Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN URINE

Event #1, 2010

March 16, 2010

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. Box 509 Albany, New York 12201-0509

Richard F. Daines, M.D.
Commissioner

James W. Clyne, Jr..
Executive Deputy Commisioner

March 16, 2010

Trace Elements in Urine
Event #1, 2010

Dear Laboratory Director:

Results from the first 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, April 28th, 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, May 26th, 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 50.7 µg/L (0.68 µmol/L) to 278.8 µg/L (3.72 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, 95.2% of test results reported were judged as satisfactory, with one out of 25 participant laboratories (4.0%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Arsenic Test Results, 2010 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L urine)				
	UE10-01	**UE10-02**	**UE10-03**	**UE10-04**	**UE10-05**
Robust Mean	**84.4**	**50.7**	**150.7**	**112.6**	**278.8**
Robust Standard Deviation	4.8	3.8	9.6	7.4	18.2
Standard Uncertainty	1.2	0.9	2.4	1.8	4.5
RSD (%)	5.7	7.5	6.3	6.5	6.5
Acceptable Range:					
Upper Limit	101.3	60.8	180.8	135.1	334.6
Lower Limit	67.5	40.6	120.6	90.1	223.0

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 #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-01	UE10-02	UE10-03	UE10-04	UE10-05	
	Target Values:	84.4	50.7	150.7	112.6	278.8	
107	DRC/CC-ICP-MS	82.4	49.9	148.4	111.5	277.4	Info
109	ETAAS-Z	78	46	162	106	262	Info
110	DRC/CC-ICP-MS	84.6	51.5	153	115	284	
114	ICP-MS	84	50	142	100	253	
116	DRC/CC-ICP-MS	81.3	50.1	149.0	113.0	284.0	Info
147	ICP-MS	81.6	48.4	142.3	107.9	271.9	Info
156	ICP-MS	75.5	50.3	138	106	278	
159	ICP-MS	83	53	150	109	266	
164	ICP-MS	86	56	156	121	287	
179	ICP-MS	85	50	142	108	270	
197	DRC/CC-ICP-MS	90	53	151	115	283	
200	ICP-MS	75	43	136	100	257	Info
206	ICP-MS	85.4	45.9	145.7	111.3	288.9	
208	ICP-MS	79.1	52.1	145.2	115.4	265.1	
293	DRC/CC-ICP-MS	79.2	47.8	142.0	104.0	264.0	Info
305	DRC/CC-ICP-MS	91.3	53.4	161.9	119.9	301.2	
312	ICP-MS	92.5	56.7	161.7	125.4	278	
324	DRC/CC-ICP-MS	84.2	50.8	161.2	114.9	300.7	Info
359	ICP-MS	85.9	54	149.6	117.1	275.6	
366	ICP-MS	84.0	46.0	143.0	106.0	260.0	Info
367	ICP-MS	91.5	50.8	154.0	117.7	302.5	Info
385	DRC/CC-ICP-MS	88.2	51.0	160	119	304	Info
391	DRC/CC-ICP-MS	128.0 ↑	76.4 ↑	228.7 ↑	169.0 ↑	428.9 ↑	Info
395	DRC/CC-ICP-MS	88.3	54	160	117.5	291.1	
401	ETAAS other	82	39 ↓	148	109	260	Info

Percent satisfactory results for all participants: 95.2 %

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

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

New York State Department of Health
Urine Arsenic Test Results, 2010 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (μg/L urine)				
	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	10	10	10	10	10
Mean:	89.8	53.8	161.5	119.9	301.8
Standard Deviation:	14.0	8.2	24.5	17.8	46.3
RSD (%):	15.6	15.2	15.2	14.9	15.3
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	82.0	39.0	148.0	109.0	260.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	78.0	46.0	162.0	106.0	262.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	13	13	13	13	13
Mean:	83.7	50.5	146.6	111.1	273.3
Standard Deviation:	5.2	4.0	7.4	7.8	13.9
RSD (%):	6.2	7.9	5.0	7.0	5.1
All Laboratories					
Number of Sample Measurements:	25	25	25	25	25
Mean:	85.8	51.2	153.2	114.3	283.7
Standard Deviation:	9.9	6.6	17.6	13.1	33.7
RSD (%):	11.6	12.9	11.5	11.5	11.9

