Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN URINE

Event #3, 2011

November 25, 2011

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

Sue Kelly
Executive Deputy Commissioner

November 25, 2011

Trace Elements in Urine
Event #3, 2011

Dear Laboratory Director:

Results from the third proficiency test (PT) event for 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 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 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.
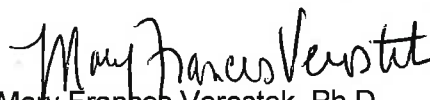
The next PT event for trace elements in urine is scheduled to be mailed Wednesday, January 25th, 2012. Please inform our laboratory staff at (518) 474-4484 if the test materials have not arrived within five days of the scheduled mail out date. **The deadline for reporting results is Wednesday, February 22nd, 2012.**

Thank you for your participation.

Sincerely,

Patrick J. Parsons, Ph.D.
Chief
Laboratory of Inorganic and Nuclear Chemistry

Mary Frances Verostek, Ph.D.
Assistant Section Head
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www.wadsworth.org/testing/lead/index.htm

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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 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 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 16.5 µg/L (0.22 µmol/L) to 275.0 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, 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 Arsenic Test Results, 2011 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results (*µg/L* urine)

	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
Robust Mean	**275.0**	**29.6**	**96.1**	**117.2**	**16.5**
Robust Standard Deviation	17.2	2.6	4.9	7.6	1.5
Standard Uncertainty	4.5	0.7	1.3	2.0	0.4
RSD (%)	6.2	8.8	5.1	6.5	9.4
Acceptable Range:					
Upper Limit	330.0	35.6	115.3	140.6	22.5
Lower Limit	220.0	23.6	76.9	93.8	10.5

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, 2011 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE11-11	UE11-12	UE11-13	UE11-14	UE11-15	
	Target Values:	275.0	29.6	96.1	117.2	16.5	
107	DRC/CC-ICP-MS	274.9	25.6	94.0	115.0	12.4	Info
110	DRC/CC-ICP-MS	280.0	31.5	94.8	124.0	16.9	
114	ICP-MS	278.0	30.0	96.0	120.0	16.0	
116	DRC/CC-ICP-MS	298.3	32.5	104.9	128.7	18.2	Info
147	ICP-MS	267.4	28.0	154.3 ↑	113.9	15.3	Info
156	ICP-MS	286.0	32.1	94.7	119.0	16.5	
159	ICP-MS	278.0	32.0	96.0	119.0	19.0	
164	ICP-MS	278.0	34.0	96.0	120.0	18.0	
179	ICP-MS	277.0	28.0	96.0	118.0	<15.0	
197	DRC/CC-ICP-MS	248.0	28.0	95.0	108.0	16.0	
200	ICP-MS	253	28.8	91.4	108	16.5	Info
206	ICP-MS	304.4	32.0	119.9 ↑	130.3	17.5	
208	ICP-MS	278.6	30.8	93.9	112.7	17.8	
293	DRC/CC-ICP-MS	273.0	29.2	95.0	116.0	16.2	Info
305	DRC/CC-ICP-MS	296.2	31.4	100.9	122.7	16.5	
312	ICP-MS	236.4	27.3	81.9	97.8	15.2	
324	HR-ICP-MS	268.5	27.3	91.4	110.2	14.8	Info
339	HR-ICP-MS	242.0	23.9	84.7	104.7	13.4	Info
359	ICP-MS	291.3	30.2	100.1	120.6	15.1	
366	ICP-MS	249.0	26.0	99.0	110.0	19.0	Info
367	DRC/CC-ICP-MS	305.0	32.2	106.0	130.0	17.0	Info
385	DRC/CC-ICP-MS	267.0	30.8	94.7	118.0	16.8	Info
391	DRC/CC-ICP-MS	260.6	27.6	91.1	119.6	15.8	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 Arsenic Test Results, 2011 Event #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	9	9	9	9	9
Mean:	278.1	29.9	97.4	120.2	16.2
Standard Deviation:	18.8	2.4	5.2	7.0	1.6
RSD (%):	6.8	8.0	5.4	5.8	9.8
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	255.3	25.6	88.1	107.5	14.1
Standard Deviation:	18.7	2.4	4.7	3.9	1.0
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	12	12	12	12	11
Mean:	273.1	29.9	101.6	115.8	16.9
Standard Deviation:	19.0	2.4	18.7	8.1	1.4
RSD (%):	6.9	7.9	18.4	7.0	8.6
All Laboratories					
Number of Sample Measurements:	23	23	23	23	22
Mean:	273.5	29.5	98.8	116.8	16.4
Standard Deviation:	19.1	2.6	14.2	8.0	1.6
RSD (%):	7.0	8.8	14.4	6.9	10.0

