



**Department
of Health**

**Wadsworth
Center**

TRACE ELEMENTS IN SERUM

Proficiency Test Report

Event #1, 2015

March 2nd, 2015



Department of Health

ANDREW M. CUOMO
Governor

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

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

March 2, 2015

Trace Elements in Serum Event #1, 2015

Dear Laboratory Director:

Results from the first 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, May 6th, 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, June 3rd, 2015.**

Thank you for your participation.

Sincerely,

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Deputy Director, Division of Environmental Health

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New York State Department of Health
Event #1, 2015

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 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 13 µg/L (0.48 µmol/L) to 103 µg/L (3.82 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, 88.7% of test results reported were judged as satisfactory, with two out of 23 participant laboratories (8.7%) 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 #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results ($\mu\text{g/L}$ serum)				
	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
Robust Mean	23	37	103	82	13
Robust Standard Deviation	3	4	9	8	3
Standard Uncertainty	0.8	1.1	2.5	2.1	0.7
RSD (%)	13.9	11.5	9.0	9.8	19.6
Number of Sample Measurements	22	23	22	23	22
Acceptable Range:					
Upper Limit:	28	44	124	98	18
Lower Limit:	18	30	82	66	8

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 #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE15-01	SE15-02	SE15-03	SE15-04	SE15-05	
	Target Values:	23	37	103	82	13	
114	ICP-MS	24	35	98	77	12	
147	FAAS	25	41	110	88	16	Info
156	ICP-MS	23	43	110	89	15	
160	ICP-MS	21	35	99	79	12	
164	ICP-MS	24	41	122	94	16	
179	DRC/CC-ICP-MS	23	37	105	82	13	
197	ICP-MS	<20	33	104	81	<20	
200	DRC/CC-ICP-MS	31 ↑	39	104	81	16	Info
206	DRC/CC-ICP-MS	25	41	>100	96	13	
287	ETAAS-Z	24	37	101	81	13	
293	ICP-MS	24	37	106	86	12	Info
305	ICP-MS	19	35	110	84	20 ↑	
324	ICP-MS	31 ↑	40	121	98	11	Info
325	ETAAS-Z	16 ↓	28 ↓	81 ↓	63 ↓	8	Info
355	ICP-MS	25	40	108	83	15	
357	ICP-MS	17 ↓	31	97	72	8	
358	ICP-MS	22	36	99	76	12	
362	ICP-MS	20	37	105	80	11	
363	ICP-MS	21	34	96	76	12	
366	ETAAS-Z	23	36	87	70	13	Info
388	ICP-MS	80 ↑	59 ↑	130 ↑	189 ↑	225 ↑	
401	ICP-AES/OES	22	35	100	81	11	Info
458	ETAAS other	19	30	90	73	10	

Percent satisfactory results for all participants: 88.7 %

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.

▲: Result not reported

New York State Department of Health
Serum Aluminum Test Results, 2015 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (µg/L serum)				
	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	2	3	3
Mean:	26	39	105	86	14
Standard Deviation:	4	2	1	8	2
RSD (%):	—	—	—	—	—
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	19	30	90	73	10
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	3	3	3	3	3
Mean:	21	34	90	71	11
Standard Deviation:	4	5	10	9	3
RSD (%):	—	—	—	—	—
FAAS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	25	41	110	88	16
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	1	1	1	1	1
Mean:	22	35	100	81	11
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	12	14	14	13	12
Mean:	23	38	108	83	13
Standard Deviation:	4	7	10	7	3
RSD (%):	15.7	17.8	9.7	9.1	23.7
All Laboratories					
Number of Sample Measurements:	21	23	22	22	21
Mean:	23	37	104	81	13
Standard Deviation:	4	6	11	8	3
RSD (%):	16.4	16.1	10.8	10.4	22.0

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #1, 2015

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 1430 $\mu\text{g/L}$ (22.50 $\mu\text{mol/L}$) to 2423 $\mu\text{g/L}$ (38.13 $\mu\text{mol/L}$).

