
Wadsworth Center

New York State Department of Health

TRACE ELEMENTS IN URINE

Event #3, 2006

October 30, 2006

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**Trace Elements in Urine
Event #3, 2006**

Dear Laboratory Director:

Results from the third Trace Elements in Urine proficiency test (PT) event have been tabulated and summarized. Target values for Arsenic, Cadmium, Mercury and Lead have been established along with acceptable ranges. As of 2006, the interlaboratory studies for trace elements are being conducted as proficiency testing events. A laboratory with an apparent significant analytical bias relative to the target value will be expected to investigate the source of the error.

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 filtered 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, Ti, 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 next PT event for trace elements in urine is scheduled to be mailed January 9th, 2007. Please inform our laboratory staff at (518) 474-4484 if the test materials have not arrived within five days of the scheduled mailout date. **The postmark deadline for reporting results is February 6th, 2007.**

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 filtered urine pools as a mercury preservative. Each pool was supplemented with inorganic As³⁺, 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 13 referee laboratories using quadrupole-based ICP-MS or ETAAS instrumentation. Values range from 19.7 µg/L (0.26 µmol/L) to 161.3 µg/L (2.15 µmol/L). Among the referee group, imprecision (SD) varied from ±1.4 µg/L (0.02 µmol/L) to ±8.5 µg/L (0.11 µmol/L).

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, 94.5% of all reported test results were satisfactory, with only 1 out of 22 laboratories (4.5%) reporting 2 or more results outside the acceptable range.

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

Lab Code	Method	Results ($\mu\text{g/L}$ urine)					Info Only
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15	
Target Values:		19.7	28.3	20.2	40.0	161.3	
107	DRC/CC-ICP-MS	19.6	28.5	19.0	40.6	169.1	
109	ETAAS-Z	20	29	15	37	161	
110	DRC/CC-ICP-MS	17.1	26.1	18.4	37.9	151.4	
114	ICP-MS	17	25	21	37	152	
116	DRC/CC-ICP-MS	11.1	25.9	17.3	35.2	111.2 ↓	Info
147	ICP-MS	18.2	27.8	19.3	38.9	155.8	
156	ICP-MS	20.5	30.7	21.4	44.3	170.0	
159	ICP-MS	22.0	23.1	29.8	35.3	147.4	
164	ICP-MS	19.8	28.2	21.5	41.3	159.3	
179	ICP-MS	21	31	21	42	162.7	
197	DRC/CC-ICP-MS	18	27	18	38	159	
200	ICP-MS	20.2	29.3	20.7	41.8	172	
206	ICP-MS	20.9	31.8	22.5	42.7	147.1	
208	ICP-MS	21.0	29.2	20.2	42.9	169.1	
305	ICP-MS	18.6	29.3	21.2	40.7	149.6	
312	ICP-MS	18.9	26.7	20.5	38.4	153.5	
324	DRC/CC-ICP-MS	18.7	27.2	17.5	39.6	160.5	Info
339	HR-ICP-MS	20.1	28.5	16.6	38.8	170	
359	ICP-MS	18.0	29.6	23.7	43.2	166.1	
366	ICP-MS	19.0	30.0	26.0	41.0	162.5	Info
385	DRC/CC-ICP-MS	20.4	30.0	20.1	40.1	165	Info
404	HR-ICP-MS	57.6 ↑	111.4 ↑	59.0 ↑	84.5 ↑	213.9 ↑	Info

Percent satisfactory results for all participants: 94.5 %

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 Arsenic Test Results, 2006 Event #3
STATISTICAL SUMMARY**

TARGET VALUE ASSIGNMENT AND STATISTICS

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

Lab Code	Method	Results ($\mu\text{g/L}$ urine)				
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
107	DRC/CC-ICP-MS	19.6	28.5	19.0	40.6	169.1
109	ETAAS-Z	20	29	15	37	161
110	DRC/CC-ICP-MS	17.1	26.1	18.4	37.9	151.4
147	ICP-MS	18.2	27.8	19.3	38.9	155.8
156	ICP-MS	20.5	30.7	21.4	44.3	170.0
159	ICP-MS	22.0	23.1	29.8	35.3	147.4
164	ICP-MS	19.8	28.2	21.5	41.3	159.3
179	ICP-MS	21	31	21	42	162.7
197	DRC/CC-ICP-MS	18	27	18	38	159
200	ICP-MS	20.2	29.3	20.7	41.8	172
208	ICP-MS	21.0	29.2	20.2	42.9	169.1
305	ICP-MS	18.6	29.3	21.2	40.7	149.6
339	HR-ICP-MS	20.1	28.5	16.6	38.8	170
Number of Sample Measurements:		13	13	13	13	13
Target value:		19.7	28.3	20.2	40.0	161.3
Standard Deviation:		1.4	2.0	3.5	2.6	8.5
RSD (%):		7.0	7.2	17.4	6.4	5.2
Acceptable Range:						
Upper Limit:		29.7	38.3	30.2	50.0	193.6
Lower Limit:		9.7	18.3	10.2	30.0	129.0

