
Wadsworth Center

NEW YORK STATE DEPARTMENT OF HEALTH

Trace Elements Laboratory

TRACE ELEMENTS IN SERUM

Educational Event

Proficiency Test Report

Event #2, 2013

May 8th, 2014

May 8, 2014

**Trace Elements in Serum
Event #2, 2013**

Dear Laboratory Director:

Results from the first of two educational proficiency test (PT) events for 2013 in the category Trace Elements in Serum have been tabulated and are summarized. Target values for aluminum, copper, selenium and zinc have been established along with acceptable ranges. Although these PT materials were circulated as ungraded educational samples, "Acceptable Ranges" are included so that participants can evaluate their own laboratory bias. Upward and downward indicator arrows next to individual results should be used as part of a laboratory's on-going internal quality assessment scheme. A confidential three-digit code number assigned by the PT program identifies participant laboratories.

PT Materials

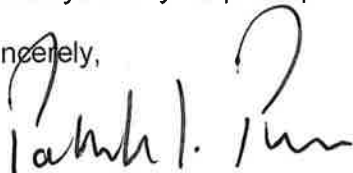
Test materials were prepared from human serum obtained from Tennessee Blood Services, Inc. Serum units were spiked with a suite of additional trace elements as described in each narrative. In addition to Al, Cu, Se and Zn, some serum pools were supplemented with the trace elements arsenic (As), antimony (Sb), barium (Ba), beryllium (Be), cadmium (Cd), manganese (Mn), molybdenum (Mo), lead (Pb), nickel (Ni), cobalt, (Co), chromium (Cr), caesium (Cs), thallium (Tl), tellurium (Te), tin (Sn), platinum (Pt), vanadium (V), tungsten (W) and uranium (U).

Summary of Bovine Calf Serum Investigation

Throughout 2013, the PT program investigated potential problems with the use of bovine calf serum and concluded that this matrix can be problematic for certain types of inorganic mass spectrometry when analyzing for serum selenium at m/z 82. Consequently, the program will revert to using human serum supplemented with trace elements of clinical interest, effective immediately. In addition, grading for serum selenium will resume based on the previous criteria ($\pm 20\%$ or $\pm 2 \mu\text{g/L}$, whichever is greater). A summary of the investigation findings will be distributed separately.

Thank you for your participation.

Sincerely,



Patrick J. Parsons, Ph.D.
Chief, Laboratory of Inorganic and Nuclear Chemistry
Deputy Director, Division of Environmental Health



Mary Frances Verostek, Ph.D.
Assistant Section Head
PT Program for Blood Lead /Trace Elements

New York State Department of Health
Event #2, 2013

Serum Aluminum

The test materials for serum Al were prepared from human serum obtained from Tennessee Blood Services, Inc. The units were tested by FDA approved methods and found to be Non-reactive for Anti-HIV-1/2, Anti-HCV 3.0 and HBsAg. The serum has also been found to be STS (RPR) Non-reactive and Negative for HIV-1 and HCV by PCR. Serum units were dispensed into acid-washed 500-mL polypropylene containers to make up five (5) serum pools. Each pool was spiked with a suite of additional trace elements including aluminum as Al³⁺ at various concentrations.

These are archived PT materials previously circulated.

The Target Value assigned for each PT material is the robust mean of the results reported by all participants in this event. The robust statistics were obtained utilizing algorithms based on those presented in **ISO 13528:2005E** Statistical methods for use in proficiency testing by interlaboratory comparisons. Values for serum aluminum range from 20 µg/L (0.74 µmol/L) to 167 µg/L (6.19 µmol/L).

Acceptable ranges for serum aluminum are based on fixed criteria of ±20%, or ±5 µg/L below 25 µg/L. These criteria are based on consensus recommendations from several EQAS organizers (1).

