
Wadsworth Center

NEW YORK STATE DEPARTMENT OF HEALTH

Trace Elements Laboratory

TRACE ELEMENTS IN URINE

Event #3, 2012

November 30th, 2012

November 30, 2012

**Trace Elements in Urine
Event #3, 2012**

Dear Laboratory Director:

Results from the third proficiency test (PT) event for 2012 in the category Trace Elements in Urine have been tabulated and summarized. Target values for Arsenic, Cadmium, Mercury and Lead have been established along with acceptable ranges. Results are graded using element-specific criteria as indicated in each narrative section. A laboratory with an unacceptable significant analytical bias relative to the target value will be expected to investigate the source of the error. A confidential three-digit code number assigned by the PT program identifies participant laboratories.

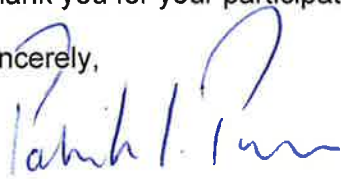
PT Materials

The source of the test materials is human urine obtained from donor volunteers with informed consent. Urine was collected into polyethylene containers and then stored at 4°C. Following collection, urine from each donor was mixed and acidified to 1% v/v with nitric acid, and 1% (v/v) sulfamic acid solution containing 200 mg/mL sulfamic acid and 10% (v/v) Triton-X 100 was added to stabilize Hg. The urine was stored frozen at -80°C; after thawing at room temperature, precipitated salts were removed by centrifugation. The urine was separated into five pools and each was supplemented with different amounts of As, Cd, Hg and Pb as inorganic salts. Each pool was also spiked with additional trace elements that comprise the "NHANES suite" and include: Ba, Be, Co, Cs, Mo, Pt, Sb, Tl, U and W. Each pool was stirred for approximately 24 hours to ensure thorough mixing prior to aliquoting 10-mL samples into acid-leached polypropylene vials. Samples were stored at -80°C prior to circulating for proficiency testing.


The next PT event for trace elements in urine is scheduled to be mailed Wednesday, January 16th, 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, February 13th, 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 #3, 2012

Urine Arsenic

The source of the test materials is human urine obtained from donor volunteers with informed consent. Urine was collected into polyethylene containers and then stored at 4°C. Following collection, urine from each donor was mixed and acidified to 1% v/v with nitric acid, and 1% (v/v) sulfamic acid solution containing 200 mg/mL sulfamic acid and 10% (v/v) Triton-X 100 was added to stabilize Hg. The urine was stored frozen at -80°C; after thawing at room temperature, precipitated salts were removed by centrifugation. The urine was separated into five pools and each was supplemented with different amounts of inorganic As³⁺. Each pool was stirred for approximately 24 hours to ensure thorough mixing prior to aliquoting 10-mL samples into acid-leached polypropylene vials. Samples were stored at -80°C prior to circulating for proficiency testing.

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 urine arsenic range from 17.1 µg/L (0.23 µmol/L) to 112.5 µg/L (1.50 µmol/L).

Acceptable ranges. The acceptable range is fixed at ±20% or ±6 µg/L for target values ≤30 µg/L. This provides a more realistic acceptability range at low concentrations of urine As, and the criteria are consistent with those in place for blood As.

Discussion. Based upon the above criteria, 100.0% of test results reported were judged as satisfactory, with none of the 25 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Arsenic Test Results, 2012 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

UE12-11 UE12-12 UE12-13 UE12-14 UE12-15

Robust Mean	27.2	60.4	17.1	112.5	82.9
Robust Standard Deviation	2.1	5.2	1.6	9.1	7.0
Standard Uncertainty	0.5	1.3	0.4	2.3	1.7
RSD (%)	7.7	8.7	9.3	8.1	8.4
Acceptable Range:					
Upper Limit	33.2	72.5	23.1	135.0	99.5
Lower Limit	21.2	48.3	11.1	90.0	66.3

