Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN URINE

Event #2, 2010

July 12, 2010

Richard F. Daines, M.D.
Commissioner

James W. Clyne, Jr..
Executive Deputy Commisioner

July 12, 2010

Trace Elements in Urine
Event #2, 2010

Dear Laboratory Director:

Results from the second 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°; 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.

Assignment of Target Values for Trace Elements
Except for blood lead, we will implement robust statistics for assigning target values for all trace element panels. Method specific and additional trace element data will continue to be calculated utilizing traditional statistics. The use of robust statistics for assigning target values for proficiency testing pools is one approach that is acceptable under ISO 13528. In collaboration with other trace element PT scheme organizers, we have conducted an evaluation of robust statistics. As a result of our evaluation, we have elected to introduce this approach in our program.

The next PT event for trace elements in urine is scheduled to be mailed Wednesday, September 22nd, 2010. 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, October 20th, 2010.**

Thank you for your participation.

Sincerely,

Patrick J. Parsons, Ph.D.
Section Head, Trace Elements Proficiency Testing Program

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°; 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 24.5 µg/L (0.33 µmol/L) to 208.4 µg/L (2.78 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, 94.2% of test results reported were judged as satisfactory, with one out of 24 participant laboratories (4.2%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Arsenic Test Results, 2010 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results (µg/L urine)

	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
Robust Mean	**24.5**	**54.2**	**111.1**	**208.4**	**72.0**
Robust Standard Deviation	2.0	3.8	7.2	12.6	4.4
Standard Uncertainty	0.5	1.0	1.8	3.2	1.1
RSD (%)	8.3	7.1	6.5	6.0	6.1
Acceptable Range:					
Upper Limit	30.5	65.0	133.3	250.1	86.4
Lower Limit	18.5	43.4	88.9	166.7	57.6

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, 2010 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-06	UE10-07	UE10-08	UE10-09	UE10-10	
	Target Values:	24.5	54.2	111.1	208.4	72.0	
107	DRC/CC-ICP-MS	24.5	56.2	119.5	218.4	77.3	Info
110	DRC/CC-ICP-MS	23.5	51.9	109	204	71.5	
114	ICP-MS	25	47	96	208	71	
116	DRC/CC-ICP-MS	22.0	49.8	104.0	196.0	66.5	Info
147	ICP-MS	21.8	46.0	101.9	181.3	61.9	Info
156	ICP-MS	22.4	57.2	107	194	68.9	
159	ICP-MS	28	59	116	218	76	
164	ICP-MS	27	67 ↑	115	220	76	
179	ICP-MS	24	52	111	214	74	
197	DRC/CC-ICP-MS	24	54	113	211	72	
200	ICP-MS	23.3	52.9	103.0	207.0	71.4	Info
206	ICP-MS	25.7	50.6	110.7	196.4	73.5	Info
208	ICP-MS	26	55.6	106.7	204.6	68	
293	DRC/CC-ICP-MS	23.8	52.0	106.0	203.0	71.4	Info
305	DRC/CC-ICP-MS	25.7	56.8	117.5	226	76.6	
312	ICP-MS	21.5	53.7	125.2	193.1	66.3	
324	DRC/CC-ICP-MS	25.2	54.5	109.8	215.0	70.4	Info
339	HR-ICP-MS	19.4	43.3 ↓	93.2	171	61.2	Info
359	ICP-MS	27.9	57.4	112.2	207.8	73.9	
366	ICP-MS	26.0	57.0	114.0	208.0	70.0	Info
367	DRC/CC-ICP-MS	24.4	53.7	113.8	214.3	75.0	Info
385	DRC/CC-ICP-MS	24.4	54.8	118.0	222.0	75.7	Info
391	DRC/CC-ICP-MS	31.9 ↑	69.0 ↑	143.5 ↑	268.9 ↑	92.1 ↑	Info
395	DRC/CC-ICP-MS	25.1	56	113.2	214.3	73.1	

