Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

TRACE ELEMENTS IN WHOLE BLOOD

Event #2, 2012

July 9th, 2012

NEW YORK
state department of
HEALTH

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

Sue Kelly
Executive Deputy Commissioner

July 9, 2012

Trace Elements in Whole Blood
Event #2, 2012

Dear Laboratory Director:

Results from the second proficiency test (PT) event in 2012 for Trace Elements in Whole Blood have been tabulated and summarized. Target values for Arsenic, Cadmium, Mercury and Lead in whole blood 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. The data for blood lead were previously reported in the Blood Lead PT Report issued June 14th, 2012, and are reproduced here for completeness.

PT Materials

Test materials for the first event were prepared from caprine (goat) whole blood obtained from animals dosed with lead acetate to create physiologically bound lead (Pb). A total of five blood pools were supplemented with arsenic (as inorganic As^{3+}), cadmium (as Cd^{2+}) and mercury as both inorganic (Hg^{2+}) and as methylmercury (CH_3Hg^+) species. In addition to As, Cd, Pb and Hg, blood pools were supplemented with the trace elements manganese (Mn), thallium (Tl), tin (Sn) and cobalt (Co).

The next PT event for trace elements in whole blood is scheduled to be mailed Wednesday, September 19th, 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, October 10th, 2012.**

Thank you for your participation in this event.

Yours 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

Whole Blood Arsenic

Test materials for arsenic were prepared from caprine (goat) whole blood preserved with K_2EDTA anticoagulant. A total of five pools were supplemented with arsenic as inorganic As^{3+}.

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 whole blood arsenic range from 6.9 µg/L (0.09 µmol/L) to 32.6 µg/L (0.44 µmol/L).

Acceptable range: The acceptable range for arsenic is set at ±6 µg/L or ±20%, whichever is greater. Thus, it is fixed at ±6 µg/L for concentrations below 30 µg/L.

Discussion: Based upon the above criteria, 92.0% of test results reported were judged as satisfactory, with two of the 20 laboratories (10.0%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Arsenic Test Results, 2012 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L whole blood)				
	BE12-06	**BE12-07**	**BE12-08**	**BE12-09**	**BE12-10**
Robust Mean	**23.8**	**9.5**	**32.6**	**6.9**	**13.8**
Robust Standard Deviation	3.1	3.0	2.7	3.0	2.6
Standard Uncertainty	0.9	0.9	0.8	0.9	0.8
RSD (%)	13.1	31.1	8.4	43.1	18.7
Acceptable Range:					
Upper Limit	29.8	15.5	39.1	12.9	19.8
Lower Limit	17.8	3.5	26.1	0.9	7.8

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

New York State Department of Health
Blood Arsenic Test Results, 2012 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L whole blood)					Info Only
		BE12-06	BE12-07	BE12-08	BE12-09	BE12-10	
	Target Values:	23.8	9.5	32.6	6.9	13.8	
103	DRC/CC-ICP-MS	24.3	8.3	34.4	5.5	13.5	Info
110	DRC/CC-ICP-MS	22.6	7.3	31.2	5.1	12.4	
114	ICP-MS	27.0	13.0	34.0	10.0	17.0	
147	ICP-MS	22.7	7.7	32.1	5.3	12.7	Info
156	ICP-MS	21.9	<11.0	31.8	<11.0	<11.0	
159	ICP-MS	28.0	11.0	36.0	9.0	18.0	
164	ICP-MS	21.0	6.0	31.0	3.0	10.0	
179	ICP-MS	22.0	<12.0	32.0	<12.0	<12.0	
197	DRC/CC-ICP-MS	23.0	<10.0	32.0	<10.0	13.0	
200	ICP-MS	27.7	11.5	30.5	8.9	15.8	Info
206	ICP-MS	25.5	12.3	34.8	10.9	15.7	
208	ICP-MS	30.3 ↑	15.2	36.8	15.5 ↑	20.9 ↑	
293	DRC/CC-ICP-MS	27.9	9.6	37.5	6.0	15.4	Info
305	DRC/CC-ICP-MS	22.0	7.0	30.0	5.0	12.0	
312	DRC/CC-ICP-MS	20.0	11.8	31.0	9.1	15.6	
324	HR-ICP-MS	24.4	8.3	33.3	5.7	12.1	Info
339	HR-ICP-MS	24.6	8.61	34.6	5.83	13.2	Info
359	ICP-MS	19.7	12.3	24.2 ↓	8.3	12.1	
391	DRC/CC-ICP-MS	24.5	8.6	34.0	5.9	14.0	Info
469	ICP-MS	2.5 ↓	1.4 ↓	5.6 ↓	2.5	6.2 ↓	

Percent satisfactory results for all participants: 92.0 %

notes: ↑ reported outside upper limit
↓ reported outside lower limit
◥: Unacceptable result

notes: Results reported as less than the method detection limit are excluded from statistical calculations.
Info only: results included for informational purposes only.