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

New York State Department of Health
Urine Arsenic Test Results, 2012 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE12-11	UE12-12	UE12-13	UE12-14	UE12-15	
Target Values:		27.2	60.4	17.1	112.5	82.9	
103	DRC/CC-ICP-MS	28.9	63.2	17.6	119.3	88.4	Info
106	ICP-MS	26.4	56.0	16.5	106.1	76.4	Info
107	DRC/CC-ICP-MS	27.7	61.6	17.0	117	84.1	Info
110	DRC/CC-ICP-MS	30.0	66.5	18.5	119.0	92.0	
114	ICP-MS	26.0	63.0	19.0	112.0	86.0	
116	DRC/CC-ICP-MS	28.8	63.9	18.1	121.2	86.4	Info
147	ICP-MS	28.5	64.2	17.0	114.6	84.6	Info
156	ICP-MS	30.1	65.8	18.2	126.0	93.2	
164	ICP-MS	28.0	61.0	19.0	114.0	83.0	
179	ICP-MS	24.0	57.0	15.0	107.0	77.0	
197	DRC/CC-ICP-MS	25.0	58.0	17.0	109.0	79.0	
200	ICP-MS	26.6	55.2	16.0	99.0	76.0	Info
206	DRC/CC-ICP-MS	27.0	56.1	16.7	104.2	79.3	
208	ICP-MS	27.5	57.9	17.7	107.5	76.4	
293	DRC/CC-ICP-MS	21.8	49.2	13.7	91.9	67.5	Info
305	DRC/CC-ICP-MS	27.2	63.1	18.1	115.4	88.5	
312	ICP-MS	26.6	57.0	16.4	107.5	78.2	
324	ICP-MS	29.7	66.1	18.3	125.1	89.5	Info
339	HR-ICP-MS	24.3	53.7	15.5	98.9	71.5	Info
359	ICP-MS	28.5	62.4	19.3	116.2	86.1	
366	ICP-MS	28.0	69.0	17.0	115.0	84.0	Info
367	ICP-MS	26.3	59.3	15.8	114.0	81.6	Info
391	DRC/CC-ICP-MS	25.4	54.8	15.3	103.1	76.5	Info
401	DRC/CC-ICP-MS	29.8	67.2	18.6	127.6	92.7	Info
472	DRC/CC-ICP-MS	24.7	56.9	14.2	115.0	86.6	Info

Percent satisfactory results for all participants: 100.0 %

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

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

New York State Department of Health
Urine Arsenic Test Results, 2012 Event #3
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ urine)				
	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	11	11	11	11	11
Mean:	26.9	60.0	16.8	113.0	83.7
Standard Deviation:	2.5	5.5	1.7	10.1	7.5
RSD (%):	9.3	9.2	10.1	8.9	9.0
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	24.3	53.7	15.5	98.9	71.5
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	13	13	13	13	13
Mean:	27.4	61.1	17.3	112.6	82.5
Standard Deviation:	1.7	4.4	1.4	7.5	5.5
RSD (%):	6.0	7.2	7.9	6.7	6.7
All Laboratories					
Number of Sample Measurements:	25	25	25	25	25
Mean:	27.1	60.3	17.0	112.2	82.6
Standard Deviation:	2.1	5.0	1.5	8.8	6.7
RSD (%):	7.7	8.2	8.9	7.9	8.1

notes: ? Insufficient data for calculation.

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

Urine Cadmium

The source of the test materials is human urine obtained from donor volunteers with informed consent. Urine was collected into polyethylene containers and then stored at 4°C. Following collection, urine from each donor was mixed and acidified to 1% v/v with nitric acid, and 1% (v/v) sulfamic acid solution containing 200 mg/mL sulfamic acid and 10% (v/v) Triton-X 100 was added to stabilize Hg. The urine was stored frozen at -80°C; after thawing at room temperature, precipitated salts were removed by centrifugation. The urine was separated into five pools and each was supplemented with different amounts of inorganic Cd²⁺. Each pool was stirred for approximately 24 hours to ensure thorough mixing prior to aliquoting 10-mL samples into acid-leached polypropylene vials. Samples were stored at -80°C prior to circulating for proficiency testing.

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 urine cadmium range from 1.8 µg/L (16 nmol/L) to 11.3 µg/L (101 nmol/L).

Acceptable ranges. The acceptable range is fixed at ±15% or ±1 µg/L (9 nmol/L) around the target value whichever is greater. These criteria are used by the U.S. Occupational Safety and Health Administration (OSHA) to assess performance for occupational medicine.

Discussion. Based upon the above criteria, 98.4% of test results reported were judged as satisfactory, with none of the 25 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Cadmium Test Results, 2012 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
--	---------	---------	---------	---------	---------

Robust Mean	5.3	1.8	11.3	2.7	4.0
Robust Standard Deviation	0.4	0.2	0.7	0.2	0.4
Standard Uncertainty	0.1	<0.1	0.2	<0.1	0.1
RSD (%)	8.0	9.0	6.4	6.5	9.8
Acceptable Range:					
Upper Limit	6.3	2.8	13.0	3.7	5.0
Lower Limit	4.3	0.8	9.6	1.7	3.0