Percent satisfactory results for all participants: 94.2 %

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 Arsenic Test Results, 2010 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	11	11	11	11	11
Mean:	25.0	55.3	115.2	217.5	74.7
Standard Deviation:	2.5	5.0	10.6	19.1	6.6
RSD (%):	10.0	9.0	9.2	8.8	8.8
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	19.4	43.3	93.2	171.0	61.2
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	12	12	12	12	12
Mean:	24.9	54.6	109.9	204.4	70.9
Standard Deviation:	2.3	5.7	7.7	11.3	4.2
RSD (%):	9.1	10.4	7.0	5.5	5.9
All Laboratories					
Number of Sample Measurements:	24	24	24	24	24
Mean:	24.7	54.5	111.6	209.0	72.2
Standard Deviation:	2.5	5.7	10.0	18.1	6.0
RSD (%):	10.3	10.4	8.9	8.7	8.3

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°; 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 1.4 µg/L (12 nmol/L) to 9.8 µg/L (87 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, 97.7% of test results reported were judged as satisfactory, with none of the 26 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Cadmium Test Results, 2010 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results (µg/L urine)

	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
Robust Mean	**2.9**	**9.8**	**1.6**	**2.1**	**1.4**
Robust Standard Deviation	0.2	0.6	0.1	0.1	0.1
Standard Uncertainty	0.0	0.1	0.0	0.0	0.0
RSD (%)	5.7	6.2	8.5	6.2	6.6
Acceptable Range:					
Upper Limit	3.9	11.3	2.6	3.1	2.4
Lower Limit	1.9	8.3	0.6	1.1	0.4

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, 2010 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-06	UE10-07	UE10-08	UE10-09	UE10-10	
	Target Values:	2.9	9.8	1.6	2.1	1.4	
103	ICP-MS	3.2	10.5	1.8	2.4	1.6	Info
107	DRC/CC-ICP-MS	3.0	9.9	1.6	2.1	1.3	Info
110	ICP-MS	2.9	9.7	1.6	2.1	1.4	
114	ICP-MS	2.7	9	1.5	2	1.2	
116	ICP-MS	2.8	9.4	1.6	2.0	1.3	Info
147	ICP-MS	3.0	9.8	1.6	2.1	1.4	Info
156	ICP-MS	2.8	8.9	1.5	2.1	1.3	
159	ICP-MS	2.9	10.2	1.7	2.1	1.3	
164	ICP-MS	2.8	9.6	1.6	2.2	1.3	
179	ICP-MS	3.6	11.5 ↑	2	2.2	1.7	
197	DRC/CC-ICP-MS	3	10.5	1.6	2.3	1.4	
200	ICP-MS	2.8	9.9	1.3	1.5	1.0	Info
206	ICP-MS	2.7	9.5	1.4	2.1	1.3	
208	ICP-MS	3	10	1.6	2.3	1.4	
293	ICP-MS	3.1	10.1	1.7	2.2	1.4	Info
305	ICP-MS	2.7	9.5	1.6	2.1	1.3	
312	ICP-MS	2.9	10.2	1.6	2.2	1.5	
324	ICP-MS	2.9	10.0	1.6	2.2	1.4	Info
339	HR-ICP-MS	2.5	8.7	1.4	1.9	1.2	Info
359	ICP-MS	3	10	1.7	2.2	1.4	
366	ICP-MS	3.1	11.8 ↑	1.8	2.1	1.4	Info
367	DRC/CC-ICP-MS	3.0	10.3	1.6	2.1	1.3	Info
385	ICP-MS	2.9	9.4	1.6	2.0	1.3	Info
391	DRC/CC-ICP-MS	3.1	10.4	1.8	2.3	1.5	Info
395	ICP-MS	2.7	9.3	1.5	2	1.2	
401	ETAAS Other	3.0	7.9 ↓	1.8	2.4	1.6	Info