New York State Department of Health
Blood Arsenic Test Results, 2012 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (μg/L whole blood)				
	BE12-06	**BE12-07**	**BE12-08**	**BE12-09**	**BE12-10**
DRC/CC-ICP-MS					
Number of Sample Measurements:	7	6	7	6	7
Mean:	23.5	8.8	32.9	6.1	13.7
Standard Deviation:	2.5	1.8	2.6	1.5	1.4
RSD (%):	10.5	20.0	7.9	25.0	10.2
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	24.5	8.5	34.0	5.8	12.7
Standard Deviation:	0.1	0.2	0.9	0.1	0.8
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	11	9	11	9	9
Mean:	22.6	10.0	29.9	8.2	14.3
Standard Deviation:	7.5	4.3	8.7	4.1	4.5
RSD (%):	33.1	42.4	29.2	50.0	31.4
All Laboratories					
Number of Sample Measurements:	20	17	20	17	18
Mean:	23.1	9.4	31.3	7.1	13.9
Standard Deviation:	5.6	3.2	6.7	3.2	3.2
RSD (%):	24.4	34.5	21.4	44.8	23.3

notes: ? Insufficient data for calculation.

Whole Blood Cadmium

Test materials for cadmium were prepared from caprine (goat) whole blood preserved with K_2EDTA anticoagulant. A total of five blood pools were supplemented with different amounts of cadmium (as Cd^{2+}).

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 whole blood cadmium range from 0.9 µg/L (8 nmol/L) to 6.5 µg/L (58 nmol/L).

Acceptable ranges are based on the OSHA criteria of ±15%, or ±1 µg/L around the target value, whichever is greater. So, the range is fixed at ±1 µg/L for concentrations below 6.6 µg/L, where above 6.6 µg/L, it is ±15%.

Discussion: Based upon the above criteria, 93.3% of the results reported by all participants were satisfactory, with three of the 30 laboratories (10.0%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Cadmium Test Results, 2012 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L whole blood)				
	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
Robust Mean	**6.5**	**5.0**	**1.7**	**0.9**	**3.9**
Robust Standard Deviation	0.5	0.5	0.2	0.1	0.4
Standard Uncertainty	0.1	0.1	<0.1	<0.1	0.1
RSD (%)	7.7	10.3	8.8	16.1	10.4
Acceptable Range:					
Upper Limit	7.5	6.0	2.7	1.9	4.9
Lower Limit	5.5	4.0	0.7	0.0	2.9

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

New York State Department of Health
Blood Cadmium Test Results, 2012 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L whole blood)					Info Only
		BE12-06	BE12-07	BE12-08	BE12-09	BE12-10	
	Target Values:	6.5	5.0	1.7	0.9	3.9	
103	DRC/CC-ICP-MS	6.7	5.2	1.8	0.8	3.8	Info
106	ICP-MS	6.8	5.1	1.8	0.9	3.8	Info
107	DRC/CC-ICP-MS	6.8	5.5	1.6	0.9	4.0	Info
109	ICP-MS	7.1	5.5	1.8	0.9	4.1	Info
110	ICP-MS	7.0	5.1	1.8	0.9	4.0	
114	ICP-MS	5.7	4.4	1.5	0.8	3.3	
116	ICP-MS	6.6	4.7	1.4	0.7	3.5	Info
147	ICP-MS	6.4	4.9	1.7	0.9	3.8	Info
156	ICP-MS	6.8	5.1	1.7	<1.0	4.0	
159	ICP-MS	6.7	5.1	1.8	1.0	4.0	
164	ICP-MS	6.0	4.7	1.6	0.8	3.5	
179	ICP-MS	6.4	4.8	1.6	0.8	3.8	
197	DRC/CC-ICP-MS	6.2	4.6	1.6	0.8	3.7	
199	ICP-MS	7.4	6.2 ↑	2.2	1.3	4.9	Info
200	ICP-MS	6.1	4.4	1.6	0.8	3.4	Info
206	ICP-MS	6.8	5.4	1.8	1.0	4.2	
208	ICP-MS	6.0	4.3	1.7	0.8	3.1	
293	ICP-MS	8.4 ↑	6.2 ↑	2.3	1.0	5.1 ↑	Info
305	ICP-MS	6.5	5.0	1.7	1.0	4.1	
312	ICP-MS	6.4	5.3	2.3	1.6	4.3	
324	HR-ICP-MS	5.9	4.5	1.6	0.9	3.5	Info
339	HR-ICP-MS	6.35	5.11	1.64	0.87	3.63	Info
359	ICP-MS	5.6	5.0	1.8	1.3	3.5	
366	ETAAS-Z	6.5	5.1	1.2	0.7	3.6	Info
367	DRC/CC-ICP-MS	6.6	4.9	1.7	0.9	3.8	Info
383	ETAAS-Z	7.5	6.5 ↑	2.1	1.2	3.9	
391	DRC/CC-ICP-MS	8.6 ↑	6.8 ↑	1.7	1.0	4.7	Info
401	ETAAS other	6.0	4.5	1.6	0.8	3.5	Info
410	ICP-MS	6.7	5.0	1.7	0.8	3.8	Info
469	ICP-MS	5.2 ↓	3.4 ↓	2.2	1.9	7.7 ↑	