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

New York State Department of Health
Urine Cadmium Test Results, 2012 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE12-11	UE12-12	UE12-13	UE12-14	UE12-15	
Target Values:		5.3	1.8	11.3	2.7	4.0	
103	DRC/CC-ICP-MS	5.2	1.8	11.5	2.6	4.1	Info
106	ICP-MS	5.4	1.9	11.7	2.7	4.1	Info
107	DRC/CC-ICP-MS	5.4	1.8	11.7	2.7	4.0	Info
110	ICP-MS	5.2	1.8	11.2	2.6	3.9	
114	ICP-MS	4.9	1.6	10.9	2.5	3.7	
116	ICP-MS	5.9	2.0	12.6	3.0	4.5	Info
147	ICP-MS	5.1	1.7	11.2	2.7	3.9	Info
156	ICP-MS	5.6	1.9	11.5	2.8	4.2	
164	ICP-MS	4.9	1.7	10.7	2.9	3.6	
179	ICP-MS	5.5	1.9	11.8	2.6	4.3	
197	DRC/CC-ICP-MS	4.8	1.7	10.5	2.5	3.7	
200	ICP-MS	5.5	2.7	10.9	2.8	4.4	Info
206	ICP-MS	5.6	1.7	10.4	2.6	4.0	
208	ICP-MS	5.7	1.8	11.4	2.6	4.2	
293	ICP-MS	5.8	2.0	12.4	2.9	4.5	Info
305	ICP-MS	5.7	1.9	11.6	2.7	4.4	
312	ICP-MS	5.3	1.8	10.9	2.7	3.9	
324	ICP-MS	5.4	1.8	11.8	2.7	4.1	Info
339	HR-ICP-MS	4.7	1.5	10.6	2.2	3.8	Info
359	ICP-MS	4.8	1.5	9.7	2.1	3.4	
366	ICP-MS	5.0	1.7	11.0	2.2	3.4	Info
367	ICP-MS	5.6	1.8	11.8	2.8	4.2	Info
391	DRC/CC-ICP-MS	5.3	2.1	11.0	3.1	5.5 ↑	Info
401	DRC/CC-ICP-MS	6.1	2.0	13.2 ↑	2.9	4.5	Info
472	ICP-MS	4.7	1.6	10.1	2.2	3.5	Info

Percent satisfactory results for all participants: 98.4 %

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
Urine Cadmium Test Results, 2012 Event #3
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ urine)				
	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	5	5	5	5	5
Mean:	5.4	1.9	11.6	2.8	4.4
Standard Deviation:	0.5	0.2	1.0	0.2	0.7
RSD (%):	8.8	8.7	8.8	8.7	16.0
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	4.7	1.5	10.6	2.2	3.8
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	19	19	19	19	19
Mean:	5.3	1.8	11.2	2.6	4.0
Standard Deviation:	0.4	0.2	0.7	0.2	0.4
RSD (%):	6.7	13.6	6.5	9.2	8.9
All Laboratories					
Number of Sample Measurements:	25	25	25	25	25
Mean:	5.3	1.8	11.3	2.6	4.1
Standard Deviation:	0.4	0.2	0.8	0.3	0.4
RSD (%):	7.3	13.0	6.9	9.6	11.0

notes: ? Insufficient data for calculation.

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

Urine Mercury

The source of the test materials is human urine obtained from donor volunteers with informed consent. Urine was collected into polyethylene containers and then stored at 4°C. Following collection, urine from each donor was mixed and acidified to 1% v/v with nitric acid, and 1% (v/v) sulfamic acid solution containing 200 mg/mL sulfamic acid and 10% (v/v) Triton-X 100 was added to stabilize Hg. The urine was stored frozen at -80°C; after thawing at room temperature, precipitated salts were removed by centrifugation. The urine was separated into five pools and each was supplemented with different amounts of inorganic Hg. Each pool was stirred for approximately 24 hours to ensure thorough mixing prior to aliquoting 10-mL samples into acid-leached polypropylene vials. Samples were stored at -80°C prior to circulating for proficiency testing.

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 urine mercury range from 10.3 µg/L (51 nmol/L) to 88.1 µg/L (439 nmol/L).

Acceptable ranges. The acceptable range is fixed at ±30% or ±3 µg/L (15 nmol/L) for target values ≤10 µg/L. The criteria are consistent with those in place for blood Hg.

Discussion. Based upon the above criteria, 98.3% of test results reported were judged as satisfactory, with none of the 23 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Mercury Test Results, 2012 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
--	---------	---------	---------	---------	---------

Robust Mean	10.3	18.7	88.1	38.2	30.6
Robust Standard Deviation	1.2	1.9	10.7	3.8	3.7
Standard Uncertainty	0.3	0.5	2.8	1.0	1.0
RSD (%)	11.5	10.3	12.1	10.0	12.1
Acceptable Range:					
Upper Limit	13.4	24.3	114.5	49.7	39.8
Lower Limit	7.2	13.1	61.7	26.7	21.4

