
Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN SERUM

Event #1, 2010

March 17, 2010



STATE OF NEW YORK DEPARTMENT OF HEALTH

Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. Box 509 Albany, New York 12201-0509

Richard F. Daines, M.D.
Commissioner

James W. Clyne, Jr.,
Executive Deputy Commissioner

March 17, 2010

Trace Elements in Serum Event #1, 2010

Dear Laboratory Director:

Results from the first proficiency test (PT) event for 2010 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.

Assignment of Target Values for Trace Elements

Except for blood lead, we will implement robust statistics for assigning target values for all trace element panels. Method specific and additional trace element data will continue to be calculated utilizing traditional statistics. The use of robust statistics for assigning target values for proficiency testing pools is one approach that is acceptable under ISO 13528. In collaboration with other trace element PT scheme organizers, we have conducted an evaluation of robust statistics. As a result of our evaluation, we have elected to introduce this approach in our program.

The next PT event for trace elements in serum is scheduled to be mailed Wednesday, April 28th, 2010. 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 26th, 2010.**

Thank you for your participation

Sincerely,

Patrick J. Parsons, Ph.D.
Section Head, Trace Elements Proficiency Testing Program

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 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.

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 16 µg/L (0.59 µmol/L) to 111 µg/L (4.11 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, 96.9% of test results reported were judged as satisfactory, with one out of 26 participant laboratories (3.8%) 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. *Clin. Chem.* 2002 48 2000-2007.

New York State Department of Health
Serum Aluminum Test Results, 2010 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
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Robust Mean	37	16	67	111	84
Robust Standard Deviation	3.2	2.7	6.1	6.8	8.5
Standard Uncertainty	0.8	0.7	1.5	1.7	2.1
RSD (%)	8.6	16.6	9.0	6.1	10.1
Acceptable Range:					
Upper Limit:	45	21	81	133	101
Lower Limit:	30	11	54	89	67

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, 2010 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L)					Info Only
		SE10-01	SE10-02	SE10-03	SE10-04	SE10-05	
	Target Values:	37	16	67	111	84	
110	ETAAS-Z	36	13	66	112	84	
114	ETAAS-Z	35	14	62	120	78	
147	ETAAS-Z	37	17	73	115	89	Info
156	ICP-MS	36	15	65	112	83	
159	ETAAS-Z	38	17	66	107	80	
160	ETAAS-Z	39	17	74	108	81	
164	ICP-MS	37	14	68	113	90	
179	DRC/CC-ICP-MS	44	16	81	130	98	
197	ICP-MS	39	<20	68	109	95	
200	DRC/CC-ICP-MS	34	16	61	98	82	Info
206	ICP-MS	41	15	80	133	95	
287	ETAAS-Z	34	17	60	102	77	
293	ICP-MS	37	21	56	96	68	Info
301	ETAAS-Z	40	14	70	115	85	
305	ICP-MS	37	22 ↑	71	116	98	
324	DRC/CC-ICP-MS	43	19	74	117	93	Info
325	ETAAS-Z	37	18	70	108	82	Info
355	ICP-MS	39	17	70	114	89	
357	ICP-MS	36	15	63	108	76	
358	ICP-MS	32	12	62	103	76	
362	ICP-MS	39	18	71	115	90	
363	ICP-MS	42	18	68	114	86	
366	ETAAS-Z	46 ↑	28 ↑	67	103	81	Info
367	ETAAS-Z	38	15	69	114	86	Info
401	ICP-AES/OES	30	11	58	102	76	Info
458	ETAAS Other	30	15	53 ↓	93	71	

Percent satisfactory results for all participants: 96.9 %

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.