Percent satisfactory results for all participants: 97.7 %

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, 2010 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	3.0	10.3	1.7	2.2	1.4
Standard Deviation:	0.0	0.3	0.1	0.1	0.1
RSD (%):	1.7	2.6	6.1	5.2	7.0
ETAAS Other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	3.0	7.9	1.8	2.4	1.6
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2.5	8.7	1.4	1.9	1.2
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	20	20	20
Mean:	2.9	9.9	1.6	2.1	1.4
Standard Deviation:	0.2	0.7	0.1	0.2	0.1
RSD (%):	7.3	7.3	9.3	8.4	10.8
All Laboratories					
Number of Sample Measurements:	26	26	26	26	26
Mean:	2.9	9.8	1.6	2.1	1.4
Standard Deviation:	0.2	0.8	0.1	0.2	0.1
RSD (%):	7.2	8.1	9.1	8.4	10.6

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°; 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 10.2 µg/L (51 nmol/L) to 77.5 µg/L (686 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, 92.8% of test results reported were judged as satisfactory, with two of the 25 participant laboratories (8.0%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Mercury Test Results, 2010 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results (µg/L urine)

	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
Robust Mean	**19.5**	**10.2**	**55.4**	**77.5**	**34.3**
Robust Standard Deviation	2.3	1.5	6.4	10.1	4.8
Standard Uncertainty	0.6	0.4	1.6	2.5	1.2
RSD (%)	11.7	14.4	11.5	13.0	13.9
Acceptable Range:					
Upper Limit	25.4	13.3	72.0	100.8	44.6
Lower Limit	13.7	7.1	38.8	54.3	24.0

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

New York State Department of Health
Urine Mercury Test Results, 2010 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-06	UE10-07	UE10-08	UE10-09	UE10-10	
	Target Values:	19.5	10.2	55.4	77.5	34.3	
103	ICP-MS	19.4	9.7	54.2	78.5	37.1	Info
107	DRC/CC-ICP-MS	21.1	14.8 ↑	56.8	83.4	36.4	Info
109	AFS	14.8	4.4 ↓	55.2	85.9	32.5	Info
110	ICP-MS	20.3	10.5	54.7	81.5	35.3	
114	ICP-MS	22	11	66	87	41	
147	CV-AAS	18.5	9.8	51.1	74.1	19.6 ↓	Info
156	ICP-MS	21.1	<11.0	62.8	88.6	33.4	
159	ICP-MS	19	10	45	67	29	
164	ICP-MS	20	11	50	74	34	
179	ICP-MS	20	10	58	84	36	
197	DRC/CC-ICP-MS	20	11	55	77	34	
200	ICP-MS	19.8	8.7	57.1	76.4	35.4	Info
206	ICP-MS	17	8	42	62	27	
208	CV-AAS	17.9	10	50.9	70.7	32.3	
293	ICP-MS	19.4	10.1	53.0	76.4	33.6	Info
305	ICP-MS	19.4	10.6	58.7	75.7	39.4	
312	ICP-MS	16.6	9.5	63	56	27.8	
324	CV-AAS	16.1	8.6	45.8	60.4	29.7	Info
339	HR-ICP-MS	17.8	7.5	48.7	65.4	30.8	Info
359	ICP-MS	17.3	9.8	52.3	72.1	32.5	
366	ICP-MS	27.1 ↑	14.8 ↑	72.8 ↑	97.0	47.0 ↑	Info
367	CV-AAS	22.0	11.9	58.7	79.8	37.2	Info
391	CV-AAS	22.9	16.0 ↑	70.3	104.0 ↑	42.2	Info
395	ICP-MS	19.2	10.5	54	79.7	34.7	
401	CV-AAS	21.9	11.3	60.5	88.3	39.2	Info

