
Wadsworth Center

NEW YORK STATE DEPARTMENT OF HEALTH

Trace Elements Laboratory

TRACE ELEMENTS IN WHOLE BLOOD

Proficiency Test Report

Event #3, 2014

November 18th, 2014

NEW YORK
state department of
HEALTH

Howard A. Zucker, M.D., J.D.
Acting Commissioner of Health

Sue Kelly
Executive Deputy Commissioner

November 18, 2014

**Trace Elements in Whole Blood
Event #3, 2014**

Dear Laboratory Director:

Results from the third proficiency test (PT) event in 2014 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 October 23rd, 2014, and are reproduced here for completeness.

PT Materials

Test materials for the third 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 inorganic Hg^{2+}). In addition to As, Cd, Pb and Hg, blood pools were supplemented with the trace elements manganese (Mn), thallium (Tl), tin (Sn), titanium (Ti), nickel (Ni), cobalt (Co), chromium (Cr), silver (Ag), tungsten (W) and vanadium (V).

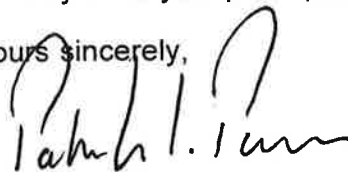
Additional Elements to Become Graded for Performance Assessment

PT results for select trace elements, including Co and Cr, are graded as part of this PT event, although the data are used for "Educational Purposes" only, to inform laboratory participants of where improved practices may be necessary. Laboratories that test and report these, and other, trace elements on patient specimens should continue to report results obtained for whole blood PT samples.

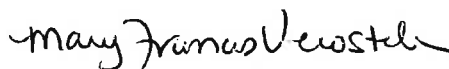
The next PT event for trace elements in whole blood is scheduled to be mailed Wednesday, January 14th, 2015. Please inform our laboratory staff at (518) 474-7161 if the test materials have not arrived within five days of the scheduled mail out date. **The deadline for reporting results is Wednesday, February 4th, 2015.**

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

New York State Department of Health
Event #3, 2014

Whole Blood Arsenic

Test materials for arsenic were prepared from caprine (goat) whole blood preserved with K₂EDTA anticoagulant. A total of five pools were supplemented with arsenic as inorganic As³⁺.

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 2.7 µg/L (0.04 µmol/L) to 42.8 µg/L (0.57 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, 98.9% of test results reported were judged as satisfactory, with none of the 19 laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

**New York State Department of Health
Blood Arsenic Test Results, 2014 Event #3
ROBUST STATISTICAL SUMMARY**

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
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Robust Mean	42.8	27.0	9.9	2.7	11.5
Robust Standard Deviation	2.8	1.5	1.8	1.1	1.4
Standard Uncertainty	0.8	0.4	0.6	0.4	0.4
RSD (%)	6.5	5.6	18.7	42.6	12.3
Number of Sample Measurements	19	19	16	12	18
Acceptable Range:					
Upper Limit	51.4	33.0	15.9	8.7	17.5
Lower Limit	34.2	21.0	3.9	0.0	5.5

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, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L whole blood)					Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15	
Target Values:		42.8	27.0	9.9	2.7	11.5	
103	DRC/CC-ICP-MS	44.8	28.2	8.9	2.0	11.2	Info
110	DRC/CC-ICP-MS	42.5	27.5	9.0	1.8	11.1	
114	ICP-MS	41.0	28.0	11.0	5.0	12.0	
147	ICP-MS	39.2	24.6	7.8	1.6	9.8	Info
156	DRC/CC-ICP-MS	43.0	27.0	8.6	<5.0	11.0	
164	ICP-MS	49.0	31.0	10.0	<3.0	11.0	
179	DRC/CC-ICP-MS	46.0	27	<12.0	<12.0	<12.0	
197	DRC/CC-ICP-MS	40	25	<10.0	<10.0	11	
200	ICP-MS	41.5	28.2	10.4	4.9	12.0	Info
206	DRC/CC-ICP-MS	41.9	25.9	<10.0	<10.0	10.9	
208	ICP-MS	43.4	28.1	12.4	<10.0	13.5	
293	DRC/CC-ICP-MS	53.1 ↑	32.6	10.4	2.5	14.1	Info
305	ICP-MS	43.0	26.0	8.0	2.0	10.0	
312	DRC/CC-ICP-MS	42.0	27.0	14.0	6.5	13.0	
324	ICP-MS	39.3	26.3	11.0	6.4	12.8	Info
339	HR-ICP-MS	44.0	26.5	8.4	1.9	10.8	Info
359	ICP-MS	42.7	27.1	12.6	6.3	15.1	
391	DRC/CC-ICP-MS	47.3	26.4	9.6	1.5	10.0	Info
481	ICP-MS	39.5	24.3	8.0	<3.0	9.7	

Percent satisfactory results for all participants: 98.9 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
▼ Result unacceptable
▲ Result not reported

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, 2014 Event #3
STATISTICAL SUMMARY BY METHOD

Results ($\mu\text{g/L}$ whole blood)					
	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	9	9	6	4	8
Mean:	44.5	27.4	10.1	2.0	11.5
Standard Deviation:	3.9	2.2	2.0	0.4	1.3
RSD (%):	8.8	7.9	20.1	21.6	11.5
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	44.0	26.5	8.4	1.9	10.8
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	9	9	9	4	9
Mean:	42.1	27.1	10.1	3.4	11.8
Standard Deviation:	3.1	2.1	1.8	1.8	1.8
RSD (%):	7.3	7.6	18.2	54.1	15.7
All Laboratories					
Number of Sample Measurements:	19	19	16	9	18
Mean:	43.3	27.2	10.0	2.6	11.6
Standard Deviation:	3.5	2.0	1.8	1.4	1.5
RSD (%):	8.2	7.4	18.3	53.3	13.3

notes: ? Insufficient data for calculation.

