Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN WHOLE BLOOD

Event #3, 2010

November 22, 2010



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

Richard F. Daines, M.D. Commissioner

James W. Clyne, Jr.. Executive Deputy Commisioner

November 22, 2010

Trace Elements in Whole Blood Event #3, 2010

Dear Laboratory Director:

Results from the third proficiency test (PT) event in 2010 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 November 18th, 2010, and are reproduced here for completeness.

PT Materials

Test materials for the second 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 different amounts of arsenic (as As^{3+}), cadmium (as Cd^{2+}) and mercury as both inorganic (Hg²⁺) and as methylmercury (CH₃Hg⁺) species. In addition to As, Cd, Pb and Hg, blood pools were supplemented with the trace elements manganese, thallium and tin.

Assignment of Target Values for Trace Elements

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

The next PT event for trace elements in whole blood is scheduled to be mailed Wednesday, January 12th, 2011. Please inform our laboratory staff at (518) 473-0452 if the test materials have not arrived within five days of the scheduled mail out date. The deadline for reporting results is Wednesday, February 2nd, 2011

Thank you for your participation in this event.

Yours sincerely.

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

Whole Blood Arsenic

Test materials for arsenic were prepared from caprine (goat) whole blood preserved with K_2 EDTA 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** <u>Statistical methods for use in proficiency testing by interlaboratory comparisons</u>. Values for whole blood arsenic range from 7.9 μ g/L (0.11 μ mol/L) to 62.1 μ g/L (0.83 μ mol/L).

Acceptable range: The acceptable range for arsenic is set at $\pm 6 \ \mu g/L$ or $\pm 20\%$, whichever is greater. Thus, it is fixed at $\pm 6 \ \mu g/L$ for concentrations below 30 $\mu g/L$.

Discussion: Based upon the above criteria, 92.0% of test results reported were judged as satisfactory, with one of the 20 laboratories (5.0%) reporting 2 or more of the 5 results outside the acceptable ranges.

TARGET VALUE ASSIGNMENT AND STATISTICS									
		Result	s (µg/L whole	e blood)					
	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15				
Robust Mean	44.5	22.4	7.9	62.1	35.4				
Robust Standard Deviation	4.3	2.6	2.9	5.8	2.9				
Standard Uncertainty	1.2	0.7	0.9	1.6	0.8				
RSD (%)	9.7	11.5	36.7	9.4	8.2				
Acceptable Range:									
Upper Limit	53.4	28.4	13.9	74.5	42.5				
Lower Limit	35.6	16.4	1.9	49.7	28.3				

New York State Department of Health Blood Arsenic Test Results, 2010 Event #3 ROBUST STATISTICAL SUMMARY

					Info			
Lab Code	Method	_	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	Only
		Target Value	s: 44.5	22.4	7.9	62.1	35.4	
103	DRC/CC-ICP-MS		44.0	21.0	5.2	62.0	34.0	Info
110	DRC/CC-ICP-MS		43.9	21.7	6.1	64.6	35.5	
114	ICP-MS		51	27	11	69	40	
147	ICP-MS		39.6	18.5	4.5	57.2	30.9	Info
156	ICP-MS		39.8	18.8	<11.0	46.4	↓ 30.6	
159	ICP-MS		47	23	8	65	36	
164	ICP-MS		46	23	12	71	39	
179	ICP-MS		44	22	<12.0	62	37	
197	DRC/CC-ICP-MS		41	19	<10.0	59	32	
200	ICP-MS		2.4	4 3.1	† 21.0	† 5.9	↓ 59.4 †	` Info
206	ICP-MS		45.1	24	10.7	64.5	35	
208	ICP-MS		40.5	24.7	14.2	† 52.9	33.5	
293	DRC/CC-ICP-MS		44.9	21.5	6.5	59.6	35.2	Info
305	DRC/CC-ICP-MS		44	20	5	60	31	
312	DRC/CC-ICP-MS		53	27	11	72	37	
324	DRC/CC-ICP-MS		53.9 <i>î</i>	25.2	12.6	67.4	40.4	Info
339	HR-ICP-MS		48.5	23.4	5.6	68.3	36.0	Info
359	ICP-MS		44.2	21.6	6.8	58	35.4	
391	DRC/CC-ICP-MS		45.6	21.9	5.8	62.9	35.6	Info
395	DRC/CC-ICP-MS		40.9	22.2	5.9	60.9	33.6	

Percent satisfactory results for all participants: 92.0 %

	Results (μ g/L whole blood)					
	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	-
DRC/CC-ICP-MS						
Number of Sample Measurements:	9	9	8	9	9	
Mean:	45.7	22.2	7.3	63.2	34.9	
Standard Deviation:	4.7	2.5	2.9	4.3	2.8	
RSD (%):	10.2	11.2	39.6	6.7	8.0	
HR-ICP-MS						
Number of Sample Measurements:	1	1	1	1	1	
Mean:	48.5	23.4	5.6	68.3	36.0	
Standard Deviation:	?	?	?	?	?	
RSD (%):	_	_	—	—	—	
ICP-MS						
Number of Sample Measurements:	9	9	7	9	10	
Mean:	44.1	22.5	9.6	60.7	37.7	
Standard Deviation:	3.7	2.7	3.3	7.9	8.2	
RSD (%):	8.5	12.0	34.7	13.0	21.8	
All Laboratories						
Number of Sample Measurements:	19	19	16	19	20	
Mean:	45.1	22.4	8.2	62.2	36.4	
Standard Deviation:	4.2	2.5	3.2	6.3	6.1	
RSD (%):	9.2	11.0	38.9	10.1	16.8	

New York State Department of Health Blood Arsenic Test Results, 2010 Event #3 STATISTICAL SUMMARY BY METHOD

Whole Blood Cadmium

Test materials for cadmium were prepared from caprine (goat) whole blood preserved with K_2 EDTA 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** <u>Statistical methods for use in proficiency</u> testing by interlaboratory comparisons. Values for whole blood cadmium range from 2.0 μ g/L (18 nmol/L) to 14.2 μ g/L (126 nmol/L).

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

Discussion: Based upon the above criteria, 96.8% of the results reported by all participants were satisfactory, with two of the 31 laboratories (6.4%) reporting 2 or more of the 5 results outside the acceptable ranges.

TARGET VALUE ASSIGNMENT AND STATISTICS									
		Result	s (µg/L whole	e blood)					
	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15				
Robust Mean	8.4	4.0	2.0	14.2	7.7				
Robust Standard Deviation	0.4	0.2	0.2	0.8	0.3				
Standard Uncertainty	0.1	0.0	0.0	0.2	0.1				
RSD (%)	5.2	4.7	7.9	5.6	4.4				
Acceptable Range:									
Upper Limit	9.7	5.0	3.0	16.3	8.9				
Lower Limit	7.1	3.0	1.0	12.1	6.5				

New York State Department of Health Blood Cadmium Test Results, 2010 Event #3 ROBUST STATISTICAL SUMMARY