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

New York State Department of Health
Urine Mercury Test Results, 2012 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE12-11	UE12-12	UE12-13	UE12-14	UE12-15	
Target Values:		10.3	18.7	88.1	38.2	30.6	
103	DRC/CC-ICP-MS	9.5	17.3	85.8	37.4	25.2	Info
107	DRC/CC-ICP-MS	12.7	18.4	78.7	36.1	29.3	Info
109	AFS	13.1	23.4	97.2	41.6	34.8	Info
110	ICP-MS	11.9	21.6	100.0	43.7	34.8	
114	ICP-MS	8.0	15.0	74.0	33.0	26.0	
147	CV-AAS	9.7	18.9	86.7	37.5	30.4	Info
156	ICP-MS	9.6	17.5	82.8	36.4	28.4	
164	ICP-MS	12.0	20.0	92.0	42.0	34.0	
179	ICP-MS	10.0	19.0	87.0	39.0	31.0	
197	DRC/CC-ICP-MS	11.0	20.0	93.0	41.0	33.0	
199	ICP-MS	10.1	17.5	78.4	36.8	29.2	Info
200	ICP-MS	9.4	17.9	84.8	36.8	28.8	Info
206	ICP-MS	10.0	18.0	92.0	38.0	30.0	
208	CV-AAS	10.9	21.6	101.2	44.3	34.0	
293	ICP-MS	9.9	17.7	79.6	34.9	28.1	Info
305	ICP-MS	10.4	19.6	83.3	38.2	30.2	
312	ICP-MS	10.3	17.1	91.2	37.1	32.6	
324	AFS	11.8	22.4	90.2	42.9	33.9	Info
339	HR-ICP-MS	8.0	15.4	70.6	29.9	21.9	Info
359	ICP-MS	10.1	16.7	74.5	31.2	26.1	
366	ICP-MS	12.0	27.0 ↑	105.0	40.0	36.0	Info
391	DRC/CC-ICP-MS	10.2	18.3	95.1	36.7	30.4	Info
401	DRC/CC-ICP-MS	7.0 ↓	19.3	113.1	44.2	33.5	Info

Percent satisfactory results for all participants: 98.3 %

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

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

New York State Department of Health
Urine Mercury Test Results, 2012 Event #3
STATISTICAL SUMMARY BY METHOD

Results ($\mu\text{g/L}$ urine)					
	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
AFS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	12.5	22.9	93.7	42.3	34.4
Standard Deviation:	0.9	0.7	4.9	0.9	0.6
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	10.3	20.3	94.0	40.9	32.2
Standard Deviation:	0.8	1.9	10.3	4.8	2.5
RSD (%):	—	—	—	—	—
DRC/CC-ICP-MS					
Number of Sample Measurements:	5	5	5	5	5
Mean:	10.1	18.7	93.1	39.1	30.3
Standard Deviation:	2.1	1.0	12.9	3.4	3.3
RSD (%):	20.8	5.5	13.8	8.8	11.0
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	8.0	15.4	70.6	29.9	21.9
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	13	13	13	13	13
Mean:	10.3	18.8	86.5	37.5	30.4
Standard Deviation:	1.1	3.0	9.3	3.4	3.2
RSD (%):	11.0	15.7	10.8	9.0	10.4
All Laboratories					
Number of Sample Measurements:	23	23	23	23	23
Mean:	10.3	19.1	88.5	38.2	30.5
Standard Deviation:	1.5	2.7	10.5	3.9	3.6
RSD (%):	14.5	14.1	11.9	10.2	11.7

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, 2012

Urine Lead

The source of the test materials is human urine obtained from donor volunteers with informed consent. Urine was collected into polyethylene containers and then stored at 4°C. Following collection, urine from each donor was mixed and acidified to 1% v/v with nitric acid, and 1% (v/v) sulfamic acid solution containing 200 mg/mL sulfamic acid and 10% (v/v) Triton-X 100 was added to stabilize Hg. The urine was stored frozen at -80°C; after thawing at room temperature, precipitated salts were removed by centrifugation. The urine was separated into five pools and each was supplemented with different amounts of inorganic Pb²⁺. Each pool was stirred for approximately 24 hours to ensure thorough mixing prior to aliquoting 10-mL samples into acid-leached polypropylene vials. Samples were stored at -80°C prior to circulating for proficiency testing.

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 urine lead range from 13.7 µg/L (0.07 µmol/L) to 74.7 µg/L (0.36 µmol/L).

Acceptable ranges. The acceptable range is fixed at ±10% or ±40 µg/L (0.19 µmol/L) around the target value, whichever is greater. These criteria are consistent with those established under CLIA '88 (Federal Register Volume 57, Number 40, §§ 493.2 and 493.937, February 28, 1992) for blood lead.

Discussion. Based upon the above criteria, 100.0% of test results were judged as satisfactory, with none of the 23 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Lead Test Results, 2012 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

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

	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
--	---------	---------	---------	---------	---------

Robust Mean	74.7	35.0	13.7	36.5	72.1
Robust Standard Deviation	4.1	2.3	0.7	2.4	4.2
Standard Uncertainty	1.1	0.6	0.2	0.6	1.1
RSD (%)	5.5	6.7	4.7	6.4	5.8
Acceptable Range:					
Upper Limit	114.7	75.0	53.7	76.5	112.1
Lower Limit	34.7	0.0	0.0	0.0	32.1