Amended 4/27/10

New York State Department of Health
Serum Aluminum Test Results, 2010 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$)				
	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	40	17	72	115	91
Standard Deviation:	6	2	10	16	8
RSD (%):	—	—	—	—	—
ETAAS Other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	30	15	53	93	71
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	10	10	10	10	10
Mean:	38	17	68	110	82
Standard Deviation:	3	4	4	6	4
RSD (%):	8.8	24.8	6.6	5.2	4.5
ICP-AES/OES					
Number of Sample Measurements:	1	1	1	1	1
Mean:	30	11	58	102	76
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	11	10	11	11	11
Mean:	38	17	67	112	86
Standard Deviation:	3	3	6	9	9
RSD (%):	7.2	18.7	9.1	8.2	10.9
All Laboratories					
Number of Sample Measurements:	26	25	26	26	26
Mean:	38	17	67	111	84
Standard Deviation:	4	3	7	9	8
RSD (%):	10.3	21.0	10.0	8.3	9.5

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 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 Cu²⁺ 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 884 µg/L (13.91 µmol/L) to 2430 µg/L (38.24 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) 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 one of the 20 participant laboratories (5.0%) reporting 2 or more of the 5 results outside the acceptable ranges.

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

New York State Department of Health
Serum Copper Test Results, 2010 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
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Robust Mean	2430	1794	884	1011	1212
Robust Standard Deviation	115	80	41	43	59
Standard Uncertainty	32	22	11	12	16
RSD (%)	4.7	4.5	4.6	4.3	4.8
Acceptable Range:					
Upper Limit:	2795	2063	1017	1163	1394
Lower Limit:	2066	1525	752	860	1031

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, 2010 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE10-01	SE10-02	SE10-03	SE10-04	SE10-05	
	Target Values:	2430	1794	884	1011	1212	
107	DRC/CC-ICP-MS	2488	1801	885	998	1215	Info
110	ICP-MS	2534	1906	911	1024	1236	
114	ICP-MS	2400	1770	870	1040	1210	
147	ICP-MS	2363	1766	896	998	1201	Info
156	FAAS	2640	1920	1230 ↑	1280 ↑	1560 ↑	
159	ICP-AES/OES	2410	1780	870	960	1120	
160	ETAAS-Z	2380	1710	850	970	1160	
164	ICP-MS	2473	1867	980	1075	1297	
179	ICP-AES/OES	2600	1870	910	1060	1250	
197	ICP-MS	2260	1730	810	960	1120	
200	FAAS	2350	1765	883	997	1207	Info
206	ICP-MS	2420	1810	800	990	1170	
293	ICP-MS	2525	1870	852	1005	1202	Info
305	ICP-MS	2409	1742	896	991	1208	
324	DRC/CC-ICP-MS	2088	1531	767	911	1033	Info
325	FAAS	2284	1670	867	1014	1243	Info
360	FAAS	2560	1860	940	1090	1320	
362	ICP-MS	2390	1770	880	1010	1220	
366	ETAAS other	2587	1863	909	1100	1270	Info
401	DRC/CC-ICP-MS	2396	1760	902	1004	1201	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, 2010 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	2324	1697	851	971	1150
Standard Deviation:	209	146	74	52	101
RSD (%):	—	—	—	—	—
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2587	1863	909	1100	1270
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2380	1710	850	970	1160
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
FAAS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	2459	1804	980	1095	1333
Standard Deviation:	169	110	170	130	159
RSD (%):	6.9	6.1	17.3	11.8	11.9
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	2505	1825	890	1010	1185
Standard Deviation:	134	64	28	71	92
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	9	9	9	9	9
Mean:	2419	1803	877	1010	1207
Standard Deviation:	84	63	54	33	48
RSD (%):	3.5	3.5	6.2	3.3	3.9
All Laboratories					
Number of Sample Measurements:	20	20	20	20	20
Mean:	2428	1788	895	1024	1222
Standard Deviation:	131	91	92	76	102
RSD (%):	5.4	5.1	10.3	7.4	8.4

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #1, 2010

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 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.