notes: ? Insufficient data for calculation.

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 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 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 1.6 µg/L (14 nmol/L) to 5.7 µg/L (51 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, 99.2% 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, 2011 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
Robust Mean	**3.3**	**5.7**	**1.6**	**1.2**	**2.9**
Robust Standard Deviation	0.3	0.4	0.1	<0.1	0.2
Standard Uncertainty	0.1	0.1	<0.1	<0.1	0.1
RSD (%)	8.3	6.7	9.0	<0.1	8.4
Acceptable Range:					
Upper Limit	4.3	6.7	2.6	2.2	3.9
Lower Limit	2.3	4.7	0.6	0.2	1.9

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, 2011 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE11-11	UE11-12	UE11-13	UE11-14	UE11-15	
	Target Values:	3.3	5.7	1.6	1.2	2.9	
103	ICP-MS	3.5	5.9	1.7	1.2	3.1	Info
107	DRC/CC-ICP-MS	3.2	5.6	1.6	1.1	2.7	Info
110	ICP-MS	3.3	5.7	1.6	1.2	2.9	
114	ICP-MS	3.2	5.8	1.6	1.2	2.8	
116	ICP-MS	2.8	5.2	1.2	0.8	2.4	Info
147	ICP-MS	3.0	5.2	1.6	1.2	3.0	Info
156	ICP-MS	3.4	6.0	1.7	1.2	3.0	
159	ICP-MS	3.2	5.6	1.4	1.1	2.6	
164	ICP-MS	3.1	5.4	1.4	1.2	2.9	
179	ICP-MS	3.5	6.0	1.6	1.3	2.9	
197	DRC/CC-ICP-MS	3.0	5.2	1.5	1.1	2.6	
200	ICP-MS	3.7	6.1	1.7	1.3	3.1	Info
206	ICP-MS	3.7	6.2	1.9	1.3	3.3	
208	ICP-MS	3.3	5.8	1.5	1.2	3.0	
293	ICP-MS	3.4	5.8	1.6	1.2	3.1	Info
305	ICP-MS	3.1	5.5	1.7	1.2	2.8	
312	ICP-MS	3.2	6.0	1.5	1.2	2.7	
324	ICP-MS	3.1	5.3	1.6	1.2	2.8	Info
339	HR-ICP-MS	3.1	5.5	1.6	1.2	2.9	Info
359	ICP-MS	3.3	5.8	1.6	1.2	2.9	
366	ICP-MS	2.8	4.5 ↓	1.4	1.1	2.5	Info
367	DRC/CC-ICP-MS	3.6	6.3	1.8	1.4	3.2	Info
385	ICP-MS	3.0	5.3	1.5	1.1	2.7	Info
391	DRC/CC-ICP-MS	3.3	5.9	1.8	1.3	3.1	Info
401	ICP-MS	3.8	5.7	1.7	1.2	3.2	Info

Percent satisfactory results for all participants: 99.2 %

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, 2011 Event #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	3.3	5.8	1.7	1.2	2.9
Standard Deviation:	0.2	0.5	0.2	0.1	0.3
RSD (%):	7.6	8.1	9.0	12.2	10.2
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	3.1	5.5	1.6	1.2	2.9
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	20	20	20
Mean:	3.3	5.6	1.6	1.2	2.9
Standard Deviation:	0.3	0.4	0.2	0.1	0.2
RSD (%):	8.5	7.1	9.6	9.0	8.0
All Laboratories					
Number of Sample Measurements:	25	25	25	25	25
Mean:	3.3	5.7	1.6	1.2	2.9
Standard Deviation:	0.3	0.4	0.1	0.1	0.2
RSD (%):	8.1	7.0	9.4	9.2	8.0

notes: ? Insufficient data for calculation.