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

New York State Department of Health
Urine Lead Test Results, 2012 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE12-11	UE12-12	UE12-13	UE12-14	UE12-15	
Target Values:		74.7	35.0	13.7	36.5	72.1	
103	DRC/CC-ICP-MS	74.8	33.6	13.4	35.5	70.2	Info
106	ICP-MS	78.7	37.0	14.5	38.8	76.5	Info
107	DRC/CC-ICP-MS	78.0	36.4	14.3	38.4	75.0	Info
110	ICP-MS	75.7	35.2	13.9	37.2	73.0	
114	ICP-MS	67.0	31.0	13.0	33.0	66.0	
116	ICP-MS	80.1	37.3	15.2	39.5	77.2	Info
147	ICP-MS	75.4	34.8	14.2	37.3	74.2	Info
156	ICP-MS	80.6	38.5	13.8	37.4	75.4	
164	ICP-MS	73.0	34.0	13.0	36.0	71.0	
179	ICP-MS	78.0	36.0	14.0	39.0	75.0	
197	DRC/CC-ICP-MS	74.1	34.2	13.8	36.6	73.3	
200	ICP-MS	72.9	33.1	12.4	33.9	70.8	Info
206	ICP-MS	75.0	31.0	13.0	34.0	69.0	
208	ICP-MS	74.7	35.7	13.8	35.1	72.9	
293	ICP-MS	85.6	39.2	16.7	41.4	83.5	Info
305	ICP-MS	69.8	33.6	12.5	34.0	68.2	
312	ICP-MS	76.0	36.9	14.3	39.1	77.5	
324	ICP-MS	74.3	34.7	13.8	36.7	71.3	Info
339	HR-ICP-MS	69.7	34.6	13.8	37.4	66.6	Info
359	ICP-MS	71.4	33.3	12.8	34.3	68.3	
366	ICP-MS	72.0	39.0	14.0	34.0	70.0	Info
391	ETAAS-Z	63.7	31.8	13.6	35.1	66.1	Info
472	ICP-MS	75.7	34.9	13.7	37.3	72.3	Info

Percent satisfactory results for all participants: 100.0 %

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

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

New York State Department of Health
Urine Lead Test Results, 2012 Event #3
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ urine)				
	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	75.6	34.7	13.8	36.8	72.8
Standard Deviation:	2.1	1.5	0.5	1.5	2.4
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	63.7	31.8	13.6	35.1	66.1
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	69.7	34.6	13.8	37.4	66.6
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	18	18	18	18	18
Mean:	75.3	35.3	13.8	36.6	72.9
Standard Deviation:	4.3	2.4	1.0	2.4	4.2
RSD (%):	5.7	6.9	7.4	6.6	5.8
All Laboratories					
Number of Sample Measurements:	23	23	23	23	23
Mean:	74.6	35.0	13.8	36.6	72.3
Standard Deviation:	4.7	2.3	0.9	2.2	4.2
RSD (%):	6.3	6.6	6.6	6.0	5.8

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 #3, 2012

Additional Trace Elements Reported in Urine

Participating laboratories reported analytical results for any other elements that are routinely reported in order to characterize these materials more completely. Results and descriptive statistics are provided for reference purposes. No target value or acceptable range is implied. As, Cd, and Pb were spiked using a stock standard containing all elements in the National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and Prevention. Refer to www.cdc.gov/exposurereport for more information on recent NHANES data for these elements in urine. In addition, these samples were spiked with leading elements present in other proficiency testing programs. The following table shows the additional elements spiked in the samples.

NHANES Elements

Ba
Be
Co
Cs
Mo
Pt
Sb
Tl
U
W

Additional Elements

Al
Cr
Cu
Mn
Ni
Se
Sn
Te
V
Zn

New York State Department of Health
Urine Additional Elements, 2012 Event #3
Page 1

Urine Aluminum (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
147	ICP-MS	37.2	15.9	<13.5	18.6	29.1
164	ICP-MS	35.0	12.0	7.0	17.0	27.0
179	DRC/CC-ICP-MS	37.0	12.0	6.0	18.0	28.0
197	ICP-MS	38.0	<20.0	<20.0	<20.0	25.0
206	DRC/CC-ICP-MS	>20.0	9.0	4.0	14.0	19.0
305	ICP-MS	31.0	6.0	<5.0	13.0	23.0
312	ICP-MS	32.4	15.4	7.3	19.0	24.8
359	ICP-MS	27.8	9.3	3.2	12.6	23.5
391	DRC/CC-ICP-MS	27.0	23.8	*18.9	20.4	23.6
Arithmetic Mean		33	13	6	17	25
*Outlier	SD	4	5	2	3	3
	n	8	8	5	8	9

Urine Antimony (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	5.3	1.7	0.9	2.6	4.0
147	ICP-MS	5.3	1.7	0.92	2.7	4
197	ICP-MS	5.3	1.7	<1.0	2.5	3.9
206	ICP-MS	*4	<2.0	<2.0	2.0	3.0
312	ICP-MS	5.0	1.7	0.8	2.4	3.9
359	ICP-MS	4.7	1.5	0.7	2.1	3.3
391	DRC/CC-ICP-MS	5.3	1.8	0.9	2.5	3.9
472	ICP-MS	5.1	1.6	0.8	2.5	3.8
Arithmetic Mean		5.1	1.7	0.8	2.4	3.7
*Outlier	SD	0.2	0.1	0.1	0.2	0.4
	n	7	7	6	8	8