A Standard Deviation displayed as 0.0 should be interpreted as <0.1

New York State Department of Health
Event #3, 2014

Whole Blood Cadmium

Test materials for cadmium were prepared from caprine (goat) whole blood preserved with K₂EDTA anticoagulant. A total of five blood pools were supplemented with different amounts of cadmium (as Cd²⁺).

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 0.6 µg/L (5 nmol/L) to 13.9 µg/L (124 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, 94.1% of the results reported by all participants were satisfactory, with two of the 27 laboratories (7.4%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Cadmium Test Results, 2014 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
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Robust Mean	4.5	0.6	8.3	2.7	13.9
Robust Standard Deviation	0.3	0.1	0.6	0.2	1.1
Standard Uncertainty	<0.1	<0.1	0.2	<0.1	0.3
RSD (%)	6.5	14.5	7.7	8.8	8.0
Number of Sample Measurements	27	27	27	27	27
Acceptable Range:					
Upper Limit	5.5	1.6	9.5	3.7	16.0
Lower Limit	3.5	0.0	7.1	1.7	11.8

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, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L whole blood)					Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15	
Target Values:		4.5	0.6	8.3	2.7	13.9	
103	DRC/CC-ICP-MS	4.5	0.7	8.8	3.0	14.8	Info
106	ICP-MS	4.7	0.6	9.0	2.9	14.5	Info
107	ICP-MS	4.4	0.7	8.6	2.9	15.0	Info
109	ICP-MS	4.4	0.7	8.3	2.8	14.2	Info
110	ICP-MS	4.6	0.6	8.5	2.7	14.3	
114	ICP-MS	3.8	<0.5	7.2	2.4	11.5 ↓	
116	ICP-MS	4.3	0.5	8.5	2.8	14.7	Info
147	ICP-MS	4.1	0.6	7.7	2.5	13.0	Info
156	DRC/CC-ICP-MS	4.7	0.6	8.0	2.7	13.0	
164	ICP-MS	4.2	0.6	7.7	2.5	13.2	
179	DRC/CC-ICP-MS	4.5	0.6	8.3	2.6	14.1	
197	DRC/CC-ICP-MS	3.4 ↓	0.5	6.8 ↓	2.2	10.9 ↓	
200	ICP-MS	4.7	0.6	8.9	2.8	14.5	Info
206	ICP-MS	5.0	<1.0	8.3	2.7	13.8	
208	ICP-MS	4.5	0.8	7.9	2.7	13.5	
293	ICP-MS	4.4	0.6	8.3	2.6	14.1	Info
305	ICP-MS	4.4	<0.9	8.0	2.8	13.4	
312	ICP-MS	4.6	1.1	8.5	3.1	14.0	
324	ICP-MS	4.8	1.6	7.4	3.0	11.4 ↓	Info
325	ETAAS-Z	4.2	0.4	9.1	2.0	17.2 ↑	Info
339	HR-ICP-MS	4.1	0.6	7.6	2.6	12.9	Info
359	ICP-MS	4.5	0.8	7.9	2.7	13.3	
366	ETAAS-Z	4.6	0.6	8.8	2.8	15.1	Info
367	DRC/CC-ICP-MS	5.8 ↑	0.4	10.4 ↑	2.1	15.6	Info
391	DRC/CC-ICP-MS	4.7	0.62	8.1	2.5	13.1	Info
401	DRC/CC-ICP-MS	4.6	0.6	8.9	2.9	15.2	Info
410	ICP-MS	4.8	0.7	8.9	2.9	14.7	Info

Percent satisfactory results for all participants: 94.1 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
▼ Result unacceptable
▲ Result not reported

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, 2014 Event #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L whole blood)				
	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	7	7	7	7	7
Mean:	4.6	0.6	8.5	2.6	13.8
Standard Deviation:	0.7	0.1	1.1	0.3	1.6
RSD (%):	15.2	16.8	12.9	13.0	11.8
ETAAS-Z					
Number of Sample Measurements:	2	2	2	2	2
Mean:	4.4	0.5	9.0	2.4	16.2
Standard Deviation:	0.3	0.1	0.2	0.6	1.5
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	4.1	0.6	7.6	2.6	12.9
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	17	13	17	17	17
Mean:	4.5	0.7	8.2	2.8	13.7
Standard Deviation:	0.3	0.2	0.5	0.2	1.0
RSD (%):	6.5	22.2	6.4	6.7	7.5
All Laboratories					
Number of Sample Measurements:	27	23	27	27	27
Mean:	4.5	0.6	8.3	2.7	13.9
Standard Deviation:	0.4	0.1	0.7	0.3	1.3
RSD (%):	9.4	22.6	8.6	10.0	9.7

notes: ? Insufficient data for calculation.

A Standard Deviation displayed as 0.0 should be interpreted as <0.1

New York State Department of Health
Event #3, 2014

Whole Blood Mercury

Test materials for mercury were prepared from caprine (goat) whole blood preserved with K₂EDTA anticoagulant. A total of five pools were supplemented with different amounts of mercury as inorganic Hg²⁺.

