TRACE ELEMENTS IN URINE

Proficiency Test Report

Event #2, 2015

July 2nd, 2015

NEW YORK STATE OF OPPORTUNITY. Department of Health

ANDREW M. CUOMO
Governor

HOWARD A. ZUCKER, M.D., J.D.
Commissioner

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Executive Deputy Commissioner

July 2, 2015

Trace Elements in Urine
Event #2, 2015

Dear Laboratory Director:

Results from the second proficiency test (PT) event for 2015 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. 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, September 16th, 2015. Please inform our laboratory staff at (518) 474-7161 if the test materials have not arrived within five days of the scheduled mail out date. **The deadline for reporting results is Wednesday, October 14th, 2015.**

Thank you for your participation.

Sincerely,

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Urine Arsenic

The source of the test materials is human urine obtained from donor volunteers. 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 As^{3+}. 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 24.1 µg/L (0.32 µmol/L) to 274.6 µg/L (3.67 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, 99.0% of test results reported were judged as satisfactory, with none of the 21 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Arsenic Test Results, 2015 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L urine)				
	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
Robust Mean	**274.6**	**24.1**	**69.3**	**27.4**	**166.4**
Robust Standard Deviation	15.3	1.7	3.2	2.6	13.3
Standard Uncertainty	4.2	0.5	0.9	0.7	3.6
RSD (%)	5.6	6.9	4.6	9.5	8.0
Number of Sample Measurements	21	21	21	21	21
Acceptable Range:					
Upper Limit	329.5	30.1	83.2	33.4	199.7
Lower Limit	219.7	18.1	55.4	21.4	133.1

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, 2015 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE15-06	UE15-07	UE15-08	UE15-09	UE15-10	
	Target Values:	274.6	24.1	69.3	27.4	166.4	
103	DRC/CC-ICP-MS	284.4	24.2	68.3	29.2	176.6	Info
106	DRC/CC-ICP-MS	279.3	23.4	70.3	28.3	170.0	Info
107	DRC/CC-ICP-MS	260	23	67	25	160	Info
110	DRC/CC-ICP-MS	294.0	27.0	70.9	29.7	178.0	
114	ICP-MS	245.0	24.0	59.0	24.0	160.0	
116	DRC/CC-ICP-MS	290	23.8	71.3	27.4	159	Info
147	ICP-MS	239.0	20.6	55.1 ↓	24.3	136.3	Info
156	DRC/CC-ICP-MS	230.0	20.0	57.0	23.0	140.0	
164	ICP-MS	272.0	23.0	70.0	32.0	169.0	
179	ICP-MS	278.0	24.0	70.0	28.0	171.0	
197	DRC/CC-ICP-MS	241.0	24.0	63.0	27.0	159.0	
200	ICP-MS	275.0	28.1	71.5	27.9	159	Info
206	DRC/CC-ICP-MS	287.0	26.1	73.5	30.4	176.3	
208	ICP-MS	232.0	22.0	64.0	26.0	139.0	
293	DRC/CC-ICP-MS	277.9	22.8	69.1	24.2	170.8	Info
305	ICP-MS	285.7	25.2	74.3	30.4	186.9	
312	DRC/CC-ICP-MS	281.0	24.0	66.6	27.9	164.0	
324	HR-ICP-MS	325.4	27.3	78.3	29.3	192.2	Info
366	ICP-MS	235.0	29.0	70.0	25.0	152.0	Info
391	ICP-MS	283.5	23.6	71.5	28.7	179.8	Info
401	DRC/CC-ICP-MS	275.8	24.3	68.1	27.4	170.2	Info

Percent satisfactory results for all participants: 99.0 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
◥: Result unacceptable
◢: Result not reported

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

New York State Department of Health
Urine Arsenic Test Results, 2015 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (μg/L urine)				
	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	11	11	11	11	11
Mean:	272.8	23.9	67.7	27.2	165.8
Standard Deviation:	20.6	1.8	4.5	2.3	11.1
RSD (%):	7.5	7.5	6.7	8.5	6.7
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	325.4	27.3	78.3	29.3	192.2
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	9	9	9	9	9
Mean:	260.6	24.4	67.3	27.4	161.4
Standard Deviation:	22.3	2.7	6.5	2.8	17.2
RSD (%):	8.6	11.1	9.6	10.1	10.7
All Laboratories					
Number of Sample Measurements:	21	21	21	21	21
Mean:	270.0	24.3	68.0	27.4	165.2
Standard Deviation:	24.7	2.3	5.7	2.4	14.9
RSD (%):	9.1	9.3	8.4	8.9	9.0