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 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 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 13.8 µg/L (69 nmol/L) to 155.9 µg/L (777 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, 93.1% of test results reported were judged as satisfactory, with two of the 26 participant laboratories (7.7%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Mercury Test Results, 2011 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L urine)				
	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
Robust Mean	**44.3**	**24.9**	**155.9**	**13.8**	**87.0**
Robust Standard Deviation	5.1	2.6	13.2	2.1	7.5
Standard Uncertainty	1.2	0.6	3.2	0.5	1.8
RSD (%)	11.5	10.6	8.4	15.5	8.7
Acceptable Range:					
Upper Limit	57.6	32.4	202.7	17.9	113.1
Lower Limit	31.0	17.4	109.1	9.7	60.9

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, 2011 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE11-11	UE11-12	UE11-13	UE11-14	UE11-15	
	Target Values:	44.3	24.9	155.9	13.8	87.0	
103	ICP-MS	38.1	20.8	135.7	11.9	77.9	Info
107	DRC/CC-ICP-MS	46.5	27.4	162.8	13.9	91.9	Info
109	AFS	44.2	24.6	170.4	13.7	89.7	Info
110	ICP-MS	45.7	25.9	160.8	15.2	89.9	
114	ICP-MS	52.0	29.0	161.0	19.0 ↑	96.0	
147	CV-AAS	39.6	22.2	137.8	11.6	77.8	Info
156	ICP-MS	44.0	23.6	160.4	10.1	90.8	
159	ICP-MS	48.0	25.0	153.0	15.0	93.0	
164	ICP-MS	46.0	25.0	147.0	15.0	84.0	
179	ICP-MS	46.0	24.0	147.0	15.0	91.0	
197	DRC/CC-ICP-MS	39.0	22.0	141.0	13.0	77.0	
199	ICP-MS	41.4	22.8	164	15.3	82.4	Info
200	ICP-MS	45.2	24.8	159	13.7	88.9	Info
206	ICP-MS	45.0	24.0	151.0	12.0	90.5	
208	CV-AAS	49.2	27.0	177.4	14.5	100.8	
293	ICP-MS	44.7	25.3	153.7	14.9	86.9	Info
305	ICP-MS	45.4	25.2	167.7	18.6 ↑	89.2	
312	ICP-MS	38.7	25.0	157.1	13.1	81.8	
324	AFS	43.4	24.2	156.0	12.4	81.4	Info
339	HR-ICP-MS	34.0	18.9	129.7	11.6	70.5	Info
359	ICP-MS	57.3	31.5	199.5	16.4	109.3	
366	ICP-MS	39.0	20.0	166.0	13.0	90.0	Info
367	CV-AAS	50.3	26.8	170.0	14.5	94.5	Info
385	ICP-MS	42.5	23.5	151.0	12.1	83.8	Info
391	CV-AAS	28.9 ↓	96.6 ↑	16.9 ↓	9.3 ↓	56.6 ↓	Info
401	ICP-MS	51	45 ↑	154	165 ↑	83	Info

Percent satisfactory results for all participants: 93.1 %

notes: ↑ reported outside upper limit   notes: Results reported as less than the method detection limit are excluded from statistical calculations.
↓ reported outside lower limit   **Info only:** results included for informational purposes only.
◤: Unacceptable result