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 2.6 µg/L (13 nmol/L) to 49.5 µg/L (247 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, 98.5% of results reported by all participants were satisfactory, with one of the 27 laboratories (3.7%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Mercury Test Results, 2014 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
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Robust Mean	10.0	49.5	2.6	4.4	15.7
Robust Standard Deviation	0.9	4.2	0.5	0.4	1.4
Standard Uncertainty	0.2	1.0	0.1	0.1	0.3
RSD (%)	9.1	8.5	20.3	9.9	9.2
Number of Sample Measurements	27	27	27	25	27
Acceptable Range:					
Upper Limit	13.0	64.4	5.6	7.4	20.4
Lower Limit	7.0	34.6	0.0	1.4	11.0

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, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L whole blood)					Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15	
Target Values:		10.0	49.5	2.6	4.4	15.7	
103	DRC/CC-ICP-MS	10.3	49.5	3.7	4.6	16.5	Info
106	DRC/CC-ICP-MS	9.9	50.6	2.3	4.8	14.8	Info
107	DRC/CC-ICP-MS	10.0	53.0	2.2	4.5	17.0	Info
109	ICP-MS	9.6	48.5	2.3	4.1	15.4	Info
110	ICP-MS	9.9	48.3	2.8	4.4	15.5	
114	ICP-MS	10.9	55.4	3.1	5.4	16.7	
116	ICP-MS	10.0	50.1	2.5	4.3	16.1	Info
147	ICP-MS	9.6	47.5	3.1	3.9	15.2	Info
156	ICP-MS	9.9	46.0	<3.0	4.3	14.0	
164	ICP-MS	11.0	57.0	<4.0	5.0	18.0	
179	DRC/CC-ICP-MS	11.0	52.0	2.0	4.0	17.0	
197	DRC/CC-ICP-MS	9.0	44.0	<5.0	<5.0	13.0	
200	ICP-MS	9.7	48.2	2.7	4.6	16.0	Info
206	ICP-MS	9.3	45.6	2.1	4.1	14.2	
208	ICP-MS	10.9	54.6	<5.0	5	16.2	
293	ICP-MS	10.3	51.1	2.7	4.6	16.3	Info
305	ICP-MS	14.0 ↑	56.0	11.0 ↑	5.0	16.0	
312	ICP-MS	10.0	48.0	2.9	4.3	15.0	
339	HR-ICP-MS	9.5	45.5	2.2	3.9	14.3	Info
359	ICP-MS	11.1	54.7	3.0	4.6	16.8	
366	ICP-MS	11.7	52.0	3.3	5.0	19.0	Info
367	CV-AAS	10.7	52.0	2.3	4.7	17.3	Info
391	CV-AAS	8.0	38.5	2.8	3.9	12.3	Info
401	DRC/CC-ICP-MS	9.4	47.1	2.0	4.2	15.4	Info
410	ICP-MS	10.2	50.9	2.5	4.3	16.2	Info
453	Atomic Spectrometry Other	8.0	45.0	2.0	4.0	14.0	Info
481	ICP-MS	8.5	43.3	<5.0	<5.0	13.1	

Percent satisfactory results for all participants: 98.5 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
▼: Result unacceptable
▲: Result not reported

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, 2014 Event #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L whole blood)				
	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
Atomic Spectrometry					
Number of Sample Measurements:	1	1	1	1	1
Mean:	8.0	45.0	2.0	4.0	14.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	9.4	45.3	2.6	4.3	14.8
Standard Deviation:	1.9	9.5	0.4	0.6	3.5
RSD (%):	—	—	—	—	—
DRC/CC-ICP-MS					
Number of Sample Measurements:	6	6	5	5	6
Mean:	9.9	49.4	2.4	4.4	15.6
Standard Deviation:	0.7	3.3	0.7	0.3	1.6
RSD (%):	7.0	6.8	29.4	7.2	10.0
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	9.5	45.5	2.2	3.9	14.3
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	17	17	12	16	17
Mean:	10.4	50.4	2.8	4.6	15.9
Standard Deviation:	1.2	4.0	0.4	0.4	1.4
RSD (%):	11.7	8.0	12.9	9.2	8.9
All Laboratories					
Number of Sample Measurements:	27	27	21	25	27
Mean:	10.1	49.4	2.6	4.5	15.6
Standard Deviation:	1.2	4.4	0.5	0.4	1.6
RSD (%):	11.8	8.8	18.3	9.3	10.0

notes: ? Insufficient data for calculation.

A Standard Deviation displayed as 0.0 should be interpreted as <0.1

New York State Department of Health
Event #3, 2014

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 K₂EDTA anticoagulant.

Target values were established as the mean of 19 measurements performed by 17 reference laboratories using ICP-MS, ETAAS and ASV methods. Values range from 3 µg/dL to 39 µg/dL. Among the reference group, imprecision (SD) varied from 0.5 - 1.5 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, 97.4% of results reported by all participants were judged as satisfactory, with one of 86 participant laboratories (1.2%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Lead Test Results, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/dL whole blood)					Normalized Mean	Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15		
Target values:		12	3	15	39	21		
103	ASV-LeadCare II	13	<3	17	39	20	1.04	Info
103	DRC/CC-ICP-MS	13	3	15	41	21	1.03	
104	ETAAS-Z	12	2	16	39	21	1.02	
106	ICP-MS	13	3	16	41	21	1.05	Info
107	ASV-LeadCare II	12	<3	15	42	21	1.02	Info
107	ICP-MS	13	3	16	41	22	1.06	
109	ASV-LeadCare II	13	<3.3	15	37	17	0.96	Info
109	ETAAS-Z	13	2	16	40	20	1.03	
109	ICP-MS	12	3	15	38	20	0.98	
110	ETAAS-Z	12	2	15	38	20	0.98	
110	ASV-LeadCare II	13	<3	15	37	18	0.97	Info
110	ICP-MS	13	3	15	40	21	1.03	
112	ETAAS-Z	13	3	15	40	20	1.02	
114	ICP-MS	14	3	17	41	22	1.10	
116	ICP-MS	13	3	15	40	21	1.03	Info
121	ETAAS-Z	12	2	14	35	18	0.92	Info
123	ETAAS-Z	11	3	14	36	18	0.91	
126	ETAAS-Z	12	<3	15	37	21	0.99	
131	ETAAS-Z	13	6	13	37	19	0.95	
143	ETAAS-Z	13	2	15	38	21	1.01	
144	ETAAS-Z	13	3	15	37	20	1.00	
147	ICP-MS	12	3	15	40	21	1.01	
150	ETAAS-Z	13	3	15	37	20	1.00	

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.

