



**CLARITAS PPT™**

Inorganic  
Reference Standards  
for Today's *New*  
Generation of  
High Performance  
ICP and ICP-MS  
Instrumentation.

**SPEX** Chemical





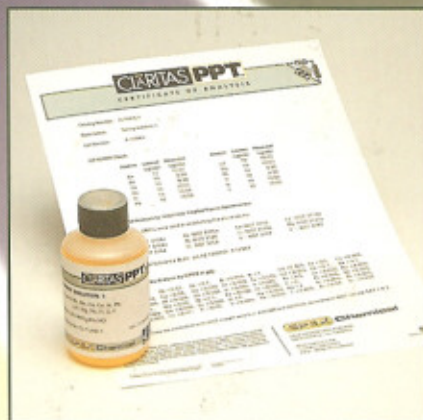


## WHEN ONE IN A MILLION ISN'T GOOD ENOUGH...

The great precision, sensitivity and rapid analysis of multi-element mixtures by ICP and ICP-MS instrumentation have mandated their widespread use in environmental, agricultural, semiconductor, metallurgical and biological laboratories. Advancements in ICP spectroscopy over recent years have extended limits of detection into the low PPB (parts per billion) range. The ICP-MS technique has provided even greater sensitivity, extending detection limits routinely into the low PPT (parts per trillion) range. No longer is one in a million good enough!

SPEX Chemical is proud to introduce **Claritas PPT**, a new class of certified inorganic reference standards designed specifically for today's new generation of high performance ICP and ICP-MS instrumentation. Based on extensive development, our chemists have formulated this new line of high purity standards for user convenience and stability, while providing documentation tailored to the new low levels of detection.

The *Claritas PPT* selection of standards includes a complete series of single- and multi-element solutions, many designed for use with US EPA Methods 6020 CLP-M and 200.8. These solutions are made with the highest purity materials available and are **tested on our state-of-the-art ICP-MS** under an internationally



accredited ISO 9001 quality assurance program. For over forty years, our commitment to quality has made SPEX Chemical the leading manufacturer of inorganic reference standards.

Every *Claritas PPT* standard is supplied with a comprehensive Certificate of Analysis which reports actual **measured values in the final solution** of both the major analytes and up to **45 trace element impurities at PPT levels**.

As always, each certificate includes **NIST documentation** and information regarding the **methods used**. SPEX Chemical will guarantee the stability and accuracy of each *Claritas PPT* standard to  $\pm 0.5\%$ , averaged labeled analyte concentrations, for one full year from date of shipment.



