Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN URINE

Event #1, 2007

May 3, 2007

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

May 3, 2007

Trace Elements in Urine
Event #1, 2007

Dear Laboratory Director:

Results from the first Trace Elements in Urine proficiency test (PT) event have been tabulated and summarized. Target values for Arsenic, Cadmium and Lead have been established along with acceptable ranges. **Target values for urine mercury (U-Hg) were not established due to a lack of consensus among the reference laboratories. The situation with regard to U-Hg is discussed more fully in the narrative section.**

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, each pool was acidified to 1% v/v nitric acid, and then stored at -80°C. After thawing each pool, precipitated salts were removed by decanting, and then filtered through a 10.0-µm Teflon membrane. Sulfamic acid was added to the urine pools as a mercury preservative. Each pool was supplemented with solutions containing As, Cd, Hg and Pb as inorganic salts. In addition, these pools were spiked with additional trace elements that comprise the "NHANES suite" and include: Ba, Be, Co, Cs, Mo, Pt, Sb, Tl, U and W. After spiking, each pool was stirred for 24 hours to ensure sample homogeneity prior to aliquoting into acid-leached polypropylene vials.

The 2nd PT event for trace elements in urine was mailed April 17th, 2007.
The postmark deadline for reporting results is May 15th, 2007.

We apologize for the delay in getting the results of the 1st survey back to you. We will try to get these reports back to you in a more timely fashion in the future.

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, each pool was acidified to 1% v/v nitric acid, and then stored at -80°C. After thawing each pool, precipitated salts were removed by decanting, and then filtered through a 10.0-µm Teflon membrane. Sulfamic acid was added to the urine pools as a mercury preservative. Each pool was supplemented with inorganic As^{3+}, and then stirred for 24 hours to ensure sample homogeneity prior to aliquoting into acid-leached polypropylene vials.

Target values were established as the mean of 16 referee laboratories using quadrupole-based ICP-MS or ETAAS instrumentation. Values range from 20.0 µg/L (0.27 µmol/L) to 149.1 µg/L (1.99 µmol/L). Among the referee group, imprecision (SD) varied from ±1.7 µg/L (0.02 µmol/L) to ±10.1 µg/L (0.13 µmol/L), increasing with concentration.

Acceptable ranges were fixed at ±20% or ±10 µg/L (0.13 µmol/L) around the target value, whichever is greater.

Discussion. Based upon these criteria, 91.3% of all reported test results were satisfactory, with only 3 out of 23 laboratories (13.0%) reporting 2 or more results outside the acceptable range.

New York State Department of Health
Urine Arsenic Test Results, 2007 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine) UE07-01	UE07-02	UE07-03	UE07-04	UE07-05	Info Only
	Target Values:	77.1	20.0	28.8	115.2	149.1	
102	DRC/CC-ICP-MS	73.3	18.8	27.2	107.2	137.6	
107	DRC/CC-ICP-MS	80.4	19.1	28.3	121.6	160.4	
109	ETAAS-Z	76	19	27	118	155	
110	DRC/CC-ICP-MS	73.1	18.6	25.2	112.9	149.6	
114	ICP-MS	75.0	21.0	30.0	123.0	159.0	
116	DRC/CC-ICP-MS	81.9	22.9	28.6	88.0 ↓	115.8 ↓	Info
147	ICP-MS	76.4	18.3	29.1	110.9	137.1	
156	ICP-MS	86.0	22.4	31.8	124.0	159.0	
159	ICP-MS	76.4	21.1	28.8	111.9	145.4	
164	ICP-MS	81	21	30	123	156	
179	ICP-MS	78.0	21.7	30.2	112.2	145.6	
197	DRC/CC-ICP-MS	76.0	20.0	29.0	112.0	148.0	
200	ICP-MS	86.8	20.7	30.7	118.0	156.0	
206	ICP-MS	74.0	23.4	33.3	111.2	139.6	
208	ICP-MS	75.0	19.7	30.4	104.8	136.5	
305	DRC/CC-ICP-MS	63.2	20.5	25.5	121.1	147.1	
312	ICP-MS	89.5	18.9	30.0	128.4	172.4	
324	DRC/CC-ICP-MS	63.0	15.8	23.7	92.5	115.7 ↓	Info
339	HR-ICP-MS	68	16.5	24	106	141	
359	ICP-MS	86.1	21.9	32.6	120.8	152.2	
385	DRC/CC-ICP-MS	78.7	19.2	29.4	116	151	Info
401	ETAAS other	56 ↓	10	13 ↓	94	127	Info
404	HR-ICP-MS	184.2 ↑	108.3 ↑	154.7 ↑	432.6 ↑	204.1 ↑	Info