Percent satisfactory results for all participants: 92.8 %

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

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

New York State Department of Health
Urine Mercury Test Results, 2010 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
AFS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	14.8	4.4	55.2	85.9	32.5
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	6	6	6	6	6
Mean:	19.9	11.3	56.2	79.6	33.4
Standard Deviation:	2.7	2.6	8.8	15.2	8.1
RSD (%):	13.8	23.0	15.6	19.1	24.4
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	20.6	12.9	55.9	80.2	35.2
Standard Deviation:	0.8	2.7	1.3	4.5	1.7
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	17.8	7.5	48.7	65.4	30.8
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	15	14	15	15	15
Mean:	19.8	10.3	56.2	77.1	34.9
Standard Deviation:	2.5	1.5	7.9	10.4	5.1
RSD (%):	12.5	14.9	14.0	13.5	14.7
All Laboratories					
Number of Sample Measurements:	25	24	25	25	25
Mean:	19.6	10.4	55.9	77.8	34.3
Standard Deviation:	2.5	2.4	7.4	11.1	5.5
RSD (%):	12.9	23.1	13.3	14.2	16.1

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°; 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 10.1 µg/L (0.05 µmol/L) to 144.2 µg/L (0.70 µmol/L).

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

Discussion. Based upon the above criteria, 100% of test results were judged as satisfactory, with none of the 27 participant laboratories reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Lead Test Results, 2010 Event #2
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results (µg/L urine)

	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
Robust Mean	**10.1**	**144.2**	**44.2**	**29.5**	**18.5**
Robust Standard Deviation	0.9	7.7	2.8	2.1	1.3
Standard Uncertainty	0.2	1.9	0.7	0.5	0.3
RSD (%)	9.2	5.4	6.4	7.2	6.9
Acceptable Range:					
Upper Limit	50.1	184.2	84.2	69.5	58.5
Lower Limit	0.0	104.2	4.2	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, 2010 Event #2
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-06	UE10-07	UE10-08	UE10-09	UE10-10	
	Target Values:	10.1	144.2	44.2	29.5	18.5	
103	ICP-MS	10.6	143.5	45.5	31.3	19.5	Info
107	DRC/CC-ICP-MS	10.2	145.5	45.7	30.3	19.3	Info
110	ICP-MS	9.3	142	43.4	29	17.7	
110	ETAAS-Z	9	134	49	26	19	Info
114	ICP-MS	9	122	40	28	17	
116	ICP-MS	10.7	145.9	45.3	30.2	18.9	Info
147	ICP-MS	10.1	142.1	44.3	29.6	18.6	Info
156	ICP-MS	<11.0	154	47.3	30.4	17.9	
159	ICP-MS	11	145	44	29	18	
164	ICP-MS	11	151	46	31	19	
179	ICP-MS	11	151	46	31	19	
197	DRC/CC-ICP-MS	9.8	144.8	42.2	28.6	17.9	
200	ICP-MS	11.2	165	51.2	33.9	21.5	Info
206	ICP-MS	8	129	40	28	16	
208	ICP-MS	9.2	137.3	41	28.5	17.2	
293	ICP-MS	10.0	144.8	45.6	30.5	19.3	Info
305	ICP-MS	10.2	147.1	41.6	29.4	17.5	
312	ICP-MS	10.8	149.5	44.1	31.2	19.4	
324	ICP-MS	10.8	151.7	45.4	32.5	20.7	Info
339	HR-ICP-MS	9.5	111	41.9	26.4	17.6	Info
359	ICP-MS	10.1	134.9	43.5	28.6	18	
366	ICP-MS	12.4	169.0	53.0	35.0	22.0	Info
383	ETAAS-Z	7.8	144.7	37.1	25.2	15.1	
385	ICP-MS	10.5	148.0	46.3	31.2	19.7	Info
391	DRC/CC-ICP-MS	10.6	149.0	45.9	29.1	19.2	Info
395	ICP-MS	9.9	140.3	43	29	18	
401	DRC/CC-ICP-MS	9.1	128.3	34.4	25.7	16.5	Info

