Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

TRACE ELEMENTS IN URINE

Proficiency Test Report

Event #2, 2014

July 7th, 2014

July 7, 2014

Trace Elements in Urine
Event #2, 2014

Dear Laboratory Director:

Results from the second proficiency test (PT) event for 2014 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.
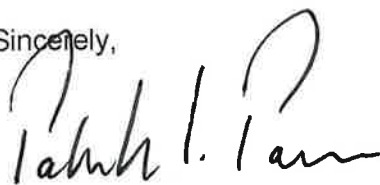
PT Materials

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 10th, 2014. 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 8th, 2014.**

Thank you for your participation.

Sincerely,

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Deputy Director, Division of Environmental Health

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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. 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 34.6 µg/L (0.46 µmol/L) to 175.9 µg/L (2.35 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, 2014 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
Robust Mean	**66.0**	**34.6**	**127.8**	**91.0**	**175.9**
Robust Standard Deviation	5.1	2.1	9.4	6.1	6.3
Standard Uncertainty	1.3	0.6	2.5	1.6	1.6
RSD (%)	7.7	6.1	7.4	6.7	3.6
Number of Sample Measurements	23	23	23	23	23
Acceptable Range:					
Upper Limit	79.2	41.5	153.4	109.2	211.1
Lower Limit	52.8	27.7	102.2	72.8	140.7

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, 2014 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE14-06	UE14-07	UE14-08	UE14-09	UE14-10	
	Target Values:	66.0	34.6	127.8	91.0	175.9	
103	DRC/CC-ICP-MS	65.8	34.5	129.2	91.8	176.6	Info
106	DRC/CC-ICP-MS	64.1	36.1	127.0	91.3	193.7	Info
107	DRC/CC-ICP-MS	67.1	34.4	130	92.4	177	Info
110	DRC/CC-ICP-MS	72.6	36.8	141.0	103.0	202.0	
114	ICP-MS	60.0	32.0	120.0	84.0	173.0	
116	DRC/CC-ICP-MS	66.8	35.7	124.0	93.4	178.7	Info
147	ICP-MS	65.1	33.9	130.3	91.4	178.3	Info
156	DRC/CC-ICP-MS	66.0	33.0	120.0	91.0	180.0	
164	ICP-MS	71.0	38.0	132.0	95.0	178.0	
179	ICP-MS	67.0	34.0	128.0	91.0	176.0	
197	DRC/CC-ICP-MS	61.0	34.0	131.0	84.0	170.0	
200	ICP-MS	66.9	36.3	165 ↑	95.6	175.0	Info
206	DRC/CC-ICP-MS	62.7	33.0	121.6	90.7	165.2	
208	ICP-MS	76.1	38.4	134.5	97.7	178.2	
293	DRC/CC-ICP-MS	65.6	34.3	128.8	92.1	177.5	Info
305	ICP-MS	76.0	39.0	153.0	112.0 ↑	191.0	
312	DRC/CC-ICP-MS	61.0	33.0	120.0	80.0	160.0	
339	HR-ICP-MS	62.8	32.5	117.7	83.4	162.0	Info
366	ICP-MS	60.0	32.0	114.0	83.0	158.0	Info
367	DRC/CC-ICP-MS	71.6	37.6	139.2	98.6	190.9	Info
391	DRC/CC-ICP-MS	57.98	32.25	108.4	73.36	151.1	Info
401	DRC/CC-ICP-MS	63.8	33.7	125.1	90.0	171.9	Info
472	DRC/CC-ICP-MS	72.4	35.0	127.4	91.3	175.0	Info

Percent satisfactory results for all participants: 98.3 %

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, 2014 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	14	14	14	14	14
Mean:	65.6	34.5	126.6	90.2	176.4
Standard Deviation:	4.4	1.6	8.1	7.3	13.3
RSD (%):	6.7	4.5	6.4	8.0	7.5
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	62.8	32.5	117.7	83.4	162.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	8	8	8	8	8
Mean:	67.8	35.5	134.6	93.7	175.9
Standard Deviation:	6.3	2.8	16.8	9.1	9.0
RSD (%):	9.3	8.0	12.5	9.7	5.1
All Laboratories					
Number of Sample Measurements:	23	23	23	23	23
Mean:	66.2	34.8	129.0	91.1	175.6
Standard Deviation:	5.1	2.1	12.2	7.9	11.8
RSD (%):	7.6	6.1	9.5	8.7	6.7