			Results	µg/L whole	blood)		1
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	Only
		Target Values: 8.4	4.0	2.0	14.2	7.7	
103	DRC/CC-ICP-MS	9.0	4.5	2.3	15.2	8.2	Info
106	ICP-MS	8.5	4.0	1.9	14.4	7.7	Info
107	ICP-MS	8.5	4.1	2.3	14.9	8.0	Info
109	ICP-MS	8.7	4.0	2.0	14.3	7.8	Info
110	ICP-MS	8.6	3.9	2.1	14.5	7.8	
114	ICP-MS	8.5	4.1	2	14	7.8	
116	ICP-MS	8.8	4.1	2.1	15.3	7.9	Info
147	ICP-MS	8.7	3.7	2.0	14.4	7.7	Info
156	ICP-MS	7.2	3.3	2.1	11.4	6.3↓	
159	ICP-MS	8.8	4.1	2.2	15	8	
164	ICP-MS	7.5	3.6	1.8	13	7	
179	ICP-MS	8.3	3.7	2	13.7	7.7	
197	DRC/CC-ICP-MS	8.8	4.1	2	14.7	7.9	
200	ICP-MS	8.8	4.3	2.1	15.2	8.2	Info
206	ICP-MS	8.5	4.1	1.8	14.7	7.6	
208	ICP-MS	8.1	3.6	2	14.2	7.3	
293	DRC/CC-ICP-MS	8.6	4.0	1.9	15.7	7.9	Info
305	ICP-MS	8.1	3.9	2.2	13.8	7.4	
312	ICP-MS	7.7	4	2.4	14	7.5	
324	ICP-MS	8.0	4.2	2.0	13.9	7.5	Info
339	HR-ICP-MS	8.4	4.1	2.0	14.0	7.5	Info
359	ICP-MS	7.4	3.6	1.9	12.5	6.6	
366	ETAAS-Z	7.2	3.1	1.9	11.3	6.2↓	Info
367	ETAAS-Z	8.5	4.0	2.5	13.6	7.8	Info
383	ETAAS-Z	7.9	3.6	1.8	12.9	7.2	
385	ICP-MS	8.3	3.9	2.0	14.0	7.5	Info
391	DRC/CC-ICP-MS	8.9	4.3	2.2	14.7	8.1	Info
395	ICP-MS	8.2	3.4	1.8	13.4	7.6	
404	HR-ICP-MS	9.6	5.0	4.0	† 15.0	8.0	Info
408	ICP-MS	7.8	3.6	1.7	13.5	7.1	Info
410	ICP-MS	8.6	4.1	2.1	14.7	7.9	Info

Percent satisfactory results for all participants: 96.8 %

notes:

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

		Results (ug/L whole	blood)		
	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	
DRC/CC-ICP-MS						
Number of Sample Measurements:	4	4	4	4	4	
Mean:	8.8	4.2	2.1	15.1	8.0	
Standard Deviation:	0.2	0.2	0.2	0.5	0.1	
RSD (%):	1.9	5.2	8.7	3.2	1.9	
ETAAS-Z						
Number of Sample Measurements:	3	3	3	3	3	
Mean:	7.9	3.6	2.1	12.6	7.1	
Standard Deviation:	0.7	0.5	0.4	1.2	0.8	
RSD (%):	_	_	_	_	_	
HR-ICP-MS						
Number of Sample Measurements:	2	2	1	2	2	
Mean:	9.0	4.6	2.0	14.5	7.8	
Standard Deviation:	0.8	0.6	?	0.7	0.4	
RSD (%):	_	_	_	_	_	
ICP-MS						
Number of Sample Measurements:	22	22	22	22	22	
Mean:	8.3	3.9	2.0	14.0	7.5	
Standard Deviation:	0.5	0.3	0.2	0.9	0.5	
RSD (%):	5.8	7.0	8.3	6.5	6.1	
All Laboratories						
Number of Sample Measurements:	31	31	30	31	31	
Mean:	8.3	3.9	2.0	14.1	7.6	
Standard Deviation:	0.6	0.4	0.2	1.0	0.5	
RSD (%):	6.6	9.4	9.2	7.4	6.6	

New York State Department of Health Blood Cadmium Test Results, 2010 Event #3 STATISTICAL SUMMARY BY METHOD

Whole Blood Mercury

Test materials for mercury were prepared from caprine (goat) whole blood preserved with K_2 EDTA anticoagulant. A total of five pools were supplemented with different amounts of mercury as both inorganic (Hg²⁺) and organometallic (as methylmercury, CH₃Hg⁺) 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** <u>Statistical methods for use in proficiency testing by interlaboratory comparisons</u>. Values for whole blood mercury range from 1.6 μ g/L (8 nmol/L) to 35.9 μ g/L (179 nmol/L).

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

Discussion: Based on the above criteria, 96.3% of results reported by all participants were satisfactory, with one of the 32 laboratories (3.1%) reporting 2 or more of the 5 results outside the acceptable ranges. Note: Some methods based on cold vapor generation (e.g., CV-AAS) may only detect inorganic Hg thus leading to a low bias compared to methods based on total Hg measurement (e.g., ICP-MS, and CV-AAS combined with on-line microwave digestion). See Barbosa et al. (2004) JAAS (1) for more details on total Hg in blood using CV-AAS.

(1) Barbosa F, Palmer CD, Krug FJ, Parsons PJ. Determination of total mercury in whole blood by flow injection cold vapor atomic absorption spectrometry with room temperature digestion using tetramethylammonium hydroxide. <u>Journal of Analytical Atomic Spectrometry</u> 2004;<u>19</u>(8):1000-1005.

TARGET VALUE ASSIGNMENT AND STATISTICS									
		Result	s (µg/L whole	e blood)					
	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15				
Robust Mean	21.3	8.1	35.9	1.6	3.6				
Robust Standard Deviation	1.8	0.7	3.2	0.3	0.5				
Standard Uncertainty	0.4	0.2	0.7	0.1	0.1				
RSD (%)	8.4	9.1	8.9	20.1	13.9				
Acceptable Range:									
Upper Limit	27.7	11.1	46.7	4.6	6.6				
Lower Limit	14.9	5.1	25.1	0.0	0.6				

New York State Department of Health

Blood Mercury Test Results, 2010 Event #3 ROBUST STATISTICAL SUMMARY

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, 2010 Event #3						
PERFORMANCE OF PARTICIPATING LABORATORIES						

Lab	Results (µg/L whole blood)							
Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	Only	
		Target Values: 21.3	8.1	35.9	1.6	3.6		
103	DRC/CC-ICP-MS	21.1	8.1	35.7	1.5	3.5	Info	
106	ICP-MS	22.0	8.3	37.8	1.4	3.6	Info	
107	ICP-MS	22.7	8.5	39.0	1.6	4.0	Info	
109	ICP-MS	21.5	7.5	33.2	1.4	3.1	Info	
110	ICP-MS	20.1	8.2	35.3	1.7	3.3		
114	ICP-MS	22	8.3	36.7	3.5	4.3		
116	ICP-MS	22.6	8.4	38.1	1.3	3.6	Info	
147	ICP-MS	21.3	8.1	33.5	1.5	3.5	Info	
156	ICP-MS	20.8	8.2	36.8	<3.0	3.6		
159	ICP-MS	21	8	37	<2.0	4		
164	ICP-MS	22	9	37	2	4		
179	ICP-MS	20	7	33	1	4		
197	DRC/CC-ICP-MS	19	9	33	<5.0	<5.0		
200	ICP-MS	24.2	8.4	38.0	10.7	3.5	Info	
206	ICP-MS	20	8	30	<3.0	4		
208	ICP-MS	19.7	6.8	31.2	<5.0	<5.0		
293	DRC/CC-ICP-MS	21.0	7.9	35.8	1.4	3.1	Info	
305	ICP-MS	27	10	41	<2.0	4		
312	ICP-MS	23	8.8	38	1.6	4		
324	CV-AAS	18.8	7.0	30.2	1.3	2.9	Info	
339	HR-ICP-MS	23.0	8.5	38.9	1.3	3.2	Info	
359	ICP-MS	19	6.8	29.4	1.7	3.5		
366	ICP-MS	23.0	8.6	37.0	1.7	3.9	Info	
367	CV-AAS	23.1	8.7	40.1	1.8	3.9	Info	
385	ICP-MS	22.3	8.9	36.8	2.3	4.4	Info	
391	CV-AAS	21.9	6.2	29.0	2.2	3.6	Info	
395	ICP-MS	21.6	7.8	35.8	1.5	3.7		
401	CV-AAS	15.1	5.4	21.7	↓ 1.7	2.7	Info	
404	HR-ICP-MS	17.7	13.8	† 46.8	† 5 '	9.5	t Info	
408	ICP-MS	19.7	7.3	33.3	<2.6	3.0	Info	
410	ICP-MS	22.6	8.2	37.6	1.3	3.5	Info	
453	CV-AAS	20.4	6.8	38.9	<2	2.4	Info	

