NEW YORK STATE Department of Health | Wadsworth Center

TRACE ELEMENTS IN URINE

Proficiency Test Report

Event #3, 2015

November 12th, 2015

November 12, 2015

Trace Elements in Urine
Event #3, 2015

Dear Laboratory Director:

Results from the third 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.

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 13.1 µg/L (0.17 µmol/L) to 108.8 µg/L (1.45 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, 99.1% 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, 2015 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
Robust Mean	**82.9**	**108.8**	**52.4**	**13.1**	**66.4**
Robust Standard Deviation	4.1	6.7	3.7	2.1	3.5
Standard Uncertainty	1.1	1.7	1.0	0.5	0.9
RSD (%)	4.9	6.2	7.1	15.7	5.3
Number of Sample Measurements	23	23	23	22	23
Acceptable Range:					
Upper Limit	99.5	130.6	62.9	19.1	79.7
Lower Limit	66.3	87.0	41.9	7.1	53.1

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 #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE15-11	UE15-12	UE15-13	UE15-14	UE15-15	
	Target Values:	82.9	108.8	52.4	13.1	66.4	
103	DRC/CC-ICP-MS	85.8	111.2	53.7	12.4	69.8	Info
106	DRC/CC-ICP-MS	84.3	117.1	55.9	12.9	68.0	Info
107	DRC/CC-ICP-MS	81.0	110.0	53.0	12.0	63.0	Info
110	DRC/CC-ICP-MS	89.9	119.0	56.6	14.5	70.6	
114	ICP-MS	84.0	99.0	48.0	14.0	63.0	
116	DRC/CC-ICP-MS	77.6	101.7	47.7	11.2	55.5	Info
147	ICP-MS	77.9	103.4	49.0	11.5	64.5	Info
156	DRC/CC-ICP-MS	78.0	100.0	50.0	11.0	68.0	
164	ICP-MS	82.0	109.0	53.0	15.0	67.0	
179	ICP-MS	80.0	105.0	50.0	<15.0	63.0	
197	DRC/CC-ICP-MS	84.0	105.0	53.0	14.0	68.0	
200	ICP-MS	85.1	110.0	51.9	15.3	65.0	Info
206	DRC/CC-ICP-MS	83.8	111.7	53.8	18.7	67.2	
208	ICP-MS	79.6	112.9	56.4	16.8	66.7	
293	DRC/CC-ICP-MS	87.6	113.9	53.3	13.0	69.7	Info
305	ICP-MS	68.4	91.3	44.3	10.5	50.9 ↓	
312	DRC/CC-ICP-MS	85.0	111.0	53.5	11.6	66.4	
324	HR-ICP-MS	75.2	104.9	47.7	10.3	61.5	Info
339	HR-ICP-MS	82.5	105.0	51.7	12.1	66.0	Info
366	ICP-MS	83.0	116.0	58.0	18.0	72.0	Info
367	DRC/CC-ICP-MS	97.4	126.8	59.5	15.1	74.3	Info
391	DRC/CC-ICP-MS	88.3	109.3	50.8	12.2	68.1	Info
401	DRC/CC-ICP-MS	83.4	108.4	52.6	12.5	65.3	Info

Percent satisfactory results for all participants: 99.1 %

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 #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	13	13	13	13	13
Mean:	85.1	111.2	53.3	13.2	67.2
Standard Deviation:	5.2	7.2	3.0	2.1	4.4
RSD (%):	6.1	6.4	5.6	15.7	6.6
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	78.9	105.0	49.7	11.2	63.8
Standard Deviation:	5.2	0.1	2.8	1.3	3.2
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	8	8	8	7	8
Mean:	80.0	105.8	51.3	14.4	64.0
Standard Deviation:	5.3	8.0	4.5	2.7	6.0
RSD (%):	6.6	7.5	8.7	18.7	9.4
All Laboratories					
Number of Sample Measurements:	23	23	23	22	23
Mean:	82.8	108.8	52.3	13.4	65.8
Standard Deviation:	5.7	7.5	3.6	2.3	5.1
RSD (%):	6.8	6.9	6.9	17.4	7.7

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 1.9 µg/L (17 nmol/L) to 19.7 µg/L (175 nmol/L).

