
Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN SERUM

Event #2, 2010

June 28, 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

June 28, 2010

Trace Elements in Serum Event #2, 2010

Dear Laboratory Director:

Results from the second 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, September 22nd, 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, October 20th 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 32 µg/L (1.19 µmol/L) to 107 µg/L (3.97 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, 88.8% of test results reported were judged as satisfactory, with three out of 25 participant laboratories (12.0%) 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, 2010 Event #2
ROBUST STATISTICAL SUMMARY**

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
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Robust Mean	3 2	1 0 7	6 3	8 2	3 6
Robust Standard Deviation	4.4	11.4	7.0	8.8	3.8
Standard Uncertainty	1.1	2.8	1.8	2.2	0.9
RSD (%)	13.6	10.6	11.2	10.7	10.7
Acceptable Range:					
Upper Limit:	38	128	76	98	43
Lower Limit:	26	86	50	66	29

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 #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L)					Info Only
		SE10-06	SE10-07	SE10-08	SE10-09	SE10-10	
Target Values:		32	107	63	82	36	
110	ETAAS-Z	34	113	70	88	36	Info
114	ETAAS-Z	41 ↑	150 ↑	68	86	43	
147	ETAAS-Z	37	118	71	91	40	
156	ICP-MS	34	133 ↑	66	91	38	
159	ETAAS-Z	31	97	60	80	33	
160	ETAAS-Z	33	105	60	69	36	Info
164	ICP-MS	30	106	58	77	35	
179	DRC/CC-ICP-MS	28	102	60	79	32	
200	DRC/CC-ICP-MS	33	109	74	89	34	
206	ICP-MS	31	114	65	88	38	
287	ETAAS-Z	29	101	59	79	33	Info
293	ICP-MS	39 ↑	86	54	69	29	
301	ETAAS-Z	37	130 ↑	79 ↑	103 ↑	46 ↑	
305	ICP-MS	37	104	57	76	34	
324	DRC/CC-ICP-MS	35	105	66	81	36	
325	ETAAS-Z	21 ↓	97	34 ↓	49 ↓	14 ↓	Info
355	ICP-MS	33	112	64	86	36	Info
357	ICP-MS	31	100	61	77	33	
358	ICP-MS	30	102	60	79	36	
362	ICP-MS	37	117	71	92	41	
363	ICP-MS	35	119	70	93	39	
366	ETAAS-Z	24 ↓	94	56	75	34	Info
367	ETAAS-Z	31	113	69	87	37	Info
401	ICP-AES/OES	29	100	60	80	33	Info
458	ETAAS Other	25 ↓	86	54	74	32	

Percent satisfactory results for all participants: 88.8 %

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, 2010 Event #2
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$)				
	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	32	105	67	83	34
Standard Deviation:	4	4	7	5	2
RSD (%):	—	—	—	—	—
ETAAS Other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	25	86	54	74	32
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	10	10	10	10	10
Mean:	32	112	63	81	35
Standard Deviation:	6	17	12	15	9
RSD (%):	19.1	15.6	19.6	18.0	24.4
ICP-AES/OES					
Number of Sample Measurements:	1	1	1	1	1
Mean:	29	100	60	80	33
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	10	10	10	10	10
Mean:	34	109	63	83	36
Standard Deviation:	3	13	6	8	3
RSD (%):	9.6	11.7	8.9	10.0	9.5
All Laboratories					
Number of Sample Measurements:	25	25	25	25	25
Mean:	32	109	63	82	35
Standard Deviation:	5	14	9	11	6
RSD (%):	14.7	13.3	14.1	12.9	16.5

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 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 931 $\mu\text{g/L}$ (14.65 $\mu\text{mol/L}$) to 2021 $\mu\text{g/L}$ (31.80 $\mu\text{mol/L}$).