## SINGLE-ELEMENT SOLUTION STANDARDS

Element • 1000 µg/mL	Catalog #	Matrix • 100 mL
Aluminum	CLAL2-2Y	Al(NO <sub>3</sub> ) <sub>3</sub> • 9 H <sub>2</sub> O in 2% HNO <sub>3</sub>
Antimony	CLSB7-2Y	Sb in H <sub>2</sub> O/0.6% Tartaric Acid/tr HNO <sub>3</sub>
Arsenic	CLAS2-2Y	H <sub>3</sub> AsO <sub>4</sub> • ½ H <sub>2</sub> O in 2% HNO <sub>3</sub>
Barium	CLBA2-2Y	BaCO <sub>3</sub> in 2% HNO <sub>3</sub>
Beryllium	CLBE2-2Y	Be <sub>4</sub> O(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>6</sub> in 2% HNO <sub>3</sub>
Bismuth (10 µg/mL)	CLBI2-1AY	Bi in 2% HNO <sub>3</sub>
Cadmium	CLCD2-2Y	Cd in 2% HNO <sub>3</sub>
Calcium	CLCA2-2Y	Ca(NO <sub>3</sub> ) <sub>2</sub> in 2% HNO <sub>3</sub>
Chromium	CLCR2-2Y	Cr(NO <sub>3</sub> ) <sub>3</sub> • 9 H <sub>2</sub> O in 2% HNO <sub>3</sub>
Cobalt	CLCO2-2Y	CoCO <sub>3</sub> in 2% HNO <sub>3</sub>
Copper	CLCU2-2Y	Cu in 2% HNO <sub>3</sub>
Germanium (10 µg/mL)	CLGE9-1AY	(NH) <sub>2</sub> GeF <sub>6</sub> in H <sub>2</sub> O/tr HF
Gold (100 µg/mL)	CLAU1-1Y	Au in 2% HCl
Indium (10 µg/mL)	CLIN2-1AY	In in 2% HNO <sub>3</sub>
Iron	CLFE2-2Y	Fe(NO <sub>3</sub> ) <sub>3</sub> in 2% HNO <sub>3</sub>
Lead	CLPB2-2Y	Pb(NO <sub>3</sub> ) <sub>2</sub> in 2% HNO <sub>3</sub>
Magnesium	CLMG2-2Y	Mg(NO <sub>3</sub> ) <sub>2</sub> in 2% HNO <sub>3</sub>
Manganese	CLMN2-2Y	Mn(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>3</sub> • 2 H <sub>2</sub> O in 2% HNO <sub>3</sub>
Mercury	CLHG4-2Y	Hg in 10% HNO <sub>3</sub>
Molybdenum	CLMO9-2Y	(NH) <sub>4</sub> ) <sub>2</sub> MoO <sub>4</sub> in H <sub>2</sub> O
Nickel	CLNI2-2Y	Ni in 2% HNO <sub>3</sub>
Potassium	CLK2-2Y	KNO <sub>3</sub> in 2% HNO <sub>3</sub>
Rhodium (10 µg/mL)	CLRH1-1AY	RhCl <sub>3</sub> • 3 H <sub>2</sub> O in 2% HCl
Scandium (10 µg/mL)	CLSC2-1AY	Sc <sub>2</sub> O <sub>3</sub> in 2% HNO <sub>3</sub>
Selenium	CLSE2-2Y	Se in 2% HNO <sub>3</sub>
Silver	CLAG2-2Y	Ag in 2% HNO <sub>3</sub>
Sodium	CLNA2-2Y	Na <sub>2</sub> CO <sub>3</sub> in 2% HNO <sub>3</sub>
Terbium (10 µg/mL)	CLTB2-1AY	Tb <sub>4</sub> O <sub>7</sub> in 2% HNO <sub>3</sub>
Thallium	CLTL2-2Y	TlNO <sub>3</sub> in 2% HNO <sub>3</sub>
Thorium	CLTH2-2Y	Th(NO <sub>3</sub> ) <sub>4</sub> • 4 H <sub>2</sub> O in 2% HNO <sub>3</sub>
Tin	CLSN2-2Y	Sn in 1% HNO <sub>3</sub> +1% HF
Titanium	CLTI9-2Y	(NH) <sub>4</sub> ) <sub>2</sub> TiF <sub>6</sub> in H <sub>2</sub> O/tr HF
Uranium	CLU2-2Y	U <sub>3</sub> O <sub>8</sub> in 2% HNO <sub>3</sub>
Vanadium	CLV2-2Y	NH <sub>4</sub> VO <sub>3</sub> in 2% HNO <sub>3</sub>
Yttrium (10 µg/mL)	CLY2-1AY	Y <sub>2</sub> O <sub>3</sub> in 2% HNO <sub>3</sub>
Zinc	CLZN2-2Y	Zn in 2% HNO <sub>3</sub>





## MULTI-ELEMENT SOLUTION STANDARDS

### Tuning Solution

For ICP-MS instrument tuning and mass calibration prior to analysis. A dilution of 100 fold to 1000 fold, depending on the sensitivity of the instrument, is suggested. Dilute with equal parts of *Claritas PPT* Nitric Acid Blank and Water Blank to yield a 1% nitric acid matrix.