ND: non-detect

▼: Result unacceptable

New York State Department of Health
Blood Lead Test Results, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/dL whole blood)					Normalized Mean	Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15		
Target values:		12	3	15	39	21		
156	DRC/CC-ICP-MS	12	3	14	37	19	0.95	
158	ICP-MS	11	<3	14	38	20	0.94	
160	ICP-MS	12	3	15	39	22	1.01	
164	ICP-MS	12	3	15	37	19	0.96	
166	ETAAS-Z	13	2	15	40	20	1.02	
168	ETAAS-Z	14	3	17	42	21	1.09	
179	DRC/CC-ICP-MS	13	3	15	39	21	1.02	
197	ICP-MS	12	3	15	38	20	0.98	
198	ETAAS-Z	12	3	15	36	20	0.97	
200	ICP-MS	12	3	16	41	23	1.05	
204	ASV-3010	12	3	17	35	20	1.00	
206	ICP-MS	12	3	15	40	21	1.01	
208	ETAAS-Z	11	<3	13	29 ↓	19	0.86	
232	ASV-3010	11	<2	13	36	19	0.90	
237	ETAAS-Z	14	3	16	41	22	1.08	
243	ASV-3010	11	2	15	40	20	0.97	
254	ETAAS-Z	13	3	16	40	23	1.07	
255	ETAAS-Z	13	3	15	38	20	1.00	
269	ETAAS-Z	14	2	16	42	22	1.09	
272	ETAAS-Z	11	3	14	32 ↓	19	0.89	
279	ETAAS-Z	12	3	15	38	21	0.99	
290	ICP-MS	13	3	16	40	21	1.04	
291	ASV-LeadCare Ultra	12	<2	16	46 ↑	21	1.06	

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.

ND: non-detect

▼: Result unacceptable

New York State Department of Health
Blood Lead Test Results, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/dL whole blood)					Normalized Mean	Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15		
Target values:		12	3	15	39	21		
293	ICP-MS	12	3	15	37	20	0.98	
295	ASV-3010	12	2	16	40	22	1.03	
301	ETAAS Other	12	2	14	36	16 ↓	0.90	
305	ETAAS-Z	12	3	14	36	19	0.94	
312	ICP-MS	12	3	16	39	20	1.00	
317	ETAAS-Z	12	2	15	39	20	0.99	
324	ETAAS-Z	13	3	15	34 ↓	19	0.96	Info
324	ICP-MS	12	3	14	34 ↓	19	0.93	Info
325	ETAAS-Z	12	3	15	39	20	0.99	
333	ETAAS-Z	13	3	15	38	20	1.00	
337	ASV-LeadCare II	13	<3	16	38	18	1.00	
339	HR-ICP-MS	12	3	14	35	19	0.93	Info
340	ETAAS-Z	12	3	15	38	20	0.98	
343	ASV-LeadCare	11	3	15	40	19	0.96	Info
345	ASV-LeadCare II	16	<3	19	41	20	1.15	
348	ETAAS-Z	13	2	15	39	21	1.02	
349	ETAAS-Z	12	2	15	36	20	0.97	
350	ASV-LeadCare Ultra	12	2	16	45 ↑	23	1.08	
365	ETAAS-Z	12	3	15	36	19	0.96	
366	ETAAS-Z	13	3	16	43	22	1.08	Info
367	DRC/CC-ICP-MS	14	3	16	40	22	1.08	Info
368	ASV-3010	12	4	15	38	20	0.98	
369	ASV-3010	12	2	15	40	20	0.99	

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.

ND: non-detect

▼: Result unacceptable

New York State Department of Health
Blood Lead Test Results, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/dL whole blood)					Normalized Mean	Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15		
Target values:		12	3	15	39	21		
374	ASV-3010	10	<2	13	39	17	0.89	
384	ASV-3010	11	3	14	32 ↓	17	0.87	
388	ASV-LeadCare Ultra	13	3	16	40	21	1.04	
389	ETAAS-Z	12	2	15	38	20	0.98	
391	ETAAS-Z	13	3	16	41	21	1.05	Info
393	ASV-LeadCare II	13	<3	16	>37	20	1.03	
401	DRC/CC-ICP-MS	13	3	16	40	21	1.04	Info
410	ICP-MS	13	3	16	39	21	1.04	Info
461	ASV-LeadCare Ultra	12	2	14	41	23	1.02	
464	ASV-LeadCare II	13	<3	17	40	20	1.05	
466	ASV-LeadCare	11	3	16	36	19	0.95	
469	ICP-MS	11	2	14	38	20	0.94	
470	ASV-LeadCare II	13	<3	16	40	20	1.03	
476	ASV-LeadCare	12	3	14	35	16 ↓	0.90	
477	ASV-LeadCare II	11	<3	15	35	20	0.94	
481	ICP-MS	11	2	12	34 ↓	14 ↓	0.81	
482	ASV-LeadCare II	12	3	16	38	18	0.97	

Percent satisfactory results for all participants: 97.4 %

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.