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, 2006 Event #3
STATISTICAL SUMMARY BY METHOD**

	Results ($\mu\text{g/L}$ urine)				
	UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	6	6	6	6	6
Mean:	17.5	27.5	18.4	38.6	152.7
Standard Deviation:	3.3	1.6	1.0	2.0	21.2
RSD (%):	19.1	5.7	5.7	5.1	13.9
ETAAS-Z					
Number of Sample Measurements:	1	1	1	1	1
Mean:	20.0	29.0	15.0	37.0	161.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	1	1	1	1	2
Mean:	20.1	28.5	16.6	38.8	192.0
Standard Deviation:	?	?	?	?	31.0
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	13	13	13	13	13
Mean:	19.6	28.6	22.2	40.7	159.0
Standard Deviation:	1.5	2.5	2.8	2.6	8.8
RSD (%):	7.5	8.6	12.8	6.4	5.5
All Laboratories					
Number of Sample Measurements:	21	21	21	21	22
Mean:	19.1	28.3	20.5	39.8	160.4
Standard Deviation:	2.3	2.1	3.3	2.6	17.6
RSD (%):	11.9	7.5	15.9	6.4	11.0

notes: ? Insufficient data for SD calculation.

**New York State Department of Health
Urine Arsenic Test Results, 2006 Event #3
STATISTICAL SUMMARY BY CLASS**

	Results ($\mu\text{g/L}$ urine)				
	UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
Evaluated					
Number of Sample Measurements:	4	4	4	4	4
Mean:	18.7	28.3	21.9	40.3	154.7
Standard Deviation:	1.7	3.0	1.5	3.1	8.1
RSD (%):	8.9	10.7	6.6	7.7	5.2
Info					
Number of Sample Measurements:	4	4	4	4	5
Mean:	17.3	28.3	20.2	39.0	162.6
Standard Deviation:	4.2	2.1	4.1	2.6	36.3
RSD (%):	24.3	7.3	20.1	6.6	22.3
Reference					
Number of Sample Measurements:	13	13	13	13	13
Mean:	19.7	28.3	20.2	40.0	161.3
Standard Deviation:	1.4	2.0	3.5	2.6	8.5
RSD (%):	7.0	7.2	17.4	6.4	5.2
All Laboratories					
Number of Sample Measurements:	21	21	21	21	22
Mean:	19.1	28.3	20.5	39.8	160.4
Standard Deviation:	2.3	2.1	3.3	2.6	17.6
RSD (%):	11.9	7.5	15.9	6.4	11.0

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 filtered urine pools as a mercury preservative. Each pool was supplemented with inorganic Cd²⁺, 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 13 referee laboratories using either quadrupole-based ICP-MS or ETAAS instrumentation. Values range from 3.6 µg/L (32 nmol/L) to 15.3 µg/L (136 nmol/L). Among the referee group, imprecision (SD) varied from ±0.2 µg/L (2 nmol/L) to ±1.1 µg/L (10 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, 92.0% of all reported test results were satisfactory, with only 3 out of 25 laboratories (12.0%) reporting 2 or more results outside the acceptable range.

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

Lab Code	Method	Results ($\mu\text{g/L}$ urine)					Info Only
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15	
Target Values:		3.6	5.3	9.3	7.5	15.3	
103	ETAAS-Z	3.5	5.4	10.6	8.2	15	Info
107	DRC/CC-ICP-MS	3.3	5.0	9.0	6.9	13.7	
110	ICP-MS	3.3	5.0	8.9	7.0	14.4	
110	ETAAS-Z	3.8	5.0	9.4	7.5	15.9	
114	ICP-MS	3.3	4.9	8.7	6.7	13.9	
116	ICP-MS	3.5	5.2	9.2	7.3	14.7	Info
126	ETAAS-Z	3.7	5.5	10.3	7.9	16.0	
147	ICP-MS	3.7	5.4	9.4	7.6	15.3	
156	ICP-MS	3.6	5.5	9.9	7.4	15.1	
159	ICP-MS	3.9	6.1	9.8	8.3	16.7	
164	ICP-MS	3.4	5.1	9.2	7.2	14.5	
179	ICP-MS	4.1	6.0	10.0	8.5	16.8	
197	ICP-MS	3.5	5.4	9.6	7.6	15.2	
200	ETAAS-Z	3.7	5.6	8.9	8.1	15.7	
206	ICP-MS	3.5	5.1	8.7	7.1	14.5	
208	ICP-MS	3.8	5.8	9.1	8.2	17.3	
305	ICP-MS	4.0	5.6	9.5	8.8 \uparrow	19.4 \uparrow	
312	ICP-MS	3.5	4.9	9.0	7.3	14.8	
324	ICP-MS	3.6	5.5	9.9	7.7	16.2	
339	HR-ICP-MS	3.0	4.5	7.2 \downarrow	5.9 \downarrow	12 \downarrow	Info
359	ICP-MS	3.4	5.4	11.3 \uparrow	8.2	16.6	
366	ICP-MS	3.5	4.9	9.1	6.7	14.5	Info
367	ETAAS-Z	2.4 \downarrow	3.5 \downarrow	8.3	5.7 \downarrow	10.0 \downarrow	Info
385	ICP-MS	3.3	5.0	8.6	7.0	13.8	Info
404	HR-ICP-MS	3.5	5.1	9.6	7.3	14.9	Info

