
Wadsworth Center

NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

TRACE ELEMENTS IN WHOLE BLOOD

Proficiency Test Report

Event #1, 2013

March 25th, 2013

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

Sue Kelly
Executive Deputy Commissioner

March 25, 2013

Trace Elements in Whole Blood Event #1, 2013

Dear Laboratory Director:

Results from the first proficiency test (PT) event in 2013 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 March 12th, 2013, 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 As³⁺), cadmium (as Cd²⁺) and mercury as both inorganic (Hg²⁺) and organic (ethylmercury (CH₃CH₂Hg⁺) and methylmercury (CH₃Hg⁺)) species. In addition to As, Cd, Pb and Hg, blood pools were supplemented with the trace elements manganese (Mn), thallium (Tl), tin (Sn), cobalt (Co), and chromium (Cr).

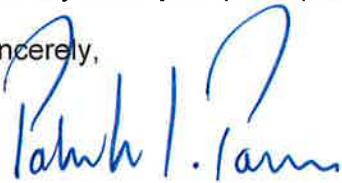
Additional Elements to Become Graded for Performance Assessment

PT results for select trace elements, including Co, Cr and Mn, will be graded as part of the next event, although the data will be used for "Educational Purposes" 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, May 8th, 2013. 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, May 29th, 2013.**

Thank you for your participation.

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 #1, 2013

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 15.1 µg/L (0.20 µmol/L) to 63.9 µg/L (0.85 µmol/L).

Acceptable range: The acceptable range for arsenic is set at ± 6 µg/L or $\pm 20\%$, 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, 2013 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results ($\mu\text{g}/\text{L}$ whole blood)				
	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
Robust Mean	45.9	15.1	21.0	17.5	63.9
Robust Standard Deviation	4.7	2.2	1.9	2.5	6.2
Standard Uncertainty	1.3	0.6	0.6	0.7	1.8
RSD (%)	10.2	14.5	9.2	14.4	9.8
Number of Sample Measurements	19	19	19	19	19
Acceptable Range:					
Upper Limit	55.1	21.1	27.0	23.5	76.7
Lower Limit	36.7	9.1	15.0	11.5	51.1

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, 2013 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g/L}$ whole blood)					Info Only
		BE13-01	BE13-02	BE13-03	BE13-04	BE13-05	
	Target Values:	45.9	15.1	21.0	17.5	63.9	
103	DRC/CC-ICP-MS	46.6	14.0	20.7	16.7	66.9	Info
110	DRC/CC-ICP-MS	46.9	16.1	22.2	18.1	66.9	
114	ICP-MS	45.0	18.0	22.0	21.0	58.0	
147	ICP-MS	39.2	11.8	15.8	13.6	55.9	Info
156	ICP-MS	42.2	12.3	18.2	13.6	56.1	
164	ICP-MS	44.0	14.0	20.0	16.0	63.0	
179	ICP-MS	49.0	15.0	23.0	19.0	70.0	
197	DRC/CC-ICP-MS	45.0	16.0	22.0	17.0	67.0	
200	ICP-MS	42.1	15.0	20.6	17.8	60.3	Info
206	DRC/CC-ICP-MS	51.8	21.1	25.5	20.4	73.5	
208	ICP-MS	46.2	19.8	21.0	20.6	70.4	
293	DRC/CC-ICP-MS	41.9	12.5	18.5	14.8	57.8	Info
305	DRC/CC-ICP-MS	44.0	13.0	18.0	15.0	62.0	
312	DRC/CC-ICP-MS	38.0	15.0	20.0	17.0	54.0	
324	ICP-MS	52.1	19.4	25.0	20.3	69.8	Info
339	HR-ICP-MS	47.1	13.8	20.4	16.7	65.3	Info
359	ICP-MS	50.9	20.6	27.3 ↑	19.6	64.5	
391	DRC/CC-ICP-MS	45.8	14.0	21.5	17.4	62.9	Info
469	ICP-MS	53.4	15.6	20.9	18.2	68.6	

