENED: 2/28/05 DR |
| | | INORG: 50476 PO: F55148 |
| | | DR 3/1/05 |

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

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

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 996 ± 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.

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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 UPLA-Filtered Clean Room. An UPLA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | | | | | | |
|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|
| Q Al | 0.02730 | M Dy | < 0.01358 | Q 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 | Q 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 |
| Q Be | < 0.00091 | M Ga | < 0.00226 | Q 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 |
| Q B | 0.02409 | M Au | < 0.00679 | M Nd | < 0.00453 | Q Sc | < 0.00091 | Q Ti | 0.01325 |
| M Cd | < 0.00679 | M Hf | < 0.00453 | Q Ni | < 0.01044 | M Se | < 0.01811 | M W | < 0.02264 |
| Q 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 | i Os | | M Ag | < 0.00453 | Q V | < 0.00408 |
| M Cs | < 0.00068 | M Ir | < 0.01132 | M Pd | < 0.01132 | Q Na | 0.02008 | M Yb | < 0.00226 |
| Q Cr | < 0.00681 | Q Fe | < 0.00499 | Q P | < 0.02269 | Q Sr | < 0.00032 | M Y | < 0.09055 |
| M Co | < 0.00679 | M La | < 0.00113 | M Pt | < 0.00453 | Q S | < 0.11342 | M Zn | < 0.04528 |
| Q Cu | < 0.00454 | M Pb | < 0.00679 | Q 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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

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

Chemical Compatibility - Soluble in HCl, HF, H_3PO_4 , H_2SO_4 , and HNO_3 as the $\text{Si}(\text{OH})_4(\text{F})_2^+$. Avoid neutral to basic media.

Unstable at ppm levels with metals that would pull F^- away (i.e. Do not mix with Alkaline or Rare Earths, or high levels of transition elements unless they are fluorinated). Stable with most inorganic anions with a tendency to hydrolyze forming silicic acid (silicic acid is soluble up to ~100 ppm in water) in all dilute acids except HF.

Stability - 2-100 ppb levels - stability unknown - (alone or mixed with all other metals) as the $\text{Si}(\text{OH})_4(\text{F})_2^+$. 1-10,000 ppm single element solutions as the $\text{Si}(\text{OH})_4(\text{F})_2^+$ chemically stable for years in 2-5 % HNO_3 / trace HF in a LDPE container.

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

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

| Technique/Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at all concs.) |
|--------------------|---------------------------------------|-------|------|---|
| ICP-OES 251.611 nm | 0.012 / 0.003 $\mu\text{g}/\text{mL}$ | 1 | ion | Ta, U, Zn, Th |
| ICP-OES 212.412 nm | 0.02 / 0.01 $\mu\text{g}/\text{mL}$ | 1 | ion | Hf, Os, <u>Mg</u> , Th |
| ICP-OES 268.158 nm | 0.03 / 0.004 $\mu\text{g}/\text{mL}$ | 1 | ion | <u>Ta</u> , Ce, Cr, Cd, Th |
| ICP-MS 28 amu | 4000 - 8000 ppt | n/a | M' | $^{14}\text{N}_2$, $^{12}\text{C}^{16}\text{O}$ |

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

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

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

10.0 **QUALITY STANDARD DOCUMENTATION**

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

Argentina (IRAM), Australia (QAS), Austria (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 Gaines

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Boron in H₂O

Catalog Number: CGB1-1, CGB1-2, and CGB1-5

Lot Number: X-B02047

Starting Material: H₃BO₃

Starting Material Purity (%): 99.999998

Starting Material Lot No OV0133

Matrix: H₂O

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 2/28/05

DATE EXPIRED: 3/11/2006 DR

DATE OPENED: 2/28/05

INORG: 5047 PD: 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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

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

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 1005 ± 2 µg/mL (Avg 2 runs)

ICP Assay NIST SRM 3107 Lot Number: 991907

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00090 | <u>M</u> Dy < 0.00600 | <u>Q</u> Li < 0.00002 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.03000 |
| <u>M</u> Sb < 0.00050 | <u>M</u> Er < 0.00500 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00100 | <u>M</u> Tb < 0.00030 |
| <u>M</u> As < 0.01000 | <u>M</u> Eu < 0.00300 | <u>Q</u> Mg < 0.00006 | <u>M</u> Rh < 0.00100 | <u>M</u> Tl < 0.00100 |
| <u>Q</u> Ba < 0.00010 | <u>M</u> Gd < 0.00100 | <u>Q</u> Mn < 0.00002 | <u>M</u> Rb < 0.00100 | <u>M</u> Th < 0.00100 |
| <u>Q</u> Be < 0.00017 | <u>Q</u> Ga < 0.00160 | <u>Q</u> Hg < 0.01500 | <u>M</u> Ru < 0.00200 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi < 0.00040 | <u>M</u> Ge < 0.00600 | <u>M</u> Mo < 0.00200 | <u>M</u> Sm < 0.00100 | <u>M</u> Sn < 0.00500 |
| <u>s</u> B | <u>M</u> Au < 0.00300 | <u>M</u> Nd < 0.00200 | <u>Q</u> Sc < 0.00002 | <u>M</u> Ti < 0.05000 |
| <u>M</u> Cd < 0.00300 | <u>M</u> Hf < 0.00200 | <u>Q</u> Ni < 0.00230 | <u>Q</u> Se < 0.00620 | <u>M</u> W < 0.01000 |
| <u>Q</u> Ca < 0.00007 | <u>M</u> Ho < 0.00050 | <u>M</u> Nb < 0.00050 | <u>Q</u> Si < 0.00067 | <u>M</u> U < 0.00200 |
| <u>Q</u> Ce < 0.00300 | <u>M</u> In < 0.01000 | <u>n</u> Os | <u>M</u> Ag < 0.00200 | <u>Q</u> V < 0.00083 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00500 | <u>M</u> Pd < 0.00500 | <u>Q</u> Na < 0.00010 | <u>M</u> Yb < 0.00100 |
| <u>M</u> Cr < 0.00500 | <u>Q</u> Fe < 0.00110 | <u>Q</u> P < 0.00250 | <u>M</u> Sr < 0.00050 | <u>M</u> Y < 0.04000 |
| <u>Q</u> Co < 0.00110 | <u>M</u> La < 0.00050 | <u>M</u> Pt < 0.00200 | <u>Q</u> S < 0.10000 | <u>Q</u> Zn < 0.00019 |
| <u>M</u> Cu < 0.00600 | <u>M</u> Pb < 0.00300 | <u>Q</u> K < 0.00300 | <u>M</u> Ta < 0.00700 | <u>M</u> Zr < 0.00500 |

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

6.0 INTENDED USE

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

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

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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

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

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

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

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); $\text{B}(\text{OH})_3$ (water soluble); Ores (avoid acid digestions and use caustic fusions in Pt^*); Organic Matrices (dry ash mixed with Na_2CO_3 in Pt^* at 450°C then increase heat to 1000°C to fuse; or perform a Na_2O_2 fusion in a Ni^* crucible / Parr bomb).

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

| Technique/Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at = concs.) |
|--------------------|--|-------|------|--|
| ICP-OES 249.773 nm | 0.003 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>W</u> , <u>Ce</u> , <u>Co</u> , <u>Th</u> , <u>Ta</u> , <u>Mn</u> , <u>Mo</u> , <u>Fe</u> |
| ICP-OES 249.676 nm | 0.004 / 0.003 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Os</u> , <u>W</u> , <u>Co</u> , <u>Cr</u> , <u>Hf</u> |
| ICP-OES 208.959 nm | 0.007 / 0.0005 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Mo</u> |
| ICP-MS 11amu | 700 ppt | n/a | M' | |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

Argentina (IRAM), Australia (QAS), Austria (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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11.1 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
1st 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 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 Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 10000 µg/mL Iron in 4.8% (abs) HNO₃

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) HNO₃

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 2/28/05

DATE EXPIRED: 3/11/2006 AR

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

$\sum s_i$ = 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 10,041 ± 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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c.d.

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00270 | <u>M</u> Dy < 0.02528 | <u>Q</u> Li < 0.00003 | <u>M</u> Pr < 0.00126 | <u>M</u> Te < 0.12640 |
| <u>M</u> Sb < 0.00211 | <u>M</u> Er < 0.02107 | <u>M</u> Lu < 0.00169 | <u>M</u> Re < 0.00421 | <u>M</u> Tb < 0.00126 |
| <u>M</u> As < 0.04213 | <u>M</u> Eu < 0.01264 | <u>Q</u> Mg < 0.00006 | <u>M</u> Rh < 0.00421 | <u>M</u> Tl < 0.00421 |
| <u>M</u> Ba < 0.04213 | <u>M</u> Gd < 0.00421 | <u>Q</u> Mn < 0.05000 | <u>M</u> Rb < 0.00421 | <u>M</u> Th < 0.00421 |
| <u>Q</u> Be < 0.00005 | <u>M</u> Ga < 0.00421 | <u>Q</u> Hg < 0.01100 | <u>M</u> Ru < 0.00843 | <u>M</u> Tm < 0.00169 |
| <u>M</u> Bi < 0.00169 | <u>I</u> Ge | <u>M</u> Mo < 0.00843 | <u>M</u> Sm < 0.00421 | <u>M</u> Sn < 0.02107 |
| <u>Q</u> B < 0.00090 | <u>M</u> Au < 0.01264 | <u>M</u> Nd < 0.00843 | <u>M</u> Sc < 0.04213 | <u>M</u> Tl < 0.21066 |
| <u>M</u> Cd < 0.01264 | <u>M</u> Hf < 0.00843 | <u>Q</u> Ni < 0.00230 | <u>M</u> Se < 0.03371 | <u>M</u> W < 0.04213 |
| <u>Q</u> Ca 0.03107 | <u>M</u> Ho < 0.00211 | <u>M</u> Nb < 0.00211 | <u>Q</u> Si 0.01673 | <u>M</u> U < 0.00843 |
| <u>M</u> Ce < 0.02107 | <u>M</u> In < 0.04213 | <u>n</u> Os | <u>M</u> Ag < 0.00843 | <u>M</u> V < 0.00843 |
| <u>M</u> Cs < 0.00126 | <u>M</u> Ir < 0.02107 | <u>M</u> Pd < 0.02107 | <u>Q</u> Na 0.00956 | <u>M</u> Yb < 0.00421 |
| <u>M</u> Cr < 0.02107 | <u>s</u> Fe | <u>I</u> P | <u>M</u> Sr < 0.00211 | <u>M</u> Y < 0.16853 |
| <u>Q</u> Co 0.01195 | <u>M</u> La < 0.00211 | <u>M</u> Pt < 0.00843 | <u>Q</u> S < 0.07200 | <u>M</u> Zn 0.08761 |
| <u>M</u> Cu < 0.02528 | <u>M</u> Pb < 0.01264 | <u>Q</u> K 0.00239 | <u>M</u> Ta < 0.02949 | <u>M</u> 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

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 55.847; +3; 6; $\text{Fe}(\text{H}_2\text{O})_6^{3+}$

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

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

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

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

| Technique/Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at = concs.) |
|--------------------|---------------------------------------|-------|------|---|
| ICP-OES 238.204 nm | 0.005 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | ion | <u>Ru</u> , Co |
| ICP-OES 238.562 nm | 0.005 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | ion | Co, <u>W</u> , Cr |
| ICP-OES 259.940 nm | 0.005 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | ion | Hf, <u>Nb</u> |
| ICP-MS 56 amu | 970 ppt | n/a | M' | $^{40}\text{Ar}^{16}\text{N}^+\text{H}$, $^{40}\text{Ar}^{16}\text{O}$, $^{39}\text{Ar}^{17}\text{O}^+\text{H}$, $^{39}\text{Ar}^{16}\text{O}$, $^{37}\text{Cl}^{16}\text{O}^+\text{H}$, $^{40}\text{Ca}^{16}\text{O}$ |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

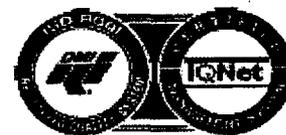
Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of **IQ Net International Certification Network**:

Argentina (IRAM), Australia (QAS), Austria (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 22, 2004

Expiration Date: **EXPIRES**
12/2006

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, Chemist, Senior Technical Director

Nick Malda
Katalin Le
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 Statistical Principles."

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

Catalog Number: CGCU1-1, CGCU1-2, and CGCU1-5
 Lot Number: X-CU02067
 Starting Material: Cu shot
 Starting Material Purity (%): 99.999437
 Starting Material Lot No: K09C13
 Matrix: 2% (abs) HNO₃

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 2/28/05
 DATE EXPIRED: 3/1/2006
 DATE OPENED: 2/28/05
 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:

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

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

(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.

| | | | | |
|----------------|----------------|----------------|----------------|----------------|
| Q Al < 0.00090 | M Dy < 0.03027 | Q 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 | Q 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 | Q 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 | Q Sn 0.00439 |
| M B < 0.35312 | M Au < 0.01513 | M Nd < 0.01009 | M Sc < 0.05045 | M Tl < 0.25223 |
| M Cd < 0.01513 | M Hf < 0.01009 | M Ni < 0.04036 | M Se < 0.04036 | M W < 0.05045 |
| Q Ca 0.00011 | M Ho < 0.00252 | M Nb < 0.00252 | Q Si < 0.00340 | M U < 0.01009 |
| M Ce < 0.02522 | M In < 0.05045 | n Os | M Ag < 0.01009 | Q V < 0.00300 |
| M Cs < 0.00151 | M Ir < 0.02522 | M Pd < 0.02522 | Q Na 0.00044 | M Yb < 0.00504 |
| M Cr < 0.02522 | Q Fe 0.00054 | Q 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 | Q 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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 63.546; +2; 6; $\text{Cu}(\text{H}_2\text{O})_6^{2+}$

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 | 0.067/001 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Nb</u> , <u>U</u> , <u>Th</u> , <u>Mo</u> , <u>Hf</u> |
| ICP-OES 224.700 nm | 0.017/001 $\mu\text{g}/\text{mL}$ | 1 | ion | <u>Pb</u> , <u>Ir</u> , <u>Ni</u> , <u>W</u> |
| ICP-OES 219.958 nm | 0.017/002 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Th</u> , <u>Te</u> , <u>Nb</u> , <u>U</u> , <u>Hf</u> |
| ICP-MS 63 amu | 10 ppt | n/a | M | ⁴⁴ Ar ³⁶ Na ⁴⁷ Ti ³⁰ O, ⁴⁹ Ti ³² Cl, ⁵⁰ Ti ³³ Cl, ⁵² Ca ³⁶ O, ⁵³ Na ³⁷ Ca |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of **IQ Net International Certification Network**:

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

10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



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

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

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

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

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

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

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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 16, 2004

Expiration Date:

EXPIRES
12 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Nicholas Maida
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Molybdenum in H₂O tr. NH₄OH

Catalog Number: CGMO1-1, CGMO1-2, and CGMO1-5

Lot Number: X-MO02004

Starting Material: (NH₄)₆Mo₇O₂₄xH₂O

Starting Material Purity (%): 99.995645

Starting Material Lot No 23221

Matrix: H₂O tr. NH₄OH

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 2/28/05

DATE EXPIRED: 3/12/06

DATE OPENED: 2/28/05

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:

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

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

(\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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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. **010262**

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.05000 | <u>M</u> Dy < 0.01202 | <u>Q</u> Li < 0.01000 | <u>Q</u> Pr < 0.10000 | <u>i</u> Te |
| <u>M</u> Sb < 0.00100 | <u>M</u> Er < 0.01002 | <u>M</u> Lu < 0.00080 | <u>M</u> Re 0.00541 | <u>M</u> Tb < 0.00060 |
| <u>M</u> As 0.00801 | <u>M</u> Eu < 0.00601 | <u>Q</u> Mg < 0.05000 | <u>M</u> Rh < 0.00200 | <u>M</u> Tl < 0.00200 |
| <u>M</u> Ba < 0.02004 | <u>M</u> Gd < 0.00200 | <u>M</u> Mn < 0.00801 | <u>M</u> Rb < 0.00200 | <u>M</u> Th < 0.00200 |
| <u>M</u> Be < 0.00100 | <u>M</u> Ga < 0.00200 | <u>i</u> Hg | <u>M</u> Ru < 0.00401 | <u>M</u> Tm < 0.00080 |
| <u>M</u> Bi < 0.00080 | <u>M</u> Ge < 0.01202 | <u>s</u> Mo | <u>M</u> Sm < 0.00200 | <u>M</u> Sn < 0.01002 |
| <u>Q</u> B < 0.50000 | <u>M</u> Au < 0.00601 | <u>Q</u> Nd < 0.05000 | <u>Q</u> Sc < 0.05000 | <u>Q</u> Ti < 0.00500 |
| <u>Q</u> Cd < 0.50000 | <u>M</u> Hf < 0.00401 | <u>M</u> Ni < 0.01603 | <u>M</u> Se < 0.01603 | <u>M</u> W 0.03907 |
| <u>Q</u> Ca 0.00150 | <u>M</u> Ho < 0.00100 | <u>M</u> Nb < 0.00100 | <u>Q</u> Si < 0.10000 | <u>M</u> U < 0.00401 |
| <u>Q</u> Ce < 0.05000 | <u>M</u> In < 0.02004 | <u>n</u> Os | <u>M</u> Ag < 0.00401 | <u>M</u> V < 0.00401 |
| <u>M</u> Cs < 0.00060 | <u>M</u> Ir < 0.01002 | <u>M</u> Pd < 0.01002 | <u>Q</u> Na < 0.10000 | <u>M</u> Yb < 0.00200 |
| <u>M</u> Cr < 0.01002 | <u>Q</u> Fe < 0.50000 | <u>i</u> P | <u>M</u> Sr < 0.00100 | <u>M</u> Y < 0.08014 |
| <u>M</u> Co < 0.00601 | <u>M</u> La < 0.00100 | <u>M</u> Pt < 0.00401 | <u>i</u> S | <u>M</u> Zn < 0.04007 |
| <u>M</u> Cu < 0.01202 | <u>M</u> Pb < 0.00601 | <u>Q</u> K 0.03500 | <u>M</u> Ta < 0.01403 | <u>M</u> 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

5150
2/8/4

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

010263

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; [MoO₄]²⁻ (chemical form as received)

Chemical Compatibility - Mo is received in a NH₄OH matrix giving the operator the option of using HCl or HF to stabilize acidic solutions. The [MoO₄]²⁻ is soluble in concentrated HCl [MoOCl₄]⁻, dilute HF / HNO₃, [MoOF₄]⁻ and basic media [MoO₄]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 [MoO₄]²⁻ chemical form.

