NEW YORK STATE | Department of Health | Wadsworth Center

TRACE ELEMENTS IN SERUM

Proficiency Test Report

Event #2, 2015

July 2nd, 2015

NEW YORK STATE OF OPPORTUNITY. | Department of Health

ANDREW M. CUOMO
Governor

HOWARD A. ZUCKER, M.D., J.D.
Commissioner

SALLY DRESLIN, M.S., R.N.
Executive Deputy Commissioner

July 2, 2015

Trace Elements in Serum
Event #2, 2015

Dear Laboratory Director:

Results from the second proficiency test (PT) event for 2015 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. Results are graded using element-specific criteria as indicated in each narrative section. A laboratory with an unacceptable significant analytical bias relative to the target value will be expected to investigate the source of the error. 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 aluminum (Al), copper (Cu), selenium (Se) and zinc (Zn), serum pools were supplemented with the trace elements arsenic (As), cadmium (Cd), chromium (Cr), cobalt, (Co), lead (Pb), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), thallium (Tl), tin (Sn), titanium (Ti), tungsten (W) and vanadium (V).

The next PT event for trace elements in serum is scheduled to be mailed Wednesday, September 16th, 2015. Please inform our laboratory staff at (518) 474-7161 if the test materials have not arrived within five days of the scheduled mail out date. **The deadline for reporting results is Wednesday, October 14th, 2015.**

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.
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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 negative for HIV 1/2 and HIV-1 RNA, and non-reactive to HBsAg, HCV3 and STS. Serum was 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 Al^{3+} at various concentrations.

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 24 µg/L (0.89 µmol/L) to 120 µg/L (4.45 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. Based on the above criteria, 98.2% of test results reported were judged as satisfactory, with none out of 22 participant laboratories 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 Test Results, 2015 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L serum)				
	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
Robust Mean	**120**	**50**	**67**	**24**	**40**
Robust Standard Deviation	3	3	3	2	3
Standard Uncertainty	0.9	0.7	0.8	0.5	0.7
RSD (%)	2.6	5.3	4.3	8.0	6.3
Number of Sample Measurements	21	22	22	22	22
Acceptable Range:					
Upper Limit:	144	60	80	29	48
Lower Limit:	96	40	54	19	32

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

New York State Department of Health
Serum Aluminum Test Results, 2015 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum) SE15-06	SE15-07	SE15-08	SE15-09	SE15-10	Info Only
	Target Values:	120	50	67	24	40	
114	ICP-MS	124	49	66	21	39	
147	FAAS	122	53	71	26	43	Info
156	ICP-MS	120	52	68	24	41	
160	ICP-MS	112	47	63	23	38	
164	ICP-MS	120	51	69	25	41	
179	DRC/CC-ICP-MS	121	52	69	24	42	
197	ICP-MS	121	51	69	26	43	
200	DRC/CC-ICP-MS	120	52	73	31 ↑	40	Info
206	DRC/CC-ICP-MS	>100	51	67	26	44	
287	ETAAS-Z	125	53	70	26	43	
293	ICP-MS	125	53	69	26	43	Info
305	ICP-MS	121	48	65	24	40	
324	HR-ICP-MS	123	47	69	23	39	Info
325	ETAAS-Z	114	51	67	26	40	Info
355	ICP-MS	123	50	69	24	40	
357	ICP-MS	121	51	68	24	40	
358	ICP-MS	110	47	65	22	38	
363	ICP-MS	106	47	61	22	38	
366	ETAAS-Z	93 ↓	45	58	22	32	Info
401	DRC/CC-ICP-MS	119	49	65	22	38	Info
458	ETAAS other	119	46	61	23	38	
485	HR-ICP-MS	121.6	53.36	69.07	23.50	44.83	Info