Discussion. Although these PT materials were circulated as ungraded educational samples, “Acceptable Ranges” are included so that participants can evaluate their own laboratory bias. Upward and downward indicator arrows next to individual results should be used as part of a laboratory’s on-going internal quality assessment scheme. Based on the above criteria, 94.5% of test results reported were judged as satisfactory, with two out of 22 participant laboratories (9.1%) reporting 2 or more of the 5 results outside the acceptable ranges.

1. Taylor, A., Angerer, J., Claeys, F., Kristiansen, J., Mazarrasa, O., Menditto, A., Patriarca, M., Pineau, A., Schoeters, I., Sykes, C., Valkonen, S. and Weykamp, C. Comparison of procedures for evaluating laboratory performance in external quality assessment schemes for lead in blood and aluminum in serum demonstrates the need for common quality specifications. Clinical Chemistry 2002 48 2000-2007.

New York State Department of Health
Serum Aluminum Educational Test Results, 2013 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results ($\mu\text{g/L}$ serum)

	SE13-16	SE13-17	SE13-18	SE13-19	SE13-20
Robust Mean	167	20	20	63	20
Robust Standard Deviation	8.9	1.7	1.6	4.0	1.9
Standard Uncertainty	2	<1	<1	1	1
RSD (%)	5.3	8.6	8.0	6.3	9.3
Number of Sample Measurements	21	21	21	22	21
Acceptable Range:					
Upper Limit	200	25	25	76	25
Lower Limit	134	15	15	50	15

notes: Results reported as less than the method detection limit are excluded from statistical calculations.

New York State Department of Health
Serum Aluminum Educational Test Results, 2013 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g/L}$ serum)					Info Only
		SE13-16	SE13-17	SE13-18	SE13-19	SE13-20	
Target Values:		167	20	20	63	20	
110	ETAAS-Z	166	21	21	65	20	
114	ICP-MS	148	18	19	57	18	
147	FAAS	151	22	23	65	22	Info
156	ICP-MS	171	19.9	20.2	63.6	23.2	
160	ETAAS-Z	159	21	21	66	21	
164	ICP-MS	156	19	20	60	19	
179	DRC/CC-ICP-MS	172	20	20	64	21	
197	ICP-MS	176	<20	<20	75	<20	
200	DRC/CC-ICP-MS	161	13 ↓	15	53	17	Info
206	DRC/CC-ICP-MS	>100	14 ↓	14 ↓	59	16	
287	ETAAS-Z	171	21	21	61	22	
293	ICP-MS	163	19	19	63	19	Info
305	ICP-MS	157	17	20	56	18	
324	ICP-MS	157	21	20	60	19	Info
325	ETAAS-Z	170	18	18	58	18	Info
355	ICP-MS	183	22	21	68	31 ↑	
357	ICP-MS	171	20	21	64	20	
358	ICP-MS	171	22	22	65	21	
362	ICP-MS	171	19	20	66	21	
363	ICP-MS	172	20	21	65	21	
401	ICP-AES/OES	170	16.19	16.19	64.75	16.19	Info
458	ETAAS other	207 ↑	20	24	78 ↑	19	

Percent satisfactory results for all participants: 94.5 %

NOTE: Grading is for educational purposes only

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

notes: Results reported as less than the method detection limit are excluded from statistical calculations.

▲: Result not reported

New York State Department of Health
Serum Aluminum Educational Test Results, 2013 Event #2
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE13-16	SE13-17	SE13-18	SE13-19	SE13-20
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	3	3	3	3
Mean:	167	16	16	59	18
Standard Deviation:	8	4	3	6	3
RSD (%):	—	—	—	—	—
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	207	20	24	78	19
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	4	4	4	4	4
Mean:	167	20	20	63	20
Standard Deviation:	5	2	2	4	2
RSD (%):	3.3	7.4	7.4	5.9	8.4
FAAS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	151	22	23	65	22
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	1	1	1	1	1
Mean:	170	16	16	65	16
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	12	11	11	12	11
Mean:	166	20	20	64	21
Standard Deviation:	10	2	1	5	4
RSD (%):	6.1	7.9	4.4	8.0	17.6
All Laboratories					
Number of Sample Measurements:	21	21	21	22	21
Mean:	168	19	20	63	20
Standard Deviation:	13	2	2	6	3
RSD (%):	7.5	12.9	12.1	8.9	15.7

