
Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN URINE

Event #3, 2010

November 22, 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 Commissioner

November 22, 2010

Trace Elements in Urine Event #3, 2010

Dear Laboratory Director:

Results from the third proficiency test (PT) event for Trace Elements in Urine have been tabulated and summarized. Target values for Arsenic, Cadmium, Mercury and Lead have been established along with acceptable ranges. Results are graded using element-specific criteria as indicated in each narrative section. A laboratory with an unacceptable significant analytical bias relative to the target value will be expected to investigate the source of the error. A confidential three-digit code number assigned by the PT program identifies participant laboratories.

PT Materials

The source of the test materials is human urine obtained from donor volunteers with informed consent. Urine was collected into polyethylene containers and then stored at 4°C. Following collection, urine from each donor was mixed and acidified to 1% v/v with nitric acid, and 1% (v/v) sulfamic acid was added to stabilize Hg. The urine was stored frozen at -80°C; after thawing at room temperature, precipitated salts were removed by centrifugation. The urine was separated into five pools and each was supplemented with different amounts of As, Cd, Hg and Pb as inorganic salts. Each pool was also spiked with additional trace elements that comprise the "NHANES suite" and include: Ba, Be, Co, Cs, Mo, Pt, Sb, Tl, U and W. Each pool was stirred for 24 hours to ensure thorough mixing prior to aliquoting 10-mL samples into acid-leached polypropylene vials. Samples were stored at -80°C prior to circulating for proficiency testing.

Assignment of Target Values for Trace Elements

We are using robust statistics to assign target values for all trace element panels except for blood lead. 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, January 12th, 2011. Please inform our laboratory staff at (518) 473-0452 if the test materials have not arrived within five days of the scheduled mail out date. **The deadline for reporting results is Wednesday, February 9th, 2011.**

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 As³⁺. 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 14.7 µg/L (0.20 µmol/L) to 284.3 µg/L (3.79 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, 93.3% 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 #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results ($\mu\text{g/L}$ urine)

UE10-11 UE10-12 UE10-13 UE10-14 UE10-15

Robust Mean	284.3	30.4	68.9	14.7	147.7
Robust Standard Deviation	18.3	3.5	5.2	2.3	7.9
Standard Uncertainty	4.7	0.9	1.3	0.6	2.0
RSD (%)	6.5	11.4	7.6	15.6	5.4
Acceptable Range:					
Upper Limit	341.2	36.5	82.7	20.7	177.2
Lower Limit	227.4	24.3	55.1	8.7	118.2

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 #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-11	UE10-12	UE10-13	UE10-14	UE10-15	
Target Values:		284.3	30.4	68.9	14.7	147.7	
107	DRC/CC-ICP-MS	271.8	29.5	69.3	13.3	147.1	Info
110	DRC/CC-ICP-MS	282	32.1	67.7	12.7	148	
114	ICP-MS	286	27	60	13	151	
116	DRC/CC-ICP-MS	293.7	31.8	71.6	15.0	153.2	Info
147	ICP-MS	247.2	27.3	59.6	14.2	119.9	Info
156	ICP-MS	272	27.6	60.5	13.2	127	
159	ICP-MS	280	34	73	18	149	
164	ICP-MS	296	32	72	15	155	
179	ICP-MS	272	26	59	<15.0	137	
197	DRC/CC-ICP-MS	302	29	68	14	145	
206	ICP-MS	271.7	34.8	73.1	20.8 ↑	150.5	
208	ICP-MS	260.5	36.7 ↑	73.2	19.1	137.7	
293	DRC/CC-ICP-MS	275.0	29.2	66.5	13.3	139.0	Info
305	DRC/CC-ICP-MS	310.3	30	68.7	12.9	148.2	
312	ICP-MS	265	27.7	64.3	11.6	137.8	
324	DRC/CC-ICP-MS	287.1	36.6 ↑	72.0	17.0	148.5	Info
339	HR-ICP-MS	261.7	28.0	64.1	25.5 ↑	138.8	Info
359	ICP-MS	282.2	33.9	76.3	15.7	150.4	
366	ICP-MS	290.0	32.0	70.0	16.0	155.0	Info
367	ICP-MS	316	30.4	69	13.5	154	Info
385	DRC/CC-ICP-MS	297.0	30.5	70.1	<16.3	153.0	Info
391	DRC/CC-ICP-MS	289.2	27.9	67.8	10.8	152.9	Info
395	DRC/CC-ICP-MS	298.2	33.6	74.6	14.5	157.3	
404	HR-ICP-MS	321.5	19.1 ↓	124.6 ↑	38.1 ↑	228.9 ↑	Info