Percent satisfactory results for all participants: 96.3 %

notes:

reported outside lower limit Unacceptable result

		Results (ug/L whole	blood)		
	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	
CV-AAS						
Number of Sample Measurements:	5	5	5	4	5	
Mean:	19.9	6.8	32.0	1.8	3.1	
Standard Deviation:	3.1	1.2	7.6	0.4	0.6	
RSD (%):	15.7	17.9	23.8	21.1	20.3	
DRC/CC-ICP-MS						
Number of Sample Measurements:	3	3	3	2	2	
Mean:	20.4	8.3	34.8	1.5	3.3	
Standard Deviation:	1.2	0.6	1.6	0.1	0.3	
RSD (%):	_	_	_	_	_	
HR-ICP-MS						
Number of Sample Measurements:	2	2	2	1	1	
Mean:	20.4	11.2	42.9	1.3	3.2	
Standard Deviation:	3.7	3.7	5.6	?	?	
RSD (%):	_	_	_	_	_	
ICP-MS						
Number of Sample Measurements:	22	22	22	14	21	
Mean:	21.7	8.1	35.7	1.6	3.7	
Standard Deviation:	1.8	0.8	3.0	0.3	0.4	
RSD (%):	8.2	9.3	8.4	20.2	9.8	
All Laboratories						
Number of Sample Measurements:	32	32	32	21	29	
Mean:	21.2	8.1	35.5	1.6	3.6	
Standard Deviation:	2.1	1.4	4.5	0.3	0.5	
RSD (%):	10.0	17.0	12.7	19.8	13.3	

New York State Department of Health Blood Mercury Test Results, 2010 Event #3 STATISTICAL SUMMARY BY METHOD

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_2 EDTA anticoagulant.

Target values were established as the mean of 18 measurements performed by 16 reference laboratories using ICP-MS, ETAAS and ASV methods. Values range from 6 μ g/dL to 104 μ g/dL. Among the reference group, imprecision (SD) varied from 0.6 - 4.8 μ g/dL, increasing with Pb concentration.

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 $\pm 10\%$ or $\pm 4 \mu$ g/dL, whichever is greater.

Discussion Based on the CLIA '88 criteria, 94.8% of results reported by all participants were judged as satisfactory, with 2 out of 103 participant laboratories (1.9%) reporting 2 or more of the 5 results outside the acceptable ranges.

Special Note: No Grading for Test Results submitted for Specimen BE10-12

Many participants will have noted that this particular test event was unusual inasmuch as the blood lead concentrations were elevated for 4 out of the 5 test samples. One particular sample, BE10-12, was found to have a target concentration of 104 µg/dL, which is well above the reportable range for many participants. We recognize that blood lead levels in this range are, thankfully, rare but as the unprecedented event in Zamfara, Nigeria has shown, massive exposure to lead can still occur in some parts of the world. It is interesting to see how participants responded to the challenge presented by BE10-12, with some attempting to quantitate well above their analytical method's reportable range. Others simply reported the result as greater than their method reportable range, so there was no firm consensus on how to handle such results. In light of this, we have elected to treat sample BE10-12 as an educational challenge. Individual responses will not be formally graded for permit purposes and all participants will be given a "satisfactory" credit for this PT sample. We hope that participants will use the data provided to review their method performance for unusually high blood lead concentrations.