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the [MoOF₄]⁻ for months in 1% HNO₃ / LDPE container. 1-10,000 ppm single element solutions as the [MoO₄]²⁻ chemically stable for years in 1% NH₄OH in a LDPE container.

Mo Containing Samples (Preparation and Solution) - Metal (Soluble in HF / HNO₃ or hot dilute HCl); Oxide (soluble in HF or NH₄OH); 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 | na | M | *As, *K, *O, *Br, *O, **Os, **Pt* |

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)

5050
304

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010264



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**
12 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 Gaines

5050
4064

SPEXTM Certificate

Certificate of Reference Material

010265

INORGANIC LABS/RADICHEM LABS
 DATE RECEIVED: 3/19/05
 DATE EXP. DATE: 3/15/06
 DATE OPENED: 3/15/05
 INORG: 5249 PO: F55152

Catalog Number: CRDL-1 **Lot No.:** 27-175AS
Description: Contract Required Detection Limits Standard
Matrix: 5% Nitric Acid/Tr-TART- 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 |
|---------|----------------|-----------------|----------|---------|----------------|-----------------|----------|
| Sb | 120 | 119.77 | 3102a | As | 20 | 20.01 | 3103a |
| Co | 100 | 99.69 | 3113 | Cr | 20 | 19.94 | 3112a |
| V | 100 | 99.90 | 3165 | TL | 20 | 19.95 | 3158 |
| Ni | 80 | 80.05 | 3136 | Be | 10 | 9.98 | 3105a |
| Cu | 50 | 50.71 | 3114 | Cd | 10 | 9.99 | 3108 |
| Zn | 40 | 39.69 | 3168a | Se | 10 | 9.98 | 3149 |
| Mn | 30 | 30.05 | 3132 | Pb | 6 | 5.99 | 3128 |
| Ag | 20 | 19.87 | 3151 | | | | |

Spex Reference Multi: Lot #5-242VY, 17-87AS, 4-29BD-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 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: MAR. -- 2005 Certifying Officer: N. Kocherakota

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995
EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition
ASTM Guide D6362-98

010266

ISO Guide 34: Quality system guidelines for the production of reference materials.
ISO Guide 17025: Certification of reference materials, general and statistical principles
ISO Guide 31: Contents of certificates of reference materials
NIST Technical Note 1297
ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers
ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



203 Norcross Avenue • Metuchen, NJ 08840 USA

732 510 7111 • 1 800 448 6767 • FAX 732 602 0647 • CRM@spex.com • WWW.SPEXCERTIPREP.COM



inorganic ventures / iv labs

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

010267

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Tin in H₂O tr HNO₃ tr HF

Catalog Number: CGSN1-1, CGSN1-2, and CGSN1-5
Lot Number: Y-QSN01140
Starting Material: Sn Shot
Starting Material Purity (%): 99.999438
Starting Material Lot No: G12M23
Matrix: H₂O tr HNO₃ tr HF

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 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:

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

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

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

$\sum s_i$ = 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.)

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
INDRG: 5174 PO: 52166

InfA

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.

010268

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 2360700

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

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

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

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

M - Checked by ICP-MS

O - Checked by ICP-OES

i - Spectral Interference

n - Not Checked For

s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 118.710; +4; 4, 5, 6, 7, 8; $\text{Sn}(\text{OH})_2\text{F}_2$

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 $\text{Sn}(\text{OH})_2\text{F}_2$ for 1 year in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $\text{Sn}(\text{OH})_2\text{F}_2$ 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 O₂ 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 $\mu\text{g}/\text{mL}$ | 1 | ion | |
| ICP-OES 242.949 nm | 0.1 / 0.01 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>W</u> , <u>Mo</u> , <u>Rh</u> , <u>Ta</u> , <u>Co</u> |
| ICP-MS 120 amu | 5 ppt | n/a | M | <u>Te</u> , <u>¹¹⁴Ru</u> , <u>¹⁶⁰O</u> , <u>¹⁵⁰Pd</u> , <u>¹⁶⁰O</u> |

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

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of IQ Net International Certification Network:

Argentina (IRAM), Australia (QAS), Austria (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)



010269

1004

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010270



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
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines



inorganic ventures / iv labs

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phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

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certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 10000 µg/mL Scandium in 5% (abs) HNO₃

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

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 10,007 ± 21 µg/mL

Certified Density: 1.071 g/mL (measured at 22° C)

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

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

$\sum s$ = The summation of all significant estimated errors

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 10,005 ± 26 µg/mL
ICP Assay NIST SRM 3148a Lot Number: 792111

Assay Method #2 10,007 ± 21 µg/mL
EDTA NIST SRM 928 Lot Number: 880710

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 3/31/05
DATE EXPIRED: 5/1/05
DATE OPENED: 3/31/05
INORG: 5175 PO: 221104

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.

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

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

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

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

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

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

6.0 INTENDED USE

- For the calibration of analytical instruments including but not limited to the following: ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Kept tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

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

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

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

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

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

| Technique/line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe at = concs.) |
|--------------------|---|-------|------|---|
| ICP-OES 335 373 nm | 0.004 / 0.00002 $\mu\text{g}/\text{mL}$ | 1 | ion | |
| ICP-OES 337 215 nm | 0.004 / 0.00002 $\mu\text{g}/\text{mL}$ | 1 | ion | Ti, U, Ni, Rh |
| ICP-OES 424 683 nm | 0.003 / 0.00002 $\mu\text{g}/\text{mL}$ | 1 | ion | Ce |
| ICP-MS 45 amu | 2.3 ppt | n/a | M | $^{16}\text{O}_2$, ^{12}CH , $^{28}\text{Si}^{16}\text{O}$, $^{88}\text{Zr}^{2}$ |

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)

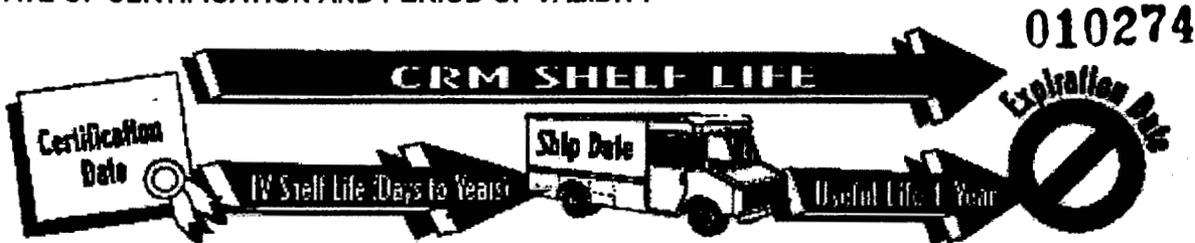
10.4 **10CFR50 Appendix B - Nuclear Regulatory Commission**

- 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)**

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 Gaines

SPE Certificate™

010275

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

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.

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 4/18/05

DATE EXPIRED: 4/30/06

DATE OPENED: 4/18/05

INORG: 5197 PO: 55169

1 of 2
5197

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

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

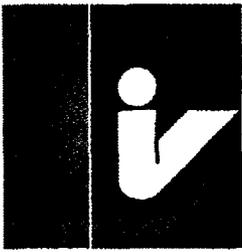
Legal Notice:

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



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5107





inorganic ventures / iv labs

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

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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 Strontium in 0.1% (abs) HNO3

| | | |
|-------------------------------|-------------------------------|-----------------------------|
| Catalog Number: | CGSR1-1, CGSR1-2, and CGSR1-5 | |
| Lot Number: | Y-SR01128 | INORGANIC LABS/RADCHEM LABS |
| Starting Material: | SrCO3 | DATE RECEIVED: 5/19/05 |
| Starting Material Purity (%): | 99.999250 | DATE EXPIRED: 6/1/06 |
| Starting Material Lot No: | 22878 | DATE OPENED: 5/19/05 |
| Matrix: | 0.1% (abs) HNO3 | 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) = $\frac{2(\sum s_i)^{1/2}}{(n)^{1/2}}$ | $\sum s_i$ = 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.

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

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

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

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

| | | | | |
|-----------------------|-------------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.00011 | <u>M</u> Dy < 0.00595 | <u>Q</u> Li 0.00013 | <u>M</u> Pr < 0.00030 | <u>Q</u> Te < 0.10000 |
| <u>M</u> Sb < 0.00050 | <u>M</u> Er < 0.00496 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00099 | <u>M</u> Tb < 0.00030 |
| <u>Q</u> As < 0.00500 | <u>M</u> Eu < 0.00297 | <u>Q</u> Mg 0.00008 | <u>Q</u> Rh < 0.00600 | <u>M</u> Tl < 0.00099 |
| <u>M</u> Ba 0.00197 | <u>M</u> Gd 0.00512 | <u>Q</u> Mn 0.00003 | <u>i</u> Rb | <u>M</u> Th < 0.00099 |
| <u>Q</u> Be < 0.00009 | <u>M</u> Ga < 0.00099 | <u>Q</u> Hg < 0.01500 | <u>Q</u> Ru < 0.00300 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi < 0.00040 | <u>M</u> Ge < 0.00595 | <u>M</u> Mo < 0.00198 | <u>M</u> Sm < 0.00099 | <u>M</u> Sn < 0.00496 |
| <u>Q</u> B < 0.00060 | <u>M</u> Au < 0.00297 | <u>M</u> Nd < 0.00198 | <u>M</u> Sc < 0.00991 | <u>M</u> Ti < 0.04956 |
| <u>M</u> Cd < 0.00297 | <u>M</u> Hf < 0.00198 | <u>Q</u> Ni < 0.00300 | <u>Q</u> Se < 0.05000 | <u>M</u> W < 0.00991 |
| <u>Q</u> Ca 0.00447 | <u>M</u> Ho < 0.00050 | <u>M</u> Nb < 0.00050 | <u>Q</u> Si < 0.00340 | <u>M</u> U < 0.00198 |
| <u>M</u> Ce < 0.00496 | <u>Q</u> In < 0.00200 | <u>n</u> Os | <u>M</u> Ag < 0.00198 | <u>M</u> V < 0.00198 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00496 - | <u>Q</u> Pd < 0.00400 | <u>Q</u> Na 0.00149 | <u>M</u> Yb 0.00059 |
| <u>Q</u> Cr < 0.00080 | <u>Q</u> Fe 0.00044 | <u>Q</u> P < 0.00480 | <u>s</u> Sr | <u>Q</u> Y < 0.00004 |
| <u>M</u> Co < 0.00297 | <u>M</u> La < 0.00050 | <u>M</u> Pt < 0.00198 | <u>n</u> S | <u>M</u> Zn < 0.01982 |
| <u>Q</u> Cu < 0.00140 | <u>M</u> Pb 0.00016 | <u>Q</u> K < 0.00170 | <u>M</u> Ta < 0.00694 | <u>M</u> Zr < 0.00496 |

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

6.0 INTENDED USE

- For the calibration of analytical instruments including but not limited to the following: ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 87.62; +2; 6; $\text{Sr}(\text{H}_2\text{O})_6^{+2}$

Chemical Compatibility - Soluble in HCl, and HNO_3 . Avoid H_2SO_4 , HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate 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 $\mu\text{g}/\text{mL}$ | 1 | ion | U, Ce |
| ICP-OES 421.552 nm | 0.0008 / 0.00004 $\mu\text{g}/\text{mL}$ | 1 | ion | Rb |
| ICP-OES 460.733 nm | 0.07 / 0.003 $\mu\text{g}/\text{mL}$ | 1 | atom | Ce |
| ICP-MS 88 amu | 1200 ppt | n/a | M* | $^{72}\text{Ge}^{16}\text{O}$, $^{176}\text{Yb}^{+2}$, $^{176}\text{Lu}^{+2}$, $^{176}\text{Hf}^{+2}$ |

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

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

Members of **IQ Net International Certification Network**:

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



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



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

A2LA Mutual Recognition Agreement Partners:

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

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

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

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

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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.

010280

Certification Date: April 15, 2005

Expiration Date:

EXPIRES
01/15/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Nickolas Maida

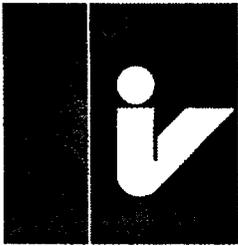
Certificate Approved By: Katalin Le, QC Manager

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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010281

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Lithium in 0.07% (abs) HNO₃

| | |
|-------------------------------|--|
| Catalog Number: | CGLI1-1, CGLI1-2, and CGLI1-5 |
| Lot Number: | X-LI02079 INORGANIC LABS/RADCHEM LABS |
| Starting Material: | Li ₂ CO ₃ DATE RECEIVED: 5/19/05 |
| Starting Material Purity (%): | 99.997165 DATE EXPIRED: 6/1/06 |
| Starting Material Lot No | 1123 DATE OPENED: 5/19/05 |
| Matrix: | 0.07% (abs) HNO ₃ INORG: 5244 PO: 55180 |

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:

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

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

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

$\sum s_i$ = 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 | 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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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.

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.00120 | <u>M</u> Dy < 0.01199 | <u>S</u> Li | <u>M</u> Pr < 0.00060 | <u>M</u> Te < 0.05994 |
| <u>M</u> Sb < 0.00100 | <u>M</u> Er < 0.00999 | <u>M</u> Lu < 0.00080 | <u>M</u> Re < 0.00200 | <u>M</u> Tb < 0.00060 |
| <u>M</u> As < 0.01998 | <u>M</u> Eu < 0.00599 | <u>Q</u> Mg 0.00650 | <u>M</u> Rh < 0.00200 | <u>M</u> Tl < 0.00200 |
| <u>M</u> Ba < 0.01998 | <u>M</u> Gd < 0.00200 | <u>Q</u> Mn 0.00006 | <u>M</u> Rb < 0.00200 | <u>M</u> Th < 0.00200 |
| <u>Q</u> Be < 0.00020 | <u>M</u> Ga < 0.00200 | <u>Q</u> Hg < 0.01500 | <u>M</u> Ru < 0.00400 | <u>M</u> Tm < 0.00080 |
| <u>M</u> Bi < 0.00080 | <u>M</u> Ge < 0.01199 | <u>M</u> Mo < 0.00400 | <u>M</u> Sm < 0.00200 | <u>Q</u> Sn < 0.00600 |
| <u>Q</u> B 0.00020 | <u>M</u> Au < 0.00599 | <u>M</u> Nd < 0.00400 | <u>M</u> Sc < 0.01998 | <u>Q</u> Ti < 0.00070 |
| <u>M</u> Cd < 0.00599 | <u>M</u> Hf < 0.00400 | <u>Q</u> Ni < 0.00230 | <u>M</u> Se < 0.01598 | <u>Q</u> W < 0.00400 |
| <u>Q</u> Ca 0.04050 | <u>M</u> Ho < 0.00100 | <u>M</u> Nb < 0.00100 | <u>Q</u> Si 0.04650 | <u>M</u> U < 0.00400 |
| <u>M</u> Ce < 0.00999 | <u>Q</u> In < 0.00400 | <u>n</u> Os | <u>M</u> Ag < 0.00400 | <u>Q</u> V 0.00009 |
| <u>M</u> Cs < 0.00060 | <u>M</u> Ir < 0.00999 | <u>M</u> Pd < 0.00999 | <u>Q</u> Na 0.03200 | <u>M</u> Yb < 0.00200 |
| <u>M</u> Cr < 0.00999 | <u>Q</u> Fe 0.00200 | <u>Q</u> P < 0.00250 | <u>Q</u> Sr 0.00026 | <u>M</u> Y < 0.07992 |
| <u>M</u> Co < 0.00599 | <u>M</u> La < 0.00100 | <u>M</u> Pt < 0.00400 | <u>Q</u> S 0.01250 | <u>Q</u> Zn 0.00145 |
| <u>Q</u> Cu 0.00100 | <u>M</u> Pb < 0.00599 | <u>Q</u> K 0.00950 | <u>M</u> Ta < 0.01399 | <u>M</u> Zr < 0.00999 |

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

6.0 INTENDED USE

- For the calibration of analytical instruments including but not limited to the following: ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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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 - 6.941; +1; (6); Li⁺(aq) large effective radius due to hydration sphere (Coordination Number in parentheses is assumed, not certain.)

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

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

Li Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Sodium carbonate fusion in Pt⁺ 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 |
|--------------------|-----------------------|-------|------|--|
| ICP-OES 670.784 nm | 0.002 / 0.00002 µg/mL | 1 | atom | 2 nd order radiation from R.E.s on some optical designs |
| ICP-OES 460.286 nm | 0.9 / 0.04 µg/mL | 1 | atom | Zr, Th |
| ICP-OES 323.261 nm | 1.1 / 0.05 µg/mL | 1 | atom | Sb, Th, Ni |
| ICP-MS 7 amu | 10 ppt | | n/a | M |

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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)

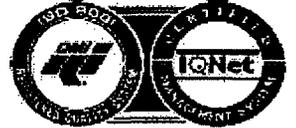
Standards Council of Canada (SCC)

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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11.1 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
01/2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Nick Maida, QA Administrator

Nicholas Maida
Katalin Le

Certificate Approved By: Katalin Le, QC Manager

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul Gaines

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SPEXcertificate TM

Certificate of Reference Material

010285

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.

