



# **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 Lead in 0.35% (abs) HNO<sub>3</sub>

Catalog Number: CGPB10-1 and CGPB10-5  
Lot Number: **T-PB02113**  
Starting Material: Pb(NO<sub>3</sub>)<sub>2</sub>  
Starting Material Purity (%): 99.99997  
Starting Material Lot No 22150  
Matrix: 0.35% (abs) HNO<sub>3</sub>

**3.0 CERTIFIED VALUES AND UNCERTAINTIES**

**Certified Concentration:** 10,009 ± 22 µg/mL  
**Certified Density:** 1.014 g/mL (measured at 22° C)

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

Certified Value ( $\bar{x}$ ) =  $\frac{\sum x_i}{n}$  ( $\bar{x}$ ) = mean  
Uncertainty ( $\pm$ ) =  $\frac{2t(\sum s_i^2)^{1/2}}{(n)^{1/2}}$   $x_i$  = individual results  
n = number of measurements  
 $\sum s_i^2$  = The summation of all significant estimated errors.  
(Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

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

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

- "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)
- This IV product is Traceable to NIST via direct comparison to NIST SRMs. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors.

**4.1 Assay Method #1** **10,009 ± 22 µg/mL**  
EDTA NIST SRM 928 Lot Number: 880710  
**Assay Method #2** **9942 ± 47 µg/mL**  
ICP Assay NIST SRM 3128 Lot Number: 991504

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

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

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

<u>O</u> Al < 0.00270	<u>M</u> Dy < 0.01193	<u>O</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>O</u> Mg 0.00080	<u>O</u> Rh < 0.00900	<u>O</u> Tl 0.01300
<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>O</u> Hg < 0.01500	<u>M</u> Ru < 0.00398	<u>M</u> Tm < 0.00080
<u>O</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>O</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>O</u> Ca 0.00085	<u>M</u> Ho < 0.00099	<u>M</u> Nb < 0.00099	<u>O</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>O</u> Na < 0.00600	<u>M</u> Yb < 0.00199
<u>M</u> Cr < 0.00994	<u>O</u> Fe 0.00105	<u>O</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>O</u> S < 0.10000	<u>M</u> Zn < 0.03977
<u>M</u> Cu < 0.01193	<u>s</u> Pb	<u>O</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

## 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** - 207.2; +2; 6;  $\text{Pb}(\text{H}_2\text{O})_6^{2+}$

**Chemical Compatibility** - Soluble in HCl, HF and  $\text{HNO}_3$ . Avoid  $\text{H}_2\text{SO}_4$ . 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%  $\text{HNO}_3$  / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2.5%  $\text{HNO}_3$  / LDPE container.

**Pb Containing Samples (Preparation and Solution)** - Metal (Best dissolved in 1:1  $\text{H}_2\text{O}$  /  $\text{HNO}_3$ ); Oxides (The many different Pb oxides are soluble in  $\text{HNO}_3$  with the exception of  $\text{PbO}_2$  which is soluble in HCl or HF); Ores and Alloys (Best attacked using 1:1  $\text{H}_2\text{O}$  /  $\text{HNO}_3$ ); Organic Matrices (Dry ash and dissolve in dilute HCl).

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

Technique/Line	Estimated D.L.	Order	Type	Interferences (underlined indicates severe at = concs.)
ICP-OES 168.215 nm	0.03 / 0.003 $\mu\text{g}/\text{mL}$	1	ion	Co
ICP-OES 220.353 nm	0.04 / 0.006 $\mu\text{g}/\text{mL}$	1	ion	Bi, Nb
ICP-OES 217.000 nm	0.09 / 0.03 $\mu\text{g}/\text{mL}$	1	atom	V, Ir, Hf, Sb, Th
ICP-MS 208 amu	5 ppt	n/a	M'	$^{187}\text{Re}$ , $^{187}\text{Os}$ , $^{187}\text{O}$

**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)**

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 25, 2002

Expiration Date:

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Debbie Newman, QA Administrator

Certificate Approved By: Katalin Le, QC Supervisor

Certifying Officer: Paul Gaines, Chemist, Senior Technical Director