#### Tuning Solution 1

Catalog #: CL-TUNE-1 • Vol: 100 mL

Contents: 10 µg/mL: Ba, Be, Ce, Co, In, Pb, Li, Mg, Rh, Tl, U, Y  
Matrix: 2% HNO<sub>3</sub>/5% HCl

### Instrument Calibration

For preparation every two weeks or as needed. Dilute to the concentration appropriate for the instrument with equal parts of *Claritas PPT* Nitric Acid Blank and Water Blank.

#### Instrument Calibration Standard 1

Catalog #: CL-CAL-1 • Vol: 100 mL

Contents: 20 µg/mL: Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Tl, Th, U, V, Zn  
Matrix: 2% HNO<sub>3</sub>/tr Tartaric Acid

#### Instrument Calibration Standard 2

Catalog #: CL-CAL-2 • Vol: 100 mL

Contents: 100 µg/mL: Al, Sb, As, Ba, Be, Cd, Co, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, Ti, Sn, Ti, V, Zn  
Matrix: 5% HNO<sub>3</sub>/tr Tartaric Acid/tr HF

### Contract Required Detection Limits

To verify linearity near the Contract Required Detection Limit (CRDL), a standard must be run at two times the CRDL. This standardization is performed at the start and the end of each sample analysis run, or at least twice in each eight hour shift.

#### Contract Required Detection Limits Standard

Catalog #: CL-CRDL-1 • Vol: 100 mL

Contents:  
500 µg/mL: Ca, Mg, K, Na  
20 µg/mL: Al, Ba  
10 µg/mL: Fe  
6 µg/mL: Sb  
5 µg/mL: Co, V  
4 µg/mL: Ni  
2.5 µg/mL: Cu  
2 µg/mL: Zn  
1.5 µg/mL: Mn  
1 µg/mL: As, Cr, Ag, Tl  
0.5 µg/mL: Be, Cd, Se  
0.3 µg/mL: Pb  
Matrix: 5% HNO<sub>3</sub>/tr Tartaric Acid

### Instrument Check Standards

For testing the calibration curves as Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) solutions. The standards may be mixed and diluted as required.

#### Instrument Check Standard 1

Catalog #: CL-ICS-1 • Vol: 100 mL

Contents: 10 µg/mL: Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, Tl, V, Zn  
Matrix: 2% HNO<sub>3</sub>/tr Tartaric Acid

#### Instrument Check Standard 2

Catalog #: CL-ICS-2 • Vol: 100 mL

Contents: 10 µg/mL: Hg  
Matrix: 2% HNO<sub>3</sub>

#### Instrument Check Standard 3

Catalog #: CL-ICS-3 • Vol: 100 mL

Contents: 200 µg/mL: Ca, Fe, Mg, K, Na  
Matrix: 2% HNO<sub>3</sub>

#### Instrument Check Standard 4

Catalog #: CL-ICS-4 • Vol: 100 mL

Contents: 10 µg/mL: Mo, Th, U  
Matrix: 2% HNO<sub>3</sub>

#### Instrument Check Standard 5

Catalog #: CL-ICS-5 • Vol: 100 mL

Contents: 10 µg/mL: Mo, Sr, Sn, Ti  
Matrix: 2% HNO<sub>3</sub>/tr HF

### Set of Instrument Check Standards

Catalog #: CL-ICS-SET

Includes one of each: CL-ICS-1, CL-ICS-2, CL-ICS-3, CL-ICS-4, CL-ICS-5





## Interference Checks

Designed to contain known concentrations of elements that will demonstrate the magnitude of interferences, and provide an adequate test for necessary corrections. Working solutions should be made at least weekly of a ten fold dilution of CL-INT-A1 and a solution containing a ten fold dilution of CL-INT-A1 and a 100 fold dilution of CL-INT-B1.