Percent satisfactory results for all participants: 93.3 %

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

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

New York State Department of Health
Urine Arsenic Test Results, 2010 Event #3
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ urine)				
	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	10	10	10	9	10
Mean:	290.6	31.0	69.6	13.7	149.2
Standard Deviation:	12.1	2.6	2.5	1.7	5.2
RSD (%):	4.2	8.3	3.5	12.5	3.5
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	1	2
Mean:	291.6	23.6	94.4	25.5	183.9
Standard Deviation:	42.3	6.3	42.8	?	63.7
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	12	12	12	11	12
Mean:	278.2	30.8	67.5	15.5	143.7
Standard Deviation:	17.9	3.6	6.4	2.8	11.7
RSD (%):	6.4	11.7	9.5	18.3	8.1
All Laboratories					
Number of Sample Measurements:	24	24	24	21	24
Mean:	284.5	30.3	70.6	15.2	149.3
Standard Deviation:	18.2	3.9	12.5	3.4	19.3
RSD (%):	6.4	12.7	17.7	22.3	12.9

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 Cd²⁺. 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 1.9 µg/L (17 nmol/L) to 12.8 µg/L (114 nmol/L).

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

Discussion. Based upon the above criteria, 99.2% of test results reported were judged as satisfactory, with none of the 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 #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results ($\mu\text{g/L}$ urine)

	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
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Robust Mean	8.1	5.1	12.8	1.9	3.5
Robust Standard Deviation	0.44	0.32	0.74	0.13	0.24
Standard Uncertainty	0.11	0.08	0.18	0.03	0.06
RSD (%)	5.5	6.1	5.8	6.6	7.0
Acceptable Range:					
Upper Limit	9.3	6.1	14.7	2.9	4.5
Lower Limit	6.9	4.1	10.9	0.9	2.5

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 #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-11	UE10-12	UE10-13	UE10-14	UE10-15	
Target Values:		8.1	5.1	12.8	1.9	3.5	
103	ICP-MS	8.9	5.6	14.0	2.2	3.9	Info
107	DRC/CC-ICP-MS	8.3	5.2	13.2	1.9	3.6	Info
110	ICP-MS	7.8	5	12.4	1.8	3.4	
114	ICP-MS	7.5	4.7	12	1.8	3.2	
116	ICP-MS	7.9	4.9	12.4	1.9	3.4	Info
147	ICP-MS	8.3	4.9	12.7	1.9	3.5	Info
156	ICP-MS	7.8	5	12	1.9	3.3	
159	ICP-MS	7.8	5.2	12.4	1.9	3.6	
164	ICP-MS	7.7	4.7	11.9	1.8	3.3	
179	ICP-MS	8.6	5.3	14.1	2	3.8	
197	DRC/CC-ICP-MS	8.5	5.4	13.5	2	3.9	
200	ICP-MS	9.4 ↑	5.7	14.3	2.2	3.9	Info
206	ICP-MS	8.5	5.3	13.3	2.1	3.6	
208	ICP-MS	7.8	5.1	12.8	2	3.3	
293	ICP-MS	8.4	5.3	13.2	2.0	3.6	Info
305	ICP-MS	8.1	5.2	13.2	1.9	3.5	
312	ICP-MS	8	5	12.6	1.8	3.5	
324	ICP-MS	8.5	5.2	13.2	2.0	3.6	Info
339	HR-ICP-MS	8.0	4.9	12.6	1.9	3.4	Info
359	ICP-MS	7.6	5	12.4	1.8	3.2	
366	ICP-MS	8.0	5.5	12.0	2.0	3.5	Info
367	ICP-MS	9.3	5.4	13.1	2.1	3.7	Info
385	ICP-MS	7.8	5.0	12.0	1.9	3.4	Info
391	DRC/CC-ICP-MS	8.8	5.6	14.0	2.1	4.0	Info
395	ICP-MS	7.8	4.8	12.2	1.8	3.2	
404	HR-ICP-MS	7.6	4.6	12.3	1.8	3.1	Info

