Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

TRACE ELEMENTS IN SERUM

Event #1, 2012

March 19th, 2012

NEW YORK
state department of
HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

March 19, 2012

Trace Elements in Serum
Event #1, 2012

Dear Laboratory Director:

Results from the first proficiency test (PT) event for 2012 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 Al, Cu, Se and Zn, serum pools were supplemented with the trace elements manganese (Mn), chromium (Cr), thallium (Tl), vanadium (V) and cobalt (Co).

The next PT event for trace elements in serum is scheduled to be mailed Wednesday, May 9th, 2012. Please inform our laboratory staff at (518) 474-4484 if the test materials have not arrived within five days of the scheduled mail out date. **The deadline for reporting results is Wednesday, May 30th, 2012.**

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

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 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 17 µg/L (0.63 µmol/L) to 117 µg/L (4.34 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, 93.3% of test results reported were judged as satisfactory, with two out of 24 participant laboratories (8.3%) 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, 2012 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L serum)				
	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
Robust Mean	**17**	**42**	**117**	**70**	**98**
Robust Standard Deviation	2.5	3.8	5.7	4.2	6.2
Standard Uncertainty	0.6	1.0	1.5	1.1	1.6
RSD (%)	14.9	9.1	4.9	6.0	6.3
Acceptable Range:					
Upper Limit:	22	50	140	84	118
Lower Limit:	12	34	94	56	78

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, 2012 Event #1

PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE12-01	SE12-02	SE12-03	SE12-04	SE12-05	
	Target Values:	17	42	117	70	98	
110	ETAAS-Z	18	40	115	70	98	
114	ETAAS-Z	19	40	109	66	89	
147	ETAAS-Z	17	46	121	73	107	Info
156	ICP-MS	18	44	122	77	107	
159	ETAAS-Z	16	41	109	69	92	
160	ETAAS-Z	15	45	114	68	90	
164	ICP-MS	15	39	110	66	97	
179	DRC/CC-ICP-MS	15	41	118	71	99	
197	ICP-MS	<20	41	120	71	101	
200	DRC/CC-ICP-MS	21	43	117	70	95	Info
206	ICP-MS	13	38	103	63	91	
287	ETAAS-Z	17	39	126	70	98	
293	ICP-MS	15	42	121	76	118 ↑	Info
305	ICP-MS	27 ↑	49	113	64	102	
324	HR-ICP-MS	22	59 ↑	146 ↑	81	114	Info
325	ETAAS-Z	12	29 ↓	87 ↓	51 ↓	75 ↓	Info
355	ICP-MS	19	43	121	75	105	
357	ICP-MS	17	41	121	70	95	
358	ICP-MS	16	45	112	66	95	
363	ICP-MS	16	43	117	70	99	
366	ETAAS-Z	17	50	113	68	95	Info
367	ETAAS-Z	17	43	119	71	100	Info
401	ICP-AES/OES	14	37	119	72	98	Info
458	ETAAS Other	16	36	120	63	88	

Percent satisfactory results for all participants: 93.3 %

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.

New York State Department of Health
Serum Aluminum Test Results, 2012 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (µg/L serum)				
	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	18	42	118	71	97
Standard Deviation:	4	1	1	1	3
RSD (%):	—	—	—	—	—
ETAAS Other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	16	36	120	63	88
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	9	9	9	9	9
Mean:	16	41	113	67	94
Standard Deviation:	2	6	11	6	9
RSD (%):	12.2	14.1	9.8	9.6	9.6
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	22	59	146	81	114
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	1	1	1	1	1
Mean:	14	37	119	72	98
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	9	10	10	10	10
Mean:	17	43	116	70	101
Standard Deviation:	4	3	6	5	8
RSD (%):	23.3	7.4	5.4	7.2	7.6
All Laboratories					
Number of Sample Measurements:	23	24	24	24	24
Mean:	17	42	116	69	98
Standard Deviation:	3	6	10	6	9
RSD (%):	18.6	13.2	8.7	8.4	9.0

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 960 µg/L (15.11 µmol/L) to 2152 µg/L (33.87 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, 97.0% of test results reported were judged as satisfactory, with none out of 20 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 Copper Test Results, 2012 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L serum)				
	SE12-01	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
Robust Mean	**1579**	**960**	**1053**	**2152**	**1294**
Robust Standard Deviation	87	63	66	132	70
Standard Uncertainty	24	18	18	37	20
RSD (%)	5.5	6.6	6.2	6.1	5.4
Acceptable Range:					
Upper Limit:	1816	1104	1211	2475	1488
Lower Limit:	1342	816	895	1829	1100