Percent satisfactory results for all participants: 100.0 %

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

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

New York State Department of Health
Urine Lead Test Results, 2010 Event #2
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
DRC/CC-ICP-MS					
Number of Sample Measurements:	4	4	4	4	4
Mean:	9.9	141.9	42.1	28.4	18.2
Standard Deviation:	0.6	9.3	5.4	2.0	1.3
RSD (%):	6.4	6.5	12.8	6.9	7.2
ETAAS-Z					
Number of Sample Measurements:	2	2	2	2	2
Mean:	8.4	139.4	43.1	25.6	17.1
Standard Deviation:	0.8	7.6	8.4	0.6	2.8
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	9.5	111.0	41.9	26.4	17.6
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	19	20	20	20	20
Mean:	10.3	145.7	44.8	30.4	18.7
Standard Deviation:	1.0	10.7	3.2	1.9	1.5
RSD (%):	9.4	7.4	7.2	6.2	8.0
All Laboratories					
Number of Sample Measurements:	26	27	27	27	27
Mean:	10.1	143.3	44.2	29.6	18.5
Standard Deviation:	1.0	11.9	3.9	2.3	1.5
RSD (%):	10.1	8.3	8.8	7.8	8.3

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 Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
164	ICP-MS	8	74	81	18	12
179	DRC/CC-ICP-MS	7	66	77	16	11
305	ICP-MS	5	66	76	15	8
312	ICP-MS	11.6	75.7	76	18.2	12.8
359	ICP-MS	0	94.3	83	8.7	2
391	DRC/CC-ICP-MS	17.10	65.21	60.73	28.35	24.14
	Arithmetic Mean, n=6	8	74	76	17	12
	SD	6	11	8	6	7

Urine Antimony Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	0.649	9.47	0.957	1.95	1.24
116	ICP-MS	0.663	9.55	0.963	1.96	1.21
147	ICP-MS	0.628	8.852	0.908	1.839	1.192
179	ICP-MS	0.7	9.5	1	2	1.3
197	ICP-MS	<1.0	9.6	1	2	1.3
312	ICP-MS	0.8	9.6	1	2	1.3
359	ICP-MS	0.8	8.3	1.1	1.9	1.3
385	ICP-MS	0.7	10.0	1.0	2.0	1.3
391	DRC/CC-ICP-MS	*2.12	*18.25	*1.98	*3.75	*2.38
395	ICP-MS	0.6	9.9	1	2	1.3
	Arithmetic Mean, n=9 (*Omitted)	0.69	9.4	0.99	1.96	1.27
	SD	0.07	0.5	0.05	0.06	0.04

Urine Barium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	1.82	13.1	3.33	3.44	2.47
116	ICP-MS	1.88	13.2	3.37	3.46	2.48
179	ICP-MS	2	13	4	4	3
197	ICP-MS	<2.0	13	3.4	3.4	2.4
312	ICP-MS	2.2	11.8	3.6	3	2.3
359	ICP-MS	2	*52.4	3.6	3.6	2.6
385	ICP-MS	1.8	13.4	3.3	3.4	2.4
395	ICP-MS	1.4	12	2.7	*5	2
	Arithmetic Mean, n=8					
	(*Omitted)	1.9	12.8	3.4	3.5	2.5
	SD	0.2	0.6	0.4	0.3	0.3

Urine Beryllium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	0.822	12.1	1.09	2.57	1.57
116	ICP-MS	0.872	13.1	1.10	2.72	1.76
179	ICP-MS	0.9	13	1.1	2.6	1.7
197	ICP-MS	0.9	11.1	1.1	2.4	1.7
312	ICP-MS	0.9	12.6	*0.5	*1.4	1.8
385	ICP-MS	0.9	12.3	1.1	2.7	1.7
391	DRC/CC-ICP-MS	0.91	13.57	1.22	2.70	1.80
	Arithmetic Mean, n=7					
	(Omitted)	0.89	12.5	1.12	2.6	1.72
	SD	0.03	0.8	0.05	0.1	0.08

Urine Cesium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	5.57	50.5	6.21	12.2	8.43
116	ICP-MS	5.71	50.5	6.27	12.0	8.37
147	ICP-MS	5.436	48.511	6.1	12.945	8.107
179	ICP-MS	5.4	48.3	6.1	11.6	8
312	ICP-MS	5.8	51.6	6.6	12.1	8.5
385	ICP-MS	5.8	51.9	6.4	12.4	8.6
	Arithmetic Mean, n=6	5.6	50	6.3	12.2	8.3
	SD	0.2	2	0.2	0.4	0.2