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 2.5 µg/L (22 nmol/L) to 20.1 µg/L (179 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 one of the 26 participant laboratories (3.8%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Cadmium Test Results, 2010 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L urine)				
	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
Robust Mean	**2.5**	**7.5**	**3.9**	**20.1**	**6.1**
Robust Standard Deviation	0.2	0.5	0.3	1.4	0.5
Standard Uncertainty	0.0	0.1	0.1	0.4	0.1
RSD (%)	7.2	7.2	6.5	7.2	8.0
Acceptable Range:					
Upper Limit	3.5	8.6	4.9	23.1	7.1
Lower Limit	1.5	6.4	2.9	17.1	5.1

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 #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-01	UE10-02	UE10-03	UE10-04	UE10-05	
	Target Values:	2.5	7.5	3.9	20.1	6.1	
103	ICP-MS	2.7	7.9	7.8 ↑	20.3	6.0	Info
107	DRC/CC-ICP-MS	2.5	7.5	4.0	20.5	6.2	Info
110	ICP-MS	2.5	7.5	4	20.1	6.1	
114	ICP-MS	2.3	6.8	3.5	18.1	5.5	
116	ICP-MS	2.2	6.7	3.5	18.0	5.5	Info
147	ICP-MS	2.8	8.1	4.2	21.8	6.8	Info
156	ICP-MS	2.3	6.9	3.6	18.5	5.7	
159	ICP-MS	2.5	7.5	3.9	19.8	6	
164	ICP-MS	2.4	7.3	3.9	19.9	6	
179	ICP-MS	3.1	8.3	4.5	21	6.9	
197	DRC/CC-ICP-MS	2.8	8	4	21.8	6.5	
200	ICP-MS	2.6	7.8	4.0	21.2	6.5	Info
206	ICP-MS	2.8	8.5	4.5	22.4	6.9	
208	ICP-MS	2.4	7.6	4	20.4	6.2	
293	ICP-MS	2.6	7.5	3.9	19.9	6.0	Info
305	ICP-MS	2.5	7.4	3.9	19.6	5.8	
312	ICP-MS	2.6	7.8	4.1	21.5	6.6	
324	ICP-MS	2.7	8.1	4.3	21.3	6.4	Info
339	HR-ICP-MS	2.6	7.5	3.9	20.9	5.6	Info
359	ICP-MS	2.4	7.7	4	18.1	5.9	
366	ICP-MS	2.0	6.4	3.4	17.4	5.1	Info
367	ETAAS-Z	2.4	7.1	3.7	20.1	6.1	Info
385	ICP-MS	2.4	7.4	3.8	19.9	5.8	Info
391	DRC/CC-ICP-MS	2.8	8.0	4.2	21.0	6.4	Info
395	ICP-MS	2.5	7.4	3.9	19.7	6	
401	ETAAS other	1.9	6.3 ↓	3.4	17.0 ↓	5.4	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 #1
STATISTICAL SUMMARY BY METHOD

	Results (μg/L urine)				
	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	2.7	7.8	4.1	21.1	6.4
Standard Deviation:	0.2	0.3	0.1	0.7	0.2
RSD (%):	—	—	—	—	—
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	1.9	6.3	3.4	17.0	5.4
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2.4	7.1	3.7	20.1	6.1
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	2.6	7.5	3.9	20.9	5.6
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	19	20	20
Mean:	2.5	7.5	3.9	19.9	6.1
Standard Deviation:	0.2	0.5	0.3	1.4	0.5
RSD (%):	9.6	7.1	7.8	6.9	7.9
All Laboratories					
Number of Sample Measurements:	26	26	25	26	26
Mean:	2.5	7.5	3.9	20.0	6.1
Standard Deviation:	0.3	0.6	0.3	1.4	0.5
RSD (%):	10.3	7.4	7.5	7.1	7.7

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 33.9 µg/L (169 nmol/L) to 124.1 µg/L (619 nmol/L).

Acceptable ranges. The acceptable range is fixed at ±30% or ±3 µg/L (15 nmol/L) for target values ≤10 µg/L. The criteria are consistent with those in place for blood Hg.