Percent satisfactory results for all participants: 99.2 %

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

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

New York State Department of Health
Urine Cadmium Test Results, 2010 Event #3
STATISTICAL SUMMARY BY METHOD

Results ($\mu\text{g/L}$ urine)					
	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	8.5	5.4	13.6	2.0	3.8
Standard Deviation:	0.3	0.2	0.4	0.1	0.2
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	7.8	4.8	12.5	1.9	3.3
Standard Deviation:	0.3	0.2	0.2	0.1	0.2
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	21	21	21	21	21
Mean:	8.2	5.1	12.8	1.9	3.5
Standard Deviation:	0.5	0.3	0.7	0.1	0.2
RSD (%):	6.6	5.4	5.7	6.6	6.1
All Laboratories					
Number of Sample Measurements:	26	26	26	26	26
Mean:	8.2	5.1	12.8	1.9	3.5
Standard Deviation:	0.5	0.3	0.7	0.1	0.2
RSD (%):	6.3	5.7	5.6	6.4	7.0

notes: ? Insufficient data for calculation.

Urine Mercury

The source of the test materials is human urine obtained from donor volunteers with informed consent. Urine was collected into polyethylene containers and then stored at 4°C. Following collection, urine from each donor was mixed and acidified to 1% v/v with nitric acid, and 1% (v/v) sulfamic acid was added to stabilize Hg. The urine was stored frozen at -80°; 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 17.6 µg/L (88 nmol/L) to 102.1 µg/L (509 nmol/L).

Acceptable ranges. The acceptable range is fixed at $\pm 30\%$ 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, 95.2% of test results reported were judged as satisfactory, with one of the 25 participant laboratories (4.0%) reporting 2 or more of the 5 results outside the acceptable ranges.

New York State Department of Health
Urine Mercury Test Results, 2010 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results ($\mu\text{g/L}$ urine)

	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
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Robust Mean	17.6	60.4	102.1	43.4	29.8
Robust Standard Deviation	2.6	7.1	10.8	6.1	3.8
Standard Uncertainty	0.6	1.8	2.7	1.5	0.9
RSD (%)	14.7	11.8	10.6	13.9	12.7
Acceptable Range:					
Upper Limit	22.9	78.5	132.7	56.4	38.7
Lower Limit	12.3	42.3	71.5	30.4	20.9

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

New York State Department of Health
Urine Mercury Test Results, 2010 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-11	UE10-12	UE10-13	UE10-14	UE10-15	
Target Values:		17.6	60.4	102.1	43.4	29.8	
103	ICP-MS	16.5	61.2	95.3	42.5	29.2	Info
107	DRC/CC-ICP-MS	20.0	65.0	106.4	48.2	33.0	Info
109	AFS	16.7	60.7	101.1	44.5	28.4	Info
110	ICP-MS	18.4	63.2	104	45.1	29.3	
114	ICP-MS	19	65	110	47	32	
147	CV-AAS	15.0	55.3	90.7	37.8	24.8	Info
156	ICP-MS	19.5	62.8	101	49.6	34.3	
159	ICP-MS	14	52	87	34	25	
164	ICP-MS	19	63	107	47	32	
179	ICP-MS	16	60	103	41	30	
197	DRC/CC-ICP-MS	17	62	97	43	28	
206	ICP-MS	15	55	92	39	26	
208	CV-AAS	17.5	66.7	108	42.4	28.5	
293	ICP-MS	18.6	70.2	117.0	51.2	34.0	Info
305	ICP-MS	24.1 ↑	67.9	110.8	53.6	36.6	
312	ICP-MS	12.6	47.6	79.5	42.3	27.9	
324	CV-AAS	16.2	57.2	102.5	41.3	28.9	Info
339	HR-ICP-MS	14.1	55.7	80.2	42.8	27.6	Info
359	ICP-MS	14.9	56.2	91.7	37	26.4	
366	ICP-MS	19.0	65.0	102.0	44.0	34.0	Info
367	CV-AAS	18.3	67.6	113.7	50.5	33.7	Info
391	CV-AAS	22.9	45.5	115.0	31.6	27.2	Info
395	ICP-MS	16.5	57.1	99.8	38.2	26	
401	CV-AAS	83.5 ↑	301.5 ↑	510.0 ↑	222.0 ↑	151.5 ↑	Info
404	HR-ICP-MS	21.5	46.8	107.2	37.9	28.3	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 Mercury Test Results, 2010 Event #3
STATISTICAL SUMMARY BY METHOD