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 2.6 µg/L (23 nmol/L) to 13.0 µg/L (116 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, 93.0% of test results reported were judged as satisfactory, with two of the 23 participant laboratories (8.7%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Cadmium Test Results, 2014 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE14-06	**UE14-07**	**UE14-08**	**UE14-09**	**UE14-10**
Robust Mean	**13.0**	**6.6**	**9.3**	**11.7**	**2.6**
Robust Standard Deviation	1.2	0.5	0.8	1.0	0.3
Standard Uncertainty	0.3	0.1	0.2	0.3	0.1
RSD (%)	9.4	7.2	8.4	8.3	10.0
Number of Sample Measurements	23	23	23	23	23
Acceptable Range:					
Upper Limit	15.0	7.6	10.7	13.5	3.6
Lower Limit	11.0	5.6	7.9	9.9	1.6

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, 2014 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE14-06	UE14-07	UE14-08	UE14-09	UE14-10	
	Target Values:	13.0	6.6	9.3	11.7	2.6	
103	DRC/CC-ICP-MS	14.0	6.9	10.1	12.8	2.8	Info
106	ICP-MS	13.2	6.5	9.2	11.7	2.6	Info
107	DRC/CC-ICP-MS	13	6.5	9.1	11	2.6	Info
110	ICP-MS	13.1	6.6	9.5	11.9	2.7	
114	ICP-MS	11.7	5.8	8.3	10.8	2.3	
116	ICP-MS	14.2	7.2	10.2	12.7	2.9	Info
147	ICP-MS	12.6	6.3	9.1	11.6	2.5	Info
156	ICP-MS	13.0	6.9	9.5	12.0	2.5	
164	ICP-MS	12.2	6.1	8.8	11.1	2.4	
179	ICP-MS	13.5	6.8	9.8	12.4	2.7	
197	DRC/CC-ICP-MS	12.9	6.5	9.0	11.4	2.7	
200	ICP-MS	14.6	7.3	10.3	12.9	2.6	Info
206	ICP-MS	14.8	6.6	9.5	12.3	2.8	
208	ICP-MS	14.3	6.8	9.8	12.3	2.8	
293	ICP-MS	13.1	6.7	9.4	11.8	2.7	Info
305	ICP-MS	13.0	7.0	10.0	12.0	3.0	
312	ICP-MS	13.0	6.5	9.3	11.0	2.6	
339	HR-ICP-MS	11.6	5.6	8.2	10.3	2.2	Info
366	ICP-MS	10.0 ↓	6.3	8.4	10.6	2.5	Info
367	DRC/CC-ICP-MS	15.4 ↑	7.9 ↑	11.0 ↑	13.9 ↑	3.1	Info
391	DRC/CC-ICP-MS	10.97 ↓	5.62	7.54 ↓	9.08 ↓	2.1	Info
401	DRC/CC-ICP-MS	13.4	6.6	9.3	11.9	2.4	Info
472	ICP-MS	11.7	6.0	8.3	10.5	2.3	Info

Percent satisfactory results for all participants: 93.0 %

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, 2014 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	6	6	6	6	6
Mean:	13.3	6.7	9.3	11.7	2.6
Standard Deviation:	1.5	0.7	1.2	1.6	0.3
RSD (%):	11.0	11.1	12.4	14.1	13.1
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	11.6	5.6	8.2	10.3	2.2
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	16	16	16	16	16
Mean:	13.0	6.6	9.3	11.7	2.6
Standard Deviation:	1.2	0.4	0.6	0.7	0.2
RSD (%):	9.4	6.4	6.8	6.3	7.7
All Laboratories					
Number of Sample Measurements:	23	23	23	23	23
Mean:	13.0	6.6	9.3	11.7	2.6
Standard Deviation:	1.3	0.5	0.8	1.0	0.2
RSD (%):	9.8	8.2	8.6	8.9	9.6