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. Based on the above criteria, 83.8% of test results reported were judged as satisfactory, with three of the 21 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 Copper Test Results, 2010 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
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Robust Mean	1121	1903	2021	1910	931
Robust Standard Deviation	95	118	156	115	63
Standard Uncertainty	26	32	42	31	17
RSD (%)	8.5	6.2	7.7	6.0	6.7
Acceptable Range:					
Upper Limit:	1289	2189	2324	2197	1071
Lower Limit:	953	1618	1718	1624	791

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 #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE10-06	SE10-07	SE10-08	SE10-09	SE10-10	
Target Values:		1121	1903	2021	1910	931	
107	DRC/CC-ICP-MS	1134	1894	1996	1921	911	Info
110	ICP-MS	1207	1968	2077	2009	941	
114	ICP-MS	1070	1810	2120	1770	860	
147	ICP-MS	1125	1893	2071	1938	921	
156	FAAS	1090	1870	1950	1930	930	
159	ICP-AES/OES	1110	1890	1980	1880	900	
160	ETAAS-Z	1100	1870	2010	1880	880	
164	ICP-MS	1121	1872	1977	1856	921	
179	DRC/CC-ICP-MS	1180	2000	2120	2000	960	
197	ICP-MS	1090	1930	2090	1990	920	
200	FAAS	1060	2432 ↑	1911	1784	832	Info
206	ICP-MS	940 ↓	1660	1760	1980	850	
293	ICP-MS	1037	1832	1870	1730	1056	Info
305	ICP-MS	120 ↓	201 ↓	233 ↓	202 ↓	99 ↓	
324	DRC/CC-ICP-MS	1186	1950	2128	1980	939	Info
325	FAAS	690 ↓	1440 ↓	1620 ↓	510 ↓	1440 ↑	
360	FAAS	1210	1860	2000	1860	980	
362	ICP-MS	1260	2360 ↑	2400 ↑	2450 ↑	1130 ↑	
366	ETAAS-Z	1138	1983	2106	1866	930	
401	DRC/CC-ICP-MS	1215	1991	2213	2010	967	Info
457	ICP-AES/OES	1278	2102	2260	2121	1084 ↑	Info

Percent satisfactory results for all participants: 83.8 %

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 #2
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	1179	1959	2114	1978	944
Standard Deviation:	34	48	89	40	25
RSD (%):	2.8	2.5	4.2	2.0	2.7
ETAAS-Z					
Number of Sample Measurements:	2	2	2	2	2
Mean:	1119	1927	2058	1873	905
Standard Deviation:	27	80	68	10	35
RSD (%):	—	—	—	—	—
FAAS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	1013	1901	1870	1521	1046
Standard Deviation:	225	407	171	677	270
RSD (%):	22.2	21.4	9.1	44.5	25.8
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	1194	1996	2120	2001	992
Standard Deviation:	119	150	198	170	130
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	9	9	9	9	9
Mean:	997	1725	1844	1769	855
Standard Deviation:	342	602	630	623	297
RSD (%):	34.3	34.9	34.1	35.2	34.8
All Laboratories					
Number of Sample Measurements:	21	21	21	21	21
Mean:	1065	1848	1947	1794	926
Standard Deviation:	250	429	427	503	230
RSD (%):	23.4	23.2	21.9	28.0	24.9

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 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 102 µg/L (1.29 µmol/L) to 299 µg/L (3.79 µmol/L).

Acceptable ranges for serum selenium are based on fixed criteria of $\pm 20\%$, 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 ($\pm 15\%$ 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, 91.6% of test results reported were judged as satisfactory, with two of the 19 participant laboratories (10.5%) 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, 2010 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
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Robust Mean	143	299	102	126	215
Robust Standard Deviation	6.5	20.0	6.8	10.5	15.4
Standard Uncertainty	1.9	5.7	1.9	3.0	4.4
RSD (%)	4.6	6.7	6.6	8.3	7.2
Acceptable Range:					
Upper Limit:	172	359	122	151	258
Lower Limit:	114	239	82	101	172