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, 94.0% of test results reported were judged as satisfactory, with one out of 20 participant laboratories (5.0%) 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 #1
ROBUST STATISTICAL SUMMARY**

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results ($\mu\text{g/L}$ serum)				
	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
Robust Mean	2423	1973	2360	2194	1430
Robust Standard Deviation	130	105	143	161	71
Standard Uncertainty	36	29	40	45	20
RSD (%)	5.3	5.3	6.1	7.3	5.0
Number of Sample Measurements	20	20	20	20	20
Acceptable Range:					
Upper Limit:	2786	2269	2714	2523	1645
Lower Limit:	2060	1677	2006	1865	1216

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 #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE15-01	SE15-02	SE15-03	SE15-04	SE15-05	
	Target Values:	2423	1973	2360	2194	1430	
107	DRC/CC-ICP-MS	2500	2000	2400	2300	1500	Info
110	ICP-MS	2433	1987	2393	2211	1440	
114	ICP-MS	2310	1890	2230	2100	1390	
147	ICP-MS	2236	1874	2186	2027	1334	Info
156	ICP-AES/OES	2500	1900	2500	1900	1400	
160	ICP-MS	2340	1870	2230	2060	1350	
164	ICP-MS	2372	1895	2248	2100	1370	
179	DRC/CC-ICP-MS	2550	2090	2450	2330	1500	
197	ICP-MS	2400	2030	2430	2310	1430	
200	ICP-MS	2515	2092	2454	2337	1499	Info
206	ICP-MS	2204	1794	2132	1988	1334	
293	ICP-MS	2378	1945	2320	2225	1430	Info
305	ICP-MS	2470	2010	2410	2220	1430	
324	ICP-MS	2933 ↑	2463 ↑	2962 ↑	2803 ↑	1795 ↑	Info
325	ICP-MS	3040 ↑	2080	2350	2090	1430	Info
359	ICP-MS	2529	2053	2590	2362	1528	
366	ETAAS-Z	2337	1918	2257	2149	1451	Info
401	DRC/CC-ICP-MS	2269	1856	2192	2053	1347	Info
457	ICP-AES/OES	2495	2055	2457	2364	1453	Info
483	DRC/CC-ICP-MS	2394	1964	2373	2261	1450	Info

Percent satisfactory results for all participants: 94.0 %

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 Copper Test Results, 2015 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	2428	1978	2354	2236	1449
Standard Deviation:	125	97	112	125	72
RSD (%):	5.1	4.9	4.8	5.6	5.0
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2337	1918	2257	2149	1451
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	2498	1978	2479	2132	1427
Standard Deviation:	4	110	30	328	37
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	13	13	13	13	13
Mean:	2474	1999	2380	2218	1443
Standard Deviation:	248	167	216	213	121
RSD (%):	10.0	8.4	9.1	9.6	8.4
All Laboratories					
Number of Sample Measurements:	20	20	20	20	20
Mean:	2460	1988	2378	2210	1443
Standard Deviation:	206	142	183	194	101
RSD (%):	8.4	7.1	7.7	8.8	7.0

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #1, 2015

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 116 $\mu\text{g/L}$ (1.47 $\mu\text{mol/L}$) to 286 $\mu\text{g/L}$ (3.62 $\mu\text{mol/L}$).