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. 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 Cd^{2+}. 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 1.3 µg/L (12 nmol/L) to 12.7 µg/L (113 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, 99.0% of test results reported were judged as satisfactory, with none of the 21 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Cadmium Test Results, 2015 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L urine)				
	UE15-06	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
Robust Mean	**6.0**	**2.9**	**12.7**	**5.3**	**1.3**
Robust Standard Deviation	0.2	0.2	0.5	0.3	0.1
Standard Uncertainty	<0.1	<0.1	0.1	0.1	<0.1
RSD (%)	3.1	5.7	3.9	5.9	9.3
Number of Sample Measurements	21	21	21	21	21
Acceptable Range:					
Upper Limit	7.0	3.9	14.6	6.3	2.3
Lower Limit	5.0	1.9	10.8	4.3	0.3

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, 2015 Event #2

PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE15-06	UE15-07	UE15-08	UE15-09	UE15-10	
	Target Values:	6.0	2.9	12.7	5.3	1.3	
103	DRC/CC-ICP-MS	6.0	2.9	13.0	5.3	1.2	Info
106	ICP-MS	6.1	3.0	13.1	5.4	1.3	Info
107	DRC/CC-ICP-MS	6.1	3.2	14	5.6	1.3	Info
110	ICP-MS	6.1	3.0	13.1	5.3	1.3	
114	ICP-MS	5.1	2.6	11.3	4.7	1.2	
116	ICP-MS	6.1	3.0	12.9	5.6	1.4	Info
147	ICP-MS	5.3	2.6	10.8	5.0	1.1	Info
156	ICP-MS	6.0	2.8	12.0	5.2	1.3	
164	ICP-MS	5.8	2.8	12.4	5.0	1.3	
179	ICP-MS	6.0	2.9	13.2	5.4	1.2	
197	DRC/CC-ICP-MS	5.9	3.0	12.6	5.4	1.3	
200	ICP-MS	5.1	2.7	11.7	6.2	1.3	Info
206	ICP-MS	6.0	3.0	13.0	5.2	1.3	
208	ICP-MS	5.0	3.0	11.0	5.0	1.0	
293	ICP-MS	6.2	3.1	13.6	5.5	1.4	Info
305	ICP-MS	6.7	2.8	12.9	5.2	1.4	
312	ICP-MS	6.2	2.9	13.2	5.8	1.3	
324	HR-ICP-MS	5.9	2.9	12.6	5.3	1.3	Info
366	ICP-MS	5.0	2.6	11.0	4.0 ↓	0.8	Info
391	ICP-MS	5.7	2.6	12.4	4.9	1.0	Info
401	DRC/CC-ICP-MS	6.1	3.0	12.9	5.4	1.2	Info

Percent satisfactory results for all participants: 99.0 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
◥: Result unacceptable
◢: Result not reported

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

New York State Department of Health
Urine Cadmium Test Results, 2015 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (μg/L urine)				
	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	6.0	3.0	13.1	5.4	1.3
Standard Deviation:	0.1	0.1	0.6	0.1	0.1
RSD (%):	1.6	4.2	4.6	2.3	4.6
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	5.9	2.9	12.6	5.3	1.3
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	16	16	16	16	16
Mean:	5.8	2.8	12.4	5.2	1.2
Standard Deviation:	0.5	0.2	0.9	0.5	0.2
RSD (%):	9.0	6.2	7.5	9.4	13.8
All Laboratories					
Number of Sample Measurements:	21	21	21	21	21
Mean:	5.8	2.9	12.5	5.3	1.2
Standard Deviation:	0.5	0.2	0.9	0.4	0.1
RSD (%):	7.9	6.1	7.1	8.3	12.1

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. 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 8.5 µg/L (42 nmol/L) to 101.7 µg/L (507 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, 96.8% of test results reported were judged as satisfactory, with none of the 19 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Mercury Test Results, 2015 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L urine)				
	UE15-06	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
Robust Mean	**81.0**	**19.9**	**101.7**	**8.5**	**62.9**
Robust Standard Deviation	4.8	1.6	10.1	1.7	4.4
Standard Uncertainty	1.4	0.4	2.9	0.5	1.3
RSD (%)	5.9	7.8	9.9	19.6	7.0
Number of Sample Measurements	19	19	19	19	19
Acceptable Range:					
Upper Limit	105.3	25.9	132.2	11.5	81.8
Lower Limit	56.7	13.9	71.2	5.5	44.0