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 16.1 µg/L (80 nmol/L) to 92.7 µg/L (462 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, 89.5% of test results reported were judged as satisfactory, with two of the 21 participant laboratories (9.5%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Mercury Test Results, 2014 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
Robust Mean	**60.8**	**16.1**	**92.7**	**32.0**	**44.9**
Robust Standard Deviation	5.7	1.8	7.1	4.0	3.7
Standard Uncertainty	1.6	0.5	1.9	1.1	1.0
RSD (%)	9.4	11.2	7.7	12.4	8.2
Number of Sample Measurements	21	21	21	21	21
Acceptable Range:					
Upper Limit	79.0	20.9	120.5	41.6	58.4
Lower Limit	42.6	11.3	64.9	22.4	31.4

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, 2014 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE14-06	UE14-07	UE14-08	UE14-09	UE14-10	
	Target Values:	60.8	16.1	92.7	32.0	44.9	
103	DRC/CC-ICP-MS	57.3	15.3	89.7	32.0	44.3	Info
107	DRC/CC-ICP-MS	62.9	16.1	94.5	33.0	45.4	Info
109	AFS	58.4	16.0	92.2	29.5	42.5	Info
110	ICP-MS	61.2	16.6	94.3	33.6	47.2	
114	ICP-MS	65.0	18.0	99.0	36.0	47.0	
147	CV-AAS	54.8	14.8	87.0	29.9	41.9	Info
156	ICP-MS	59.0	15.0	89.0	31.0	44.0	
164	ICP-MS	66.0	18.0	96.0	35.0	47.0	
179	ICP-MS	59.0	16.0	90.0	31.0	44.0	
197	DRC/CC-ICP-MS	64.0	17.0	99.0	35.0	48.0	
199	ICP-MS	63.6	16.1	99.2	34.8	50.2	Info
200	ICP-MS	49.4	13.0	72.4	25.8	38.2	Info
206	ICP-MS	58.2	17.3	93.4	33.4	44.6	
208	CV-AAS	135.5 ↑	8.8 ↓	53.8 ↓	19.1 ↓	26.4 ↓	
293	ICP-MS	60.5	16.6	93.6	32.5	45.7	Info
305	ICP-MS	80.0 ↑	21.0 ↑	114.0	46.0 ↑	51.0	
312	ICP-MS	64.0	17.0	95.0	32.0	45.0	
339	HR-ICP-MS	40.2 ↓	13.5	69.9	25.0	39.4	Info
366	ICP-MS	69.0	23.0 ↑	104.0	39.0	50.0	Info
367	CV-AAS	59.0	16.5	94.0	32.0	47.0	Info
401	DRC/CC-ICP-MS	51.4	10.3 ↓	77.8	24.6	36.7	Info

Percent satisfactory results for all participants: 89.5 %

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, 2014 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
AFS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	58.4	16.0	92.2	29.5	42.5
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	2	3	3	3	3
Mean:	56.9	13.4	78.3	27.0	38.4
Standard Deviation:	3.0	4.0	21.5	6.9	10.7
RSD (%):	—	—	—	—	—
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	58.9	14.7	90.3	31.2	43.6
Standard Deviation:	5.8	3.0	9.1	4.5	4.9
RSD (%):	9.8	20.4	10.1	14.6	11.1
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	40.2	13.5	69.9	25.0	39.4
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	12	12	12	12	12
Mean:	62.9	17.3	95.0	34.2	46.2
Standard Deviation:	7.3	2.6	9.8	4.9	3.5
RSD (%):	11.6	15.1	10.3	14.4	7.6
All Laboratories					
Number of Sample Measurements:	20	21	21	21	21
Mean:	60.1	16.0	90.4	31.9	44.1
Standard Deviation:	8.0	3.1	12.9	5.5	5.5
RSD (%):	13.3	19.2	14.3	17.4	12.5

