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New York State Biomonitoring PT Program for Trace Elements

Event #1, 2016

Trace Elements in Whole Blood, Urine and Serum

May 2016

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

2016 Event #1:
Trace Elements in Whole Blood, Urine and Serum

May 5, 2016

Dear Laboratory Director,

This report summarizes performance for the first biomonitoring proficiency test (PT) event of 2016 for **Trace Elements in Whole Blood, Urine and Serum**. One of the key goals of this PT program is to achieve harmonization of biomonitoring data for trace elements.

Target Value Assignment and Performance Evaluation

For these PT materials, target values have been assigned for a limited number of trace elements that are gradable under criteria set by the NYS DOH Biomonitoring PT program. See assay-specific narratives for details. Data for additional trace elements are reported and are included here in order to characterize the PT materials more completely. Participant data and descriptive statistics are provided for educational purposes. No target value or acceptable range is implied.

Where the data permit, robust statistics were used to assign target values based on Algorithm A as defined by ISO 13528:2005E *"Statistical methods for use in proficiency testing by inter-laboratory comparisons"* [1]. Acceptable ranges for the "graded elements" are based on consensus criteria and/or those set by the NYS DOH's PT program. For example, some are fixed based on US regulatory guidelines (Pb, Cd) while for other elements the criteria are based on a consensus of the Network of PT scheme organizers for trace elements in occupational and environmental laboratory medicine [2]. Quality specifications are element and matrix specific; full details are provided under each element specific narrative.

A confidential, three-digit code number assigned by PT program staff identifies all laboratory participants.

Samples for the next PT event (Event #2 of 2016) will be shipped July 2nd 2016. Comments about this report may be directed to trel@health.ny.gov.

Sincerely,

Patrick J. Parsons. PhD
Chief, Inorganic and Nuclear Chemistry,
Division of Environmental Sciences
Wadsworth Center

Aubrey L. Galusha, PhD
Coordinator, Biomonitoring PT Program
Inorganic and Nuclear Chemistry
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Event #1, 2016
Trace Elements in Whole Blood

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

2016 Event #1:
Trace Elements in Whole Blood

PT Materials

Caprine (goat) whole blood was obtained from animals dosed with lead acetate to create physiologically bound lead (Pb). The blood was collected in Hospira “empty container” blood bags and preserved with K_2EDTA. Each unit of whole blood was transferred into polypropylene containers and supplemented with arsenic (As), cadmium (Cd), mercury (Hg), manganese (Mn), thallium (Tl), Tin (Sn), titanium (Ti), nickel (Ni), cobalt (Co), chromium (Cr), silver (Ag), tungsten (W) and vanadium (V). Whole blood samples were homogenized overnight prior to aliquoting 2-mL into polypropylene vials. PT samples were stored at -80°C until the week of the PT event, when they were thawed at 4°C prior to circulation to laboratories for analysis.

Graded Elements

Seven elements in whole blood are formally graded: As, Cd, Co, Cr, Hg, Mn and Pb. Target values for the graded elements are assigned to these pools based on (a) the robust mean calculated from data reported by all laboratories, or (b) where a robust mean is not possible, the arithmetic mean after outlier deletion.

Additional Elements

An additional 23 elements (beyond the seven graded) were reported by at least one participant: Ag, Al, Ba, Be, Bi, Cs, Cu, I, Li Mo, Ni, Pt, Sb, Se, Sn, Sr, Te, Ti, Tl, U, V, W, and Zn. These data are included here to provide a more complete characterization of the PT materials. All results reported by participant laboratories are tabulated and organized by lab code. The PT data are graphed for visual comparison purposes for all elements where at least five laboratories reported a value greater than the LOD. A statistical summary table is provided for samples where at least two comparable values were reported as above the LOD.

The summary statistics for the additional elements are provided for educational purposes only, i.e., no acceptable response is implied. However, it is expected that each laboratory would wish to investigate a potential source of bias if warranted by these data. Future events might result in additional elements becoming graded if a consensus can be reached regarding desired quality specifications.