Acceptable ranges for serum selenium are based on fixed criteria of $\pm 20\%$, or $\pm 2 \mu\text{g/L}$ below 10 $\mu\text{g/L}$. These criteria are a little less stringent than those proposed by the OELM Network of EQAS organizers ($\pm 15\%$ or $\pm 8 \mu\text{g/L}$ below 55 $\mu\text{g/L}$) (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 16 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 #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
Robust Mean	230	286	137	189	116
Robust Standard Deviation	15	20	11	17	8
Standard Uncertainty	5	6	3	5	2
RSD (%)	6.6	6.9	8.0	8.8	6.9
Number of Sample Measurements	16	16	16	16	16
Acceptable Range:					
Upper Limit:	276	343	164	227	139
Lower Limit:	184	229	110	151	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 #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE15-01	SE15-02	SE15-03	SE15-04	SE15-05	
Target Values:		230	286	137	189	116	
107	DRC/CC-ICP-MS	240	290	150	200	110	Info
110	DRC/CC-ICP-MS	228	275	134	181	114	
114	ICP-MS	216	291	126	173	110	
147	ICP-MS	209	270	126	168	110	
156	DRC/CC-ICP-MS	230	290	130	170	110	
160	ICP-MS	231	275	140	190	124	
164	DRC/CC-ICP-MS	247	313	148	209	133	
179	DRC/CC-ICP-MS	236	302	144	194	124	
200	DRC/CC-ICP-MS	221	281	135	179	112	Info
206	DRC/CC-ICP-MS	218	268	131	173	110	
293	DRC/CC-ICP-MS	259	305	148	209	126	Info
305	ICP-MS	225	290	139	189	117	
325	ETAAS-Z	233	239	127	202	115	Info
366	ETAAS-Z	211	251	122	173	101	Info
401	DRC/CC-ICP-MS	252	308	148	202	125	Info
483	DRC/CC-ICP-MS	238	297	149	204	124	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 #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	10	10	10	10	10
Mean:	237	293	142	192	119
Standard Deviation:	13	15	8	15	8
RSD (%):	5.6	5.1	5.8	7.8	7.1
ETAAS-Z					
Number of Sample Measurements:	2	2	2	2	2
Mean:	222	245	125	188	108
Standard Deviation:	16	8	4	21	10
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	220	282	133	180	115
Standard Deviation:	10	11	8	11	7
RSD (%):	4.4	3.8	5.9	6.2	5.8
All Laboratories					
Number of Sample Measurements:	16	16	16	16	16
Mean:	231	284	137	189	117
Standard Deviation:	14	20	10	15	9
RSD (%):	6.2	7.2	7.0	7.8	7.3

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #1, 2015

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 695 µg/L (10.63 µmol/L) to 3332 µg/L (50.96 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, 96.2% 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, 2015 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results ($\mu\text{g/L}$ serum)				
	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
Robust Mean	3332	1270	1982	763	695
Robust Standard Deviation	208	96	162	68	54
Standard Uncertainty	53	23	40	17	13
RSD (%)	6.2	7.5	8.2	8.9	7.8
Number of Sample Measurements	24	26	26	26	26
Acceptable Range:					
Upper Limit:	3832	1461	2279	877	799
Lower Limit:	2832	1080	1685	649	591

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 #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L serum)					Info Only
		SE15-01	SE15-02	SE15-03	SE15-04	SE15-05	
	Target Values:	3332	1270	1982	763	695	
107	DRC/CC-ICP-MS	3300	1400	2100	740	680	Info
110	ICP-MS	3415	1268	1995	755	685	
114	ICP-MS	3050	1190	1790	730	680	
147	ICP-MS	3157	1157	1824	654	614	Info
156	ICP-AES/OES	3200	1200	1800	710	650	
160	ICP-MS	3080	1140	1760	690	640	
164	ICP-MS	3353	1213	1922	732	681	
179	DRC/CC-ICP-MS	3420	1260	1970	750	690	
197	ICP-MS	3310	1280	2050	790	690	
200	ICP-MS	3519	1357	2099	843	729	Info
206	ICP-MS	3159	1200	1884	767	705	
287	FAAS	3290	1230	1950	740	650	
293	ICP-MS	3634	1360	2144	830	765	Info
305	ICP-MS	3160	1170	1820	700	630	
324	ICP-MS	3523	1428	2223	909 ↑	821 ↑	Info
325	ICP-MS	4400 ↑	1300	1900	700	700	Info
355	ICP-MS	3162	1253	1852	706	657	
357	ICP-MS	2961	1117	1784	675	615	
358	ICP-MS	>3500	1380	2150	790	760	
359	ICP-MS	3578	1351	2225	847	764	
362	ICP-MS	>3000	1350	2090	860	756	
363	ICP-MS	3250	1240	1990	770	700	
401	DRC/CC-ICP-MS	3446	1242	2027	752	680	Info
457	ICP-AES/OES	3365	1266	1937	770	697	Info
458	FAAS	3494	1393	2125	820	709	
483	DRC/CC-ICP-MS	3428	1290	2131	966 ↑	876 ↑	Info