Percent satisfactory results for all participants: 93.3 %

notes: ↑ reported outside upper limit
↓ reported outside lower limit
◥: Unacceptable result

notes: Results reported as less than the method detection limit are excluded from statistical calculations.
Info only: results included for informational purposes only.

New York State Department of Health
Blood Cadmium Test Results, 2012 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (μg/L whole blood)				
	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	5	5	5	5	5
Mean:	7.0	5.4	1.7	0.9	4.0
Standard Deviation:	0.9	0.9	0.1	0.1	0.4
RSD (%):	13.4	15.8	5.0	9.5	10.2
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	6.0	4.5	1.6	0.8	3.5
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	2	2	2	2	2
Mean:	7.0	5.8	1.7	1.0	3.8
Standard Deviation:	0.7	1.0	0.6	0.4	0.2
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	6.1	4.8	1.6	0.9	3.6
Standard Deviation:	0.3	0.4	0.0	0.0	0.1
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	20	19	20
Mean:	6.5	5.0	1.8	1.0	4.1
Standard Deviation:	0.7	0.6	0.3	0.3	1.0
RSD (%):	10.7	12.5	14.2	30.6	23.9
All Laboratories					
Number of Sample Measurements:	30	30	30	29	30
Mean:	6.6	5.1	1.8	1.0	4.0
Standard Deviation:	0.7	0.7	0.3	0.3	0.8
RSD (%):	11.0	13.5	14.3	27.5	20.7

notes: ? Insufficient data for calculation.
A Standard Deviation displayed as 0.0 should be interpreted as <0.1 (see HR-ICP-MS participants)

Whole Blood Mercury

Test materials for mercury were prepared from caprine (goat) whole blood preserved with K_2EDTA anticoagulant. A total of five pools were supplemented with different amounts of mercury as both inorganic (Hg^{2+}) and organometallic (as methylmercury, CH_3Hg^+) species.

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 whole blood mercury range from 2.8 µg/L (14 nmol/L) to 51.1 µg/L (255 nmol/L).

Acceptable ranges were fixed at ±30%, or ±3 µg/L around the target value, whichever is greater. That is, the range is fixed at ±3 µg/L for concentrations below 10 µg/L, while above 10 µg/L, it is ±30%.

Discussion: Based on the above criteria, 94.5% of results reported by all participants were satisfactory, with three of the 29 laboratories (10.3%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Mercury Test Results, 2012 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L whole blood)				
	BE12-06	**BE12-07**	**BE12-08**	**BE12-09**	**BE12-10**
Robust Mean	**23.6**	**51.1**	**4.3**	**2.8**	**14.6**
Robust Standard Deviation	2.4	5.1	0.6	0.5	1.5
Standard Uncertainty	0.6	1.2	0.1	0.1	0.4
RSD (%)	10.1	10.0	13.9	16.6	10.6
Acceptable Range:					
Upper Limit	30.7	66.4	7.3	5.8	19.0
Lower Limit	16.5	35.8	1.3	0.0	10.2