Percent satisfactory results for all participants: 91.3 %

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

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, 2007 Event #1
STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Lab Code	Method	Results (µg/L urine)				
		UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
102	DRC/CC-ICP-MS	73.3	18.8	27.2	107.2	137.6
107	DRC/CC-ICP-MS	80.4	19.1	28.3	121.6	160.4
109	ETAAS-Z	76	19	27	118	155
110	DRC/CC-ICP-MS	73.1	18.6	25.2	112.9	149.6
147	ICP-MS	76.4	18.3	29.1	110.9	137.1
156	ICP-MS	86.0	22.4	31.8	124.0	159.0
159	ICP-MS	76.4	21.1	28.8	111.9	145.4
164	ICP-MS	81	21	30	123	156
179	ICP-MS	78.0	21.7	30.2	112.2	145.6
197	DRC/CC-ICP-MS	76.0	20.0	29.0	112.0	148.0
200	ICP-MS	86.8	20.7	30.7	118.0	156.0
206	ICP-MS	74.0	23.4	33.3	111.2	139.6
208	ICP-MS	75.0	19.7	30.4	104.8	136.5
305	DRC/CC-ICP-MS	63.2	20.5	25.5	121.1	147.1
312	ICP-MS	89.5	18.9	30.0	128.4	172.4
339	HR-ICP-MS	68	16.5	24	106	141
Number of Sample Measurements:		16	16	16	16	16
Target value:		**77.1**	**20.0**	**28.8**	**115.2**	**149.1**
Standard Deviation:		6.7	1.7	2.5	7.0	10.1
RSD (%):		8.7	8.6	8.7	6.1	6.8
Acceptable Range:						
Upper Limit:		92.5	30.0	38.8	138.2	178.9
Lower Limit:		61.7	10.0	18.8	92.2	119.3

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, 2007 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (μg/L urine)				
	UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	8	8	8	8	8
Mean:	73.7	19.4	27.1	108.9	140.7
Standard Deviation:	7.2	2.0	2.1	12.5	16.6
RSD (%):	9.8	10.3	7.7	11.5	11.8
ETAAS other					
Number of Sample Measurements:	1	1	1	1	1
Mean:	56.0	10.0	13.0	94.0	127.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	76.0	19.0	27.0	118.0	155.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	2
Mean:	68.0	16.5	24.0	106.0	172.6
Standard Deviation:	?	?	?	?	44.6
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	11	11	11	11	11
Mean:	80.4	20.9	30.6	117.1	150.8
Standard Deviation:	5.7	1.5	1.4	7.3	11.1
RSD (%):	7.1	7.2	4.6	6.2	7.4
All Laboratories					
Number of Sample Measurements:	22	22	22	22	23
Mean:	76.1	19.6	28.1	112.6	148.3
Standard Deviation:	8.2	2.9	4.2	10.6	18.3
RSD (%):	10.8	14.6	15.0	9.5	12.3

notes: ? Insufficient data for SD calculation.

New York State Department of Health
Urine Arsenic Test Results, 2007 Event #1
STATISTICAL SUMMARY BY CLASS

	Results (μg/L urine)				
	UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
Evaluated					
Number of Sample Measurements:	2	2	2	2	2
Mean:	80.6	21.5	31.3	121.9	155.6
Standard Deviation:	7.8	0.6	1.8	1.6	4.8
RSD (%):	—	—	—	—	—
Info					
Number of Sample Measurements:	4	4	4	4	5
Mean:	69.9	17.0	23.7	97.6	142.7
Standard Deviation:	12.4	5.5	7.5	12.5	37.2
RSD (%):	17.8	32.3	31.9	12.8	26.1
Reference					
Number of Sample Measurements:	16	16	16	16	16
Mean:	77.1	20.0	28.8	115.2	149.1
Standard Deviation:	6.7	1.7	2.5	7.0	10.1
RSD (%):	8.7	8.6	8.7	6.1	6.8
All Laboratories					
Number of Sample Measurements:	22	22	22	22	23
Mean:	76.1	19.6	28.1	112.6	148.3
Standard Deviation:	8.2	2.9	4.2	10.6	18.3
RSD (%):	10.8	14.6	15.0	9.5	12.3

notes: ? Insufficient data for SD 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, each pool was acidified to 1% v/v nitric acid, and then stored at -80°C. After thawing each pool, precipitated salts were removed by decanting, and then filtered through a 10.0-µm Teflon membrane. Sulfamic acid was added to the urine pools as a mercury preservative. Each pool was supplemented with inorganic Cd^{2+}, and then stirred for 24 hours to ensure sample homogeneity prior to aliquoting into acid-leached polypropylene vials.

Target values were established as the mean of 17 referee laboratories using either quadrupole-based ICP-MS or ETAAS instrumentation. Values range from 3.7 µg/L (33 nmol/L) to 28.7 µg/L (255 nmol/L). Among the referee group, imprecision (SD) varied from ±0.3 µg/L (3 nmol/L) to ±1.6 µg/L (14 nmol/L), increasing with concentration.

Acceptable ranges were 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 these criteria, 97.5% of all reported test results were satisfactory, with only 1 out of 24 laboratories (4.2%) reporting 2 or more results outside the acceptable range.