Results ($\mu\text{g/L}$ urine)					
	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
AFS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	16.7	60.7	101.1	44.5	28.4
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	5	5	5	5	5
Mean:	18.0	58.5	106.0	40.7	28.6
Standard Deviation:	3.0	9.1	9.9	6.9	3.3
RSD (%):	16.8	15.6	9.3	16.9	11.4
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	18.5	63.5	101.7	45.6	30.5
Standard Deviation:	2.1	2.1	6.6	3.7	3.5
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	17.8	51.3	93.7	40.4	28.0
Standard Deviation:	5.2	6.3	19.1	3.5	0.5
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	14	14	14	14	14
Mean:	17.4	60.4	100.0	43.7	30.2
Standard Deviation:	2.9	6.3	10.1	5.6	3.7
RSD (%):	16.7	10.3	10.1	12.9	12.2
All Laboratories					
Number of Sample Measurements:	24	24	24	24	24
Mean:	17.6	59.5	100.9	43.0	29.6
Standard Deviation:	2.8	6.8	10.2	5.5	3.3
RSD (%):	16.0	11.5	10.1	12.8	11.1

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #3, 2010

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 Pb²⁺. 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 27.3 µg/L (0.13 µmol/L) to 237.6 µg/L (1.15 µmol/L).

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

Discussion. Based upon the above criteria, 99.2% of test results 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 Lead Test Results, 2010 Event #3
ROBUST STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Results ($\mu\text{g/L}$ urine)

	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
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Robust Mean	120.6	74.2	237.6	27.3	143.4
Robust Standard Deviation	4.9	4.6	11.2	1.5	6.2
Standard Uncertainty	1.2	1.1	2.7	0.4	1.5
RSD (%)	4.1	6.3	4.7	5.7	4.3
Acceptable Range:					
Upper Limit	160.6	114.2	277.6	67.3	183.4
Lower Limit	80.6	34.2	197.6	0.0	103.4

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 #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine)					Info Only
		UE10-11	UE10-12	UE10-13	UE10-14	UE10-15	
Target Values:		120.6	74.2	237.6	27.3	143.4	
103	ICP-MS	134.6	81.2	268.7	30.2	162.2	Info
107	DRC/CC-ICP-MS	122.3	76.4	245.2	28.0	147.7	Info
110	ICP-MS	117	72.9	233	26.5	140	
114	ICP-MS	117	67	231	24	140	
116	ICP-MS	122.0	77.3	250.3	28.4	148.6	Info
147	ICP-MS	118.5	70.5	234.1	26.3	138.0	Info
156	ICP-MS	126	75.2	213	28.9	135	
159	ICP-MS	113	72	229	26	139	
164	ICP-MS	126	79	253	29	152	
179	ICP-MS	125	76	247	29	147	
197	DRC/CC-ICP-MS	128.1	79.7	263	28.9	151	
200	ICP-MS	126	78.5	265	27.1	150	Info
206	ICP-MS	119	72	233	26	137	
208	ICP-MS	117	78.6	268	28.7	142.5	
293	ICP-MS	121.2	75.6	242.4	27.4	142.6	Info
305	ICP-MS	121.7	70.1	226.7	26.4	138.8	
312	ICP-MS	118.2	73.3	233.4	27.6	141.4	
324	ICP-MS	123.3	77.2	242.2	28.4	145.6	Info
339	HR-ICP-MS	105.0	69.9	191.3 ↓	28.2	141.3	Info
359	ICP-MS	121.8	78.7	230.9	27.8	151	
366	ICP-MS	122.0	69.0	237.0	27.0	150.0	Info
383	ETAAS-Z	118.3	73.4	234	25.3	138.8	
385	ICP-MS	122.0	76.4	239.0	28.0	146.0	Info
391	DRC/CC-ICP-MS	94.7	65.7	215.4	25.6	136.6	Info
395	ICP-MS	118.7	74.2	233.6	26.8	141	
404	HR-ICP-MS	112.7	64.7	240.5	24.9	136.7	Info