Percent satisfactory results for all participants: 98.2 %

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 Test Results, 2015 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L serum)				
	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	4	4	4	4
Mean:	120	51	69	26	41
Standard Deviation:	1	1	3	4	3
RSD (%):	—	2.8	5.0	15.0	6.3
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	119	46	61	23	38
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	3	3	3	3	3
Mean:	111	50	65	25	38
Standard Deviation:	16	4	6	2	6
RSD (%):	—	—	—	—	—
FAAS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	122	53	71	26	43
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	122	50	69	23	42
Standard Deviation:	1	4	0	0	4
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	11	11	11	11	11
Mean:	118	50	67	24	40
Standard Deviation:	6	2	3	2	2
RSD (%):	5.2	4.3	4.2	6.8	4.5
All Laboratories					
Number of Sample Measurements:	21	22	22	22	22
Mean:	118	50	67	24	40
Standard Deviation:	8	3	4	2	3
RSD (%):	6.4	5.1	5.4	9.0	7.0

notes: ? Insufficient data for calculation.

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.

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 1156 µg/L (18.19 µmol/L) to 3171 µg/L (49.90 µmol/L).

Acceptable ranges for serum copper are based on fixed criteria of ±15%, or ±95 µg/L below 635 µg/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 (±10%).

Discussion. Based on the above criteria, 93.6% 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. 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 Test Results, 2015 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L serum)				
	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
Robust Mean	**1814**	**1445**	**3171**	**1821**	**1156**
Robust Standard Deviation	96	94	233	105	76
Standard Uncertainty	26	25	62	28	20
RSD (%)	5.3	6.5	7.4	5.8	6.6
Number of Sample Measurements	22	22	22	22	22
Acceptable Range:					
Upper Limit:	2086	1662	3647	2094	1329
Lower Limit:	1542	1228	2695	1548	983

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

New York State Department of Health
Serum Copper Test Results, 2015 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum) SE15-06	SE15-07	SE15-08	SE15-09	SE15-10	Info Only
	Target Values:	1814	1445	3171	1821	1156	
107	DRC/CC-ICP-MS	1800	1400	3600	1800	1200	Info
110	ICP-MS	1942	1560	3505	1937	1227	
114	ICP-MS	1820	1450	3010	1810	1170	
147	ICP-MS	1747	1385	2986	1760	1093	Info
156	ICP-AES/OES	1800	1500	3300	1900	1100	
160	ICP-MS	1740	1370	2950	1710	1070	
164	ICP-MS	1833	1467	3178	1841	1163	
179	DRC/CC-ICP-MS	1860	1500	3270	1870	1180	
197	ICP-MS	1800	1400	3190	1790	1110	
200	ICP-MS	1949	1562	3429	1988	1251	Info
206	ICP-MS	1750	1385	3052	1812	1118	
293	ICP-MS	1844	1526	3319	1850	1195	Info
305	ICP-MS	1540 ↓	1280	2930	1810	1080	
324	HR-ICP-MS	1748	1358	3000	1720	1098	Info
325	ICP-MS	2370 ↑	2090 ↑	3330	2200 ↑	1550 ↑	Info
359	ICP-MS	1893	1463	3407	1847	1196	
366	ETAAS-Z	1820	1450	2931	1690	1184	Info
388	ICP-MS	2136 ↑	1661	3414	2074	1409 ↑	
401	DRC/CC-ICP-MS	1703	1379	2923	1709	1087	Info
457	ICP-AES/OES	1845	1448	3135	1857	1214	Info
483	DRC/CC-ICP-MS	1733	1367	2949	1714	1075	Info
484	ICP-MS	1704	1351	3037	1705	1076	

Percent satisfactory results for all participants: 93.6 %

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 Test Results, 2015 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L serum)				
	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	1774	1412	3186	1773	1136
Standard Deviation:	70	61	318	77	64
RSD (%):	4.0	4.3	10.0	4.3	5.6
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	1820	1450	2931	1690	1184
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	1748	1358	3000	1720	1098
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	1823	1474	3218	1879	1157
Standard Deviation:	32	37	117	30	81
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	14	14	14	14	14
Mean:	1862	1496	3196	1867	1193
Standard Deviation:	201	198	202	139	137
RSD (%):	10.8	13.2	6.3	7.5	11.5
All Laboratories					
Number of Sample Measurements:	22	22	22	22	22
Mean:	1835	1471	3175	1836	1175
Standard Deviation:	165	163	213	127	116
RSD (%):	9.0	11.1	6.7	6.9	9.8

notes: ? Insufficient data for calculation.