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #2, 2013

Serum Copper

The test materials for serum Cu were prepared from human serum obtained from Tennessee Blood Services, Inc. The units were tested by FDA approved methods and found to be Non-reactive for Anti-HIV-1/2, Anti-HCV 3.0 and HBsAg. The serum has also been found to be STS (RPR) Non-reactive and Negative for HIV-1 and HCV by PCR. Serum units were dispensed into acid-washed 500-mL polypropylene containers to make up five (5) serum pools. Each pool was spiked with a suite of additional trace elements including copper as Cu^{2+} at various concentrations.

These are archived PT materials previously circulated.

The Target Value assigned for each PT material is the robust mean of the results reported by all participants in this event. The robust statistics were obtained utilizing algorithms based on those presented in **ISO 13528:2005E** Statistical methods for use in proficiency testing by interlaboratory comparisons. Values for serum copper range from 1004 $\mu\text{g/L}$ (15.80 $\mu\text{mol/L}$) to 2112 $\mu\text{g/L}$ (33.24 $\mu\text{mol/L}$).

Acceptable ranges for serum copper are based on fixed criteria of $\pm 15\%$, or $\pm 95 \mu\text{g/L}$ below 635 $\mu\text{g/L}$. These criteria are consistent with those proposed by the OELM Network of EQAS organizers (1, 2) for trace elements in serum, and are slightly less stringent than those previously suggested for NYS ($\pm 10\%$).

Discussion. Although these PT materials were circulated as ungraded educational samples, "Acceptable Ranges" are included so that participants can evaluate their own laboratory bias. Upward and downward indicator arrows next to individual results should be used as part of a laboratory's on-going internal quality assessment scheme. Based on the above criteria, 95.3% of test results reported were judged as satisfactory, with one out of 17 participant laboratories (5.9%) reporting 2 or more of the 5 results outside the acceptable ranges.

1. A. Taylor, J. Angerer, J. Arnaud, F. Claeys, R.L. Jones, O. Mazarrasa, E. Mairiaux, A. Menditto, P.J. Parsons, M. Patriarca, A. Pineau, S. Valkonen, J.-P. Weber and C. Weykamp Accreditation and Quality Assurance 2006 11 440-445.

2. J. Arnaud, J.-P. Weber, C.W. Weykamp, P.J. Parsons, J. Angerer, E. Mairiaux, O. Mazarrasa, S. Valkonen, A. Menditto, M. Patriarca, and A. Taylor Clinical Chemistry 2008 54 1892-1899.

New York State Department of Health
Serum Copper Educational Test Results, 2013 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results ($\mu\text{g/L}$ serum)

	SE13-16	SE13-17	SE13-18	SE13-19	SE13-20
Robust Mean	1624	1004	1930	2112	1213
Robust Standard Deviation	135	73	140	199	63
Standard Uncertainty	41	22	42	60	19
RSD (%)	8.3	7.3	7.3	9.4	5.2
Number of Sample Measurements	17	17	17	17	17
Acceptable Range:					
Upper Limit	1868	1155	2220	2429	1395
Lower Limit	1380	853	1640	1795	1031

notes: Results reported as less than the method detection limit are excluded from statistical calculations.