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 5/24/05
 DATE EXPIRED: 5/20/06
 DATE OPENED: 5/24/05
 INORG: 5240 PO: 150180

Date of Certification: MAY - 2005 **Certifying Officer:** N. Kocherakota

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



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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

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certificate of analysis

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

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

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) HNO₃

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:

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

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

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

$\sum s_i$ = 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 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

DATE OPENED: 5/27/05

INORG: 5253 PO: 55195

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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.

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

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

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

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

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

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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 9.01218; +2; 4; $\text{Be}^+(\text{H}_2\text{O})_4^{+2}$

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 ($\text{H}_2\text{SO}_4/\text{HF}$ 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):

| <u>Technique/Line</u> | <u>Estimated D.L.</u> | <u>Order</u> | <u>Type</u> | <u>Interferences</u> (underlined indicates severe) |
|-----------------------|--|--------------|--------------|--|
| ICP-OES 313.042 nm | 0.0003 / 0.00009 $\mu\text{g}/\text{mL}$ | 1 | ion | V, Ce, U |
| ICP-OES 234.861 nm | 0.0003 / 0.00016 $\mu\text{g}/\text{mL}$ | 1 | atom | Fe, Ta, Mo |
| ICP-OES 313.107 nm | 0.0007 / 0.0005 $\mu\text{g}/\text{mL}$ | 1 | ion | Ce, Th, Tm |
| ICP-MS 9 amu | 4 ppt | n/a | M^+ | |

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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 / 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.

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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

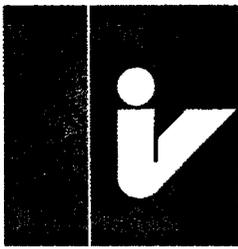
Certificate Approved By: Katalin Le, QC Manager

Katalin Le

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

Paul 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

CUSTOM-GRADE SOLUTION **1000 µg/mL Phosphorus in H₂O** **010291**
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:

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

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

(\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.

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

M - checked by ICP-MS O - checked by ICP-OES i - spectral interference n - not checked for s - solution standard element

ANALYZED DENSITY OF SOLUTION (measured at 22°C): 0.999 g/mL

QA:KL Rev. 020606CG

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 5/27/05
DATE EXPIRED: 4/1/06
DATE OPENED: 5/27/05
INORG: 5254 PO: 55195

Paul R. Gaines

Quality Assurance Manager

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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 μ m filter and in-house procedure IV-PACK-001 is used to clean all bottles. Contact us for technical information relating to contamination issues in packaging materials.

GLASSWARE CALIBRATION

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

BALANCE CALIBRATION

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

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

THERMOMETER CALIBRATION

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

TECHNICAL SUPPORT

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

TEL 1-800-569-6799

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 Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Lead in 0.35% (abs) HNO₃ **010293**

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) HNO₃

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:

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

(\bar{x}) = mean

x_i = individual results

n = number of measurements

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

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

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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

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

4.1 Assay Method #1 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: 52550 PO: 55105

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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. 010294

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00270 | <u>M</u> Dy < 0.01193 | <u>Q</u> Li < 0.00002 | <u>M</u> Pr < 0.00060 | <u>M</u> Te < 0.05965 |
| <u>M</u> Sb < 0.00099 | <u>M</u> Er < 0.00994 | <u>M</u> Lu < 0.00080 | <u>M</u> Re < 0.00199 | <u>M</u> Tb < 0.00060 |
| <u>M</u> As < 0.01989 | <u>M</u> Eu < 0.00597 | <u>Q</u> Mg 0.00008 | <u>Q</u> Rh < 0.00900 | <u>Q</u> Tl 0.00130 |
| <u>M</u> Ba < 0.01989 | <u>M</u> Gd < 0.00199 | <u>M</u> Mn < 0.00795 | <u>M</u> Rb < 0.00199 | <u>M</u> Th < 0.00199 |
| <u>M</u> Be < 0.00099 | <u>M</u> Ga < 0.00199 | <u>Q</u> Hg < 0.01500 | <u>M</u> Ru < 0.00398 | <u>M</u> Tm < 0.00080 |
| <u>Q</u> Bi < 0.02000 | <u>M</u> Ge < 0.01193 | <u>M</u> Mo < 0.00398 | <u>M</u> Sm < 0.00199 | <u>M</u> Sn < 0.00994 |
| <u>Q</u> B < 0.04000 | <u>M</u> Au < 0.00597 | <u>M</u> Nd < 0.00398 | <u>M</u> Sc < 0.01989 | <u>M</u> Ti < 0.09942 |
| <u>M</u> Cd < 0.00597 | <u>M</u> Hf < 0.00398 | <u>M</u> Ni < 0.01591 | <u>M</u> Se < 0.01591 | <u>M</u> W < 0.01989 |
| <u>Q</u> Ca 0.00009 | <u>M</u> Ho < 0.00099 | <u>M</u> Nb < 0.00099 | <u>Q</u> Si < 0.00340 | <u>M</u> U < 0.00398 |
| <u>M</u> Ce < 0.00994 | <u>M</u> In < 0.01989 | <u>n</u> Os | <u>M</u> Ag < 0.00398 | <u>M</u> V < 0.00398 |
| <u>M</u> Cs < 0.00060 | <u>M</u> Ir < 0.00994 | <u>M</u> Pd < 0.00994 | <u>Q</u> Na < 0.00600 | <u>M</u> Yb < 0.00199 |
| <u>M</u> Cr < 0.00994 | <u>Q</u> Fe 0.00011 | <u>Q</u> P < 0.00500 | <u>M</u> Sr < 0.00099 | <u>M</u> Y < 0.07954 |
| <u>M</u> Co < 0.00597 | <u>M</u> La < 0.00099 | <u>M</u> Pt < 0.00398 | <u>Q</u> S < 0.10000 | <u>M</u> Zn < 0.03977 |
| <u>M</u> Cu < 0.01193 | <u>s</u> Pb | <u>Q</u> K < 0.00180 | <u>M</u> Ta < 0.01392 | <u>M</u> 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

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7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

010295

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 207.2; +2; 6; $\text{Pb}(\text{H}_2\text{O})_6^{2+}$

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 $\mu\text{g/mL}$ concs.) |
|--------------------------|-------------------------------|-------|------|--|
| ICP-OES 168.215 nm | 0.03 / 0.003 $\mu\text{g/mL}$ | 1 | ion | Co |
| ICP-OES 220.353 nm | 0.04 / 0.006 $\mu\text{g/mL}$ | 1 | ion | Bi, Nb |
| ICP-OES 217.000 nm | 0.09 / 0.03 $\mu\text{g/mL}$ | 1 | atom | W, Ir, Hf, Sb, Th |
| ICP-MS 208 μm | 5 ppt | n/a | M' | ¹⁰⁹ Pt, ¹⁸⁷ Os, ¹⁸⁸ Os |

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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11.1 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**
01/2006

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 Gaines

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SPEX[™] Certificate 010297

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 |

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. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 6/30/05
 DATE EXPIRED: 6/30/06
 DATE OPENED: 6/30/05
 INORG: 5279 PO: 155205

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



203 Norcross Avenue • Metuchen, NJ 08840 USA

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

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SPEXTM Certificate

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# 049411. 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. Kocherakota

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 6/30/05

DATE EXPIRED: 6/30/06

DATE OPENED: 6/30/05

INORG: 5280 PO: 152205

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



010301

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. Kocherakota

Report of Certification

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

Guide To The Expression Of Uncertainty In Measurement 1995

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

ASTM Guide D6362-98

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

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

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

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

ISO/REMCO N280

Material Source:

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

Instructions for Use:

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

Method of Preparation:

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

Homogeneity:

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

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

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

m = the sub-sampling mass

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

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

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

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

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

Certification Traveler Report:

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

Legal Notice:

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



INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 7/9/05
 DATE EXPIRED: 7/15/05
 DATE OPENED: 7/15/05
 INORG: 5896 PO: F55002

SPEXTM Certificate

Certificate of Reference Material

010303

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. Kocherakota

SPEXcertificate™

010304

Certificate of Reference Material

Catalog Number: INT-A1 **Lot No.:** 29-98AS
Description: Interferents A
Matrix: 5% Nitric Acid

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

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

Refer to side 2 for details of measurement uncertainties.

Instrumental Analysis by ICP Spectrometer:

| Element | Labeled (mg/L) | Measured (mg/L) | NIST SRM | Element | Labeled (mg/L) | Measured (mg/L) | NIST SRM |
|---------|----------------|-----------------|----------|---------|----------------|-----------------|----------|
| Al | 5,000 | 4,978 | 3101a | Mg | 5,000 | 4,977 | 3131a |
| Ca | 5,000 | 4,975 | 3109a | Fe | 2,000 | 1,993 | 3126a |

Spex Reference Multi: Lot #20-167AS, 13-74AS, 15-97AS, 18-59AS-REF

Trace Metallic Impurities in the Actual Solution, in PPB, via ICPMS Analysis:

| | | | | | | | | | | | |
|----|--------|----|--------|----|-------|----|--------|----|----------|----|-------|
| Ag | <200.0 | Cs | <0.20 | In | 0.10 | Ni | 12.00 | Sc | <6.00 | Tl | <0.50 |
| As | <4.00 | Cu | 2.00 | Ir | <0.70 | P | 450.00 | Se | <30.00 | Tm | 0.10 |
| Au | <0.70 | Dy | <0.20 | K | 750.0 | Pb | 7.00 | Si | <1000.00 | U | <0.40 |
| B | <10.00 | Er | <0.06 | La | 50.00 | Pd | <0.30 | Sm | <0.20 | V | <0.70 |
| Ba | 10.00 | Eu | 0.40 | Li | <5.00 | Pr | 0.02 | Sn | <0.30 | W | <0.90 |
| Be | <7.00 | Ga | <0.30 | Lu | <0.02 | Pt | <0.30 | Sr | 100.00 | Y | 5.00 |
| Bi | <0.20 | Gd | <0.20 | Mn | 50.00 | Rb | <0.10 | Ta | <0.20 | Yb | <0.30 |
| Cd | <0.30 | Ge | <10.00 | Mo | 0.60 | Re | <0.30 | Tb | <0.06 | Zn | 60.00 |
| Ce | 6.00 | Hf | <0.10 | Na | 60.00 | Rh | 0.80 | Te | <2.00 | Zr | 2.00 |
| Co | 10.00 | Hg | <6.00 | Nb | <0.09 | Ru | <0.40 | Th | <5.00 | | |
| Cr | <8.00 | Ho | <1.00 | Nd | <0.20 | Sb | <1.00 | Ti | <5.00 | | |

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: JUL -- 2005 Certifying Officer: *N. Kocherakota*

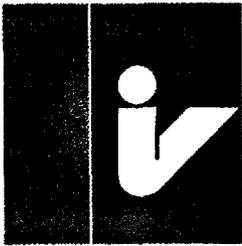
INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 7/20/05

DATE EXPIRED: 7/15/06

DATE OPENED: 7/20/05

INORG: 5300 PO: 55212



inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Tungsten in 0.1% (abs) HNO₃ 1% (abs) HF 010305
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) HNO₃ 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:

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

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

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

$\sum s_i$ = The summation of all significant estimated errors.
(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

- "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)
- This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 Assay Method #1 998 ± 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 PD: F55213

1 of 4
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.

010306

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

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

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

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

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.01998 | <u>M</u> Dy < 0.00599 | <u>Q</u> Li < 0.00008 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.02995 |
| <u>M</u> Sb < 0.00050 | <u>M</u> Er < 0.00499 | <u>M</u> Lu < 0.00040 | <u>i</u> Re | <u>M</u> Tb < 0.00030 |
| <u>M</u> As < 0.00999 | <u>M</u> Eu < 0.00300 | <u>Q</u> Mg 0.00256 | <u>M</u> Rh < 0.00100 | <u>M</u> Tl < 0.00100 |
| <u>M</u> Ba < 0.00999 | <u>M</u> Gd < 0.00100 | <u>M</u> Mn < 0.00399 | <u>M</u> Rb < 0.00100 | <u>M</u> Th < 0.00100 |
| <u>M</u> Be < 0.00050 | <u>M</u> Ga < 0.00100 | <u>Q</u> Hg < 0.04794 | <u>M</u> Ru < 0.00200 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi < 0.00040 | <u>M</u> Ge < 0.00599 | <u>M</u> Mo < 0.00200 | <u>M</u> Sm < 0.00100 | <u>M</u> Sn < 0.00499 |
| <u>Q</u> B 0.07191 | <u>M</u> Au < 0.00300 | <u>M</u> Nd < 0.00200 | <u>Q</u> Sc < 0.00036 | <u>Q</u> Ti < 0.00360 |
| <u>M</u> Cd < 0.00300 | <u>M</u> Hf 0.00100 | <u>Q</u> Ni < 0.03995 | <u>M</u> Se < 0.00799 | <u>s</u> W |
| <u>Q</u> Ca 0.00240 | <u>M</u> Ho < 0.00050 | <u>Q</u> Nb < 0.06392 | <u>i</u> Si | <u>M</u> U < 0.00200 |
| <u>M</u> Ce < 0.00499 | <u>M</u> In < 0.00999 | <u>n</u> Os | <u>M</u> Ag < 0.00200 | <u>M</u> V < 0.00200 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00499 | <u>M</u> Pd < 0.00499 | <u>Q</u> Na 0.05194 | <u>M</u> Yb < 0.00100 |
| <u>M</u> Cr < 0.00499 | <u>Q</u> Fe < 0.03995 | <u>n</u> P | <u>M</u> Sr < 0.00050 | <u>M</u> Y < 0.03994 |
| <u>M</u> Co < 0.00300 | <u>M</u> La < 0.00050 | <u>M</u> Pt < 0.00200 | <u>n</u> S | <u>M</u> Zn 0.00120 |
| <u>M</u> Cu < 0.00599 | <u>M</u> Pb < 0.00300 | <u>Q</u> K 0.03436 | <u>Q</u> Ta < 0.39951 | <u>M</u> 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

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5308

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 183.85; +6; 6, 7, 8, 9; WOF_5^{2-} (chemical form as received)

010307

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 $\mu\text{g}/\text{mL}$ | 1 | ion | Ru, In |
| ICP-OES 224.875 nm | 0.05 / 0.005 $\mu\text{g}/\text{mL}$ | 1 | ion | Co, Rh, Ag |
| ICP-OES 209.475 nm | 0.05 / 0.005 $\mu\text{g}/\text{mL}$ | 1 | ion | Mo |
| ICP-MS 182 amu | 5 ppt | n/a | M* | $^{166}\text{Er}^{16}\text{O}$ |

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

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

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

10.0 QUALITY STANDARD DOCUMENTATION

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

Recognized by:

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



Members of IQ Net International Certification Network:

Argentina (IRAM), Australia (QAS), Austria (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

010308

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**

102006

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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5308



inorganic ventures / iv labs

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

certificate of analysis

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

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Bismuth in 3.5% (abs) HNO₃

010309

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) HNO₃

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:

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

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

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$\sum s_i$ = The summation of all significant estimated errors.
(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

• "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

• This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 Assay Method #1 1000 ± 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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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.

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4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an UHPA-Filtered Clean Room. An UHPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.00012 | <u>M</u> Dy < 0.01202 | <u>Q</u> Li < 0.00002 | <u>M</u> Pr < 0.00060 | <u>M</u> Te < 0.06008 |
| <u>M</u> Sb < 0.00100 | <u>M</u> Er < 0.01001 | <u>M</u> Lu < 0.00080 | <u>M</u> Re < 0.00200 | <u>M</u> Tb < 0.00060 |
| <u>M</u> As < 0.02003 | <u>M</u> Eu < 0.00601 | <u>Q</u> Mg 0.00070 | <u>M</u> Rh < 0.00200 | <u>M</u> Tl < 0.00200 |
| <u>M</u> Ba < 0.02003 | <u>M</u> Gd < 0.00200 | <u>Q</u> Mn < 0.00020 | <u>M</u> Rb < 0.00200 | <u>M</u> Th < 0.00200 |
| <u>M</u> Be < 0.00100 | <u>M</u> Ga < 0.00200 | <u>Q</u> Hg < 0.01500 | <u>M</u> Ru < 0.00401 | <u>M</u> Tm < 0.00080 |
| <u>s</u> Bi | <u>M</u> Ge < 0.01202 | <u>M</u> Mo < 0.00401 | <u>M</u> Sm < 0.00200 | <u>M</u> Sn < 0.01001 |
| <u>M</u> B < 0.14018 | <u>M</u> Au < 0.00601 | <u>M</u> Nd < 0.00401 | <u>M</u> Sc < 0.02003 | <u>M</u> Ti < 0.10013 |
| <u>Q</u> Cd 0.00017 | <u>M</u> Hf < 0.00401 | <u>M</u> Ni < 0.01602 | <u>M</u> Se < 0.01602 | <u>M</u> W < 0.02003 |
| <u>Q</u> Ca 0.00245 | <u>M</u> Ho < 0.00100 | <u>M</u> Nb < 0.00100 | <u>Q</u> Si 0.00105 | <u>M</u> U < 0.00401 |
| <u>M</u> Ce < 0.01001 | <u>Q</u> In 0.00105 | <u>n</u> Os | <u>M</u> Ag < 0.00401 | <u>M</u> V < 0.00401 |
| <u>M</u> Cs < 0.00060 | <u>M</u> Ir < 0.01001 | <u>Q</u> Pd < 0.00400 | <u>Q</u> Na 0.00240 | <u>M</u> Yb < 0.00200 |
| <u>Q</u> Cr 0.00020 | <u>Q</u> Fe 0.00014 | <u>Q</u> P < 0.01000 | <u>M</u> Sr < 0.00100 | <u>M</u> Y < 0.08011 |
| <u>M</u> Co < 0.00601 | <u>M</u> La < 0.00100 | <u>M</u> Pt < 0.00401 | <u>Q</u> S < 0.03000 | <u>Q</u> Zn 0.00008 |
| <u>Q</u> Cu 0.00014 | <u>Q</u> Pb 0.00135 | <u>Q</u> K 0.00039 | <u>M</u> Ta < 0.01402 | <u>M</u> Zr < 0.01001 |

M - Checked by ICP-MS Q - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
 ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
 For the validation of analytical methods
 For the preparation of "working reference samples"
 For interference studies and the determination of correction coefficients
 For detection limit and linearity studies
 For additional intended uses, contact IV Technical Staff

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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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 208.9804; +3; 6 ; $\text{Bi}(\text{O})(\text{H}_2\text{O})_x^{1+}$
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 $\mu\text{g}/\text{mL}$ 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):

| <u>Technique/Line</u> | <u>Estimated D.L.</u> | <u>Order</u> | <u>Type</u> | <u>Interferences</u> (underlined indicates severe) |
|-----------------------|--------------------------------------|--------------|-------------|---|
| ICP-OES 223.061 nm | 0.04 / 0.005 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Th</u> , <u>Ir</u> , <u>Ti</u> Cu |
| ICP-OES 306.772 nm | 0.08 / 0.01 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Th</u> , <u>U</u> , <u>Zr</u> , <u>Hf</u> , <u>Fe</u> |
| ICP-OES 222.825 nm | 0.1 / 0.02 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Cr</u> , <u>Hf</u> , <u>Ce</u> , <u>Os</u> |
| ICP-MS 209 amu | 2 ppt | n/a | M* | <u>^{193}Ir</u> , <u>^{16}O</u> |

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8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety Data sheet for information regarding this CRM.