ND: non-detect

▼: Result unacceptable

**New York State Department of Health
Blood Lead Test Results, 2014 Event #3
STATISTICAL SUMMARY**

Lab Code	Method	TARGET VALUE ASSIGNMENT AND STATISTICS				
		Results (µg/dL whole blood)				
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
103	DRC/CC-ICP-MS	13	3	15	41	21
104	ETAAS-Z	12	2	16	39	21
107	ICP-MS	13	3	16	41	22
109	ETAAS-Z	13	2	16	40	20
109	ICP-MS	12	3	15	38	20
110	ETAAS-Z	12	2	15	38	20
110	ICP-MS	13	3	15	40	21
112	ETAAS-Z	13	3	15	40	20
147	ICP-MS	12	3	15	40	21
156	DRC/CC-ICP-MS	12	3	14	37	19
160	ICP-MS	12	3	15	39	22
164	ICP-MS	12	3	15	37	19
166	ETAAS-Z	13	2	15	40	20
179	DRC/CC-ICP-MS	13	3	15	39	21
198	ETAAS-Z	12	3	15	36	20
200	ICP-MS	12	3	16	41	23
243	ASV-3010	11	2	15	40	20
293	ICP-MS	12	3	15	37	20
325	ETAAS-Z	12	3	15	39	20
Number of Sample Measurements:		19	19	19	19	19
Mean (target value):		12	3	15	39	21
Standard Deviation:		0.6	0.5	0.5	1.5	1.0
RSD (%):		4.7	16.5	3.3	3.9	5.0
Acceptable Range:						
Upper Limit:		16	7	19	43	25
Lower Limit:		8	0	11	35	17

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, 2014 Event #3
STATISTICAL SUMMARY BY CLASS**

	Results ($\mu\text{g/dL}$ whole blood)				
	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
Evaluated					
Number of Sample Measurements:	51	38	51	50	51
Mean:	12.3	2.7	15.1	38.1	19.9
Standard Deviation:	1.1	0.5	1.3	3.0	1.8
RSD (%):	8.6	19.6	8.3	7.9	8.9
Info					
Number of Sample Measurements:	16	12	16	16	16
Mean:	12.7	2.9	15.3	38.6	19.9
Standard Deviation:	0.7	0.3	0.9	2.9	1.5
RSD (%):	5.5	9.9	5.7	7.5	7.7
Reference					
Number of Sample Measurements:	19	19	19	19	19
Mean:	12.3	2.7	15.2	39.1	20.5
Standard Deviation:	0.6	0.5	0.5	1.5	1.0
RSD (%):	4.7	16.5	3.3	3.9	5.0
All Laboratories					
Number of Sample Measurements:	86	69	86	85	86
Mean:	12.4	2.7	15.2	38.4	20.0
Standard Deviation:	0.9	0.5	1.1	2.7	1.6
RSD (%):	7.4	17.3	7.0	7.1	8.0

notes: ? Insufficient data for calculation.

**New York State Department of Health
Blood Lead Test Results, 2014 Event #3
STATISTICAL SUMMARY BY METHOD**

		Results (µg/dL whole blood)				
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
ASV-3010						
Number of Sample Measurements:		8	6	8	8	8
Mean:		11.4	2.7	14.8	37.5	19.4
Standard Deviation:		0.7	0.8	1.4	2.9	1.7
RSD (%):		6.5	30.6	9.4	7.8	8.7
ASV-LeadCare						
Number of Sample Measurements:		3	3	3	3	3
Mean:		11.3	3.0	15.0	37.0	18.0
Standard Deviation:		0.6	0.0	1.0	2.6	1.7
RSD (%):		—	—	—	—	—
ASV-LeadCare II						
Number of Sample Measurements:		11	1	11	10	11
Mean:		12.9	3.0	16.1	38.7	19.3
Standard Deviation:		1.2	?	1.2	2.1	1.3
RSD (%):		9.5	—	7.6	5.5	6.6
ASV-LeadCare Ultra						
Number of Sample Measurements:		4	3	4	4	4
Mean:		12.3	2.3	15.5	43.0	22.0
Standard Deviation:		0.5	0.6	1.0	2.9	1.2
RSD (%):		4.1	—	6.5	6.8	5.2
DRC/CC-ICP-MS						
Number of Sample Measurements:		5	5	5	5	5
Mean:		13.0	3.0	15.2	39.4	20.8
Standard Deviation:		0.7	0.0	0.8	1.5	1.1
RSD (%):		5.4	0.0	5.5	3.8	5.3
ETAAS Other						
Number of Sample Measurements:		1	1	1	1	1
Mean:		12.0	2.0	14.0	36.0	16.0
Standard Deviation:		?	?	?	?	?
RSD (%):		—	—	—	—	—
ETAAS-Z						
Number of Sample Measurements:		33	30	33	33	33
Mean:		12.5	2.6	15.0	37.8	20.2
Standard Deviation:		0.8	0.5	0.8	2.9	1.1
RSD (%):		6.4	18.6	5.6	7.5	5.6
HR-ICP-MS						
Number of Sample Measurements:		1	1	1	1	1
Mean:		12.0	3.0	14.0	35.0	19.0
Standard Deviation:		?	?	?	?	?
RSD (%):		—	—	—	—	—

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, 2014 Event #3
STATISTICAL SUMMARY BY METHOD**

		Results ($\mu\text{g/dL}$ whole blood)				
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
ICP-MS						
Number of Sample Measurements:		20	19	20	20	20
Mean:		12.3	2.9	15.1	38.8	20.4
Standard Deviation:		0.8	0.3	1.1	2.1	1.8
RSD (%):		6.4	10.9	7.1	5.4	8.9
All Laboratories						
Number of Sample Measurements:		86	69	86	85	86
Mean:		12.4	2.7	15.2	38.4	20.0
Standard Deviation:		0.9	0.5	1.1	2.7	1.6
RSD (%):		7.4	17.3	7.0	7.1	8.0

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
Event #3, 2014

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 the additional trace elements cobalt (Co) and chromium (Cr) are reported here. Although these data are provided solely for educational and informational purposes, target values and acceptable ranges are provided. The New York State grading criteria were established after discussions with the FDA and with other trace element PT scheme organizers. Departures from the acceptable ranges should trigger an internal Quality Assurance review.