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

New York State Department of Health
Blood Mercury Test Results, 2012 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L whole blood)					Info Only
		BE12-06	BE12-07	BE12-08	BE12-09	BE12-10	
	Target Values:	23.6	51.1	4.3	2.8	14.6	
103	DRC/CC-ICP-MS	22.4	49.6	4.0	2.4	14.0	Info
106	ICP-MS	24.1	52.5	4.5	2.7	15.2	Info
107	DRC/CC-ICP-MS	23.8	50.7	4.2	2.6	14.6	Info
109	ICP-MS	23.5	47.6	4.0	2.5	13.7	Info
110	ICP-MS	22.7	49.6	4.0	2.6	14.4	
114	ICP-MS	20.0	43.8	4.6	2.7	13.0	
116	ICP-MS	24.6	54.0	4.6	2.7	15.4	Info
147	ICP-MS	23.3	49.9	4.1	2.5	14.1	Info
156	ICP-MS	18.7	41.0	3.3	<3.0	11.4	
159	ICP-MS	23.0	49.0	4.0	3.0	14.0	
164	ICP-MS	24.0	53.0	5.0	2.9	15.0	
179	ICP-MS	22.0	47.0	4.0	2.0	14.0	
197	DRC/CC-ICP-MS	25.0	53.0	6.0	<5.0	14.0	
199	ICP-MS	26.0	55.0	5.0	2.7	16.9	Info
200	ICP-MS	28.4	54.7	7.8 ↑	6.1 ↑	17.1	Info
206	ICP-MS	23.0	47.0	4.0	3.0	13.0	
208	ICP-MS	33.6 ↑	70.9 ↑	<5.0	<5.0	17.9	
293	ICP-MS	27.7	61.4	5.6	3.4	17.5	Info
305	ICP-MS	25.0	54.0	3.0	2.0	15.0	
312	ICP-MS	23.5	56.5	5.3	3.0	15.5	
324	AFS	21.7	50.5	4.2	3.4	14.7	Info
339	HR-ICP-MS	22.4	49.5	4.09	2.61	14.5	Info
359	ICP-MS	19.4	40.6	3.5	12.5 ↑	12.5	
366	ICP-MS	22.5	48.4	4.5	3.0	12.4	Info
367	CV-AAS	26.9	55.0	6.4	4.8	17.1	Info
391	CV-AAS	40.9 ↑	79.2 ↑	5.9	2.3	18.2	Info
401	CV-AAS	17.3	28.3 ↓	2.4	1.4	11.8	Info
410	ICP-MS	25.0	55.0	4.5	2.7	16.1	Info
453	CV-AAS	23.4	50.3	4.2	2.8	14.6	Info

Percent satisfactory results for all participants: 94.5 %

notes: ↑ reported outside upper limit
↓ reported outside lower limit
◥: Unacceptable result

notes: Results reported as less than the method detection limit are excluded from statistical calculations.
Info only: results included for informational purposes only.

New York State Department of Health
Blood Mercury Test Results, 2012 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (μg/L whole blood)				
	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
AFS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	21.7	50.5	4.2	3.4	14.7
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	27.1	53.2	4.7	2.8	15.4
Standard Deviation:	10.0	20.9	1.8	1.4	2.8
RSD (%):	36.9	39.2	38.4	50.9	18.5
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	2	3
Mean:	23.7	51.1	4.7	2.5	14.2
Standard Deviation:	1.3	1.7	1.1	0.1	0.3
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	22.4	49.5	4.1	2.6	14.5
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	19	18	20
Mean:	24.0	51.5	4.5	3.4	14.7
Standard Deviation:	3.3	6.9	1.0	2.4	1.8
RSD (%):	13.8	13.5	23.1	70.3	12.2
All Laboratories					
Number of Sample Measurements:	29	29	28	26	29
Mean:	24.3	51.6	4.5	3.2	14.7
Standard Deviation:	4.5	9.0	1.1	2.1	1.8
RSD (%):	18.4	17.4	24.2	64.3	12.1

notes: ? Insufficient data for calculation.

Whole Blood Lead

Test materials for lead were prepared from caprine (goat) whole blood obtained from animals dosed with lead acetate to create physiologically-bound Pb. Whole blood was collected into collection bags containing K_2EDTA anticoagulant.

Target values were established as the mean of 21 measurements performed by 19 reference laboratories using ICP-MS, ETAAS and ASV methods. Values range from 4 µg/dL to 31 µg/dL. Among the reference group, imprecision (SD) varied from 0.3 - 1.1 µg/dL.

Acceptable ranges are based on the CLIA '88 criteria (Federal Register Volume 57, Number 40, §§ 493.2 and 493.937, February 28, 1992). The criteria are set at ±10% or ±4 µg/dL, whichever is greater.

Discussion Based on the CLIA '88 criteria, 97.8% of results reported by all participants were judged as satisfactory, with two out of 92 participant laboratories (3.3%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Lead Test Results, 2012 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/dL whole blood)					Normalized Mean	Info Only
		BE12-06	BE12-07	BE12-08	BE12-09	BE12-10		
	Target values:	4	10	30	25	31		
103	DRC/CC-ICP-MS	4	10	30	25	31	1.00	
103	ASV-LeadCare	5	11	31	26	34	1.07	Info
104	ETAAS-Z	4	11	31	26	32	1.05	
106	ICP-MS	4	10	30	25	31	1.00	Info
107	DRC/CC-ICP-MS	4	10	29	25	30	0.98	
107	ASV-LeadCare	4	12	32	26	33	1.09	Info
109	ETAAS-Z	4	10	30	26	32	1.02	
109	ICP-MS	4	10	30	25	32	1.01	
109	ASV-LeadCare	3	10	28	23	29	0.93	Info
109	ASV-LeadCare	4	10	29	23	32	0.97	Info
110	ETAAS-Z	5	12	31	26	32	1.08	
110	ASV-LeadCare	4	9	25 ↓	22	29	0.88	Info
110	ASV-LeadCare	4	10	29	24	32	0.99	Info
110	ICP-MS	4	10	29	24	31	0.98	
112	ETAAS-Z	4	10	29	26	31	1.00	
114	ETAAS-Z	4	10	30	26	30	1.00	
116	ICP-MS	4	10	30	25	31	1.00	Info
121	ETAAS-Z	5	10	27	24	31	0.95	Info
123	ETAAS-Z	3	9	26	21	26 ↓	0.85	
126	ETAAS-Z	3	9	27	25	31	0.97	
131	ETAAS-Z	5	10	28	27	32	1.02	
143	ETAAS-Z	2	8	26	21	28	0.87	
144	ETAAS-Z	3	9	27	24	29	0.93	
146	ETAAS-Z	3	9	27	23	27	0.90	
147	ICP-MS	4	10	29	25	31	0.99	
150	ASV-LeadCare	4	>8	>8	>8	>8	?.?	
156	ICP-MS	3	9	29	25	31	0.99	
158	ICP-MS	3	9	29	25	32	1.00	
159	ICP-MS	4	10	30	26	32	1.02	
160	ICP-MS	4	10	29	25	31	0.99	
164	ICP-MS	4	10	28	24	30	0.95	