### Interferents A

Catalog #: CL-INT-A1 • Vol: 100 mL

#### Contents:

21215 µg/mL: Cl	2000 µg/mL: C
3000 µg/mL: Ca	1000 µg/mL: Al, Mg, P, K, S
2500 µg/mL: Fe, Na	20 µg/mL: Mo, Ti

Matrix: 5% HNO<sub>3</sub>/tr HF

### Analytes B

Catalog #: CL-INT-B1 • Vol: 100 mL

#### Contents:

20 µg/mL: Cr, Co, Cu, Mn, Ni, V	5 µg/mL: Ag
10 µg/mL: As, Cd, Se, Zn	

Matrix: 2% HNO<sub>3</sub>

### Set of Interference Check Standards

Catalog #: CL-INT-SET

Includes one of each: CL-INT-A1, CL-INT-B1

## Spike Sample Analysis

Designed for addition to a matrix blank prior to digestion for both water and soil. An aliquot of the respective Spike Standard should be added to produce the proper concentration levels in the digestate.

### Spike Sample Standard 1 (water)

Catalog #: CL-SPIKE-1 • Vol: 100 mL

#### Contents:

500 µg/mL: Fe	50 µg/mL: As, Pb
250 µg/mL: Ba, Zn	25 µg/mL: Be, Cd, Se, Ag, Ti
100 µg/mL: Sb, Cr, Co, Cu, Mn, Ni, V	

Matrix: 5% HNO<sub>3</sub>/tr Tartaric Acid/tr HF

### Spike Sample Standard 2 (soil)

Catalog #: CL-SPIKE-2 • Vol: 100 mL

#### Contents:

250 µg/mL: Ba, Cr, Cu, Zn	100 µg/mL: Sb, Co, Pb
150 µg/mL: V	50 µg/mL: As, Cd
125 µg/mL: Ni	25 µg/mL: Be, Se, Ag, Ti

Matrix: 5% HNO<sub>3</sub>/tr Tartaric Acid/tr HF

## Memory Test Solutions

To identify or confirm the maximum concentration of an analyte that does not cause a memory effect greater than CRDL. The test solutions are not analyzed directly; equal volumes of the two are mixed and then introduced into the instrument for a normal sample exposure time. A blank is then run to confirm that all analyte memory effects are below the CRDL.

### Memory Test 1

Catalog #: CL-MEM-1 • Vol: 100 mL

#### Contents:

1000 µg/mL: Al, Ca, Fe, Mg, K, Na
20 µg/mL: As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, Ti, V, Zn

Matrix: 5% HNO<sub>3</sub>

### Memory Test 2

Catalog #: CL-MEM-2 • Vol: 100 mL

#### Contents:

7200 µg/mL: Cl	1000 µg/mL: P, S
2000 µg/mL: C	20 µg/mL: Sb, Mo, Ti

Matrix: H<sub>2</sub>O/tr HF

### Set of Memory Test Solutions

Catalog #: CL-MEM-SET

Includes one of each: CL-MEM-1, CL-MEM-2

## Calibration and Matrix Blanks

May be used for dilution or to establish base lines. The calibration, reagent, and rinse blanks are prepared by diluting the appropriate acid with water and any necessary internal standards to produce the required acid concentration, generally 1% HNO<sub>3</sub>.

### Nitric Acid Blank

Catalog #: CLBLK-HNO<sub>3</sub> • Vol: 100 mL

Matrix: 2% HNO<sub>3</sub> in ASTM Type I Water

### Hydrochloric Acid Blank

Catalog #: CLBLK-HCL • Vol: 100 mL

Matrix: 2% HCl in ASTM Type I Water

### Water Blank

Catalog #: CLBLK-H<sub>2</sub>O • Vol: 100 mL

Matrix: ASTM Type I Water, 18 megohm





## Custom Standards

No two plasma labs face exactly the same samples and problems, or have precisely the same requirements. In the real world you have trace element determinations in the presence of one or several major constituents, varying interelement effects, matrix effects...the list goes on and on. These problems become increasingly important as you go for lower limits of detection.