http://www.cdc.gov/media/mmwrnews/2010/n100715.htm#3

Lady Method BE10-11 BE10-12 BE10-13 BE10-14 BE10-16 Ninal col ning Target values: 38 104 25 6 55 103 DRC/CC-ICP-MS 36 101 24 5 53 0.96 103 ASV-LeadCare 40 >65 24 5 55 1.04 Info 104 ETAAS-Z 38 103 26 7 54 1.00 Info 106 ICP-MS 38 103 26 7 54 1.00 Info 107 ICP-MS 39 110 26 6 55 1.04 Info 107 ICP-MS 39 100 24 5 2 0.96 1.04 Info 108 ETAAS-Z 41 106 27 6 55 1.01 Info 109 ASV-LeadCare 41 26 27 5 1.01 Info	Lab		I	Results (µg	/dL whole	blood)		Normalized	Info
Target values: 38 104 25 6 55 103 DRC/CC-ICP-MS 36 101 24 5 53 0.96 103 ASV-LeadCare 40 >65 24 5 57 1.02 Info 104 ETAAS-Z 38 103 26 7 54 1.00 Info 106 ICP-MS 38 105 25 6 55 1.04 Info 107 ICP-MS 39 110 26 6 56 1.04 Info 107 ASV-LeadCare 41 >65 27 5 53 1.04 Info 108 ETAAS-Z 41 106 27 6 58 1.06 108 ETAAS-Z 38 104 26 6 55 1.01 Info 108 ASV-LeadCare 36 >65 26 6 56 1.01 Info 110	Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	Mean	Only
103 DRC/CC-ICP-MS 36 101 24 5 53 0.96 103 ASV-LeadCare 40 >65 24 5 57 1.02 Info 103 ASV-LeadCare 42 >65 25 5 55 1.04 Info 104 ETAAS-Z 38 103 26 7 54 1.00 Info 106 ICP-MS 38 105 25 6 55 1.04 Info 107 ICP-MS 39 110 26 6 56 1.04 Info 108 ETAAS-Z 41 106 27 6 58 1.06 Info 108 ETAAS-Z 38 104 26 6 55 1.01 Info 108 ASV-LeadCare 36 >65 26 6 56 1.01 Info 109 ASV-LeadCare 36 >65 27 6 65 1.01 Info 110 ASV-LeadCare 41 >65 27 <t< th=""><th></th><th>Target value</th><th>s: 38</th><th>104</th><th>25</th><th>6</th><th>55</th><th></th><th></th></t<>		Target value	s: 38	104	25	6	55		
103 ASV-LeadCare 40 >65 24 5 57 1.02 Info 103 ASV-LeadCare 42 >65 25 5 55 1.04 Info 104 ETAAS-Z 38 103 26 7 54 1.00 Info 106 ICP-MS 38 105 25 6 55 1.04 Info 107 ICP-MS 39 110 26 6 56 1.04 Info 108 ETAAS-Z 41 >65 27 5 53 1.04 Info 109 ASV-LeadCare 41 >65 27 6 55 1.01 Info 109 ASV-LeadCare 36 104 26 6 55 1.01 Info 109 ASV-LeadCare 41 >65 27 6 65 1.01 Info 110 ICP-MS 38 105 25 6 58 1.02 Info 110 ASV-LeadCare 37 >65 <t< td=""><td>103</td><td>DRC/CC-ICP-MS</td><td>36</td><td>101</td><td>24</td><td>5</td><td>53</td><td>0.96</td><td></td></t<>	103	DRC/CC-ICP-MS	36	101	24	5	53	0.96	
103 ASV-LeadCare 42 >65 25 5 55 1.04 Info 104 ETAAS-Z 38 103 26 7 54 1.00 106 ICP-MS 38 105 25 6 55 1.00 Info 107 ICP-MS 39 110 26 6 56 1.04 Info 108 ETAAS-Z 41 >65 27 5 53 1.04 Info 109 ETAAS-Z 41 106 27 6 58 1.06 .06 109 ETAAS-Z 38 104 26 6 55 1.01 .01 109 ASV-LeadCare 36 >65 26 6 56 1.00 .01 101 ETAAS-Z 41 104 28 6 58 1.06 .00 .01 101 ASV-LeadCare 42 >65 23 4 51 0.94 .016 110 ASV-LeadCare 37 >65 23	103	ASV-LeadCare	40	>65	24	5	57	1.02	Info
104 ETAAS-Z 38 103 26 7 54 1.00 106 ICP-MS 38 105 25 6 55 1.00 Info 107 ICP-MS 39 110 26 6 56 1.04 Info 107 ASV-LeadCare 41 >65 27 5 53 1.04 Info 108 ETAAS-Z 41 106 27 6 58 1.06 109 ICP-MS 37 100 24 5 52 0.96 109 ETAAS-Z 38 104 26 6 56 1.01 Info 109 ASV-LeadCare 36 >65 26 6 56 1.01 Info 110 ASV-LeadCare 41 >65 27 6 65 f 1.01 Info 110 ICP-MS 38 105 25 6 56 1.01 Info 110 ASV-LeadCare 37 >65 23 4 51 0.94	103	ASV-LeadCare	42	>65	25	5	55	1.04	Info
106 ICP-MS 38 105 25 6 55 1.00 Info 107 ICP-MS 39 110 26 6 56 1.04 107 ASV-LeadCare 41 >65 27 5 53 1.04 Info 108 ETAAS-Z 41 106 27 6 58 1.06 109 ICP-MS 37 100 24 5 52 0.96 109 ETAAS-Z 38 104 26 6 55 1.01 Info 109 ASV-LeadCare 36 >65 27 6 65 ft 1.11 Info 100 ASV-LeadCare 41 >65 27 6 65 ft 1.01 Info 110 ICP-MS 38 105 25 6 56 1.01 Info 110 ASV-LeadCare 42 >6 25 57 1.04 Info 111 ASV-LeadCare 37 >65 23 4 51 0.94 Info	104	ETAAS-Z	38	103	26	7	54	1.00	
107 ICP-MS 39 110 26 6 56 1.04 107 ASV-LeadCare 41 >65 27 5 53 1.04 Info 108 ETAAS-Z 41 106 27 6 58 1.06 109 ICP-MS 37 100 24 5 52 0.96 109 ETAAS-Z 38 104 26 6 56 1.01 109 ASV-LeadCare 36 >65 26 6 56 1.00 Info 109 ASV-LeadCare 41 >65 27 6 65 ↑ 1.11 Info 110 ETAAS-Z 41 104 28 6 58 1.06 110 ICP-MS 38 105 25 6 56 1.01 Info 111 ASV-LeadCare 37 >65 23 4 51 0.94 Info 112 ASV-3010 41 >90 25 5 57 1.04 Info	106	ICP-MS	38	105	25	6	55	1.00	Info
107 ASV-LeadCare 41 >65 27 5 53 1.04 Info 108 ETAAS-Z 41 106 27 6 58 1.06 109 ICP-MS 37 100 24 5 52 0.96 109 ETAAS-Z 38 104 26 6 55 1.01 109 ASV-LeadCare 36 >65 26 6 56 1.00 Info 109 ASV-LeadCare 41 >65 27 6 65 ↑ 1.11 Info 110 ETAAS-Z 41 104 28 6 58 1.06 110 ICP-MS 38 105 25 6 56 1.01 110 ASV-LeadCare 37 >65 23 4 51 0.94 Info 111 ASV-LeadCare 37 >65 23 4 51 0.94 Info 112 ASV-3010 41 >90 25 5 57 1.04 Info <t< td=""><td>107</td><td>ICP-MS</td><td>39</td><td>110</td><td>26</td><td>6</td><td>56</td><td>1.04</td><td></td></t<>	107	ICP-MS	39	110	26	6	56	1.04	
108 ETAAS-Z 41 106 27 6 58 1.06 109 ICP-MS 37 100 24 5 52 0.96 109 ETAAS-Z 38 104 26 6 55 1.01 109 ASV-LeadCare 36 >65 26 6 56 1.00 Info 110 ETAAS-Z 41 104 28 6 58 1.01 Info 110 ICP-MS 38 105 25 6 56 1.01 Info 110 ASV-LeadCare 42 >65 27 5 60 1.09 Info 110 ASV-LeadCare 42 >65 23 4 51 0.94 Info 111 ASV-S010 41 >90 25 5 57 1.04 Info 1114 ETAAS-Z 42 99 29 7 58 1.07 1.04 1114 ETAAS-Z 40 99 26 5 55 1.01 <t< td=""><td>107</td><td>ASV-LeadCare</td><td>41</td><td>>65</td><td>27</td><td>5</td><td>53</td><td>1.04</td><td>Info</td></t<>	107	ASV-LeadCare	41	>65	27	5	53	1.04	Info
109 ICP-MS 37 100 24 5 52 0.96 109 ETAAS-Z 38 104 26 6 55 1.01 109 ASV-LeadCare 36 >65 26 6 56 1.00 Info 109 ASV-LeadCare 41 >65 27 6 65 ↑ 1.11 Info 110 ETAAS-Z 41 104 28 6 56 1.01 110 ICP-MS 38 105 25 6 56 1.01 110 ASV-LeadCare 42 >65 27 5 60 1.09 Info 111 ASV-LeadCare 42 >65 23 4 51 0.94 Info 112 ASV-LeadCare 37 >65 23 4 51 0.94 Info 1114 ETAAS-Z 42 99 26 5 57 1.04 Info 1121 ETAAS-Z 40 99 26 5 55 1.01 Info </td <td>108</td> <td>ETAAS-Z</td> <td>41</td> <td>106</td> <td>27</td> <td>6</td> <td>58</td> <td>1.06</td> <td></td>	108	ETAAS-Z	41	106	27	6	58	1.06	
109 ETAAS-Z 38 104 26 6 55 1.01 109 ASV-LeadCare 36 >65 26 6 56 1.00 Info 109 ASV-LeadCare 41 >65 27 6 65 1 1.11 Info 110 ETAAS-Z 41 104 28 6 58 1.06 110 ICP-MS 38 105 25 6 56 1.01 110 ASV-LeadCare 42 >65 27 5 60 1.09 Info 110 ASV-LeadCare 37 >65 23 4 51 0.94 Info 111 ASV-LeadCare 37 >65 23 4 51 0.94 Info 111 ASV-LeadCare 37 >65 23 4 51 0.94 Info 111 ETAAS-Z 42 99 29 7 58 1.07 1.04 Info 112 ETAAS-Z 40 99 26 5 5<	109	ICP-MS	37	100	24	5	52	0.96	