Discussion. Based upon the above criteria, 93.8% of test results reported were judged as satisfactory, with two of the 26 participant laboratories (7.7%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Mercury Test Results, 2010 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (μg/L urine)				
	UE10-01	**UE10-02**	**UE10-03**	**UE10-04**	**UE10-05**
Robust Mean	**62.2**	**92.3**	**33.9**	**124.1**	**80.7**
Robust Standard Deviation	4.8	6.6	2.9	8.6	5.2
Standard Uncertainty	1.2	1.6	0.7	2.1	1.3
RSD (%)	7.7	7.1	8.7	6.9	6.4
Acceptable Range:					
Upper Limit	80.9	120.0	44.1	161.3	104.9
Lower Limit	43.5	64.6	23.7	86.9	56.5

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 #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-01	UE10-02	UE10-03	UE10-04	UE10-05	
	Target Values:	62.2	92.3	33.9	124.1	80.7	
103	ICP-MS	59.2	89.9	35.2	129.0	83.5	Info
107	DRC/CC-ICP-MS	67.4	98.5	36.5	127.3	84.1	Info
109	AFS	65.6	97.1	32.2	115.8	74.6	Info
110	ICP-MS	59.1	91.7	34.2	126	80.6	
114	ICP-MS	61	90	36	121	84	
147	CV-AAS	57.9	82.5	33.9	123.6	79.2	Info
156	ICP-MS	57.8	90.4	31.1	123	80	
159	ICP-MS	67	95	34	126	79	
164	ICP-MS	64	95	36	129	83	
179	ICP-MS	63	98	37	119	80	
197	DRC/CC-ICP-MS	64	97	35	135	85	
200	ICP-MS	65.3	88.1	33.6	95.6	78.2	Info
206	ICP-MS	63	91	31	124	78	
208	CV-AAS	60.2	93.6	35.6	129.8	83.6	
293	ICP-MS	5.8 ↓	87.8	30.4	113.8	75.8	Info
305	ICP-MS	51.7	78.9	29.3	92.2	73.3	
312	ICP-MS	67.6	98.3	33.9	133.9	83.5	
324	CV-AAS	60.1	97.6	37.4	123.9	83.8	Info
339	HR-ICP-MS	64.3	89.2	30.2	121	76.6	Info
359	ICP-MS	60.9	89.2	35.2	126.6	83.9	
366	ICP-MS	64.5	96.0	35.0	136.0	88.0	Info
367	CV-AAS	73.8	113.4	41.7	149.6	99.8	Info
391	CV-AAS	42.1 ↓	47.3 ↓	18.0 ↓	73.6 ↓	41.0 ↓	Info
395	ICP-MS	66.7	106.2	36.8	143.8	93.5	
401	CV-AAS	66.0	92.8	33.0	123.0	78.1	Info
448	CV-AAS	44.0	64.0 ↓	20.0 ↓	105.0	74.0	Info

Percent satisfactory results for all participants: 93.8 %

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 #1
STATISTICAL SUMMARY BY METHOD

	Results (μg/L urine)				
	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
AFS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	65.6	97.1	32.2	115.8	74.6
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	7	7	7	7	7
Mean:	57.7	84.5	31.4	118.4	77.1
Standard Deviation:	11.3	22.2	8.9	23.7	17.9
RSD (%):	19.6	26.3	28.5	20.0	23.2
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	65.7	97.8	35.8	131.2	84.6
Standard Deviation:	2.4	1.1	1.1	5.4	0.6
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	64.3	89.2	30.2	121.0	76.6
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	14	15	15	15	15
Mean:	62.2	92.4	33.9	122.6	81.6
Standard Deviation:	4.3	6.2	2.4	13.7	4.9
RSD (%):	7.0	6.7	7.1	11.2	6.1
All Laboratories					
Number of Sample Measurements:	25	26	26	26	26
Mean:	61.4	90.7	33.2	121.8	80.2
Standard Deviation:	7.0	12.6	5.0	15.9	9.9
RSD (%):	11.4	13.9	15.0	13.1	12.3

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 35.0 µg/L (0.17 µmol/L) to 293.2 µg/L (1.42 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, 95.4% of test results were judged as satisfactory, with one of the 26 participant laboratories (3.8%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Lead Test Results, 2010 Event #1
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

	Results (µg/L urine)				
	UE10-01	**UE10-02**	**UE10-03**	**UE10-04**	**UE10-05**
Robust Mean	**35.0**	**106.9**	**55.3**	**293.2**	**86.0**
Robust Standard Deviation	2.4	7.9	3.7	23.1	5.2
Standard Uncertainty	0.6	1.9	0.9	5.7	1.3
RSD (%)	6.9	7.4	6.7	7.9	6.0
Acceptable Range:					
Upper Limit	75.0	146.9	95.3	333.2	126.0
Lower Limit	0.0	66.9	15.3	253.2	46.0