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 Se^{4+} at various concentrations.

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 91 µg/L (1.15 µmol/L) to 269 µg/L (3.41 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. Based on the above criteria, 100% of test results reported were judged as satisfactory, with none of the 19 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 Test Results, 2015 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L serum)				
	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
Robust Mean	**269**	**134**	**223**	**91**	**116**
Robust Standard Deviation	15	11	14	6	8
Standard Uncertainty	4	3	4	2	2
RSD (%)	5.5	8.0	6.3	7.0	6.7
Number of Sample Measurements	19	19	19	19	19
Acceptable Range:					
Upper Limit:	323	161	268	109	139
Lower Limit:	215	107	178	73	93

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

New York State Department of Health
Serum Selenium Test Results, 2015 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum) SE15-06	SE15-07	SE15-08	SE15-09	SE15-10	Info Only
	Target Values:	269	134	223	91	116	
103	DRC/CC-ICP-MS	281	136	228	93.5	118	Info
107	DRC/CC-ICP-MS	260	120	210	84	110	Info
110	DRC/CC-ICP-MS	261	132	218	90	114	
114	ICP-MS	269	137	224	95	116	
147	ICP-MS	242	119	207	85	107	Info
156	DRC/CC-ICP-MS	280	130	230	93	110	
160	ICP-MS	264	130	223	93	118	
164	DRC/CC-ICP-MS	306	146	258	98	129	
179	DRC/CC-ICP-MS	268	133	219	84	120	
200	DRC/CC-ICP-MS	261	133	213	88	115	Info
206	DRC/CC-ICP-MS	245	127	203	88	109	
293	DRC/CC-ICP-MS	291	148	235	100	125	Info
305	ICP-MS	276	138	224	96	120	
324	HR-ICP-MS	259	120	211	85	109	Info
325	ETAAS-Z	260	155	240	85	115	Info
366	ETAAS-Z	283	143	234	96	129	Info
388	ICP-MS	275	140	227	100	119	
401	DRC/CC-ICP-MS	289	145	238	97	124	Info
483	DRC/CC-ICP-MS	250	124	205	86	105	Info

Percent satisfactory results for all participants: 100.0 %

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 Test Results, 2015 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L serum)				
	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	11	11	11	11	11
Mean:	272	134	223	91	116
Standard Deviation:	19	9	16	6	8
RSD (%):	6.9	6.8	7.4	6.2	6.6
ETAAS-Z					
Number of Sample Measurements:	2	2	2	2	2
Mean:	272	149	237	91	122
Standard Deviation:	16	8	4	8	10
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	259	120	211	85	109
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	5	5	5	5	5
Mean:	265	133	221	94	116
Standard Deviation:	14	9	8	6	5
RSD (%):	5.2	6.5	3.6	5.9	4.5
All Laboratories					
Number of Sample Measurements:	19	19	19	19	19
Mean:	269	135	224	91	116
Standard Deviation:	16	10	14	6	7
RSD (%):	6.1	7.5	6.3	6.2	6.1

notes: ? Insufficient data for calculation.

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 zinc as Zn^{2+} at various concentrations.