9.0 **HOMOGENEITY** - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

Entidad Mexicana de Acreditacion, a.c.(EMA)

Members of **IQ Net International Certification Network:**

Argentina (IRAM), Australia (QAS), Austria (OQS), Belgium (Avinter), Brazil (FCAV), Canada (QMI), Hong Kong (HKQAA), Columbia (ICONTEC), Czech Republic (CQS), Denmark (DS), Finland (SFS), France (AFAQ), Germany (DQS), Greece (ELOT), Hungary (MSZT), Ireland (NSAI), Israel (SII), Italy (CISQ), Japan (JQA), Korea (KSA-QA), Netherlands (KEMA), Norway (NCS), Poland(PCBC), Portugal (APCER), Singapore (PSB), Slovenia (SIQ), Spain (AENOR), Switzerland (SQS)



10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- Chemical Testing - Accredited A2LA Certificate Number 883.01



10.3 ISO/IEC Guide 34 - 2000 "General Requirements for the Competence of Reference Material Producers"

- Reference Materials Production - Accredited A2LA Certificate Number 883.02

A2LA Mutual Recognition Agreement Partners:

Australia (NATA), Austria (BmwA), Belgium (BELTEST) (BKO-OBE), Canada (SCC), Chinese Taipei (CNLA), Czech Republic (NAO), Denmark (DANAK), Finland (FINAS), France (COFRAC), Germany (DAR), Hong Kong (HKAS, Ireland (NAB), Italy (SIT) (SINAL), Japan (JAB) (JNLA), Republic of Korea (KOLAS), The Netherlands (RvA), New Zealand (IANZ), Norway (NA), Portugal (IPQ), Singapore (SAC-SINGLAS), Spain (ENAC), Sweden (SWEDAC), Switzerland (SAS), United Kingdom (UKAS) and United States (NVLAP) (ICBO ES)

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission - Reporting Defects and Non-Compliance

10.6 MIL-STD-45662A (Obsolete/Observed)

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11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010312

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**
11/2005

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

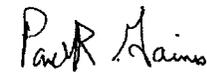
Certificate Prepared By: Nick Maida, QA Administrator



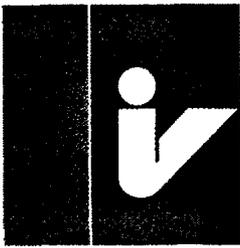
Certificate Approved By: Katalin Le, QC Manager



Certifying Officer: Paul Gaines, Chemist, Senior Technical Director



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certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s)), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade **10000 µg/mL 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:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

(\bar{x}) = mean
 x_i = individual results
 n = number of measurements

$$\text{Uncertainty } (\pm) = 2 \left(\frac{\sum s_i^2}{n} \right)^{1/2}$$

$\sum s_i^2$ = The summation of all significant estimated errors.
 (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

"Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

This IV product is Traceable to NIST via 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: 8/11/06
DATE OPENED: 7/22/05
INORG: 5310 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.

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4.3 THERMOMETER CALIBRATION - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 GLASSWARE CALIBRATION - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00090 | <u>M</u> Dy < 0.00600 | <u>Q</u> Li < 0.00003 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.02998 |
| <u>M</u> Sb < 0.00050 | <u>M</u> Er < 0.00500 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00100 | <u>M</u> Tb < 0.00030 |
| <u>M</u> As < 0.00999 | <u>M</u> Eu < 0.00300 | <u>Q</u> Mg 0.00010 | <u>M</u> Rh < 0.00100 | <u>M</u> Tl < 0.00100 |
| <u>M</u> Ba < 0.00999 | <u>M</u> Gd < 0.00100 | <u>Q</u> Mn < 0.00003 | <u>M</u> Rb < 0.00100 | <u>M</u> Th < 0.00100 |
| <u>Q</u> Be < 0.00020 | <u>M</u> Ga < 0.00100 | <u>Q</u> Hg < 0.01500 | <u>M</u> Ru < 0.00200 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi < 0.00040 | <u>Q</u> Ge < 0.00150 | <u>M</u> Mo < 0.00200 | <u>M</u> Sm < 0.00100 | <u>M</u> Sn < 0.00500 |
| <u>Q</u> B < 0.00060 | <u>Q</u> Au < 0.00300 | <u>M</u> Nd < 0.00200 | <u>Q</u> Sc < 0.00002 | <u>Q</u> Ti < 0.00070 |
| <u>M</u> Cd < 0.00300 | <u>M</u> Hf < 0.00200 | <u>Q</u> Ni < 0.00230 | <u>Q</u> Se < 0.05000 | <u>M</u> W < 0.00999 |
| <u>Q</u> Ca 0.00050 | <u>M</u> Ho < 0.00050 | <u>M</u> Nb < 0.00050 | <u>Q</u> Si < 0.00340 | <u>M</u> U < 0.00200 |
| <u>M</u> Ce < 0.00500 | <u>M</u> In < 0.00999 | <u>n</u> Os | <u>M</u> Ag < 0.00200 | <u>Q</u> V < 0.00090 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00500 | <u>M</u> Pd < 0.00500 | <u>S</u> Na | <u>M</u> Yb < 0.00100 |
| <u>M</u> Cr < 0.00500 | <u>Q</u> Fe < 0.00110 | <u>Q</u> P < 0.04000 | <u>M</u> Sr < 0.00050 | <u>M</u> Y < 0.03997 |
| <u>M</u> Co < 0.00300 | <u>M</u> La < 0.00050 | <u>M</u> Pt < 0.00200 | <u>Q</u> S < 0.07200 | <u>Q</u> Zn 0.00250 |
| <u>Q</u> Cu < 0.00140 | <u>M</u> Pb < 0.00300 | <u>Q</u> K 0.04000 | <u>M</u> Ta < 0.00700 | <u>M</u> Zr < 0.00500 |

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:

ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP

For the validation of analytical methods

For the preparation of "working reference samples"

For interference studies and the determination of correction coefficients

For detection limit and linearity studies

For additional intended uses, contact IV Technical Staff

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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 - 22.98977; +1; (6); Na⁺(aq) largely ionic in nature (Coordination Number in parentheses is assumed, not certain.)

Chemical Compatibility - Soluble in HCl, HNO₃, H₂SO₄ and HF aqueous matrices. Stable with all metals and inorganic anions.

Stability - 2-100 ppb levels stable for months in 1% HNO₃ / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO₃ / LDPE container.

Na Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Lithium carbonate fusion in graphite crucible followed by HCl dissolution - blank levels of Na in lithium carbonate critical); Organic Matrices (Sulfuric / peroxide digestion or nitric/sulfuric/perchloric acid decomposition).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

| Technique/Line | Estimated D.L. | Order | Type | Interferences (underlined indicates severe) |
|--------------------|----------------------|-------|----------------|--|
| ICP-OES 588.995 nm | 0.07 / 0.00009 µg/mL | 1 | atom | 2 nd order radiation from R.E.s on some optical designs |
| ICP-OES 588.995 nm | 0.03 / 0.006 µg/mL | 1 | atom | 2 nd order radiation from R.E.s on some optical designs |
| ICP-OES 330.237 nm | 2.0 / 0.09 µg/mL | 1 | atom | <u>Pd, Zn</u> |
| ICP-MS 23 µmu | 310 ppt | n/a | M ⁺ | <u>Ti</u> , <u>Ce</u> |

010315

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 / 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.

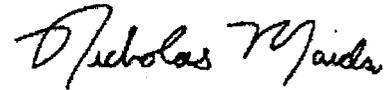
11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Inorganic Ventures / IV Labs concurs with state and federal regulatory 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



Certificate Approved By: Katalin Le, QC Manager



Certifying Officer: Paul Gaines, Chemist, Senior Technical Director





inorganic ventures / iv labs

195 lehigh avenue, suite 4, lakewood, nj 08701 usa
phone: 800-669-6799 • 732-901-1900 • fax: 732-901-1903
e-mail: ivsales@ivstandards.com • website: www.ivstandards.com

010317

certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s)), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Zirconium in H₂O tr. HNO₃ tr. HF

Catalog Number: CGZR1-1, CGZR1-2, and CGZR1-5
Lot Number: Y-ZR01062
Starting Material: ZrO₂
Starting Material Purity (%): 99.994542
Starting Material Lot No 22855
Matrix: H₂O tr. HNO₃ 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:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

(\bar{x}) = mean
 x_i = individual results
 n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i^2)^{1/2}]}{(n)^{1/2}}$$

$\sum s_i$ = The summation of all significant estimated errors.
(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

• "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

• This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 Assay Method #1 995 ± 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
INDRG: 5311 PD: F55213

10F4
5311

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.

010318

4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.01416 | <u>M</u> Dy < 0.01188 | <u>Q</u> Li < 0.00012 | <u>M</u> Pr < 0.00059 | <u>M</u> Te < 0.05942 |
| <u>M</u> Sb < 0.00099 | <u>M</u> Er < 0.00990 | <u>M</u> Lu < 0.00079 | <u>M</u> Re < 0.00198 | <u>M</u> Tb < 0.00059 |
| <u>M</u> As < 0.01981 | <u>M</u> Eu < 0.00594 | <u>Q</u> Mg < 0.00012 | <u>M</u> Rh < 0.00198 | <u>M</u> Tl < 0.00198 |
| <u>M</u> Ba < 0.01981 | <u>M</u> Gd < 0.00198 | <u>Q</u> Mn < 0.00401 | <u>M</u> Rb < 0.00198 | <u>M</u> Th < 0.00198 |
| <u>Q</u> Be < 0.40048 | <u>M</u> Ga < 0.00198 | <u>Q</u> Hg < 0.04405 | <u>M</u> Ru < 0.00396 | <u>M</u> Tm < 0.00079 |
| <u>M</u> Bi < 0.00079 | <u>M</u> Ge < 0.01188 | <u>Q</u> Mo < 0.40048 | <u>M</u> Sm < 0.00198 | <u>M</u> Sn < 0.00990 |
| <u>M</u> B < 0.13864 | <u>M</u> Au < 0.00594 | <u>M</u> Nd < 0.00396 | <u>Q</u> Sc < 0.00064 | <u>Q</u> Ti < 0.16019 |
| <u>Q</u> Cd < 0.02123 | <u>M</u> Hf 0.04403 | <u>Q</u> Ni 0.01214 | <u>M</u> Se < 0.01585 | <u>M</u> W < 0.01981 |
| <u>Q</u> Ca 0.00809 | <u>M</u> Ho < 0.00099 | <u>Q</u> Nb < 0.08010 | <u>Q</u> Si < 0.80096 | <u>M</u> U < 0.00396 |
| <u>M</u> Ce < 0.00990 | <u>M</u> In < 0.01981 | <u>n</u> Os | <u>Q</u> Ag < 0.40048 | <u>M</u> V < 0.00396 |
| <u>M</u> Cs < 0.00059 | <u>M</u> Ir < 0.00990 | <u>M</u> Pd < 0.00990 | <u>Q</u> Na < 0.02803 | <u>M</u> Yb < 0.00198 |
| <u>Q</u> Cr < 0.00881 | <u>Q</u> Fe 0.00344 | <u>Q</u> P < 0.01922 | <u>M</u> Sr < 0.00099 | <u>Q</u> Y < 0.00401 |
| <u>M</u> Co < 0.00594 | <u>M</u> La < 0.00099 | <u>M</u> Pt < 0.00396 | <u>Q</u> S < 0.28033 | <u>Q</u> Zn < 0.04005 |
| <u>M</u> Cu < 0.01188 | <u>M</u> Pb < 0.00594 | <u>Q</u> K < 0.00681 | <u>M</u> Ta < 0.01386 | <u>s</u> 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

Storage & Handling - Keep tightly sealed when not in use. Store and use at $20 \pm 4^\circ\text{C}$. Do not pipette 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; $\text{Zr}(\text{F})_6^{-2}$

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 $\text{Zr}(\text{F})_6^{-2}$ + $\text{Zr}(\text{OH})_4\text{F}_2^{-2}$ for months in 1% HNO_3 / LDPE container. 1-10,000 ppm single element solutions as the $\text{Zr}(\text{F})_6^{-2}$ 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 $\mu\text{g}/\text{mL}$ | 1 | ion | Hf, Nb |
| ICP-OES 339.198 nm | 0.008 / 0.0007 $\mu\text{g}/\text{mL}$ | 1 | ion | <u>Th</u> , Mo |
| ICP-OES 272.261 nm | 0.018 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | ion | <u>Cr</u> , V, <u>Th</u> , W |
| ICP-MS 90 amu | 2 ppt | n/a | M ⁺ | <u>$^{74}\text{Ge}^{16}\text{O}$</u> , <u>$^{74}\text{Se}^{16}\text{O}$</u> , [<u>$^{180}\text{X}^{+2}$</u> (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 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

010320

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.

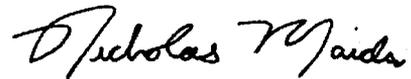
Certification Date: March 16, 2005

Expiration Date:

EXPIRES
16 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

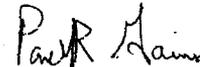
Certificate Prepared By: Nick Maida, QA Administrator



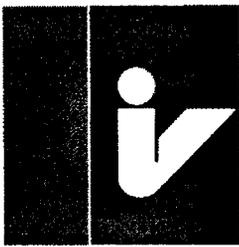
Certificate Approved By: Katalin Le, QC Manager



Certifying Officer: Paul Gaines, Chemist, Senior Technical Director



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5311



certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 10000 µg/mL Magnesium in 1.4% (abs) HNO₃ **010321**
Catalog Number: CGMG10-1, CGMG10-2, and CGMG10-5
Lot Number: **X-MG03018**
Starting Material: Mg metal
Starting Material Purity (%): 99.994984
Starting Material Lot No 91191
Matrix: 1.4% (abs) HNO₃

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 10,039 ± 31 µg/mL
Certified Density: 1.051 g/mL (measured at 22° C)

The Certified Value is the instrument analysis value. The following equations are used in the calculation of the certified value and the uncertainty:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

(\bar{x}) = mean

x_i = individual results

n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$\sum S$ = The summation of all significant estimated errors.

(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

□ "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

□ This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 Assay Method #1 10,039 ± 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 $\mu\text{g/mL}$ 010322

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 μm .

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.04714 | <u>M</u> Dy < 0.03601 | <u>Q</u> Li 0.00623 | <u>M</u> Pr < 0.00180 | <u>M</u> Te < 0.18002 |
| <u>M</u> Sb < 0.00300 | <u>M</u> Er < 0.03000 | <u>M</u> Lu < 0.00240 | <u>M</u> Re < 0.00600 | <u>M</u> Tb < 0.00180 |
| <u>M</u> As < 0.06001 | <u>M</u> Eu < 0.01800 | <u>s</u> Mg | <u>M</u> Rh < 0.00600 | <u>M</u> Tl < 0.00600 |
| <u>M</u> Ba < 0.06001 | <u>M</u> Gd < 0.00600 | <u>Q</u> Mn 0.07408 | <u>M</u> Rb < 0.00600 | <u>M</u> Th < 0.00600 |
| <u>Q</u> Be < 0.00017 | <u>M</u> Ga < 0.00600 | <u>Q</u> Hg < 0.00900 | <u>M</u> Ru < 0.01200 | <u>M</u> Tm < 0.00240 |
| <u>M</u> Bi < 0.00240 | <u>M</u> Ge < 0.03601 | <u>M</u> Mo < 0.01200 | <u>M</u> Sm < 0.00600 | <u>M</u> Sn < 0.03000 |
| <u>Q</u> B 0.00303 | <u>M</u> Au < 0.01800 | <u>M</u> Nd < 0.01200 | <u>M</u> Sc < 0.06001 | <u>Q</u> Ti 0.09765 |
| <u>M</u> Cd < 0.01800 | <u>M</u> Hf < 0.01200 | <u>Q</u> Ni 0.01229 | <u>M</u> Se < 0.04801 | <u>M</u> W < 0.06001 |
| <u>Q</u> Ca 0.14984 | <u>M</u> Ho < 0.00300 | <u>M</u> Nb < 0.00300 | <u>Q</u> Si 0.02357 | <u>M</u> U < 0.01200 |
| <u>M</u> Ce < 0.03000 | <u>M</u> In < 0.06001 | <u>n</u> Os | <u>M</u> Ag < 0.01200 | <u>M</u> V < 0.01200 |
| <u>M</u> Cs < 0.00180 | <u>M</u> Ir < 0.03000 | <u>M</u> Pd < 0.03000 | <u>Q</u> Na 0.02189 | <u>M</u> Yb < 0.00600 |
| <u>Q</u> Cr 0.02189 | <u>Q</u> Fe 0.03704 | <u>Q</u> P < 0.01600 | <u>M</u> Sr < 0.00300 | <u>M</u> Y 0.02021 |
| <u>M</u> Co < 0.01800 | <u>M</u> La < 0.00300 | <u>M</u> Pt < 0.01200 | <u>n</u> S | <u>Q</u> Zn 0.00572 |
| <u>Q</u> Cu 0.00674 | <u>Q</u> Pb 0.02694 | <u>Q</u> K < 0.05000 | <u>M</u> Ta < 0.04201 | <u>M</u> Zr < 0.03000 |

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments including but not limited to the following: ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 24.305, +2; 6, $\text{Mg}(\text{H}_2\text{O})_6^{2+}$

Chemical Compatibility - Soluble in HCl, HNO_3 , and H_2SO_4 , avoid HF, H_3PO_4 , and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicates, carbonates, hydroxides, oxides, and tungstates in neutral and slightly acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-10% HNO_3 / LDPE container.