New York State Department of Health
Urine Mercury Test Results, 2011 Event #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
AFS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	43.8	24.4	163.2	13.1	85.6
Standard Deviation:	0.6	0.3	10.2	0.9	5.9
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	4	3	4	4	4
Mean:	42.0	25.3	125.5	12.5	82.4
Standard Deviation:	10.0	2.7	74.4	2.5	19.8
RSD (%):	23.7	—	59.3	20.2	24.0
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	42.8	24.7	151.9	13.5	84.5
Standard Deviation:	5.3	3.8	15.4	0.6	10.5
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	34.0	18.9	129.7	11.6	70.5
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	17	17	17	16	17
Mean:	45.3	25.9	158.1	14.4	88.7
Standard Deviation:	4.9	5.6	13.3	2.4	7.1
RSD (%):	10.9	21.6	8.4	16.6	8.0
All Laboratories					
Number of Sample Measurements:	26	25	26	25	26
Mean:	44.0	25.3	151.9	13.8	86.5
Standard Deviation:	5.9	4.9	31.0	2.3	10.1
RSD (%):	13.4	19.4	20.4	16.5	11.6

notes: ? Insufficient data for calculation.

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 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 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 15.6 µg/L (0.08 µmol/L) to 281.7 µg/L (1.36 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, 97.4% of test results were judged as satisfactory, with one of the 23 participant laboratories (4.3%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Lead Test Results, 2011 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
Robust Mean	**281.7**	**80.6**	**169.4**	**15.6**	**39.3**
Robust Standard Deviation	15.9	4.1	7.2	1.1	2.4
Standard Uncertainty	4.1	1.1	1.9	0.3	0.6
RSD (%)	5.6	5.1	4.3	6.8	6.2
Acceptable Range:					
Upper Limit	321.7	120.6	209.4	55.6	79.3
Lower Limit	241.7	40.6	129.4	0.0	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, 2011 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE11-11	UE11-12	UE11-13	UE11-14	UE11-15	
	Target Values:	281.7	80.6	169.4	15.6	39.3	
103	ICP-MS	315.3	86.5	192.0	17.4	44.6	Info
107	ICP-MS	295.0	83.5	178.0	16.3	41.5	Info
110	ICP-MS	290.0	81.9	174.0	16.0	40.7	
114	ICP-MS	282.0	86.0	167.0	17.0	41.0	
116	ICP-MS	286.5	81.1	172.2	15.8	40.1	Info
147	ICP-MS	271.4	76.9	161.4	15.1	38.3	Info
156	ICP-MS	275.0	83.4	170.0	13.9	35.0	
159	ICP-MS	297.0	81.0	169.0	16.0	40.0	
164	ICP-MS	277.0	79.0	164.0	16.0	39.0	
179	ICP-MS	297.0	84.0	177.0	16.0	43.0	
197	DRC/CC-ICP-MS	236.4 ↓	75.4	156.4	14.2	35.4	
200	ICP-MS	276	81.3	167	18.1	39.3	Info
206	ICP-MS	289.5	81.0	175.0	15.0	39.0	
208	ICP-MS	287.0	77.2	163.0	14.7	36.1	
293	ICP-MS	294.2	83.7	175.9	16.3	40.8	Info
305	ICP-MS	277.8	78.5	164.0	16.0	38.8	
312	ICP-MS	280.9	82.0	167.8	15.1	39.5	
324	ICP-MS	282.5	85.7	173.4	16.7	42.1	Info
339	HR-ICP-MS	253.7	71.4	167.6	15.1	36.2	Info
359	ICP-MS	266.8	76.7	161.5	15.1	39.4	
366	ICP-MS	252.0	72.0	170.0	14.0	37.0	Info
385	ICP-MS	307.0	82.1	179.0	15.6	40.9	Info
391	ETAAS-Z	199.1 ↓	62.3	125.9 ↓	11.2	32.5	Info

Percent satisfactory results for all participants: 97.4 %

notes: ↑ reported outside upper limit   notes: Results reported as less than the method detection limit are excluded from statistical calculations.
　　　　↓ reported outside lower limit   Info only: results included for informational purposes only.
　　　　◤: Unacceptable result

New York State Department of Health
Urine Lead Test Results, 2011 Event #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	236.4	75.4	156.4	14.2	35.4
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	199.1	62.3	125.9	11.2	32.5
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	253.7	71.4	167.6	15.1	36.2
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	20	20	20
Mean:	285.0	81.2	171.1	15.8	39.8
Standard Deviation:	14.3	3.6	7.4	1.1	2.2
RSD (%):	5.0	4.5	4.3	6.7	5.6
All Laboratories					
Number of Sample Measurements:	23	23	23	23	23
Mean:	277.8	79.7	168.3	15.5	39.1
Standard Deviation:	24.7	5.6	11.9	1.4	2.8
RSD (%):	8.9	7.0	7.1	9.0	7.1

notes: ? Insufficient data for calculation.