Percent satisfactory results for all participants: 98.9 %

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, 2013 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ whole blood)				
	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	8	8	8	8	8
Mean:	45.0	15.2	21.1	17.1	63.9
Standard Deviation:	4.0	2.7	2.4	1.8	6.1
RSD (%):	8.9	17.8	11.3	10.4	9.5
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	47.1	13.8	20.4	16.7	65.3
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	10	10	10	10	10
Mean:	46.4	16.2	21.4	18.0	63.7
Standard Deviation:	4.8	3.1	3.3	2.7	5.9
RSD (%):	10.3	19.4	15.2	15.2	9.2
All Laboratories					
Number of Sample Measurements:	19	19	19	19	19
Mean:	45.9	15.6	21.2	17.5	63.8
Standard Deviation:	4.3	2.9	2.7	2.3	5.6
RSD (%):	9.3	18.3	13.0	13.0	8.8

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 #1, 2013

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 2.4 µg/L (21 nmol/L) to 15.5 µg/L (138 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, 89.6% of the results reported by all participants were satisfactory, with three of the 27 laboratories (11.1%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Cadmium Test Results, 2013 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results ($\mu\text{g}/\text{L}$ whole blood)				
	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
Robust Mean	4.2	12.6	8.7	2.4	15.5
Robust Standard Deviation	0.4	0.9	0.8	0.3	1.3
Standard Uncertainty	0.1	0.2	0.2	0.1	0.3
RSD (%)	8.3	7.1	8.7	13.5	8.6
Number of Sample Measurements	27	27	27	27	27
Acceptable Range:					
Upper Limit	5.2	14.5	10.0	3.4	17.8
Lower Limit	3.2	10.7	7.4	1.4	13.2

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, 2013 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g/L}$ whole blood)					Info Only
		BE13-01	BE13-02	BE13-03	BE13-04	BE13-05	
	Target Values:	4.2	12.6	8.7	2.4	15.5	
103	DRC/CC-ICP-MS	4.3	12.8	8.9	2.3	15.9	Info
106	ICP-MS	4.3	13.1	9.0	2.4	16.2	Info
107	DRC/CC-ICP-MS	4.3	12.9	8.8	2.2	15.7	Info
109	ICP-MS	4.6	13.5	9.2	2.4	16.5	Info
110	ICP-MS	4.3	12.7	8.8	2.2	15.5	
114	ICP-MS	3.6	11.0	7.0 ↓	2.0	12.9 ↓	
116	ICP-MS	4.3	12.5	8.9	2.4	15.8	Info
147	ICP-MS	4.2	13.2	8.2	2.2	15.2	Info
156	ICP-MS	4.0	11.9	8.2	2.8	14.7	
164	ICP-MS	3.5	11.0	7.7	2.0	13.3	
179	ICP-MS	4.0	12.1	8.5	2.2	15.5	
197	DRC/CC-ICP-MS	4.1	12.8	8.7	2.2	16.0	
200	ICP-MS	4.0	13.5	8.1	2.5	16.1	Info
206	ICP-MS	4.7	15.5 ↑	10.4 ↑	3.7 ↑	18.6 ↑	
208	ICP-MS	5.3 ↑	13.3	9.9	3.1	17.2	
293	ICP-MS	3.3	12.4	6.3 ↓	2.3	12.8 ↓	Info
305	ICP-MS	3.4	11.4	6.8 ↓	2.4	13.9	
312	ICP-MS	4.8	12.0	9.1	2.9	16.0	
324	ICP-MS	4.0	11.2	7.9	2.1	15.1	Info
339	HR-ICP-MS	4.0	12.1	8.2	2.3	14.8	Info
359	ICP-MS	4.0	11.7	8.1	2.3	14.5	
367	ICP-MS	4.1	13.3	12.9 ↑	3.0	17.4	Info
383	ETAAS-Z	4.6	14.2	9.2	3.8 ↑	14.6	
391	DRC/CC-ICP-MS	5.8 ↑	12.9	9.2	2.8	16.9	Info
401	ETAAS other	3.9	12.6	8.8	2.4	13.0 ↓	Info
410	ICP-MS	4.5	13.4	9.3	2.9	16.8	Info
469	ICP-MS	4.5	12.4	9.0	2.2	16.2	