New York State Department of Health
Urine Cadmium Test Results, 2007 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine) UE07-01	UE07-02	UE07-03	UE07-04	UE07-05	Info Only
	Target Values:	14.9	3.7	5.5	28.7	10.4	
102	ICP-MS	14.2	3.5	5.2	27.8	10.1	
103	ETAAS-Z	14.4	3.4	5.6	30.3	11.9	Info
107	DRC/CC-ICP-MS	14.7	3.6	5.4	29.1	10.4	
110	ICP-MS	13.4	3.1	4.8	26.7	9.5	
110	ETAAS-Z	15.8	3.9	5.8	30.6	10.1	
114	ICP-MS	13.3	3.2	4.7	25.2	9.5	
116	ICP-MS	14.7	3.5	5.3	28.4	10.3	Info
147	ICP-MS	14.8	3.5	5.2	29.1	10.4	
156	ICP-MS	15.7	3.9	5.8	31.3	11.4	
159	ICP-MS	14.7	3.7	5.2	28.3	10.1	
164	ICP-MS	14.6	3.6	5.5	29.0	10.4	
179	ICP-MS	16.4	4.1	6.0	30.5	11.2	
197	ICP-MS	15.6	3.7	5.6	30.1	11.0	
200	ETAAS-Z	15.2	3.7	5.7	28.3	10.5	
206	ICP-MS	14.1	3.6	5.7	26.8	10.6	
208	ICP-MS	15.1	4.0	5.9	29.8	10.6	
305	ICP-MS	13.8	3.5	5.1	26.9	9.3	
312	ICP-MS	15.3	3.7	5.5	28.1	10.4	
324	ICP-MS	14.8	3.5	5.3	28.3	11.4	
339	HR-ICP-MS	15.6	4.2	6.1	28.8	9.5	
359	ICP-MS	14.3	3.5	5.3	27.9	10.0	
367	ETAAS-Z	11.0 ↓	3.0	4.5	23.4 ↓	8.7 ↓	Info
385	ICP-MS	13.6	3.5	5.0	26.6	9.8	Info
404	HR-ICP-MS	14.6	4.0	5.3	29.3	10.5	Info

Percent satisfactory results for all participants: 97.5 %

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

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, 2007 Event #1
STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Lab Code	Method	Results (µg/L urine)				
		UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
102	ICP-MS	14.2	3.5	5.2	27.8	10.1
107	DRC/CC-ICP-MS	14.7	3.6	5.4	29.1	10.4
110	ICP-MS	13.4	3.1	4.8	26.7	9.5
110	ETAAS-Z	15.8	3.9	5.8	30.6	10.1
114	ICP-MS	13.3	3.2	4.7	25.2	9.5
147	ICP-MS	14.8	3.5	5.2	29.1	10.4
156	ICP-MS	15.7	3.9	5.8	31.3	11.4
159	ICP-MS	14.7	3.7	5.2	28.3	10.1
164	ICP-MS	14.6	3.6	5.5	29.0	10.4
179	ICP-MS	16.4	4.1	6.0	30.5	11.2
197	ICP-MS	15.6	3.7	5.6	30.1	11.0
200	ETAAS-Z	15.2	3.7	5.7	28.3	10.5
206	ICP-MS	14.1	3.6	5.7	26.8	10.6
208	ICP-MS	15.1	4.0	5.9	29.8	10.6
312	ICP-MS	15.3	3.7	5.5	28.1	10.4
324	ICP-MS	14.8	3.5	5.3	28.3	11.4
339	HR-ICP-MS	15.6	4.2	6.1	28.8	9.5
Number of Sample Measurements:		17	17	17	17	17
	Target value:	**14.9**	**3.7**	**5.5**	**28.7**	**10.4**
	Standard Deviation:	0.8	0.3	0.4	1.6	0.6
	RSD (%):	5.6	7.8	7.2	5.4	5.8
	Acceptable Range:					
	Upper Limit:	17.1	4.7	6.5	33.0	12.0
	Lower Limit:	12.7	2.7	4.5	24.4	8.8

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, 2007 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	14.7	3.6	5.4	29.1	10.4
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	4	4	4	4	4
Mean:	14.1	3.5	5.4	28.2	10.3
Standard Deviation:	2.1	0.4	0.6	3.3	1.3
RSD (%):	15.2	11.2	11.2	11.8	12.8
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	15.1	4.1	5.7	29.1	10.0
Standard Deviation:	0.7	0.1	0.6	0.4	0.7
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	17	17	17	17	17
Mean:	14.6	3.6	5.4	28.3	10.4
Standard Deviation:	0.8	0.3	0.4	1.6	0.6
RSD (%):	5.8	7.0	6.8	5.6	6.2
All Laboratories					
Number of Sample Measurements:	24	24	24	24	24
Mean:	14.6	3.6	5.4	28.4	10.3
Standard Deviation:	1.1	0.3	0.4	1.8	0.7
RSD (%):	7.5	8.2	7.5	6.4	7.1

notes: ? Insufficient data for SD calculation.