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 Nutritional 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

Urine Aluminum (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
147	ICP-MS	<26.983*	43.173	<26.983*	<26.983*	<26.983*
164	ICP-MS	25.0	42.0	14.0	11.0	23.0
179	DRC/CC-ICP-MS	26.0	43.0	14.0	11.0	23.0
197	ICP-MS	<20.0*	39.0	<20.0*	<20.0*	<20.0*
305	ICP-MS	27.0	39.0	15.0	11.0	24.0
312	ICP-MS	26.3	40.9	15.9	11.8	21.3
359	ICP-MS	19.1*	34	8.9*	6.2*	17.8
Omitted*						
Arithmetic Mean		**26.1**	**40**	**14.7**	**11.2**	**22**
SD		0.8	3	0.9	0.4	2

Urine Antimony (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	DRC/CC-ICP-MS	3.13	5.53	1.48	1.05	2.79
110	ICP-MS	3.1	5.5	1.5	1.10	2.8
147	ICP-MS	2.908	5.202	1.438	1.033	2.601
179	ICP-MS	2.7	5.0	1.3	0.9	2.5
197	ICP-MS	3.0	5.4	1.4	1.0	2.5
312	ICP-MS	2.9	5.4	1.7	1.0	2.7
359	ICP-MS	3.2	5.4	1.6	1.0	2.8
385	ICP-MS	3.1	5.7	1.5	1.1	2.8
Arithmetic Mean (n=8)		**3.0**	**5.4**	**1.5**	**1.0**	**2.7**
SD		0.2	0.2	0.1	0.1	0.1

Urine Barium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	DRC/CC-ICP-MS	4.48	62	20.9	2.01	27
110	ICP-MS	4.5	61.9	21.1	2.3	27.1
116	ICP-MS	4.21	62.1	20.8	1.72	26.6
147	ICP-MS	3.996	56.295	19.497	1.771	24.303
197	ICP-MS	4.3	60.4	20.4	<2.0*	26.1
312	ICP-MS	4.5	63.9	21.5	1.7	24.9
359	ICP-MS	4.1	58.4	19.7	1.7	25.7
385	ICP-MS	4.5	61.4	20.9	2.0	26.4
Omitted*						
Arithmetic Mean		**4.3**	**61**	**20.6**	**1.9**	**26**
SD		0.2	2	0.7	0.2	1

Urine Beryllium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
110	ICP-MS	13.2	82.0	2.0	1.5	3.6
116	ICP-MS	14.6	87.4	2.25	1.67	3.95
147	ICP-MS	14.144	85.135	1.667	1.396	3.865
197	ICP-MS	11.1	76	1.7	1.2	2.9
312	ICP-MS	13.7	77.8	1.1	0.9	3.8
385	ICP-MS	13.2	79.2	1.9	1.3	3.4
Arithmetic Mean (n=6)		**13**	**81**	**1.8**	**1.3**	**3.6**
SD		1	4	0.4	0.3	0.4

Urine Bismuth (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
147	ICP-MS	<0.012	<0.012	<0.012	<0.012	<0.012

Urine Cesium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	DRC/CC-ICP-MS	17.8	30	9.77	7.62	16.1
110	ICP-MS	17.6	29.9	9.7	7.7	16.3
147	ICP-MS	15.816	27.512	8.985	6.898	14.62
312	ICP-MS	17.8	30.8	9.6	7.4	16.1
385	ICP-MS	17.8	29.9	9.8	7.6	16.0
Arithmetic Mean (n=5)		**17.4**	**30**	**9.6**	**7.4**	**15.8**
SD		0.9	1	0.3	0.3	0.7