Percent satisfactory results for all participants: 99.2 %

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

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

New York State Department of Health
Urine Lead Test Results, 2010 Event #3
STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ urine)				
	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	3	3	3	3	3
Mean:	115.0	73.9	241.2	27.5	145.1
Standard Deviation:	17.8	7.3	24.1	1.7	7.5
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	118.3	73.4	234.0	25.3	138.8
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	108.9	67.3	215.9	26.6	139.0
Standard Deviation:	5.4	3.7	34.8	2.3	3.3
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	20	20	20	20	20
Mean:	121.5	74.7	240.5	27.5	144.4
Standard Deviation:	4.7	3.8	14.5	1.4	6.6
RSD (%):	3.9	5.1	6.0	5.2	4.5
All Laboratories					
Number of Sample Measurements:	26	26	26	26	26
Mean:	119.7	74.0	238.5	27.3	143.8
Standard Deviation:	7.6	4.5	17.3	1.5	6.4
RSD (%):	6.4	6.0	7.3	5.5	4.5

notes: ? Insufficient data for calculation.

New York State Department of Health
Event #3, 2010

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

Ba
Be
Co
Cs
Mo
Pt
Sb
Tl
U
W

Additional Elements

Al
Cr
Cu
Mn
Ni
Se
Sn
Te
V
Zn

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Urine Aluminum Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
147	ICP-MS	66.649	52.887	105.774		41.554
164	ICP-MS	61	44	92	16	29
179	DRC/CC-ICP-MS	60	43	94	17	32
197	ICP-MS	74	54	118	<20.0	35
305	ICP-MS	64	46	113	18	32
312	ICP-MS	53.4	37.9	82.7	17.4	23.7
359	ICP-MS	63.4	45.1	93.6	20.2	35
391	DRC/CC-ICP-MS	41.7	39.1	56	21.8	31.9
Arithmetic Mean (n=9)		61	45	94	18	33
SD		10	6	19	2	5

Urine Antimony Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	7.7	4.8	12.2	1.8	3.4
116	ICP-MS	8.28	5.13	12.9	1.85	3.52
147	ICP-MS	7.866	4.663	12.42	1.717	3.251
179	ICP-MS	8	5	12.8	1.8	3.4
197	ICP-MS	9.3	5.8	15	2.1	4
312	ICP-MS	7.7	5.1	12.4	1.8	3.5
359	ICP-MS	8.2	5.4	13	2	3.7
385	ICP-MS	8.0	5.1	12.8	2.0	3.6
395	ICP-MS	8.1	5.1	12.9	1.9	3.6
Arithmetic Mean (n=9)		8.1	5.1	12.9	1.9	3.6
SD		0.5	0.3	0.8	0.1	0.2

Urine Barium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	10.5	7.2	16.6	3.3	5.3
116	ICP-MS	11.2	7.53	17.2	3.40	5.45
147	ICP-MS	10.106	6.728	16.065	3.034	4.97
179	ICP-MS	10	7	15	3	5
197	ICP-MS	10.9	7.5	17.6	3.4	5.6
312	ICP-MS	11.6	7.3	17.1	3.3	5.3
359	ICP-MS	10.4	7.2	16	3.2	5.2
366	ICP-MS	8.8	5.8	13.0	2.4	4.4
385	ICP-MS	11.2	7.7	17.6	3.4	5.6
395	ICP-MS	10.6	7.2	16.6	3.2	5
Arithmetic Mean (n=10)		10.5	7.1	16	3.2	5.2
SD		0.8	0.5	1	0.3	0.4