notes: ↑ reported value outside upper limit

↓ reported value outside lower limit

Normalized mean: The average of each reported result divided by the corresponding target value. It measures bias.

Info only: results included for informational purposes only.

New York State Department of Health
Blood Lead Test Results, 2012 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/dL whole blood) BE12-06	BE12-07	BE12-08	BE12-09	BE12-10	Normalized Mean	Info Only
	Target values:	4	10	30	25	31		
166	ASV-3010	4	9	29	25	31	0.99	
168	ETAAS-Z	4	11	32	27	35	1.09	
179	ICP-MS	4	10	30	25	31	1.00	
197	ICP-MS	3	9	26	22	28	0.88	
198	ETAAS-Z	4	11	30	26	32	1.04	
199	ETAAS-Z	4	10	28	24	29	0.94	
199	ICP-MS	4	10	28	24	30	0.95	Info
200	ETAAS-Z	4	11	31	26	32	1.05	
204	ASV-3010	3	7	27	24	30	0.94	
206	ICP-MS	4	10	30	25	30	0.99	
208	ETAAS-Z	4	9	28	24	30	0.95	
221	ETAAS-Z	4	11	32	27	35	1.09	
232	ASV-3010	6	13	33	28	36 ↑	1.17	
237	ETAAS-Z	3	10	31	26	32	1.04	
243	ASV-3010	4	11	30	26	31	1.04	
254	ETAAS-Z	3	9	28	23	30	0.94	
255	ETAAS-Z	4	10	28	24	30	0.95	
261	ETAAS-Z	3	10	28	23	30	0.94	
269	ETAAS-Z	2	9	28	24	30	0.95	
271	ETAAS-Z	4	11	29	23	29	0.98	
272	ETAAS-Z	4	10	30	25	31	1.00	
279	ETAAS-Z	4	10	29	24	30	0.96	
282	ASV-3010	3	8	27	23	29	0.92	
290	ICP-MS	4	11	30	24	31	1.02	
291	ASV-3010	4	12	38 ↑	25	31	1.12	
293	ICP-MS	4	11	32	28	32	1.08	
295	ASV-3010	7	13	34	27	34	1.15	
301	ETAAS Other	2	9	27	24	30	0.94	
305	ETAAS-Z	3	10	27	23	29	0.92	
312	ICP-MS	4	11	30	26	33	1.05	
317	ETAAS-Z	4	10	27	23	30	0.93	

notes: ↑ reported value outside upper limit
↓ reported value outside lower limit

Normalized mean: The average of each reported result divided by the corresponding target value. It measures bias.
Info only: results included for informational purposes only.