Percent satisfactory results for all participants: 89.6 %

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, 2013 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ whole blood)				
	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	4.6	12.9	8.9	2.4	16.1
Standard Deviation:	0.8	0.1	0.2	0.3	0.5
RSD (%):	17.1	0.4	2.4	12.1	3.3
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	3.9	12.6	8.8	2.4	13.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	4.6	14.2	9.2	3.8	14.6
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	4.0	12.1	8.2	2.3	14.8
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	20	20	20
Mean:	4.2	12.6	8.7	2.5	15.5
Standard Deviation:	0.5	1.1	1.4	0.4	1.5
RSD (%):	11.9	8.7	16.3	17.4	9.8
All Laboratories					
Number of Sample Measurements:	27	27	27	27	27
Mean:	4.2	12.6	8.7	2.5	15.4
Standard Deviation:	0.5	1.0	1.2	0.5	1.4
RSD (%):	12.7	7.9	14.1	18.5	9.3

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, 2012

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 both inorganic (Hg²⁺) and organometallic (as both ethylmercury, CH₃CH₂Hg⁺, and methylmercury, CH₃Hg⁺) species.

Sample	Mercury species added
BE13-01	Hg ²⁺ , CH ₃ Hg ⁺ , and CH ₃ CH ₂ Hg ⁺
BE13-02	Hg ²⁺ , CH ₃ Hg ⁺ , and CH ₃ CH ₂ Hg ⁺
BE13-03	Hg ²⁺ and CH ₃ Hg ⁺
BE13-04	Hg ²⁺ and CH ₃ Hg ⁺
BE13-05	Hg ²⁺ , CH ₃ Hg ⁺ , and CH ₃ CH ₂ Hg ⁺

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 3.0 µg/L (15 nmol/L) to 50.9 µg/L (254 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, 97.7% of results reported by all participants were satisfactory, with one of the 26 laboratories (3.8%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Mercury Test Results, 2013 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results ($\mu\text{g}/\text{L}$ whole blood)				
	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
Robust Mean	3.0	5.4	22.2	50.9	7.2
Robust Standard Deviation	0.3	0.5	2.6	4.3	0.6
Standard Uncertainty	0.1	0.1	0.6	1.1	0.1
RSD (%)	10.6	8.8	11.8	8.5	7.8
Number of Sample Measurements	24	26	26	26	26
Acceptable Range:					
Upper Limit	6.0	8.4	28.9	66.2	10.2
Lower Limit	0.0	2.4	15.5	35.6	4.2

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, 2013 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g/L}$ whole blood)					Info Only
		BE13-01	BE13-02	BE13-03	BE13-04	BE13-05	
	Target Values:	3.0	5.4	22.2	50.9	7.2	
103	DRC/CC-ICP-MS	2.8	5.2	21.7	48.2	6.8	Info
106	ICP-MS	3.4	5.7	24.6	53.8	7.5	Info
107	DRC/CC-ICP-MS	3.1	5.6	24.9	53.7	7.1	Info
109	ICP-MS	3.1	5.8	24.7	53.3	7.5	Info
110	ICP-MS	2.7	5.1	22.6	48.9	7.1	
114	ICP-MS	2.7	5.3	18.9	48.0	6.2	
116	ICP-MS	3.0	5.5	24.4	53.1	7.3	Info
147	ICP-MS	3.1	5.6	24.3	52.8	7.1	Info
156	ICP-MS	3.1	5.3	20.6	49.6	6.7	
164	ICP-MS	<4.0	5.0	21.0	50.0	7.0	
179	ICP-MS	3.0	5.0	20.0	53.0	6.0	
197	DRC/CC-ICP-MS	<5.0	5.0	22.0	52.0	9.0	
200	ICP-MS	4.1	6.1	24.4	57.4	7.9	Info
206	ICP-MS	4.0	5.0	20.0	42.0	7.0	
208	ICP-MS	5.2	6.5	23.9	58.0	9.9	
293	ICP-MS	3.2	5.5	20.6	41.1	7.5	Info
305	ICP-MS	2.0	5.0	25.0	63.0	7.0	
312	ICP-MS	3.2	5.9	22.0	53.0	7.7	
324	AFS	3.0	5.3	18.9	41.8	6.7	Info
339	HR-ICP-MS	3.0	5.5	23.2	52.7	7.2	Info
359	ICP-MS	2.9	5.0	20.7	40.8	6.7	
391	HG-AAS	3.0	4.7	18.2	40.6	7.8	Info
401	CV-AAS	1.0	2.0 ↓	8.2 ↓	46.9	3.0 ↓	Info
410	ICP-MS	2.6	5.6	23.1	51.6	7.2	Info
453	CV-AAS	3.0	5.7	22.8	54.4	7.4	Info
469	ICP-MS	5.1	6.4	26.2	47.9	8.9	