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Urine Beryllium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	10.3	6	15.9	2.3	4.2
116	ICP-MS	11.9	7.29	19.6	2.76	5.40
147	ICP-MS	9.82	6.207	16.126	2.099	4.171
179	ICP-MS	11	6.4	17.1	2.4	4.5
197	ICP-MS	12.9	6.6	17	2.3	4.3
312	ICP-MS	9.4	6.3	15.7	2.6	4.1
385	ICP-MS	10.6	7.2	17.9	2.7	5.0
Arithmetic Mean (n=7)		11	6.6	17	2.5	4.5
SD		1	0.5	1	0.2	0.5

Urine Cesium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	40.8	27	64.6	11.4	19.3
116	ICP-MS	43.8	28.8	68.3	12.1	20.5
179	ICP-MS	38.2	24.3	58.9	10.3	17.8
312	ICP-MS	42.4	28.2	66.8	12	20
366	ICP-MS	34.0	24.0	53.0	9.6	18.0
385	ICP-MS	42.4	28.3	67.2	12.0	20.2
Arithmetic Mean (n=6)		40	27	63	11	19
SD		4	2	6	1	1

Urine Chromium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	DRC/CC-ICP-MS	20.3	13.8	33.3	5.3	10.3
147	ICP-MS	19.813	12.637	31.097	4.618	8.476
164	ICP-MS	19	11.8	29.2	4.5	7.9
179	DRC/CC-ICP-MS	19.7	12.3	31.4	4.9	9
197	DRC/CC-ICP-MS	19.9	12.3	31.1	4.7	8.5
312	DRC/CC-ICP-MS	21.6	13.7	35.8	5.3	9.9
359	ICP-MS	21	14.7	34.8	5.3	9.9
391	DRC/CC-ICP-MS	20.3	12.9	32.1	4.4	8.8
395	DRC/CC-ICP-MS	19.3	12.7	32	4.6	8.5
Arithmetic Mean (n=9)		20	13	32	4.8	9.0
SD		1	1	2	0.4	0.8

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Urine Cobalt Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	6	14.6	6.8	1.3	2.1
116	ICP-MS	6.45	15.7	7.35	1.36	2.18
147	ICP-MS	5.804	13.73	6.423	1.267	1.974
159	ICP-MS	5.7	13.9	6.5	1.3	2
179	ICP-MS	6	14	6.6	1.3	2
197	ICP-MS	6.3	15	7.1	1.3	2.2
312	ICP-MS	5.6	13.4	6.2	1.2	1.9
359	ICP-MS	6.2	15.4	6.7	1.3	2
385	ICP-MS	5.9	15.0	6.9	1.3	2.1
391	DRC/CC-ICP-MS	6.5	15.5	7.0	1.3	2.1
395	ICP-MS	5.8	14.4	6.7	1.3	2
Arithmetic Mean (n=11)		6.0	14.6	6.8	1.29	2.05
SD		0.3	0.8	0.3	0.04	0.09

Urine Copper Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	418	263	652	101	184
147	ICP-MS	404.701	244.6	619.441	92.122	170.902
159	ICP-MS	405	252	604	97	176
164	ICP-MS	365.4	228.1	583.9	91	161.6
179	DRC/CC-ICP-MS	418	259	653	97	181
197	ICP-MS	408.6	259.3	652.7	101.6	184.4
305	ICP-MS	400	256	627	97	174
312	ICP-MS	370.4	236.6	576.3	89.7	164.7
359	ICP-MS	397.4	254.7	600.1	96.5	176.3
391	DRC/CC-ICP-MS	899.3*	559.6*	1366*	94.3	255.9*
395	ICP-MS	409.9	260.3	631.4	103	184.3
Arithmetic Mean (n=11)						
(*Omitted)		400	251	620	96	176
SD		18	11	28	4	8

Urine Iron Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
179		6	14	6	7	9

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Urine Manganese Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	DRC/CC-ICP-MS	10.1	6.4	16.1	2.4	4.7
110	DRC/CC-ICP-MS	9.5	5.90	15.7	2.20	4.20
110	ICP-MS	11.2	7.76	17.4	3.48	5.85
110	ICP-MS	10.4	6.40	16.4	2.60	5.00
147	ICP-MS	9.78	6.044	15.824	2.291	4.258
159	ICP-MS	10.2	7.1	16.4	3.2	5.2
179	DRC/CC-ICP-MS	9.6	6	15.4	2.2	4.3
305	ICP-MS	10.5	7.1	16.4	3.3	5.2
312	ICP-MS	9.4	6.3	14.4	2.9	5.4
359	ICP-MS	11.1	7.6	16.5	3.3	5.7
391	DRC/CC-ICP-MS	10.8	7.0	16.2	2.9	5.2
Arithmetic Mean (n=11)		10.2	6.7	16.1	2.8	5.0
SD		0.6	0.7	0.8	0.5	0.6