New York State Department of Health
Urine Cadmium Test Results, 2007 Event #1
STATISTICAL SUMMARY BY CLASS

	Results (μg/L urine)				
	UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
Evaluated					
Number of Sample Measurements:	2	2	2	2	2
Mean:	14.1	3.5	5.2	27.4	9.7
Standard Deviation:	0.4	0.0	0.1	0.7	0.5
RSD (%):	—	—	—	—	—
Info					
Number of Sample Measurements:	5	5	5	5	5
Mean:	13.7	3.5	5.1	27.6	10.2
Standard Deviation:	1.5	0.4	0.4	2.7	1.2
RSD (%):	11.3	10.2	8.1	9.8	11.3
Reference					
Number of Sample Measurements:	17	17	17	17	17
Mean:	14.9	3.7	5.5	28.7	10.4
Standard Deviation:	0.8	0.3	0.4	1.6	0.6
RSD (%):	5.6	7.8	7.2	5.4	5.8
All Laboratories					
Number of Sample Measurements:	24	24	24	24	24
Mean:	14.6	3.6	5.4	28.4	10.3
Standard Deviation:	1.1	0.3	0.4	1.8	0.7
RSD (%):	7.5	8.2	7.5	6.4	7.1

notes: ? Insufficient data for SD calculation.

Urine Mercury

PT Sample Stability - Important Information

Target values for urine mercury (U-Hg) were not established due to a lack of consensus among the reference laboratories.

After the last PT event of 2006 (#3), we received a report from one of our participants of an unusual discrepancy between their U-Hg results, as reported to the program, and the consensus target value. The original urine PT samples were shipped back to us for investigation and re-analysis. As a result, we have reason to believe that PT sample stability may have been compromised for U-Hg. Furthermore, we have detected inconsistencies in the distribution of U-Hg data reported by our reference laboratories for the first PT event of 2007. Consequently, we are suspending PT grading for U-Hg for both the third test event of 2006 and for this first event of 2007.

We are conducting further studies of archived PT materials and investigating our protocol for preparing PT materials, to determine the cause of this problem. At present, we are considering making some changes to the urine sample preparation protocol to address Hg stability issues.

We plan to continue circulating urine PT samples spiked with inorganic Hg, and stabilized with both 1% (v/v) nitric acid and with 1% (m/v) sulfamic acid. We are actively evaluating the quality of our PT samples used to monitor performance for U-Hg, and, thus, we may ask selected participants to ship PT samples back to us for further testing.

We hope to have a better understanding of the situation with respect to U-Hg stability in the next few months, and we will keep you updated on our progress.

We apologize for any inconvenience this may cause in your ongoing QA/QC programs.

New York State Department of Health
Urine Mercury Test Results, 2006 Event #3
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (μg/L urine)					Info Only
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15	
103	CV-AAS	40	27	3.1	10	180	
107	DRC/CC-ICP-MS	47.6	33.2	4.3	15.5	206.3	
108	CV-AAS	32.0	17.7	1.8	6.9	159.9	
109	AFS	36	26	3	8	164	
110	ICP-MS	46.8	30.6	3.3	11.2	192.3	
114	ICP-MS	50	31	5	12	226	
126	CV-AAS	37.0	25.0	<4.0	<4.0	160.0	
147	ICP-MS	44.0	30.2	3.0	11.7	184.5	
156	CV-AAS	47.5	30.9	<3.0	11.0	53.7	
159	ICP-MS	51.6	33.6	6.8	11.0	220.0	
164	ICP-MS	41.8	28.7	4.5	13.4	200.2	
179	ICP-MS	45.6	31.5	3	11.6	190.5	
197	ICP-MS	44	30	<5	11	193	
200	ICP-MS	30.4	20.7	3.4	8.7	135	
206	ICP-MS	29.0	18.0	2.0	9.0	153.0	
208	ICP-MS	41.7	27.9	<5.0	11.3	194.3	
305	ICP-MS	49.7	38.0	5.1	14.0	221.9	
312	ICP-MS	34.3	21.3	2.9	9.6	170.5	
324	ICP-MS	38.2	28.4	3.2	11.2	208.4	
339	HR-ICP-MS	35.8	24.1	3.1	9.1	194	
347	CV-AAS	39	24	2	11	200	
359	DRC/CC-ICP-MS	44.9	31.4	5.5	11.6	195.9	
366	ICP-MS	40.5	28.6	4.2	10.5	231.0	
404	HR-ICP-MS	39.19	24.81	13.27	13.65	150.68	

Percent satisfactory results for all participants: 100.0 %

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

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, 2007 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (μg/L urine)					Info Only
		UE07-01	UE07-02	UE07-03	UE07-04	UE07-05	
103	CV-AAS	29	36	24	21	33	
107	DRC/CC-ICP-MS	39.9	51.0	35.6	26.9	40.9	
108	CV-AAS	40.0	63.0	41.0	33.0	58.0	
109	Atomic Spectrometry Other	34.2	37.9	27.8	21.4	35.6	
110	ICP-MS	30.9	43.2	30.4	22.4	36.6	
114	ICP-MS	31.0	50.0	31.0	26.0	156.0	
126	Other	19.0	36.0	23.0	16.0	27.0	
147	ICP-MS	33.3	46.9	32.2	23.7	39.0	
156	CV-AAS	30.8	48.0	33.6	22.8	37.1	
159	ICP-MS	28.5	46.0	30.8	22.1	36.0	
164	ICP-MS	32	52	36	24	39	
179	ICP-MS	36.0	52.0	36.0	24.8	39.7	
197	ICP-MS	25.0	40.0	28.0	20.0	33.0	
200	ICP-MS	23.8	33.8	21.2	20.8	33.0	
206	ICP-MS	30.0	37.0	27.0	22.0	32.0	
208	ICP-MS	33.0	47.0	30.9	23.2	36.7	
305	DRC/CC-ICP-MS	33.1	41.4	30.4	24.2	33.9	
312	ICP-MS	29.7	41.2	28.6	19.9	32.6	
324	ICP-MS	25.1	40.7	30.5	25.0	41.0	
339	HR-ICP-MS	26.9	35.8	20.9	19.0	27.5	
359	DRC/CC-ICP-MS	28.5	45.1	33.7	26.9	36.7	
367	CV-AAS	29.0	36.8	25.5	21.2	33.5	
401	CV-AAS	32.3	41.6	26.4	20.6	34.2	
404	HR-ICP-MS	20.2	16.5	14.1	18.1	30.4	