Percent satisfactory results for all participants: 96.2 %

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 Zinc Test Results, 2015 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ serum)				
	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	3399	1298	2057	802	732
Standard Deviation:	67	71	73	109	96
RSD (%):	2.0	5.5	3.5	13.6	13.2
FAAS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	3392	1312	2038	780	680
Standard Deviation:	144	115	124	57	42
RSD (%):	—	—	—	—	—
ICP-AES/OES					
Number of Sample Measurements:	2	2	2	2	2
Mean:	3283	1233	1869	740	674
Standard Deviation:	117	47	97	42	33
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	16	18	18	18	18
Mean:	3357	1264	1972	764	700
Standard Deviation:	343	92	156	72	58
RSD (%):	10.2	7.3	7.9	9.4	8.2
All Laboratories					
Number of Sample Measurements:	24	26	26	26	26
Mean:	3361	1271	1982	769	701
Standard Deviation:	283	86	143	74	61
RSD (%):	8.4	6.8	7.2	9.6	8.7

notes: ? Insufficient data for calculation.

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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	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	<0.2	<0.2	<0.2	<0.2	<0.2
147	ICP-MS	<0.030	<0.030	<0.030	<0.030	<0.030

Serum Arsenic (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	5.80	11.9	16.5	7.09	4.44
197	DRC/CC-ICP-MS	<10	11	15	<10	<10

Serum Barium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	1.3	1.7	1.9	3.3	3.0
147	ICP-MS	1.15	1.47	1.71	3.08	2.75
197	ICP-MS	<2.0	<2.0	<2.0	3.4	2.9
Arithmetic mean		-	-	-	3.3	2.9
SD		-	-	-	0.2	0.1
n		2	2	2	3	3

Serum Beryllium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	<0.3	0.40	<0.3	<0.3	<0.3
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	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	<0.042	<0.042	<0.042	<0.042	<0.042
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Cadmium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	6.1	10.9	3.0	3.2	1.1
147	ICP-MS	6.31	11.1	3.29	3.17	1.08
197	DRC/CC-ICP-MS	6.3	11.2	3.2	3.3	1.1
Arithmetic mean		6.2	11.1	3.2	3.2	1.1
SD		0.1	0.2	0.1	0.07	0.01
n		3	3	3	3	3

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Serum Chromium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
114	ICP-MS	11.2	17.3	7.8	3.7	1.7
147	DRC/CC-ICP-MS	11.1	16.2	7.85	3.53	1.59
156	DRC/CC-ICP-MS	11	17	7.3	3.2	1.3
160	ICP-MS	10	15	6	3	1
164	DRC/CC-ICP-MS	9.8	15.4	6.8	3.2	1.3
179	DRC/CC-ICP-MS	11.3	17.4	7.7	3.6	1.5
197	DRC/CC-ICP-MS	11.3	17.2	7.8	3.7	1.6
206	DRC/CC-ICP-MS	10.9	16.0	7.4	3.7	1.6
305	ICP-MS	11.2	16.3	7.4	3.2	1.3
Arithmetic mean		10.9	16.4	7.3	3.4	1.4
SD		0.6	0.9	0.6	0.3	0.2
n		9	9	9	9	9

Serum Cobalt (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	17.3	11.7	8.0	3.9	1.6
114	ICP-MS	15.7	11.2	7.6	3.7	1.6
147	ICP-MS	16.0	11.2	7.42	3.48	1.37
156	DRC/CC-ICP-MS	16	12	7.5	3.3	1.3
164	ICP-MS	16.3	11.5	7.5	3.7	1.4
179	DRC/CC-ICP-MS	17	12	8.1	4.1	1.5
197	ICP-MS	15.4	11.0	7.3	3.4	1.4
206	ICP-MS	15.3	10.8	7.3	3.7	1.5
324	ICP-MS	19.1	13.7	9.2	4.5	1.8
Arithmetic mean		16.5	11.7	7.8	3.8	1.5
SD		1.2	0.9	0.6	0.4	0.2
n		9	9	9	9	9

Serum Iodine (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
114	ICP-MS	97.7	58.6	46.3	54.2	42.2
147	ICP-MS	105	70.1	53.8	63.5	49.6
156	DRC/CC-ICP-MS	110	74	57	67	52
164	ICP-MS	105	69	57	65	53
179	ICP-MS	113	76	58	69	53
197	ICP-MS	112.2	73.7	56.6	66.9	51.9
206	ICP-MS	101.1	64.8	50.7	57.7	46.1
Arithmetic mean		106	69	54	63	50
SD		6	6	4	5	4
n		7	7	7	7	7