New York State Department of Health
Serum Copper Educational Test Results, 2013 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g/L}$ serum)					Info Only
		SE13-16	SE13-17	SE13-18	SE13-19	SE13-20	
	Target Values:	1624	1004	1930	2112	1213	
107	DRC/CC-ICP-MS	1692	1050	2023	2250	1288	Info
110	ICP-MS	1784	1103	2115	2324	1360	
114	ICP-MS	1580	960	1840	1990	1150	
147	ICP-MS	1690	1048	1982	2173	1220	Info
156	ICP-AES/OES	1800	1130	2120	2330	1330	
160	ETAAS-Z	1580	990	1950	1820	1210	
164	ICP-MS	1471	934	1787	1985	1131	
179	DRC/CC-ICP-MS	1610	990	1930	2110	1230	
197	ICP-MS	1630	1030	1940	2310	1210	
206	ICP-MS	1470	930	1830	1980	1140	
293	ICP-MS	1583	998	1914	2130	1208	Info
305	ICP-MS	1780	960	1810	2060	1180	
324	ICP-MS	1796	1123	2158	2391	1363	Info
325	ICP-MS	1250 ↓	900	1600 ↓	1750 ↓	1000 ↓	Info
359	ICP-MS	1489	937	1808	1936	1193	
401	DRC/CC-ICP-MS	1609	998.5	1889	2099	1208	Info
457	ICP-AES/OES	1629	1024	2009	2191	1246	Info

Percent satisfactory results for all participants: 95.3 %

NOTE: Grading is for educational purposes only

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

notes: Results reported as less than the method detection limit are excluded from statistical calculations.

▲: Result not reported

New York State Department of Health
Serum Copper Educational Test Results, 2013 Event #2
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE13-16	SE13-17	SE13-18	SE13-19	SE13-20
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	1637	1013	1947	2153	1242
Standard Deviation:	48	32	69	84	41
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	1580	990	1950	1820	1210
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	1715	1077	2065	2261	1288
Standard Deviation:	121	75	78	98	59
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	11	11	11	11	11
Mean:	1593	993	1889	2094	1196
Standard Deviation:	168	74	157	194	102
RSD (%):	10.5	7.5	8.3	9.3	8.5
All Laboratories					
Number of Sample Measurements:	17	17	17	17	17
Mean:	1614	1006	1924	2108	1216
Standard Deviation:	143	68	141	183	89
RSD (%):	8.9	6.8	7.3	8.7	7.3

notes: ? Insufficient data for calculation.

New York State Department of Health
Educational Event #2, 2013

Serum Selenium

The test materials for serum Se were prepared from human serum obtained from Tennessee Blood Services, Inc. The units were tested by FDA approved methods and found to be Non-reactive for Anti-HIV-1/2, Anti-HCV 3.0 and HBsAg. The serum has also been found to be STS (RPR) Non-reactive and Negative for HIV-1 and HCV by PCR. Serum units were dispensed into acid-washed 500-mL polypropylene containers to make up five (5) serum pools. Each pool was spiked with a suite of additional trace elements including selenium as Se⁴⁺ at various concentrations.

These are archived PT materials previously circulated.

The Target Value assigned for each PT material is the robust mean of the results reported by all participants in this event. The robust statistics were obtained utilizing algorithms based on those presented in **ISO 13528:2005E** Statistical methods for use in proficiency testing by interlaboratory comparisons. Values for serum selenium range from 94 µg/L (1.19 µmol/L) to 251 µg/L (3.18 µmol/L).

Acceptable ranges for serum selenium are based on fixed criteria of ±20%, or ±2 µg/L below 10 µg/L. These criteria are a little less stringent than those proposed by the OELM Network of EQAS organizers (±15% or ±8 µg/L below 55 µg/L) (1, 2) for trace elements in serum. As performance for serum Se improves among NYS-permit laboratories, consideration will be given to adopting the OELM criteria.

Discussion. Although these PT materials were circulated as ungraded educational samples, “Acceptable Ranges” are included so that participants can evaluate their own laboratory bias. Upward and downward indicator arrows next to individual results should be used as part of a laboratory’s on-going internal quality assessment scheme. Based on the above criteria, 100% of test results reported were judged as satisfactory, with none of the 14 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

1. A. Taylor, J. Angerer, J. Arnaud, F. Claeys, R.L. Jones, O. Mazarrasa, E. Mairiaux, A. Menditto, P.J. Parsons, M. Patriarca, A. Pineau, S. Valkonen, J.-P. Weber and C. Weykamp Accreditation and Quality Assurance 2006 **11** 440-445.