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 36.7 µg/L (0.18 µmol/L) to 189.8 µg/L (0.92 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, 99.0% of test results 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 Lead Test Results, 2014 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
Robust Mean	**189.8**	**95.7**	**136.1**	**170.9**	**36.7**
Robust Standard Deviation	8.7	4.2	6.1	9.1	2.2
Standard Uncertainty	2.4	1.1	1.7	2.5	0.6
RSD (%)	4.6	4.3	4.5	5.3	6.0
Number of Sample Measurements	20	21	21	21	21
Acceptable Range:					
Upper Limit	229.8	135.7	176.1	210.9	76.7
Lower Limit	149.8	55.7	96.1	130.9	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, 2014 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE14-06	UE14-07	UE14-08	UE14-09	UE14-10	
	Target Values:	189.8	95.7	136.1	170.9	36.7	
103	DRC/CC-ICP-MS	201.5	101.5	143.5	182.1	39.2	Info
106	ICP-MS	188.2	94.5	135.2	169.9	36.6	Info
107	DRC/CC-ICP-MS	>200	110	150	190	39	Info
110	ICP-MS	188.0	94.0	133.0	169.0	36.2	
114	ICP-MS	172.0	83.0	121.0	154.0	32.0	
116	ICP-MS	196.3	99.2	140.5	175.9	38.5	Info
147	ICP-MS	193.7	96.8	136.1	170.3	37.1	Info
156	DRC/CC-ICP-MS	180.0	95.0	130.0	160.0	36.0	
164	ICP-MS	206.0	100.0	140.0	180.0	38.0	
179	ICP-MS	196.0	97.0	140.0	178.0	38.0	
197	DRC/CC-ICP-MS	192.8	97.5	138.1	175.4	36.9	
200	ICP-MS	188	97.3	137	180	33.1	Info
206	ICP-MS	182.0	90.4	128.0	160.4	35.2	
208	ICP-MS	192.0	94.5	130.7	167.0	35.2	
293	ICP-MS	184.7	93.3	134.4	168.0	36.8	Info
305	ICP-MS	193.0	90.0	137.0	177.0	35.0	
312	ICP-MS	200.0	100.0	140.0	170.0	40.0	
339	HR-ICP-MS	148.2 ↓	86.1	113.3	136.7	35.1	Info
366	ICP-MS	180.0	95.0	136.0	164.0	35.0	Info
391	ETAAS-Z	193.4	102.3	147.6	175.6	46.25	Info
472	ICP-MS	188.2	95.1	133.5	169.2	36.7	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 Lead Test Results, 2014 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	4	4	4	4
Mean:	191.4	101.0	140.4	176.9	37.8
Standard Deviation:	10.8	6.6	8.5	12.7	1.6
RSD (%):	—	6.5	6.0	7.2	4.2
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	193.4	102.3	147.6	175.6	46.3
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	148.2	86.1	113.3	136.7	35.1
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	15	15	15	15	15
Mean:	189.9	94.7	134.8	170.2	36.2
Standard Deviation:	8.4	4.4	5.2	7.3	2.1
RSD (%):	4.4	4.7	3.9	4.3	5.7
All Laboratories					
Number of Sample Measurements:	20	21	21	21	21
Mean:	188.2	95.8	135.5	170.1	36.9
Standard Deviation:	12.4	5.8	8.2	11.3	2.9
RSD (%):	6.6	6.0	6.0	6.7	7.8

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

Urine Aluminum (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
147	DRC/CC-ICP-MS	95.5	48.0	67.7	86.9	31.0
164	ICP-MS	96	49	71	83	21
179	DRC/CC-ICP-MS	97	50	70	88	20
197	ICP-MS	107	56	69	87	<20
206	ICP-MS	>20	>20	>20	>20	>20
305	ICP-MS	101	55	75	92	25
312	ICP-MS	84	49	62	90	29
	Arithmetic Mean	**97**	**51**	**69**	**88**	**25**
	SD	8	3	4	3	5
	n	6	6	6	6	5