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 597 µg/L (9.13 µmol/L) to 2827 µg/L (43.23 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. Based on the above criteria, 89.3% of test results reported were judged as satisfactory, with four out of 28 participant laboratories (14.3%) 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 Test Results, 2015 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L serum)				
	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
Robust Mean	**2827**	**1657**	**2017**	**597**	**679**
Robust Standard Deviation	245	125	152	55	63
Standard Uncertainty	58	30	36	13	15
RSD (%)	8.7	7.5	7.5	9.3	9.3
Number of Sample Measurements	28	28	28	28	28
Acceptable Range:					
Upper Limit:	3251	1906	2320	687	781
Lower Limit:	2403	1408	1714	507	577

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

New York State Department of Health
Serum Zinc Test Results, 2015 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum) SE15-06	SE15-07	SE15-08	SE15-09	SE15-10	Info Only
	Target Values:	2827	1657	2017	597	679	
107	DRC/CC-ICP-MS	3200	1900	2200	630	720	Info
110	ICP-MS	3200	1967 ↑	2321 ↑	689 ↑	795 ↑	
114	ICP-MS	2610	1610	1910	630	690	
147	ICP-MS	2614	1556	1902	601	620	Info
156	ICP-AES/OES	2600	1600	1900	570	640	
160	ICP-MS	2710	1580	1900	550	640	
164	ICP-MS	2795	1661	2007	580	668	
179	DRC/CC-ICP-MS	2780	1610	2000	560	640	
197	ICP-MS	2840	1590	1980	570	630	
200	ICP-MS	3041	1799	2217	634	739	Info
206	ICP-MS	2694	1581	2005	601	668	
287	FAAS	2980	1790	2180	700 ↑	730	
293	ICP-MS	2752	1654	2007	562	667	Info
305	ICP-MS	2280 ↓	1400 ↓	1740	560	610	
324	HR-ICP-MS	2306 ↓	1326 ↓	1647 ↓	474 ↓	560 ↓	Info
325	ICP-MS	3150	2000 ↑	2175	740 ↑	875 ↑	Info
355	ICP-MS	2881	1665	2038	591	671	
357	ICP-MS	2507	1486	1831	523	619	
358	ICP-MS	3110	1770	2170	640	740	
359	ICP-MS	2955	1691	2107	613	711	
363	ICP-MS	3020	1750	2150	600	700	
366	FAAS	2960	1760	2100	645	717	Info
388	ICP-MS	3101	1765	2083	652	768	
401	DRC/CC-ICP-MS	2844	1622	2027	569	654	Info
457	ICP-AES/OES	2664	1575	1897	573	640	Info
458	FAAS	2908	1773	2072	663	757	
483	DRC/CC-ICP-MS	2680	1562	1846	523	589	Info
484	ICP-MS	2680	1570	1940	530	670	

Percent satisfactory results for all participants: 89.3 %

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 Test Results, 2015 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L serum)				
	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	2876	1674	2018	571	651
Standard Deviation:	226	153	145	44	54
RSD (%):	7.9	9.2	7.2	7.8	8.3
FAAS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	2949	1774	2117	669	735
Standard Deviation:	37	15	56	28	20
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2306	1326	1647	474	560
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	2632	1588	1899	572	640
Standard Deviation:	45	18	2	2	0
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	18	18	18	18	18
Mean:	2830	1672	2027	604	693
Standard Deviation:	249	153	147	55	69
RSD (%):	8.8	9.1	7.2	9.1	10.0
All Laboratories					
Number of Sample Measurements:	28	28	28	28	28
Mean:	2817	1665	2013	599	683
Standard Deviation:	244	153	153	59	68
RSD (%):	8.7	9.2	7.6	9.9	9.9

notes: ? Insufficient data for calculation.

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. Results for additional trace elements are reported here, but no target value is implied nor are any acceptable ranges provided. These data are provided solely for educational and informational purposes.

In addition to Al, Cu, Se and Zn, the serum pools were supplemented with additional trace elements as indicated below.