Percent satisfactory results for all participants: 100.0 %

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

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

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, each pool was acidified to 1% v/v nitric acid, and then stored at -80°C. After thawing each pool, precipitated salts were removed by decanting, and then filtered through a 10.0-µm Teflon membrane. Sulfamic acid was added to the urine pools as a mercury preservative. Each pool was supplemented with inorganic Pb^{2+}, and then stirred for 24 hours to ensure sample homogeneity prior to aliquoting into acid-leached polypropylene vials.

Target values were established as the mean of 16 referee laboratories using quadrupole-based ICP-MS or ETAAS instrumentation. Values range from 79.5 µg/L (0.38 µmol/L) to 356.7 µg/L (1.72 µmol/L). Among the referee group, imprecision (SD) varied from ±4.2 µg/L (0.02 µmol/L) to ±12.4 µg/L (0.06 µmol/L), increasing with concentration.

Acceptable ranges were 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 for blood lead.

Discussion. Based upon these criteria, 94.4% of all reported test results were satisfactory, with only 1 out of 25 laboratories (4%) reporting 2 or more results outside the acceptable range.

New York State Department of Health
Urine Lead Test Results, 2007 Event #1
PERFORMANCE OF PARTICIPATING LABORATORIES

Lab Code	Method	Results (µg/L urine) UE07-01	UE07-02	UE07-03	UE07-04	UE07-05	Info Only
	Target Values:	215.1	356.7	79.5	167.9	156.9	
102	ICP-MS	224.2	365.8	82.0	174.9	163.0	
103	ETAAS-Z	237	378	92	174	165	
107	DRC/CC-ICP-MS	220.1	360.9	80.9	171.9	160.5	
110	ICP-MS	214.7	360.1	78.8	168.4	157.9	
110	ETAAS-Z	204	322	75	158	147	
114	ICP-MS	207.0	357.0	72.0	167.0	42.0 ↓	
116	ICP-MS	227.3	371.9	81.8	168.5	161.0	Info
147	ICP-MS	215.5	368.8	77.5	170.5	159.8	
156	ICP-MS	223.0	358.0	77.6	162	157.0	
159	ICP-MS	239.5	398.6 ↑	82.3	165.8	155.2	
164	ICP-MS	219	356	80	163	152	
179	ICP-MS	226.5	360.5	81.6	176.3	164.0	
197	ICP-MS	201.4	354.3	75.7	160.2	152.6	
200	ICP-MS	229	364	80.7	195	177	
206	ICP-MS	203.0	340.0	81.0	167.0	165.0	
208	ICP-MS	207.2	357.0	80.5	161.8	146.2	
305	DRC/CC-ICP-MS	204.7	354.6	77.0	174.8	153.5	
312	ICP-MS	216.0	354.0	79.0	156.0	141.5	
324	ICP-MS	195.6	353.6	72.7	153.1	148.6	
339	HR-ICP-MS	244	425 ↑	92	172	159	Info
347	ETAAS-Z		368	78	183	171	Info
359	ICP-MS	>100.0 ◥	>100.0 ◥	72.6	>100.0 ◥	>100.0 ◥	
383	ETAAS-Z	219.5	367.6	72.1	165.6	137.9	
385	ICP-MS	221	376	79.8	169	160	Info
404	HR-ICP-MS	218.7	373.1	80.2	168.5	169.9	Info

Percent satisfactory results for all participants: 94.4 %

notes: ↑ reported outside upper limit
↓ reported outside lower limit

Info only: results included for informational purposes only.