Urine Antimony (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	12	6.4	8.8	11	2.5
110	ICP-MS	12.9	6.46	9.28	11.8	2.56
147	ICP-MS	12.4	6.21	8.80	11.2	2.44
197	ICP-MS	13.1	6.5	9.3	11.5	2.5
206	ICP-MS	12.0	6.0	8.6	10.7	2.3
312	ICP-MS	12.0	5.9	8.5	10	2.3
472	ICP-MS	12.5	6.3	8.9	11.2	2.4
	Arithmetic Mean	**12.4**	**6.3**	**8.9**	**11.1**	**2.4**
	SD	0.5	0.2	0.3	0.6	0.1
	n	7	7	7	7	7

Urine Barium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
106	ICP-MS	17.0	9.0	12.0	15.4	3.5
107	DRC/CC-ICP-MS	16	8.0	11	14	3.3
110	ICP-MS	16.1	8.25	11.6	14.7	3.31
116	ICP-MS	15.6	8.01	11.4	14.0	3.19
147	ICP-MS	15.8	8.14	11.3	14.4	3.34
197	ICP-MS	16.2	8.4	11.8	15.2	3.4
312	ICP-MS	16	8.2	11	14	3.3
472	ICP-MS	15.7	7.9	11.2	14.1	3.1
	Arithmetic Mean	**16**	**8.2**	**11**	**14**	**3.3**
	SD	0.4	0.3	0.4	0.6	0.1
	n	8	8	8	8	8

Urine Beryllium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
106	ICP-MS	16.0	7.9	11.6	15.1	3.1
107	DRC/CC-ICP-MS	17	9.0	12	15	3.5
110	ICP-MS	17.0	7.69	12.0	15.2	3.41
116	ICP-MS	17.5	9.08	12.6	15.7	3.65
147	ICP-MS	16.9	8.32	11.4	14.6	3.15
197	ICP-MS	15.3	8.2	11.8	15.2	3.2
312	ICP-MS	16	7.4	10	12	3.0
472	ICP-MS	16.1	8.1	11.4	14.5	3.1
	Arithmetic Mean	**16**	**8.2**	**11.6**	**15**	**3.3**
	SD	0.7	0.6	0.8	1	0.2
	n	8	8	8	8	8

Urine Bismuth (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
147	ICP-MS	<0.105	<0.105	<0.105	<0.105	<0.105
197	ICP-MS	<1.0	<1.0	<1.0	<1.0	<1.0
206	ICP-MS	0.1	0.0	0.0	0.0	0.0
305	ICP-MS	<0.5	<0.5	<0.5	<0.5	<0.5
312	ICP-MS	<0.08	<0.08	<0.08	<0.08	<0.08

Urine Cesium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	62	31	44	54	14
110	ICP-MS	66.6	34.2	47.7	59.9	14.4
147	ICP-MS	63.5	32.6	46.3	57.8	14.2
312	ICP-MS	66	34	47	57	14
366	ICP-MS	65	32	45	57	14
472	ICP-MS	66.1	34.0	47.7	59.8	14.3
	Arithmetic Mean	**65**	**33**	**46**	**58**	**14.2**
	SD	2	1	2	2	0.2
	n	6	6	6	6	6

Urine Chromium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	30	17	22	27	6.7
110	DRC/CC-ICP-MS	33.9	18.0	24.1	30.2	7.52
147	DRC/CC-ICP-MS	31.5	14.9	21.1	26.8	6.08
156	DRC/CC-ICP-MS	29	14	21	26	5.9
164	DRC/CC-ICP-MS	32.7	17.0	23.3	29.9	6.8
179	DRC/CC-ICP-MS	29.3	14.8	20.7	26.3	5.7
197	DRC/CC-ICP-MS	32.5	16.6	23.5	29.8	6.5
206	DRC/CC-ICP-MS	31.1	17.0	23.0	29.0	6.8
305	ICP-MS	31.8	15.9	23.9	27.8	6.1
312	DRC/CC-ICP-MS	29	14	22	25	5.8
366	DRC/CC-ICP-MS	29	15	24	28	4.9
367	DRC/CC-ICP-MS	34.3	17.1	24.4	30.7	6.6
391	DRC/CC-ICP-MS	37.62	19.93	25.43	30.49	7.29
401	DRC/CC-ICP-MS	29.9	14.8	21.3	27.2	5.7
	Arithmetic Mean	**32**	**16**	**23**	**28**	**6.3**
	SD	3	2	1	2	0.7
	n	14	14	14	14	14