Additional Elements

As, Cd, Cr, Co, Hg, Pb, Mn, Mo, Ni, Sn, Ti, Tl, W and V

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Serum Antimony (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
103	DRC/CC-ICP-MS	0.0145	<0.0101	0.0130	0.0132	<0.0101
110	ICP-MS	<0.2	<0.2	<0.2	<0.2	<0.2
147	ICP-MS	<0.03	<0.03	<0.03	<0.03	<0.03

Serum Arsenic (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
103	DRC/CC-ICP-MS	4.82	16.90	6.25	4.47	11.4
147	ICP-MS	4.22	14.5	5.44	3.87	9.81
197	DRC/CC-ICP-MS	<10	16	<10	<10	10
	Arithmetic mean	**-**	**15.8**	**-**	**-**	**10.4**
	SD	-	1.2	-	-	0.9
	n	2	3	2	2	3

Serum Barium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
110	ICP-MS	1.3	0.8	1.2	0.4	0.9
147	ICP-MS	0.924	0.614	0.777	0.313	0.814
197	ICP-MS	<2.0	<2.0	<2.0	<2.0	<2.0

Serum Beryllium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
110	ICP-MS	0.7	<0.3	0.33	0.30	0.7
147	ICP-MS	<0.36	<0.36	<0.36	<0.36	<0.36
197	ICP-MS	<0.2	<0.2	<0.2	<0.2	<0.2

Serum Bismuth (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Cadmium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
103	DRC/CC-ICP-MS	1.13	2.93	2.88	5.30	10.7
110	ICP-MS	1.1	3.3	3.2	5.7	11.3
147	ICP-MS	1.00	2.87	2.80	5.20	10.5
197	DRC/CC-ICP-MS	1.1	3.0	2.9	5.4	10.6
324	HR-ICP-MS	0.95	2.6	2.6	4.7	9.6
	Arithmetic mean	**1.06**	**2.9**	**2.9**	**5.3**	**10.5**
	SD	0.08	0.3	0.2	0.4	0.6
	n	5	5	5	5	5

Serum Chromium (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
103	DRC/CC-ICP-MS	17.5	6.90	3.55	9.86	1.10
114	ICP-MS	16.8	7.0	3.1	*1.4	*9.7
147	DRC/CC-ICP-MS	16.1	6.50	2.75	8.84	1.14
156	DRC/CC-ICP-MS	16	6.6	2.8	9.2	<1
160	ICP-MS	16	6	3	8	1
164	DRC/CC-ICP-MS	14.9	5.5	2.5	8.0	0.8
179	DRC/CC-ICP-MS	18.1	7.3	3.1	10.1	1.1
197	DRC/CC-ICP-MS	17.4	7.0	3.0	9.5	1.3
206	DRC/CC-ICP-MS	16.3	6.7	2.9	9.0	1.1
305	ICP-MS	18.4	7.0	3.0	10.2	1.0
324	HR-ICP-MS	17.6382	6.5147	3.0527	9.3048	1.1236
485	HR-ICP-MS	17.02	6.90	3.09	9.22	1.08
**Outlier*	**Arithmetic mean**	**17**	**6.7**	**3.0**	**9.2**	**1.1**
	SD	1	0.5	0.3	0.7	0.1
	n	12	12	12	11	10

Serum Cobalt (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
103	DRC/CC-ICP-MS	2.23	6.83	4.00	18.6	11.0
110	ICP-MS	2.5	7.3	4.3	18.6	11.1
114	ICP-MS	2.3	6.8	4.0	18.6	10.6
147	ICP-MS	2.11	6.48	3.83	17.7	10.2
156	DRC/CC-ICP-MS	2.2	7.1	4.2	18	11
164	ICP-MS	2.1	6.6	3.9	17.6	9.9
179	DRC/CC-ICP-MS	2.2	6.8	4.2	18	11
197	ICP-MS	1.9	6.3	3.6	16.8	10.1
206	ICP-MS	2.5	6.9	4.2	18.2	11.1
324	HR-ICP-MS	2.5	7.1	4.3	18.9	11.3
485	HR-ICP-MS	2.15	7.34	4.28	18.08	11.07
	Arithmetic mean	**2.2**	**6.9**	**4.1**	**18.1**	**10.8**
	SD	0.2	0.3	0.2	0.6	0.5
	n	11	11	11	11	11