109 ASV-LeadCare 36 >65 26 6 56 1.00 Info 109 ASV-LeadCare 41 >65 27 6 65 ↑ 1.11 Info 110 ETAAS-Z 41 104 28 6 58 1.06 110 ICP-MS 38 105 25 6 56 1.01 110 ASV-LeadCare 42 >65 27 5 60 1.09 Info 110 ASV-LeadCare 37 >65 23 4 51 0.94 Info 111 ASV-JeadCare 37 >65 23 4 51 0.94 Info 111 ASV-JeadCare 37 >65 23 4 51 0.94 Info 1112 ASV-JeadCare 37 >65 23 4 51 0.94 Info 112 ASV-JeadCare 37 109 26 5 57 1.04 Info 112 ETAAS-Z 39 103 26 5	109	ETAAS-Z	38	104	26	6	55	1.01	
109 ASV-LeadCare 41 >65 27 6 65 ↑ 1.11 Info 110 ETAAS-Z 41 104 28 6 58 1.06 110 ICP-MS 38 105 25 6 56 1.01 110 ASV-LeadCare 42 >65 27 5 60 1.09 Info 110 ASV-LeadCare 42 >65 23 4 51 0.94 Info 1112 ASV-LeadCare 37 >65 23 4 51 0.94 Info 1114 ETAAS-Z 42 99 25 5 57 1.04 Info 114 ETAAS-Z 42 99 29 7 58 1.07 1.04 Info 121 ETAAS-Z 40 99 26 5 55 1.01 Info 123 ETAAS-Z 38 105 24 6 55 0.99 124 ETAAS-Z 37 103 24 7 57	109	ASV-LeadCare	36	>65	26	6	56	1.00	Info
110 ETAAS-Z 41 104 28 6 58 1.06 110 ICP-MS 38 105 25 6 56 1.01 110 ASV-LeadCare 42 >65 27 5 60 1.09 Info 110 ASV-LeadCare 37 >65 23 4 51 0.94 Info 112 ASV-JeadCare 37 >65 23 4 51 0.94 Info 114 ETAAS-Z 42 99 29 7 58 1.07 116 ICP-MS 39 109 26 6 57 1.04 Info 121 ETAAS-Z 40 99 26 5 55 1.01 Info 123 ETAAS-Z 38 105 24 6 55 0.99 126 ETAAS-Z 39 103 24 7 57 1.01 132 ETAAS-Z 37 105 25 53 0.99 143 ETAAS-Z <t< td=""><td>109</td><td>ASV-LeadCare</td><td>41</td><td>>65</td><td>27</td><td>6</td><td>65</td><td>† 1.11</td><td>Info</td></t<>	109	ASV-LeadCare	41	>65	27	6	65	† 1.11	Info
110 ICP-MS 38 105 25 6 56 1.01 110 ASV-LeadCare 42 >65 27 5 60 1.09 Info 110 ASV-LeadCare 37 >65 23 4 51 0.94 Info 112 ASV-3010 41 >90 25 5 57 1.04 114 ETAAS-Z 42 99 29 7 58 1.07 116 ICP-MS 39 109 26 6 57 1.04 Info 123 ETAAS-Z 40 99 26 5 55 1.01 Info 124 ETAAS-Z 38 105 24 6 55 0.99 126 ETAAS-Z 39 103 26 5 56 1.02 131 ETAAS-Z 37 105 25 5 53 0.99 143 ETAAS-Z 37 105 25 5 54 1.00 144 ETAAS-Z 37 <td>110</td> <td>ETAAS-Z</td> <td>41</td> <td>104</td> <td>28</td> <td>6</td> <td>58</td> <td>1.06</td> <td></td>	110	ETAAS-Z	41	104	28	6	58	1.06	
110 ASV-LeadCare 42 >65 27 5 60 1.09 Info 110 ASV-LeadCare 37 >65 23 4 51 0.94 Info 112 ASV-3010 41 >90 25 5 57 1.04 - 114 ETAAS-Z 42 99 29 7 58 1.07 - 116 ICP-MS 39 109 26 6 57 1.04 Info 121 ETAAS-Z 40 99 26 5 55 1.01 Info 123 ETAAS-Z 38 105 24 6 55 0.99 - 126 ETAAS-Z 39 103 26 5 56 1.02 - 131 ETAAS-Z 39 103 24 7 57 1.01 - 132 ETAAS-Z 37 105 25 5 53 0.99 - 143 ETAAS-Z 37 105 25 5 5	110	ICP-MS	38	105	25	6	56	1.01	
110 ASV-LeadCare 37 >65 23 4 51 0.94 Info 112 ASV-3010 41 >90 25 5 57 1.04 114 ETAAS-Z 42 99 29 7 58 1.07 116 ICP-MS 39 109 26 6 57 1.04 Info 121 ETAAS-Z 40 99 26 5 55 1.01 Info 123 ETAAS-Z 40 99 26 5 55 0.99 126 ETAAS-Z 38 105 24 6 55 0.99 131 ETAAS-Z 39 103 26 5 56 1.02 132 ETAAS-Z 40 103 24 7 57 1.01 132 ETAAS-Z 37 105 25 53 0.99 99 144 ETAAS-Z 37 100 25 54 1.00 144 144 ETAAS-Z 40 >60	110	ASV-LeadCare	42	>65	27	5	60	1.09	Info
112 ASV-3010 41 >90 25 5 57 1.04 114 ETAAS-Z 42 99 29 7 58 1.07 116 ICP-MS 39 109 26 6 57 1.04 Info 121 ETAAS-Z 40 99 26 5 55 1.01 Info 123 ETAAS-Z 38 105 24 6 55 0.99 126 ETAAS-Z 39 103 26 5 56 1.02 131 ETAAS-Z 39 103 24 7 57 1.01 132 ETAAS-Z 39 103 24 7 57 1.01 132 ETAAS-Z 37 105 25 5 53 0.99 143 ETAAS-Z 36 96 23 5 50 0.92 144 ETAAS-Z 37 110 25 5 54 1.00 144 ETAAS-Z 40 >60 26	110	ASV-LeadCare	37	>65	23	4	51	0.94	Info
114ETAAS-Z4299297581.07116ICP-MS39109266571.04Info121ETAAS-Z4099265551.01Info123ETAAS-Z38105246550.99126ETAAS-Z39103265561.02131ETAAS-Z40103247571.01132ETAAS-Z3710525530.99143ETAAS-Z3696235500.92144ETAAS-Z3711025541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 ↑ >65276601.11156ICP-MS3610324564 ↑ 1.02	112	ASV-3010	41	>90	25	5	57	1.04	
116ICP-MS39109266571.04Info121ETAAS-Z4099265551.01Info123ETAAS-Z38105246550.99126ETAAS-Z39103265561.02131ETAAS-Z40103247571.01132ETAAS-Z37105255530.99143ETAAS-Z3696235500.92144ETAAS-Z37110255541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 †>65276601.11156ICP-MS3610324564 †1.02	114	ETAAS-Z	42	99	29	7	58	1.07	
121ETAAS-Z4099265551.01Info123ETAAS-Z38105246550.99126ETAAS-Z39103265561.02131ETAAS-Z40103247571.01132ETAAS-Z37105255530.99143ETAAS-Z3696235500.92144ETAAS-Z37110255541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 ↑>65276601.11156ICP-MS3610324564 ↑1.02	116	ICP-MS	39	109	26	6	57	1.04	Info
123ETAAS-Z38105246550.99126ETAAS-Z39103265561.02131ETAAS-Z40103247571.01132ETAAS-Z37105255530.99143ETAAS-Z3696235500.92144ETAAS-Z37110255541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 ↑>65276601.11156ICP-MS3610324564 ↑1.02	121	ETAAS-Z	40	99	26	5	55	1.01	Info
126ETAAS-Z39103265561.02131ETAAS-Z40103247571.01132ETAAS-Z37105255530.99143ETAAS-Z3696235500.92144ETAAS-Z37110255541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 ↑ >65276601.11156ICP-MS3610324564 ↑ 1.02	123	ETAAS-Z	38	105	24	6	55	0.99	
131ETAAS-Z40103247571.01132ETAAS-Z37105255530.99143ETAAS-Z3696235500.92144ETAAS-Z37110255541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 \uparrow >65276601.11156ICP-MS3610324564 \uparrow 1.02	126	ETAAS-Z	39	103	26	5	56	1.02	
132ETAAS-Z37105255530.99143ETAAS-Z3696235500.92144ETAAS-Z37110255541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 ↑>65276601.11156ICP-MS3610324564 ↑1.02	131	ETAAS-Z	40	103	24	7	57	1.01	
143ETAAS-Z3696235500.92144ETAAS-Z37110255541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 ↑>65276601.11156ICP-MS3610324564 ↑1.02	132	ETAAS-Z	37	105	25	5	53	0.99	
144ETAAS-Z37110255541.00146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 ↑>65276601.11156ICP-MS3610324564 ↑1.02	143	ETAAS-Z	36	96	23	5	50	0.92	
146ETAAS-Z40>60265561.04147ICP-MS37100245530.96150ASV-LeadCare44 ↑>65276601.11156ICP-MS3610324564 ↑1.02	144	ETAAS-Z	37	110	25	5	54	1.00	
147ICP-MS37100245530.96150ASV-LeadCare44 ↑ >65276601.11156ICP-MS3610324564 ↑ 1.02	146	ETAAS-Z	40	>60	26	5	56	1.04	
150ASV-LeadCare44 ↑ >65276601.11156ICP-MS3610324564 ↑ 1.02	147	ICP-MS	37	100	24	5	53	0.96	
156 ICP-MS 36 103 24 5 64 † 1.02	150	ASV-LeadCare	44	♦ >65	27	.6	60	1.11	
	156	ICP-MS	36	103	24	5	64	† 1.02	