Mg Containing Samples (Preparation and Solution) - Metal (Best dissolved in diluted HNO_3); Oxide (Readily soluble in above compatible aqueous acidic solutions); Ores (Carbonate fusion in Pt^{H} 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 |
|--------------------|--|-------|------|---|
| ICP-OES 279.553 nm | 0.0002 / 0.00003 $\mu\text{g}/\text{mL}$ | 1 | ion | Th |
| ICP-OES 280.270 nm | 0.0003 / 0.00005 $\mu\mathbf{g}/\text{mL}$ | 1 | ion | U, V |
| ICP-OES 285.213 nm | 0.002 / 0.00003 $\mu\text{g}/\text{mL}$ | 1 | atom | U, Hf, Cr, Zr |
| ICP-MS 24 amu | 42 ppt | n/a | M' | ⁶ Li, ⁴⁶ Ti, ⁴⁰ Ca ¹² |

010323

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), 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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5312

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
10/2006

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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010025

certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Selenium in 1.4% (abs) HNO₃

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) HNO₃

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:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

(\bar{x}) = mean
 x_i = individual results
 n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$\sum s_i$ = The summation of all significant estimated errors.
(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

• "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

• This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 Assay Method #1 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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5313

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.

010326

4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 **TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL**

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.00030 | <u>M</u> Dy < 0.01196 | <u>Q</u> Li < 0.00003 | <u>M</u> Pr < 0.00060 | <u>M</u> Te < 0.05982 |
| <u>M</u> Sb < 0.00100 | <u>M</u> Er < 0.00997 | <u>M</u> Lu < 0.00080 | <u>Q</u> Re < 0.00900 | <u>M</u> Tb < 0.00060 |
| <u>Q</u> As < 0.00500 | <u>M</u> Eu < 0.00598 | <u>Q</u> Mg 0.00021 | <u>M</u> Rh < 0.00199 | <u>M</u> Tl < 0.00199 |
| <u>M</u> Ba < 0.01994 | <u>M</u> Gd < 0.00199 | <u>M</u> Mn < 0.00798 | <u>M</u> Rb < 0.00199 | <u>M</u> Th < 0.00199 |
| <u>Q</u> Be < 0.00009 | <u>M</u> Ga < 0.00199 | <u>Q</u> Hg 0.01054 | <u>Q</u> Ru < 0.00700 | <u>M</u> Tm < 0.00080 |
| <u>M</u> Bi < 0.00080 | <u>M</u> Ge < 0.01196 | <u>Q</u> Mo < 0.00400 | <u>M</u> Sm < 0.00199 | <u>M</u> Sn < 0.00997 |
| <u>Q</u> B < 0.00006 | <u>M</u> Au < 0.00598 | <u>M</u> Nd < 0.00399 | <u>M</u> Sc < 0.01994 | <u>M</u> Ti < 0.09969 |
| <u>M</u> Cd 0.00060 | <u>M</u> Hf < 0.00399 | <u>Q</u> Ni 0.00028 | <u>S</u> Se | <u>M</u> W < 0.01994 |
| <u>Q</u> Ca 0.00100 | <u>M</u> Ho < 0.00100 | <u>Q</u> Nb < 0.00400 | <u>Q</u> Si < 0.00300 | <u>M</u> U < 0.00399 |
| <u>M</u> Ce < 0.00997 | <u>M</u> In < 0.01994 | <u>n</u> Os | <u>M</u> Ag < 0.00399 | <u>M</u> V < 0.00399 |
| <u>M</u> Cs < 0.00060 | <u>M</u> Ir < 0.00997 | <u>M</u> Pd < 0.00997 | <u>Q</u> Na 0.00402 | <u>M</u> Yb < 0.00199 |
| <u>M</u> Cr 0.00080 | <u>Q</u> Fe 0.00271 | <u>Q</u> P < 0.00300 | <u>M</u> Sr < 0.00100 | <u>M</u> Y < 0.07976 |
| <u>M</u> Co < 0.00598 | <u>M</u> La < 0.00100 | <u>M</u> Pt < 0.00399 | <u>Q</u> S < 0.04000 | <u>M</u> Zn 0.00400 |
| <u>M</u> Cu 0.00130 | <u>M</u> Pb < 0.00598 | <u>Q</u> K 0.00060 | <u>M</u> Ta < 0.01396 | <u>Q</u> 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

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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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 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_3 or 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 $\mu\text{g}/\text{mL}$ | 1 | atom | Fe |
| ICP-OES 203.985 nm | 0.2 / 0.05 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Sb</u> , <u>Ir</u> , <u>Cr</u> , <u>Ta</u> |
| ICP-OES 206.279 nm | 0.3 / 0.16 $\mu\text{g}/\text{mL}$ | 1 | atom | <u>Cr</u> , <u>Pt</u> |
| ICP-MS 82 amu | 200 ppt | n/a | M ⁺ | ¹² C ³⁵ Cl ₂ |

010327

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 / 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.

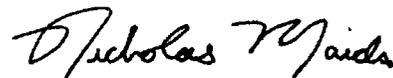
010328

Certification Date: August 30, 2004

Expiration Date: **EXPIRES**
102006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

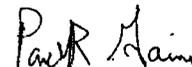
Certificate Prepared By: Nick Maida, QA Administrator



Certificate Approved By: Katalin Le, QC Manager



Certifying Officer: Paul Gaines, Chemist, Senior Technical Director



4024
5313

SPEXTM Certificate

Certificate of Reference Material

010329

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 |

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. Kocherakota

INORGANIC LABS/RADCHEM LABS
 DATE RECEIVED: 7/24/05
 DATE EXPIRED: 7/30/06
 DATE OPENED: 7/28/05
 INORG: 534 PO: 155213

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

010330

Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression $k_s = s^2 m$ is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ where $k=2$ is the coverage factor at the 95% confidence level

u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c = \sqrt{\sum u_i^2}$

Certification Traveler Report:

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

Legal Notice:

SPEX CertiPrep reference materials are not for any cosmetic, drug or household application and are to be used only by qualified individuals who are trained in appropriate procedures. No claims against SPEX CertiPrep, Inc. of any kind whatsoever, whether based on breach of warranty, alleged negligence, or otherwise, with respect to this RM shall be greater than the purchase price. In no event shall SPEX CertiPrep, Inc. be liable for any loss of profits or any incidental, special, or consequential damages.



203 Norcross Avenue • Metuchen, NJ 08840 USA

732-549-7144 • 1-800-LAB-SPEX • Fax: 732-603-9647 • CRMSales@spexcsp.com • www.spexcsp.com

SPEXTM Certificate

010331

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.

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 8/4/05
DATE EXPIRED: 8/15/06
DATE OPENED: 8/15/05
INORG: 5325 FO: F2423

Date of Certification: AUG - 2005 Certifying Officer: N. Kocherakota

Report of Certification

010332

This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition

ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers

ISO/REMCO N280

Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression $k_s = s^2 m$ is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ where $k=2$ is the coverage factor at the 95% confidence level

u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c = \sqrt{\sum u_i^2}$

Certification Traveler Report:

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

Legal Notice:

SPEX CertiPrep reference materials are not for any cosmetic, drug or household application and are to be used only by qualified individuals who are trained in appropriate procedures. No claims against SPEX CertiPrep, Inc. of any kind whatsoever, whether based on breach of warranty, alleged negligence, or otherwise, with respect to this RM shall be greater than the purchase price. In no event shall SPEX CertiPrep, Inc. be liable for any loss of profits or any incidental, special, or consequential damages.



203 Norcross Avenue • Metuchen, NJ 08840 USA

SPEXTM Certificate

010333

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)₂₄·4H₂O Lot# 03011C. The certified value listed is the average of values obtained by classical wet assay and ICP spectrometer analysis. Refer to side 2 for details of measurement uncertainties.

Classical Wet Assay: 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: 8/10/05

DATE EXPIRED: 8/10/06

DATE OPENED: 8/10/05

INDRG: 53240 PO: 152483

Date of Certification: AUG - 2005

Certifying Officer: N. Kocherakota

Report of Certification

This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition

ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers

ISO/REMCO N280

Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression $k_s = s^2 m$ is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ where $k=2$ is the coverage factor at the 95% confidence level

u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c = \sqrt{\sum u_i^2}$

Certification Traveler Report:

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

Legal Notice:

SPEX CertiPrep reference materials are not for any cosmetic, drug or household application and are to be used only by qualified individuals who are trained in appropriate procedures. No claims against SPEX CertiPrep, Inc. of any kind whatsoever, whether based on breach of warranty, alleged negligence, or otherwise, with respect to this RM shall be greater than the purchase price. In no event shall SPEX CertiPrep, Inc. be liable for any loss of profits or any incidental, special, or consequential damages.



SPEXTM Certificate

Certificate of Reference Material

010335

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.

Date of Certification: AUG - 2005

Certifying Officer: N. Kocherakota

INORGANIC LABS/RADCHEM LABS

DATE RECEIVED: 8/11/05

DATE EXPIRED: 8/11/06

DATE OPENED: 8/16/05

INDRG: 5327 PO: F52483

Report of Certification

This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition

ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers

ISO/REMCO N280

Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression $k_s = s^2 m$ is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ where $k=2$ is the coverage factor at the 95% confidence level

u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c = \sqrt{\sum u_i^2}$

Certification Traveler Report:

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

Legal Notice:

SPEX CertiPrep reference materials are not for any cosmetic, drug or household application and are to be used only by qualified individuals who are trained in appropriate procedures. No claims against SPEX CertiPrep, Inc. of any kind whatsoever, whether based on breach of warranty, alleged negligence, or otherwise, with respect to this RM shall be greater than the purchase price. In no event shall SPEX CertiPrep, Inc. be liable for any loss of profits or any incidental, special, or consequential damages.



SPEXTM Certificate

Certificate of Reference Material

010337

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: D2004000

Date of Certification: AUG - 2005 Certifying Officer: N. Kocherakota

Report of Certification

This Certified Reference Material has been prepared and certified under an ISO 9001 system consistent with the following guides:

Guide To The Expression Of Uncertainty In Measurement 1995

EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement – Second Edition

ASTM Guide D6362-98

ISO Guide 34: Quality system guidelines for the production of reference materials.

ISO Guide 17025: Certification of reference materials, general and statistical principles

ISO Guide 31: Contents of certificates of reference materials

NIST Technical Note 1297

ILAC-G12-2000: Guidelines for the requirements for the competence of reference materials producers

ISO/REMCO N280

Material Source:

All analytes and matrix materials are obtained and verified by SPEX CertiPrep from pre-qualified vendors as per ISO 9000 guidelines. Vendor identifications are proprietary, however sources of all materials used in the preparation and testing of SPEX CertiPrep CRMs are tracked and documented. For further information contact CRM Sales.

Instructions for Use:

Primary usage of this CRM is in neat form or diluted serially with matrix of a purity at or greater than the purity of the original matrix solution. If dilution is required the diluent must be compatible with all certified analytes and contain stabilizers appropriate for the period of intended use. The CRM can also be used as a spike or with a spike, again with appropriate compatibility considerations. All solutions should be thoroughly mixed, by shaking, prior to use and never pipetted directly from the bottle. All surfaces that come in contact with the solution must be thoroughly cleaned and leached prior to use. Dilutions should be performed only with Class A volumetric glassware.

Method of Preparation:

Clean laboratory procedures and techniques have been used throughout the preparation. All materials, equipment, analytical instrumentation and personnel have been qualified prior to use. The highest purity acids applicable, 18 megohm, double deionized water, acid-leached triple-rinsed bottles, and Class A glassware have been used in all preparations.

Homogeneity:

The Homogeneity of the CRM has been confirmed by procedures consistent with ISO guide 17025, ISO/REMCO N280 and ASTM D6362-98 Appendix X2. Random, replicate samples of the final, packaged material have been analyzed for the certified values by procedures consistent with the intended use of the CRM.

The mathematical expression $k_s = s^2 m$ is employed to determine the sampling size

s = relative standard deviation in % for one component of the sample. (ie. The sub-sampling uncertainty)

m = the sub-sampling mass

k_s = mass of sub-sample necessary to ensure a relative sub-sampling error of 1% (68% confidence level) in a single determination

Statistical estimator and Confidence limits:

The certified value 'x' listed on the reverse of this document is at the 95% level of confidence and can be expressed as

$X = x \pm U$ where X = True value (Labeled Value), U = Expanded uncertainty

$U = k u_c$ where $k=2$ is the coverage factor at the 95% confidence level

u_c is obtained by combining the individual element standard uncertainty components u_i and $u_c = \sqrt{\sum u_i^2}$

Certification Traveler Report:

All certified values reported were derived from Traveler Report (Spex CertiPrep's traceability documentation) identified by the lot number of this CRM. For further information contact CRM Sales.

Legal Notice:

SPEX CertiPrep reference materials are not for any cosmetic, drug or household application and are to be used only by qualified individuals who are trained in appropriate procedures. No claims against SPEX CertiPrep, Inc. of any kind whatsoever, whether based on breach of warranty, alleged negligence, or otherwise, with respect to this RM shall be greater than the purchase price. In no event shall SPEX CertiPrep, Inc. be liable for any loss of profits or any incidental, special, or consequential damages.





Fisher Scientific

010339

TRACEMETAL GRADE NITRIC ACID
CERTIFICATE OF ANALYSIS

Dr. B. McKelvey
QA/QC Manager

CATALOG NUMBER: A509
LOT NUMBER: 1105010
RELEASE DATE: February, 2005
EXPIRY DATE: February, 2008

Table with 4 columns: Tests, Maximum Specification, Actual Value, Units. Rows include ASSAY (HNO3, w/w) and Color.

Main table with 6 columns: Analyte, Maximum Specification, Actual Value (in ppb), Analyte, Maximum Specification, Actual Value (in ppb). Lists various elements like Aluminum, Antimony, Arsenic, etc.

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.

INORGANIC LABS/RADCHEM LABS
DATE RECEIVED: 8/28/05
DATE EXPIRED: 9/18/2015
DATE OPENED: 9/18/05
INORG: 538-5373 PO: 152601



For customer service, call 1-800-766-7000.
To fax an order, use 1-800-925-1165.
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010340



TRACEMETAL GRADE HYDROCHLORIC ACID CERTIFICATE OF ANALYSIS

B McKelvey
Dr. B. McKelvey
QA/QC Manager

CATALOG NUMBER: A508

LOT NUMBER: 4105031
RELEASE DATE: July, 2005
EXPIRY DATE: July, 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 in particular, Ca, Si, K, Na, B, Al, Mg & Mn will increase due to storage in glass bottles.

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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. **010342**

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 UPLA-Filtered Clean Room. An UPLA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al < 0.00100 | <u>M</u> Dy < 0.00598 | <u>M</u> Li < 0.00997 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.02990 |
| <u>M</u> Sb < 0.00050 | <u>M</u> Er < 0.00498 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00100 | <u>M</u> Tb < 0.00030 |
| <u>M</u> As < 0.00997 | <u>M</u> Eu < 0.00299 | <u>Q</u> Mg 0.00010 | <u>M</u> Rh < 0.00100 | <u>M</u> Tl < 0.00100 |
| <u>M</u> Ba < 0.00997 | <u>M</u> Gd < 0.00100 | <u>M</u> Mn < 0.00399 | <u>M</u> Rb < 0.00100 | <u>M</u> Th 0.01175 |
| <u>M</u> Be < 0.00050 | <u>M</u> Ga < 0.00100 | <u>Q</u> Hg < 0.01000 | <u>M</u> Ru < 0.00199 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi < 0.00040 | <u>M</u> Ge < 0.00598 | <u>M</u> Mo < 0.00199 | <u>M</u> Sm < 0.00100 | <u>M</u> Sn < 0.00498 |
| <u>M</u> B < 0.06976 | <u>M</u> Au < 0.00299 | <u>M</u> Nd < 0.00199 | <u>s</u> Sc | <u>Q</u> Tl < 0.00100 |
| <u>M</u> Cd < 0.00299 | <u>M</u> Hf < 0.00199 | <u>Q</u> Ni < 0.00090 | <u>M</u> Se < 0.00797 | <u>M</u> W < 0.00997 |
| <u>Q</u> Ca 0.01149 | <u>M</u> Ho < 0.00050 | <u>M</u> Nb < 0.00050 | <u>Q</u> Si 0.00200 | <u>M</u> U < 0.00199 |
| <u>M</u> Ce < 0.00498 | <u>M</u> In < 0.00997 | <u>n</u> Os | <u>M</u> Ag < 0.00199 | <u>M</u> V < 0.00199 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00498 | <u>M</u> Pd < 0.00498 | <u>Q</u> Na < 0.09000 | <u>M</u> Yb < 0.00100 |
| <u>Q</u> Cr 0.00047 | <u>Q</u> Fe 0.00037 | <u>n</u> P | <u>M</u> Sr < 0.00050 | <u>Q</u> Y < 0.00100 |
| <u>M</u> Co < 0.00299 | <u>M</u> La < 0.00050 | <u>M</u> Pt < 0.00199 | <u>Q</u> S < 0.02500 | <u>Q</u> Zn 0.00060 |
| <u>Q</u> Cu < 0.00140 | <u>M</u> Pb < 0.00299 | <u>Q</u> K < 0.10000 | <u>M</u> Ta < 0.00698 | <u>Q</u> Zr 0.02298 |

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

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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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 44.95591; +3; 6; $\text{Sc}(\text{H}_2\text{O})_6^{+3}$

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 PbO 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 $\mu\text{g}/\text{mL}$ | 1 | ion | |
| ICP-OES 337.215 nm | 0.004 / 0.00002 $\mu\text{g}/\text{mL}$ | 1 | ion | Ti, U, Ni, Rh |
| ICP-OES 424.683 nm | 0.003 / 0.00002 $\mu\text{g}/\text{mL}$ | 1 | ion | Ce $^{16}\text{O}^{12}\text{C}$, $^{28}\text{Si}^{16}\text{O}$, $^{90}\text{Zr}^{+2}$ |
| ICP-MS 45 amu | 2.3 ppt | n/a | M ⁺ | |

8.0 **HAZARDOUS INFORMATION** - Please refer to the enclosed Material Safety Data sheet for information regarding this CRM.