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 #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine) UE10-01	UE10-02	UE10-03	UE10-04	UE10-05	Info Only
	Target Values:	35.0	106.9	55.3	293.2	86.0	
103	ICP-MS	33.2	101.4	53.3	271.0	82.1	Info
107	DRC/CC-ICP-MS	35.5	108.6	56.3	292.9	87.4	Info
110	ICP-MS	34.9	109	56	296	87.7	
110	ETAAS-Z	30	100	46	278	81	Info
114	ICP-MS	33	99	52	263	83	
116	ICP-MS	35.9	110.0	57.0	302.0	89.8	Info
147	ICP-MS	34.8	105.9	54.1	308.7	84.5	Info
156	ICP-MS	33.6	102	49.3	292	80.2	
159	ICP-MS	35	105	54	286	85	
164	ICP-MS	35	108	57	293	88	
179	ICP-MS	37	113	60	309	91	
197	DRC/CC-ICP-MS	35.3	108.3	54.4	308.5	86.4	
200	ICP-MS	33.2	103	55.7	280	83.9	Info
206	ICP-MS	34	104.3	55	306	84	
208	ICP-MS	32	101.4	53.1	272.1	83	
293	ICP-MS	35.4	110.4	56.8	300.4	87.9	Info
305	ICP-MS	28.2	85	45.1	232.8 ↓	70.6	
312	ICP-MS	36.5	110	57.4	300	88	
324	ICP-MS	36.6	112.6	58.6	302.8	91.4	Info
339	HR-ICP-MS	39.1	124	62.9	348 ↑	104	Info
359	ICP-MS	32.3	99.2	51.8	254.1	80.1	
366	ICP-MS	35.8	89.0	47.0	249.0 ↓	72.6	Info
383	ETAAS-Z	42.6	120.1	64.7	315.5	98.9	
385	ICP-MS	39.4	121	62.3	347 ↑	97.0	Info
391	ETAAS other	39.9	139.5	79.5	383.4 ↑	138.7 ↑	Info
395	ICP-MS	34.4	103.4	53.7	279.7	83.6	

Percent satisfactory results for all participants: 95.4 %

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 #1
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	35.4	108.5	55.4	300.7	86.9
Standard Deviation:	0.1	0.2	1.3	11.0	0.7
RSD (%):	—	—	—	—	—
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	39.9	139.5	79.5	383.4	138.7
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	2	2	2	2	2
Mean:	36.3	110.1	55.4	296.8	90.0
Standard Deviation:	8.9	14.2	13.2	26.5	12.7
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	39.1	124.0	62.9	348.0	104.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	20	20	20
Mean:	34.5	104.6	54.5	287.2	84.7
Standard Deviation:	2.3	8.1	4.2	25.7	6.1
RSD (%):	6.7	7.7	7.6	8.9	7.2
All Laboratories					
Number of Sample Measurements:	26	26	26	26	26
Mean:	35.1	107.4	55.9	295.0	88.1
Standard Deviation:	3.0	10.8	6.8	31.8	12.5
RSD (%):	8.6	10.1	12.2	10.8	14.2

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

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Urine Additional Elements, 2010 Event #1
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Urine Aluminum Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
164	ICP-MS	21	57	31	149	46
179	DRC/CC-ICP-MS	24	56	33	147	47
197	ICP-MS	<20.0	53	27	158	43
305	ICP-MS	25	60	32	152	51
312	ICP-MS	37.1	79	52.1	177.3	65.2
359	ICP-MS	22.3	59.7	32.4	151.2	47.8
Arithmetic Mean, n=6		26	61	35	156	50
SD		6	9	9	11	8

Urine Barium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	4.0	10.7	6.2	26.4	8.7
116	ICP-MS	3.86	10.1	5.87	24.9	8.17
179	ICP-MS	4	10	6	25	8
197	ICP-MS	4.2	11.4	6.6	28.2	9.3
312	ICP-MS	4.4	10.5	6.3	26.2	8.7
359	ICP-MS	3.6	9.7	5.7	24.5	7.8
385	ICP-MS	4.0	11.7	6.5	28.3	9.0
Arithmetic Mean, n=7		4.0	10.6	6.2	26.2	8.5
SD		0.3	0.7	0.3	1.6	0.5