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

Discussion. Based upon the above criteria, 98.3% of test results reported 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 Cadmium Test Results, 2015 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
Robust Mean	**2.5**	**19.7**	**9.7**	**1.9**	**4.9**
Robust Standard Deviation	0.1	0.8	0.5	0.1	0.3
Standard Uncertainty	<0.1	0.2	0.1	<0.1	0.1
RSD (%)	5.5	4.0	5.0	7.3	5.7
Number of Sample Measurements	23	23	23	23	23
Acceptable Range:					
Upper Limit	3.5	22.7	11.2	2.9	5.9
Lower Limit	1.5	16.7	8.2	0.9	3.9

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, 2015 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE15-11	UE15-12	UE15-13	UE15-14	UE15-15	
	Target Values:	2.5	19.7	9.7	1.9	4.9	
103	DRC/CC-ICP-MS	2.5	20.5	10.2	2.0	5.1	Info
106	ICP-MS	2.5	19.6	9.5	1.9	4.9	Info
107	DRC/CC-ICP-MS	2.5	22.0	10.0	1.9	5.2	Info
110	ICP-MS	2.6	20.2	9.9	2.0	5.0	
114	ICP-MS	2.2	18.2	8.9	1.8	4.6	
116	ICP-MS	2.5	20.2	10.2	2.0	5.0	Info
147	ICP-MS	2.3	19.0	9.3	1.7	4.8	Info
156	ICP-MS	2.4	19.0	9.5	1.7	4.7	
164	ICP-MS	2.3	19.0	9.3	1.9	4.8	
179	ICP-MS	2.6	20.1	10.0	2.0	5.1	
197	DRC/CC-ICP-MS	2.5	20.2	9.7	2.0	5.0	
200	ICP-MS	2.5	19.2	9.3	1.8	4.7	Info
206	ICP-MS	2.3	20.0	9.5	1.6	4.7	
208	ICP-MS	2.6	20.5	10.3	2.0	5.1	
293	ICP-MS	2.5	19.7	9.7	1.9	4.8	Info
305	ICP-MS	2.8	19.2	10.4	2.0	5.3	
312	ICP-MS	2.5	20.6	10.0	1.8	5.0	
324	HR-ICP-MS	2.4	19.7	9.4	1.8	4.8	Info
339	HR-ICP-MS	2.0	16.5 ↓	8.1 ↓	1.6	4.0	Info
366	ICP-MS	2.4	19.0	9.4	1.9	4.5	Info
367	DRC/CC-ICP-MS	2.7	20.7	10.3	2.1	5.5	Info
391	DRC/CC-ICP-MS	2.5	19.4	9.1	1.8	4.5	Info
401	DRC/CC-ICP-MS	2.5	20.1	9.7	1.9	4.9	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 Cadmium Test Results, 2015 Event #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	6	6	6	6	6
Mean:	2.5	20.5	9.8	2.0	5.0
Standard Deviation:	0.1	0.9	0.4	0.1	0.3
RSD (%):	3.2	4.2	4.4	5.4	6.6
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	2.2	18.1	8.8	1.7	4.4
Standard Deviation:	0.3	2.3	0.9	0.1	0.6
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	15	15	15	15	15
Mean:	2.5	19.6	9.7	1.9	4.9
Standard Deviation:	0.2	0.7	0.4	0.1	0.2
RSD (%):	6.3	3.5	4.5	6.9	4.4
All Laboratories					
Number of Sample Measurements:	23	23	23	23	23
Mean:	2.5	19.7	9.6	1.9	4.9
Standard Deviation:	0.2	1.1	0.5	0.1	0.3
RSD (%):	6.8	5.4	5.5	7.2	6.4