Urine Cobalt (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	7.9	3.6	5.1	7.0	8.8
110	ICP-MS	8.09	3.69	5.07	7.05	9.30
147	ICP-MS	7.42	3.45	4.76	6.78	8.78
156	DRC/CC-ICP-MS	6.6	3.0	4.2	5.9	8.2
164	ICP-MS	7.1	3.1	4.4	6.0	8.0
179	DRC/CC-ICP-MS	8.1	3.6	5.2	6.9	9.1
197	ICP-MS	7.3	3.5	4.8	6.6	8.9
206	ICP-MS	7.0	3.3	4.4	6.2	8.1
305	ICP-MS	7.9	3.7	4.9	6.6	8.8
312	ICP-MS	8.0	3.8	5.1	6.7	9.1
391	DRC/CC-ICP-MS	6.80	3.24	4.07	5.30	7.59
401	DRC/CC-ICP-MS	7.1	3.1	4.4	6.1	8.2
472	ICP-MS	7.5	3.4	4.8	6.6	8.7
	Arithmetic Mean	**7.4**	**3.4**	**4.7**	**6.4**	**8.6**
	SD	0.5	0.3	0.4	0.5	0.5
	n	13	13	13	13	13

Urine Copper (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
110	ICP-MS	646	326	469	593	134
147	ICP-MS	632	323	459	579	132
164	ICP-MS	568	296	418	520	118
179	DRC/CC-ICP-MS	648	328	460	585	129
197	ICP-MS	702.3	364.5	519.2	647.3	150.0
206	ICP-MS	605	303	429	539	120
305	ICP-MS	658	338	479	598	133
312	ICP-MS	640	330	460	550	130
401	DRC/CC-ICP-MS	658.9	329.4	471.3	594.7	128.5
	Arithmetic Mean	**640**	**326**	**463**	**578**	**131**
	SD	37	20	29	38	9
	n	9	9	9	9	9

Urine Iodine (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	48.1	47.8	49.6	48.0	48.8
156	DRC/CC-ICP-MS	45	46	45	46	46
164	DRC/CC-ICP-MS	46	45	44	46	46
179	ICP-MS	47	47	47	48	48
197	ICP-MS	49	49	48	49	51
206	ICP-MS	45.1	46.3	46.0	45.8	45.9
312	ICP-MS	55.4	57.0	56.5	56.3	57.5
	Arithmetic Mean	**48**	**48**	**48**	**48**	**49**
	SD	4	4	4	4	4
	n	7	7	7	7	7

Urine Iron (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
391	DRC/CC-ICP-MS	6.42	3.50	1.07	1.47	5.31

Urine Lithium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
147	ICP-MS	6.81	6.86	6.75	7.07	6.80

Urine Manganese (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
103	DRC/CC-ICP-MS	16.3	8.2	11.6	14.6	3.2
107	DRC/CC-ICP-MS	15	7.6	11	14	3.0
110	DRC/CC-ICP-MS	16.0	8.52	11.2	14.2	3.14
147	DRC/CC-ICP-MS	16.0	7.80	11.3	14.4	3.18
179	DRC/CC-ICP-MS	14.7	7.7	11.1	13.6	3.0
206	ICP-MS	15.4	7.8	11.0	13.8	3.2
305	ICP-MS	15.0	7.8	10.8	14.1	3.2
312	DRC/CC-ICP-MS	15	8.2	11	13	3.3
391	DRC/CC-ICP-MS	14.7	7.87	9.94	12.20	2.91
	Arithmetic Mean	**15.3**	**7.9**	**11.0**	**13.8**	**3.1**
	SD	0.6	0.3	0.5	0.8	0.1
	n	9	9	9	9	9