Urine Molybdenum Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	114	84.1	179	44.4	64.8
116	ICP-MS	121	90.6	194	46.9	69.0
147	ICP-MS	116.123	86.084	184.261	45.873	66.603
179	ICP-MS	115	87	180	48	64
197	ICP-MS	120.9	92	187.6	49	70.6
312	ICP-MS	112	83.2	174.7	43.2	62.8
359	ICP-MS	119.5	90.7	181.3	47.3	66.6
385	ICP-MS	119.0	87.3	187.0	45.6	67.4
391	DRC/CC-ICP-MS	113.8	88.9	170.6	52.5	71.8
395	ICP-MS	118	87.3	183.7	45.2	67
Arithmetic Mean (n=10)		117	88	182	47	67
SD		3	3	7	3	3

Urine Nickel Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	12.3	10.4	17.8	4.3	10.1
147	ICP-MS	10.804	8.221	16.383	2.877	4.891
159	ICP-MS	13	11	21	6	8
164	ICP-MS	10	7.9	15	2.7	4.5
179	ICP-MS	11	8.3	16	2.9	4.9
197	ICP-MS	10.4	8.2	16.1	2.8	4.8
312	ICP-MS	9.9	8.3	14.9	3.4	5.3
359	ICP-MS	11	9.3	16.1	3.7	5.4
391	DRC/CC-ICP-MS	12.4	8.1	21.9	6.2	19.9*
Arithmetic Mean (n=9)						
(*Omitted)		11	9	17	4	6
SD		1	1	3	1	2

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Urine Platinum Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	3.5	2.3	5.8	0.8	1.5
116	ICP-MS	3.81	2.40	6.12	0.859	1.60
147	ICP-MS	3.687	2.282	5.892	0.837	1.578
179	ICP-MS	3.6	2.4	5.9	0.8	1.6
312	ICP-MS	4	2.4	6.3	0.9	1.7
385	ICP-MS	3.9	2.4	6.2	0.9	1.7
Arithmetic Mean (n=6)		3.7	2.36	6.0	0.85	1.6
SD		0.2	0.06	0.2	0.05	0.1

Urine Selenium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	DRC/CC-ICP-MS	129	93.7	187	43	51.4
116	DRC/CC-ICP-MS	123	93.0	193	50.5	71.2
147	ICP-MS	113.744	82.938	172.196	45.103	65.561
179	DRC/CC-ICP-MS	109	80	175	40	62
197	ICP-MS	133	100	208	51	76
305	ICP-MS	105	85	161	47	65
312	ICP-MS	115.5	90.7	185.8	47.3	69.5
359	ICP-MS	138.6	112.1	214.7	60.3	87.9
385	DRC/CC-ICP-MS	127.0	94.7	196.0	50.1	74.8
391	DRC/CC-ICP-MS	153.8	122.7	219.6	81.1*	103.8
Arithmetic Mean (n=10)		125	95	191	48	73
(*Omitted)						
SD		15	13	19	6	15

Urine Tellurium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	7.9	4.8	11.9	1.7	3.1
197	ICP-MS	7.7	4.9	12.3	1.7	3.2
312	ICP-MS	7.8	5.1	13.1	1.8	3.5
359	ICP-MS	8.9	5.7	15	2.1	4.1
Arithmetic Mean (n=4)		8.1	5.1	13	1.8	3.5
SD		0.6	0.4	1	0.2	0.5