9.0 **HOMOGENEITY** - This solution was mixed according to procedure IV-MPM-004 and is guaranteed to be homogeneous.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001:2000 Quality Management System Registration - QMI Certificate Number 010105

Recognized by:

Registrar Accreditation Board (ANSI-RAB)

Standards Council of Canada (SCC)

Dutch Council for Accreditation (RVA)

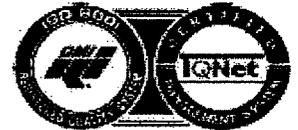
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10.2 ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration"

- 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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9-10-04

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

010344



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**
12/2006

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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52104



certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s)), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

010345

2.0 DESCRIPTION OF CRM Custom-Grade 10000 µg/mL Aluminum in 5% (abs) HNO₃

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) HNO₃

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

$$\text{Uncertainty } (\pm) = 2 \left[\frac{\sum s_i^2}{n} \right]^{1/2}$$

$\sum s_i$ = 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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5405

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- 4.2 **BALANCE CALIBRATION** - All balances are checked daily using in-house procedure number 6-IMM-001. The weights used for testing are annually compared to Gerhart Scale Corporation's master weights and are traceable to the National Institute of Standards and Technology (NIST). The NIST Traceability numbers are 692476 - Class 1 and 692476A - Class 2. The NIST test number is 822/260017-98. All analytical balances are calibrated every 4 months by Gerhart Scale Corp. of South Amboy. The balances are calibrated with a class 1 and/or class 2 analytical weight set. These weights are tested annually by a NIST / NVLAP accredited calibration lab. The NIST test number is 822/260017-98.
- 4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.
- 4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>s</u> Al | <u>M</u> Dy < 0.03378 | <u>Q</u> Li < 0.00020 | <u>M</u> Pr < 0.00169 | <u>M</u> Te < 0.16892 |
| <u>M</u> Sb < 0.00282 | <u>M</u> Er < 0.02815 | <u>M</u> Lu < 0.00225 | <u>M</u> Re < 0.00563 | <u>M</u> Tb < 0.00169 |
| <u>M</u> As < 0.05631 | <u>M</u> Eu < 0.01689 | <u>Q</u> Mg 0.00498 | <u>M</u> Rh < 0.00563 | <u>M</u> Tl < 0.00563 |
| <u>M</u> Ba < 0.05631 | <u>M</u> Gd < 0.00563 | <u>M</u> Mn < 0.02252 | <u>M</u> Rb < 0.00563 | <u>M</u> Th < 0.00563 |
| <u>Q</u> Be < 0.00017 | <u>M</u> Ga < 0.00563 | <u>Q</u> Hg < 0.00700 | <u>M</u> Ru < 0.01126 | <u>M</u> Tm < 0.00225 |
| <u>M</u> Bi < 0.00225 | <u>M</u> Ge < 0.03378 | <u>M</u> Mo < 0.01126 | <u>M</u> Sm < 0.00563 | <u>M</u> Sn < 0.02815 |
| <u>Q</u> B 0.01173 | <u>M</u> Au < 0.01689 | <u>M</u> Nd < 0.01126 | <u>M</u> Sc < 0.05631 | <u>Q</u> Ti 0.00213 |
| <u>M</u> Cd < 0.01689 | <u>M</u> Hf < 0.01126 | <u>Q</u> Ni < 0.00600 | <u>M</u> Se < 0.04505 | <u>M</u> W < 0.05631 |
| <u>Q</u> Ca 0.01013 | <u>M</u> Ho < 0.00282 | <u>M</u> Nb < 0.00282 | <u>Q</u> Si 0.07462 | <u>M</u> U < 0.01126 |
| <u>M</u> Ce < 0.02815 | <u>M</u> In < 0.05631 | <u>n</u> Os | <u>M</u> Ag < 0.01126 | <u>M</u> V < 0.01126 |
| <u>M</u> Cs < 0.00169 | <u>M</u> Ir < 0.02815 | <u>M</u> Pd < 0.02815 | <u>Q</u> Na 0.06396 | <u>M</u> Yb < 0.00563 |
| <u>Q</u> Cr 0.00533 | <u>Q</u> Fe 0.00586 | <u>Q</u> P < 0.03000 | <u>M</u> Sr < 0.00282 | <u>M</u> Y < 0.22523 |
| <u>M</u> Co < 0.01689 | <u>M</u> La < 0.00282 | <u>M</u> Pt < 0.01126 | <u>Q</u> S < 0.10000 | <u>M</u> Zn 0.00450 |
| <u>M</u> Cu < 0.03378 | <u>M</u> Pb < 0.01689 | <u>Q</u> K 0.01208 | <u>M</u> Ta < 0.03942 | <u>M</u> 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

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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 - 26.98154; +3; $6; Al(H_2O)_6$

Chemical Compatibility - Soluble in HCl, HNO₃, HF and H₂SO₄. Avoid neutral media. Soluble in strongly basic NaOH forming the $Al(OH)_4(H_2O)_2^-$ species. Stable with most metals and inorganic anions. The phosphate is insoluble in water and only slightly soluble in acid.

Stability - 2-100 ppb levels stable for months in 1% HNO₃ / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO₃ / LDPE container.

Al Containing Samples (Preparation and Solution) - Metal (Best dissolved in HCl / HNO₃); α - Al₂O₃ (Na₂CO₃ fusion in Pt^D);

γ - Al₂O₃ (Soluble in acids such as HCl); Ores (Carbonate fusion in Pt^D 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):

| <u>Technique/Line</u> | <u>Estimated D.L.</u> | <u>Order</u> | <u>Type</u> | <u>Interferences</u> (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 | <u>Mn</u> , Zr, Ce |
| ICP-OES 167.078 nm | 0.1 / 0.009 µg/mL | 1 | ion | <u>Fe</u> |
| ICP-MS 27 amu | 30 ppt | n/a | M ⁺ | <u>¹²C¹⁵N</u> , <u>¹³C¹⁴N</u> , <u>¹H¹²C¹⁴N</u> , <u>¹B¹⁰O</u> , <u>⁵¹Cr²⁺</u> , <u>⁵⁴Fe²⁺</u> |

010347

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)

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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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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**
12/2005 - 010348

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

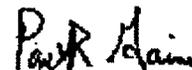
Certificate Prepared By: Nick Maida, QA Administrator



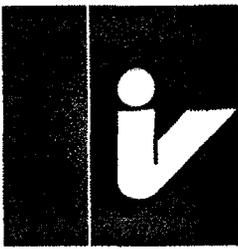
Certificate Approved By: Katalin Le, QC Manager



Certifying Officer: Paul Gaines, Chemist, Senior Technical Director



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5405



certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

010349

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Silver in 3.5% (abs) HNO₃

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) HNO₃

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:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

(\bar{x}) = mean
 x_i = individual results
 n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2[(\sum s_i)^2]^{1/2}}{(n)^{1/2}}$$

$\sum s_i$ = The summation of all significant estimated errors.
(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

The independent samples t-test was used to determine if there is agreement between the above assay methods at the 95% confidence interval. Both methods were compared and showed agreement within the stated uncertainties. This agreement is a confirmation of the accuracy of this CRM.

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

• "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

• This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

4.1 Assay Method #1 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

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DATE RECEIVED: 9/23/05
DATE EXPIRED: 10/1/06 (7)
DATE OPENED: 9/27/05
INORG: 5406 PO: D20096135

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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 $\mu\text{g/mL}$**

010350

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 μm .

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>Q</u> Al 0.00165 | <u>M</u> Dy < 0.01198 | <u>Q</u> Li 0.00001 | <u>M</u> Pr < 0.00060 | <u>M</u> Te < 0.05991 |
| <u>M</u> Sb < 0.00100 | <u>M</u> Er < 0.00998 | <u>M</u> Lu < 0.00080 | <u>M</u> Re < 0.00200 | <u>M</u> Tb < 0.00060 |
| <u>M</u> As < 0.01997 | <u>M</u> Eu < 0.00599 | <u>Q</u> Mg 0.00012 | <u>M</u> Rh < 0.00200 | <u>M</u> Tl < 0.00200 |
| <u>M</u> Ba < 0.01997 | <u>M</u> Gd < 0.00200 | <u>M</u> Mn < 0.00799 | <u>M</u> Rb < 0.00200 | <u>M</u> Th < 0.00200 |
| <u>M</u> Be < 0.00100 | <u>M</u> Ga < 0.00200 | <u>Q</u> Hg < 0.01500 | <u>M</u> Ru < 0.00399 | <u>M</u> Tm < 0.00080 |
| <u>M</u> Bi < 0.00080 | <u>M</u> Ge < 0.01198 | <u>M</u> Mo < 0.00399 | <u>M</u> Sm < 0.00200 | <u>M</u> Sn < 0.00998 |
| <u>M</u> B < 0.13978 | <u>Q</u> Au < 0.00300 | <u>M</u> Nd < 0.00399 | <u>M</u> Sc < 0.01997 | <u>M</u> Ti < 0.09984 |
| <u>Q</u> Cd 0.00042 | <u>M</u> Hf < 0.00399 | <u>Q</u> Ni < 0.00300 | <u>M</u> Se < 0.01598 | <u>M</u> W < 0.01997 |
| <u>Q</u> Ca 0.00250 | <u>M</u> Ho < 0.00100 | <u>M</u> Nb < 0.00100 | <u>Q</u> Si 0.00399 | <u>M</u> U < 0.00399 |
| <u>M</u> Ce < 0.00998 | <u>M</u> In < 0.01997 | <u>i</u> Os | <u>s</u> Ag | <u>M</u> V < 0.00399 |
| <u>M</u> Cs < 0.00060 | <u>M</u> Ir < 0.00998 | <u>Q</u> Pd < 0.00400 | <u>Q</u> Na 0.00319 | <u>M</u> Yb < 0.00200 |
| <u>M</u> Cr < 0.00998 | <u>Q</u> Fe 0.00100 | <u>Q</u> P < 0.00300 | <u>M</u> Sr < 0.00100 | <u>M</u> Y < 0.07987 |
| <u>M</u> Co < 0.00599 | <u>M</u> La < 0.00100 | <u>Q</u> Pt < 0.01700 | <u>Q</u> S < 0.02500 | <u>Q</u> Zn < 0.00040 |
| <u>Q</u> Cu 0.00150 | <u>M</u> Pb 0.00199 | <u>Q</u> K 0.00035 | <u>M</u> Ta < 0.01398 | <u>M</u> Zr < 0.00998 |

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference n - Not Checked For s - Solution Standard Element

6.0 **INTENDED USE**

- For the calibration of analytical instruments including but not limited to the following: ICP-MS, ICP-OES, FAAS, GFAA, XRF, and DCP
- For the validation of analytical methods
- For the preparation of "working reference samples"
- For interference studies and the determination of correction coefficients
- For detection limit and linearity studies
- For additional intended uses, contact IV Technical Staff

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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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 107.8682; +1; 6;

$\text{Ag}(\text{H}_2\text{O})_6^+$

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 $\mu\text{g}/\text{mL}$ 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):

| <u>Technique/Line</u> | <u>Estimated D.L.</u> | <u>Order</u> | <u>Type</u> | <u>Interferences</u> (underlined indicates severe) |
|-----------------------|--|--------------|----------------|--|
| ICP-OES 328.068 nm | 0.007 / 0.0007 $\mu\text{g}/\text{mL}$ | 1 | atom | Ce, Rh, V |
| ICP-OES 338.289 nm | 0.013 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | atom | Ce, Cr, Th |
| ICP-OES 243.779 nm | 0.12 / 0.01 $\mu\text{g}/\text{mL}$ | 1 | ion | Mn, Th, Ni, Rh |
| ICP-MS 107 amu | 1 ppt | n/a | M ⁺ | ⁹¹ Zr ¹⁶ O |

010351

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 / 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.

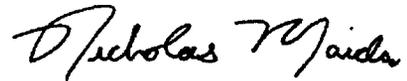
Certification Date: March 21, 2005

Expiration Date:

EXPIRES 010352
1 2006

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

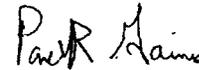
Certificate Prepared By: Nick Maida, QA Administrator



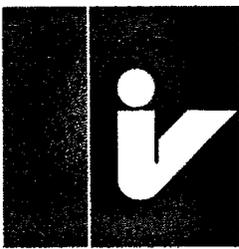
Certificate Approved By: Katalin Le, QC Manager



Certifying Officer: Paul Gaines, Chemist, Senior Technical Director



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5/10/06



certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

010353

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Lanthanum in 1.4% (abs) HNO₃

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) HNO₃

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:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$
$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i)^2}{(n)^{1/2}}$$

(\bar{x}) = mean
 x_i = individual results
 n = number of measurements
 $\sum s_i$ = The summation of all significant estimated errors
(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
DATE OPENED: 9/27/05
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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.

010354

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>M</u> Al < 0.00992 | <u>M</u> Dy < 0.00595 | <u>Q</u> Li < 0.00002 | <u>M</u> Pr < 0.00030 | <u>M</u> Te < 0.02975 |
| <u>M</u> Sb < 0.00050 | <u>M</u> Er < 0.00496 | <u>M</u> Lu < 0.00040 | <u>M</u> Re < 0.00099 | <u>M</u> Tb < 0.00030 |
| <u>M</u> As < 0.00992 | <u>M</u> Eu < 0.00298 | <u>Q</u> Mg 0.00281 | <u>M</u> Rh < 0.00099 | <u>M</u> Tl < 0.00099 |
| <u>M</u> Ba < 0.00992 | <u>Q</u> Gd < 0.00080 | <u>Q</u> Mn < 0.00002 | <u>M</u> Rb < 0.00099 | <u>M</u> Th < 0.00099 |
| <u>M</u> Be < 0.00050 | <u>M</u> Ga < 0.00099 | <u>i</u> Hg | <u>M</u> Ru < 0.00198 | <u>M</u> Tm < 0.00040 |
| <u>M</u> Bi < 0.00040 | <u>M</u> Ge < 0.00595 | <u>M</u> Mo < 0.00198 | <u>M</u> Sm < 0.00099 | <u>M</u> Sn < 0.00496 |
| <u>Q</u> B < 0.03600 | <u>M</u> Au < 0.00298 | <u>M</u> Nd 0.00020 | <u>Q</u> Sc < 0.00003 | <u>M</u> Ti < 0.04958 |
| <u>M</u> Cd < 0.00298 | <u>M</u> Hf < 0.00198 | <u>M</u> Ni < 0.00793 | <u>M</u> Se < 0.00793 | <u>M</u> W < 0.00992 |
| <u>Q</u> Ca 0.00903 | <u>M</u> Ho < 0.00050 | <u>M</u> Nb < 0.00050 | <u>Q</u> Si < 0.01000 | <u>M</u> U < 0.00198 |
| <u>Q</u> Ce < 0.00300 | <u>M</u> In < 0.00992 | <u>n</u> Os | <u>M</u> Ag < 0.00198 | <u>Q</u> V < 0.00080 |
| <u>M</u> Cs < 0.00030 | <u>M</u> Ir < 0.00496 | <u>M</u> Pd < 0.00496 | <u>Q</u> Na < 0.05000 | <u>M</u> Yb < 0.00099 |
| <u>M</u> Cr < 0.00496 | <u>Q</u> Fe < 0.00150 | <u>n</u> P | <u>Q</u> Sr < 0.00004 | <u>M</u> Y < 0.03966 |
| <u>M</u> Co < 0.00298 | <u>s</u> La | <u>M</u> Pt < 0.00198 | <u>Q</u> S < 0.04300 | <u>Q</u> Zn 0.10539 |
| <u>M</u> Cu < 0.00595 | <u>M</u> Pb < 0.00298 | <u>Q</u> K < 0.10000 | <u>M</u> Ta < 0.00694 | <u>Q</u> 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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 138.9055; +3; 6 to 8, 9, 10 for some compounds; $\text{La}(\text{OH})_3(\text{H}_2\text{O})_9$

Chemical Compatibility - Soluble in HCl, and HNO_3 . Avoid HF, H_2PO_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 $\mu\text{g}/\text{mL}$ | 1 | ion | |
| ICP-OES 408.672 nm | 0.01 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | ion | Th |
| ICP-OES 412.323 nm | 0.01 / 0.001 $\mu\text{g}/\text{mL}$ | 1 | ion | Ce , Th |
| ICP-MS 139 amu | 1 ppt | n/a | M* | ^{125}Sb , ^{16}O , ^{128}Te , ^{16}O |

010355

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)

3064
5407

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 Gaines

4 of 4
5407



certificate of analysis

1.0 Inorganic Ventures / IV Labs is an ISO Guide 34-2000 Certified Reference Material (CRM) Manufacturer: Certificate #883-02. The certificate is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31-2000 (Reference Materials - Contents of certificates and label(s)), ISO Guide 34-2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

2.0 DESCRIPTION OF CRM Custom-Grade 1000 µg/mL Uranium in 1% (abs) HNO₃ **010357**

Catalog Number: CGU1-1, CGU1-2, and CGU1-5
Lot Number: **Y-QU01075**
Starting Material: UO₂(NO₃)₂·6H₂O
Starting Material Purity (%): 99.994419
Starting Material Lot No: RB0018
Matrix: 1% (abs) HNO₃

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:

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

(\bar{x}) = mean
 x_i = individual results
 n = number of measurements

$$\text{Uncertainty } (\pm) = \frac{2(\sum s_i)^2}{(n)^{1/2}}$$

$\sum s_i$ = 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 **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 PD: 02090435

pg. 1 of 4
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.