◥: Unacceptable result

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, 2007 Event #1
STATISTICAL SUMMARY

TARGET VALUE ASSIGNMENT AND STATISTICS

Lab Code	Method	Results (µg/L urine)				
		UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
102	ICP-MS	224.2	365.8	82.0	174.9	163.0
103	ETAAS-Z	237	378	92	174	165
107	DRC/CC-ICP-MS	220.1	360.9	80.9	171.9	160.5
110	ICP-MS	214.7	360.1	78.8	168.4	157.9
110	ETAAS-Z	204	322	75	158	147
147	ICP-MS	215.5	368.8	77.5	170.5	159.8
156	ICP-MS	223.0	358.0	77.6	162	157.0
164	ICP-MS	219	356	80	163	152
179	ICP-MS	226.5	360.5	81.6	176.3	164.0
197	ICP-MS	201.4	354.3	75.7	160.2	152.6
200	ICP-MS	229	364	80.7	195	177
206	ICP-MS	203.0	340.0	81.0	167.0	165.0
208	ICP-MS	207.2	357.0	80.5	161.8	146.2
305	DRC/CC-ICP-MS	204.7	354.6	77.0	174.8	153.5
312	ICP-MS	216.0	354.0	79.0	156.0	141.5
324	ICP-MS	195.6	353.6	72.7	153.1	148.6
Number of Sample Measurements:		16	16	16	16	16
Target value:		**215.1**	**356.7**	**79.5**	**167.9**	**156.9**
Standard Deviation:		11.5	12.4	4.2	10.3	9.0
RSD (%):		5.4	3.5	5.3	6.1	5.7
Acceptable Range:						
Upper Limit:		255.1	396.7	119.5	207.9	196.9
Lower Limit:		175.1	316.7	39.5	127.9	116.9

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, 2007 Event #1
STATISTICAL SUMMARY BY METHOD

	Results (µg/L urine)				
	UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	212.4	357.8	79.0	173.4	157.0
Standard Deviation:	10.9	4.5	2.8	2.1	4.9
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	3	4	4	4	4
Mean:	220.2	358.9	79.3	170.2	155.2
Standard Deviation:	16.5	25.1	8.8	10.8	15.4
RSD (%):	—	7.0	11.1	6.3	9.9
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	231.4	399.1	86.1	170.3	164.5
Standard Deviation:	17.9	36.7	8.3	2.5	7.7
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	16	16	17	16	16
Mean:	216.9	362.2	78.6	167.4	150.2
Standard Deviation:	11.7	12.9	3.4	9.6	30.0
RSD (%):	5.4	3.6	4.3	5.7	20.0
All Laboratories					
Number of Sample Measurements:	23	24	25	24	24
Mean:	218.2	364.4	79.3	168.6	152.8
Standard Deviation:	12.6	19.1	5.0	8.9	25.3
RSD (%):	5.8	5.3	6.3	5.3	16.6

notes: ? Insufficient data for SD calculation.

New York State Department of Health
Urine Lead Test Results, 2007 Event #1
STATISTICAL SUMMARY BY CLASS

	Results (µg/L urine)				
	UE07-01	UE07-02	UE07-03	UE07-04	UE07-05
Evaluated					
Number of Sample Measurements:	3	3	4	3	3
Mean:	222.0	374.4	74.8	166.1	111.7
Standard Deviation:	16.4	21.6	5.0	0.8	61.0
RSD (%):	—	—	6.7	—	—
Info					
Number of Sample Measurements:	4	5	5	5	5
Mean:	227.8	382.8	82.4	172.2	164.2
Standard Deviation:	11.4	23.8	5.6	6.2	5.8
RSD (%):	5.0	6.2	6.7	3.6	3.5
Reference					
Number of Sample Measurements:	16	16	16	16	16
Mean:	215.1	356.7	79.5	167.9	156.9
Standard Deviation:	11.5	12.4	4.2	10.3	9.0
RSD (%):	5.4	3.5	5.3	6.1	5.7
All Laboratories					
Number of Sample Measurements:	23	24	25	24	24
Mean:	218.2	364.4	79.3	168.6	152.8
Standard Deviation:	12.6	19.1	5.0	8.9	25.3
RSD (%):	5.8	5.3	6.3	5.3	16.6

notes: ? Insufficient data for SD 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	NYS Elements
Ba	Al
Be	Cr
Co	Cu
Cs	Mn
Mo	Ni
Pt	Se
Sb	Sn
Tl	Te
U	V
W	Zn

New York State Department of Health
Event #1, 2007
Urine Additional Elements

UE07-01

Lab Code	102	107	110	116	164	179	197	206	287	305	347	359	385	404	n	Mean	SD	%RSD
Element (µg/L)	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ETAAS	ICP-MS	ETAAS	ICP-MS	ICP-MS	HR-ICP-MS				
Al			116.1 (DRC)		114	113.8	117.0			153.5		130.5			6	124.2	15.7	12.6
Ba	20.5		18.3	20.2									20.1		4	19.8	1.0	5.0
Be	19.3		23.7	20.8									19.5		4	20.8	2.0	9.8
Co	7.9		8.4	7.7			7.6						8.1		5	7.9	0.3	4.0
Cr			36.3 (DRC)		35.8 (ETAAS)	35.2 (DRC)	39.3 (DRC)				31.9				5	35.7	2.6	7.4
Cs	79.2		71.3	76.5									79.0		4	76.5	3.7	4.8
Cu			727.9		696.1	768.0 (DRC)	688.0		791.7						5	734.3	44.9	6.1
I		52.0 (DRC)													1	52.0	NA	NA
Mg										45000					1	45000	NA	NA
Mn			18.4			17.7 (DRC)		18.1		19.7					4	18.5	0.9	4.7
Mo	208.4		206.7	215									215		4	211.3	4.4	2.1
Ni			21.1		17.8										2	19.5	2.3	12.0
Pt	7.0		7.1	7.0									6.9		4	7.0	0.1	1.3
Sb	15.2		14.2	15.5									15.2		4	15.0	0.6	3.8
Se	188.2 (DRC)		187.8 (DRC)	210 (DRC)		183	182.0			182.6			193 (DRC)		7	189.5	9.9	5.2
Sn			37.5												1	37.5	NA	NA
Te			12.5												1	12.5	NA	NA
Tl	37.6		38.1	38.5		37.6	34.0	35.2					37.3		7	36.9	1.7	4.5
U	1.9		1.7	1.9									1.8	1.8	5	1.8	0.1	4.9
V			15.3 (DRC)												1	15.3	NA	NA
W	14.9		14.8	14.8									15.0		4	14.9	0.1	0.6
Zn			799.6		756.2	923.5 (DRC)	812.0								4	822.8	71.3	8.7