Percent satisfactory results for all participants: 97.7 %

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, 2013 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ whole blood)				
	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
AFS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	3.0	5.3	18.9	41.8	6.7
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	2.0	3.9	15.5	50.7	5.2
Standard Deviation:	1.4	2.6	10.3	5.3	3.1
RSD (%):	—	—	—	—	—
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	3	3	3	3
Mean:	3.0	5.3	22.9	51.3	7.6
Standard Deviation:	0.2	0.3	1.8	2.8	1.2
RSD (%):	—	—	—	—	—
HG-AAS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	3.0	4.7	18.2	40.6	7.8
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	3.0	5.5	23.2	52.7	7.2
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	17	18	18	18	18
Mean:	3.3	5.5	22.6	51.0	7.3
Standard Deviation:	0.8	0.5	2.2	5.8	0.9
RSD (%):	25.4	8.8	9.6	11.4	12.3
All Laboratories					
Number of Sample Measurements:	24	26	26	26	26
Mean:	3.1	5.3	21.8	50.3	7.2
Standard Deviation:	0.9	0.8	3.5	5.7	1.2
RSD (%):	27.1	15.2	16.2	11.2	16.7

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 #1, 2013

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 18 measurements performed by 16 reference laboratories using ICP-MS, ETAAS and ASV methods. Values range from 5 µg/dL to 22 µg/dL. Among the reference group, imprecision (SD) varied from 0.5 - 1.1 µg/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 ± 4 µg/dL, whichever is greater.

Discussion Based on the CLIA '88 criteria, 98.7% of results reported by all participants were judged as satisfactory, with none of 91 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Blood Lead Test Results, 2013 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g}/\text{dL}$ whole blood)					Normalized Mean	Info Only
		BE13-01	BE13-02	BE13-03	BE13-04	BE13-05		
	Target values:	22	7	5	15	9		
103	DRC/CC-ICP-MS	22	7	5	15	10	1.00	
104	ETAAS-Z	24	7	5	16	10	1.08	
106	ICP-MS	22	7	5	15	10	1.00	Info
107	DRC/CC-ICP-MS	23	7	5	15	10	1.02	
107	ASV-LeadCare	25	7	5	15	10	1.07	Info
109	ETAAS-Z	23	6	5	15	10	1.02	
109	ICP-MS	23	7	5	15	10	1.02	
109	ASV-LeadCare	24	6	5	14	8	1.01	Info
110	ETAAS-Z	22	6	6	14	9	0.97	
110	ASV-LeadCare	22	6	4	14	9	0.97	Info
110	ICP-MS	22	7	5	15	9	1.00	
112	ETAAS-Z	20	6	5	14	7	0.92	
114	ICP-MS	23	7	5	16	10	1.06	
116	ICP-MS	23	7	5	15	10	1.02	Info
121	ETAAS-Z	24	8	6	17	12	1.19	Info
123	ETAAS-Z	21	7	5	14	9	0.94	
126	ETAAS-Z	22	6	5	15	9	1.00	
131	ETAAS-Z	22	9	5	17	11	1.12	
143	ETAAS-Z	20	5	4	13	8	0.89	
144	ETAAS-Z	22	6	5	14	10	0.97	
146	ETAAS-Z	19	6	4	12	9	0.83	
147	ICP-MS	22	7	5	14	9	0.97	
150	Other Atomic	23	7	6	15	9	1.02	
156	ICP-MS	22	6	4	14	8	0.97	
158	ICP-MS	23	7	6	16	10	1.06	
160	ICP-MS	20	6	4	13	9	0.89	
164	ICP-MS	21	6	5	13	9	0.91	
166	ASV-3010	23	7	5	16	11	1.11	
168	ETAAS-Z	23	7	6	15	10	1.02	