Additional Elements

Co and Cr

New York State Department of Health
Event #3, 2014

Whole Blood Cobalt

Test materials for chromium were prepared from caprine (goat) whole blood preserved with K₂EDTA anticoagulant. A total of five pools were supplemented with cobalt as inorganic Co²⁺.

The Target Values assigned for each PT material is the arithmetic mean of the results reported by all participants for the event. Values for whole blood cobalt range from 2.7 µg/L to 19.4 µg/L after outlier exclusion.

Acceptable range: The acceptable range for cobalt is set at ±1.5 µg/L or ±20%, whichever is greater. Thus, it is fixed at ±1.5 µg/L for concentrations below 7.5 µg/L. These NYS grading criteria were established after discussions with the FDA and with other trace element PT scheme organizers.

Discussion: Based upon the above criteria, 98.2% of test results reported were within the acceptable ranges, with none of the 11 laboratories reporting 2 or more of the 5 results outside the acceptable ranges. Upward and downward indicator arrows next to individual results should be used as part of a laboratory's on-going internal quality assessment (QA) program. Note that this grading scheme is intended for educational purposes. Departures from the acceptable ranges should trigger an internal QA review.

New York State Department of Health
Blood Cobalt Test Results, 2014 Event #3
STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

BE14-11 BE14-12 BE14-13 BE14-14 BE14-15

Arithmetic Mean*	15.2	2.7	7.0	7.8	19.4
Standard Deviation	1.2	0.3	0.6	0.7	2.2
RSD (%)	7.9	10.6	8.6	8.4	11.1
Number of Sample Measurements*	11	11	11	11	11
Acceptable Range:					
Upper Limit	18.2	4.2	8.5	9.4	23.3
Lower Limit	12.2	1.2	5.5	6.2	15.5

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

* Outliers identified by Grubbs' test excluded

New York State Department of Health
Blood Cobalt Test Results, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L whole blood)					Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15	
Target Values:		15.2	2.7	7.0	7.8	19.4	
103	DRC/CC-ICP-MS	15.5	2.8	7.4	8.5	20.2	Info
110	ICP-MS	15.7	3.0	7.2	8.2	19.5	
147	ICP-MS	15.4	2.77	7.07	7.78	19.6	Info
156	DRC/CC-ICP-MS	14	2.4	6.5	7.4	18	
164	ICP-MS	14.9	2.9	6.7	7.9	18.9	
197	ICP-MS	13.2	2.3	5.9	6.8	16.7	
206	ICP-MS	15.1	2.6	6.9	7.6	19.0	
305	ICP-MS	13.6	2.6	6.3	7.1	17.5	
312	ICP-MS	17	3.2	8.0	8.7	22	
366	ICP-MS	16.7	3.1	7.6	8.5	24.1 ↑	Info
391	DRC/CC-ICP-MS	15.7	2.5	7.1	7.0	17.5	Info

Percent satisfactory results for all participants: 98.2 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
▼ Result unacceptable
▲ Result not reported

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 Cobalt Test Results, 2014 Event #3
STATISTICAL SUMMARY BY METHOD

Results ($\mu\text{g/L}$ whole blood)					
	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	15.1	2.6	7.0	7.6	18.6
Standard Deviation:	0.9	0.2	0.5	0.8	1.4
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	8	8	8	8	8
Mean:	15.2	2.8	7.0	7.8	19.7
Standard Deviation:	1.3	0.3	0.7	0.7	2.4
RSD (%):	8.8	10.7	9.7	8.4	12.1
All Laboratories					
Number of Sample Measurements:	11	11	11	11	11
Mean:	15.2	2.7	7.0	7.8	19.4
Standard Deviation:	1.2	0.3	0.6	0.7	2.2
RSD (%):	7.9	10.6	8.6	8.4	11.1

notes: ? Insufficient data for calculation.

A Standard Deviation displayed as 0.0 should be interpreted as <0.1

New York State Department of Health
Event #3, 2014

Whole Blood Chromium

Test materials for chromium were prepared from caprine (goat) whole blood preserved with K₂EDTA anticoagulant. A total of five pools were supplemented with chromium as inorganic Cr³⁺.

The Target Values assigned for each PT material is the arithmetic mean of the results reported by all participants for the event. Values for whole blood chromium range from 2.7 µg/L (52 nmol/L) to 15.9 µg/L (306 nmol/L) after outlier exclusion.

Acceptable range: The acceptable range for chromium is set at ±2 µg/L or ±20%, whichever is greater. Thus, it is fixed at ±2 µg/L for concentrations below 10 µg/L. These NYS grading criteria were established after discussions with the FDA and with other trace element PT scheme organizers.

Discussion: Based upon the above criteria, 96.0% of test results reported were within the acceptable ranges, with none of the 10 laboratories reporting 2 or more of the 5 results outside the acceptable ranges. Upward and downward indicator arrows next to individual results should be used as part of a laboratory's on-going internal quality assessment (QA) program. Note that this grading scheme is intended for educational purposes. Departures from the acceptable ranges should trigger an internal QA review.