2. J. Arnaud, J.-P. Weber, C.W. Weykamp, P.J. Parsons, J. Angerer, E. Mairiaux, O. Mazarrasa, S. Valkonen, A. Menditto, M. Patriarca, and A. Taylor Clinical Chemistry 2008 **54** 1892-1899.

New York State Department of Health
Serum Selenium Educational Test Results, 2013 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results ($\mu\text{g/L}$ serum)

	SE13-16	SE13-17	SE13-18	SE13-19	SE13-20
Robust Mean	187	114	111	251	94
Robust Standard Deviation	9	6	6	15	5
Standard Uncertainty	3	2	2	5	2
RSD (%)	4.9	5.6	5.1	6.0	5.8
Number of Sample Measurements	14	14	14	14	14
Acceptable Range:					
Upper Limit	224	137	133	301	113
Lower Limit	150	91	89	201	75

notes: Results reported as less than the method detection limit are excluded from statistical calculations.

New York State Department of Health
Serum Selenium Educational Test Results, 2013 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g/L}$ serum)					Info Only
		SE13-16	SE13-17	SE13-18	SE13-19	SE13-20	
	Target Values:	187	114	111	251	94	
107	DRC/CC-ICP-MS	180	111	106	241	91	Info
110	DRC/CC-ICP-MS	178	110	106	239	89.9	
114	ICP-MS	190	118	112	250	93	
147	DRC/CC-ICP-MS	191	115	126	279	107	Info
156	ICP-MS	181	110	109	242	86.5	
164	DRC/CC-ICP-MS	203	127	121	276	101	
179	DRC/CC-ICP-MS	189	113	110	239	93	
200	DRC/CC-ICP-MS	184	107	108	246	95	Info
206	DRC/CC-ICP-MS	185	118	110	260	97	
293	DRC/CC-ICP-MS	178	110	107	243	92	Info
305	ICP-MS	210	121	111	257	91	
324	ICP-MS	209	123	116	283	97	Info
367	DRC/CC-ICP-MS	166	98	91	215	83	Info
401	DRC/CC-ICP-MS	187.1	112.9	118.4	266.1	97.91	Info

Percent satisfactory results for all participants: 100.0 %

NOTE: Grading is for educational purposes only

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

notes: Results reported as less than the method detection limit are excluded from statistical calculations.

▲: Result not reported

New York State Department of Health
Serum Selenium Educational Test Results, 2013 Event #2
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE13-16	SE13-17	SE13-18	SE13-19	SE13-20
DRC/CC-ICP-MS					
Number of Sample Measurements:	10	10	10	10	10
Mean:	184	112	110	250	95
Standard Deviation:	10	7	10	20	7
RSD (%):	5.3	6.7	8.8	7.9	7.0
ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	198	118	112	258	92
Standard Deviation:	14	6	3	18	4
RSD (%):	7.3	4.8	2.6	6.9	4.8
All Laboratories					
Number of Sample Measurements:	14	14	14	14	14
Mean:	188	114	111	253	94
Standard Deviation:	12	7	8	19	6
RSD (%):	6.6	6.4	7.5	7.4	6.4

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #2, 2013

Serum Zinc

The test materials for serum Zn were prepared from human serum obtained from Tennessee Blood Services, Inc. The units were tested by FDA approved methods and found to be Non-reactive for Anti-HIV-1/2, Anti-HCV 3.0 and HBsAg. The serum has also been found to be STS (RPR) Non-reactive and Negative for HIV-1 and HCV by PCR. Serum units were dispensed into acid-washed 500-mL polypropylene containers to make up five (5) serum pools. Each pool was spiked with a suite of additional trace elements including copper as Zn²⁺ at various concentrations.

These are archived PT materials previously circulated.

The Target Value assigned for each PT material is the robust mean of the results reported by all participants in this event. The robust statistics were obtained utilizing algorithms based on those presented in **ISO 13528:2005E** Statistical methods for use in proficiency testing by interlaboratory comparisons. Values for serum zinc range from 574 µg/L (8.78 µmol/L) to 2859 µg/L (43.72 µmol/L).