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 10.5 µg/L (52 nmol/L) to 125.9 µg/L (628 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, 84.0% of test results reported were judged as satisfactory, with four of the 20 participant laboratories (20%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Mercury Test Results, 2015 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
Robust Mean	**62.8**	**125.9**	**10.5**	**43.7**	**86.8**
Robust Standard Deviation	9.1	17.6	1.7	7.5	14.8
Standard Uncertainty	2.5	4.9	0.5	2.1	4.1
RSD (%)	14.5	13.9	15.9	17.1	17.7
Number of Sample Measurements	20	20	20	20	20
Acceptable Range:					
Upper Limit	81.6	163.7	13.7	56.8	112.8
Lower Limit	44.0	88.1	7.3	30.6	60.8

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 #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (μg/L urine)					Info Only
		UE15-11	UE15-12	UE15-13	UE15-14	UE15-15	
	Target Values:	62.8	125.9	10.5	43.7	86.8	
103	DRC/CC-ICP-MS	60.3	124.3	10.7	43.3	85.4	Info
110	ICP-MS	66.6	137.4	12.3	47.8	94.7	
114	ICP-MS	55.0	134.0	17.0 ↑	45.0	67.0	
147	CV-AAS	57.7	121.5	9.8	43.4	87.6	Info
156	ICP-MS	64.0	120.0	10.0	43.0	90.0	
164	ICP-MS	65.0	128.0	11.0	44.0	88.0	
179	ICP-MS	63.0	124.0	10.0	44.0	86.0	
197	DRC/CC-ICP-MS	77.0	147.0	12.0	50.0	111.0	
199	ICP-MS	61.0	123	9.7	43.5	96.7	Info
200	ICP-MS	70.0	131.8	10.6	45.8	87.0	Info
206	ICP-MS	64.2	127.3	11.0	43.9	86.3	
208	CV-AAS	88.0 ↑	173.2 ↑	13.3	58.2 ↑	111.5	
293	ICP-MS	53.1	111.2	8.4	36.1	81.2	Info
305	ICP-MS	55.8	110.7	9.3	37.5	77.8	
312	ICP-MS	57.1	122.0	9.5	37.3	78.1	
339	HR-ICP-MS	56.2	89.0	9.4	37.1	70.8	Info
366	ICP-MS	56.0	109.0	8.0	35.0	66.0	Info
367	CV-AAS	92.3 ↑	177.6 ↑	14.6 ↑	61.3 ↑	124.0 ↑	Info
391	DRC/CC-ICP-MS	95.4 ↑	196.8 ↑	16.9 ↑	65.1 ↑	146.7 ↑	Info
401	DRC/CC-ICP-MS	49.7	73.5 ↓	7.8	22.0 ↓	62.8	Info

Percent satisfactory results for all participants: 84.0 %

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 Mercury Test Results, 2015 Event #3
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
CV-AAS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	79.3	157.4	12.6	54.3	107.7
Standard Deviation:	18.9	31.2	2.5	9.6	18.5
RSD (%):	—	—	—	—	—
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	70.6	135.4	11.9	45.1	101.5
Standard Deviation:	20.0	51.2	3.8	17.9	36.0
RSD (%):	28.3	37.8	32.0	39.7	35.5
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	56.2	89.0	9.4	37.1	70.8
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	12	12	12	12	12
Mean:	60.9	123.2	10.6	41.9	83.2
Standard Deviation:	5.4	9.3	2.3	4.2	9.7
RSD (%):	8.8	7.5	22.1	10.1	11.6
All Laboratories					
Number of Sample Measurements:	20	20	20	20	20
Mean:	65.4	129.1	11.1	44.2	89.9
Standard Deviation:	13.1	28.4	2.6	9.6	20.5
RSD (%):	20.0	22.0	23.7	21.8	22.8

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 26.7 µg/L (0.13 µmol/L) to 292.5 µg/L (1.41 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, 98.1% 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, 2015 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results (µg/L urine)

	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
Robust Mean	**34.8**	**292.5**	**142.1**	**26.7**	**66.2**
Robust Standard Deviation	1.9	9.7	4.7	1.5	4.2
Standard Uncertainty	0.5	2.7	1.3	0.4	1.1
RSD (%)	5.5	3.3	3.3	5.6	6.4
Number of Sample Measurements	21	20	21	21	21
Acceptable Range:					
Upper Limit	74.8	332.5	182.1	66.7	106.2
Lower Limit	0.0	252.5	102.1	0.0	26.2