New York State Department of Health
Blood Lead Test Results, 2012 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/dL whole blood)					Normalized Mean	Info Only
		BE12-06	BE12-07	BE12-08	BE12-09	BE12-10		
	Target values:	4	10	30	25	31		
324	HR-ICP-MS	4	10	28	25	30	0.97	
325	ETAAS-Z	4	10	29	19 ↓	31	0.91	Info
333	ETAAS-Z	4	10	28	24	29	0.94	
337	ASV-LeadCare	4	10	30	24	30	0.98	
339	HR-ICP-MS	3.7	9.5	28	25	31	0.98	Info
340	ETAAS-Z	4	11	31	26	34	1.07	
343	ASV-LeadCare	4	10	30	25	34	1.03	Info
348	ETAAS-Z	3	10	29	25	32	1.00	
349	ETAAS-Z	3	8	27	23	29	0.92	
350	ASV-3010	6	11	35 ↑	25	36 ↑	1.11	
352	ASV-3010	3	9	30	26	34	1.05	
353	ETAAS-Z	3	9	29	25	30	0.98	
365	ETAAS-Z	4	11	31	27	29	1.04	
366	ETAAS-Z	4	11	33	29	35	1.12	Info
367	DRC/CC-ICP-MS	4	10	29	25	30	0.98	Info
368	ASV-3010	3	11	30	25	31	1.03	
369	ASV-3010	2	8	28	24	32	0.98	
374	ASV-3010	<2	9	28	24	31	0.96	
383	ETAAS-Z	4	10	25 ↓	22	26 ↓	0.85	
388	ASV-3010	2	9	28	25	32	0.99	
389	ETAAS-Z	4	10	28	24	30	0.95	
391	ETAAS-Z	5	11	32	27	34	1.09	Info
393	ASV-LeadCare	<3	9	32	25	28	0.99	
401	ETAAS Other	4	11	29	26	33	1.04	Info
410	ICP-MS	4	11	30	26	32	1.04	Info
461	ASV-3010	3	8	30	25	31	1.00	
463	ASV-LeadCare	4	11	30	28	33	1.07	
464	ASV-LeadCare	4	10	30	25	32	1.01	
469	ICP-MS	4	9	26	21	26 ↓	0.85	
470	ASV-LeadCare	3	9	32	25	33	1.04	

Percent satisfactory results for all participants: 97.8 %

notes: ↑ reported value outside upper limit
↓ reported value outside lower limit

Normalized mean: The average of each reported result divided by the corresponding target value. It measures bias.
Info only: results included for informational purposes only.

New York State Department of Health
Blood Lead Test Results, 2012 Event #2
STATISTICAL SUMMARY

Lab Code	Method	TARGET VALUE ASSIGNMENT AND STATISTICS Results (µg/dL whole blood) BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
103	DRC/CC-ICP-MS	4	10	30	25	31
104	ETAAS-Z	4	11	31	26	32
107	DRC/CC-ICP-MS	4	10	29	25	30
109	ETAAS-Z	4	10	30	26	32
109	ICP-MS	4	10	30	25	32
110	ETAAS-Z	5	12	31	26	32
110	ICP-MS	4	10	29	24	31
112	ETAAS-Z	4	10	29	26	31
147	ICP-MS	4	10	29	25	31
156	ICP-MS	3	9	29	25	31
159	ICP-MS	4	10	30	26	32
160	ICP-MS	4	10	29	25	31
164	ICP-MS	4	10	28	24	30
166	ASV-3010	4	9	29	25	31
179	ICP-MS	4	10	30	25	31
198	ETAAS-Z	4	11	30	26	32
199	ETAAS-Z	4	10	28	24	29
200	ETAAS-Z	4	11	31	26	32
243	ASV-3010	4	11	30	26	31
293	ICP-MS	4	11	32	28	32
324	HR-ICP-MS	4	10	28	25	30
Number of Sample Measurements:		21	21	21	21	21
Mean (target value):		**4**	**10**	**30**	**25**	**31**
Standard Deviation:		0.3	0.7	1.1	0.9	0.9
RSD (%):		7.9	6.8	3.6	3.6	2.7
Acceptable Range:						
Upper Limit:		8	14	34	29	35
Lower Limit:		0	6	26	21	27

notes: Results reported as less than the detection limits are treated as zero for statistical and grading purposes.

New York State Department of Health
Blood Lead Test Results, 2012 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/dL whole blood)				
	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
ASV-3010					
Number of Sample Measurements:	13	14	14	14	14
Mean:	3.8	9.9	30.5	25.1	32.1
Standard Deviation:	1.6	2.0	3.3	1.3	2.1
RSD (%):	40.9	19.8	10.8	5.1	6.6
ASV-LeadCare					
Number of Sample Measurements:	12	12	12	12	12
Mean:	3.9	10.1	29.8	24.7	31.6
Standard Deviation:	0.5	0.9	2.0	1.6	2.1
RSD (%):	13.1	8.9	6.7	6.5	6.5
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	4.0	10.0	29.3	25.0	30.3
Standard Deviation:	0.0	0.0	0.6	0.0	0.6
RSD (%):	—	—	—	—	—
ETAAS Other					
Number of Sample Measurements:	2	2	2	2	2
Mean:	3.0	10.0	28.0	25.0	31.5
Standard Deviation:	1.4	1.4	1.4	1.4	2.1
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	39	39	39	39	39
Mean:	3.7	10.0	28.9	24.6	30.6
Standard Deviation:	0.7	0.9	1.9	2.0	2.2
RSD (%):	19.5	8.9	6.7	8.1	7.1
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	3.9	9.8	28.0	25.0	30.5
Standard Deviation:	0.2	0.4	0.0	0.0	0.7
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	19	19	19	19	19
Mean:	3.8	10.0	29.2	24.7	30.8
Standard Deviation:	0.4	0.7	1.4	1.5	1.6
RSD (%):	9.8	6.7	4.9	6.0	5.1
All Laboratories					
Number of Sample Measurements:	90	91	91	91	91
Mean:	3.8	10.0	29.3	24.7	31.0
Standard Deviation:	0.8	1.1	2.1	1.7	2.0
RSD (%):	21.5	10.5	7.2	6.7	6.5

notes: ? Insufficient data for calculation.
A Standard Deviation displayed as 0.0 should be interpreted as <0.1 (see DRC/CC-ICP-MS and HR-ICP-MS participants)