Acceptable ranges for serum zinc are based on fixed criteria of ±15%, or ±15 µg/L below 100 µg/L. These criteria are consistent with those proposed by the OELM network of EQAS organizers (1) for trace elements in serum.

Discussion. Although these PT materials were circulated as ungraded educational samples, “Acceptable Ranges” are included so that participants can evaluate their own laboratory bias. Upward and downward indicator arrows next to individual results should be used as part of a laboratory’s on-going internal quality assessment scheme. Based on the above criteria, 87.5% of test results reported were judged as satisfactory, with four out of 24 participant laboratories (16.7 %) reporting 2 or more of the 5 results outside the acceptable ranges.

1. A. Taylor, J. Angerer, J. Arnaud, F. Claeys, R.L. Jones, O. Mazarrasa, E. Mairiaux, A. Menditto, P.J. Parsons, M. Patriarca, A. Pineau, S. Valkonen, J.-P. Weber and C. Weykamp Accreditation and Quality Assurance 2006 **11** 440-445.

2. J. Arnaud, J.-P. Weber, C.W. Weykamp, P.J. Parsons, J. Angerer, E. Mairiaux, O. Mazarrasa, S. Valkonen, A. Menditto, M. Patriarca, and A. Taylor Clinical Chemistry 2008 **54** 1892-1899.

New York State Department of Health
Serum Zinc Educational Test Results, 2013 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results ($\mu\text{g/L}$ serum)

	SE13-16	SE13-17	SE13-18	SE13-19	SE13-20
Robust Mean	2271	672	639	2859	574
Robust Standard Deviation	181	50	37	259	51
Standard Uncertainty	46	13	9	66	13
RSD (%)	8.0	7.4	5.8	9.1	8.8
Number of Sample Measurements	24	24	24	24	24
Acceptable Range:					
Upper Limit	2612	773	735	3288	660
Lower Limit	1930	571	543	2430	488

notes: Results reported as less than the method detection limit are excluded from statistical calculations.

New York State Department of Health
Serum Zinc Educational Test Results, 2013 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE13-16	SE13-17	SE13-18	SE13-19	SE13-20	
	Target Values:	2271	672	639	2859	574	
107	DRC/CC-ICP-MS	2636 ↑	777 ↑	739 ↑	3273	646	Info
110	ICP-MS	2511	725	685	3104	616	
114	ICP-MS	2070	620	610	2520	530	
147	ICP-MS	2333	673	653	2967	584	Info
156	ICP-AES/OES	2490	746	693	3070	617	
160	FAAS	2280	700	660	2760	620	
164	ICP-MS	2085	615	621	2633	528	
179	DRC/CC-ICP-MS	2270	650	630	2850	560	
197	ICP-MS	2310	670	620	3040	560	
206	ICP-MS	2170	660	650	2720	560	
287	FAAS	1780 ↓	630	550	2600	530	
293	ICP-MS	2281	699	699	2948	616	Info
305	ICP-MS	2390	620	590	2640	550	
324	ICP-MS	2068	651	629	2641	565	Info
325	ICP-MS	1130 ↓	450 ↓	430 ↓	1430 ↓	390 ↓	Info
355	ICP-MS	2297	702	636	2824	604	
357	ICP-MS	1900 ↓	634	624	2740	557	
358	ICP-MS	2297	670	640	2810	580	
359	ICP-MS	2163	824 ↑	616	2680	567	
362	ICP-MS	2210	690	670	3220	640	
363	ICP-MS	2390	700	670	3060	640	
401	DRC/CC-ICP-MS	2386	692.9	660.2	2961	588.3	Info
457	ICP-AES/OES	2886 ↑	703	640	3359 ↑	511	Info
458	ETAAS other	2305	605	543 ↓	2864	454 ↓	

Percent satisfactory results for all participants: 87.5 %

NOTE: Grading is for educational purposes only

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

notes: Results reported as less than the method detection limit are excluded from statistical calculations.