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, 2012 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum) SE12-01	SE12-02	SE12-03	SE12-04	SE12-05	Info Only
	Target Values:	1579	960	1053	2152	1294	
107	DRC/CC-ICP-MS	1644	1003	1112	2285	1415	Info
110	ICP-MS	1578	981	1071	2219	1327	
114	ICP-MS	1486	945	1011	1930	1236	
147	ICP-MS	1569	940	1067	2122	1283	Info
156	FAAS	1546	92 ↓	986	2114	1234	
159	ICP-AES/OES	1580	980	1070	2160	1300	
160	ETAAS-Z	1520	860	800 ↓	1970	1250	
164	ICP-MS	1458	897	983	2000	1189	
179	DRC/CC-ICP-MS	1680	1010	1100	2250	1360	
197	ICP-MS	1530	940	1050	2140	1250	
200	ICP-MS	1591	987	1045	2169	1321	Info
206	ICP-MS	1520	950	1040	2060	1240	
293	ICP-MS	1486	914	991	2025	1213	Info
305	ICP-MS	1664	915	1062	2189	1311	
324	HR-ICP-MS	1603	988	1093	2195	1316	Info
325	FAAS	1710	1080	2580 ↑	2370	1350	Info
360	FAAS	1600	990	1030	2180	1320	
366	ETAAS other	1632	1020	1122	2256	1350	Info
401	DRC/CC-ICP-MS	1476	890	973	2029	1221	Info
457	ICP-AES/OES	1709	1055	1159	2412	1475	Info

Percent satisfactory results for all participants: 97.0 %

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.

New York State Department of Health
Serum Copper Test Results, 2012 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (µg/L serum)				
	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	1600	968	1062	2188	1332
Standard Deviation:	109	67	77	139	100
RSD (%):	—	—	—	—	—
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	1632	1020	1122	2256	1350
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	1520	860	800	1970	1250
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
FAAS					
Number of Sample Measurements:	3	2	2	3	3
Mean:	1619	1035	1008	2221	1301
Standard Deviation:	84	64	31	133	60
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	1603	988	1093	2195	1316
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	1645	1018	1115	2286	1388
Standard Deviation:	91	53	63	178	124
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	9	9	9	9	9
Mean:	1542	941	1036	2095	1263
Standard Deviation:	64	30	33	97	49
RSD (%):	4.2	3.2	3.2	4.6	3.9
All Laboratories					
Number of Sample Measurements:	20	19	19	20	20
Mean:	1579	966	1040	2154	1298
Standard Deviation:	77	57	77	128	72
RSD (%):	4.9	5.9	7.4	5.9	5.5

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 121 µg/L (1.53 µmol/L) to 360 µg/L (4.56 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 17 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, 2012 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L serum)				
	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
Robust Mean	**225**	**121**	**206**	**360**	**151**
Robust Standard Deviation	10.8	5.0	12.2	14.7	9.5
Standard Uncertainty	3.3	1.5	3.7	4.5	2.9
RSD (%)	4.8	4.2	5.9	4.1	6.3
Acceptable Range:					
Upper Limit:	270	145	247	432	181
Lower Limit:	180	97	165	288	121

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, 2012 Event #1

PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE12-01	SE12-02	SE12-03	SE12-04	SE12-05	
	Target Values:	225	121	206	360	151	
107	DRC/CC-ICP-MS	214	115	181	357	145	Info
110	DRC/CC-ICP-MS	214	115	197	344	142	
114	ICP-MS	246	109	228	313	160	
147	ICP-MS	221	122	205	360	149	Info
156	ICP-MS	237	125	216	363	154	
159	ETAAS-Z	224	123	197	343	121	
164	DRC/CC-ICP-MS	218	116	196	366	142	
179	DRC/CC-ICP-MS	217	116	200	351	145	
197	ICP-MS	236	131	217	396	170	
200	DRC/CC-ICP-MS	226	119	212	367	152	Info
206	ICP-MS	193	106	180	315	135	
293	DRC/CC-ICP-MS	228	122	208	375	151	Info
305	ICP-MS	220	119	214	365	168	
324	HR-ICP-MS	223	122	203	370	152	Info
366	ETAAS-Z	234	125	207	361	153	Info
367	DRC/CC-ICP-MS	226	125	210	360	151	Info
401	DRC/CC-ICP-MS	242	126	220	397	160	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.