New York State Department of Health
Blood Lead Test Results, 2012 Event #2
STATISTICAL SUMMARY BY CLASS

	Results (μg/dL whole blood)				
	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
Evaluated					
Number of Sample Measurements:	51	52	52	52	52
Mean:	3.6	9.8	29.2	24.5	30.7
Standard Deviation:	1.0	1.2	2.5	1.7	2.4
RSD (%):	27.4	12.4	8.5	6.8	7.7
Info					
Number of Sample Measurements:	18	18	18	18	18
Mean:	4.1	10.3	29.4	24.7	31.8
Standard Deviation:	0.5	0.7	1.9	2.1	1.8
RSD (%):	11.7	6.9	6.5	8.7	5.6
Reference					
Number of Sample Measurements:	21	21	21	21	21
Mean:	4.0	10.2	29.6	25.4	31.1
Standard Deviation:	0.3	0.7	1.1	0.9	0.9
RSD (%):	7.9	6.8	3.6	3.6	2.7
All Laboratories					
Number of Sample Measurements:	90	91	91	91	91
Mean:	3.8	10.0	29.3	24.7	31.0
Standard Deviation:	0.8	1.1	2.1	1.7	2.0
RSD (%):	21.5	10.5	7.2	6.7	6.5

notes: ? Insufficient data for calculation.

Additional Trace Elements Reported in Whole Blood

Participant laboratories reported their analytical results for any additional trace elements (other than As, Cd, Hg and Pb) that are routinely reported so that a more complete characterization can be recorded for these proficiency test 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 As, Cd, Pb and Hg, the whole blood pools were supplemented with additional trace elements as indicated below.

Additional Elements

Mn, Sn, Tl, Co

New York State Department of Health
Whole Blood Additional Elements, 2012 Event #2
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Blood Aluminum (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	< 10.8	< 10.8	< 10.8	< 10.8	< 10.8

Blood Antimony (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
147	ICP-MS	< 0.037	< 0.037	< 0.037	< 0.037	< 0.037
206	ICP-MS	<2.0	<2.0	<2.0	<2.0	<2.0

Blood Barium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	11.8	18.6	15.3	28.2	19.1
147	ICP-MS	11.51	17.58	14.83	28.29	19.086
197	ICP-MS	12.5	19.4	16.3	29.8	19.9
312	ICP-MS	13.5	19.5	16.3	30.2	20.1
Arithmetic Mean (n=4)		**12.3**	**18.8**	**15.7**	**29.1**	**19.5**
SD		0.9	0.9	0.7	1.0	0.5

Blood Beryllium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	< 0.14	< 0.14	< 0.14	0.37	0.42
147	ICP-MS	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90
197	ICP-MS	<0.2	0.2	<0.2	<0.2	<0.2

Blood Bismuth (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021

Blood Cesium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	0.32	0.57	0.55	0.46	0.31

Blood Chromium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	5.46	1.79	4.48	8	1.52
159	DRC/CC-ICP-MS	4.6	1.4	4.0	7.1	1.2
164	DRC/CC-ICP-MS	4.8	1.6	3.9	6.8	1.2
197	DRC/CC-ICP-MS	5.1	1.4	4.3	7.9	1.3
312	DRC/CC-ICP-MS	6.8	2.3	5.1	9.6	1.4
Arithmetic mean (n=5)		5.4	1.7	4.4	7.9	1.3
SD		0.9	0.4	0.5	1.1	0.1

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Blood Cobalt (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	14.2	10.7	3.9	2.4	8.5
147	ICP-MS	13.61	10.67	4.02	2.27	8.13
159	ICP-MS	14.1	11.1	4.2	2.6	7.9
164	ICP-MS	13.3	10.4	3.9	2.1	7.7
197	ICP-MS	13.7	10.5	3.8	2.0	7.8
206	ICP-MS	14.1	11.1	4.0	2.2	7.9
312	ICP-MS	13.8	11.2	4.0	2.4	8.0
391	DRC/CC-ICP-MS	13.3	10.4	3.9	2.2	7.9
Arithmetic mean (n=8)		**13.8**	**10.8**	**4.0**	**2.3**	**8.0**
SD		0.4	0.3	0.1	0.2	0.2