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 119 µg/L (1.51 µmol/L) to 339 µg/L (4.29 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) 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 16 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

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

New York State Department of Health
Serum Selenium Test Results, 2010 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
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Robust Mean	339	145	278	119	191
Robust Standard Deviation	11	11	13	5	10
Standard Uncertainty	3.4	3.3	4.1	1.6	3.1
RSD (%)	3.2	7.3	4.8	4.2	5.2
Acceptable Range:					
Upper Limit:	407	174	334	143	229
Lower Limit:	271	116	223	95	152

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, 2010 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE10-01	SE10-02	SE10-03	SE10-04	SE10-05	
	Target Values:	339	145	278	119	191	
107	DRC/CC-ICP-MS	335	131	260	111	173	Info
110	DRC/CC-ICP-MS	340	143	280	119	190	
114	ICP-MS	329	153	274	122	196	
147	ICP-MS	335	139	276	117	184	Info
156	ETAAS-Z	383	152	304	119	211	
159	ETAAS-Z	320	133	262	117	182	
164	ETAAS-Z	334	147	268	117	176	
179	DRC/CC-ICP-MS	340	138	280	116	191	
197	ICP-MS	355	164	291	128	207	
200	DRC/CC-ICP-MS	325	130	263	107	181	Info
206	ICP-MS	334	145	276	124	188	
293	DRC/CC-ICP-MS	366	147	288	118	196	Info
305	ICP-MS	333	163	276	143	188	
324	DRC/CC-ICP-MS	364	152	291	115	196	Info
367	ETAAS-Z	340	144	275	119	193	Info
401	DRC/CC-ICP-MS	347	140	294	126	201	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.

Amended 4/27/10

New York State Department of Health
Serum Selenium Test Results, 2010 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	7	7	7	7	7
Mean:	345	140	279	116	190
Standard Deviation:	15	8	13	6	10
RSD (%):	4.4	5.7	4.8	5.2	5.1
ETAAS-Z					
Number of Sample Measurements:	4	4	4	4	4
Mean:	344	144	277	118	191
Standard Deviation:	27	8	19	1	15
RSD (%):	7.9	5.6	6.7	1.0	8.1
ICP-MS					
Number of Sample Measurements:	5	5	5	5	5
Mean:	337	153	279	127	193
Standard Deviation:	10	11	7	10	9
RSD (%):	3.0	7.2	2.5	7.8	4.8
All Laboratories					
Number of Sample Measurements:	16	16	16	16	16
Mean:	343	145	279	120	191
Standard Deviation:	17	10	12	8	10
RSD (%):	4.9	7.0	4.5	6.7	5.5

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 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 649 µg/L (9.93 µmol/L) to 2530 µg/L (38.69 µmol/L).

Acceptable ranges for serum zinc are based on fixed criteria of $\pm 15\%$, 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, 87.7% of test results reported were judged as satisfactory, with three out of 26 participant laboratories (11.5%) reporting 2 or more of the 5 results outside the acceptable ranges.

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

New York State Department of Health
Serum Zinc Test Results, 2010 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
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Robust Mean	1556	1000	2530	649	745
Robust Standard Deviation	114	75	203	60	76
Standard Uncertainty	28	18	50	15	19
RSD (%)	7.3	7.5	8.0	9.2	10.2
Acceptable Range:					
Upper Limit:	1790	1150	2910	747	857
Lower Limit:	1323	850	2151	552	634

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, 2010 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE10-01	SE10-02	SE10-03	SE10-04	SE10-05	
Target Values:		1556	1000	2530	649	745	
107	DRC/CC-ICP-MS	1597	1000	2507	664	695	Info
110	ICP-MS	1716	1040	2706	660	770	
114	ICP-MS	1430	1060	2410	780 ↑	750	
147	ICP-MS	1595	1046	2588	686	784	
156	ICP-MS	1000 ↓	679 ↓	1470 ↓	778 ↑	635	
159	ICP-AES/OES	1520	970	2490	610	900 ↑	
160	FAAS	1440	910	2270	550 ↓	660	
164	ICP-MS	1515	962	2464	652	747	
179	ICP-AES/OES	1560	990	2760	670	720	
197	ICP-MS	1500	960	2380	580	920 ↑	
200	FAAS	1648	1066	2649	732	824	Info
206	ICP-MS	1570	1020	2480	640	710	
287	FAAS	1600	1010	2600	650	780	
293	ICP-MS	1511	961	2400	602	661	Info
305	ICP-MS	1594	1079	2632	623	872 ↑	
324	DRC/CC-ICP-MS	1326	848 ↓	2161	562	611 ↓	Info
325	FAAS	1230 ↓	852	2046 ↓	558	552 ↓	Info
355	ICP-MS	1576	1057	2628	659	778	
357	ICP-MS	1460	910	2470	610	690	
358	ICP-MS	1576	998	2575	647	737	
360	FAAS	1620	1050	2660	650	750	
362	ICP-MS	1430	920	2340	590	670	
363	ICP-MS	1710	1070	2780	690	800	
366	FAAS	1702	1130	2703	753 ↑	780	Info
401	DRC/CC-ICP-MS	1654	1039	2746	673	778	Info
458	FAAS	1717	1075	2956 ↑	687	794	