Percent satisfactory results for all participants: 92.0 %

notes: \uparrow reported outside upper limit
 \downarrow 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, 2006 Event #3
STATISTICAL SUMMARY**

TARGET VALUE ASSIGNMENT AND STATISTICS

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

Lab Code	Method	Results ($\mu\text{g/L}$ urine)				
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
107	DRC/CC-ICP-MS	3.3	5.0	9.0	6.9	13.7
110	ICP-MS	3.3	5.0	8.9	7.0	14.4
110	ETAAS-Z	3.8	5.0	9.4	7.5	15.9
114	ICP-MS	3.3	4.9	8.7	6.7	13.9
126	ETAAS-Z	3.7	5.5	10.3	7.9	16.0
147	ICP-MS	3.7	5.4	9.4	7.6	15.3
164	ICP-MS	3.4	5.1	9.2	7.2	14.5
179	ICP-MS	4.1	6.0	10.0	8.5	16.8
197	ICP-MS	3.5	5.4	9.6	7.6	15.2
200	ETAAS-Z	3.7	5.6	8.9	8.1	15.7
206	ICP-MS	3.5	5.1	8.7	7.1	14.5
208	ICP-MS	3.8	5.8	9.1	8.2	17.3
324	ICP-MS	3.6	5.5	9.9	7.7	16.2
Number of Sample Measurements:		13	13	13	13	13
Target value:		3.6	5.3	9.3	7.5	15.3
Standard Deviation:		0.2	0.3	0.5	0.5	1.1
RSD (%):		6.7	6.5	5.5	7.2	7.2
Acceptable Range:						
Upper Limit:		4.6	6.3	10.7	8.6	17.6
Lower Limit:		2.6	4.3	7.9	6.4	13.0

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, 2006 Event #3**

STATISTICAL SUMMARY BY METHOD

	Results ($\mu\text{g/L}$ urine)				
	UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	3.3	5.0	9.0	6.9	13.7
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	5	5	5	5	5
Mean:	3.4	5.0	9.5	7.5	14.5
Standard Deviation:	0.6	0.9	1.0	1.0	2.6
RSD (%):	17.0	17.4	10.1	13.8	17.6
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	3.3	4.8	8.4	6.6	13.5
Standard Deviation:	0.4	0.4	1.7	1.0	2.1
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	17	17	17	17	17
Mean:	3.6	5.3	9.4	7.6	15.5
Standard Deviation:	0.2	0.4	0.7	0.6	1.5
RSD (%):	6.8	7.1	7.0	8.4	9.4
All Laboratories					
Number of Sample Measurements:	25	25	25	25	25
Mean:	3.5	5.2	9.3	7.4	15.1
Standard Deviation:	0.3	0.5	0.8	0.8	1.8
RSD (%):	9.6	9.9	8.6	10.1	11.9

notes: ? Insufficient data for SD calculation.