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, 2015 Event #2

PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE15-06	UE15-07	UE15-08	UE15-09	UE15-10	
	Target Values:	81.0	19.9	101.7	8.5	62.9	
103	DRC/CC-ICP-MS	77.7	18.3	97.9	9.0	59.3	Info
107	DRC/CC-ICP-MS	91	20	110	9.4	70	Info
109	AFS	76.6	21.1	96.6	10.3	61.5	Info
110	ICP-MS	84.1	21.4	108.0	9.8	65.7	
114	ICP-MS	83.0	20.0	117.0	8.0	67.0	
147	CV-AAS	73.6	19.6	99.7	9.0	63.2	Info
156	ICP-MS	82.0	19.0	100.0	7.7	66.0	
164	ICP-MS	84.0	23.0	107.0	10.0	65.0	
179	ICP-MS	80.0	20.0	98.0	7.0	61.0	
197	DRC/CC-ICP-MS	79.0	19.0	96.0	8.0	62.0	
199	ICP-MS	89.8	20.7	109.0	6.3	66.4	Info
200	ICP-MS	82.6	20.8	104.8	8.0	63.2	Info
206	ICP-MS	72.8	19.5	92.9	9.6	53.7	
208	CV-AAS	97.0	24.0	123.0	10.0	76.0	
293	ICP-MS	81.4	17.5	88.6	4.3 ↓	61.9	Info
305	ICP-MS	80.0	20.2	113.5	11.3	64.0	
312	ICP-MS	83.9	20.0	102.0	8.9	59.8	
366	ICP-MS	69.3	17.0	85.5	4.1 ↓	53.2	Info
401	DRC/CC-ICP-MS	71.9	17.1	90.6	4.3 ↓	55.8	Info

Percent satisfactory results for all participants: 96.8 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
◥: Result unacceptable
◢: Result not reported

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

New York State Department of Health
Urine Mercury Test Results, 2015 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (μg/L urine)				
	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
AFS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	76.6	21.1	96.6	10.3	61.5
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	85.3	21.8	111.4	9.5	69.6
Standard Deviation:	16.5	3.1	16.5	0.7	9.1
RSD (%):	—	—	—	—	—
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	79.9	18.6	98.6	7.7	61.8
Standard Deviation:	8.0	1.2	8.2	2.3	6.0
RSD (%):	10.0	6.6	8.3	30.3	9.8
ICP-MS					
Number of Sample Measurements:	12	12	12	12	12
Mean:	81.1	19.9	102.2	7.9	62.2
Standard Deviation:	5.4	1.6	9.7	2.2	4.7
RSD (%):	6.6	8.1	9.5	28.1	7.5
All Laboratories					
Number of Sample Measurements:	19	19	19	19	19
Mean:	81.0	19.9	102.1	8.2	62.9
Standard Deviation:	6.9	1.8	9.9	2.1	5.4
RSD (%):	8.5	9.0	9.7	26.0	8.7

notes: ? Insufficient data for calculation.
A Standard Deviation displayed as 0.0 should be interpreted as <0.1

Urine Lead

The source of the test materials is human urine obtained from donor volunteers. 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 Pb^{2+}. 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 9.9 µg/L (0.05 µmol/L) to 234.0 µg/L (1.13 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, 97.0% of test results were judged as satisfactory, with none of the 20 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Lead Test Results, 2015 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE15-06	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
Robust Mean	**86.1**	**9.9**	**234.0**	**76.3**	**17.5**
Robust Standard Deviation	5.7	0.6	11.4	4.4	0.9
Standard Uncertainty	1.6	0.2	3.3	1.2	0.2
RSD (%)	6.6	5.7	4.9	5.8	5.1
Number of Sample Measurements	20	19	19	20	20
Acceptable Range:					
Upper Limit	126.1	49.9	274.0	116.3	57.5
Lower Limit	46.1	0.0	194.0	36.3	0.0