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Results for Event #1, 2016
Whole Blood Arsenic (As)

Summary Statistics

	Whole Blood As (µg/L)				
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Target (Arithmetic Mean (x̄))	3.46	15.0	7.07	23.4	11.0
Upper Limit	9.46	21.0	13.07	29.4	17.0
Lower Limit	0	9.0	1.07	17.3	5.0
Arithmetic SD (s)	1.49	2.6	1.87	3.0	2.0
Arithmetic RSD (%)	43	17	26	12	18
Number of Sample Measurements (N)	7	8	7	8	8

The acceptable range is based on quality specifications:
±6 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±6 µg/L at concentrations less than or equal to 30 µg/L. These quality specifications were established by New York State Department of Health's Wadsworth Center, the PT Program organizer.

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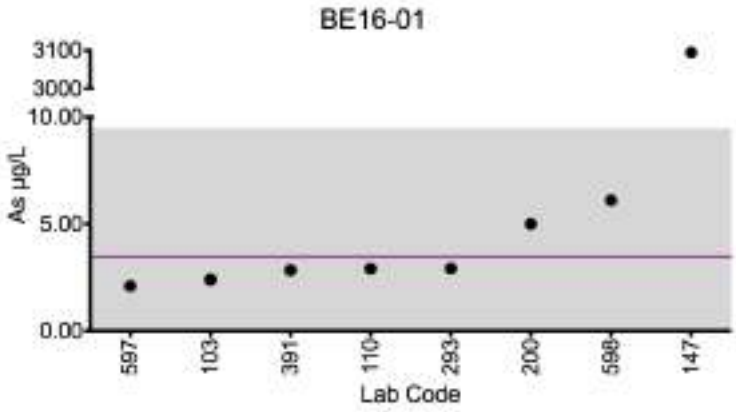
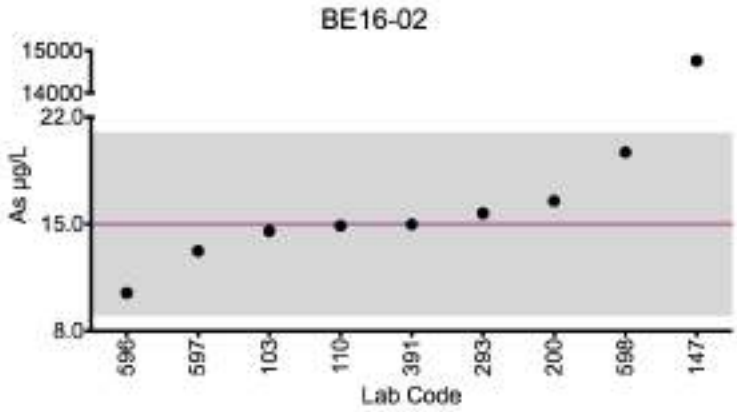
Results for Event #1, 2016
Whole Blood Arsenic (As)
Performance of Participating Laboratories