New York State Department of Health
Serum Selenium Test Results, 2012 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (μg/L serum)				
	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	8	8	8	8	8
Mean:	223	119	203	365	149
Standard Deviation:	9	5	12	16	6
RSD (%):	4.2	3.8	6.0	4.5	4.2
ETAAS-Z					
Number of Sample Measurements:	2	2	2	2	2
Mean:	229	124	202	352	137
Standard Deviation:	7	1	7	13	23
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	223	122	203	370	152
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	6	6	6	6	6
Mean:	226	119	210	352	156
Standard Deviation:	19	10	16	32	13
RSD (%):	8.3	8.1	7.8	9.1	8.4
All Laboratories					
Number of Sample Measurements:	17	17	17	17	17
Mean:	225	120	205	359	150
Standard Deviation:	13	6	13	22	12
RSD (%):	5.6	5.3	6.2	6.2	7.8

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 527 µg/L (8.06 µmol/L) to 2056 µg/L (31.44 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, 92.3% of test results reported were judged as satisfactory, with two out of 26 participant laboratories (7.7%) 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 Test Results, 2012 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L serum)				
	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
Robust Mean	**2056**	**1296**	**527**	**697**	**802**
Robust Standard Deviation	97	80	33	49	64
Standard Uncertainty	24	20	8	12	16
RSD (%)	4.7	6.2	6.3	7.1	8.0
Acceptable Range:					
Upper Limit:	2364	1490	606	802	922
Lower Limit:	1748	1102	448	593	682

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, 2012 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum) SE12-01	SE12-02	SE12-03	SE12-04	SE12-05	Info Only
	Target Values:	2056	1296	527	697	802	
107	DRC/CC-ICP-MS	2378 ↑	1493 ↑	535	809 ↑	935 ↑	Info
110	ICP-MS	2094	1364	543	730	829	
114	ICP-MS	1859	1222	520	730	753	
147	ICP-MS	2007	1229	488	646	758	Info
156	ICP-MS	2007	1286	483	679	767	
159	ICP-AES/OES	2010	1300	530	700	790	
160	FAAS	2110	1380	580	740	850	
164	ICP-MS	1819	1165	456	609	697	
179	DRC/CC-ICP-MS	2230	1040 ↓	540	730	850	
197	ICP-MS	2040	1280	490	650	720	
200	ICP-MS	1975	1321	474	651	772	Info
206	ICP-MS	2020	1330	570	710	820	
287	FAAS	1920	1200	490	650	740	
293	ICP-MS	2060	1308	510	680	778	Info
305	ICP-MS	2126	1195	501	681	778	
324	HR-ICP-MS	2162	1332	676 ↑	700	890	Info
325	FAAS	2310	1500 ↑	630 ↑	795	945 ↑	Info
355	ICP-MS	2029	1325	551	673	801	
357	ICP-MS	1920	1230	520	660	740	
358	ICP-MS	2070	1260	524	666	840	
360	FAAS	2080	1320	550	740	830	
363	ICP-MS	2240	1410	540	740	900	
366	FAAS	1820	1224	534	631	678 ↓	Info
401	DRC/CC-ICP-MS	2072	1334	530	706	804	Info
457	ICP-AES/OES	2069	1288	522	713	822	Info
458	FAAS	2070	1340	540	760	820	

Percent satisfactory results for all participants: 92.3 %

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.

New York State Department of Health
Serum Zinc Test Results, 2012 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (µg/L serum)				
	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	2227	1289	535	748	863
Standard Deviation:	153	230	5	54	66
RSD (%):	—	—	—	—	—
FAAS					
Number of Sample Measurements:	6	6	6	6	6
Mean:	2052	1327	554	719	811
Standard Deviation:	169	109	47	65	92
RSD (%):	8.2	8.2	8.5	9.0	11.4
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2162	1332	676	700	890
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	2040	1294	526	707	806
Standard Deviation:	42	8	6	9	23
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	14	14	14	14	14
Mean:	2019	1280	512	679	782
Standard Deviation:	107	68	32	37	53
RSD (%):	5.3	5.3	6.3	5.5	6.7
All Laboratories					
Number of Sample Measurements:	26	26	26	26	26
Mean:	2058	1295	532	699	804
Standard Deviation:	135	97	46	49	67
RSD (%):	6.6	7.5	8.7	7.0	8.3

