

## 1.0 ACCREDITATION / REGISTRATION

**INORGANIC VENTURES** is accredited to ISO Guide 34, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories".

Inorganic Ventures is also an ISO 9001 registered manufacturer (SAI Global File Number 010105).



## 2.0 PRODUCT DESCRIPTION

Product Code: Single Analyte Mass Spec Solution

Catalog Number: MSW-10PPM

Lot Number: J2-W02030

Matrix: 0.14% (v/v) HNO<sub>3</sub>

0.2% (v/v) HF

Value / Analyte(s): 10 µg/mL ea:  
W

Starting Material: W Powder

Starting Material Lot#: 1898

Starting Material Purity: 99.9953%

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

**Certified Value:** 9.997 ± 0.076 µg/mL

**Certified Density:** 0.999 g/mL (measured at 20 ± 1 °C)

### Assay Information:

ANALYTE	METHOD	NIST SRM#	SRM LOT#
W	ICP Assay	3163	080331

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.

**Characterization of CRM/RM by Two Methods**

Certified Value,  $X_{\text{CRM/RM}}$ , where two methods of characterization are used is the weighted mean of the two results:

$$X_{\text{CRM/RM}} = [(w_a)(X_a) + (w_b)(X_b)]$$

$X_a$  = mean of Assay Method A with standard uncertainty  $u_{\text{char a}}$

$X_b$  = mean of Assay Method B with standard uncertainty  $u_{\text{char b}}$

$w_a$  and  $w_b$  = the weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/u_{\text{char a}})^2 / ((1/u_{\text{char a}})^2 + (1/u_{\text{char b}})^2)$$

$$w_b = (1/u_{\text{char b}})^2 / ((1/u_{\text{char a}})^2 + (1/u_{\text{char b}})^2)$$

$$\text{CRM/RM Expanded Uncertainty } (\pm) = U_{\text{CRM/RM}} = k (u_{\text{char a\&b}}^2 + u_{\text{bb}}^2 + u_{\text{its}}^2 + u_{\text{sts}}^2)^{1/2}$$

$k$  = coverage factor = 2 in all cases at Inorganic Ventures

$u_{\text{char a\&b}} = [(w_a)^2 (u_{\text{char a}})^2 + (w_b)^2 (u_{\text{char b}})^2]^{1/2}$  where  $u_{\text{char a}}$  and  $u_{\text{char b}}$  are the square root of the sum of the squares of errors from characterization which include instrument measurement, density, NIST SRM uncertainty, weighing, and volume

$u_{\text{bb}}$  = bottle to bottle homogeneity standard uncertainty

$u_{\text{its}}$  = long term stability standard uncertainty (storage)

$u_{\text{sts}}$  = short term stability standard uncertainty (transportation)

**Characterization of CRM/RM by One Method**

Certified Value,  $X_{\text{CRM/RM}}$ , where one method of characterization is used is the mean of individual results:

$$X_{\text{CRM/RM}} = \text{mean of Assay Method A with standard uncertainty } u_{\text{char a}}$$

$$\text{CRM/RM Expanded Uncertainty } (\pm) = U_{\text{CRM/RM}} = k (u_{\text{char a}}^2 + u_{\text{bb}}^2 + u_{\text{its}}^2 + u_{\text{sts}}^2)^{1/2}$$

$k$  = coverage factor = 2 in all cases at Inorganic Ventures

$u_{\text{char a}}$  = square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume

$u_{\text{bb}}$  = bottle to bottle homogeneity standard uncertainty

$u_{\text{its}}$  = long term stability standard uncertainty (storage)

$u_{\text{sts}}$  = short term stability standard uncertainty (transportation)

**4.0 TRACEABILITY TO NIST**

- 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/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