**New York State Department of Health
Urine Cadmium Test Results, 2006 Event #3
STATISTICAL SUMMARY BY CLASS**

	Results ($\mu\text{g/L}$ urine)				
	UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
Evaluated					
Number of Sample Measurements:	5	5	5	5	5
Mean:	3.7	5.5	9.9	8.0	16.5
Standard Deviation:	0.3	0.4	0.9	0.6	1.8
RSD (%):	7.0	7.8	8.7	8.0	11.0
Info					
Number of Sample Measurements:	7	7	7	7	7
Mean:	3.2	4.8	8.9	6.9	13.6
Standard Deviation:	0.4	0.6	1.1	0.9	1.9
RSD (%):	12.8	13.3	11.9	12.6	13.9
Reference					
Number of Sample Measurements:	13	13	13	13	13
Mean:	3.6	5.3	9.3	7.5	15.3
Standard Deviation:	0.2	0.3	0.5	0.5	1.1
RSD (%):	6.7	6.5	5.5	7.2	7.2
All Laboratories					
Number of Sample Measurements:	25	25	25	25	25
Mean:	3.5	5.2	9.3	7.4	15.1
Standard Deviation:	0.3	0.5	0.8	0.8	1.8
RSD (%):	9.6	9.9	8.6	10.1	11.9

notes: ? Insufficient data for SD 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, 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 filtered urine pools as a mercury preservative. Each pool was supplemented with inorganic Hg²⁺, 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 9 referee laboratories using either quadrupole-based ICP-MS or CV-AAS instrumentation. Values range from 4.0 µg/L (20 nmol/L) to 198.4 µg/L (989 nmol/L). Among the referee group, imprecision (SD) varied from ±0.9 µg/L (4 nmol/L) to ±16.6 µg/L (83 nmol/L).

Acceptable ranges were fixed at ±20% or ±3 µg/L (15 nmol/L) around the target value, whichever is greater.

Discussion. Based upon these criteria, 85.8% of all reported test results were satisfactory, with only 6 out of 24 laboratories (25.0%) reporting 2 or more results outside the acceptable range.

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

Lab Code	Method	Results ($\mu\text{g/L}$ urine)					Info Only
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15	
Target Values:		44.0	29.8	4.0	11.3	198.4	
103	CV-AAS	40	27	3.1	10	180	
107	DRC/CC-ICP-MS	47.6	33.2	4.3	15.5 \uparrow	206.3	Info
108	CV-AAS	32.0 \downarrow	17.7 \downarrow	1.8	6.9 \downarrow	159.9	
109	AFS	36	26	3	8 \downarrow	164	Info
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 \downarrow	
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 \downarrow	20.7 \downarrow	3.4	8.7	135 \downarrow	Info
206	ICP-MS	29.0 \downarrow	18.0 \downarrow	2.0	9.0	153.0 \downarrow	
208	ICP-MS	41.7	27.9	<5.0	11.3	194.3	
305	ICP-MS	49.7	38.0 \uparrow	5.1	14.0	221.9	
312	ICP-MS	34.3 \downarrow	21.3 \downarrow	2.9	9.6	170.5	
324	ICP-MS	38.2	28.4	3.2	11.2	208.4	Info
339	HR-ICP-MS	35.8	24.1	3.1	9.1	194	Info
347	CV-AAS	39	24	2	11	200	Info
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 \uparrow	13.65	150.68 \downarrow	Info

Percent satisfactory results for all participants: 85.8 %

notes: \uparrow reported outside upper limit
 \downarrow 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, 2006 Event #3
STATISTICAL SUMMARY**

TARGET VALUE ASSIGNMENT AND STATISTICS

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

Lab Code	Method	Results ($\mu\text{g/L}$ urine)				
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
103	CV-AAS	40	27	3.1	10	180
110	ICP-MS	46.8	30.6	3.3	11.2	192.3
147	ICP-MS	44.0	30.2	3.0	11.7	184.5
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
208	ICP-MS	41.7	27.9	<5.0	11.3	194.3
366	ICP-MS	40.5	28.6	4.2	10.5	231.0
Number of Sample Measurements:		9	9	7	9	9
Target value:		44.0	29.8	4.0	11.3	198.4
Standard Deviation:		3.6	2.0	1.4	0.9	16.6
RSD (%):		8.3	6.7	34.6	8.4	8.4
Acceptable Range:						
Upper Limit:		52.8	35.8	7.0	14.3	238.1
Lower Limit:		35.2	23.8	1.0	8.3	158.7

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, 2006 Event #3
STATISTICAL SUMMARY BY METHOD**

	Results ($\mu\text{g/L}$ urine)				
	UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
AFS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	36.0	26.0	3.0	8.0	164.0
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
CV-AAS					
Number of Sample Measurements:	5	5	3	4	5
Mean:	39.1	24.9	2.3	9.7	150.7
Standard Deviation:	5.6	4.8	0.7	1.9	56.7
RSD (%):	14.4	19.4	—	20.0	37.6
DRC/CC-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	46.3	32.3	4.9	13.6	201.1
Standard Deviation:	1.9	1.3	0.8	2.8	7.4
RSD (%):	—	—	—	—	—
HR-ICP-MS					
Number of Sample Measurements:	2	2	1	2	2
Mean:	37.5	24.5	3.1	11.4	172.3
Standard Deviation:	2.4	0.5	?	3.2	30.6
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	14	14	12	14	14
Mean:	42.0	28.5	3.9	11.2	194.3
Standard Deviation:	7.0	5.3	1.3	1.5	27.6
RSD (%):	16.7	18.6	33.8	13.1	14.2
All Laboratories					
Number of Sample Measurements:	24	24	19	23	24
Mean:	41.1	27.6	3.6	11.0	182.7
Standard Deviation:	6.3	5.0	1.3	2.0	37.3
RSD (%):	15.3	18.1	35.7	18.0	20.4

notes: ? Insufficient data for SD calculation.