Urine Beryllium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	3.1	9.7	4.8	27.0	7.7
116	ICP-MS	2.88	9.54	5.01	26.3	8.05
179	ICP-MS	3.1	9.8	4.8	26.3	7.9
197	ICP-MS	2.5	7.7	4.1	21.2	6.4
312	ICP-MS	3.7	10.5	5.3	29.1	8.1
385	ICP-MS	3.2	10.1	5.3	28.9	8.3
Arithmetic Mean, n=6		3.1	9.6	4.9	26.5	7.7
SD		0.4	1.0	0.4	2.9	0.7

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Urine Cobalt Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	1.5	5.0	3.0	11.1	3.6
116	ICP-MS	1.59	4.91	3.06	11.5	3.78
159	ICP-MS	1.5	4.8	3	10.8	3.5
179	ICP-MS	1.6	5.1	3.1	11	3.6
197	ICP-MS	1.5	5.2	3.2	11.2	3.7
312	ICP-MS	1.8	5.6	3.4	12.1	4
359	ICP-MS	1.4	4.6	2.7	10.6	3.4
385	ICP-MS	1.6	5.2	3.2	11.9	3.8
391	DRC/CC-ICP-MS	1.4	4.5	2.7	10.3	3.2
Arithmetic Mean, n=9		1.5	5.0	3.0	11.2	3.6
SD		0.1	0.3	0.2	0.6	0.2

Urine Chromium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	DRC/CC-ICP-MS	7.7	21.3	12.4	53.2	17.0
116	DRC/CC-ICP-MS	6.95	24.1	11.0	63.9	19.3
164	ETAAS-Z	6.2	18.1	9.7	49.7	15.1
179	DRC/CC-ICP-MS	6.3	17.8	9.5	46.5	14.4
197	DRC/CC-ICP-MS	5.5	16.4	8.9	43.6	13.2
312	DRC/CC-ICP-MS	7.3	21.8	12.6	59.6	18.8
359	ICP-MS	6	17	9.7	44.9	14
391	DRC/CC-ICP-MS	6.2	17.4	9.9	45.9	13.9
395	DRC/CC-ICP-MS	5.8	17.8	9.3	48.4	14.5
Arithmetic Mean, n=9		6.4	19.1	10.3	50.6	15.6
SD		0.7	2.6	1.4	7.0	2.2

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Urine Cesium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	14.1	40.0	22.3	102	31.9
116	ICP-MS	13.7	38.5	21.5	97.5	30.9
147	ICP-MS	15.28	47.8	23.52	108.45	34.29
179	ICP-MS	13.4	37.1	20.5	93.1	29.4
312	ICP-MS	14	39.5	22.7	99.3	30.9
385	ICP-MS	15.3	43.6	24.0	110	33.9
Arithmetic Mean, n=6		14.3	41.1	22.4	101.7	31.9
SD		0.8	3.9	1.3	6.5	1.9

Urine Copper Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	126	382	203	1031	310
159	ICP-MS	123	357	194	954	295
164	ICP-MS	125.1	380.4	199	1007.4	305
179	DRC/CC-ICP-MS	125	376	196	1053	301
197	ICP-MS	133.6	383.1	211.8	1056	311.7
305	ICP-MS	118	356	183	964	286
312	ICP-MS	134.7	394	209.3	1074	320
359	ICP-MS	128.3	379.4	200.6	>750.0	304.5
Arithmetic Mean, n=8		127	376	200	1020	304
SD		5	13	9	47	10

Urine Manganese Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	3.8	10.5	6.0	26.7	8.6
159	ICP-MS	3.5	9.8	6	24.8	9.8
179	DRC/CC-ICP-MS	2.8	8.7	4.6	23.1	7
305	ICP-MS	2.9	8.7	4.7	23.6	7
312	ICP-MS	3.6	11.3	5.9	29.1	9.4
359	ICP-MS	5	10.8	7.2	24.7	8.8
366	ICP-MS	2.7	7.4	3.9	21.6	6.8
391	DRC/CC-ICP-MS	3.2	8.8	5.6	22.4	7.3
Arithmetic Mean, n=8		3.4	9.5	5.5	24.5	8.1
SD		0.7	1.3	1.0	2.4	1.2