Urine Chromium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	HR-ICP-MS	7.7	13.3	3.9	2.9	7.0
110	DRC/CC-ICP-MS	8.1	14.1	4.0	3.3	7.4
147	ICP-MS	7.904	13.469	4.181	2.782	7.124
164	ICP-MS	8.1	13.2	4.2	3.0	7.0
179	DRC/CC-ICP-MS	7.5	13.3	4.0	2.9	6.6
197	ICP-MS	6.9	12.9	3.4	2.3	5.9
305	ICP-MS	8.2	14.3	4.5	3.1	7.4
312	DRC/CC-ICP-MS	8.6	14.0	3.5	3.3	7.3
359	ICP-MS	6.6	12.2	3.2	2.1	6.1
391	DRC/CC-ICP-MS	7.7	12.9	4.1	3.1	7.0
401	ICP-MS	9.1	23.5*	4.3	3.1	7.1
Omitted*						
Arithmetic Mean		**7.9**	**13.4**	**3.9**	**2.9**	**6.9**
SD		0.7	0.6	0.4	0.4	0.5

Urine Cobalt (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	DRC/CC-ICP-MS	1.81	3.03	0.98	5.3	1.59
110	ICP-MS	1.9	3.2	1.1	5.7	1.6
147	ICP-MS	1.78	3.035	1.008	5.704	1.644
159	ICP-MS	1.9	3.2	1.1	5.6	1.7
179	ICP-MS	1.7	2.9	1.0	5.1	1.6
197	ICP-MS	1.8	3.0	1.0	5.2	1.7
312	ICP-MS	1.9	3.1	1.0	5.2	1.6
359	ICP-MS	1.6	2.7	0.8	5.1	1.4
385	ICP-MS	1.9	2.6	3.4*	5.5	1.6
391	DRC/CC-ICP-MS	1.8	3.2	1.0	5.8	1.7
401	ICP-MS	2.2	1.0	0.8	4.9	1.4
Omitted*						
Arithmetic Mean		**1.8**	**2.8**	**1.0**	**5.4**	**1.6**
SD		0.2	0.6	0.1	0.3	0.1

Urine Copper (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
110	ICP-MS	165.0	290.0	84.4	63.4	149.0
147	ICP-MS	163.278	284.625	79.416	58.958	144.854
159	ICP-MS	167.0	291.0	81.0	61.0	145.0
164	ICP-MS	152.0	264.0	79.0	60.0	136.0
179	DRC/CC-ICP-MS	167.0	293.0	81.0	60.0	148.0
197	ICP-MS	162.8	286.7	83.7	63.9	146.5
305	ICP-MS	149.0	278.0	75.0	57.0	138.0
312	ICP-MS	153.9	271.0	75.8	55.3	133.9
359	ICP-MS	155.9	278.0	75.8	57.4	140.8
Arithmetic Mean (n=9)		**160**	**282**	**79**	**60**	**142**
SD		7	10	3	3	5

Urine Iodine (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	**DRC/CC-**ICP-MS	100.7	101.9	108.2	106.1	107.5

Urine Lithium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
147	ICP-MS	11.5	11.7	12.2	12.1	12.8

Urine Manganese (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
103	ICP-MS	3.6	5.5	1.2	0.6	2.6
107	DRC/CC-ICP-MS	3.93	6.51	1.7	1.17	3
110	DRC/CC-ICP-MS	3.7	7.1	1.7	1.1	3.5
147	ICP-MS	3.797	6.813	2.049	1.478	3.764
159	ICP-MS	4.8	8.1	2.9	2.4	4.5
179	DRC/CC-ICP-MS	3.7	6.8	1.9	1.3	3.4
305	ICP-MS	4.0	7.2	2.6	2.2	4.2
312	ICP-MS	4.1	6.7	2.3	2.0	3.5
359	ICP-MS	5.8*	8.2	4.0	3.3	5.4
391	DRC/CC-ICP-MS	4.2	7.1	2.2	1.9	3.8
Omitted*						
Arithmetic Mean		**4.0**	**7.0**	**2.3**	**1.7**	**3.8**
SD		0.4	0.8	0.8	0.8	0.8