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 #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE15-11	UE15-12	UE15-13	UE15-14	UE15-15	
	Target Values:	34.8	292.5	142.1	26.7	66.2	
103	DRC/CC-ICP-MS	35.6	294.9	144.6	27.5	66.6	Info
106	ICP-MS	35.7	297.4	146.6	28.0	69.1	Info
107	DRC/CC-ICP-MS	38.0	>200	160	29.0	74.0	Info
110	ICP-MS	34.8	290.2	142.3	27.1	67.5	
114	ICP-MS	32.0	258.0	129.0	25.0	61.0	
116	ICP-MS	34.8	298.7	142.0	26.9	68.7	Info
147	ICP-MS	36.9	294.2	148.4	27.6	70.7	Info
156	DRC/CC-ICP-MS	36.0	290.0	140.0	27.0	69.0	
164	ICP-MS	34.0	295.0	140.0	28.0	66.0	
179	ICP-MS	36.0	298.0	145.0	28.0	68.0	
197	DRC/CC-ICP-MS	35.1	310.0	140.5	26.1	71.7	
200	ICP-MS	40.0	287.7	142.4	23.0	60.7	Info
206	ICP-MS	33.0	274.0	128.0	25.0	64.0	
208	ICP-MS	35.1	297.1	145.1	28.3	69.5	
293	ICP-MS	34.2	294.2	142.1	26.1	65.5	Info
305	ICP-MS	28.3	247.7 ↓	118.6	23.1	53.8	
312	ICP-MS	36.4	307.0	149.0	27.7	66.0	
324	HR-ICP-MS	31.0	259.8	127.8	23.0	62.5	Info
339	HR-ICP-MS	33.3	224.6 ↓	122.3	25.9	62.4	Info
366	ICP-MS	33.0	284.0	143.0	26.0	60.0	Info
391	DRC/CC-ICP-MS	34.7	310.7	143.2	27.3	67.2	Info

Percent satisfactory results for all participants: 98.1 %

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 #3
STATISTICAL SUMMARY BY METHOD

	Results (μg/L urine)				
	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	5	4	5	5	5
Mean:	35.9	301.4	145.7	27.4	69.7
Standard Deviation:	1.3	10.5	8.2	1.1	3.1
RSD (%):	3.6	3.5	5.7	3.8	4.5
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	32.2	242.2	125.1	24.5	62.5
Standard Deviation:	1.6	24.9	3.9	2.1	0.1
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	14	14	14	14	14
Mean:	34.6	287.4	140.1	26.4	65.0
Standard Deviation:	2.7	16.7	8.8	1.8	4.7
RSD (%):	7.7	5.8	6.3	6.8	7.2
All Laboratories					
Number of Sample Measurements:	21	20	21	21	21
Mean:	34.7	285.7	140.0	26.5	65.9
Standard Deviation:	2.5	22.2	9.7	1.8	4.6
RSD (%):	7.1	7.8	6.9	6.7	7.1

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	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
147	DRC/CC-ICP-MS	21.8	142	80.4	22.9	31.8
164	ICP-MS	22	152	74	18	31
179	DRC/CC-ICP-MS	23	146	74	19	31
206	DRC/CC-ICP-MS	>20	>20	>20	>20	>20
305	ICP-MS	27	153	73	20	33
312	ICP-MS	19.9	144	72.5	17.1	28.3
324	HR-ICP-MS	24.19	159.97	89.93	17.59	30.99
	Arithmetic Mean	**23**	**149**	**77**	**19**	**31**
	SD	2	7	7	2	2
	n	6	6	6	6	6

Urine Antimony (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	2.39	20.3	10.0	1.88	3.84
107	ICP-MS	2.4	20	9.9	1.8	3.8
110	ICP-MS	2.42	20.2	9.89	1.91	3.87
147	ICP-MS	2.40	19.6	9.55	1.94	3.76
197	ICP-MS	2.5	20.4	9.9	1.8	3.8
312	ICP-MS	2.3	20	9.4	1.7	3.8
	Arithmetic Mean	**2.4**	**20.1**	**9.8**	**1.8**	**3.81**
	SD	0.1	0.3	0.2	0.1	0.04
	n	6	6	6	6	6