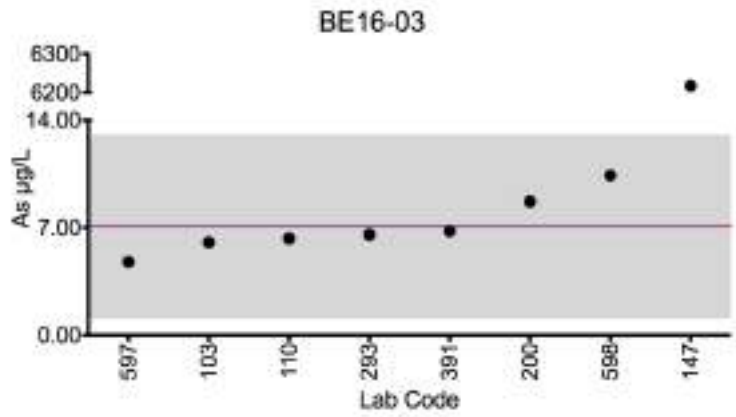
		Whole Blood As (µg/L)				
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
	Target	**3.46**	**15.0**	**7.07**	**23.4**	**11.0**
103	DRC/CC-ICP-MS	2.39	14.6	6.04	23.1	10.9
110	DRC/CC-ICP-MS	2.9	14.9	6.3	22.9	11.4
147	ICP-MS	*3094 ↑	*14757 ↑	*6217 ↑	*23071 ↑	*10637 ↑
200	ICP-MS	5	16.5	8.69	24.5	12.1
293	ICP-MS	2.91	15.7	6.55	25	11.4
391	DRC/CC-ICP-MS	2.83	14.9	6.78	23.4	10.9
596	HR-ICP-MS	<5.26	10.5	<5.26	18.8	7.56
597	DRC/CC-ICP-MS	2.09	13.2	4.78	20.6	9.31
598	DRC/CC-ICP-MS	6.1	19.7	10.4	28.9	14.7

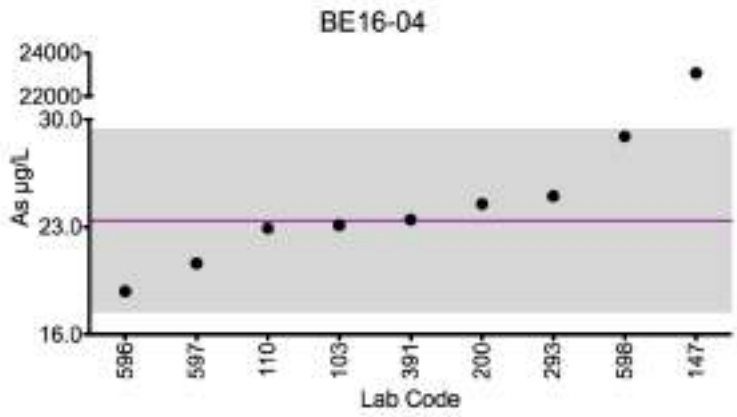
Based on the grading criteria for As in Whole Blood, 89% of results were satisfactory, with one of the nine laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

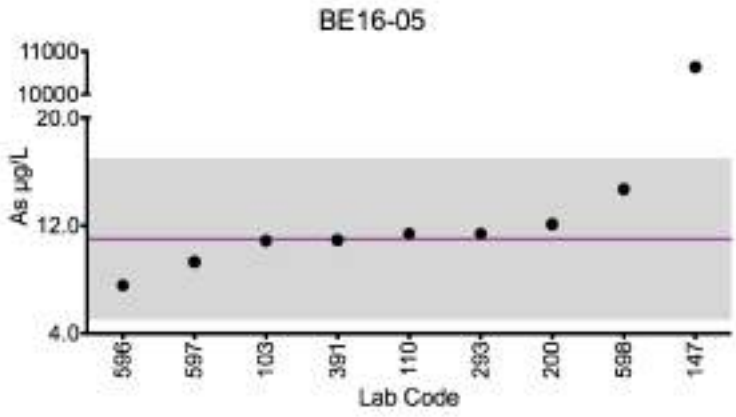
Results for Event #1, 2016: Whole Blood As











Legend:
Horizontal purple line = assigned target value based on the arithmetic mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±6 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±6 µg/L at concentrations less than or equal to 30 µg/L.

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Results for Event #1, 2016
Whole Blood Cadmium (Cd)

Summary Statistics

Whole Blood Cd (µg/L)	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
Target (Robust Mean (x*))	0.943	2.41	6.61	0.96	3.16
Upper Limit	1.943	3.41	7.61	1.96	4.16
Lower Limit	0	1.41	5.61	0	2.16
Robust SD (s*)	0.170	0.14	0.41	0.237	0.20
Robust RSD (%)	18	5.6	6.2	24	6.3
Number of Sample Measurements (N)	12	14	14	13	14
Standard Uncertainty (*u*)	0.06	0.04	0.13	0.08	0.06

The acceptable range is based on quality specifications:
±1 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 6.7 µg/L. These quality specifications are based on those used by US OSHA for occupational exposure.