▲: Result not reported

New York State Department of Health
Serum Zinc Educational Test Results, 2013 Event #2
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE13-16	SE13-17	SE13-18	SE13-19	SE13-20
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	2431	707	676	3028	598
Standard Deviation:	187	65	56	219	44
RSD (%):	—	—	—	—	—
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2305	605	543	2864	454
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
FAAS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	2030	665	605	2680	575
Standard Deviation:	354	49	78	113	64
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	2688	725	667	3215	564
Standard Deviation:	280	30	37	204	75
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	16	16	16	16	16
Mean:	2163	663	628	2749	568
Standard Deviation:	315	76	60	405	59
RSD (%):	14.6	11.5	9.6	14.7	10.4
All Laboratories					
Number of Sample Measurements:	24	24	24	24	24
Mean:	2235	671	632	2821	567
Standard Deviation:	327	70	61	372	59
RSD (%):	14.6	10.5	9.7	13.2	10.5

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #2, 2013

Additional Trace Elements Reported in Serum

Participant laboratories reported their analytical results for any additional trace elements (other than Al, Cu, Se and Zn) that are routinely reported so that a more complete characterization can be recorded for these PT materials. However, results for these additional trace elements are not reported here.

Human serum samples were selected from archived PT material based upon selenium (Se) concentrations, and were relabeled for distribution with bovine serum samples with similar Se levels for analysis during 2013 PT Event 2. The levels of aluminum (Al), copper (Cu) and Zinc (Zn), and the additional trace elements, if any, were not a consideration. We asked that participants consider analyzing both the bovine PT samples (SE13-06 through 10) and the human educational samples (SE13-16 through 20) within the same run, if possible, to minimize intralaboratory variability. We were only able to provide one set of the educational samples (SE13-16 through 20), and the priority for analysis was for Se analysis, followed by Al, Cu and Zn. With any remaining material, analysis of serum additional elements should be considered. Consequently, the small number of values reported for the additional trace elements by participants for some of the educational PT materials reflects background levels that are largely below laboratory reportable limits.

**New York State Department of Health
Trace Elements in Serum
METHOD NOTES**

ATOMIC SPECTROMETRY METHODS

- A-1 ETAAS-Z (Electrothermal atomic absorption spectrometry with Zeeman background correction)
- A-2 ETAAS other (i.e., D₂, S-H background correction)
- A-3 FAAS (Flame atomic absorption spectrometry)
- A-4 CV-AAS (Cold vapor atomic absorption spectrometry)
- A-5 HG-AAS (Hydride generation atomic absorption spectrometry)
- A-6 AFS (Atomic fluorescence spectrometry)
- A-7 Other

INDUCTIVELY COUPLED PLASMA

- P-1 ICP-MS (Inductively coupled plasma - mass spectrometry)
- P-2 DRC/CC-ICP-MS (ICP-MS used in the Dynamic Reaction Cell or Collision Cell mode)
- P-3 ICP-AES/OES (ICP atomic/optical emission spectrometry)
- P-4 HR-ICP-MS (High resolution ICP-MS)
- P-5 ETV-ICP-MS (Electrothermal vaporization ICP-MS)
- P-6 ID-ICP-MS (Isotope dilution ICP-MS)
- P-7 Other

ELECTROCHEMICAL METHODS

- E-1 ASV (Anodic stripping voltammetry without digestion)
- E-2 ASV-LeadCare[®] (Anodic stripping voltammetry using the ESA LeadCare[®] system)
- E-3 Fluoride specific electrode
- E-4 Other

MOLECULAR FLUORIMETRY

- F-1 EtOAc (Ethyl acetate-acetic acid extraction method for determination of erythrocyte protoporphyrin)
- F-2 Aviv hematofluorometry (for determination of EP at hematocrit 35)
- F-3 Helena ZPP (for determination of zinc protoporphyrin in $\mu\text{mol ZPP/mol heme}$)
- F-4 Other

OTHER METHODS

If your method is not listed in the above list, please describe it briefly.