**New York State Department of Health
Urine Mercury Test Results, 2006 Event #3
STATISTICAL SUMMARY BY CLASS**

	Results ($\mu\text{g/L}$ urine)				
	UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
Evaluated					
Number of Sample Measurements:	8	8	6	7	8
Mean:	40.6	26.7	3.7	10.6	167.6
Standard Deviation:	8.4	7.3	1.7	2.3	54.1
RSD (%):	20.8	27.4	45.1	21.8	32.3
Info					
Number of Sample Measurements:	7	7	6	7	7
Mean:	38.0	25.9	3.2	11.0	179.8
Standard Deviation:	5.2	4.0	0.7	2.7	29.5
RSD (%):	13.6	15.3	23.3	24.9	16.4
Reference					
Number of Sample Measurements:	9	9	7	9	9
Mean:	44.0	29.8	4.0	11.3	198.4
Standard Deviation:	3.6	2.0	1.4	0.9	16.6
RSD (%):	8.3	6.7	34.6	8.4	8.4
All Laboratories					
Number of Sample Measurements:	24	24	19	23	24
Mean:	41.1	27.6	3.6	11.0	182.7
Standard Deviation:	6.3	5.0	1.3	2.0	37.3
RSD (%):	15.3	18.1	35.7	18.0	20.4

notes: ? Insufficient data for SD 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, 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- μ m Teflon membrane. Sulfamic acid was added to the filtered urine pools as a mercury preservative. Each pool was supplemented with inorganic Pb²⁺, 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 11 referee laboratories using quadrupole-based ICP-MS instrumentation. Values range from 40.6 μ g/L (0.20 μ mol/L) to 349.9 μ g/L (1.69 μ mol/L). Among the referee group, imprecision (SD) varied from \pm 2.4 μ g/L (0.01 μ mol/L) to \pm 9.4 μ g/L (0.05 μ mol/L), increasing with concentration.

Acceptable ranges were fixed at \pm 10% or \pm 40 μ g/L (0.19 μ mol/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, 93.8% of all reported test results were satisfactory, with only 1 out of 26 laboratories (3.8%) reporting 2 or more results outside the acceptable range.

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

Lab Code	Method	Results ($\mu\text{g/L}$ urine)					Info Only
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15	
Target Values:		349.9	77.7	40.6	109.7	220.9	
103	ETAAS-Z	384	88	43	126	235	Info
107	DRC/CC-ICP-MS	354.1	79.1	40.4	109.4	224.2	
108	ETAAS-Z	350.0	80.0	45.0	110.0	220.0	
110	ICP-MS	351.2	77.9	41.2	108.8	223.5	
110	ETAAS-Z	306 ↓	73	33	86	186	
114	ICP-MS	336	71	38	107	212	
116	ICP-MS	341.3	82.6	42.5	114.7	218.6	Info
147	ICP-MS	350.2	78.5	40.8	110.9	217.6	
156	ICP-MS	339.0	76.4	46.3	108.6	213.5	
159	ICP-MS	431.9 ↑	86.8	45.2	122.2	245.3	
164	ICP-MS	342.8	77.6	43.9	109.4	224.0	
179	ICP-MS	361.7	81.4	42	114.4	230.8	
197	ICP-MS	371.3	82.1	40.6	113.1	225.7	
200	ICP-MS	368	83.4	44.7	116	234	
206	ICP-MS	338.0	74.0	38.0	107.0	208.0	
208	ICP-MS	347.6	75.7	37.9	111.3	219.5	
305	ICP-MS	406.0 ↑	92.7	48.3	134.4	252.6	
312	ICP-MS	333.0	66.7	33.8	96.1	199.7	
324	ICP-MS	351.2	78.0	41.5	107.7	212.7	
339	HR-ICP-MS	348	78.4	38.3	105	224	
347	ETAAS-Z	444 ↑	103	49	160 ↑	295 ↑	Info
359	ICP-MS	>100.0	74.9	37.5	>100.0	>100.0	
366	ICP-MS	328.5	64.0	33.0	92.5	203.0	Info
383	ETAAS-Z	406.0 ↑	71.9	39.9	112.3	211.9	
385	ICP-MS	372	81.9	42.6	113	232	Info
404	HR-ICP-MS	331.3	65.0	32.8	86.9	173.3 ↓	Info