010358

4.3 **THERMOMETER CALIBRATION** - The thermometers used in the determination of the final densities are calibrated vs standard thermometer No. 903-2680 which was certified in accordance with the procedures outlined by ASTM E77-87 and NIST Monograph 150 using NIST Test Nos. and Std Nos.: 769543, 217368/769543, 217368/P14452, 176240/P14452, 176240. The in-house procedure No. is 2-QC-001. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification Nos. 92564, 119016, 471047 and NIST test report Nos. 811/258522, 811/2557078, and 236090.

4.4 **GLASSWARE CALIBRATION** - In-house procedure 3-QC-002 is used to calibrate all Class A Glassware used in the manufacture and quality control of Custom Grade Standards.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP/MS AND ICP-OES IN µg/mL

Custom-Grade solutions are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <u>M</u> Al 0.05166 | <u>M</u> Dy < 0.01494 | <u>M</u> Li < 0.02490 | <u>M</u> Pr < 0.00075 | <u>M</u> Te < 0.07470 |
| <u>M</u> Sb < 0.00125 | <u>M</u> Er < 0.01245 | <u>M</u> Lu < 0.00100 | <u>M</u> Re < 0.00249 | <u>M</u> Tb 0.00003 |
| <u>M</u> As < 0.02490 | <u>M</u> Eu < 0.00747 | <u>M</u> Mg < 0.07470 | <u>M</u> Rh < 0.00249 | <u>M</u> Tl < 0.00249 |
| <u>M</u> Ba < 0.02490 | <u>M</u> Gd 0.00310 | <u>M</u> Mn 0.00083 | <u>M</u> Rb < 0.00249 | <u>M</u> Th < 0.00249 |
| <u>M</u> Be < 0.00125 | <u>M</u> Ga < 0.00249 | i Hg | <u>M</u> Ru < 0.00498 | <u>M</u> Tm < 0.00100 |
| <u>M</u> Bi < 0.00100 | <u>M</u> Ge < 0.01494 | <u>M</u> Mo 0.00093 | <u>M</u> Sm 0.00010 | <u>Q</u> Sn < 0.10000 |
| <u>M</u> B < 0.17429 | <u>M</u> Au < 0.00747 | <u>M</u> Nd < 0.00498 | <u>M</u> Sc < 0.02490 | <u>M</u> Ti 0.00258 |
| <u>M</u> Cd 0.00103 | <u>M</u> Hf < 0.00498 | <u>M</u> Ni < 0.01992 | <u>M</u> Se < 0.01992 | <u>M</u> W < 0.02490 |
| <u>Q</u> Ca 0.05395 | <u>M</u> Ho 0.00052 | <u>M</u> Nb < 0.00125 | i Si | s U |
| <u>M</u> Ce 0.00010 | <u>M</u> In < 0.02490 | n Os | <u>M</u> Ag < 0.00498 | <u>M</u> V < 0.00498 |
| <u>M</u> Cs < 0.00075 | <u>M</u> Ir < 0.01245 | <u>M</u> Pd < 0.01245 | <u>Q</u> Na 0.00664 | <u>M</u> Yb < 0.00249 |
| <u>M</u> Cr < 0.01245 | <u>M</u> Fe < 0.49798 | i P | <u>M</u> Sr < 0.00125 | <u>M</u> Y 0.00062 |
| <u>M</u> Co < 0.00747 | <u>M</u> La 0.00145 | <u>M</u> Pt < 0.00498 | i S | <u>M</u> Zn 0.00114 |
| <u>M</u> Cu 0.00072 | <u>M</u> Pb 0.00217 | i K | <u>M</u> Ta < 0.01743 | <u>M</u> 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

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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 $20 \pm 4^\circ\text{C}$. Do not pipet from container. Do not return portions removed for pipetting to container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 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 $\mu\text{g}/\text{mL}$ | 1 | ion | Th, Fe |
| ICP-OES 367.007 nm | 0.3 / 0.02 $\mu\text{g}/\text{mL}$ | 1 | ion | Th, Ce |
| ICP-OES 263.553 nm | 0.3 / 0.01 $\mu\text{g}/\text{mL}$ | 1 | ion | Ce, Ir, Th, Rh, W, Zr, Ta, Ti, V, Hf, Fe, Re, Ru |
| ICP-MS 238 amu | 2 ppt | n/a | M^+ | $^{206}\text{Pb}^{16}\text{O}_2$ |

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)

50fcl
5409

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.

010360

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.

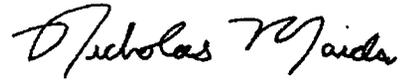
Certification Date: March 23, 2005

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



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5410

010361

***NOTICE TO ICP-MS USERS:** The ^{235}U in this standard is depleted.
The certified abundances in Atom % are as follows:

| | | Natural Abundance | IV's Certified Abundance |
|---------|------------------|----------------------|-----------------------------|
| | <u>Isotope</u> | <u>Atom %</u> | <u>Atom %</u> |
| Uranium | ^{238}U | 99.3 | 99.8 ± 0.1 |
| | ^{235}U | 0.70 | 0.207 ± 0.002 |

5408

**SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT**

CLIENT: Division 20

010362

TASK ORDER: 051011-4

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

Pipette Calibrations

SwRI - Div. 01, Inorganic Labs' Fixed Volume Pipette Verification Log

(Space provide for Inorganic Laboratories' Fixed Volume Pipette Verification Spreadsheet)

KE 9/21/05

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 | 0.9964 | 0.9968 | 0.9963 | 0.996 | 99.65 |
| TMA1 | 1000 | 1.0022 | 1.0055 | 1.0045 | 1.004 | 100.41 |
| TMA2 | 1000 | 1.0046 | 1.0047 | 1.0021 | 1.004 | 100.38 |
| TMA3 | 1000 | not | found | | | |
| TMA6 | 1000 | 1.0076 | 1.0042 | 1.0037 | 1.005 | 100.52 |
| TMB1 | 900 | 0.8959 | 0.9013 | 0.8910 | 0.896 | 99.56 |
| TMC1 | 800 | 0.7955 | 0.7947 | 0.7920 | 0.794 | 99.26 |
| TMDD1 | 750 | 0.7509 | 0.7522 | 0.7502 | 0.751 | 100.15 |
| TMD1 | 700 | 0.7024 | 0.7006 | 0.6992 | 0.701 | 100.10 |
| TMD2 | 700 | 0.7029 | 0.7025 | 0.6997 | 0.702 | 100.24 |
| TME1 | 600 | 0.5935 | 0.5896 | 0.5925 | 0.592 | 98.64 |
| TMF2 | 500 | 0.5010 | 0.4996 | 0.4999 | 0.500 | 100.03 |
| TMF5 | 500 | 0.5022 | 0.5036 | 0.5039 | 0.503 | 100.65 |
| ICF1 | 500 | 0.4973 | 0.4960 | 0.4947 | 0.496 | 99.20 |
| L30-500 | 500 | 0.5078 | 0.5071 | 0.5064 | 0.507 | 101.42 |
| TMG3 | 400 | 0.3952 | 0.3964 | 0.3948 | 0.395 | 98.87 |
| TMH1 | 300 | Out | of | service | | |
| TMH2 | 300 | 0.3000 | 0.3025 | 0.2981 | 0.300 | 100.07 |
| TMJ1 | 250 | 0.2490 | 0.2499 | 0.2490 | 0.249 | 99.72 |
| TMJ2 | 250 | 0.2491 | 0.2483 | 0.2479 | 0.248 | 99.37 |
| TMJ3 | 250 | 0.2500 | 0.2498 | 0.2497 | 0.250 | 99.93 |
| TMK2 | 200 | 0.1999 | 0.2018 | 0.2010 | 0.201 | 100.45 |
| TML1 | 150 | 0.1489 | 0.1499 | 0.1499 | 0.150 | 99.71 |
| TMM1 | 120 | 0.1186 | 0.1190 | 0.1196 | 0.119 | 99.22 |
| TMN3 | 100 | out | of | service | | |
| ICN1 | 100 | 0.0998 | 0.0982 | 0.1001 | 0.099 | 99.37 |
| TMQ1 | 80 | 0.0800 | 0.0797 | 0.0799 | 0.080 | 99.83 |
| TMR1 | 70 | Out | of | service | | |
| TMS1 | 60 | Out | of | service | | |
| LAB-30A | 50 | out | of | service | | |
| TMU1 | 40 | 0.0403 | 0.0398 | 0.0396 | 0.040 | 99.75 |
| TMU2 | 40 | 0.0397 | 0.0395 | 0.0393 | 0.040 | 98.75 |
| TMV1 | 30 | 0.0297 | 0.0297 | 0.0294 | 0.030 | 98.67 |
| L30-20 | 20 | 0.0200 | 0.0200 | 0.0199 | 0.020 | 99.83 |
| TMW1 | 25 | 0.0249 | 0.0249 | 0.0247 | 0.025 | 99.33 |
| TMY1 | 15 | Out | of | service | | |

FRM-246 (Rev 1/Mar 03)

FRM-243-a (Rev 3/Mar 03)

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

J. Williams
9-20-05

010364

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 | 0.0199 | 0.0200 | 0.0200 | 0.020 | 99.83 |
| ADJ200-A | 100 | 0.0990 | 0.0992 | 0.0998 | 0.099 | 99.33 |
| | 200 | 0.1984 | 0.1989 | 0.1985 | 0.199 | 99.30 |
| | 20 | | | | | |
| ADJ200-C | 100 | OUT | OF | SERVICE | | |
| | 200 | | | | | |
| | 20 | | | | | |
| ADJ200-D | 100 | 0.0202 | 0.0202 | 0.0201 | 0.020 | 100.83 |
| | 100 | 0.0994 | 0.0994 | 0.0993 | 0.099 | 99.37 |
| | 200 | 0.1990 | 0.1992 | 0.1988 | 0.199 | 99.50 |
| ADJ200-G | 20 | | | | | |
| | 100 | | | | | |
| | 200 | | | | | |
| ADJ200-H | 20 | | | | | |
| | 100 | | | | | |
| | 200 | | | | | |
| ADJ200-J | 20 | | | | | |
| | 100 | | | | | |
| | 200 | | | | | |
| ADJ200-K | 20 | | | | | |
| | 100 | NOT | IN USE- | GLOVEBOX | | |
| | 200 | | | | | |
| ADJ200 | 20 | | | | | |
| | 100 | | | | | |
| | 200 | | | | | |
| ADJ200 | 20 | | | | | |
| | 100 | | | | | |
| | 200 | | | | | |

FRM-247a (Rev 4/Apr 04)

FRM-244 (Rev 2/Sept 02)

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 34

Thermometer #: G011

diH2O Temperature (°C) 21

| Eppendorf # | True Value (µL) | 1 st Reading (g) | 2 nd Reading (g) | 3 rd Reading (g) |
|-------------|-----------------|-----------------------------|-----------------------------|-----------------------------|
| ADJ200-A | 20 | .0199 | .0200 | .0200 |
| | 100 | .0990 | .0992 | .0998 |
| | 200 | .1984 | .1989 | .1985 |
| ADJ200-C | 20 | | | |
| | 100 | out | of | service |
| | 200 | | | |
| ADJ200-D | 20 | .0202 | .0202 | .0201 |
| | 100 | .0994 | .0994 | .0993 |
| | 200 | .1990 | .1992 | .1988 |
| ADJ200-G | 20 | | | |
| | 100 | | | |
| | 200 | | | |
| ADJ200-H | 20 | | | |
| | 100 | | | |
| | 200 | | | |
| ADJ200-J | 20 | | | |
| | 100 | | | |
| | 200 | | | |
| ADJ200-K | 20 | | | |
| | 100 | NOT IN USE — | | GLOVEBOX |
| | 200 | | | |
| ADJ200 | 20 | | | |
| | 100 | | | |
| | 200 | | | |

20 µL – 200 µL

JW 9-20-05

JW 9-20-05

Analyst: *John Willis*
 Reviewed by: *B. J. ...*

Date: 9-20-05
 Date: 9-20-05

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

010366

mf 10/5/05

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 | | | | | |
| ADJ200-A | 100 | | | | | |
| | 200 | | | | | |
| | 20 | | | | | |
| ADJ200-C | 100 | | | | | |
| | 200 | | | | | |
| | 20 | | | | | |
| ADJ200-D | 100 | | | | | |
| | 200 | | | | | |
| | 20 | 0.0205 | 0.0203 | 0.0202 | 0.0203 | 101.67 |
| ADJ200-G | 100 | 0.0988 | 0.0983 | 0.0990 | 0.0987 | 98.70 |
| | 200 | 0.1978 | 0.1980 | 0.1979 | 0.1979 | 98.95 |
| | 20 | 0.0204 | 0.0203 | 0.0201 | 0.0203 | 101.33 |
| ADJ200-H | 100 | 0.0997 | 0.0997 | 0.0993 | 0.0996 | 99.57 |
| | 200 | 0.1998 | 0.1999 | 0.1980 | 0.1992 | 99.62 |
| | 20 | 0.0202 | 0.0203 | 0.0203 | 0.0203 | 101.33 |
| ADJ200-J | 100 | 0.0989 | 0.0997 | 0.0990 | 0.0992 | 99.20 |
| | 200 | 0.1988 | 0.1996 | 0.1979 | 0.1988 | 99.38 |
| | 20 | | | | | |
| ADJ200 | 100 | | | | | |
| | 200 | | | | | |
| | 20 | | | | | |
| ADJ200 | 100 | | | | | |
| | 200 | | | | | |
| | 20 | | | | | |
| ADJ200-K | 100 | | | | | |
| | 200 | | | | | |

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 12

Thermometer #: G011

diH2O Temperature (°C) 21.0

| Eppendorf # | True Value (µL) | 1 st Reading (g) | 2 nd Reading (g) | 3 rd Reading (g) |
|-------------|-----------------|-----------------------------|-----------------------------|-----------------------------|
| ADJ200-A | 20 | | | |
| | 100 | | | |
| | 200 | | | |
| ADJ200-C | 20 | | | |
| | 100 | | | |
| | 200 | | | |
| ADJ200-D | 20 | | | |
| | 100 | | | |
| | 200 | | | |
| ADJ200-G | 20 | 0.0205 | 0.0203 | 0.0202 |
| | 100 | 0.0988 | 0.0983 | 0.0990 |
| | 200 | 0.1978 | 0.1980 | 0.1979 |
| ADJ200-H | 20 | 0.0204 | 0.0203 | 0.0201 |
| | 100 | 0.0997 | 0.0997 | 0.0993 |
| | 200 | 0.1998 | 0.1999 | 0.1980 |
| ADJ200-J * | 20 | 0.0202 | 0.0203 | 0.0203 |
| | 100 | 0.0989 | 0.0997 | 0.0990 |
| | 200 | 0.1988 | 0.1996 | 0.1979 |
| ADJ200-K | 20 | | | |
| | 100 | | | |
| | 200 | | | |
| ADJ200 | 100 | | | |
| | 200 | | | |

20 µL – 200 µL

* This p. pette was verified on 10/5/05 - mf

Analyst: Richard Hardy

Date: 10/4/05

Reviewed by: John Walker

Date: 10-14-05

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

Handwritten: f.w. 9-20-05

010368

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 | 0.1014 | 0.1013 | 0.1016 | 0.101 | 101.43 |
| ADJ1000-C | 500 | 0.4982 | 0.4986 | 0.4991 | 0.499 | 99.73 |
| | 1000 | 1.0078 | 1.0048 | 1.0022 | 1.005 | 100.49 |
| | 100 | 0.0998 | 0.0992 | 0.0991 | 0.099 | 99.37 |
| ADJ1000-D | 500 | 0.4924 | 0.4930 | 0.4939 | 0.493 | 98.62 |
| | 1000 | 0.9998 | 0.9979 | 0.9966 | 0.998 | 99.81 |
| | 100 | 0.0990 | 0.1007 | 0.1008 | 0.100 | 100.17 |
| ADJ1000-E | 500 | 0.4953 | 0.4965 | 0.4981 | 0.497 | 99.33 |
| | 1000 | 1.0026 | 1.0021 | 1.0020 | 1.002 | 100.22 |
| | 100 | 0.1010 | 0.1006 | 0.1015 | 0.101 | 101.03 |
| ADJ1000-F | 500 | 0.4987 | 0.4985 | 0.4986 | 0.499 | 99.72 |
| | 1000 | 0.9998 | 1.0012 | 1.0008 | 1.001 | 100.06 |
| | 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 | | | | | |
| | 100 | | | | | |