 $\textbf{notes:} \uparrow \quad \text{reported value outside upper limit}$

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

↓ reported value outside lower limit

Info only: results included for informational purposes only.

l a h		· F	Results (µg/	/dL whole b	olood)		Neumelined	lufa
Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	Mean	Only
	Target values	: 38	104	25	6	55		
158	ICP-MS	40	110	26	6	58	1.05	
159	ICP-MS	39	105	26	6	57	1.03	
160	ETAAS-Z	38	112	26	6	56	1.03	
164	ICP-MS	38	99	24	5	53	0.97	
166	ASV-3010	36	105	23	6	55	0.97	
168	ETAAS-Z	41	120	28	6	59	1.11	
179	ICP-MS	40	85	26	6	56	0.98	
197	ICP-MS	34	93	22	5	48	↓ 0.89	
198	ETAAS-Z	39	104	25	6	56	1.01	
199	ETAAS-Z	36	99	23	5	49	↓ 0.93	Info
200	ETAAS-Z	40	102	27	6	57	1.04	
204	ASV-3010	46 †	>100	26	7	58	1.10	
206	ICP-MS	37	106	25	6	55	1.00	
208	ETAAS-Z	39	>100	27	6	57	1.05	
215	ETAAS-Z	36	>60	23	7	47	↓ 0.91	
221	ETAAS-Z	35	102	23	4	49	↓ 0.93	
232	ASV-3010	39	117	25	5	57	1.05	
237	ETAAS-Z	40	103	26	5	54	1.02	
243	ASV-3010	41	113	27	7	59	1.08	
249	ASV-3010	34	103	22	1	51	0.92	
254	ETAAS-Z	37	119	24	5	60	1.04	
255	ETAAS-Z	36	104	24	5	53	0.97	
261	ETAAS-Z	8 🖡	. 16	3 🛔	2	3	↓ 0.15	
269	ETAAS-Z	30 🛔	, 79	20 🕇	4	45	↓ 0.79	
271	ASV-3010	40	>60	26	6	57	1.04	
272	ETAAS-Z	38	106	26	5	53	1.01	
279	ETAAS-Z	41	>60	29	5	57	1.09	
282	ASV-3010	42	120	25	2	64	† 1.11	
286	ASV-LeadCare	41	>65	25	5	56	1.03	
290	ICP-MS	35	96	23	5	50	0.92	

notes: † reported value outside upper limit

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

↓ reported value outside lower limit

Info only: results included for informational purposes only.

Lab			Normalized	Info				
Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	Mean	Only
	Target values:	38	104	25	6	55		
291	ASV-3010	39	112	26	6	56	1.04	
293	ICP-MS	40	111	26	6	57	1.05	
295	ASV-3010	36	98	24	4	50	0.94	
300	ASV-3010	40	103	24	5	54	1.00	
301	ETAAS-Z	36	103	24	4	53	0.97	
305	ETAAS-Z	35	96	23	5	54	0.94	
312	ICP-MS	36	100	24	5	53	0.96	
317	ETAAS-Z	41	108	25	7	58	1.04	
324	ICP-MS	38	106	25	5	55	1.00	
325	ETAAS-Z	39	95	26	6	54	0.99	
333	ETAAS-Z	38	101	26	4	54	1.00	
337	ASV-LeadCare	36	93	27	6	50	0.96	
339	HR-ICP-MS	38	104	25	5	53	0.99	Info
340	ETAAS-Z	36	106	23	5	51	0.95	
343	ASV-LeadCare	40	>65	25	5	59	1.04	Info
348	ETAAS-Z	40	115	28	6	65	1.12	
349	ETAAS-Z	40	104	25	5	55	1.01	
350	ASV-3010	40	118	25	6	58	1.06	
352	ASV-3010	34	>94	25	6	47	0.92	
353	ETAAS-Z	38	104	26	4	57	1.02	
359	ICP-MS	31 🕽	. 84	19.	↓ 4	41	L 0.78	
365	ETAAS-Z	37	· · · · 103·	23	· 6	53	0.96	
366	ETAAS-Z	30	90	21	5	52	0.86	Info
367	ETAAS-Z	39	97	26	7	55	1.00	Info
368	ASV-3010	36	99	24	6	49 .	0.94	
369	ASV-3010	37	103	25	4	55	0.99	
374	ASV-3010	40	120	24	4	57	1.05	
376	ASV-LeadCare	36	>65	22	4	55	0.94	
383	ETAAS-Z	35	104	24	5	60	0.99	
384	ASV-3010	39	112	25	3	59	1.04	

notes: 1 reported value outside upper limit

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

↓ reported value outside lower limit

Info only: results included for informational purposes only.

Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	Normalized Mean	Info Only
	Target values	s: 38	104	25	6	55		
385	ICP-MS	37	102	25	5	54	0.98	Info
388	ASV-LeadCare	38	104	23	4	55	0.98	
389	ETAAS-Z	36	110	25	5	54	1.00	
391	ETAAS-Z	36	96	24	5	56	0.96	Info
395	ICP-MS	36	103	24	5	53	0.97	
401	ETAAS-Z	38	102	26	6	56	1.01	Info
404	HR-ICP-MS	48 †	130	32 🕇	5	76	1.29	Info
408	ICP-MS	36	97	23	5	51	0.93	Info
410	ICP-MS	38	104	25	6	56	1.00	Info
455	ASV-LeadCare	38	>65	27	5	55	1.03	
456	ASV-LeadCare	47 †	>65	29	4	>65	1.20	
461	ASV-3010	37	>100	23	4	52	0.95	
462	ASV-LeadCare	42	>65	26	4	54	1.04	
463	ASV-LeadCare	40	>65	23	5	60	1.02	

Percent satisfactory results for all participants: 94.8 %

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, 2010 Event #3 STATISTICAL SUMMARY