Blood Copper (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	1289	1334	1200	1176	1244
147	ICP-MS	1175	1213	1118	1099	1144
197	ICP-MS	1310.0	1370.0	1210.0	1180.0	1270.0
312	ICP-MS	1172.0	1231.0	1103.0	1100.0	1126.0
Arithmetic mean (n=4)		**1237**	**1287**	**1158**	**1139**	**1196**
SD		73	77	55	45	72

Blood Iodine (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	25.82	33.54	39.24	35.57	37.22

Blood Lithium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	0.78	1.17	1.26	0.91	0.96

Blood Manganese (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
103	DRC/CC-ICP-MS	38.4	34.3	31.0	29.6	63.6
107	DRC/CC-ICP-MS	39.0	35.1	31.9	31.2	64.8
110	ETAAS-Z	36.8	32.9	30.0	29.2	61.0
147	ICP-MS	37.25	32.42	30.44	29.56	60.99
156	ICP-MS	34.0	29.8	25.2	24.4	56.2
159	ICP-MS	44.0	39.0	35.0	34.0	65.0
179	ETAAS-Z	36.8	32.3	29.7	28.5	60.5
197	DRC/CC-ICP-MS	36.6	33.5	28.8	27.7	62.4
293	ICP-MS	44.0	38.9	35.8	37.2	69.6
305	ICP-MS	35.5	31.0	26.0	26.2	60.3
312	DRC/CC-ICP-MS	43.4	41.9	37.0	36.5	72.9
391	DRC/CC-ICP-MS	36.6	31.0	28.4	28.2	61.5
Arithmetic mean (n=12)		**38.5**	**34.3**	**30.8**	**30.2**	**63.2**
SD		3.4	3.7	3.7	3.9	4.5

Blood Molybdenum (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	11.32	11.1	11.3	18.43	21.37

Blood Nickel (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	0.86	1.12	0.72	0.99	0.72

Blood Platinum (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	<0.10	0.23	<0.10	<0.10	<0.10

Blood Selenium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
107	DRC/CC-ICP-MS	271.8	295.5	296.9	280.2	285.8
109	ICP-MS	258	274	286	269	272
147	ICP-MS	247.00	260	284	265	270
197	ICP-MS	252.0	285.0	288.0	268.0	278.0
305	ICP-MS	266.0	296.0	297.0	284.0	287.0
312	ICP-MS	271.0	316.0	319.0	300.0	311.0
359	ICP-MS	232.0	223.0	235.0	221.0	231.0
391	DRC/CC-ICP-MS	317.5	344.7	362.0	350.7	361.6
Arithmetic mean (n=8)		**264**	**287**	**296**	**280**	**287**
SD		25	36	36	37	38

Blood Tellurium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38

Blood Thorium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12

Blood Thallium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	10.0	14.2	4.6	2.5	7.5
147	ICP-MS	10.04	14	4.46	2.29	7.4
156	ICP-MS	<11.0	15.3	<11.0	<11.0	<11.0
159	ICP-MS	10.8	15.1	4.7	2.4	8.0
179	ICP-MS	10.0	15.0	5.0	2.0	8.0
197	ICP-MS	9.8	14.4	4.3	2.2	7.5
206	ICP-MS	10.6	14.8	4.4	2.3	7.4
312	ICP-MS	10.6	14.8	4.5	2.4	7.9
Arithmetic mean (n=7-8)		**10.3**	**14.7**	**4.6**	**2.3**	**7.7**
SD		0.4	0.5	0.2	0.2	0.3

Blood Tin (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	2.3	12.2	3.3	3.6	12.8
147	ICP-MS	2.01	11.15	4.67	3.92	13.06
156	ICP-MS	<11.0	<11.0	<11.0	<11.0	<11.0
197	ICP-MS	<5.0	10.5	<5.0	<5.0	11.9

Blood Uranium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
103	DRC/CC-ICP-MS	0.0	0.0	0.0	0.0	0.0
110	ICP-MS	<0.02	<0.02	<0.02	<0.02	<0.02
147	ICP-MS	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071
312	ICP-MS	<0.1	<0.1	<0.1	<0.1	<0.1

Blood Vanadium (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
147	ICP-MS	0.044	0.043	0.047	0.05	0.042

Blood Zinc (µg/L)

Lab Code	Method	BE12-06	BE12-07	BE12-08	BE12-09	BE12-10
110	ICP-MS	3207	3076	2248	2370	2139
114	ID-ICP-MS	3260.0	3160.0	2340.0	2420.0	2190.0
147	ICP-MS	3072	3007	2255	2320	2078
197	ICP-MS	2890.0	3500.0	2630.0	2710.0	2310.0
312	ICP-MS	3573.0	3499.0	2504.0	2706.0	2384.0
Arithmetic mean (n=5)		**3200**	**3248**	**2395**	**2505**	**2220**
SD		253	236	167	188	125

New York State Department of Health
Trace Elements in Whole Blood
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.