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, 2015 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE15-06	UE15-07	UE15-08	UE15-09	UE15-10	
	Target Values:	86.1	9.9	234.0	76.3	17.5	
103	DRC/CC-ICP-MS	87.2	10.0	237.8	76.9	17.4	Info
106	ICP-MS	87.0	10.2	241.4	79.0	18.1	Info
107	ICP-MS	94	10	>200.0	84	19	Info
110	ICP-MS	85.9	9.6	237.0	76.6	17.5	
114	ICP-MS	78.0	9.0	220.0	71.0	17.0	
116	ICP-MS	88.3	10.3	246	79.3	18.2	Info
147	ICP-MS	83.7	9.6	223.8	76.5	17.4	Info
156	DRC/CC-ICP-MS	91.0	9.7	240.0	80.0	17.0	
164	ICP-MS	86.0	<10.0	236.0	75.0	17.0	
179	ICP-MS	88.0	10.0	244.0	78.0	18.0	
197	DRC/CC-ICP-MS	81.2	9.4	217.9	73.8	17.1	
200	ICP-MS	86.9	10.4	231.8	73.1	18.0	Info
206	ICP-MS	84.0	10.0	225.0	74.0	17.0	
208	ICP-MS	68.0	8.0	181.0 ↓	61.0	13.0	
293	ICP-MS	92.5	11.1	253.5	80.5	19.5	Info
305	ICP-MS	90.8	10.4	240.0	79.5	18.0	
312	ICP-MS	91.4	10.3	241.0	77.4	17.7	
324	HR-ICP-MS	90.8	10.6	243.9	81.3	18.9	Info
366	ICP-MS	78.0	10.0	22.0 ↓	66.0	15.0	Info
391	ETAAS-Z	59.4	6.0	169.4 ↓	44.5	11.4	Info

Percent satisfactory results for all participants: 97.0 %

notes: ↑ Reported outside upper limit
↓ Reported outside lower limit
◥: Result unacceptable
◢: Result not reported

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

New York State Department of Health
Urine Lead Test Results, 2015 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	86.5	9.7	231.9	76.9	17.2
Standard Deviation:	4.9	0.3	12.2	3.1	0.2
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	59.4	6.0	169.4	44.5	11.4
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	90.8	10.6	243.9	81.3	18.9
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	15	14	13	15	15
Mean:	85.5	9.9	232.3	75.4	17.4
Standard Deviation:	6.7	0.7	18.1	5.9	1.6
RSD (%):	7.8	7.4	7.8	7.8	9.1
All Laboratories					
Number of Sample Measurements:	20	19	18	20	20
Mean:	84.6	9.7	229.4	74.4	17.1
Standard Deviation:	8.5	1.1	21.9	8.8	1.9
RSD (%):	10.0	11.5	9.6	11.8	11.4

notes: ? Insufficient data for calculation.
A Standard Deviation displayed as 0.0 should be interpreted as <0.1

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	Additional Elements
Ba	Al
Be	Cr
Co	Cu
Cs	Mn
Mo	Ni
Pt	Se
Sb	Sn
Tl	Te
U	V
W	Zn

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Urine Aluminum (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
114	ICP-MS	48	8	97	39	9
147	DRC/CC-ICP-MS	51.3	<14	108	41.6	<14
164	ICP-MS	45	9	95	39	11
179	DRC/CC-ICP-MS	47	10	101	39	12
197	ICP-MS	43	<20	96	34	<20
206	DRC/CC-ICP-MS	>20.0	>20.0	>20.0	>20.0	>20.0
305	ICP-MS	50	13	102	41	15
312	ICP-MS	58	*24	95	39	13
324	HR-ICP-MS	51.82	8.61	114.30	41.30	15.92
*Outlier	**Arithmetic Mean**	**49**	**10**	**101**	**39**	**13**
	SD	5	2	7	2	3
	n	8	5	8	8	6

Urine Antimony (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
103	DRC/CC-ICP-MS	5.95	0.654	12.9	5.36	1.23
107	ICP-MS	5.9	0.66	13	5.1	1.1
110	ICP-MS	6.16	0.748	13.6	5.28	1.17
147	ICP-MS	5.88	0.673	12.3	5.16	1.13
197	ICP-MS	6.1	<1.0	14.8	5.7	1.3
206	ICP-MS	5.0	<2.0	11.0	5.0	<2.0
312	ICP-MS	6.0	0.74	12.8	5.3	1.2
	Arithmetic Mean	**5.9**	**0.70**	**13**	**5.3**	**1.19**
	SD	0.4	0.05	1	0.2	0.07
	n	7	5	7	7	6

Urine Barium (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
106	ICP-MS	8.4	1.8	17.4	7.2	1.7
107	ICP-MS	8.7	1.9	18	7.2	1.7
110	ICP-MS	8.47	1.76	19.1	6.87	1.42
116	ICP-MS	8.38	1.75	17.0	6.99	1.60
147	ICP-MS	7.83	1.62	15.4	6.63	1.51
197	ICP-MS	8.2	<2.0	17.1	6.9	<2.0
312	ICP-MS	*11.8	1.7	16.0	6.6	1.6
*Outlier	**Arithmetic Mean**	**8.3**	**1.76**	**17**	**6.9**	**1.6**
	SD	0.3	0.09	1	0.2	0.1
	n	6	6	7	7	6