Percent satisfactory results for all participants: 87.7 %

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, 2010 Event #1
STATISTICAL SUMMARY BY METHOD**

	Results ($\mu\text{g/L}$ serum)				
	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	1526	962	2471	633	695
Standard Deviation:	175	101	294	62	84
RSD (%):	—	—	—	—	—
FAAS					
Number of Sample Measurements:	7	7	7	7	7
Mean:	1565	1013	2555	654	734
Standard Deviation:	174	99	301	79	96
RSD (%):	11.1	9.7	11.8	12.0	13.0
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	1540	980	2625	640	810
Standard Deviation:	28	14	191	42	127
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	14	14	14	14	14
Mean:	1513	983	2452	657	752
Standard Deviation:	172	104	311	61	79
RSD (%):	11.4	10.6	12.7	9.3	10.5
All Laboratories					
Number of Sample Measurements:	26	26	26	26	26
Mean:	1531	989	2495	652	745
Standard Deviation:	160	95	290	62	86
RSD (%):	10.5	9.6	11.6	9.6	11.5

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

**New York State Department of Health
Serum Additional Elements, 2010 Event #1
Page 1**

Serum Arsenic Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
197	DRC/CC-ICP-MS	<10	<10	<10	<10	<10

Serum Barium Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
197	ICP-MS	<2.0	<2.0	<2.0	<2.0	<2.0

Serum Beryllium Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
197	ICP-MS	<0.2	<0.2	<0.2	<0.2	<0.2

Serum Cadmium Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
197	DRC/CC-ICP-MS	<0.5	<0.5	<0.5	<0.5	<0.5

Serum Cobalt Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
179	ICP-MS	0.5	0.2	0.3	0.2	0.3
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Chromium Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
147	ICP-MS	3.1	1.2	6.6	9.3	7.4
164	ETAAS-Z	4	1	7	10	8
179	DRC/CC-ICP-MS	3.6	1.6	6.5	10.2	8.1
197	DRC/CC-ICP-MS	3.6	1.5	6.7	10.3	8.3
324	DRC/CC-ICP-MS	4	1	6	9	7
Arithmetic Mean, n=5		3.6	1.3	6.7	10.0	8.0
SD		0.4	0.3	0.2	0.5	0.4

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Serum Manganese Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
107	DRC/CC-ICP-MS	6.5	8.4	5.8	0.3	3.1
179	DRC/CC-ICP-MS	8.2	10.6	7.4	2.4	4.8
197	DRC/CC-ICP-MS	8.5	10.9	7.6	2.5	5.2
305	ICP-MS	8.2	10.2	7.5	2.3	4.4
324	DRC/CC-ICP-MS	9	11	7	2	5
Arithmetic Mean, n=5		8.1	10.2	7.1	1.9	4.5
SD		0.9	1.1	0.7	0.9	0.8

Serum Lead Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
197	DRC/CC-ICP-MS	<0.4	<0.4	<0.4	<0.4	0.6

Serum Tin Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
197	ICP-MS	<5.0	<5.0	<5.0	<5.0	<5.0

Serum Tellurium Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Thallium Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Vanadium Results (µg/L)						
Lab Code	Method	SE10-01	SE10-02	SE10-03	SE10-04	SE10-05
107	DRC/CC-ICP-MS	7.5	9.4	6.7	1.2	3.9

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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.