Urine Molybdenum (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	180	110	140	170	55
110	ICP-MS	184	102	136	166	53.6
147	ICP-MS	182	104	138.0	168	51.2
179	ICP-MS	182	106	137	169	56
197	ICP-MS	195.7	116.9	151.9	184.4	*65.6
312	ICP-MS	190	100	140	160	54.9
Outlier	**Arithmetic Mean**	**186**	**106**	**140**	**170**	**54**
	SD	6	6	6	8	2
	n	6	6	6	6	5

Urine Nickel (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	17	9.5	12	16	6.1
110	ICP-MS	18.3	10.1	14.8	18.9	7.22
147	DRC/CC-ICP-MS	16.7	8.63	11.9	15.3	5.93
164	ICP-MS	16.8	8.7	12.5	15	5.7
179	DRC/CC-ICP-MS	16.5	8.4	12.1	15.2	5.4
197	ICP-MS	17.7	9.3	12.7	16.3	5.9
206	ICP-MS	14.6	7.0	10.4	12.9	4.2
312	ICP-MS	15	7.7	10	13	6.0
391	DRC/CC-ICP-MS	18.78	10.16	12.84	15.19	6.10
401	DRC/CC-ICP-MS	15.0	7.5	10.9	13.8	4.8
	Arithmetic Mean	**17**	**9**	**12**	**15**	**5.7**
	SD	1	1	1	2	0.8
	n	10	10	10	10	10

Urine Platinum (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	5.8	3.0	4.1	5.3	1.2
110	ICP-MS	6.42	3.24	4.55	5.82	1.25
147	ICP-MS	6.13	3.10	4.29	5.17	1.18
312	ICP-MS	5.7	2.8	4.2	4.8	1.2
472	ICP-MS	5.9	3.0	4.2	5.3	1.2
	Arithmetic Mean	**6.0**	**3.0**	**4.3**	**5.3**	**1.21**
	SD	0.3	0.2	0.2	0.4	0.03
	n	5	5	5	5	5

Urine Selenium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
110	DRC/CC-ICP-MS	176	90.7	125	156	37.6
147	ICP-MS	163	87.7	119	147	43.1
179	DRC/CC-ICP-MS	164	87	117	144	43
206	ICP-MS	165.6	87.8	121.5	150.2	41.1
305	ICP-MS	154	88	126	157	42
312	ICP-MS	160	89	120	140	43
391	DRC/CC-ICP-MS	166.5	95.29	113.2	137.3	43.41
	Arithmetic Mean	**164**	**89**	**120**	**147**	**42**
	SD	7	3	4	8	2
	n	7	7	7	7	7

Urine Strontium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	30	30	31	31	31

Urine Tellurium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
110	ICP-MS	13.4	6.74	9.68	12.3	2.73
197	ICP-MS	12.4	6.4	8.8	11.3	2.5
206	ICP-MS	>10	5.9	8.5	>10	2.5
312	ICP-MS	12	5.7	8.0	9.8	2.3
	Arithmetic Mean	**12.6**	**6.2**	**8.7**	**11**	**2.5**
	SD	0.7	0.5	0.7	1	0.2
	n	3	4	4	3	4

Urine Thallium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
106	ICP-MS	31.0	15.5	22.4	28.1	6.1
107	DRC/CC-ICP-MS	34	17	24	30	6.3
110	ICP-MS	31.9	15.9	22.4	28.4	6.17
116	ICP-MS	32.2	16.2	23.1	29.1	6.28
147	ICP-MS	31.3	15.8	22.9	28.4	6.21
179	ICP-MS	31	15	21	28	6
197	ICP-MS	28.6	14.4	20.8	25.6	5.5
206	ICP-MS	>10	>10	>10	>10	6.0
305	ICP-MS	31	15	21	27	6
312	ICP-MS	32	16	22	27	6.2
472	ICP-MS	30.6	15.6	21.8	27.4	6.0
	Arithmetic Mean	**31**	**16**	**22**	**28**	**6.1**
	SD	1	0.7	1	1	0.2
	n	10	10	10	10	11