New York State Department of Health
Event #1, 2007
Urine Additional Elements

UE07-02

Lab Code	102	107	110	116	164	179	197	206	287	305	347	359	385	404	n	Mean	SD	%RSD
Element (µg/L)	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ETAAS	ICP-MS	ETAAS	ICP-MS	ICP-MS	HR-ICP-MS				
Al			31.0 (DRC)		35	29.0	45.0			36.2		35.6			6	35.3	5.5	15.7
Ba	5.2		4.4	5.2									5.1		4	5.0	0.4	7.5
Be	4.7		6.2	4.7									4.7		4	5.1	0.7	14.8
Co	2.0		2.2	1.9			1.9						1.8		5	2.0	0.1	7.6
Cr			8.3 (DRC)		9.4 (ETAAS)	8.6 (DRC)	9.5 (DRC)				7.7				5	8.7	0.8	8.7
Cs	20.0		17.3	19.9									19.9		4	19.3	1.3	6.8
Cu			183.9		177.0	196.0 (DRC)	175.6		190.6						5	184.6	8.7	4.7
I		42.8 (DRC)													1	42.8	NA	NA
Mg										21000					1	21000	NA	NA
Mn			4.6			4.4 (DRC)		4.8		5.3					4	4.8	0.4	8.1
Mo	53.9		51.8	53.7									53.4		4	53.2	1.0	1.8
Ni			6.3		4.9										2	5.6	1.0	17.7
Pt	1.7		1.7	1.7									1.7		4	1.7	0.02	1.3
Sb	3.7		3.3	3.8									3.6		4	3.6	0.2	5.7
Se	53.0 (DRC)		53.1 (DRC)	58.5 (DRC)		52.4	55.0			52.9			50.5 (DRC)		7	53.6	2.5	4.7
Sn			8.6												1	8.6	NA	NA
Te			3.2												1	3.2	NA	NA
Tl	9.1		9.3	9.6		9.0	8.4	8.4					9.1		7	9.0	0.4	5.0
U	0.5		0.4	0.5									0.5	0.5	5	0.5	0.04	9.0
V			3.0 (DRC)												1	3.0	NA	NA
W	3.6		3.5	3.8									3.7		4	3.6	0.1	3.5
Zn			221.0		228.5	292.0 (DRC)	242.0								4	245.9	32.0	13.0

New York State Department of Health
Event #1, 2007
Urine Additional Elements

UE07-03

Lab Code	102	107	110	116	164	179	197	206	287	305	347	359	385	404	n	Mean	SD	%RSD
Element (µg/L)	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ETAAS	ICP-MS	ETAAS	ICP-MS	ICP-MS	HR-ICP-MS				
Al			46.1 (DRC)		48	44.8	55.0			59.0		54.4			6	51.2	5.7	11.1
Ba	7.6		6.4	7.6									7.5		4	7.3	0.6	8.0
Be	6.9		9.1	6.8									6.8		4	7.4	1.1	15.4
Co	2.9		3.2	2.8			2.9						2.9		5	2.9	0.2	5.2
Cr			12.9 (DRC)		13.6 (ETAAS)	13.5 (DRC)	13.5 (DRC)				11.6				5	13.0	0.8	6.5
Cs	29.6		25.6	29.8									29.1		4	28.5	2.0	6.9
Cu			269.2		260.6	283.5 (DRC)	260.3		283.8						5	271.5	11.7	4.3
I		56.9 (DRC)													1	56.9	NA	NA
Mg										28000					1	28000	NA	NA
Mn			6.7			6.7 (DRC)		6.7		7.4					4	6.9	0.4	5.1
Mo	78.3		76.2	80.0									79.2		4	78.4	1.6	2.1
Ni			8.9		7.0										2	8.0	1.3	16.9
Pt	2.6		2.6	2.6									2.5		4	2.6	0.1	2.1
Sb	5.4		4.9	5.6									5.4		4	5.3	0.3	5.9
Se	76.9 (DRC)		70.9 (DRC)	81.3 (DRC)		73.9	83.0			73.8			78.3 (DRC)		7	76.9	4.3	5.6
Sn			13.0												1	13.0	NA	NA
Te			4.6												1	4.6	NA	NA
Tl	13.6		13.9	14.1		13.4	12.3	12.8					13.4		7	13.4	0.6	4.7
U	0.7		0.6	0.7									0.7	0.7	5	0.7	0.04	6.6
V			5.5 (DRC)												1	5.5	NA	NA
W	5.4		5.4	5.5									5.4		4	5.4	0.1	1.4
Zn			324.8		323.8	401.0 (DRC)	336.0								4	346.4	36.8	10.6