Urine Beryllium (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
106	ICP-MS	8.3	1.0	18.4	7.4	1.7
107	ICP-MS	7.5	0.82	16	6.5	1.5
110	ICP-MS	7.94	0.854	16.2	6.74	1.51
116	ICP-MS	7.86	0.906	17.5	7.24	1.59
147	ICP-MS	7.35	0.74	15.0	6.17	1.36
197	ICP-MS	6.1	0.8	12.4	5.4	1.2
312	ICP-MS	8.3	0.83	18.3	7.5	1.8
	Arithmetic Mean	**7.6**	**0.85**	**16**	**6.7**	**1.5**
	SD	0.8	0.08	2	0.8	0.2
	n	7	7	7	7	7

Urine Bismuth (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
147	ICP-MS	1.15	2.13	0.351	<0.10	<0.10
197	ICP-MS	1.3	2.7	<1.0	<1.0	<1.0
206	ICP-MS	1.4	2.8	<1.0	<1.0	<1.0
305	ICP-MS	1.1	2.1	<0.5	<0.5	<0.5
312	ICP-MS	1.2	2.4	0.31	0.0032	0.0006
	Arithmetic Mean	**1.2**	**2.4**	**-**	**-**	**-**
	SD	0.1	0.3	-	-	-
	n	5	5	-	-	-

Urine Cesium (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
107	ICP-MS	32	5.8	66	27	6.9
110	ICP-MS	33.4	6.00	70.8	28.6	7.22
147	ICP-MS	30.6	5.28	61.8	26.7	6.49
312	ICP-MS	31.2	5.4	64.0	26.5	6.6
	Arithmetic Mean	**32**	**5.6**	**66**	**27**	**6.8**
	SD	1	0.3	4	1	0.3
	n	4	4	4	4	4

Urine Chromium (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
103	DRC/CC-ICP-MS	15.5	2.05	32.9	14.1	3.21
107	DRC/CC-ICP-MS	15	2.1	30	12	3.1
110	DRC/CC-ICP-MS	16.3	2.59	34.3	14.0	3.44
114	ICP-MS	14.0	2.0	29.8	12.2	2.9
147	DRC/CC-ICP-MS	15.2	1.98	32.1	13.1	3.00
156	DRC/CC-ICP-MS	14	1.9	30	12	3.1
164	DRC/CC-ICP-MS	13.8	1.9	28.3	12.5	2.8
179	DRC/CC-ICP-MS	15.0	2.0	32.8	12.8	3.1
197	DRC/CC-ICP-MS	15.0	2.2	32.5	13.2	3.3
206	DRC/CC-ICP-MS	14.8	*3.1	32.4	12.9	*4.7
305	ICP-MS	16.8	2.1	34.9	13.6	3.3
312	DRC/CC-ICP-MS	15.8	2.7	29.0	12.4	2.4
324	HR-ICP-MS	15.42	2.16	35.05	14.17	3.20
366	DRC/CC-ICP-MS	13.7	2.0	30.0	*10.0	2.4
401	DRC/CC-ICP-MS	14.4	2.1	31.3	12.7	3.2
**Outlier*	**Arithmetic Mean**	**15.0**	**2.1**	**32**	**13.0**	**3.0**
	SD	0.9	0.2	2	0.8	0.3
	n	15	14	15	14	14

Urine Cobalt (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
103	DRC/CC-ICP-MS	3.38	0.446	6.40	2.73	2.97
107	ICP-MS	3.6	0.61	6.7	2.7	3.0
110	ICP-MS	3.58	0.586	6.88	2.78	3.02
114	ICP-MS	3.5	<1.0	6.5	2.6	3.2
147	ICP-MS	3.15	0.464	5.95	2.49	2.73
156	DRC/CC-ICP-MS	3.2	<1	6.2	2.4	2.6
164	ICP-MS	3.7	<0.5	6.2	2.6	2.8
179	DRC/CC-ICP-MS	3.4	0.5	6.1	2.7	2.8
197	ICP-MS	3.0	<1.0	6.1	2.4	2.6
206	ICP-MS	3.3	<1.0	6.4	2.6	2.9
305	ICP-MS	3.1	0.5	6.2	2.5	2.7
312	ICP-MS	3.3	0.53	6.4	2.6	2.9
324	HR-ICP-MS	3.49	0.54	6.85	2.72	2.96
366	ICP-MS	3.1	0.5	5.9	2.3	3.0
391	DRC/CC-ICP-MS	3.1	0.3	6.3	2.6	*3.8
401	DRC/CC-ICP-MS	3.1	0.4	5.9	2.5	2.8
**Outlier*	**Arithmetic Mean**	**3.3**	**0.5**	**6.3**	**2.6**	**2.9**
	SD	0.2	0.1	0.3	0.1	0.2
	n	16	11	16	16	15