**4.1 Thermometer Calibration**

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

**4.2 Balance Calibration**

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

**4.3 Glassware Calibration**

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

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

CRM/RMs 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	Ag	<	0.000742	M	Eu	<	0.000185	O	Na	<	0.000019	M	Se	<	0.022259	M	Zn	<	0.027823
M	Al	<	0.037098	O	Fe	<	0.021300	M	Nb	<	0.020404	i	Si	<		O	Zr	<	0.006846
M	As	<	0.018549	M	Ga	<	0.000927	M	Nd	<	0.005565	M	Sm	<	0.000185				
O	Au	<	0.053249	M	Gd	<	0.000185	M	Ni	<	0.009274	M	Sn	<	0.004637				
M	B	<	0.007420	M	Ge	<	0.000927	n	Os	<		M	Sr	<	0.000371				
M	Ba	<	0.003710	M	Hf	<	0.003710	i	P	<		M	Ta	<	0.000016				
M	Be	<	0.002782	i	Hg	<		M	Pb	<	0.000927	M	Tb	<	0.000185				
M	Bi	<	0.003710	M	Ho	<	0.000185	M	Pd	<	0.000742	M	Te	<	0.004637				
O	Ca	<	0.000008	M	In	<	0.000927	M	Pr	<	0.000927	M	Th	<	0.032460				
M	Cd	<	0.000927	M	Ir	<	0.000185	M	Pt	<	0.000927	M	Ti	<	0.002782				
M	Ce	<	0.000742	O	K	<	0.000475	M	Rb	<	0.013912	M	Tl	<	0.001855				
M	Co	<	0.001855	M	La	<	0.000185	M	Re	<	0.126132	M	Tm	<	0.000185				
M	Cr	<	0.009274	O	Li	<	0.000400	M	Rh	<	0.000185	M	U	<	0.000927				
M	Cs	<	0.000005	M	Lu	<	0.000185	M	Ru	<	0.001855	M	V	<	0.009274				
M	Cu	<	0.003710	O	Mg	<	0.004004	i	S	<		s	W	<					
M	Dy	<	0.000185	M	Mn	<	0.004637	M	Sb	<	0.001855	M	Y	<	0.000185				
M	Er	<	0.000185	M	Mo	<	0.004637	O	Sc	<	0.004004	M	Yb	<	0.000185				

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 and validation of analytical methods as appropriate.

## 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

### 7.1 Storage and Handling Recommendations

- Keep cap 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 removed aliquots to container.

**Atomic Weight; Valence; Coordination Number; Chemical Form in Solution** - 183.85 +6 6,7,8,9

WOF5-2(chemical form as received)

**Chemical Compatibility** -W is very readily hydrolyzed requiring 0.1 to 1% HF solutions for stabile acidic solutions. The [WOF5]-2 is soluble in % levels of HCl and HNO<sub>3</sub> provided it is in the [WOF5]-2 form. Stable at ppm levels with some metals provided it is fluorinated. <U>Do not mix with Alkaline or Rare Earths</U>. W is best to be mixed only with other fluorinated metals (Ti, Zr, Hf, Nb, Ta, Mo, Si, Sn, Ge). Look for yellow WO<sub>3</sub> precipitate if mixed with other transitions at higher levels indicating instability. The yellow WO<sub>3</sub> will form over a period of weeks even in trace HF, therefore, <U>HF levels of W multi-element blends should be &sim; 1%</U>.

**Stability** - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the [WOF5]-2 for months in 1% HNO<sub>3</sub> / LDPE container. 1-10,000 ppm single element solutions as the [WOF5]-2 chemically stable for years in 1% HF in a LDPE container.

**W Containing Samples (Preparation and Solution)** -Metal (Soluble in HF / HNO<sub>3</sub>); Oxide (soluble in HF or NH<sub>4</sub>OH) ; Organic Matrices (dry ash at 450 0C in Pt0 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	Interferences (underlined indicates severe)
ICP-MS 182 amu	5 ppt	N/A	166Er16O
ICP-OES 207.911 nm	0.03/0.001 µg/mL	1	Ru, In
ICP-OES 209.475 nm	0.05/0.008 µg/mL	1	Mo
ICP-OES 224.875 nm	0.05/0.005 µg/mL	1	Co, Rh, Ag

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

## 8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

## 9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

## 10.0 QUALITY STANDARD DOCUMENTATION

### 10.1 10CFR50 Appendix B - Nuclear Regulatory Commission

- Domestic Licensing of Production and Utilization Facilities

### 10.2 10CFR21 - Nuclear Regulatory Commission

- Reporting defects and Non-Compliance

### 10.3 ISO 9001 Quality Management System Registration

- SAI Global File Number 010105

### 10.4 ISO/IEC Guide 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

### 10.5 ISO/IEC Guide 34 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

## 11.0 CERTIFICATION, EXPIRATION AND PERIOD OF VALIDITY

**11.1 Certification Issue Date**

September 18, 2015

**11.2 Expiration Date****11.3 Period of Validity**

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is handled and stored in accordance with instructions given in Sec 7.0 and used prior to the date given in Sec 11.2. This certification is nullified if the CRM/RM is damaged, contaminated, or otherwise modified.

**12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS****Certificate Prepared By:**

James King Jr  
Product Documentation Supervisor

**Certificate Approved By:**

Michael Booth  
QC Supervisor

**Certifying Officer:**

Paul Gaines  
PhD., Senior Technical Director