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, 2013 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g}/\text{dL}$ whole blood)					Normalized Mean	Info Only
		BE13-01	BE13-02	BE13-03	BE13-04	BE13-05		
	Target values:	22	7	5	15	9		
179	ICP-MS	23	7	5	15	10	1.02	
197	ICP-MS	21	6	5	14	9	0.94	
198	ETAAS-Z	23	8	5	15	10	1.02	
200	ICP-MS	27 ↑	7	5	16	9	1.15	Info
204	ASV-3010	23	8	3	12	8	0.92	
206	ICP-MS	25	8	6	15	11	1.12	
208	ETAAS-Z	21	6	5	14	9	0.94	
221	ETAAS-Z	21	7	5	14	9	0.94	
232	ASV-3010	21	7	5	13	9	0.91	
237	ETAAS-Z	23	6	5	15	10	1.02	
243	ASV-3010	23	7	5	15	10	1.02	
254	ETAAS-Z	20	5	3	13	8	0.89	
255	ETAAS-Z	29 ↑	8	6	15	10	1.16	
261	ETAAS-Z	22	7	5	16	10	1.03	
269	ETAAS-Z	18	5	3	11	8	0.78	
271	ETAAS-Z	21	7	5	14	10	0.94	
272	ETAAS-Z	23	6	5	15	9	1.02	
279	ETAAS-Z	24	7	6	16	10	1.08	
290	ICP-MS	22	6	5	14	9	0.97	
291	ASV-3010	27 ↑	10	6	19	13	1.31	
293	ICP-MS	17 ↓	6	4	13	8	0.82	Info
295	ASV-3010	23	5	4	13	9	0.96	
301	ETAAS Other	20	4	3	12	7	0.85	
305	ETAAS-Z	21	6	5	15	10	0.98	
312	ICP-MS	23	7	5	15	10	1.02	
317	ETAAS-Z	23	7	5	15	10	1.02	
324	ICP-MS	21	5	4	12	9	0.88	
325	ETAAS-Z	23	7	5	15	10	1.02	
333	ETAAS-Z	25	7	5	16	11	1.14	

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, 2013 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g}/\text{dL}$ whole blood)					Normalized Mean	Info Only
		BE13-01	BE13-02	BE13-03	BE13-04	BE13-05		
	Target values:	22	7	5	15	9		
337	ASV-LeadCare	25	7	5	14	10	1.03	
339	HR-ICP-MS	22	6	6	14	9	0.97	Info
340	ETAAS-Z	23	7	5	15	10	1.02	
343	ASV-LeadCare	23	6	4	14	8	0.99	Info
348	ETAAS-Z	24	7	5	15	9	1.05	
349	ETAAS-Z	22	6	4	14	9	0.97	
350	ASV-3010	22	5	3	13	9	0.93	
352	ASV-3010	22	4	5	15	7	1.00	
353	ETAAS-Z	21	6	5	13	9	0.91	
365	ETAAS-Z	20	6	5	15	10	0.95	
367	ICP-MS	22	7	8	15	10	1.00	Info
368	ASV-3010	26	6	4	14	10	1.06	
369	ASV-3010	23	6	4	14	10	0.99	
374	ASV-3010	19	4	<2	12	9	0.83	
383	ETAAS-Z	23	6	5	15	10	1.02	
384	ASV-3010	21	5	3	11	8	0.84	
388	ASV-3010	22	6	4	14	10	0.97	
389	ETAAS-Z	22	7	5	14	9	0.97	
391	ETAAS-Z	25	8	7	18	11	1.19	Info
393	ASV-LeadCare	23	5	4	14	9	0.99	
401	ETAAS Other	23	7	5	14	10	0.99	Info
410	ICP-MS	20	7	5	15	10	0.95	Info
461	ASV-3010	21	7	4	13	10	0.91	
463	ASV-LeadCare	27 ↑	8	4	17	10	1.18	
464	ASV-LeadCare	25	5	3	12	8	0.97	
469	ICP-MS	24	6	5	15	10	1.05	
470	ASV-LeadCare	21	5	<3	12	7	0.88	
473	ASV-LeadCare	24	7	4	17	9	1.11	
474	ASV-LeadCare	24	5	3	12	9	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, 2013 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results ($\mu\text{g}/\text{dL}$ whole blood)					Normalized Mean	Info Only
		BE13-01	BE13-02	BE13-03	BE13-04	BE13-05		
	Target values:	22	7	5	15	9		
475	ASV-LeadCare	24	6	4	14	8	1.01	
476	ASV-LeadCare	23	5	3	11	7	0.89	
477	ASV-LeadCare	24	7	4	15	10	1.05	
478	ASV-LeadCare	27 ↑	6	3	15	10	1.11	