New York State Department of Health
Blood Chromium Test Results, 2014 Event #3
STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
Arithmetic Mean*	13.5	2.7	15.9	3.9	9.0
Standard Deviation	1.7	0.5	1.6	0.5	0.7
RSD (%)	12.9	16.5	10.1	12.4	8.2
Number of Sample Measurements*	10	10	10	10	9
Acceptable Range:					
Upper Limit	16.2	4.7	19.1	5.9	11.0
Lower Limit	10.8	0.7	12.7	1.9	7.0

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

* Outliers identified by Grubbs' test excluded

New York State Department of Health
Blood Chromium Test Results, 2014 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L whole blood)					Info Only
		BE14-11	BE14-12	BE14-13	BE14-14	BE14-15	
Target Values:		13.5	2.7	15.9	3.9	9.0	
103	DRC/CC-ICP-MS	14.1	2.7	18.0	4.5	9.7	Info
110	DRC/CC-ICP-MS	13.4	2.6	16.3	4.0	9.1	
147	DRC/CC-ICP-MS	13.7	2.66	16.90	4.02	9.57	Info
156	DRC/CC-ICP-MS	14	2.6	16	3.8	8.9	
164	DRC/CC-ICP-MS	12.8	2.5	15.1	3.7	8.5	
197	DRC/CC-ICP-MS	12.5	2.7	15.0	3.9	8.5	
305	ICP-MS	11.7	1.9	13.3	3.1	7.6	
312	DRC/CC-ICP-MS	11	3.5	14	4.9	6.0 ↓	
366	ICP-MS	14.0	3.4	15.8	3.9	9.6	Info
391	DRC/CC-ICP-MS	17.4 ↑	2.8	18.3	3.6	9.9	Info

Percent satisfactory results for all participants: 96.0 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
▼: Result unacceptable
▲: Result not reported

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 Chromium Test Results, 2014 Event #3
STATISTICAL SUMMARY BY METHOD

Results ($\mu\text{g/L}$ whole blood)					
	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	8	8	8	8	8
Mean:	13.6	2.8	16.2	4.1	8.8
Standard Deviation:	1.8	0.3	1.5	0.4	1.2
RSD (%):	13.5	11.3	9.2	10.8	14.1
ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	12.9	2.7	14.6	3.5	8.6
Standard Deviation:	1.6	1.1	1.8	0.6	1.4
RSD (%):	—	—	—	—	—
All Laboratories					
Number of Sample Measurements:	10	10	10	10	10
Mean:	13.5	2.7	15.9	3.9	8.7
Standard Deviation:	1.7	0.5	1.6	0.5	1.2
RSD (%):	12.9	16.5	10.1	12.4	13.6

notes: ? Insufficient data for calculation.

A Standard Deviation displayed as 0.0 should be interpreted as <0.1

New York State Department of Health
Event #3, 2014

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 the following additional trace elements as indicated below

Additional Elements

Mn, Sn, Tl, Ti, V, W, Ni, Ag

New York State Department of Health
Whole Blood Additional Elements, 2014 Event #3
Page 1

Blood Aluminum (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
147	ICP-MS	<5.40	<5.40	<5.40	<5.40	<5.40
305	ICP-MS	18.4	26.7	18.7	30.1	29.7
359	ICP-MS	34.7	31.3	40.4	38.3	41

Blood Antimony (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
103	DRC/CC-ICP-MS	<0.17	<0.17	<0.17	<0.17	<0.17
110	ICP-MS	<0.10	0.11	<0.10	0.13	0.10
147	ICP-MS	<0.037	<0.037	<0.037	<0.037	<0.037
206	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0

Blood Barium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
147	ICP-MS	13.7	19.6	17.2	17.2	17.4
197	ICP-MS	13.4	19.8	17.6	16.9	17.7
312	ICP-MS	14	22	19	17	18
	Arithmetic Mean	13.7	20	18	17.0	17.7
	SD	0.3	1	1	0.2	0.3
	n	3	3	3	3	3

Blood Beryllium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
110	ICP-MS	1.3	1.3	1.5	1.6	1.7
147	ICP-MS	<1.80	<1.80	<1.80	<1.80	<1.80
197	ICP-MS	0.2	0.2	0.2	<0.2	0.2

Blood Bismuth (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
114	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0
147	ICP-MS	<0.0063	<0.0063	<0.0063	<0.0063	<0.0063
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0
206	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0
305	ICP-MS	<0.5	<0.5	<0.5	<0.5	<0.5

Blood Cesium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
110	ICP-MS	0.4	0.3	0.5	0.4	0.4

Blood Copper (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
110	ICP-MS	1213	1124	1123	1143	1154
147	ICP-MS	1131	1061	1056	1048	1067
197	ICP-MS	1110	1000	1010	1010	1030
312	ICP-MS	1254	1182	1157	1191	1224
	Arithmetic mean	1177	1092	1087	1098	1119
	SD	68	79	66	84	87
	n	4	4	4	4	4

Blood Iodine (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
147	ICP-MS	40	30.4	41.1	37.7	54.9

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Blood Lithium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
147	ICP-MS	1.08	3.21	2.55	2.42	2.92

Blood Manganese (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
103	DRC/CC-ICP-MS	19.8	15.3	30.1	34.3	29.4
107	DRC/CC-ICP-MS	19	16	30	36	30
110	ETAAS-Z	19.9	16.0	29.9	35.3	30.2
114	ICP-MS	17.1	14.5	27.8	30.4	25.8
147	ICP-MS	18.4	15	28.6	33.5	28.4
156	ICP-MS	19	15	29	38	33
179	DRC/CC-ICP-MS	20.1	16.7	31.0	36.5	30.9
197	DRC/CC-ICP-MS	18.4	13.5	27.3	33.6	26.6
206	ICP-MS	24.1	19.3	35.4	42.9	37.2
293	ICP-MS	18.5	16.2	28.6	34.0	27.7
305	ICP-MS	17.1	13.7	26.6	30.7	26.1
312	DRC/CC-ICP-MS	23	21	*43	41	39
324	HR-ICP-MS	*3.908	*3.508	18.575	*20.133	*13.6
391	DRC/CC-ICP-MS	23.1	13.5	28.7	31.8	27.8
<i>*Outlier</i>	Arithmetic mean	20	16	29	35	30
	SD	2	2	4	4	4
	n	13	13	13	13	13