Urine Barium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	7.0	2.7	1.7	3.7	5.4
116	ICP-MS	7.00	2.73	2.12	3.71	5.43
147	ICP-MS	6.7	2.6	1.6	3.6	5.1
197	ICP-MS	6.7	2.6	<2.0	3.7	5.3
312	ICP-MS	7.1	2.8	1.8	3.9	5.6
359	ICP-MS	6.1	2.3	1.4	*2.9	*4.4
472	ICP-MS	6.8	2.6	1.6	3.7	5.3
Arithmetic Mean		6.8	2.6	1.7	3.7	5.4
*Outlier	SD	0.3	0.2	0.2	0.1	0.2
	n	7	7	6	6	6

Urine Beryllium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	6.5	2.3	1.0	3.0	5.1
116	ICP-MS	6.79	2.29	1.14	3.33	5.14
147	ICP-MS	6.4	2.4	1.3	3.4	5.2
197	ICP-MS	6.6	2.2	1.2	3.3	4.8
312	ICP-MS	7.3	2.4	1.2	3.8	5.0
391	DRC/CC-ICP-MS	6.4	2.2	1.0	3.1	5.0
472	ICP-MS	5.9	2.0	1.0	-	4.7
Arithmetic Mean		6.6	2.3	1.1	3.3	5.0
	SD	0.4	0.1	0.1	0.3	0.2
	n	7	7	7	6	7

New York State Department of Health
Urine Additional Elements, 2012 Event #3
Page 2

Urine Bismuth (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
147	ICP-MS	<0.1	<0.1	<0.1	<0.1	<0.1

Urine Cesium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	27.1	10.1	6.0	14.2	20.9
147	ICP-MS	26.3	9.6	5.9	13.3	20.3
312	ICP-MS	27.9	10.6	6.3	14.9	22.5
359	ICP-MS	24.4	8.6	5.0	11.6	17.4
472	ICP-MS	27.0	10.1	5.9	14.1	20.8
Arithmetic Mean		27	9.8	5.8	14	20
SD		1	0.8	0.5	1	2
n		5	5	5	5	5

Urine Chromium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	DRC/CC-ICP-MS	13.6	4.8	2.8	7.0	10.5
147	ICP-MS	13.2	4.4	2.4	6.7	9.9
164	ICP-MS	12.4	4.4	2.4	6.1	9.2
179	DRC/CC-ICP-MS	13.6	4.7	2.5	6.8	10.6
197	DRC/CC-ICP-MS	11.0	3.3	<1.0	4.4	8.2
206	DRC/CC-ICP-MS	12.7	4.3	2.2	6.3	9.6
305	ICP-MS	13.8	4.6	2.3	6.3	10.3
312	DRC/CC-ICP-MS	11.2	4.1	2.1	5.9	9.7
359	ICP-MS	10.3	3.6	1.9	5.3	8.5
391	DRC/CC-ICP-MS	14.7	4.6	2.9	7.4	9.8
401	DRC/CC-ICP-MS	12.68	4.22	2.15	6.37	9.78
Arithmetic Mean		13	4.3	2.4	6.2	9.6
SD		1	0.5	0.3	0.8	0.8
n		11	11	10	11	11

Urine Cobalt (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	2.6	8.6	0.5	24.7	2.2
147	ICP-MS	2.6	8.7	0.5	24.7	2.1
164	ICP-MS	2.7	9.0	0.5	25.5	2.1
179	ICP-MS	3.0	9.5	0.7	28.0	2.3
197	ICP-MS	2.6	8.5	<1.0	24.5	2.2
206	ICP-MS	2.8	8.7	<1.0	22.7	2.1
305	ICP-MS	2.8	8.6	0.7	24.6	2.2
312	ICP-MS	2.6	8.8	0.5	25.0	2.2
359	ICP-MS	2.5	7.8	0.6	22.3	2.0
391	DRC/CC-ICP-MS	2.7	8.7	0.5	25.1	2.1
401	DRC/CC-ICP-MS	2.63	8.65	0.5	24.79	2.09
472	ICP-MS	2.6	8.6	0.5	-	2.1
Arithmetic Mean		2.7	8.7	0.6	25	2.1
SD		0.1	0.4	0.1	1	0.1
n		12	12	10	11	12

New York State Department of Health
Urine Additional Elements, 2012 Event #3
Page 3