Percent satisfactory results for all participants: 98.7 %

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, 2013 Event #1
STATISTICAL SUMMARY

Lab Code	Method	TARGET VALUE ASSIGNMENT AND STATISTICS				
		Results ($\mu\text{g/dL}$ whole blood)				
		BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
103	DRC/CC-ICP-MS	22	7	5	15	10
104	ETAAS-Z	24	7	5	16	10
107	DRC/CC-ICP-MS	23	7	5	15	10
109	ETAAS-Z	23	6	5	15	10
109	ICP-MS	23	7	5	15	10
110	ETAAS-Z	22	6	6	14	9
110	ICP-MS	22	7	5	15	9
112	ETAAS-Z	20	6	5	14	7
147	ICP-MS	22	7	5	14	9
156	ICP-MS	22	6	4	14	8
160	ICP-MS	20	6	4	13	9
164	ICP-MS	21	6	5	13	9
166	ASV-3010	23	7	5	16	11
179	ICP-MS	23	7	5	15	10
198	ETAAS-Z	23	8	5	15	10
243	ASV-3010	23	7	5	15	10
324	ICP-MS	21	5	4	12	9
325	ETAAS-Z	23	7	5	15	10
Number of Sample Measurements:		18	18	18	18	18
Mean (target value):		2.2	7	5	1.5	9
Standard Deviation:		1.1	0.7	0.5	1.0	0.9
RSD (%):		5.0	10.6	9.6	7.2	9.8
Acceptable Range:						
Upper Limit:		26	11	9	19	13
Lower Limit:		18	3	1	11	5

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, 2013 Event #1
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/dL}$ whole blood)				
	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
ASV-3010					
Number of Sample Measurements:	14	14	13	14	14
Mean:	22.6	6.2	4.2	13.9	9.5
Standard Deviation:	2.0	1.6	0.9	2.0	1.5
RSD (%):	9.0	26.2	21.9	14.4	15.3
ASV-LeadCare					
Number of Sample Measurements:	15	15	14	15	15
Mean:	24.1	6.1	3.9	14.0	8.8
Standard Deviation:	1.6	1.0	0.7	1.7	1.1
RSD (%):	6.7	15.8	18.6	12.4	12.3
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	22.5	7.0	5.0	15.0	10.0
Standard Deviation:	0.7	0.0	0.0	0.0	0.0
RSD (%):	—	—	—	—	—
ETAAS Other					
Number of Sample Measurements:	2	2	2	2	2
Mean:	21.5	5.5	4.0	13.0	8.5
Standard Deviation:	2.1	2.1	1.4	1.4	2.1
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	35	35	35	35	35
Mean:	22.3	6.6	5.0	14.7	9.6
Standard Deviation:	2.0	0.9	0.8	1.4	1.0
RSD (%):	9.0	13.8	15.3	9.3	10.2
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	22.0	6.0	6.0	14.0	9.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	21	21	21	21	21
Mean:	22.2	6.6	5.0	14.5	9.5
Standard Deviation:	2.0	0.7	0.9	1.1	0.7
RSD (%):	9.0	10.1	17.1	7.4	7.9
Other Atomic					
Number of Sample Measurements:	1	1	1	1	1
Mean:	23.0	7.0	6.0	15.0	9.0
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)

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STATISTICAL SUMMARY BY CLASS