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

Mn, Cr, V, Tl, Co

New York State Department of Health
Serum Additional Elements, 2012 Event #1
Page 1

Serum Antimony (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	<0.609	<0.609	<0.609	<0.609	<0.609

Serum Arsenic (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
197	DRC/CC-ICP-MS	<10	<10	<10	<10	<10

Serum Barium (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	0.873	0.555	1.47	1.12	0.743
197	ICP-MS	<2.0	<2.0	<2.0	<2.0	<2.0

Serum Beryllium (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	<0.360	<0.36	<0.36	<0.36	<0.36
197	ICP-MS	<0.2	<0.2	<0.2	<0.2	<0.2

Serum Cadmium (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	<0.0247	<0.0247	0.029	0.0323	0.322
197	DRC/CC-ICP-MS	<0.5	<0.5	<0.5	<0.5	<0.5

Serum Chromium (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	0.321	3.35	0.931	1.78	2.24
164	ICP-MS	0.5	3.4	1.0	1.8	2.4
179	DRC/CC-ICP-MS	0.3	3.8	1.0	2.0	2.5
197	DRC/CC-ICP-MS	<1.0	3.5	<1.0	1.8	2.4
305	ICP-MS	0.3	3.3	0.9	1.9	2.3
Arithmetic mean (n=4-5)		**0.4**	**3.5**	**1.0**	**1.9**	**2.4**
SD		0.1	0.2	0.1	0.1	0.1

Serum Cobalt (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	2.829	0.248	0.319	<0.0413	0.636
179	ICP-MS	3.3	0.5	0.6	0.3	1.0
197	ICP-MS	3.0	<1.0	<1.0	<1.0	<1.0

Serum Iodine (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	52.15	48.86	42.91	54.94	61.52

Serum Lead (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	<0.414	<0.414	<0.414	<0.414	<0.414
197	DRC/CC-ICP-MS	<0.4	<0.4	<0.4	<0.4	<0.4

Serum Lithium (µg/L)

Lab Code	Method	SE12-01	SE12-02	SE12-03	SE12-04	SE12-05
147	ICP-MS	0.589	0.805	0.812	1.305	0.625

New York State Department of Health
Serum Additional Elements, 2012 Event #1
Page 2

Serum Manganese (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	1.36	0.753	1.37	3.055	0.956
179	DRC/CC-ICP-MS	1.4	0.6	1.3	3.1	0.9
197	DRC/CC-ICP-MS	1.7	<1.0	1.6	3.3	1.2
305	ICP-MS	1.2	0.6	1.2	2.9	0.9
Arithmetic mean (n=3-4)		**1.4**	**0.7**	**1.4**	**3.1**	**1.0**
SD		0.2	0.1	0.2	0.2	0.1

Serum Mercury (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	<0.12	0.203	<0.12	<0.12	<0.12

Serum Molybdenum (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	0.969	0.969	1.12	0.36	1.094

Serum Nickel (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	<0.294	<0.294	<0.294	<0.294	<0.294

Serum Tellurium (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	<0.0893	<0.0893	<0.0893	<0.0893	<0.0893
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Thallium (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	1.27	0.425	0.229	0.891	2.23
197	ICP-MS	1.6	<1.0	<1.0	1.2	2.7

Serum Thorium (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	<0.0302	<0.0302	<0.0302	<0.0302	<0.0302

Serum Tin (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	<0.19	<0.190	<0.19	<0.19	<0.19
197	ICP-MS	<5.0	<5.0	<5.0	<5.0	<5.0

Serum Uranium (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
147	ICP-MS	<0.0143	<0.0143	<0.0143	<0.0143	<0.0143

Serum Vanadium (µg/L)						
Lab Code	**Method**	**SE12-01**	**SE12-02**	**SE12-03**	**SE12-04**	**SE12-05**
179	DRC/CC-ICP-MS	0.4	0.2	0.7	4.3	1.2

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., 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)

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 μmol ZPP/mol heme)

F-4 Other

OTHER METHODS

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