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Urine Thallium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	19.6	12.2	31.1	4.4	8.4
116	ICP-MS	21.0	12.9	33.2	4.75	8.94
147	ICP-MS	19.399	11.631	31.071	4.334	8.115
159	ICP-MS	18.4	11.7	29.7	4.3	8
179	ICP-MS	21	14	32	<10.0	<10.0
197	ICP-MS	19	11.8	29.5	4.1	7.9
312	ICP-MS	19.6	12.1	31.1	4.6	8.4
359	ICP-MS	19.7	12.7	30.8	4.7	8.7
385	ICP-MS	20.3	12.7	31.9	4.7	8.7
395	ICP-MS	19	11.8	30.1	4.2	8.2
Arithmetic Mean (n=10)		19.7	12.4	31	4.5	8.4
SD		0.9	0.7	1	0.2	0.4

Urine Tin Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	19.7	12.2	30.9	4.6	10.6
147	ICP-MS			27.435		8.183
179	ICP-MS	19.5	12.4	31.3	4.5	8.5
312	ICP-MS	19.5	12.5	30.9	4.7	8.6
359	ICP-MS	21.5	13.8	34.1	5.1	9.4
395	ICP-MS	19.8	12.7	32.1	4.8	8.8
Arithmetic Mean (n=6)		20.0	12.7	31	4.7	9.0
SD		0.8	0.6	2	0.2	0.9

Urine Tungsten Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	8	5	12.9	1.8	3.5
116	ICP-MS	8.10	5.10	13.1	1.82	3.52
179	ICP-MS	7.5	4.6	11.6	1.7	3.2
312	ICP-MS	7.8	4.9	12.4	1.8	3.4
359	ICP-MS	8.1	5.2	12.4	2	3.4
385	ICP-MS	7.9	5.0	12.8	1.9	3.5
Arithmetic Mean (n=6)		7.9	5.0	12.5	1.8	3.4
SD		0.2	0.2	0.5	0.1	0.1

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Urine Uranium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	1	0.6	1.6	0.2	0.4
116	ICP-MS	1.01	0.661	1.64	0.238	0.449
147	ICP-MS	0.943	0.602	1.545	0.23	0.407
197	ICP-MS	<1.0	<1.0	1.4	<1.0	<1.0
312	ICP-MS	1	0.6	1.5	0.2	0.4
359	ICP-MS	1.1	0.7	1.6	0.3	0.5
366	ICP-MS	0.8	0.5	1.2	0.2	0.4
385	ICP-MS	1.0	0.6	1.6	0.2	0.4
395	ICP-MS	0.9	0.6	1.5	0.2	0.4
Arithmetic Mean (n=6)		1.0	0.61	1.5	0.22	0.42
SD		0.1	0.06	0.1	0.04	0.04

Urine Vanadium Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
147	ICP-MS	7.296	4.628	12.092	1.724	3.27
179	DRC/CC-ICP-MS	7.2	4.5	11.5	1.7	3.2
312	DRC/CC-ICP-MS	8.5	5.8	13.3	2.3	3.8
359	ICP-MS	12.8	11.3*	18.7	8.1*	10.6*
391	DRC/CC-ICP-MS	6.4	4.2	10.1	1.8	3.2
Arithmetic Mean (n=6)						
(*Omitted)		8	4.8	13	1.9	3.4
SD		3	0.7	3	0.3	0.3

Urine Zinc Results (µg/L)						
Lab Code	Method	UE10-11	UE10-12	UE10-13	UE10-14	UE10-15
110	ICP-MS	511	377	775	209	297
147	ICP-MS	498.039	335.294	732.026	182.353	267.32
159	ICP-MS	459	352	713	193	273
164	ICP-MS	462.1	358.2	693.3	196.8	276.3
179	DRC/CC-ICP-MS	502	368	768	208	289
197	ICP-MS	481	350	750	<200.0	271
305	ICP-MS	463	355	697	200	274
312	ICP-MS	447.5	330.2	668.8	179.9	256.8
359	ICP-MS	461.3	353.2	697.3	186.7	269.2
391	DRC/CC-ICP-MS	214.8*	156.2*	570.3*	81.9*	126.4*
395	ICP-MS	467.4	346.6	723.2	190.2	271.4
Arithmetic Mean (n=11)						
(*Omitted)		475	353	722	194	275
SD		21	14	35	10	11

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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., D₂, 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 $\mu\text{mol ZPP/mol heme}$)
- F-4 Other

OTHER METHODS

If your method is not listed in the above list, please describe it briefly.