Percent satisfactory results for all participants: 93.8 %

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 Lead Test Results, 2006 Event #3
STATISTICAL SUMMARY**

TARGET VALUE ASSIGNMENT AND STATISTICS

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

Lab Code	Method	Results ($\mu\text{g/L}$ urine)				
		UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
107	DRC/CC-ICP-MS	354.1	79.1	40.4	109.4	224.2
110	ICP-MS	351.2	77.9	41.2	108.8	223.5
114	ICP-MS	336	71	38	107	212
147	ICP-MS	350.2	78.5	40.8	110.9	217.6
164	ICP-MS	342.8	77.6	43.9	109.4	224.0
179	ICP-MS	361.7	81.4	42	114.4	230.8
200	ICP-MS	368	83.4	44.7	116	234
206	ICP-MS	338.0	74.0	38.0	107.0	208.0
208	ICP-MS	347.6	75.7	37.9	111.3	219.5
324	ICP-MS	351.2	78.0	41.5	107.7	212.7
339	HR-ICP-MS	348	78.4	38.3	105	224
Number of Sample Measurements:		11	11	11	11	11
Target value:		349.9	77.7	40.6	109.7	220.9
Standard Deviation:		9.4	3.3	2.4	3.3	8.0
RSD (%):		2.7	4.3	5.9	3.0	3.6
Acceptable Range:						
Upper Limit:		389.9	117.7	80.6	149.7	260.9
Lower Limit:		309.9	37.7	0.6	69.7	180.9

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, 2006 Event #3
STATISTICAL SUMMARY BY METHOD**

	Results ($\mu\text{g/L}$ urine)				
	UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
DRC/CC-ICP-MS					
Number of Sample Measurements:	1	1	1	1	1
Mean:	354.1	79.1	40.4	109.4	224.2
Standard Deviation:	?	?	?	?	?
RSD (%):	—	—	—	—	—
ETAAS-Z					
Number of Sample Measurements:	5	5	5	5	5
Mean:	378.0	83.2	42.0	118.9	229.6
Standard Deviation:	52.8	12.8	6.0	27.1	40.7
RSD (%):	14.0	15.4	14.3	22.8	17.7
HR-ICP-MS					
Number of Sample Measurements:	2	2	2	2	2
Mean:	339.7	71.7	35.6	96.0	198.7
Standard Deviation:	11.8	9.5	3.9	12.8	35.9
RSD (%):	—	—	—	—	—
ICP-MS					
Number of Sample Measurements:	17	18	18	17	17
Mean:	357.0	78.1	41.0	111.0	221.9
Standard Deviation:	27.1	6.8	4.1	9.2	14.1
RSD (%):	7.6	8.8	10.0	8.3	6.3
All Laboratories					
Number of Sample Measurements:	25	26	26	25	25
Mean:	359.7	78.6	40.7	111.3	221.7
Standard Deviation:	32.7	8.4	4.5	14.8	22.8
RSD (%):	9.1	10.6	11.0	13.3	10.3

notes: ? Insufficient data for SD calculation.

**New York State Department of Health
Urine Lead Test Results, 2006 Event #3
STATISTICAL SUMMARY BY CLASS**

	Results ($\mu\text{g/L}$ urine)				
	UE06-11	UE06-12	UE06-13	UE06-14	UE06-15
Evaluated					
Number of Sample Measurements:	8	9	9	8	8
Mean:	367.9	78.3	41.1	110.3	219.3
Standard Deviation:	43.5	8.0	5.5	14.8	22.1
RSD (%):	11.8	10.3	13.5	13.4	10.1
Info					
Number of Sample Measurements:	6	6	6	6	6
Mean:	366.9	80.8	40.5	115.5	226.2
Standard Deviation:	44.0	14.7	6.4	26.2	40.6
RSD (%):	12.0	18.2	15.7	22.7	17.9
Reference					
Number of Sample Measurements:	11	11	11	11	11
Mean:	349.9	77.7	40.6	109.7	220.9
Standard Deviation:	9.4	3.3	2.4	3.3	8.0
RSD (%):	2.7	4.3	5.9	3.0	3.6
All Laboratories					
Number of Sample Measurements:	25	26	26	25	25
Mean:	359.7	78.6	40.7	111.3	221.7
Standard Deviation:	32.7	8.4	4.5	14.8	22.8
RSD (%):	9.1	10.6	11.0	13.3	10.3

notes: ? Insufficient data for SD calculation.