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Serum Iron (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
457	ICP-AES/OES	647	844	775	3557	814

Serum Lead (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	10.8	5.76	8.7	2.36	2.0
197	DRC/CC-ICP-MS	11.1	5.6	8.6	2.3	2.0

Serum Lithium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	0.400	0.888	0.594	0.499	0.492

Serum Manganese (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
114	ICP-MS	21.6	9.6	7.7	6.7	4.1
147	ICP-MS	21.0	9.40	7.36	6.21	3.90
179	DRC/CC-ICP-MS	24.3	11.1	8.7	7.6	4.6
197	DRC/CC-ICP-MS	19.9	8.9	7.0	6.0	3.6
206	ICP-MS	19.3	9.0	6.7	6.2	4.0
305	ICP-MS	19.1	9.7	7.9	6.7	4.1
324	ICP-MS	25.4	11.5	9.4	8.1	*5.97
<i>*Outlier</i>	Arithmetic mean	21.5	9.9	7.8	6.8	4.1
	SD	2.5	1.0	1.0	0.8	0.3
	n	7	7	7	7	6

Serum Mercury (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	13.9	7.82	4.03	5.28	1.12
197	ICP-MS	18	10	5	7	<5

Serum Molybdenum (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	2.8	8.3	10.3	6.2	2.9
147	ICP-MS	2.96	8.24	9.88	6.04	2.74
179	ICP-MS	3.3	9.0	11	6.6	3.2
197	ICP-MS	3.2	9.0	10.9	6.6	3.2
	Arithmetic mean	3.1	8.6	10.5	6.4	3.0
	SD	0.2	0.4	0.5	0.3	0.2
	n	4	4	4	4	4

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Serum Nickel (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
114	ICP-MS	17.1	8.0	12.1	6.9	4.4
147	ICP-MS	15.5	5.72	9.98	4.32	2.14
179	DRC/CC-ICP-MS	16	5.8	11	4.7	2.4
197	ICP-MS	18.5	7.5	12.0	5.9	2.9
206	ICP-MS	14.7	<10	<10	<10	<10
Arithmetic mean		16.4	6.8	11.3	5.5	3.0
SD		1.5	1.2	1.0	1.2	1.0
n		5	4	4	4	4

Serum Platinum (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
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	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	0.121	0.394	0.102	0.125	0.122
179	ICP-MS	<0.2	0.4	<0.2	<0.2	<0.2
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Tellurium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	<0.077	<0.077	<0.077	<0.077	<0.077
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Serum Thallium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	2.2	5.4	6.2	2.1	1.1
147	ICP-MS	1.97	5.34	5.81	2.04	1.01
197	ICP-MS	1.9	5.1	5.8	2.0	1.0
Arithmetic mean		2.0	5.3	5.9	2.0	1.0
SD		0.2	0.2	0.2	0.1	0.1
n		3	3	3	3	3

Serum Thorium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	<0.007	<0.007	<0.007	<0.007	<0.007

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Serum Tin (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	2.1	3.5	2.4	9.4	7.8
147	ICP-MS	2.46	3.57	2.45	9.94	7.99
197	ICP-MS	<5.0	<5.0	<5.0	9.4	7.7
Arithmetic mean		-	-	-	9.6	7.8
SD		-	-	-	0.3	0.1
n		2	2	2	3	3

Serum Tungsten (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	ICP-MS	8.79	2.35	10.6	3.31	2.24

Serum Uranium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
110	ICP-MS	<0.05	<0.05	<0.05	<0.05	<0.05
147	ICP-MS	<0.007	<0.007	<0.007	<0.007	<0.007

Serum Vanadium (µg/L)						
Lab Code	Method	SE15-01	SE15-02	SE15-03	SE15-04	SE15-05
147	DRC/CC-ICP-MS	3.30	5.77	2.25	3.40	15.2
179	DRC/CC-ICP-MS	3.7	6.5	2.4	3.6	16.2

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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)

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.