A **Claritas PPT** custom solution standard can remove some of these variables. Our chemists will be happy to discuss your specific application, and then customize the most compatible, shelf-stable mixtures. As always, we will guarantee your **Claritas PPT** custom solution standard for one full year from date of shipment and supply certified concentration and impurity analysis. For further information, please contact our sales department.



### Internal Standard Stock Solutions

May be used to monitor and correct for changes that occur from differences between standards and samples. Since environmental samples often contain significant amounts of Lithium, isotopically enriched 95% Li6 can be analyzed as an internal standard, avoiding the signal from the Li7 peak.

#### Multi-element Internal Standard

Catalog #: CLISS-1 • Vol: 100 mL

Contents: 10 µg/mL: Bi, Ho, In, Li6, Sc, Tb, Y

Matrix: 2% HNO3

#### Single-element Internal Standards

Each 10 µg/mL • Vol: 100 mL

Bismuth in 2% HNO3 ..... CLBI2-1AY

Germanium in H2O ..... CLGE9-1AY

Indium in 2% HNO3 ..... CLIN2-1AY

Rhodium in 2% HCl ..... CLRH1-1AY

Scandium in 2% HNO3 ..... CLSC2-1AY

Terbium in 2% HNO3 ..... CLTB2-1AY

Yttrium in 2% HNO3 ..... CLY2-1AY

### Quality Control Standard

May be used to check the standard curve, the procedure for interelement correction and other spectral interferences.

#### Quality Control Standard 21

Catalog #: CL-QC-21 • Vol: 100 mL

Contents: 100 µg/mL: Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Li, Mg, Mn, Mo, Ni, Se, Sr, Ti, Tl, V, Zn

Matrix: 5% HNO3

### Gold Blank Standard

May be run between samples to reduce the memory effect arising from mercury. It is recommended that a solution of gold be run which is five times the concentration of the mercury in the prior sample.

#### Gold Blank Standard 1

Catalog #: CLAU1-1Y • Vol: 100 mL

Contents: 100 µg/mL: Au

Matrix: 2% HCl

### Contract Laboratory Program Modification (CLP-M) Set

Set of 15 standards for use with US EPA ICP-MS Method 6020 CLP-M

Catalog #: CL-CLPM-SET

Includes one of each: CL-TUNE-1, CL-CAL-1, CL-CAL-2, CL-SPIKE-1, CL-SPIKE-2, CL-ICS-1, CL-ICS-2, CL-ICS-3, CL-ICS-4, CL-ICS-5, CL-INT-A1, CL-INT-B1, CL-CRDL-1, CL-MEM-1, CL-MEM-2

### Multi-element Solution Standards

Designed to contain virtually every element in the mass spectrum for concentration verification checks.

#### Multi-element Solution 1

Catalog #: CLMS-1 • Vol: 100 mL

Contents: 10 µg/mL: Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sm, Sc, Tb, Th, Tm, Y, Yb

Matrix: 5% HNO3

#### Multi-element Solution 2

Catalog #: CLMS-2 • Vol: 100 mL

Contents: 10 µg/mL: Al, As, Ba, Be, Bi, Cd, Ca, Cs, Cr, Co, Cu, Ga, In, Fe, Pb, Li, Mg, Mn, Hg\*, Ni, K, Rb, Se, Ag, Na, Sr, Ti, U, V, Zn

Matrix: 5% HNO3

\*Mercury is supplied as a separate solution due to incompatibility with other elements.