		TARGET VALUE ASSIGNMENT AND STATISTICS						
Lah		Results (µg/dL whole blood)						
Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15		
103	DRC/CC-ICP-MS	36	101	24	5	53		
104	ETAAS-Z	38	103	26	7	54		
107	ICP-MS	39	110	26	6	56		
109	ICP-MS	37	100	24	5	52		
109	ETAAS-Z	38	104	26	6	55		
110	ETAAS-Z	41	104	28	6	58		
110	ICP-MS	38	105	25	6	56		
147	ICP-MS	37	100	24	5	53		
159	ICP-MS	39	105	26	6	57		
160	ETAAS-Z	38	112	26	6	56		
164	ICP-MS	38	99	24	5	53		
166	ASV-3010	36	105	23	6	55		
198	ETAAS-Z	39	104	25	6	56		
200	ETAAS-Z	40	102	27	6	57		
243	ASV-3010	41	113	27	7	59		
293	ICP-MS	40	111	26	6	57		
324	ICP-MS	38	106	25	5	55		
325	ETAAS-Z	39	95	26	6	54		
Numb	per of Sample Measurements:	18	18	18	18	18		
	Mean (target value):	38	104	2 5	6	5 5		
	Standard Deviation:	1.5	4.8	1.3	0.6	1.9		
	RSD (%):	3.8	4.6	5.1	10.6	3.5		
	Acceptable Range:		an a		, - ¹			
	Upper Limit:	42	114	29	10	61 50		
	Lower Limit:	34	34	- 1	ک ر ان میں	50	. Anna Anna A	

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, 2010 Event #3 STATISTICAL SUMMARY BY METHOD

Results (µg/dL whole blood)					
BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	
18	13	18	17	18	
38.7	109.5	24.7	5.1	55.3	
3.0	8.0	1.2	1.4	4.2	
7.8	7.3	5.0	27.5	7.6	
17	2	17	17	16	
40.1	98.5	25.5	4.9	56.3	
3.0	7.8	1.9	0.7	3.8	
7.5		7.6	15.1	6.7	
: 1	1	1	1	1	
36.0	101.0	24.0	5.0	53.0	
?	?	?	?	?	
	-				
43	39	43	44	43	
37.8	103.1	25.1	5.4	54.8	<i>,</i>
2.6	7.2	1.9	1.0	3.6	
6.9	7.0	7.7	18.9	6.5	
: 2	2	2	2	2	
43.0	117.0	28.5	5.0	64.5	
7.1	18.4	4.9	0.0	16.3	
· ·					
					,
22	22	22	22	22	
37.2	101.5	24.4	5.4	54.1	
2.1	7.2	1.7	0.6	4.4	
5.7	7.1	6.8	10.9	8.1	
, i					
103	79	103	103	102	
38.3	103.9	25.0	5.3	55.2	
2.9	8.2	1.9	1.0	4.4	
7.6	7.9	7.6	18.4	8.0	
	BE10-11 18 38.7 3.0 7.8 17 40.1 3.0 7.5 1 36.0 ? 43 37.8 2.6 6.9 2 43.0 7.1 22 37.2 2.1 5.7 103 38.3 2.9 7.6	Results BE10-11 BE10-12 18 13 38.7 109.5 3.0 8.0 7.8 7.3 17 2 40.1 98.5 3.0 7.8 7.5 1 1 36.0 7.8 7.5 1 1 36.0 7.8 7.5 1 1 36.0 101.0 ? ? 43 39 37.8 103.1 2.6 7.2 6.9 7.0 2 2 43.0 117.0 7.1 18.4	Results (µg/dL whol BE10-11 BE10-12 BE10-13 18 13 18 38.7 109.5 24.7 3.0 8.0 1.2 7.8 7.3 5.0 17 2 17 40.1 98.5 25.5 3.0 7.8 1.9 7.5 7.6 1 1 1 1 36.0 101.0 24.0 ? ? ? ? 1 1.1 1 1 36.0 101.0 24.0 ? ? ? ? 43 39 43 37.8 103.1 25.1 2.6 7.2 1.9 6.9 7.0 7.7 2 2 2 43.0 117.0 28.5 7.1 18.4 4.9 <	Results(µg/dlwholeblood)BE10-11BE10-12BE10-14BE10-141813181738.7109.524.75.13.08.01.21.47.87.35.027.5172171740.198.525.54.93.07.81.90.77.57.615.1111136.0101.024.05.0????111.11.136.0101.024.05.0????4339434437.8103.125.15.422224339434437.8103.125.15.4222243.0117.028.55.07.118.44.90.0222237.2101.524.45.42.17.21.70.65.77.16.810.938.3103.925.05.32.98.21.91.038.3103.925.05.32.98.21.91.07.67.97.65.32.98.21.91.038.3103.925.05.3 </td <td>Results (µg/d. whole blood)BE10-11BE10-12BE10-13BE10-14BE10-15181318171838.7109.524.75.155.33.08.01.21.44.27.87.35.027.57.617217171640.198.525.54.956.33.07.81.90.73.87.57.615.16.71111136.0101.024.05.053.0?????1111136.0101.024.05.053.0?????4339434437.8103.125.15.42.67.21.91.03.87.07.718.96.97.07.718.96.97.07.718.96.97.028.55.06.44.44.90.06.524.45.47.118.44.90.128.55.06.45.17.11.524.45.45.77.16.810.37.91.031037.95.358.3103.925.058.3103.9</td>	Results (µg/d. whole blood)BE10-11BE10-12BE10-13BE10-14BE10-15181318171838.7109.524.75.155.33.08.01.21.44.27.87.35.027.57.617217171640.198.525.54.956.33.07.81.90.73.87.57.615.16.71111136.0101.024.05.053.0?????1111136.0101.024.05.053.0?????4339434437.8103.125.15.42.67.21.91.03.87.07.718.96.97.07.718.96.97.07.718.96.97.028.55.06.44.44.90.06.524.45.47.118.44.90.128.55.06.45.17.11.524.45.45.77.16.810.37.91.031037.95.358.3103.925.058.3103.9

		Results (µg/dL whole	e blood)		
	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15	
Evaluated						
Number of Sample Measurements	: 64	48	64	64	63	
Mean	: 38.2	104.1	24.8	5.1	54.7	
Standard Deviation	: 3.1	8.9	1.9	1.1	4.4	
RSD (%)	: 8.0	8.5	7.8	21.1	8.0	
Info						
Number of Sample Measurements	: 21	13	21	21	21	
Mean	: 38.7	102.6	25.3	5.3	56.2	
Standard Deviation	: 3.4	9.5	2.2	0.7	5.7	
RSD (%)	: 8.9	9.3	8.6	12.3	10.1	
Reference						\$
Number of Sample Measurements	: 18	18	18	18	18	
Mean	: 38.4	104.4	25.4	5.8	55.3	
Standard Deviation	: 1.5	4.8	1.3	0.6	1.9	
RSD (%)	: 3.8	4.6	5.1	10.6	3.5	
All Laboratories	19 H. AVIACI - ANN W. AVIA					
Number of Sample Measurements	: 103	79	103	103	102	
Mean	: 38.3	103.9	25.0	5.3	55.2	
Standard Deviation	: 2.9	8.2	1.9	1.0	4.4	
RSD (%)	: 7.6	7.9	7.6	18.4	8.0	

New York State Department of Health Blood Lead Test Results, 2010 Event #3 STATISTICAL SUMMARY BY CLASS

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

New York State Department of Health Whole Blood Additional Elements, 2010 Event #3 Page 1