Blood Molybdenum (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
103	DRC/CC-ICP-MS	3.8	3.6	2.9	4.6	3.0
110	ICP-MS	4.3	4.6	3.6	5.3	3.9
147	ICP-MS	3.62	3.6	2.73	4.28	2.78
197	ICP-MS	3.6	3.6	2.6	4.3	2.7
305	ICP-MS	3.5	2.9	2.5	4.1	2.3
312	ICP-MS	4.5	4.9	4.0	5.6	3.5
324	HR-ICP-MS	3.525	3.433	2.717	4.067	2.842
	Arithmetic mean	3.8	3.8	3.0	4.6	3.0
	SD	0.4	0.7	0.6	0.6	0.5
	n	7	7	7	7	7

Blood Nickel (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
110	DRC/CC-ICP-MS	8.3	19.0	12.6	2.0	6.5
147	ICP-MS	8.28	20.1	13.8	2.04	5.54
197	ICP-MS	8.9	21.8	14.9	2.4	6.0
312	ICP-MS	11	25	17	*4.5	7.4
<i>*Outlier</i>	Arithmetic mean	9	21	15	2.1	6.4
	SD	1	3	2	0.2	0.8
	n	4	4	4	3	4

Blood Platinum (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
110	ICP-MS	<0.10	<0.10	<0.10	<0.10	<0.10
312	ICP-MS	<0.2	<0.2	<0.2	<0.2	<0.2

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Blood Selenium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
103	DRC/CC-ICP-MS	243	257	320	230	260
107	DRC/CC-ICP-MS	250	270	360	280	280
109	ICP-MS	239	262	345	263	271
114	ICP-MS	259	268	338	276	276
147	ICP-MS	220	245	314	241	248
305	ICP-MS	281	298	402	295	289
312	ICP-MS	275	308	423	306	320
359	ICP-MS	266	283	368	282	291
	Arithmetic Mean	254	274	359	272	279
	SD	20	21	38	26	22
	n	8	8	8	8	8

Blood Silver (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
147	ICP-MS	16.4	3.18	10.1	2.52	5.24
197	ICP-MS	17.0	3.3	10.3	2.7	5.2

Blood Tellurium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
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

Blood Thorium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
147	ICP-MS	<0.028	<0.028	<0.028	<0.028	<0.028

Blood Thallium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
103	DRC/CC-ICP-MS	10.3	6.9	15.9	2.5	1.0
110	ICP-MS	10.3	6.8	15.0	2.4	1.0
147	ICP-MS	10.1	6.73	15.2	2.25	0.92
156	DRC/CC-ICP-MS	10	7	15	2.1	0.84
179	ICP-MS	10	7	15	2	<1
197	ICP-MS	9.9	6.3	13.9	2.0	<1.0
206	ICP-MS	9.8	6.5	14.7	2.3	<1.0
305	ICP-MS	8.2	5.3	*11.4	1.8	0.3
312	ICP-MS	10	7.1	15	2.3	0.9
324	HR-ICP-MS	*0.819	*2.008	13.242	*5.942	*9.042
<i>*Outlier</i>	Arithmetic mean	9.8	6.6	14.8	2.2	0.8
	SD	0.6	0.6	0.8	0.2	0.3
	n	9	9	9	9	6

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Blood Tin (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
110	ICP-MS	19.1	3.5	14.5	2.0	9.0
147	ICP-MS	17.6	3.1	13.4	*1.65	8.42
156	DRC/CC-ICP-MS	19	3.6	12	2	8.5
197	ICP-MS	17.5	<5.0	12.7	<5.0	8.0
<i>*Outlier</i>	Arithmetic Mean	18	3.4	13	-	8.5
	SD	1	0.3	1	-	0.4
	n	4	3	4	-	4

Blood Tungsten (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
324	HR-ICP-MS	9.333	7.283	13.867	1.521	4.667

Blood Uranium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
103	DRC/CC-ICP-MS	<0.0099	<0.0099	<0.0099	<0.0099	<0.0099
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
324	HR-ICP-MS	0.009	0.008	0.009	0.009	0.011

Blood Vanadium (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
110	DRC/CC-ICP-MS	17.9	5.1	8.2	12.1	2.1
147	DRC/CC-ICP-MS	19.4	5.71	8.78	10.8	2.24
312	DRC/CC-ICP-MS	23	8.2	10	13	3.4
	Arithmetic Mean	20	6	9	12	2.6
	SD	3	2	1	1	0.7
	n	3	3	3	3	3

Blood Zinc (µg/L)						
Lab Code	Method	BE14-11	BE14-12	BE14-13	BE14-14	BE14-15
110	ICP-MS	3049	1982	2027	1968	2349
114	ICP-MS	*308	*213	*194	*207	*241
147	ICP-MS	2961	1922	1752	1915	2314
197	ICP-MS	2750	1770	1600	1590	2060
206	ICP-MS	3336	2209	2003	2138	2537
312	ICP-MS	3363	2217	2067	2183	2622
<i>*Outlier</i>	Arithmetic mean	3092	2020	1890	1959	2376
	SD	259	192	204	235	218
	n	5	5	5	5	5

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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.