Serum Iodine (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
114	ICP-MS	56.3	59.1	70.2	68.5	78.9
147	ICP-MS	53.2	56.8	68.1	75.1	74.1
156	DRC/CC-ICP-MS	54	61	73	78	79
164	ICP-MS	50	55	67	71	72
179	ICP-MS	57	61	73	79	80
197	ICP-MS	51.8	54.1	65.7	71.3	73.1
206	ICP-MS	55.6	59.8	69.0	78.3	77.3
	Arithmetic mean	**54**	**58**	**69**	**74**	**76**
	SD	3	3	3	4	3
	n	7	7	7	7	7

Serum Iron (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
457	ICP-AES/OES	739	693	487	1650	215

Serum Lead (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
103	DRC/CC-ICP-MS	5.48	8.80	2.18	14.2	2.11
110	ICP-MS	5.78	9.56	2.22	15.40	2.55
147	ICP-MS	5.99	9.10	2.18	15.2	2.26
197	DRC/CC-ICP-MS	5.2	8.6	*2.6	13.9	2.0
**Outlier*	**Arithmetic mean**	**5.6**	**9.0**	**2.19**	**14.7**	**2.2**
	SD	0.3	0.4	0.02	0.7	0.2
	n	4	4	3	4	4

Serum Lithium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
147	ICP-MS	0.694	0.467	0.472	0.393	0.325

Serum Manganese (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
103	DRC/CC-ICP-MS	12.8	6.93	4.56	15.0	22.0
114	ICP-MS	13.2	7.4	4.7	15.2	21.2
147	ICP-MS	12.0	6.54	4.27	14.2	20.4
179	DRC/CC-ICP-MS	13.1	7.4	4.9	15.3	22.2
197	DRC/CC-ICP-MS	12.8	6.8	4.4	14.8	21.7
206	ICP-MS	12.8	7.2	4.4	*13.3	20.9
305	ICP-MS	12.6	7.1	4.6	15.1	21.3
324	ICP-MS	12.7517	6.7826	4.5232	14.8123	22.4821
**Outlier*	**Arithmetic mean**	**12.8**	**7.0**	**4.5**	**14.9**	**21.5**
	SD	0.4	0.3	0.2	0.4	0.7
	n	8	8	8	7	8

Serum Mercury (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
103	DRC/CC-ICP-MS	3.29	4.55	5.77	15.0	9.08
147	ICP-MS	3.07	4.09	5.40	14.9	8.73
197	ICP-MS	<5	<5	7	18	10
	Arithmetic mean	**-**	**-**	**6.1**	**16.0**	**9.3**
	SD	-	-	0.8	1.8	0.7
	n	2	2	3	3	3

Serum Molybdenum (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
103	DRC/CC-ICP-MS	3.60	16.8	5.67	12.2	8.03
110	ICP-MS	3.7	16.7	5.7	12.3	8.5
147	ICP-MS	3.45	15.9	5.36	11.4	7.34
179	ICP-MS	3.5	17	5.9	12	8.2
197	ICP-MS	3.6	18.5	5.8	12.8	8.5
485	HR-ICP-MS	3.44	16.49	5.84	11.41	8.12
	Arithmetic mean	**3.5**	**16.9**	**5.7**	**12.0**	**8.1**
	SD	0.1	0.9	0.2	0.5	0.4
	n	6	6	6	6	6