Urine Barium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
106	ICP-MS	3.7	24.8	12.6	3.1	4.7
107	ICP-MS	3.9	26	13	3.3	4.8
110	ICP-MS	4.02	26.5	14.0	3.42	5.15
116	ICP-MS	3.92	26.1	13.2	3.34	4.96
147	ICP-MS	3.71	23.9	12.3	3.03	4.65
197	ICP-MS	3.5	24.0	12.6	3.0	4.5
312	ICP-MS	3.9	27.7	13.2	3.3	4.7
	Arithmetic Mean	**3.8**	**26**	**13.0**	**3.2**	**4.8**
	SD	0.2	1	0.6	0.2	0.2
	n	7	7	7	7	7

Urine Beryllium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
106	ICP-MS	3.2	27.0	13.6	2.4	5.0
107	ICP-MS	3.0	25	12	2.3	4.8
110	ICP-MS	2.87	24.7	12.2	2.49	4.82
116	ICP-MS	3.02	24.1	12.5	2.33	5.41
147	ICP-MS	3.14	26.9	13.0	2.37	5.16
197	ICP-MS	3.0	23.9	11.5	2.2	4.4
312	ICP-MS	3.4	25	11.8	2.3	5.0
	Arithmetic Mean	**3.1**	**25**	**12.4**	**2.3**	**4.9**
	SD	0.2	1	0.7	0.1	0.3
	n	7	7	7	7	7

Urine Bismuth (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
147	ICP-MS	1.18	1.43	2.70	0.451	0.0441
197	ICP-MS	2.0	1.8	3.0	<1.0	<1.0
305	ICP-MS	1.0	1.1	2.5	<0.5	<0.5
312	ICP-MS	1.1	1.3	2.5	0.29	<0.08
	Arithmetic Mean	1.3	1.4	2.7	-	-
	SD	0.5	0.3	0.2	-	-
	n	4	4	4	-	-

Urine Boron (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
200	ICP-MS	595	692	878	629	308

Urine Cesium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
107	ICP-MS	14	100	52	12	20
110	ICP-MS	14.3	104	52.1	12.1	20.8
147	ICP-MS	13.6	93.0	*47.7	*10.8	18.9
312	ICP-MS	14.4	109	52.4	12.1	19.1
*Outlier	Arithmetic Mean	14.1	102	52.2	12.1	19.7
	SD	0.4	7	0.2	0.1	0.9
	n	4	4	3	3	4

Urine Chromium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	6.21	50.9	25.2	4.85	9.86
107	DRC/CC-ICP-MS	6.0	50	24	5.7	9.3
110	DRC/CC-ICP-MS	6.8	51.5	26.0	5.80	10.3
147	DRC/CC-ICP-MS	6.24	50.0	24.8	4.74	9.78
156	DRC/CC-ICP-MS	5.9	48	23	4.6	9.5
164	DRC/CC-ICP-MS	5.6	45.0	21.9	4.4	9.0
179	DRC/CC-ICP-MS	5.5	45.7	22.3	4.3	8.6
197	DRC/CC-ICP-MS	6.2	49.2	24.5	5.0	9.7
206	DRC/CC-ICP-MS	6.1	48.2	24.6	4.4	9.5
305	ICP-MS	6.3	54.9	27.0	5.1	9.9
312	DRC/CC-ICP-MS	5.7	45.4	22.4	4.5	9
324	HR-ICP-MS	6.88	*60.09	29.52	5.17	10.04
366	DRC/CC-ICP-MS	5.2	45.0	21.0	4.0	8.9
391	DRC/CC-ICP-MS	6.3	48.8	23.2	4.7	9.3
401	DRC/CC-ICP-MS	6.5	51.7	25.6	5.0	9.9
*Outlier	Arithmetic Mean	6.1	49	24	4.8	9.5
	SD	0.5	3	2	0.5	0.5
	n	15	14	15	15	15