New York State Department of Health
Event #3, 2006

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

NYS Elements

Al
Cr
Cu
Mn
Ni
Se
Sn
Te
V
Zn

**New York State Department of Health
Event #3, 2006
Urine Additional Elements**

UE06-11

Element	Lab Code	107	110	116	179	197	287	347	385	n	Mean	SD	%R.S.D.
(µg/L)	Technique	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ETAAS	ETAAS	ICP-MS				
Al			37.8 (DRC)			32.0				2	34.9	4.1	11.8
Ba			4.4	4.9					4.9	3	4.7	0.3	6.1
Be		4.3	6.8	4.5					4.5	4	5.0	1.2	23.6
Co		1.8	2.2	1.9		1.7			1.9	5	1.9	0.2	9.8
Cr			9.5 (DRC)			8.4 (DRC)		9.6		3	9.2	0.7	7.2
Cs		19.9	17.5	20.0					19.7	4	19.3	1.2	6.2
Cu			194.4			187.7	181.6			3	187.9	6.4	3.4
Mn			5.2							1	5.2	NA	NA
Mo		50.6	51.1	52.5					51.9	4	51.5	0.8	1.6
Ni			8.3							1	8.3	NA	NA
Pt		1.6	1.7	1.7					1.7	4	1.7	0.1	3.0
Sb		3.6	3.5	3.7					3.6	4	3.6	0.1	2.3
Se			60.2	30.1 (DRC)		<50.0			53.2 (DRC)	3	47.8	15.8	32.9
Sn			8.3							1	8.3	NA	NA
Te													
Tl		8.9	9.2	9.6	<10	9.3			9.5	5	9.3	0.3	2.9
U		0.4	0.4	0.5					0.453	4	0.4	0.0	11.0
V			3.3 (DRC)							1	3.3	NA	NA
W		3.6	3.7	3.7					3.7	4	3.7	0.1	1.4
Zn			267.6			253.0				2	260.3	10.3	4.0

New York State Department of Health
Event #3, 2006
Urine Additional Elements

UE06-12

Element (µg/L)	Lab Code Technique	107 ICP-MS	110 ICP-MS	116 ICP-MS	179 ICP-MS	197 ICP-MS	287 ETAAS	347 ETAAS	385 ICP-MS	n	Mean	SD	%R.S.D.
Al			61.8 (DRC)			44.0				2	52.9	12.6	23.8
Ba			6.5	7.5					7.4	3	7.1	0.6	7.7
Be		6.5	9.8	6.7					6.5	4	7.4	1.6	22.0
Co		2.7	3.2	2.8		2.6			2.8	5	2.8	0.2	8.1
Cr			12.4 (DRC)			13.3 (DRC)		10.1		3	11.9	1.7	13.8
Cs		29.4	26.1	29.6					30.0	4	28.8	1.8	6.3
Cu			284.3			275.2	274.8			3	278.1	5.4	1.9
Mn			7.8							1	7.8	NA	NA
Mo		75.3	75.7	78.2					77.8	4	76.8	1.5	1.9
Ni			11.7							1	11.7	NA	NA
Pt		2.5	2.5	2.6					2.6	4	2.6	0.1	2.3
Sb		5.4	5.2	5.3					5.5	4	5.4	0.1	2.4
Se			82.4	72.4 (DRC)		75.0			80.7 (DRC)	4	77.6	4.7	6.1
Sn			12.5							1	12.5	NA	NA
Te													
Tl		13.1	13.8	14.1	12.8	13.6			14.3	6	13.6	0.6	4.2
U		0.7	0.6	0.7					0.753	4	0.7	0.1	9.3
V			6.1 (DRC)							1	6.1	NA	NA
W		5.4	5.5	5.5					5.5	4	5.5	0.1	0.9
Zn			386.9			355.0				2	371.0	22.6	6.1