Urine Copper (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	251.0	84.8	44.9	125.0	193.0
147	ICP-MS	262	90.9	47.6	131.5	199
164	ICP-MS	255.0	87.0	46.0	126.0	192.0
179	DRC/CC-ICP-MS	267.0	88.0	46.0	130.0	201.0
197	ICP-MS	282.5	96.8	53.2	143.1	217.6
206	ICP-MS	239.0	74.0	42.0	108.0	166.0
305	ICP-MS	269.0	85.0	44.0	124.0	198.0
312	ICP-MS	239.3	83.3	43.0	122.0	184.9
359	ICP-MS	188.9	74.3	39.1	107.9	164.7
391	DRC/CC-ICP-MS	293.9	85.9	44.8	125.8	198.3
401	DRC/CC-ICP-MS	225.14	71.87	34.98	106.21	166
Arithmetic Mean		252	84	44	123	189
SD		29	8	5	11	17
n		11	11	11	11	11
Urine Iron (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
391	DRC/CC-ICP-MS	11.8	11.6	6.2	8.5	4.7
Urine Lithium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
147	ICP-MS	6.5	6.7	6.8	6.9	7.1
Urine Manganese (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
103	DRC/CC-ICP-MS	6.2	2.0	1.3	3.2	4.8
110	DRC/CC-ICP-MS	6.9	2.3	1.2	3.2	5.2
147	ICP-MS	6.5	2.2	1.2	3.3	5
179	DRC/CC-ICP-MS	6.0	1.9	1.0	2.8	4.6
206	ICP-MS	6.6	2.4	1.7	3.2	5.0
305	ICP-MS	6.5	2.5	1.6	3.8	5.3
312	ICP-MS	6.4	2.5	1.6	3.5	5.4
359	ICP-MS	*4.3	1.5	0.8	2.3	*3.7
391	DRC/CC-ICP-MS	6.6	2.4	1.5	3.5	5.1
Arithmetic Mean		6.5	2.2	1.3	3.2	5.1
SD		0.3	0.3	0.3	0.4	0.3
n		8	9	9	9	8
*Outlier						
Urine Molybdenum (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	85.8	42.0	31.6	52.1	69.9
147	ICP-MS	82.1	40.5	30.3	50.1	66.4
179	ICP-MS	90.0	42.0	32.0	54.0	70.0
197	ICP-MS	89.4	43.5	33.3	55.2	71.8
312	ICP-MS	84.2	41.8	31.6	52.7	68.5
359	ICP-MS	75.1	36.3	27.6	44.9	60.5
472	ICP-MS	79.1	38.1	28.0	47.6	64.4
Arithmetic Mean		84	41	31	51	67
SD		5	3	2	4	4
n		7	7	7	7	7

New York State Department of Health
Urine Additional Elements, 2012 Event #3
Page 4

Urine Nickel (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	7.4	5.2	2.2	8.4	5.8
147	ICP-MS	7	4.7	1.5	8.1	5.2
164	ICP-MS	7.2	4.7	1.7	7.7	5.3
179	DRC/CC-ICP-MS	7.2	4.6	1.5	8.2	5.3
197	ICP-MS	8.3	4.3	2.0	7.6	4.9
206	ICP-MS	6.5	4.7	<2.0	7.7	5.6
312	ICP-MS	6.6	5.9	2.0	8.0	5.5
359	ICP-MS	5.4	3.9	1.9	*6.1	4.4
391	DRC/CC-ICP-MS	6.4	4.2	1.3	7.3	4.9
401	DRC/CC-ICP-MS	6.15	4.1	1.3	7.43	4.85
Arithmetic Mean		6.8	4.6	1.7	7.8	5.2
*Outlier	SD	0.8	0.6	0.3	0.4	0.4
	n	10	10	9	9	10

Urine Platinum (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	2.2	0.7	0.3	1.1	1.8
147	ICP-MS	2.2	0.73	0.35	1.04	1.7
312	ICP-MS	2.3	0.7	0.4	1.1	1.4
359	ICP-MS	*2.8	*0.9	0.5	1.2	1.6
472	ICP-MS	2.3	0.7	0.3	1.1	1.7
Arithmetic Mean		2.3	0.71	0.4	1.1	1.6
*Outlier	SD	0.1	0.02	0.1	0.1	0.2
	n	4	4	5	5	5

Urine Selenium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	DRC/CC-ICP-MS	71.4	30.4	17.6	39.3	53.6
147	ICP-MS	75.8	33.5	23.4	43.4	60.6
179	DRC/CC-ICP-MS	81.0	36.0	24.0	47.0	64.0
197	ICP-MS	82.0	<50.0	<50.0	<50.0	70.0
206	ICP-MS	74.0	39.0	29.0	44.0	63.0
305	ICP-MS	64.0	32.0	23.0	39.0	51.0
312	ICP-MS	79.3	35.7	25.6	46.7	59.4
359	ICP-MS	72.2	32.9	25.6	38.7	58.1
391	DRC/CC-ICP-MS	89.9	*54.3	*46.9	*64.2	78.7
472	DRC/CC-ICP-MS	73.9	29.9	21.8	41.2	63.5
Arithmetic Mean		76	34	24	42	62
*Outlier	SD	7	3	3	3	8
	n	10	8	8	8	10

Urine Tellurium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	4.8	1.6	0.8	2.2	3.4
197	ICP-MS	5.0	1.6	<1.0	2.2	3.5
206	ICP-MS	4.0	2.0	1.0	2.0	3.0
312	ICP-MS	4.8	1.7	0.9	2.1	3.5
359	ICP-MS	*9.4	2.5	0.9	*3.2	*5.6
Arithmetic Mean		4.7	1.9	0.9	2.1	3.4
*Outlier	SD	0.4	0.4	0.1	0.1	0.2
	n	4	5	4	4	4