#### Multi-element Solution 3

Catalog #: CLMS-3 • Vol: 100 mL

Contents: 10 µg/mL: Sb, Au, Hf, Ir, Pd, Pt, Rh, Ru, Te, Sn

Matrix: 10% HCl

#### Multi-element Solution 4

Catalog #: CLMS-4 • Vol: 100 mL

Contents: 10 µg/mL: B, Ge, Mo, Nb, P, Re, S, Si, Ta, Ti, W, Zr

Matrix: H2O/tr HF

#### Multi-element Solution 5

Catalog #: CLMS-5 • Vol: 100 mL

Contents: 10 µg/mL: Be, Bi, Ce, Co, In, Pb, Mg, Ni, U

Matrix: 2% HNO3





# MULTI-ELEMENT REFERENCE CHART

Catalog#	CL-TUNE-1	CL-CAL-1	CL-CAL-2	CL-CRDL-1	CL-ICS-1	CL-ICS-2	CL-ICS-3	CL-ICS-4	CL-ICS-5	CL-INT-A1	CL-INT-B1	CL-SPIKE-1	CL-SPIKE-2	CL-MEM-1	CL-MEM-2	CLISS-1	CL-QC-21	CLMS-1	CLMS-2	CLMS-3	CLMS-4	CLMS-5
Element																						
Al		20	100	20	10				1000				1,000					10				
Sb		20	100	6	10						100	100		20			100		10			
As		20	100	1	10					10	50	50	20				100		10	10		
Ba	10	20	100	20	10						250	250	20					10				
Be	10	20	100	0.5	10						25	25	20				100		10			10
Bi															10			10				10
B																						10
Cd		20	100	0.5	10					10	25	50	20				100		10		10	
Ca			100	500		200			3,000				1,000				100		10			
C									2,000					2,000			100		10			
Ce	10																	10				10
Cs																						
Cl									21,215					7,200				10				
Cr		20	100	1	10					20	100	250	20				100		10			
Co	10	20	100	5	10					20	100	100	20				100		10			
Cu		20	100	2.5	10					20	100	250	20				100		10			10
Dy																		10				
Er																	10					
Eu																	10					
Gd																	10					
Ga																		10				
Ge																				10		
Au																						
Hf																			10			
Ho																	10		10			
In	10																10		10			
Ir																	10		10			10
Fe			100	10		200			2,500		500		1,000				100		10		10	
La																	10		10			
Pb	10	20	100	0.3	10						50	100	20				100		10			10
Li	10																100		10			
Lu																	10		10			
Mg	10		100	500		200			1,000				1,000				100		10			10
Mn		20	100	1.5	10					20	100		20				100		10			
Hg					10												100		10			
Mo		20	100				10	10	20					20			100		10			
Nd																					10	
Ni		20	100	4	10					20	100	125	20				100		10			10
Nb																						
Pd																				10		10
P									1,000					1,000						10		10
Pt																						
K			100	500		200			1,000				1,000						10			
Pr																						
Re																	10		10			
Rh	10																			10		
Rb																						
Ru																			10			
Sm																				10		
Sc																	10		10			
Se		20	100	0.5	10					10	25	25	20				100		10			
Si																						
Ag		20	100	1	10					5	25	25	20						10			10
Na			100	500		200			2,500				1,000						10			
Sr			100					10									100		10			
S									1,000					1,000								10
Ta																					10	
Te																						
Tb																				10		
Tl	10	20	100	1	10						25	25	20				100		10			
Th		20					10												10			
Tm																						
Sn			100																			
Ti			100					10	20					20			100			10		10
W								10														
U	10	20																				
V		20	100	5	10					20	100	150	20				100		10			10
Yb																						
Y	10																10		10			
Zn		20	100	2	10					10	250	250	20			10	100		10			
Zr																					10	

All concentrations stated as µg/mL.



## ORDERING INFORMATION:

Orders may be phoned in from 8 a.m. – 5:30 p.m. EST, or faxed 24 hours a day. For technical information and custom orders, please call between 8:30 a.m. – 5:00 p.m. EST.

TELEPHONE:  
1-908-549-7144



OR TOLL FREE:  
**1-800-LAB-SPEX**  
(1-800-522-7739)



FAX:  
1-908-603-9647

ADDRESS:  
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Sales Department  
203 Norcross Avenue  
Metuchen, NJ 08840  
USA

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