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 34

Thermometer #: G611

diH2O Temperature (°C) 21

| Eppendorf # | True Value (µL) | 1 st Reading (g) | 2 nd Reading (g) | 3 rd Reading (g) |
|-------------|-----------------|-----------------------------|-----------------------------|-----------------------------|
| | 100 | .1014 | .1013 | .1016 |
| ADJ1000-C | 500 | .4982 | .4986 | .4991 |
| | 1000 | 1.0078 | 1.0048 | 1.0022 |
| | 100 | .0998 | .0992 | .0991 |
| ADJ1000-D | 500 | .4924 | .4930 | .4939 |
| | 1000 | .9998 | .9979 | .9966 |
| | 100 | .0990 | .1007 | .1008 |
| ADJ1000-E | 500 | .4953 | .4965 | .4981 |
| | 1000 | 1.0024 | 1.0021 | 1.0020 |
| | 100 | .1010 | .1004 | .1015 |
| ADJ1000-F | 500 | .4987 | .4985 | .4984 |
| | 1000 | .9998 | 1.0012 | 1.0008 |
| | 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 | | | |

100 µL – 1000 µL

John Wilks 9-20-05

Analyst: John Wilks
 Reviewed by: [Signature]

Date: 9-20-05
 Date: 9-20-05

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

uf 10/5/05

010370

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 | 0.1013 | 0.1016 | 0.1007 | 0.101 | 101.20 |
| ADJ1000-G | 500 | 0.4938 | 0.4962 | 0.4947 | 0.495 | 98.98 |
| | 1000 | 0.9902 | 0.9906 | 0.9891 | 0.990 | 99.00 |
| | 100 | 0.1007 | 0.1005 | 0.1003 | 0.101 | 100.50 |
| ADJ1000-H | 500 | 0.4919 | 0.4954 | 0.4969 | 0.495 | 98.95 |
| | 1000 | 0.9924 | 0.9960 | 0.9926 | 0.994 | 99.37 |
| | 100 | 0.0996 | 0.0990 | 0.0998 | 0.099 | 99.47 |
| ADJ1000-J | 500 | 0.4907 | 0.4910 | 0.4910 | 0.491 | 98.18 |
| | 1000 | 0.9819 | 0.9823 | 0.9842 | 0.983 | 98.28 |
| | 100 | | | | 0.000 | 0.00 |
| ADJ1000 | 500 | | | | 0.000 | 0.00 |
| | 1000 | | | | 0.000 | 0.00 |
| | 100 | | | | 0.000 | 0.00 |
| ADJ1000 | 500 | | | | 0.000 | 0.00 |
| | 1000 | | | | 0.000 | 0.00 |

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

Handwritten signature and date: 8/20/05

010372

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 | 0.5037 | 0.5048 | 0.5030 | 0.504 | 100.77 |
| ADJ5000-C | 2500 | 2.4960 | 2.4968 | 2.4958 | 2.496 | 99.85 |
| | 5000 | 5.0209 | 5.0171 | 5.0085 | 5.016 | 100.31 |
| | 500 | | | | | |
| ADJ5000-G | 2500 | OUT | OF | SERVICE | | |
| | 5000 | | | | | |
| | 500 | | | | | |
| ADJ5000-H | 2500 | OUT | OF | SERVICE | | |
| | 5000 | | | | | |
| | 500 | | | | | |
| ADJ5000-I | 2500 | 0.5048 | 0.5022 | 0.5024 | 0.503 | 100.63 |
| | 5000 | 2.5025 | 2.4912 | 2.4905 | 2.495 | 99.79 |
| | 5000 | 5.0064 | 5.0032 | 4.9998 | 5.003 | 100.06 |
| ADJ5000-J | 500 | | | | | |
| | 2500 | | | | | |
| | 5000 | | | | | |
| ADJ5000-K | 500 | | | | | |
| | 2500 | | | | | |
| | 5000 | | | | | |
| ADJ5000-L | 500 | | | | | |
| | 2500 | | | | | |
| | 5000 | | | | | |
| ADJ5000-M | 500 | | | | | |
| | 2500 | NOT | IN USE- | GLOVEBOX | | |
| | 5000 | | | | | |
| ADJ5000-N | 500 | 0.4997 | 0.5007 | 0.5001 | 0.500 | 100.03 |
| | 2500 | 2.4904 | 2.4939 | 2.4923 | 2.492 | 99.69 |
| | 5000 | 5.0274 | 5.0318 | 5.0187 | 5.026 | 100.52 |
| ADJ5000-O | 500 | 0.5030 | 0.5053 | 0.5037 | 0.504 | 100.80 |
| | 2500 | 2.4973 | 2.4981 | 2.4948 | 2.497 | 99.87 |
| | 5000 | 5.0324 | 5.0160 | 5.0038 | 5.017 | 100.35 |
| ADJ5000 | 500 | | | | | |
| | 2500 | | | | | |
| | 5000 | | | | | |

FRM-247c (Rev 3/Apr 04)

FRM-244 (Rev 2/Sept 02)

010373

Book/page: 08 148

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 34Thermometer #: G-011diH₂O Temperature (° C) 21

| Eppendorf # | True Value (µL) | 1 st Reading (g) | 2 nd Reading (g) | 3 rd Reading (g) |
|-------------|-----------------|-----------------------------|-----------------------------|-----------------------------|
| | 500 | .5037 | .5048 | .5030 |
| ADJ5000-C | 2500 | 2.4960 | 2.4968 | 2.4958 |
| | 5000 | 5.0209 | 5.0171 | 5.0085 |
| | 500 | | | |
| ADJ5000-G | 2500 | OUT | OF | SERVICE |
| | 5000 | | | |
| | 500 | | | |
| ADJ5000-H | 2500 | OUT | OF | SERVICE |
| | 5000 | | | |
| | 500 | .5048 | .5022 | .5024 |
| ADJ5000-I | 2500 | 2.5025 | 2.4912 | 2.4905 |
| | 5000 | 5.0064 | 5.0032 | 4.9998 |
| | 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 | .4997 | .5007 | .5001 |
| ADJ5000-N | 2500 | 2.4964 | 2.4939 | 2.4923 |
| | 5000 | 5.0274 | 5.0318 | 5.0187 |
| | 500 | .5030 | .5053 | .5037 |
| ADJ5000-O | 2500 | 2.4973 | 2.4981 | 2.4948 |
| | 5000 | 5.0324 | 5.0160 | 5.0038 |
| | 500 | | | |
| ADJ5000 | 2500 | | | |
| | 5000 | | | |

Note: ADJ 5000-O was placed in service 9-20-05 JW

Analyst: John Wilker
 Reviewed by: B-J

Date: 9-20-05
 Date: 9-20-05

SwRI – Div. 01, Inorganic Labs' Adjustable Volume Pipette Verification Log

(Space provided for Inorganic Laboratories' Adjustable Volume Pipette Verification Spreadsheet)

Inf 10/4/05

010374

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 | 0.5050 | 0.4915 | 0.4951 | 0.497 | 99.44 |
| ADJ5000-J | 2500 | 2.4949 | 2.4965 | 2.4957 | 2.496 | 99.83 |
| | 5000 | 4.9926 | 4.9919 | 4.9947 | 4.993 | 99.86 |
| | 500 | 0.4914 | 0.4921 | 0.4919 | 0.492 | 98.36 |
| ADJ5000-K | 2500 | 2.4973 | 2.4979 | 2.4969 | 2.497 | 99.89 |
| | 5000 | 5.0084 | 5.0009 | 5.0106 | 5.007 | 100.13 |
| | 500 | 0.4956 | 0.4981 | 0.4973 | 0.497 | 99.40 |
| ADJ5000-L | 2500 | 2.4884 | 2.4967 | 2.4926 | 2.493 | 99.70 |
| | 5000 | 4.9849 | 4.9843 | 4.9887 | 4.986 | 99.72 |
| | 500 | | | | 0.000 | 0.00 |
| ADJ5000 | 2500 | | | | 0.000 | 0.00 |
| | 5000 | | | | 0.000 | 0.00 |
| | 500 | | | | 0.000 | 0.00 |
| ADJ5000 | 2500 | | | | 0.000 | 0.00 |
| | 5000 | | | | 0.000 | 0.00 |
| | 500 | | | | 0.000 | 0.00 |
| ADJ5000 | 2500 | | | | 0.000 | 0.00 |
| | 5000 | | | | 0.000 | 0.00 |
| | 500 | | | | 0.000 | 0.00 |
| ADJ5000 | 2500 | | | | 0.000 | 0.00 |
| | 5000 | | | | 0.000 | 0.00 |

SwRI Div. 01 – Inorganic Laboratory Adjustable Pipette Verification Log

Balance #: 12

Thermometer #: G011

diH2O Temperature (°C) 21.0

500 µL – 5000 µL

| Eppendorf # | True Value (µL) | 1 st Reading (g) | 2 nd Reading (g) | 3 rd Reading (g) |
|-------------|-----------------|-----------------------------|-----------------------------|-----------------------------|
| | 500 | | | |
| ADJ5000-C | 2500 | | | |
| | 5000 | | | |
| | 500 | | | |
| ADJ5000-G | 2500 | | | |
| | 5000 | | | |
| | 500 | | | |
| ADJ5000-H | 2500 | | | |
| | 5000 | | | |
| | 500 | | | |
| ADJ5000-I | 2500 | | | |
| | 5000 | | | |
| | 500 | 0.5050 | 0.4915 | 0.4951 |
| ADJ5000-J* | 2500 | 2.4949 | 2.4965 | 2.4957 |
| | 5000 | 4.9926 | 4.9919 | 4.9947 |
| | 500 | 0.4914 | 0.4921 | 0.4919 |
| ADJ5000-K | 2500 | 2.4973 | 2.4979 | 2.4969 |
| | 5000 | 5.0084 | 5.0009 | 5.0106 |
| | 500 | 0.4956 | 0.4981 | 0.4973 |
| ADJ5000-L | 2500 | 2.4884 | 2.4967 | 2.4926 |
| | 5000 | 4.9849 | 4.9843 | 4.9887 |
| | 500 | | | |
| ADJ5000-M | 2500 | | | |
| | 5000 | | | |
| | 500 | | | |
| ADJ5000-N | 2500 | | | |
| | 5000 | | | |
| | 500 | | | |
| ADJ5000 | 2500 | | | |
| | 5000 | | | |
| | 500 | | | |
| ADJ5000 | 2500 | | | |
| | 5000 | | | |

mf 10/4/05

mf 10/4/05

*This pipette was verified on 10/5/05.
mf

Analyst: *Richard Hardy*
Reviewed by: *John Wilkes*

Date: 10/4/05
Date: 10-14-05

010376

**SOUTHWEST RESEARCH INSTITUTE
NUCLEAR PROJECT**

CLIENT: Division 20

TASK ORDER: 051011-4

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

Balance Calibrations

#1 - SN: 99-J 50526-15

Southwest Research Institute
Division 01

#2 - SN: 99-J 50031-1

BALANCE VERIFICATION LOG

010377

| BALANCE #: | LOCATION: | SERIAL #: | TOLERANCE: | COMMENTS: |
|-------------|-------------------|------------------------|-----------------|-----------|
| 12 | Bldg. 70 Lab 47 | 1122510787 | ±0.0005 | |
| Date | Std Wt (g) | Recorded Wt (g) | Operator | |
| 10-12-05 | 2.0000 | 2.0000 | JW | 1 |
| " | 100.0000 | 99.9999 | JW | 2 |
| 10-13-05 | 2.0000 | 2.0000 | JW | 1 |
| " | 100.0000 | 99.9998 | JW | 2 |
| 10-14-05 | 2.0000 | 2.0000 | JW | 1 |
| " | 100.0000 | 99.9997 | JW | 2 |
| 10-17-05 | 2.0000 | 2.0001 | JW | 1 |
| " | 100.0000 | 100.0000 | " | 2 |
| 10-18-05 | 2.0000 | 2.0003 | JW | 1 |
| " | 100.0000 | 100.0002 | " | 2 |

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (DQA) for service.

#1 - SN: 99-JS0624-5

Southwest Research Institute
Division 01

#2 - SN: 5537

BALANCE VERIFICATION LOG

| BALANCE #: | LOCATION: | SERIAL #: | TOLERANCE: | COMMENTS: |
|-------------|-------------------|------------------------|-----------------|-----------|
| 19 | Bldg. 70 Lab 47 | 0068597 | ±0.05 | |
| Date | Std Wt (g) | Recorded Wt (g) | Operator | |
| 10-10-05 | 10.00 | 10.01 | KE | 1 |
| 10-10-05 | 400.04 | 400.04 | KE | 2 |
| 10-11-05 | 10.00 | 10.01 | JW | 1 |
| " | 400.04 | 400.04 | JW | 2 |
| 10-12-05 | 10.00 | 10.00 | JW | 1 |
| " | 400.04 | 400.04 | JW | 2 |
| 10-13-05 | 10.00 | 10.01 | JW | 1 |
| " | 400.04 | 400.05 | JW | 2 |
| 10-14-05 | 10.00 | 10.00 | JW | 1 |
| " | 400.04 | 400.04 | JW | 2 |

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (DQA) for service.

010378

#1 - SN: 99-J50524-1.
#2 - SN: 99-J50031-1

Southwest Research Institute
Division 01
BALANCE VERIFICATION LOG

| BALANCE #: | LOCATION: | SERIAL #: | TOLERANCE: | COMMENTS: |
|------------|-----------------|-----------------|-----------------|-----------|
| 34 | Bldg. 70 Lab 47 | 1116031935 | ±0.0005/0.00005 | |
| Date | Std Wt (g) | Recorded Wt (g) | Operator | |
| 10-10-05 | 2.0000 | 2.0000 | KE | 1 |
| " | 100.0000 | 99.9998 | " | 2 |
| 10-11-05 | 2.0000 | 2.0001 | JW | 1 |
| " | 100.0000 | 100.0001 | " | 2 |
| 10-12-05 | 2.0000 | 1.9999 | JW | 1 |
| " | 100.0000 | 100.0000 | " | 2 |
| 10-13-05 | 2.0000 | 1.9999 | JW | 1 |
| " | 100.0000 | 100.0001 | " | 2 |
| 10-14-05 | 2.0000 | 2.0000 | JW | 1 |
| " | 100.0000 | 100.0000 | " | 2 |

If balance is out of limits, clean the balance and re-calibrate using Class "S" weights.
If balance is still out of limits, place a "DO NOT USE" sign on it and call (DQA) for service.

SOUTHWEST RESEARCH INSTITUTE

NUCLEAR PROJECT

CLIENT: Division 20

TASK ORDER: 051011-4

010379

SRR: 28120

SDG: 268259

CASE: CNWRA

VTSR: October 07, 2005

PROJECT#: 06002.01.242

DI Water Verification

D.I. WATER SYSTEM NOTEBOOK SOUTHWEST RESEARCH INSTITUTE BUILDING 70

*MA
100027
20-31-05*

Contact U.S. Filter (1-800-466-7873) for repairs/exchanges. (Make sure to have a P.O.)

HIGH PURITY SYSTEM (HP)

010380

| DATE / TIME | INITIALS | RESISTIVITY MONITOR | | QC LIGHTS | | USAGE (GALS) | COMMENTS |
|-----------------|----------|---------------------|--------|-----------|------|--------------|----------|
| | | (M OHMS) | QC LT. | QC 1 | QC 2 | | |
| 10/12/05 6:59pm | DR | 18.02 | ✓ | ✓ | ✓ | 11879.8 | ✓ |
| 10/13/05 6:57pm | DR | 18.02 | ✓ | ✓ | ✓ | 11902.0 | ✓ |
| 10/14/05 5:03pm | DR | 18.02 | ✓ | ✓ | ✓ | 11908.4 | ✓ |
| 10/17/05 6:04pm | DR | 18.02 | ✓ | ✓ | ✓ | 11939.5 | ✓ |
| 10/18/05 5:48pm | DR | 18.01 | ✓ | ✓ | ✓ | 11956.0 | ✓ |
| 10/19/05 6:55pm | DR | 18.02 | ✓ | ✓ | ✓ | 11972.4 | ✓ |
| 10/20/05 6:05pm | DR | 18.01 | ✓ | ✓ | ✓ | 11989.1 | ✓ |
| 10/21/05 4pm | DR | 18.02 | ✓ | ✓ | ✓ | 12017.2 | ✓ |
| 10/21/05 3pm | DR | 18.01 | ✓ | ✓ | ✓ | 12035.1 | ✓ |
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Legend: Check = Green (OK); X = Red (call for service)

LOW PURITY SYSTEM (LP)

| DATE / TIME | INITIALS | QC LIGHTS | | USAGE (GALS) | COMMENTS |
|-----------------|----------|-----------|-------|--------------|----------|
| | | QC 1 | QC 2 | | |
| 10/12/05 7pm | DR | X | ✓ 7.5 | 30913.2 | Residue |
| 10/13/05 6:52pm | DR | X | ✓ 7.5 | 30913.2 | Residue |
| 10/14/05 5:04pm | DR | ✓ | ✓ 7 | 30913.6 | ✓ |
| 10/17/05 6:04pm | DR | ✓ | ✓ 7 | 30914.8 | ✓ |
| 10/18/05 5:46pm | DR | ✓ | ✓ 6.5 | 30917.2 | ✓ |
| 10/19/05 6:56pm | DR | ✓ | ✓ 6.5 | 30917.8 | ✓ |
| 10/20/05 6:06pm | DR | ✓ | ✓ 6.5 | 30921.6 | ✓ |
| 10/21/05 4:01pm | DR | ✓ | ✓ 7.5 | 30930.5 | ✓ |
| 10/21/05 3pm | DR | ✓ | ✓ 7.5 | 30930.8 | ✓ |
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Legend: Check = Green (OK); X = Red (call for service)