New York State Department of Health
Urine Additional Elements, 2012 Event #3
Page 5

Urine Thallium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	12.7	4.2	2.2	6.2	9.6
116	ICP-MS	13.2	4.38	2.27	6.54	10.0
147	ICP-MS	12.5	4.1	2.2	6.2	9.5
179	ICP-MS	13.0	4.0	2.0	6.0	10.0
197	ICP-MS	12.3	4.1	2.2	6.0	9.2
206	ICP-MS	>10.0	3.9	2.0	5.4	9.0
305	ICP-MS	12.5	4.2	2.2	6.2	9.7
312	ICP-MS	13.1	4.6	2.3	6.8	10.2
359	ICP-MS	11.8	3.9	2.0	5.6	8.7
391	DRC/CC-ICP-MS	*10.2	*3.3	*1.6	4.8	*7.6
472	ICP-MS	12.5	4.2	2.2	6.1	9.5
Arithmetic Mean		12.6	4.2	2.2	6.0	9.5
*Outlier	SD	0.4	0.2	0.1	0.5	0.5
	n	9	10	10	11	10

Urine Thorium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
147	ICP-MS	<0.005	<0.005	<0.005	<0.005	<0.005

Urine Tin (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	12.8	4.3	2.2	6.3	9.6
147	ICP-MS	11.9	3.9	2.1	5.8	8.9
312	ICP-MS	12.3	4.1	2.2	6.2	9.8
359	ICP-MS	11.2	3.6	1.9	5.1	8.1
Arithmetic Mean		12.1	4.0	2.1	5.9	9.1
	SD	0.7	0.3	0.1	0.5	0.8
	n	4	4	4	4	4

Urine Tungsten (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	5.2	1.8	0.9	2.6	4.0
147	ICP-MS	7	2.5	*2	3.3	5
312	ICP-MS	4.7	1.6	0.8	2.3	3.7
359	ICP-MS	6.6	2.1	1.1	3.2	5.0
472	ICP-MS	4.8	1.6	0.8	2.3	3.6
Arithmetic Mean		6	1.9	0.9	2.7	4.3
*Outlier	SD	1	0.4	0.1	0.5	0.7
	n	5	5	4	5	5

Urine Uranium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
103	DRC/CC-ICP-MS	0.6	0.2	0.1	0.3	0.5
110	ICP-MS	0.6	0.2	0.1	0.3	0.5
116	ICP-MS	0.636	0.210	0.104	0.308	0.481
147	ICP-MS	0.55	*0.18	0.097	0.27	0.44
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0
312	ICP-MS	0.7	0.2	0.1	0.4	0.5
359	ICP-MS	0.6	0.2	0.1	0.3	0.4
391	DRC/CC-ICP-MS	0.5	0.2	0.1	0.2	0.4
472	ICP-MS	0.6	0.2	0.1	0.3	0.5
Arithmetic Mean		0.60	0.201	0.100	0.30	0.47
*Outlier	SD	0.06	0.004	0.002	0.05	0.05
	n	8	7	8	8	8

New York State Department of Health
Urine Additional Elements, 2012 Event #3
Page 6

Urine Vanadium (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
147	ICP-MS	5	1.7	0.91	2.5	3.8
179	DRC/CC-ICP-MS	4.4	1.5	0.7	2.1	3.4
312	DRC/CC-ICP-MS	4.7	2.0	0.8	2.6	4.3
359	ICP-MS	6.1	2.1	1.1	3.1	5.1
391	DRC/CC-ICP-MS	4.9	1.8	1.1	2.6	3.7
	Arithmetic Mean	5.0	1.8	0.9	2.6	4.1
	SD	0.6	0.2	0.2	0.4	0.7
	n	5	5	5	5	5

Urine Zinc (µg/L)						
Lab Code	Method	UE12-11	UE12-12	UE12-13	UE12-14	UE12-15
110	ICP-MS	334.0	135.0	104.0	176.0	245.0
147	ICP-MS	335	150	100	193	273
164	ICP-MS	*424	152.0	108.0	194.0	262.0
179	DRC/CC-ICP-MS	338.0	151.0	104.0	187.0	260.0
197	ICP-MS	307.0	<200.0	<200.0	<200.0	245.0
206	ICP-MS	300.0	120.0	90.0	160.0	210.0
305	ICP-MS	308.0	133.0	94.0	174.0	243.0
312	ICP-MS	276.5	129.3	89.0	162.0	245.7
359	ICP-MS	295.8	130.5	89.9	170.5	239.7
391	DRC/CC-ICP-MS	278.5	118.1	81.7	155.5	225.4
401	DRC/CC-ICP-MS	320.97	138.58	94.13	180.42	250.37
	Arithmetic Mean	309	136	95	175	245
*Outlier	SD	22	12	8	14	17
	n	10	10	10	10	11

New York State Department of Health
Trace Elements in Urine
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 $\mu\text{mol ZPP/mol heme}$)
- F-4 Other

OTHER METHODS

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