Urine Cobalt (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	1.40	10.7	9.39	1.16	2.11
107	ICP-MS	1.6	11	9.7	1.4	2.1
110	ICP-MS	1.52	11.0	9.74	1.29	2.17
147	ICP-MS	1.43	10.4	9.31	1.14	2.22
156	DRC/CC-ICP-MS	1.2	10	8.7	1	1.8
164	ICP-MS	1.5	10.0	8.7	1.2	2.0
179	DRC/CC-ICP-MS	1.4	11	9.3	1.2	2.1
197	ICP-MS	1.4	9.8	8.6	1.3	1.9
206	ICP-MS	1.2	9.8	8.4	1.0	1.6
305	ICP-MS	1.7	10.4	9.5	1.4	2.2
312	ICP-MS	1.5	10.7	9.6	1.3	2.0
324	HR-ICP-MS	1.79	*13.05	*10.99	1.49	2.35
366	ICP-MS	1.6	11.2	9.3	1.4	2.3
391	DRC/CC-ICP-MS	1.5	10.4	8.7	1.1	2.0
401	DRC/CC-ICP-MS	1.4	10.5	9.2	1.1	2.1
*Outlier	Arithmetic Mean	1.5	10.5	9.2	1.2	2.1
	SD	0.2	0.5	0.4	0.2	0.2
	n	15	14	14	15	15

Urine Copper (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
110	ICP-MS	118	949	474	94.5	204
147	ICP-MS	123	991	476	92.1	214
164	ICP-MS	116	936	457	92	194
179	DRC/CC-ICP-MS	121	977	488	94	206
197	ICP-MS	122.0	931.8	473.8	97.7	201.1
206	ICP-MS	119	943	474	95	201
305	ICP-MS	121	929	468	95	200
312	ICP-MS	119	934	466	93.7	191
324	HR-ICP-MS	120.99	*1051.94	499.15	91.17	199.58
401	DRC/CC-ICP-MS	115.8	962.3	464.9	88.4	194.6
*Outlier	**Arithmetic Mean**	**120**	**950**	**474**	**93**	**201**
	SD	2	22	12	3	7
	n	10	9	10	10	10

Urine Iodine (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
156	DRC/CC-ICP-MS	71	82	86	92	47
164	ICP-MS	63	72	80	84	44
197	ICP-MS	65	76	82	87	44
206	ICP-MS	57.4	68.8	71.7	76.7	40.7
312	ICP-MS	70	77.8	84.6	89.4	49.1
	Arithmetic Mean	**65**	**75**	**81**	**86**	**45**
	SD	6	5	6	6	3
	n	5	5	5	5	5

Urine Iron (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
324	HR-ICP-MS	4.10	7.75	4.71	6.49	8.13

Urine Lithium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
147	ICP-MS	13.2	16.1	11.2	18.7	5.25
200	ICP-MS	13.6	16.3	11.0	19.5	5.2

Urine Manganese (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	3.09	25.3	12.3	2.44	4.95
107	DRC/CC-ICP-MS	3.0	25	12	2.5	4.9
110	DRC/CC-ICP-MS	2.96	24.5	11.9	2.28	4.92
147	DRC/CC-ICP-MS	2.93	24.0	11.8	2.21	4.86
179	DRC/CC-ICP-MS	3.4	24.9	12.1	2.5	5.2
206	ICP-MS	3.6	24.4	11.4	2.6	5.8
305	ICP-MS	3.4	23.7	12.5	2.9	5.2
312	DRC/CC-ICP-MS	3.3	23.1	11.6	2.8	4.3
324	HR-ICP-MS	3.13	*28.15	*14.31	2.27	4.99
391	DRC/CC-ICP-MS	3.6	23.6	11.4	2.3	4.8
*Outlier	**Arithmetic Mean**	**3.2**	**24.3**	**11.9**	**2.5**	**5.0**
	SD	0.3	0.7	0.4	0.2	0.4
	n	10	9	9	10	10