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 #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE10-06	SE10-07	SE10-08	SE10-09	SE10-10	
	Target Values:	143	299	102	126	215	
107	DRC/CC-ICP-MS	139	295	98	120	210	Info
110	DRC/CC-ICP-MS	138	286	97	118	203	
114	ICP-MS	144	284	104	123	201	
147	ICP-MS	137	280	98	118	201	Info
156	ICP-MS	183 ↑	358	130 ↑	155 ↑	250	
159	ETAAS-Z	133	274	92	110	205	
164	ICP-MS	145	309	101	128	219	
179	DRC/CC-ICP-MS	141	301	101	121	213	
197	ICP-MS	142	293	104	126	212	
200	DRC/CC-ICP-MS	147	303	103	126	220	Info
206	ICP-MS	137	278	100	118	197	
293	DRC/CC-ICP-MS	145	318	103	129	228	Info
305	ICP-MS	145	294	109	140	211	
324	DRC/CC-ICP-MS	146	306	104	126	228	Info
366	ETAAS-Z	124	259	90	106	174	Info
367	DRC/CC-ICP-MS	160	319	110	133	232	Info
401	DRC/CC-ICP-MS	147	308	103	127	221	Info
403	ETAAS-Z	140	300	96	133	224	Info
457	ICP-AES/OES	332 ↑	498 ↑	290 ↑	310 ↑	390 ↑	Info

Percent satisfactory results for all participants: 91.6 %

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.

New York State Department of Health
Serum Selenium Test Results, 2010 Event #2
STATISTICAL SUMMARY BY METHOD

Results ($\mu\text{g/L}$ serum)					
	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	8	8	8	8	8
Mean:	145	305	102	125	219
Standard Deviation:	7	11	4	5	10
RSD (%):	4.8	3.6	3.9	4.0	4.6
ETAAS-Z					
Number of Sample Measurements:	3	3	3	3	3
Mean:	132	278	93	116	201
Standard Deviation:	8	21	3	15	25
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	0	1	0	0	1
Mean:		498			390
Standard Deviation:		?			?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	7	7	7	7	7
Mean:	148	299	107	130	213
Standard Deviation:	16	28	11	13	18
RSD (%):	10.8	9.3	10.2	10.3	8.5
All Laboratories					
Number of Sample Measurements:	18	19	18	18	19
Mean:	144	309	102	125	223
Standard Deviation:	12	50	9	11	44
RSD (%):	8.4	16.4	8.4	8.8	19.5

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 624 µg/L (9.54 µmol/L) to 2307 µg/L (35.28 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, 88.1% of test results reported were judged as satisfactory, with five out of 27 participant laboratories (18.5%) 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, 2010 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
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Robust Mean	1 5 6 5	1 2 2 8	6 2 4	7 9 7	2 3 0 7
Robust Standard Deviation	155	109	54	89	197
Standard Uncertainty	37	26	13	21	47
RSD (%)	9.9	8.8	8.7	11.2	8.5
Acceptable Range:					
Upper Limit:	1800	1412	718	917	2653
Lower Limit:	1330	1044	530	678	1961

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 #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE10-06	SE10-07	SE10-08	SE10-09	SE10-10	
Target Values:		1565	1228	624	797	2307	
107	DRC/CC-ICP-MS	1567	1235	600	793	2351	Info
110	ICP-MS	1751	1320	687	857	2432	
114	ICP-MS	1440	1150	660	740	2150	
147	ICP-MS	1536	1203	596	752	2346	
156	ICP-MS	1388	1069	615	823	2120	
159	ICP-AES/OES	1570	1230	630	790	2270	
160	FAAS	1340	1000 ↓	530	660 ↓	1960 ↓	
164	ICP-MS	1462	1140	582	726	2200	
179	DRC/CC-ICP-MS	1700	1310	660	820	2520	
197	ICP-MS	1530	1240	630	810	2390	
200	FAAS	1727	1275	680	883	2466	Info
206	ICP-MS	1550	1170	600	880	2380	
287	FAAS	1400	1060	490 ↓	670 ↓	2100	
293	ICP-MS	1445	1262	549	713	2289	Info
305	ICP-MS	164 ↓	124 ↓	68 ↓	78 ↓	233 ↓	
324	DRC/CC-ICP-MS	1710	1296	683	845	2449	Info
325	FAAS	2250 ↑	1560 ↑	630	2880 ↑	960 ↓	Info
355	ICP-MS	1619	1291	642	840	2424	
357	ICP-MS	1460	1120	570	700	2140	
358	ICP-MS	1639	1287	669	871	2420	
360	FAAS	1630	1240	610	780	2460	
362	ICP-MS	1390	1100	560	690	2000	
363	ICP-MS	1710	1320	660	860	2580	
366	FAAS	1626	1401	817 ↑	942 ↑	2484	Info
401	DRC/CC-ICP-MS	1765	1353	699	863	2569	Info
457	ICP-AES/OES	1539	1221	643	803	2130	Info
458	FAAS	1640	1270	620	800	2390	