Urine Chromium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	DRC/CC-ICP-MS	3.21	25.7	35.5	5.74	4.21
164	ICP-MS	1.9	22.9	32	4.9	3.3
179	DRC/CC-ICP-MS	2.2	23	33	5.1	3.5
197	DRC/CC-ICP-MS	1.7	20.8	28.6	4.5	2.9
312	DRC/CC-ICP-MS	2.3	25.9	34.9	5.9	3.9
359	ICP-MS	3.3	30	41.1	7.1	5.2
391	DRC/CC-ICP-MS	1.9	22.0	31.6	4.9	3.1
395	DRC/CC-ICP-MS	2.4	24.7	34.5	5.6	3.5
	Arithmetic Mean, n=8	2.4	24	34	5.5	3.7
	SD	0.6	3	4	0.8	0.7

Urine Cobalt Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	0.567	9.59	3.81	1.41	1.06
116	ICP-MS	0.639	9.63	3.81	1.39	1.06
147	ICP-MS	0.566	9.311	3.518	1.349	0.99
159	ICP-MS	0.5	9.2	3.6	1.3	1
179	ICP-MS	0.6	9	3.4	1.3	1.1
197	ICP-MS	<1.0	9.5	3.8	1.4	1.1
312	ICP-MS	0.6	10.2	3.7	1.4	1.1
359	ICP-MS	0.6	11.4	3.9	1.5	1.1
391	DRC/CC-ICP-MS	0.5	8.8	3.4	1.2	0.9
385	ICP-MS	0.5	9.4	3.6	1.3	1.0
395	ICP-MS	0.6	8.9	3.5	1.3	1
	Arithmetic Mean, n=11	0.57	9.5	3.6	1.35	1.04
	SD	0.05	0.7	0.2	0.08	0.06

Urine Copper Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	41.0	501	78.8	109	70.5
147	ICP-MS	37.294	475.858	74.333	101.017	64.803
159	ICP-MS	40	484	79	108	70
164	ICP-MS	37.1	483.9	79	102.2	65.6
179	DRC/CC-ICP-MS	38	503	78	107	68
197	ICP-MS	42.2	487.5	78.3	103.8	68.8
305	ICP-MS	36	458	74	100	68
312	ICP-MS	41.1	507.9	73.9	109.3	70.6
359	ICP-MS	40.1	486	78.3	104.7	67.9
395	ICP-MS	46.1	477.6	79.1	106.3	69.3
	Arithmetic Mean, n=10	40	486	77	105	68
	SD	3	15	2	3	2

Urine Iodine Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
107	DRC/CC-ICP-MS	77.5	77.6	72.1	74.1	73.1
n=1						

Urine Iron Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
391	DRC/CC-ICP-MS	35.33	17.18	374.8	15.69	13.41
n=1						

Urine Manganese Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	1.90	13.2	11.2	3.48	2.47
147	ICP-MS	0.67	11.484	9.615	2.236	1.143
159	ICP-MS	1.8	13.3	11.1	*5.8	2.8
179	DRC/CC-ICP-MS	0.9	12	10.1	2.6	1.6
305	ICP-MS	1.4	12.5	10.5	3.2	2.1
312	ICP-MS	1.4	12.7	10.5	3	2.1
359	ICP-MS	2.5	13.3	10.9	3.7	2.8
366	ICP-MS	1.1	11.2	10.6	2.9	1.9
391	DRC/CC-ICP-MS	1.1	11.1	9.7	2.7	1.8
	Arithmetic Mean, n=9 (*Omitted)	1.4	12.3	10.5	3.0	2.1
	SD	0.6	0.9	0.6	0.5	0.5