Serum Nickel (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
114	ICP-MS	4.3	13.8	5.5	19.8	8.1
147	ICP-MS	1.99	11.9	3.50	17.7	6.58
179	DRC/CC-ICP-MS	2.5	13	4.0	19	7.0
197	ICP-MS	2.9	13.8	4.0	19.4	7.8
206	ICP-MS	<10.0	12.9	<10.0	17.8	<10.0
485	HR-ICP-MS	2.27	12.55	4.08	18.08	7.65
	Arithmetic mean	**2.8**	**13.0**	**4.2**	**18.6**	**7.4**
	SD	0.9	0.7	0.8	0.9	0.6
	n	5	6	5	6	5

Serum Platinum (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
110	ICP-MS	<0.6	<0.6	<0.6	<0.6	<0.6
179	ICP-MS	<10	<10	<10	<10	<10

Serum Silver (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
147	ICP-MS	0.247	0.114	0.0947	0.288	0.169
179	ICP-MS	<0.2	<0.2	<0.2	0.2	<0.2
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Strontium (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
103	DRC/CC-ICP-MS	34.1	34.6	29.0	26.3	20.7

Serum Tellurium (µg/L)

Lab Code	Method	SE15-06	SE15-07	SE15-08	SE15-09	SE15-10
147	ICP-MS	<0.077	<0.077	<0.077	<0.077	<0.077

Serum Thallium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
103	DRC/CC-ICP-MS	1.06	11.0	1.82	1.71	5.51
110	ICP-MS	1.2	12.0	2.0	1.9	6.0
147	ICP-MS	0.848	10.1	1.73	1.47	5.09
197	ICP-MS	1.0	10.9	1.8	1.6	5.4
324	HR-ICP-MS	1.0979	11.7492	1.9617	1.8216	6.0017
	Arithmetic mean	**1.0**	**11.1**	**1.9**	**1.7**	**5.6**
	SD	0.1	0.8	0.1	0.2	0.4
	n	5	5	5	5	5

Serum Thorium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
147	ICP-MS	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070

Serum Tin (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
110	ICP-MS	13.4	2.1	10.5	5.5	3.4
147	ICP-MS	12.1	1.94	9.62	5.02	2.98
197	ICP-MS	13.6	<5.0	10.3	5.6	<5.0
	Arithmetic mean	**13.0**	**-**	**10.1**	**5.4**	**-**
	SD	0.8	-	0.5	0.3	-
	n	3	2	3	3	2

Serum Titamium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
485	HR-ICP-MS	17.02	2.41	8.52	1.84	4.23

Serum Tungsten (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
147	ICP-MS	2.00	10.2	2.85	7.76	1.97

Serum Uranium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
103	DRC/CC-ICP-MS	0.00231	<0.0012	<0.0012	<0.0012	0.00138
110	ICP-MS	<0.05	<0.05	<0.05	<0.05	<0.05
147	ICP-MS	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071

Serum Vanadium (µg/L)						
Lab Code	**Method**	**SE15-06**	**SE15-07**	**SE15-08**	**SE15-09**	**SE15-10**
147	DRC/CC-ICP-MS	14.5	9.13	2.65	1.68	4.37
179	DRC/CC-ICP-MS	17.4	11.3	3.5	2.2	5.3
485	HR-ICP-MS	15.00	9.93	3.15	1.76	4.92
	Arithmetic mean	**15.6**	**10.1**	**3.1**	**1.9**	**4.9**
	SD	1.6	1.1	0.4	0.3	0.5
	n	3	3	3	3	3

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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., D_2, 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)

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)

ELECTROCHEMICAL METHODS

E-1 ASV (Anodic stripping voltammetry without digestion)

E-2 ASV-LeadCare® Blood Lead Testing System

E-5 ASV-LeadCare® II Blood Lead Testing System

E-6 ASV-LeadCare® Ultra™ Blood Lead Testing System

E-3 Fluoride specific electrode

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 μmol ZPP/mol heme)

OTHER METHODS

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