	Results ($\mu\text{g/dL}$ whole blood)				
	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
Evaluated					
Number of Sample Measurements:	59	59	57	59	59
Mean:	22.6	6.3	4.5	14.2	9.3
Standard Deviation:	2.1	1.2	0.9	1.6	1.1
RSD (%):	9.3	18.5	20.4	11.3	11.7
Info					
Number of Sample Measurements:	14	14	14	14	14
Mean:	22.8	6.8	5.3	14.9	9.6
Standard Deviation:	2.4	0.7	1.1	1.3	1.2
RSD (%):	10.5	10.3	21.5	8.9	12.1
Reference					
Number of Sample Measurements:	18	18	18	18	18
Mean:	22.2	6.6	4.9	14.5	9.4
Standard Deviation:	1.1	0.7	0.5	1.0	0.9
RSD (%):	5.0	10.6	9.6	7.2	9.8
All Laboratories					
Number of Sample Measurements:	91	91	89	91	91
Mean:	22.6	6.4	4.7	14.4	9.4
Standard Deviation:	2.0	1.0	0.9	1.5	1.1
RSD (%):	8.8	16.1	19.6	10.3	11.3

notes: ? Insufficient data for calculation.

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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, Cr

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Blood Antimony ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	< 0.10	< 0.10	0.33	< 0.10	< 0.10
206	ICP-MS	<2.0	<2.0	<2.0	<2.0	<2.0

Blood Barium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
147	ICP-MS	12.6	6.36	11.9	9.31	11.5
197	ICP-MS	13.7	7.2	15.8	11.3*	13.9
312	ICP-MS	13.9	5.8	13.7	9.5	12.8
*Omitted	Arithmetic Mean	13.4	6.5	13.8		12.7
	SD	0.7	0.7	2.0		1.2
	n	3	3	3		3

Blood Beryllium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14
147	ICP-MS	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
197	ICP-MS	<0.2	<0.2	<0.2	<0.2	<0.2

Blood Cesium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	0.81	0.62	0.72	0.89	0.58

Blood Chromium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	DRC/CC-ICP-MS	8.0	25.8	4.6	18.6	3.0
147	DRC/CC-ICP-MS	8.7	30.5	4.53	18.4	2.88
156	ICP-MS	6.6	24.0	2.3	*11.0	1.2
164	ICP-MS	6.8	24.4	3.9	16.0	2.6
197	DRC/CC-ICP-MS	8.5	27.5	4.5	17.4	2.6
305	ICP-MS	6.5	30.2	2.7	17.6	0.6
312	DRC/CC-ICP-MS	8.6	29.0	4.8	20.0	2.8
*Omitted	Arithmetic mean	7.7	27.3	3.9	18.0	2.2
	SD	1.0	2.7	1.0	1.3	0.9
	n	7	7	7	6	7

Blood Cobalt ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	10.9	22.3	4.6	14.9	1.7
147	ICP-MS	10.4	23.7	4.53	14.3	1.42
156	ICP-MS	7.8	18.0	*2.3	*9.0	*0.0
164	ICP-MS	8.9	21.7	4.4	14.2	1.3
197	ICP-MS	9.1	20.6	4.2	13.3	1.2
206	ICP-MS	10.8	25.3	4.3	14.3	1.6
305	ICP-MS	9.6	21.1	4.1	14.8	1.5
312	ICP-MS	11.0	23.0	4.9	15.0	1.6
324	ICP-MS	9.1	19.6	3.9	12.2	1.2
391	DRC/CC-ICP-MS	9.4	20.8	4.2	13.4	1.3
*Omitted	Arithmetic mean	9.7	21.6	4.3	14.0	1.4
	SD	1.0	2.1	0.3	0.9	0.2
	n	10	10	9	9	9

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Blood Copper ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	1385	1257	1485	1518	1310
147	ICP-MS	1385	1245.2	1499.4	1499.4	1302.4
197	ICP-MS	1380.0	1220.0	1530.0	1490.0	1280.0
312	ICP-MS	1400.0	1260.0	1530.0	1550.0	1330.0
Arithmetic mean		1388	1246	1511	1514	1306
SD		9	18	23	26	21
n		4	4	4	4	4

Blood Iodine ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
147	ICP-MS	37.8	25.2	40.9	54.9	42.9