Urine Molybdenum (μg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	49.2	274	145	44.9	73.4
107	ICP-MS	49	270	140	45	70
110	ICP-MS	51.8	278	147	46.9	73.7
147	ICP-MS	48.0	259	143	45.5	70.8
179	ICP-MS	48	269	144	47	70
197	ICP-MS	48.0	247.8	133.8	45.6	70.6
312	ICP-MS	47	263	137	42.5	66.4
324	HR-ICP-MS	52.64	*311.06	155.59	46.32	74.78
Outlier	**Arithmetic Mean**	**49**	**266**	**143**	**45**	**71**
	SD	2	10	7	1	3
	n	8	7	8	8	8

Urine Nickel (μg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
107	DRC/CC-ICP-MS	3.3	26	15	2.9	5.2
110	ICP-MS	4.50	26.5	14.8	4.43	5.88
147	DRC/CC-ICP-MS	4.21	26.4	14.4	3.24	5.78
164	ICP-MS	4.2	24.4	13.1	3.4	5.4
179	DRC/CC-ICP-MS	3.7	26.6	14.0	3.1	5.6
197	ICP-MS	2.5	24.2	12.7	2.1	5.4
206	ICP-MS	3.4	26.0	13.8	4.0	6.0
312	ICP-MS	4.6	24.2	13.8	4.6	5.3
324	HR-ICP-MS	1.31	25.25	11.90	*0.59	*3.08
391	DRC/CC-ICP-MS	4.0	*38.3	12.3	3.6	6.0
401	DRC/CC-ICP-MS	5.4	25.4	13.4	3.8	5.5
Outlier	**Arithmetic Mean**	**4**	**25**	**14**	**3.5**	**5.6**
	SD	1	1	1	0.7	0.3
	n	11	10	11	10	10

Urine Platinum (μg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
107	ICP-MS	1.2	10	5.0	1.0	2.0
110	ICP-MS	1.14	9.96	4.78	0.860	1.88
147	ICP-MS	1.21	9.33	4.56	0.858	1.90
312	ICP-MS	1.0	9.5	4.5	0.82	1.6
	Arithmetic Mean	**1.1**	**9.7**	**4.7**	**0.9**	**1.8**
	SD	0.1	0.3	0.2	0.1	0.2
	n	4	4	4	4	4

Urine Selenium (μg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	58.5	279	135	45.1	61.9
110	DRC/CC-ICP-MS	61.7	301	148	49.7	58.3
147	ICP-MS	59.2	269	136	44.5	58.5
179	DRC/CC-ICP-MS	55	278	134	45	59
206	ICP-MS	57	255	129	48	57
305	ICP-MS	59	285	147	47	59
312	ICP-MS	62.5	286	146	51.3	56.1
	Arithmetic Mean	**59**	**279**	**139**	**47**	**59**
	SD	3	14	8	3	2
	n	7	7	7	7	7

Urine Silver (μg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
147	ICP-MS	<0.11	<0.11	<0.11	<0.11	1.69

Urine Strontium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	60.5	71.6	63.2	64.9	37.4
107	ICP-MS	63	73	65	67	38
200	ICP-MS	67.4	75.3	66.6	68.3	39.4
	Arithmetic Mean	**64**	**73**	**65**	**67**	**38**
	SD	3	2	2	2	1
	n	3	3	3	3	3

Urine Tellurium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
110	ICP-MS	2.35	19.3	8.83	1.79	3.74
197	ICP-MS	2.4	18.1	7.7	1.8	3.8
312	ICP-MS	2.3	19.6	7.6	1.7	3.5
	Arithmetic Mean	**2.4**	**19.0**	**8.0**	**1.8**	**3.7**
	SD	0.1	0.8	0.7	0.1	0.2
	n	3	3	3	3	3

Urine Thallium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	5.77	47.6	23.3	4.39	9.11
106	ICP-MS	6.1	50.6	24.7	4.6	9.9
107	ICP-MS	6.6	*62	*29	5.2	*12
110	ICP-MS	5.97	49.3	24.2	4.59	9.74
116	ICP-MS	5.97	48.7	24.2	4.49	9.74
147	ICP-MS	6.03	49.1	24.7	4.56	10
179	ICP-MS	6	51	25	5	10
197	ICP-MS	5.5	45.4	22.3	4.1	9.2
206	ICP-MS	5.5	>25.0	21.7	4.3	8.7
305	ICP-MS	5.5	44.8	22.0	4.2	8.7
312	ICP-MS	6.2	51.6	24.9	4.7	9.2
*Outlier	**Arithmetic Mean**	**5.9**	**49**	**24**	**4.6**	**9.4**
	SD	0.3	2	1	0.3	0.5
	n	11	9	10	11	10