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Urine Molybdenum Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	49.3	120	76.2	273	95.5
116	ICP-MS	52.1	122	78.1	280	99.5
147	ICP-MS	46.35	115.16	73.8	265.83	92.71
179	ICP-MS	48	117	76	260	94
197	ICP-MS	49.3	124.2	78.6	283.8	99.6
312	ICP-MS	48.6	120.9	74.8	269.4	94.1
359	ICP-MS	49.1	120.2	75.7	277	95.4
366	ICP-MS	49.0	113.0	77.0	265.0	95.0
385	ICP-MS	53.7	135	86.0	304	107
(391)	(DRC/CC-ICP-MS)	(85.4)	(143.5)	(135.6)	(235.9)	(161.2)
Arithmetic Mean, n=9 (outliers deleted)		49	121	77	275	97
SD		2	6	4	13	4

Urine Nickel Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	5.2	12.7	8.3	28.4	10.1
147	ICP-MS	4.18	11.92	6.1	27.95	9.4
159	ICP-MS	5	13	8	28	12
164	ICP-MS	3.9	10.1	5.7	24.3	7.8
179	ICP-MS	3.4	9.3	5.3	25	7.4
197	ICP-MS	3.6	10.3	4.9	27.3	8.3
312	ICP-MS	5.9	13.7	8.4	30.5	10.1
359	ICP-MS	3.4	10.1	5.7	25.1	7.8
(391)	(DRC/CC-ICP-MS)	(9.6)	(59.9)	(16.2)	(52.7)	(32.0)
Arithmetic Mean, n=8 (outliers deleted)		4.3	11.4	6.5	27.1	9.1
SD		0.9	1.6	1.4	2.1	1.6

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Urine Platinum Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	1.2	3.6	1.9	10.0	2.9
116	ICP-MS	1.04	3.45	1.83	9.46	2.82
147	ICP-MS	1.15	3.3	1.78	10.12	2.98
179	ICP-MS	1.1	3.1	1.6	8.6	2.6
312	ICP-MS	1	3.6	1.8	9.2	2.8
385	ICP-MS	1.2	4.0	2.0	10.9	3.2
Arithmetic Mean, n=6		1.1	3.5	1.8	9.7	2.9
SD		0.1	0.3	0.1	0.8	0.2

Urine Antimony Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	2.4	7.3	3.8	19.6	5.8
116	ICP-MS	2.28	7.01	3.66	18.7	5.62
147	ICP-MS	2.36	7.24	3.65	19.36	5.67
179	ICP-MS	2.6	7.3	3.8	20	6.1
197	ICP-MS	2.5	7.6	3.9	21.1	6.1
312	ICP-MS	2.4	7.5	3.8	20.6	5.8
359	ICP-MS	2.6	7.3	3.9	17.8	5.8
385	ICP-MS	2.6	8.1	4.2	21.6	6.3
(391)	(DRC/CC-ICP-MS)	(6.3)	(16.6)	(8.6)	(44.1)	(13.2)
Arithmetic Mean, n=8 (outliers deleted)		2.5	7.4	3.8	19.8	5.9
SD		0.1	0.3	0.2	1.3	0.2

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Urine Selenium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	DRC/CC-ICP-MS	60.1	137	88.1	288	107
116	DRC/CC-ICP-MS	60.9	133	91.6	316	111
147	ICP-MS	57.5	127.17	84.52	267.77	101.11
179	DRC/CC-ICP-MS	54	123	82	265	98
197	ICP-MS	<50.0	116	73	249	93
305	ICP-MS	66	130	95	253	104
312	ICP-MS	67.6	161.4	107.8	333.7	124
359	ICP-MS	65.6	134.4	103.6	284.4	118.6
385	DRC/CC-ICP-MS	61.5	145	95.4	325	115
(391)	(DRC/CC-ICP-MS)	(105.9)	(159.7)	(135.4)	(251.9)	(163.6)
Arithmetic Mean, n=9 (outliers deleted)		62	134	91	287	108
SD		5	13	11	31	10

Urine Tin Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	6.3	18.9	10.1	49.8	15.0
147	ICP-MS	5.71	17.7	9.37	46.56	14.13
179	ICP-MS	6.8	18.1	9.7	49	15.3
312	ICP-MS	6.1	18.5	10.1	48.9	14.8
359	ICP-MS	6.1	18.5	9.9	48.7	14.6
Arithmetic Mean, n=5		6.2	18.3	9.8	48.6	14.8
SD		0.4	0.5	0.3	1.2	0.4