Urine Molybdenum Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	28.3	138	28.7	42.9	33.3
116	ICP-MS	30.7	147	31.0	46.2	36.3
147	ICP-MS	27.063	134.357	28.023	41.555	32.917
179	ICP-MS	29	128	27	41	32
197	ICP-MS	30	144.8	30.4	45.8	35.6
312	ICP-MS	30.6	143.5	31	44.1	33.3
359	ICP-MS	31.6	154.3	31.9	49.1	38.1
385	ICP-MS	28.1	145.0	29.5	44.5	34.3
391	DRC/CC-ICP-MS	*46.04	*82.76	*46.93	53.22	*47.15
395	ICP-MS	29.6	143.3	29.5	44.5	34.6
Arithmetic Mean, n=10 (*Omitted)		29	142	30	45	34
SD		1	8	2	4	2

Urine Nickel Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	3.47	15.5	279	4.65	3.70
147	ICP-MS	1.327	12.214	258.955	3.048	1.856
159	ICP-MS	3	16	272	5	4
164	ICP-MS	1.1	12.7	257.2	2.8	1.8
179	ICP-MS	1.5	12.5	277	3.1	2.2
197	ICP-MS	<2.0	14.3	280	3.5	2.5
312	ICP-MS	2.3	14.8	254.4	4	3.4
359	ICP-MS	2.5	13.7	255.5	4.1	2.9
391	DRC/CC-ICP-MS	*10.85	15.10	*189.2	*8.17	*5.32
Arithmetic Mean, n=9 (*Omitted)		2.2	14	255	3.8	2.8
SD		0.9	1	31	0.8	0.8

Urine Platinum Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	0.288	4.60	0.357	0.912	0.568
116	ICP-MS	0.384	4.63	0.420	0.941	0.633
179	ICP-MS	0.3	4.4	0.3	0.9	0.6
312	ICP-MS	0.3	4.8	0.4	0.9	0.7
385	ICP-MS	0.3	4.9	0.4	1.0	0.6
	Arithmetic Mean, n=5	0.31	4.7	0.38	0.93	0.62
	SD	0.04	0.2	0.05	0.04	0.05

Urine Selenium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	DRC/CC-ICP-MS	30.6	136	27.3	40.2	33.3
116	DRC/CC-ICP-MS	29.0	130	12.7	41.5	32.4
147	ICP-MS	30.016	139.021	30.49	43.207	34.913
179	DRC/CC-ICP-MS	27	134	27	42	32
197	ICP-MS	<50.0	145	<50.0	<50.0	<50.0
305	ICP-MS	38	153	36	52	39
312	ICP-MS	34.8	165.9	40.6	57.8	49
359	ICP-MS	41.3	165.5	40	57.9	44.3
385	DRC/CC-ICP-MS	32.1	155.0	34.7	49.7	38.1
391	DRC/CC-ICP-MS	*174.2	*192.6	*165.4	*162.7	*161.4
	Arithmetic Mean, n=9 (*Omitted)	33	147	31	48	38
	SD	5	13	9	7	6

Urine Silver Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
147	ICP-MS	<0.1	<0.1	<0.1	<0.1	<0.1
n=1						

Urine Tellurium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	0.524	9.22	0.808	1.93	1.17
197	ICP-MS	<1.0	7.6	<1.0	1.6	1
312	ICP-MS	0.7	9	0.9	1.8	1.2
359	ICP-MS	0.7	9.5	0.8	1.9	1.2
	Arithmetic Mean, n=4	0.6	8.8	0.8	1.8	1.1
	SD	0.1	0.8	0.1	0.1	0.1

Urine Thallium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	1.74	24.2	2.11	5.06	3.17
116	ICP-MS	1.72	19.3	2.17	5.08	3.22
147	ICP-MS	1.668	23.508	2.036	4.865	3.066
159	ICP-MS	1.7	23.2	2	4.5	3
179	ICP-MS	<10.0	25	<10.0	<10.0	<10.0
197	ICP-MS	1.6	21.6	1.9	4.7	3
312	ICP-MS	1.5	24.5	2	6.3	3.3
359	ICP-MS	1.7	22.9	2.1	4.9	3.1
385	ICP-MS	1.8	24.9	2.2	5.3	3.3
391	DRC/CC-ICP-MS	1.87	25.08	2.18	4.95	3.30
395	ICP-MS	1.6	23.3	2	4.8	3
	Arithmetic Mean, n=11	1.7	23	2.1	5.0	3.1
	SD	0.1	2	0.1	0.5	0.1