**New York State Department of Health
Event #3, 2006
Urine Additional Elements**

UE06-13

Element	Lab Code	107	110	116	179	197	287	347	385	n	Mean	SD	%R.S.D.
(µg/L)	Technique	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ETAAS	ETAAS	ICP-MS				
Al			38.3 (DRC)			29.0				2	33.7	6.6	19.5
Ba			6.5	7.8					7.2	3	7.2	0.7	9.1
Be		3.5	4.4	3.5					3.2	4	3.7	0.5	14.2
Co		1.7	1.8	1.6		1.6			1.7	5	1.7	0.1	5.0
Cr			8.4 (DRC)			6.9 (DRC)		7.4		3	7.6	0.8	10.1
Cs		18.0	16.6	18.4					18.0	4	17.8	0.8	4.4
Cu			152.6			151.1	152.5			3	152.1	0.8	0.5
Mn			4.8							1	4.8	NA	NA
Mo		133.2	132.2	137.1					138	4	135.1	2.9	2.1
Ni			10.3							1	10.3	NA	NA
Pt		1.4	1.5	1.5					1.4	4	1.5	0.1	4.0
Sb		2.9	2.9	3.2					3.0	4	3.0	0.1	4.7
Se			105.8	78.6 (DRC)		76.0			88.9 (DRC)	4	87.3	13.5	15.5
Sn			7.1							1	7.1	NA	NA
Te													
Tl		6.9	7.4	7.4	<10	6.9			7.6	5	7.2	0.3	4.4
U		0.4	0.4	0.4					0.363	4	0.4	0.0	4.7
V			3.5 (DRC)							1	3.5	NA	NA
W		3.0	3.0	3.1					3.1	4	3.1	0.1	1.9
Zn			479.5			478.0				2	478.8	1.1	0.2

New York State Department of Health
Event #3, 2006
Urine Additional Elements

UE06-14

Element (µg/L)	Lab Code Technique	107 ICP-MS	110 ICP-MS	116 ICP-MS	179 ICP-MS	197 ICP-MS	287 ETAAS	347 ETAAS	385 ICP-MS	n	Mean	SD	%R.S.D.
Al			65.3 (DRC)			65.0				2	65.2	0.2	0.3
Ba			9.5	11.0					10.6	3	10.4	0.8	7.5
Be		8.8	13.2	9.8					9.2	4	10.3	2.0	19.6
Co		3.8	4.4	3.9		3.6			3.9	5	3.9	0.3	7.5
Cr			16.8 (DRC)			18.6 (DRC)		19.4		3	18.3	1.3	7.3
Cs		40.7	37.0	39.9					41.7	4	39.8	2.0	5.1
Cu			386.1			372.8	369.0			3	376.0	9.0	2.4
Mn			11.0							1	11.0	NA	NA
Mo		109.0	110.1	112.8					112	4	111.0	1.7	1.6
Ni			13.3							1	13.3	NA	NA
Pt		3.3	3.6	3.5					3.4	4	3.5	0.1	3.7
Sb		7.6	7.6	15.2					7.7	4	9.5	3.8	39.7
Se			116.3	93.8 (DRC)		101.0			104 (DRC)	4	103.8	9.4	9.0
Sn			18.7							1	18.7	NA	NA
Te													
Tl		18.4	19.5	19.7	18.0	18.7			19.9	6	19.0	0.8	4.1
U		0.9	0.9	1.0					1.06	4	1.0	0.1	8.2
V			8.1 (DRC)							1	8.1	NA	NA
W		7.5	7.7	7.8					7.8	4	7.7	0.1	1.8
Zn			480.6			439.0				2	459.8	29.4	6.4

New York State Department of Health
Event #3, 2006
Urine Additional Elements

UE06-15

Element	Lab Code	107	110	116	179	197	287	347	385	n	Mean	SD	%R.S.D.
(µg/L)	Technique	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ETAAS	ETAAS	ICP-MS				
Al			140.7 (DRC)			120.0				2	130.4	14.6	11.2
Ba			19.3	20.6					21.5	3	20.5	1.1	5.4
Be		18.5	26.8	19.8					19.8	4	21.2	3.8	17.7
Co		8.2	9.2	8.7		7.5			8.2	5	8.4	0.6	7.6
Cr			32.8 (DRC)			39.5 (DRC)		33.4		3	35.2	3.7	10.5
Cs		81.1	73.7	78.7					82.6	4	79.0	3.9	4.9
Cu			804.7			777.3	771.6			3	784.5	17.7	2.2
Mn			21.4							1	21.4	NA	NA
Mo		230.1	232.3	237.5					237	4	234.2	3.6	1.5
Ni			24.1							1	24.1	NA	NA
Pt		7.2	7.6	7.5					7.6	4	7.5	0.2	2.5
Sb		15.5	15.3	15.2					15.6	4	15.4	0.2	1.2
Se				147.0 (DRC)		191.0			203 (DRC)	4	192.8	34.6	17.9
Sn			37.0							1	37.0	NA	NA
Te													
Tl		37.6	39.8	37.1	36.4	38.8			40.8	6	38.4	1.7	4.4
U		1.9	1.7	2.0					2.21	4	2.0	0.2	10.9
V			17.1 (DRC)							1	17.1	NA	NA
W		15.6	16.0	15.6					16.0	4	15.8	0.2	1.5
Zn			976.9			920.0				2	948.5	40.2	4.2

**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., 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 vaproization 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.