Urine Tellurium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	2.2	7.1	3.7	19.3	5.6
197	ICP-MS	2	6	3.1	16.5	5
312	ICP-MS	2.2	7.2	3.7	20.6	5.8
359	ICP-MS	2.3	7.3	3.9	19.1	5.7
Arithmetic Mean, n=4		2.2	6.9	3.6	18.9	5.5
SD		0.1	0.6	0.3	1.7	0.4

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Urine Thallium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	6.1	18.6	9.6	50.0	14.9
116	ICP-MS	6.04	18.3	9.57	50.4	14.9
147	ICP-MS	5.83	17.76	9.14	47.63	14.17
159	ICP-MS	5.5	16.5	8.5	44.8	13.3
179	ICP-MS	<10.0	20	10	52	15
197	ICP-MS	5.2	16.4	8.2	43.6	13.2
312	ICP-MS	6.1	18.5	9.3	50.3	14.8
359	ICP-MS	5.6	16.8	8.8	>20.0	13.4
385	ICP-MS	6.6	20.8	10.6	57.5	16.3
391	DRC/CC-ICP-MS	6	17.5	9.1	46.8	13.9
Arithmetic Mean, n=10		5.9	18.1	9.3	49.2	14.4
SD		0.4	1.5	0.7	4.2	1.0

Urine Uranium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	0.3	0.9	0.5	2.5	0.8
116	ICP-MS	0.311	0.923	0.482	2.49	0.758
147	ICP-MS	0.28	0.88	0.46	2.36	0.71
197	ICP-MS	<1.0	1	<1.0	2.7	<1.0
312	ICP-MS	0.3	1	0.5	2.6	0.7
359	ICP-MS	0.3	0.8	0.4	2.1	0.7
366	ICP-MS	0.2	0.6	0.3	2.0	0.5
385	ICP-MS	0.3	1.0	0.5	2.7	0.8
(391)	(DRC/CC-ICP-MS)	(0)	(0.3)	(0)	(1.6)	(0.01)
Arithmetic Mean, n=8 (outliers deleted)		0.3	0.9	0.4	2.4	0.7
SD		0.0	0.1	0.1	0.3	0.1

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Urine Vanadium Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
179	DRC/CC-ICP-MS	2	6.3	3.2	17.8	4.9
312	DRC/CC-ICP-MS	3	10.5	5	27.7	8.1
359	ICP-MS	7.1	13.5	10.6	25.4	10.8
391	DRC/CC-ICP-MS	0.8	4	1.8	11.6	2.4
Arithmetic Mean, n=4		3.2	8.6	5.2	20.6	6.6
SD		2.7	4.2	3.9	7.4	3.7

Urine Tungsten Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	2.4	7.3	3.8	19.8	5.8
116	ICP-MS	2.30	7.00	3.75	19.3	5.76
147	ICP-MS	3.2	9.73	5.08	26.48	7.71
179	ICP-MS	2.4	7	3.6	18.3	5.5
312	ICP-MS	2.4	7.4	3.8	19.9	5.8
359	ICP-MS	2.3	6.8	3.6	17.4	5.6
385	ICP-MS	2.6	8.0	4.2	21.7	6.4
Arithmetic Mean, n=7		2.5	7.6	4.0	20.4	6.1
SD		0.3	1.0	0.5	3.0	0.8

Urine Zinc Results (µg/L)

Lab Code	Method	UE10-01	UE10-02	UE10-03	UE10-04	UE10-05
110	ICP-MS	238	527	356	1151	433
159	ICP-MS	233	520	352	1121	429
164	ICP-MS	260.3	542.4	362.9	1138.8	435.3
179	DRC/CC-ICP-MS	268	555	367	1187	447
197	ICP-MS	221	519	339	1151	422
305	ICP-MS	286	577	430	1133	463
312	ICP-MS	282	585	403.9	1292	485
359	ICP-MS	232.9	521.4	348.9	1148.3	421.2
Arithmetic Mean, n=8		253	543	370	1165	442
SD		25	26	31	55	22

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Trace Elements in Urine
METHOD NOTES

ATOMIC SPECTROMETRY METHODS

A-1 ETAAS-Z (Electrothermal atomic absorption spectrometry with Zeeman background correction)

A-2 ETAAS other (i.e., D_2, S-H background correction)

A-3 FAAS (Flame atomic absorption spectrometry)

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

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

A-6 AFS (Atomic fluorescence spectrometry)

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.