Urine Copper (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
110	ICP-MS	289	38.5	633	260	65.0
114	ICP-MS	259	33	545	232	54
147	ICP-MS	290	36.7	616	260	64.8
164	ICP-MS	257	31	577	236	57
179	DRC/CC-ICP-MS	295	35	636	272	63
197	ICP-MS	278.8	39.6	613.5	247.3	64.1
206	ICP-MS	273.4	36.9	600.2	252.5	63.2
305	ICP-MS	267	36	581	230	57
312	ICP-MS	276	38	590	244	60
324	HR-ICP-MS	275.77	33.52	611.15	239.67	59.45
401	DRC/CC-ICP-MS	270.3	33.1	597.2	236.0	58.5
	Arithmetic Mean	**276**	**36**	**600**	**246**	**61**
	SD	12	3	26	13	4
	n	11	11	11	11	11

Urine Iodine (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
107	ICP-MS	76	82	94	58	47
114	ICP-MS	71.6	77.3	85.6	53.0	53.8
156	DRC/CC-ICP-MS	75	78	87	58	45
164	ICP-MS	73	76	90	55	44
197	ICP-MS	70	74	89	52	43
206	ICP-MS	66.7	72.9	81.8	51.9	44.3
312	ICP-MS	82	89	101	61	52
	Arithmetic Mean	**73**	**78**	**90**	**56**	**47**
	SD	5	6	6	4	4
	n	7	7	7	7	7

Urine Iron (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
324	HR-ICP-MS	6.38	1.53	3.73	0.15	7.80

Urine Lithium (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
147	ICP-MS	16.0	11.5	21.5	6.94	5.59

Urine Manganese (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
103	DRC/CC-ICP-MS	7.39	0.877	16.0	6.61	1.60
107	DRC/CC-ICP-MS	7.6	0.98	18	6.8	1.6
110	DRC/CC-ICP-MS	7.27	0.898	16.2	6.5	1.5
114	ICP-MS	8.3	<2.5	17.2	7.4	<2.5
147	DRC/CC-ICP-MS	7.80	0.868	16.6	6.87	1.62
179	DRC/CC-ICP-MS	7.1	0.9	16.1	6.2	1.6
206	ICP-MS	6.5	1.1	14.4	6.2	1.6
305	ICP-MS	7.4	0.8	15.3	6.3	1.5
312	DRC/CC-ICP-MS	7.2	*1.7	14.6	6.3	1.5
324	HR-ICP-MS	7.41	0.81	16.38	6.48	1.44
**Outlier*	**Arithmetic Mean**	**7.4**	**0.9**	**16**	**6.6**	**1.6**
	SD	0.5	0.1	1	0.4	0.1
	n	10	8	10	10	9

Urine Molybdenum (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
103	DRC/CC-ICP-MS	93.9	28.1	181	83.4	39.1
107	ICP-MS	97	29	190	83	39
110	ICP-MS	97.7	29.5	190	84.4	40.3
147	ICP-MS	91.8	28.1	181	80.1	38.4
179	ICP-MS	91	29	177	81	39
197	ICP-MS	102.8	31.3	184.0	87.3	43.7
312	ICP-MS	91.8	27.6	178.0	80.3	36.6
324	HR-ICP-MS	99.99	29.88	197.89	81.31	40.81
	Arithmetic Mean	**96**	**29**	**185**	**83**	**40**
	SD	4	1	7	2	2
	n	8	8	8	8	8

Urine Nickel (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
107	DRC/CC-ICP-MS	8.0	1.6	17	6.9	2.7
110	ICP-MS	8.41	<2.2	17.5	6.85	2.20
114	ICP-MS	9.1	2.5	17.6	7.2	3.1
147	DRC/CC-ICP-MS	7.52	1.50	16.6	7.16	2.59
164	ICP-MS	8.3	2.0	16.6	6.6	2.4
179	DRC/CC-ICP-MS	7.4	1.5	15.6	6.3	2.3
197	ICP-MS	8.0	<2.0	16.4	6.6	2.4
206	ICP-MS	8.4	<2.0	15.9	5.6	<2.0
312	ICP-MS	8.0	2.7	15.5	6.6	2.6
324	HR-ICP-MS	7.12	0.75	16.27	6.14	1.70
391	DRC/CC-ICP-MS	7.8	2.2	15.5	7.3	3.9
401	DRC/CC-ICP-MS	8.3	2.5	17.2	7.7	3.5
	Arithmetic Mean	**8.0**	**1.9**	**16.5**	**6.7**	**2.7**
	SD	0.5	0.6	0.8	0.6	0.6
	n	12	9	12	12	11