Urine Molybdenum (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
110	ICP-MS	55.4	85.2	36.8	31.2	52.0
107	DRC/CC-ICP-MS	55.4	85.4	36.7	31.3	52.6
147	ICP-MS	56.718	85.701	38.1	32.054	52.975
179	ICP-MS	52.0	78.0	35.0	29.0	49.0
197	ICP-MS	55.8	84.8	37.6	31.4	51.9
312	ICP-MS	55.0	87.5	36.4	31.3	53.3
359	ICP-MS	58.6	90.9	38.5	33.3	55.6
366	ICP-MS	57.0	85.0	47.0	34.0	60.0
385	ICP-MS	56.6	87.9	37.4	31.7	53.4
Arithmetic Mean (n=9)		**56**	**86**	**38**	**32**	**53**
SD		2	3	3	1	3

Urine Nickel (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	HR-ICP-MS	4.4	7.5	2.6	2.8	4.7
110	ICP-MS	6.6	9.0	3.9	3.9	4.9
147	ICP-MS	4.492	7.634	2.742	3.271	4.463
159	ICP-MS	6.0	9.0	4.0	4.0	6.0
164	ICP-MS	4.7	7.0	3.0	3.1	4.2
179	ICP-MS	4.3	7.0	2.2	2.6	3.8
197	ICP-MS	8.3	7.0	2.1	2.5	3.4
312	ICP-MS	4.8	7.8	3.2	3.4	4.4
359	ICP-MS	4.0	6.7	2.4	2.5	3.6
Arithmetic Mean (n=9)		**5**	**7.6**	**2.9**	**3.1**	**4.4**
SD		1	0.9	0.7	0.6	0.8

Urine Platinum (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
110	ICP-MS	1.4	2.5	0.6	0.5	1.1
147	ICP-MS	1.282	2.243	0.597	0.482	1.053
179	ICP-MS	1.3	2.4	0.6	0.4	1.2
312	ICP-MS	1.4	2.5	0.6	0.4	1.1
385	ICP-MS	1.5	2.6	0.7	0.5	1.3
Arithmetic Mean (n=5)		**1.4**	**2.4**	**0.62**	**0.5**	**1.2**
SD		0.1	0.1	0.05	0.1	0.1

Urine Selenium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
110	DRC/CC-ICP-MS	66.2	71.4	36.8	27.4	51.4
147	ICP-MS	51.66	78.041	34.281	29.147	47.077
179	DRC/CC-ICP-MS	50.0	80.0	33.0	29.0	47.0
197	ICP-MS	54.0	82.0	<50.0*	<50.0*	<50.0*
305	ICP-MS	69.0	94.0	52.0*	47.0*	65.0*
312	ICP-MS	55.8	86.8	39.6	30.2	54.7
359	ICP-MS	55.1	84.3	31.6	29.2	48.4
385	DRC/CC-ICP-MS	51.6	83.4	34.3	29.9	49.3
Omitted*						
Arithmetic Mean		**57**	**82**	**35**	**29**	**50**
SD		7	7	3	1	3

Urine Strontium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	DRC/CC-ICP-MS	40	41.3	42.5	42.4	43.5

Urine Tellurium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
110	ICP-MS	2.9	5.1	1.4	1.1	2.5
197	ICP-MS	3.1	5.0	1.4	<1.0*	2.5
312	ICP-MS	2.7	4.8	0.9	0.9	2.2
359	ICP-MS	2.6	4.8	1.0	0.6	2.2
Omitted*						
Arithmetic Mean		**2.8**	**4.9**	**1.2**	**0.9**	**2.4**
SD		0.2	0.2	0.3	0.3	0.2

Urine Thallium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
110	ICP-MS	17.1	13.8	3.7	2.7	6.8
116	ICP-MS	16.8	13.6	3.70	2.67	6.76
159	ICP-MS	16.8	13.2	3.5	2.6	6.6
179	ICP-MS	17.0	13.0	4.0	3.0	7.0
197	ICP-MS	15.4	12.5	3.4	2.5	6.2
312	ICP-MS	16.3	13.7	3.6	2.6	6.6
359	ICP-MS	18.7	14.8	3.8	2.7	7.1
385	ICP-MS	17.5	14.0	3.9	2.8	7.0
Arithmetic Mean (n=8)		**17.0**	**13.6**	**3.7**	**2.7**	**6.8**
SD		0.9	0.7	0.2	0.2	0.3