Urine Tin Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	1.86	23.7	2.31	5.07	3.25
179	ICP-MS	1.8	23.1	2.2	4.8	3.2
312	ICP-MS	1.9	23.4	2.4	5.6	3.6
359	ICP-MS	2.2	26.4	2.7	5.6	3.7
395	ICP-MS	1.8	24	2.4	5.1	3.2
	Arithmetic Mean, n=5	1.9	24	2.4	5.2	3.4
	SD	0.2	1	0.2	0.4	0.2

Urine Tungsten Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	0.625	9.37	0.801	1.90	1.20
116	ICP-MS	0.681	9.52	0.861	1.95	1.25
147	ICP-MS	*1.876	*12.413	1.094	2.574	1.537
179	ICP-MS	0.7	9.2	0.9	1.9	1.2
312	ICP-MS	0.8	9.9	0.9	2.1	1.3
359	ICP-MS	0.7	9.4	0.9	2	1.3
366	ICP-MS	0.9	11.9	0.9	2.7	1.0
385	ICP-MS	0.7	9.6	0.9	2.0	1.2
	Arithmetic Mean, n=8 (*Omitted)	0.73	9.8	0.91	2.1	1.2
	SD	0.09	0.9	0.08	0.3	0.1

Urine Uranium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	0.0834	1.20	0.101	0.250	0.162
116	ICP-MS	0.096	1.24	0.110	0.256	0.164
147	ICP-MS	0.075	1.124	0.098	0.236	0.143
197	ICP-MS	<1.0	1.1	<1.0	<1.0	<1.0
312	ICP-MS	0.1	1.2	0.1	0.3	0.2
359	ICP-MS	0.2	1.1	0.1	0.2	0.1
366	ICP-MS	0.2	2.5	0.2	0.5	0.4
385	ICP-MS	0.1	1.3	0.1	0.3	0.2
391	DRC/CC-ICP-MS	0.07	1.19	0.09	0.21	0.13
395	ICP-MS	0.1	1.2	0.1	0.2	0.1
	Arithmetic Mean, n=10	0.11	1.3	0.11	0.27	0.18
	SD	0.05	0.4	0.03	0.09	0.09

Urine Vanadium Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
147	ICP-MS	0.658	9.949	0.867	2.046	1.082
179	DRC/CC-ICP-MS	0.7	8.6	0.9	1.7	1.1
312	DRC/CC-ICP-MS	0.8	11.1	1.2	2.4	1.6
359	ICP-MS	*8.1	*17.2	*7	*8.5	*7.7
391	DRC/CC-ICP-MS	1.32	6.41	1.32	1.87	1.36
	Arithmetic Mean, n=4 (*Omitted)	0.73	9.8	0.91	2.1	1.2
	SD	0.09	0.9	0.08	0.3	0.1

Urine Zinc Results (µg/L)

Lab Code	Method	UE10-06	UE10-07	UE10-08	UE10-09	UE10-10
110	ICP-MS	145	614	3010	211	169
147	ICP-MS	128.105	592.81	3012.418	193.464	148.366
159	ICP-MS	140	636	2910	207	171
164	ICP-MS	140.3	581	3008.8	203.9	163.4
179	DRC/CC-ICP-MS	158	643	3248	221	178
197	ICP-MS	<200.0	608	2985	202	<200.0
305	ICP-MS	159	581	2669	207	187
312	ICP-MS	150.4	648	2267.7	219.9	182.4
359	ICP-MS	138.6	580.9	2893.5	195.8	154.4
395	ICP-MS	142.5	589.7	2880.3	202.1	162.3
	Arithmetic Mean, n=10	145	607	2888	206	168
	SD	10	27	262	9	13

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.