Blood Manganese ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
103	DRC/CC-ICP-MS	31.2	43.4	13.8	51.4	26.5
107	DRC/CC-ICP-MS	30.6	41.8	13.4	48.4	25.0
110	ETAAS-Z	32.2	44.3	14.1	52.3	28.0
114	ICP-MS	24.0	37.0	12.0	47.0	23.0
147	ICP-MS	32.8	43.5	14.9	50.5	28.0
156	ICP-MS	31.8	46.0	17.6	53.4	28.8
197	DRC/CC-ICP-MS	31.8	40.3	12.6	48.6	25.1
293	ICP-MS	33.0	41.5	13.8	47.1	23.8
305	ICP-MS	25.9	35.4	11.5	45.5	23.5
324	ICP-MS	32.1	40.3	13.9	45.4	27.5
312	DRC/CC-ICP-MS	37.0	49.0	16.0	58.0	30.0
391	DRC/CC-ICP-MS	29.0	38.0	12.3	44.0	23.1
Arithmetic mean		31.0	41.7	13.8	49.3	26.0
SD		3.4	3.9	1.7	4.0	2.4
n		12	12	12	12	12

Blood Molybdenum ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
147	ICP-MS	27.3	30.9	7.02	15.7	52.8

Blood Nickel ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
147	ICP-MS	0.64	1.47	0.381	0.423	0.249

Blood Platinum ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	<0.10	<0.10	<0.10	<0.10	<0.10

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Blood Selenium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
107	DRC/CC-ICP-MS	301.0	287.1	385.6	337.5	293.3
109	ICP-MS	311	296	380	348	302
114	ICP-MS	324.0	310.0	403.0	361.0	297.0
147	ICP-MS	275.70	266.2	361	303.3	268.6
197	ICP-MS	330.0	326.0	391.0	361.0	315.0
305	ICP-MS	335.0	311.0	395.0	386.0	327.0
312	ICP-MS	320.0	311.0	429.0	375.0	314.0
324	ICP-MS	283.0	268.5	341.0	313.5	288.0
359	ICP-MS	292.0	304.0	377.0	350.0	293.0
Arithmetic mean		308	298	385	348	300
SD		21	20	25	27	17
n		9	9	9	9	9

Blood Tellurium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
147	ICP-MS	<0.06	<0.06	<0.06	<0.06	<0.06

Blood Thorium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
147	ICP-MS	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12

Blood Thallium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	3.5	10.6	0.1	13.9	5.1
147	ICP-MS	3.1	10.2	*0.14	13.1	4.99
156	ICP-MS	<11.0	11.1	<11.0	14.5	<11.0
179	ICP-MS	3.0	10.0	<1.0	13.0	5.0
197	ICP-MS	2.6	8.2	<1.0	10.6	3.9
206	ICP-MS	3.7	12.7	<1.0	13.8	5.5
305	ICP-MS	2.8	9.0	<0.2	11.9	4.4
312	ICP-MS	3.3	10.0	<0.1	14.0	4.9
324	ICP-MS	3.2	9.6	0.1	12.0	4.7
<i>*Omitted</i>		3.2	10.2		13.0	4.8
SD		0.4	1.3		1.3	0.5
n		8	9		9	8

Blood Tin ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	0.2	1.8	5.0	22.7	11.3
147	ICP-MS	0.16	1.96	5.62	19.8	12.7
156	ICP-MS	<11.0	<11.0	<11.0	11.4	<11.0
197	ICP-MS	<5.0	<5.0	<5.0	16.6	8.7
Arithmetic Mean					17.6	10.9
SD					4.8	2.0
n					4	3

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Blood Uranium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
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	<0.007	<0.007	<0.007	<0.007	<0.007
312	ICP-MS	<0.1	<0.1	<0.1	<0.1	<0.1

Blood Vanadium ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
147	DRC/CC-ICP-MS	0.11	0.0786	0.105	0.0725	0.0969

Blood Zinc ($\mu\text{g/L}$)

Lab Code	Method	BE13-01	BE13-02	BE13-03	BE13-04	BE13-05
110	ICP-MS	3032	3165	1970	2232	1911
147	ICP-MS	3039.2	3235.3	1993.5	2235.3	1941.2
114	HR-ICP-MS	3000.0	3003.0	2010.0	2290.0	2060.0
197	ICP-MS	2870.0	3030.0	1900.0	2190.0	1800.0
312	ICP-MS	3470.0	3700.0	2220.0	2470.0	2140.0
Arithmetic mean		3082	3227	2019	2283	1970
SD		227	281	120	110	132
n		5	5	5	5	5

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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 µmol ZPP/mol heme)
- F-4 Other

OTHER METHODS

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