Percent satisfactory results for all participants: 88.1 %

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 #2
STATISTICAL SUMMARY BY METHOD

Results ($\mu\text{g/L}$ serum)					
	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	1686	1299	661	830	2472
Standard Deviation:	84	49	43	30	95
RSD (%):	5.0	3.8	6.6	3.7	3.8
FAAS					
Number of Sample Measurements:	7	7	7	6	7
Mean:	1659	1258	625	789	2117
Standard Deviation:	296	191	106	112	550
RSD (%):	17.8	15.2	17.0	14.3	26.0
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	1555	1226	637	797	2200
Standard Deviation:	22	6	9	9	99
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	14	14	14	13	14
Mean:	1435	1128	578	789	2150
Standard Deviation:	383	301	153	71	574
RSD (%):	26.7	26.7	26.5	9.0	26.7
All Laboratories					
Number of Sample Measurements:	27	27	27	25	27
Mean:	1539	1194	607	796	2193
Standard Deviation:	328	243	125	74	500
RSD (%):	21.3	20.4	20.6	9.3	22.8

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

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Serum Arsenic Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
197	DRC/CC-ICP-MS	<10	<10	<10	<10	<10

Serum Barium Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
197	ICP-MS	<2.0	<2.0	2.1	2.2	<2.0

Serum Cadmium Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
197	DRC/CC-ICP-MS	<0.5	<0.5	<0.5	<0.5	<0.5

Serum Cobalt Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
179	ICP-MS	0.5	0.3	0.4	0.3	0.4
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Chromium Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
147	ICP-MS	0.7	0.3	1.5	7.6	2.7
164	ICP-MS	1	0	1	7	3
179	DRC/CC-ICP-MS	0.8	0.4	1.5	6.9	2.8
197	DRC/CC-ICP-MS	<1.0	<1.0	1.2	5.6	2.3
324	DRC/CC-ICP-MS	0.1	0.3	0.9	5.1	1.7
Arithmetic Mean, n=5		0.7	0.3	1.2	6.4	2.5
SD		0.4	0.2	0.3	1.0	0.5

Serum Iron Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
457	ICP-AES/OES	715	875	592	1012	1048

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Serum Manganese Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
107	DRC/CC-ICP-MS	14.7	5.4	2	2.8	4.4
179	DRC/CC-ICP-MS	14.2	5.4	1.9	2.8	4.2
197	DRC/CC-ICP-MS	13.4	5.1	1.9	2.6	4
305	ICP-MS	13.4	5.3	1.9	2.8	4.2
324	DRC/CC-ICP-MS	13	5	3	4	4
Arithmetic Mean, n=5		13.7	5.2	2.1	3.0	4.2
SD		0.7	0.2	0.5	0.6	0.2

Serum Lead Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
197	DRC/CC-ICP-MS	<0.4	<0.4	<0.4	<0.4	<0.4

Serum Tin Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
197	ICP-MS	<5.0	<5.0	<5.0	<5.0	<5.0

Serum Tellurium Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Thallium Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
197	ICP-MS	1.3	3.2	<1.0	<1.0	<1.0

Serum Vanadium Results (µg/L)						
Lab Code	Method	SE10-06	SE10-07	SE10-08	SE10-09	SE10-10
107	DRC/CC-ICP-MS	0.3	153.5	0.6	5.1	2.4
179	DRC/CC-ICP-MS	0.3	1.4	0.7	5.0	2.3

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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.