Urine Platinum (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
107	ICP-MS	2.9	0.32	6.2	2.1	0.60
110	ICP-MS	2.90	0.257	6.20	1.76	0.512
147	ICP-MS	2.77	0.357	5.60	1.87	0.609
312	ICP-MS	2.7	0.3	5.8	1.9	0.5
	Arithmetic Mean	**2.8**	**0.31**	**6.0**	**1.9**	**0.56**
	SD	0.1	0.04	0.3	0.1	0.06
	n	4	4	4	4	4

Urine Selenium (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
103	DRC/CC-ICP-MS	102	26.7	181	75.9	27.4
110	DRC/CC-ICP-MS	116	33.1	204	71.5	32.4
114	ICP-MS	95	31	171	67	28
147	ICP-MS	97.2	27.4	161	68.3	24.4
179	DRC/CC-ICP-MS	98	26	175	68	25
206	ICP-MS	105.0	32.0	191.0	73.0	24.0
305	ICP-MS	114	30	199	74	29
312	ICP-MS	107	34.7	181	69.2	28.6
	Arithmetic Mean	**104**	**30**	**183**	**71**	**27**
	SD	8	3	14	3	3
	n	8	8	8	8	8

Urine Silver (µg/L)

Lab Code	Method	UE15-06	UE15-07	UE15-08	UE15-09	UE15-10
147	ICP-MS	<0.11	<0.11	<0.11	<0.11	1.68

Urine Strontium (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
103	DRC/CC-ICP-MS	66.0	59.2	64.8	36.4	36.5
107	ICP-MS	71	63	70	38	39

Urine Tellurium (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
110	ICP-MS	5.95	0.662	13.0	3.09	1.19
197	ICP-MS	5.7	<1.0	12.5	2.4	1.2
206	ICP-MS	5.0	1.0	12.0	4.0	1.0
312	ICP-MS	5.5	0.58	12.6	3.2	1.1
	Arithmetic Mean	**5.5**	**0.7**	**12.5**	**3.2**	**1.1**
	SD	0.4	0.2	0.4	0.7	0.1
	n	4	3	4	4	4

Urine Thallium (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
103	DRC/CC-ICP-MS	14.0	1.61	30.3	12.3	2.78
106	ICP-MS	14.5	1.7	31.6	13.0	3.0
107	ICP-MS	16	1.7	34	*14	3.0
110	ICP-MS	14.6	1.72	31.8	13.0	3.01
114	ICP-MS	14.2	1.7	30.8	12.5	3.0
116	ICP-MS	14.9	1.74	32.3	13.2	3.02
147	ICP-MS	13.9	1.62	29.8	12.5	2.86
179	ICP-MS	15	2	32	13	3
197	ICP-MS	13.4	1.6	29.1	12.2	2.9
206	ICP-MS	13.9	1.7	>25.0	12.4	2.9
305	ICP-MS	13.7	1.7	29.8	12.6	2.9
312	ICP-MS	15.4	1.7	31.9	12.8	2.8
	Arithmetic Mean	**14.5**	**1.71**	**31**	**12.7**	**2.9**
	SD	0.8	0.10	1	0.3	0.1
	n	12	12	11	11	12

Urine Thorium (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
147	ICP-MS	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046

Urine Tin (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
107	ICP-MS	16	2.0	32	12	3.0
110	ICP-MS	15.8	1.95	34.0	12.5	3.15
147	ICP-MS	14.8	1.75	31.8	12.4	3.16
312	ICP-MS	15.9	1.9	32.2	12.9	3.2
	Arithmetic Mean	**15.6**	**1.9**	**33**	**12.5**	**3.1**
	SD	0.6	0.1	1	0.4	0.1
	n	4	4	4	4	4

