

**1.0 INORGANIC VENTURES** is an ISO Guide 34:2000 registered Certified Reference Material (CRM) Manufacturer (Certificate #883-02). The certificate is designed and the data is determined in accordance with ISO Guide 31:2000 (Reference Materials-Contents of Certificates and Labels), ISO Guide 34:2000 "Quality System Guidelines for the Production of Reference Materials," and ISO Guide 35-1989 "Certification of Reference Materials - General and Statistical Principles."

**2.0 DESCRIPTION OF CRM** Stock Solution  
 Catalog No.: CMS-1  
 Lot Number: **B2-MEB236089**  
 Matrix: 5% HNO<sub>3</sub>(v/v)

10.00 µg/mL ea:

Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sc, Sm, Tb, Th, Tm, U,  
 Y, Yb

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Cerium, Ce	10.01 ± 0.03 µg/mL	Dysprosium, Dy	10.04 ± 0.02 µg/mL	Erbium, Er	10.01 ± 0.02 µg/mL
Europium, Eu	10.04 ± 0.02 µg/mL	Gadolinium, Gd	10.04 ± 0.02 µg/mL	Holmium, Ho	9.98 ± 0.06 µg/mL
Lanthanum, La	10.04 ± 0.04 µg/mL	Lutetium, Lu	9.99 ± 0.02 µg/mL	Neodymium, Nd	10.04 ± 0.02 µg/mL
Praeseodymium, Pr	10.02 ± 0.03 µg/mL	Samarium, Sm	10.01 ± 0.03 µg/mL	Scandium, Sc	9.99 ± 0.04 µg/mL
Terbium, Tb	10.01 ± 0.02 µg/mL	Thorium, Th	10.03 ± 0.02 µg/mL	Thulium, Tm	10.02 ± 0.02 µg/mL
Uranium, U	9.99 ± 0.02 µg/mL	Ytterbium, Yb	10.02 ± 0.03 µg/mL	Yttrium, Y	10.02 ± 0.02 µg/mL

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

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

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

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

(O) = mean

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

n = number of measurements

Σs<sub>i</sub> = 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.)

**Certified Abundance:** The <sup>235</sup>U in this standard is depleted. The Certified abundances in Atom % are as follows:

IV's Certified Abundance

Isotope	Atom%
Uranium 238U	99.6 ± 0.1
235U	0.39 ± 0.05

## 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 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 INFORMATION

ELEMENT	METHOD	NIST SRM#	SRM LOT#	ELEMENT	METHOD	NIST SRM#	SRM LOT#
Ce	EDTA	928	928	Ce	ICP Assay	3110	890602
Dy	ICP Assay	3115a	990504	Dy	EDTA	928	928
Er	EDTA	928	928	Er	ICP Assay	3116a	000831
Eu	ICP Assay	3117a	991307	Eu	EDTA	928	928
Gd	EDTA	928	928	Gd	ICP Assay	3118a	992004
Ho	ICP Assay	3123a	790812	Ho	EDTA	928	928
La	EDTA	928	928	La	ICP Assay	3127a	890402
Lu	ICP Assay	3130a	892704	Lu	EDTA	928	928
Nd	EDTA	928	928	Nd	ICP Assay	3135a	992803
Pr	ICP Assay	3142a	990501	Pr	EDTA	928	928
Sc	EDTA	928	928	Sc	ICP Assay	3148a	792111
Sm	ICP Assay	3147a	892911	Sm	EDTA	928	928
Tb	EDTA	928	928	Tb	ICP Assay	3157a	891603
Th	ICP Assay	3159	992912	Th	EDTA	928	928
Tm	EDTA	928	928	Tm	ICP Assay	3160a	790912
U	ICP Assay	3164	891509	U	Gravimetric		See Sec. 4.2
Y	ICP Assay	3167a	790412	Y	EDTA	928	928
Yb	EDTA	928	928	Yb	ICP Assay	3166a	790512

**4.2 BALANCE CALIBRATION** - All balances are checked daily using an in-house procedure. The weights used for testing are annually compared to 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. 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

**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. Thermometers which are not calibrated vs standard thermometer No. 903-2680 are traceable to NIST Identification

**4.4 GLASSWARE CALIBRATION** - An in-house procedure is used to calibrate all Class A Glassware used in the manufacturing and quality control of CRM's.

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

### 6.0 INTENDED USE

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

HPLC, IC, TLC, ISE, IR, NMR, UV/VIS, MS, Capillary Electrophoresis, Potentiometry, Wet Chemistry and Voltammetry

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 Technical Staff

This CRM was manufactured using 18 megohm doubly deionized water that has been filtered through a 0.2 micron filter.

## 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 the container. **Do Not** return portions removed from pipetting to container.

Element Specific Information - For specific information regarding any element: Contact technical staff.

**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 in-house 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 17025:2005 "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 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 of chemically-stable solutions performed at the manufacturer's facility show a CRM shelf-life of twenty one months for solutions packaged in 125-mL low density polyethylene bottles. When stored under special environmental controls that minimize transpiration and instability, the shelf life can be extended past this limit.

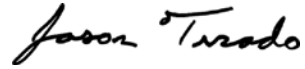
**11.2 Expiration Date** - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Manufacturer concurs with state and federal regulatory agencies' recommendations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

**Certification Date:** October 16, 2008

**Expiration Date:**

**12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS**

**Certificate Prepared By:** Jason Tirado, Product Documentation Administrator

Handwritten signature of Jason Tirado in black ink.

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

Handwritten signature of Katalin Le in black ink.

**Certifying Officer:** Paul Gaines, PhD., Senior Technical Director

Handwritten signature of Paul R. Gaines in black ink.