Urine Thorium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
147	ICP-MS	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046

Urine Tin (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
107	ICP-MS	7.0	53	26	5.3	10
110	ICP-MS	6.41	51.3	24.8	4.94	9.92
147	ICP-MS	6.21	48.0	22.9	4.68	9.49
312	ICP-MS	6.2	48.9	23.4	4.5	9.5
	Arithmetic Mean	**6.5**	**50**	**24**	**4.9**	**9.7**
	SD	0.4	2	1	0.3	0.3
	n	4	4	4	4	4

Urine Tungsten (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
107	ICP-MS	2.4	19	9.5	1.9	3.7
110	ICP-MS	2.43	20.2	9.82	1.89	3.89
147	ICP-MS	2.39	19.9	9.78	1.89	3.86
200	ICP-MS	2.6	19.3	9.7	*2.4	3.1
312	ICP-MS	2.3	20.1	9.5	1.8	3.6
324	HR-ICP-MS	2.60	*23.08	*10.75	1.97	4.05
*Outlier	**Arithmetic Mean**	**2.5**	**19.7**	**9.7**	**1.9**	**3.7**
	SD	0.1	0.5	0.2	0.1	0.3
	n	6	5	5	5	6

Urine Uranium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
103	DRC/CC-ICP-MS	0.304	2.52	1.25	0.236	0.488
106	ICP-MS	0.3	2.6	1.3	0.2	0.5
107	ICP-MS	*0.33	2.7	1.4	0.26	0.55
110	ICP-MS	0.294	2.45	1.21	0.239	0.481
116	ICP-MS	0.290	2.45	1.23	0.237	0.498
147	ICP-MS	0.288	2.43	1.22	0.234	0.476
197	ICP-MS	<1.0	2.3	1.1	<1.0	<1.0
312	ICP-MS	0.29	2.6	1.2	0.23	0.43
324	HR-ICP-MS	0.30	2.67	1.25	0.22	0.47
*Outlier	**Arithmetic Mean**	**0.30**	**2.52**	**1.24**	**0.23**	**0.49**
	SD	0.01	0.13	0.08	0.02	0.03
	n	7	9	9	8	8

Urine Vanadium (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
147	DRC/CC-ICP-MS	2.34	19.4	9.74	1.77	3.68
179	DRC/CC-ICP-MS	2.4	19.6	9.4	1.8	3.8
197	ICP-MS	2.40	19.90	9.60	1.90	3.70
312	DRC/CC-ICP-MS	2.7	*24.6	10.7	2.5	3.6
*Outlier	**Arithmetic Mean**	**2.5**	**19.6**	**9.9**	**2.0**	**3.7**
	SD	0.2	0.3	0.6	0.3	0.1
	n	4	3	4	4	4

Urine Zinc (µg/L)

Lab Code	Method	UE15-11	UE15-12	UE15-13	UE15-14	UE15-15
110	ICP-MS	224	1074	577	197	275
147	ICP-MS	231	1163	578	191	305
164	ICP-MS	223	988	563	201	274
179	DRC/CC-ICP-MS	220	1101	591	189	282
197	ICP-MS	226.00	1095.0	590.00	<200	276.00
206	ICP-MS	210	1040	550	180	250
305	ICP-MS	212	1026	540	180	279
312	ICP-MS	221	1070	575	190	265
324	HR-ICP-MS	221.66	1096.60	571.83	175.58	258.78
401	DRC/CC-ICP-MS	228.8	1111.3	594.9	196.1	281.1
	Arithmetic Mean	**222**	**1076**	**573**	**189**	**275**
	SD	7	49	18	9	15
	n	10	10	10	9	10

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.