Blood Bariu	m (µg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
110	ICP-MS	39.7	37.8	47.4	31.6	27.7
147	ICP-MS	35.562	30.207	41.466	25.539	24.440
197	ICP-MS	36.9	36.2	46.1	27.4	27.3
312	ICP-MS	42.9	41.2	50.6	31.2	29.7
Arithmetic Mea	an (n=4)	38.8	36.4	46.4	28.9	27.3
SD		3.3	4.6	3.8	3.0	2.2
Blood Beryl	lium (µg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
110	ICP-MS	<0.14	<0.14	<0.14	<0.14	<0.14
197	ICP-MS	<0.2	<0.2	<0.2	NA	NA
Blood Coba	It (µg/L)	BE40 44	BE40.40	BE40.42	BE40 44	BE40 45
110		0.5	50	6 1	12 0	DE 10-13
110		0.5	5.9 5.202	0.1	10.9	3.Z
147		~1 0	5.382	5.009	12.310	2.034
109		<1.0	5.5	5.0	13 2	2.0
197		<1.0	5.0	5.0	10.0	2.9
293		0.0	5.0	5.2	12	2.7
312		0.7	5.0	5.9	10	2.9
391	DRC/CC-ICP-MS	0.6	5.8	5.7	12.8	3.1
Arithmetic mea	an (n=7)	0.6	5.5	5.7	12.8	2.9
SD		0.1	0.3	0.3	0.9	0.2
Blood Chror	nium (µg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
197	DRC/CC-ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0
147	ICP-MS	0.312	0.28	0.323	0.357	0.348
293	DRC/CC-ICP-MS	4.5	4.8	4.9	5.1	4.5
312	DRC/CC-ICP-MS	0.8	0.8	0.8	1.2	0.9
Arithmetic mea	an (n=3)	1.9	2.0	2.0	2.2	1.9
SD		2.3	2.5	2.5	2.5	2.3
Blood Cesiu	im (µg/L)	DE40.44	BE40.42	BE40.42	BE40.44	DE40.45
110	ICP-MS	0.26	0.23	0.29	0.25	0.28
Blood Copp	er (µg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
110	ICP-MS	1015	1125	1214	1249	1126
147	ICP-MS	946.633	1086.404	1099.111	1137.230	1016.518
197	ICP-MS	940	1030	1040	1070	1020
312	ICP-MS	960	1130	1100	1200	1050
Arithmetic mea	an (n=4)	965	1093	1113	1164	1053

New York State Department of Health Whole Blood Additional Elements, 2010 Event #3 Page 2

Blood lodine	e (μg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
147	ICP-MS	38.734	43.038	38.228	38.481	38.481
Blood Mang	anese (µɑ/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
103	DRC/CC-ICP-MS	40.5	51.6	39.1	12.8	68
107	DRC/CC-ICP-MS	43.1	52.8	39.9	13.2	71.8
110	ETAAS-Z	42.1	53.1	40.5	12.8	71.3
147	ICP-MS	43.407	53.956	41.209	14.286	72.527
156	ICP-MS	44.4	55.2	39.6	14.7	75.4
159	ICP-MS	41	53	39	17	66
179	ETAAS-Z	40.6	50	38.4	12.9	68.4
197	DRC/CC-ICP-MS	42.1	61.8	37.7	13.1	70.4
293	ICP-MS	47 7	60 1	60.0	14 0	80.9
305	ICP-MS	42.9	53.5	39.4	14.3	73.5
312	DRC/CC-ICP-MS	46	60	46	16	78
391	DRC/CC-ICP-MS	37.0	44.3	33.0	12.4	58.8
001		57.0	-+5	55.0	12.4	50.0
Arithmetic mea	n (n=12)	42.6	54 1	41 2	14 0	71.3
SD	(2.8	4.8	6.6	14	5.8
		2.0	1.0	0.0		0.0
Blood Molvh	denum (ua/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
147		4 866	12.86	3 608	2 476	4 472
Blood Nicke	l (µg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
147	ICP-MS	6.224	0.424	0.517	0.403	0.569
Black Distin						
BIOOU Platin	um (µg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
110	ICP-MS	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Blood Antim	opy (ug/L)					
Lab Code	Mothod	BE10 11	BE10 12	BE10 12	BE10 14	BE10 15
110		<0.10	<0.10	<0.10	0.25	<0.10
		\$0.10	50.10	-0.10	0.23	\$0.10
Blood Selen	ium (ua/L)					
Lab Code	Method	BE10-11	BE10-12	BF10-13	BF10-14	BE10-15
109	ICP-MS	270	220	308	329	242
147		263 033	263 033	315 956	344 302	257 504
107		200.000	200.000	320	355	207.004
305		210	240	370	703 200	201
310		200	200 257	320	403	290
312 391	DRC/CC-ICP-MS	290 298.4	257 245.3	357.8	384.0	∠ou 318.0
A	(a=0)	000	070	000		070
Arithmetic mea	in (n=6)	286	250	338	367	279
SD		19	17	24	28	27

New York State Department of Health Whole Blood Additional Elements, 2010 Event #3 Page 3

Blood Tin (µg/	L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
110	ICP-MS	3.8	<1.1	5.6	12.0	2.1
147	ICP-MS	3.444		4.739	10.819	1.77
156	ICP-MS	<11.0	<11.0	13.4	25.6	<11.0
197	ICP-MS	<5.0	<5.0	5.8	12.4	<5.0
Arithmetic mean (n=4) SD		3.6 0.3		7.4 4.0	15.2 7.0	1.9 0.2
				-		-
Blood Thalliur	n (µg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
110	ICP-MS	0.04	4.91	1.96	11.80	4.05
147	ICP-MS		4.702	1.881	11.468	3.863
156	ICP-MS	na	<11.0	<11.0	12.8	<11.0
159	ICP-MS	<1.0	4.8	2.0	12.2	4.1
179	ICP-MS	<10.0	<10.0	<10.0	12	<10.0
197	ICP-MS	<1.0	4.6	1.8	11.4	3.8
312	ICP-MS	<0.1	4.9	2.0	12	4
Arithmetic mean	(n=7)		4.8	1.9	12.0	4.0
SD			0.1	0.1	0.5	0.1
Blood Uraniun	n (µg/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
103	ICP-MS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
110	ICP-MS	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
312	ICP-MS	<0.1	<0.1	<0.1	<0.1	<0.1
Blood Zinc (µç	g/L)					
Lab Code	Method	BE10-11	BE10-12	BE10-13	BE10-14	BE10-15
197	ICP-MS	1820	3340	2200	1370	1470
312	ICP-MS	2360	4000	2590	2100	2130
147	ICP-MS	2000	3464.052	2254.902	1758.17	1830.065
110	ICP-MS	2122	3472	2472	1916	2004
Arithmetic mean	(n=4)	2076	3569	2379	1786	1859
SD		227	294	183	311	287

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., D₂, S-H background correction)
- A-3 FAAS (Flame atomic absorption spectrometry)
- A-4 CV-AAS (Cold vapor atomic absorption spectrometry)
- A-5 HG-AAS (Hydride generation atomic absorption spectrometry)
- A-6 AFS (Atomic fluorescence spectrometry)
- A-7 Other

INDUCTIVELY COUPLED PLASMA

- P-1 ICP-MS (Inductively coupled plasma mass spectrometry)
- P-2 DRC/CC-ICP-MS (ICP-MS used in the Dynamic Reaction Cell or Collision Cell mode)
- P-3 ICP-AES/OES (ICP atomic/optical emission spectrometry)
- P-4 HR-ICP-MS (High resolution ICP-MS)
- P-5 ETV-ICP-MS (Electrothermal vaporization ICP-MS)
- P-6 ID-ICP-MS (Isotope dilution ICP-MS)
- P-7 Other

ELECTROCHEMICAL METHODS

- E-1 ASV (Anodic stripping voltammetry without digestion)
- E-2 ASV-LeadCare® (Anodic stripping voltammetry using the ESA LeadCare® system)
- E-3 Fluoride specific electrode
- E-4 Other

MOLECULAR FLUORIMETRY

- F-1 EtOAc (Ethyl acetate-acetic acid extraction method for determination of erythrocyte protoporphyrin)
- F-2 Aviv hematofluorometry (for determination of EP at hematocrit 35)
- F-3 Helena ZPP (for determination of zinc protoporphyrin in μ mol ZPP/mol heme)
- F-4 Other

OTHER METHODS

If your method is not listed in the above list, please describe it briefly.