Urine Thorium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
147	ICP-MS	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016

Urine Tin (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	DRC/CC-ICP-MS	8.26	14.5	4.08	2.93	7.28
110	ICP-MS	7.8	13.9	3.8	2.8	6.9
179	ICP-MS	6.5	11.7	3.1	2.3	5.9
312	ICP-MS	6.8	12.5	3.5	2.5	6.3
359	ICP-MS	7.5	13.6	3.6	2.7	7.0
366	ICP-MS	8.9	15.0	5.3	3.4	8.5
Arithmetic Mean (n=6)		**7.6**	**14**	**3.9**	**2.8**	**7.0**
SD		0.9	1	0.8	0.4	0.9

Urine Tungsten (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
107	DRC/CC-ICP-MS	3.21	5.64	1.51	1.1	2.83
110	ICP-MS	3.0	5.4	1.4	1.0	2.7
147	ICP-MS	4.781*	8.477*	2.317	1.662*	4.23*
312	ICP-MS	3.0	5.3	1.4	1.0	2.6
359	ICP-MS	3.1	5.7	1.5	1.1	2.8
385	ICP-MS	3.1	5.6	3.4	1.0	2.7
Omitted*						
Arithmetic Mean		**3.1**	**5.5**	**1.9**	**1.0**	**2.7**
SD		0.1	0.2	0.8	0.1	0.1

Urine Uranium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
103	ICP-MS	1.7	0.8	0.3*	0.2	0.4
107	DRC/CC-ICP-MS	1.51	0.7	0.18	0.13	0.34
110	ICP-MS	1.5	0.7	0.2	0.1	0.3
116	ICP-MS	1.49	0.669	0.173	0.118	0.323
197	ICP-MS	1.3	<1.0*	<1.0*	<1.0*	<1.0*
312	ICP-MS	1.4	0.7	0.2	0.1	0.3
359	ICP-MS	1.6	0.7	0.2	0.1	0.3
366	ICP-MS	1.0	0.5*	0.2	0.1	0.3
385	ICP-MS	1.6	0.7	0.2	0.2	0.4
Omitted*						
Arithmetic Mean[+]		**1.5**	**0.71**	**0.19**	**0.13**	**0.33**
SD[+]		0.2	0.04	0.01	0.04	0.04

[+] *Reviewed and Updated 12/9/11*

Urine Vanadium (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
179	DRC/CC-ICP-MS	3.0	5.5	1.6	1.1	2.8
312	DRC/CC-ICP-MS	2.1	3.4	1.0	0.8	1.7
359	ICP-MS	5.4	7.6	4.1	4.3	5.2
Arithmetic Mean (n=3)		**4**	**6**	**2**	**2**	**3**
SD		2	2	2	2	2

Urine Zinc (µg/L)

Lab Code	Method	UE11-11	UE11-12	UE11-13	UE11-14	UE11-15
110	ICP-MS	231.0	356.0	154.0	129.0	219.0
147	ICP-MS	231.373	360.131	148.366	124.183	221.569
159	ICP-MS	209.0	333.0	127.0	106.0	193.0
164	ICP-MS	213.0	330.0	145.0	122.0	204.0
179	DRC/CC-ICP-MS	243.0	378.0	159.0	132.0	231.0
197	ICP-MS	<200.0*	294.0	<200.0*	<200.0*	<200.0*
305	ICP-MS	211.0	325.0	139.0	134.0	262.0
312	ICP-MS	196.7	314.1	116.4	91.7	170.8
359	ICP-MS	204.1	331.2	128.5	110.4	194.0
Omitted*						
Arithmetic Mean		**217**	**336**	**140**	**119**	**212**
SD		16	25	15	15	28

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)

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.