Urine Thorium (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
147	ICP-MS	<0.116	<0.116	<0.116	<0.116	<0.116

Urine Tin (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
107	DRC/CC-ICP-MS	33	18	25	30	7.1
110	ICP-MS	32.5	16.2	23.0	29.0	6.37
147	ICP-MS	31.7	15.60	22.2	28.4	6.15
312	ICP-MS	30	15	22	26	5.9
	Arithmetic Mean	**32**	**16**	**23**	**28**	**6.4**
	SD	1	1	1	2	0.5
	n	4	4	4	4	4

Urine Tungsten (µg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
103	DRC/CC-ICP-MS	12.4	6.2	8.9	11.2	2.4
107	DRC/CC-ICP-MS	12	6.1	8.3	11	2.4
110	ICP-MS	12.9	6.45	9.19	11.6	2.47
147	ICP-MS	12.9	6.38	9.30	11.6	2.61
312	ICP-MS	13	6.4	9.1	11	2.6
472	ICP-MS	12.5	6.4	8.9	11.2	2.7
	Arithmetic Mean	**12.6**	**6.3**	**8.9**	**11.3**	**2.5**
	SD	0.4	0.1	0.4	0.3	0.1
	n	6	6	6	6	6

Urine Uranium (μg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
106	ICP-MS	1.6	0.8	1.1	1.4	0.3
107	DRC/CC-ICP-MS	1.7	0.8	1.2	1.5	0.33
110	ICP-MS	1.58	0.779	1.10	1.39	0.300
116	ICP-MS	1.52	0.761	1.08	1.36	0.289
147	ICP-MS	1.59	0.788	1.11	1.40	0.298
197	ICP-MS	1.5	<1.0	1.1	1.4	<1.0
312	ICP-MS	1.8	0.9	1.3	1.5	0.4
472	ICP-MS	1.5	0.75	1.1	1.3	0.29
	Arithmetic Mean	**1.6**	**0.80**	**1.14**	**1.41**	**0.32**
	SD	0.1	0.05	0.08	0.07	0.04
	n	8	7	8	8	7

Urine Vanadium (μg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
147	DRC/CC-ICP-MS	12.5	6.12	8.93	11.4	2.49
179	DRC/CC-ICP-MS	10.3	5.2	7.6	9.4	2.1
197	ICP-MS	12.40	6.20	8.80	11.20	2.40
312	DRC/CC-ICP-MS	11	7.1	9.0	9.7	2.3
391	DRC/CC-ICP-MS	14.18	7.84	9.79	11.62	3.22
	Arithmetic Mean	**12**	**6**	**8.8**	**11**	**2.5**
	SD	2	1	0.8	1	0.4
	n	5	5	5	5	5

Urine Zinc (μg/L)

Lab Code	Method	UE14-06	UE14-07	UE14-08	UE14-09	UE14-10
110	ICP-MS	773	428	587	728	241
147	ICP-MS	732	422	537	693	273
164	ICP-MS	667	407	537	634	218
179	DRC/CC-ICP-MS	762	431	565	701	230
197	ICP-MS	715.00	397.00	540.00	668.00	<200.00
206	ICP-MS	693	384	523	629	196
305	ICP-MS	710	407	552	667	210
312	ICP-MS	680	390	520	600	200
391	DRC/CC-ICP-MS	*330.22	*186.25	*243.65	*266.07	*94.73
401	DRC/CC-ICP-MS	686.4	385.7	516.4	627.6	196.1
*Outlier	**Arithmetic Mean**	**713**	**406**	**542**	**661**	**221**
	SD	37	18	23	42	27
	n	9	9	9	9	8

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.