Urine Tungsten (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
107	ICP-MS	6.0	0.67	13	5.3	1.1
110	ICP-MS	6.01	0.697	13.4	5.32	1.17
147	ICP-MS	5.63	0.675	12.6	5.11	1.18
312	ICP-MS	5.8	0.68	12.6	5.0	1.1
324	HR-ICP-MS	*8.48	0.78	*15.61	5.86	1.29
**Outlier*	**Arithmetic Mean**	**5.9**	**0.70**	**12.9**	**5.3**	**1.17**
	SD	0.2	0.05	0.4	0.3	0.08
	n	4	5	4	5	5

Urine Uranium (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
103	DRC/CC-ICP-MS	0.750	0.0912	1.61	0.657	0.149
106	ICP-MS	0.7	0.1	1.6	0.7	0.1
107	ICP-MS	0.80	0.10	2.0	0.75	0.17
110	ICP-MS	0.743	0.0849	1.65	0.646	0.149
116	ICP-MS	0.736	0.0846	1.65	0.664	0.151
147	ICP-MS	0.636	0.0745	1.42	0.560	0.122
197	ICP-MS	<1.0	<1.0	1.4	<1.0	<1.0
312	ICP-MS	0.72	0.08	1.6	0.60	0.14
324	HR-ICP-MS	0.84	0.10	1.92	0.72	0.16
	Arithmetic Mean	**0.74**	**0.09**	**1.7**	**0.66**	**0.14**
	SD	0.06	0.01	0.2	0.06	0.02
	n	8	8	9	8	8

Urine Vanadium (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
147	DRC/CC-ICP-MS	5.92	0.679	12.9	5.31	1.20
179	DRC/CC-ICP-MS	5.9	0.7	13.0	4.7	1.1
197	ICP-MS	6.10	<1.00	13.10	5.40	1.20
312	DRC/CC-ICP-MS	6.3	0.75	13.8	5.6	1.2
324	HR-ICP-MS	6.78	0.76	15.18	5.75	1.25
	Arithmetic Mean	**6.2**	**0.72**	**14**	**5.4**	**1.19**
	SD	0.4	0.04	1	0.4	0.05
	n	5	4	5	5	5

Urine Zinc (µg/L)						
Lab Code	**Method**	**UE15-06**	**UE15-07**	**UE15-08**	**UE15-09**	**UE15-10**
110	ICP-MS	408	137	743	316	138
114	ICP-MS	376	150	636	303	140
147	ICP-MS	415	141	712	326	144
164	ICP-MS	367	122	689	295	121
179	DRC/CC-ICP-MS	411	144	743	325	145
197	ICP-MS	397.00	<200	710.00	297.00	<200
206	ICP-MS	385.0	130.0	710.0	319.0	141.0
305	ICP-MS	358	127	664	277	124
312	ICP-MS	392	131	697	297	127
324	HR-ICP-MS	363.65	119.68	659.57	290.71	128.82
401	DRC/CC-ICP-MS	385.7	130.7	706.0	294.2	130.7
	Arithmetic Mean	**387**	**133**	**697**	**304**	**134**
	SD	20	10	33	16	9
	n	11	10	11	11	10

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., D_2, S-H background correction)

A-3 FAAS (Flame atomic absorption spectrometry)

A-4 CV-AAS (Cold vapor atomic absorption spectrometry)

A-5 HG-AAS (Hydride generation atomic absorption spectrometry)

A-6 AFS (Atomic fluorescence spectrometry)

INDUCTIVELY COUPLED PLASMA

P-1 ICP-MS (Inductively coupled plasma - mass spectrometry)

P-2 DRC/CC-ICP-MS (ICP-MS used in the Dynamic Reaction Cell or Collision Cell mode)

P-3 ICP-AES/OES (ICP atomic/optical emission spectrometry)

P-4 HR-ICP-MS (High resolution ICP-MS)

P-5 ETV-ICP-MS (Electrothermal vaporization ICP-MS)

P-6 ID-ICP-MS (Isotope dilution ICP-MS)

ELECTROCHEMICAL METHODS

E-1 ASV (Anodic stripping voltammetry without digestion)

E-2 ASV-LeadCare® Blood Lead Testing System

E-5 ASV-LeadCare® II Blood Lead Testing System

E-6 ASV-LeadCare® Ultra™ Blood Lead Testing System

E-3 Fluoride specific electrode

MOLECULAR FLUORIMETRY

F-1 EtOAc (Ethyl acetate-acetic acid extraction method for determination of erythrocyte protoporphyrin)

F-2 Aviv hematofluorometry (for determination of EP at hematocrit 35)

F-3 Helena ZPP (for determination of zinc protoporphyrin in μmol ZPP/mol heme)

OTHER METHODS

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