New York State Department of Health
Event #1, 2007
Urine Additional Elements

UE07-04

Lab Code	102	107	110	116	164	179	197	206	287	305	347	359	385	404	n	Mean	SD	%RSD
Element (µg/L)	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ETAAS	ICP-MS	ETAAS	ICP-MS	ICP-MS	HR-ICP-MS				
Al			106.4 (DRC)		94	97.2	96.0			106.0		113.4			6	102.2	7.6	7.4
Ba	18.0		16.4	18.1									17.5		4	17.5	0.8	4.4
Be	13.3		15.4	12.9									13.3		4	13.7	1.1	8.2
Co	6.1		6.4	6.2			6.0						6.5		5	6.2	0.2	3.3
Cr			26.7 (DRC)		25.3 (ETAAS)	24.6 (DRC)	24.5 (DRC)				27.0				5	25.6	1.2	4.6
Cs	59.1		54.9	56.1									58.4		4	57.1	2.0	3.4
Cu			546.4		542.4	574.0 (DRC)	544.3		646.2						5	570.7	44.2	7.7
I		80.1 (DRC)													1	80.1	NA	NA
Mg										60000					1	60000	NA	NA
Mn			12.5			13.2 (DRC)		12.1		13.9					4	12.9	0.8	6.1
Mo	233.8		226.0	242									243		4	236.2	8.0	3.4
Ni			16.3		13.2										2	14.8	2.2	14.9
Pt	5.2		5.3	5.3									5.1		4	5.2	0.1	1.7
Sb	10.4		10.0	10.2									10.3		4	10.2	0.2	1.8
Se	160.9 (DRC)		164.3 (DRC)	126 (DRC)		149.1	155.0			150.6			172 (DRC)		7	154.0	14.7	9.6
Sn			31.2												1	31.2	NA	NA
Te			10.2												1	10.2	NA	NA
Tl	24.2		24.6	23.7		24.3	21.8	22.3					23.7		7	23.5	1.1	4.5
U	1.2		1.2	1.3									1.2	1.2	5	1.2	0.02	2.0
V			11.9 (DRC)												1	11.9	NA	NA
W	10.3		10.1	10.2									10.4		4	10.3	0.1	1.3
Zn			691.7		670.0	766.5 (DRC)	699.0								4	706.8	41.7	5.9

New York State Department of Health
Event #1, 2007
Urine Additional Elements

UE07-05

Lab Code	102	107	110	116	164	179	197	206	287	305	347	359	385	404	n	Mean	SD	%RSD
Element (µg/L)	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ETAAS	ICP-MS	ETAAS	ICP-MS	ICP-MS	HR-ICP-MS				
Al			90.0 (DRC)		86	85.7	92.0			98.0		102.3			6	92.3	6.7	7.2
Ba	17.1		15.3	17.2									16.5		4	16.5	0.9	5.3
Be	12.5		15.2	12.2									12.3		4	13.0	1.4	11.0
Co	5.8		6.2	5.7			5.7						6.2		5	5.9	0.3	4.3
Cr			22.1 (DRC)		23.5 (ETAAS)	23.5 (DRC)	22.7 (DRC)				24.4				5	23.2	0.9	3.8
Cs	55.6		50.4	52.0									54.6		4	53.1	2.4	4.5
Cu			514.1		510.5	541.5 (DRC)	505.6		602.6						5	534.9	40.4	7.5
I		79.3 (DRC)													1	79.3	NA	NA
Mg										60000					1	60000	NA	NA
Mn			11.9			12.7 (DRC)		12.2		13.0					4	12.5	0.5	4.0
Mo	225.3		217.6	231									233		4	226.7	6.9	3.0
Ni			16.0		12.2										2	14.1	2.7	19.1
Pt	4.8		4.8	4.7									4.7		4	4.8	0.05	1.0
Sb	9.6		9.1	9.6									9.6		4	9.5	0.3	2.7
Se	149.7 (DRC)		149.9 (DRC)	120 (DRC)		143.6	142.0			145.3			162 (DRC)		7	144.6	12.7	8.8
Sn			28.9												1	28.9	NA	NA
Te			9.0												1	9.0	NA	NA
Tl	22.3		22.7	22.6		21.9	20.5	22.3					22.0		7	22.0	0.7	3.3
U	1.1		1.1	1.2									1.1	1.5	5	1.2	0.2	14.1
V			9.8 (DRC)												1	9.8	NA	NA
W	9.6		9.4	9.4									9.7		4	9.5	0.2	1.6
Zn			670.6		647.7	727.5 (DRC)	667.0								4	678.2	34.4	5.1

New York State Department of Health
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.