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Results for Event #1, 2016
Whole Blood Cadmium (Cd)
Performance of Participating Laboratories

		Whole Blood Cd (µg/L)				
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
	Target	**0.943**	**2.41**	**6.61**	**0.960**	**3.16**
103	DRC/CC-ICP-MS	0.916	2.45	7.12	0.931	3.30
107	ICP-MS	0.97	2.5	6.7	0.98	3.2
110	ICP-MS	0.9	2.5	6.7	0.9	3.1
116	DRC/CC-ICP-MS	1.39	2.84	7.58	1.35	3.76
147	ICP-MS	0.818	2.27	6.08	0.941	2.97
200	ICP-MS	1.2	2.29	6.4	0.9	3.5
293	ICP-MS	0.92	2.41	6.99	0.87	3.04
391	DRC/CC-ICP-MS	0.799	2.41	6.61	0.693	3.26
596	HR-ICP-MS	1.03	2.25	6.01	1.21	3.07
597	DRC/CC-ICP-MS	0.716	2.31	6.39	0.591	3.04
598	DRC/CC-ICP-MS	1.1	2.5	6.5	1.4	3
605	ICP-MS	0.802	2.31	6.29	0.793	2.92
606	ICP-MS	<1.50	3.10	7.62 ↑	1.69	3.67
686	ICP-MS	<MDL	2.34	6.55	<MDL	3.17

Based on the grading criteria for Cd in Whole Blood, 99% of results were satisfactory, with none of the fourteen laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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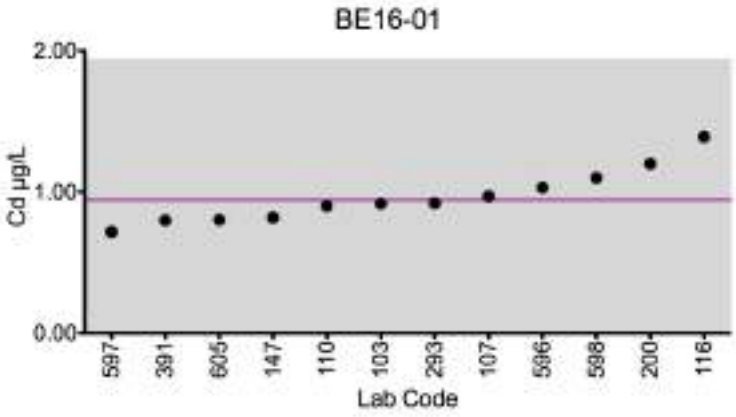
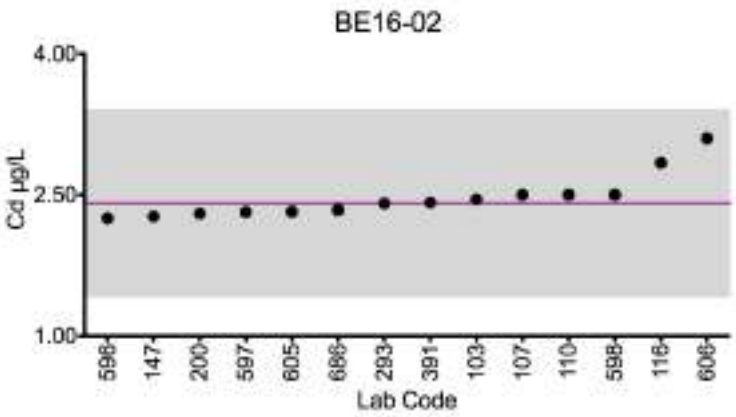
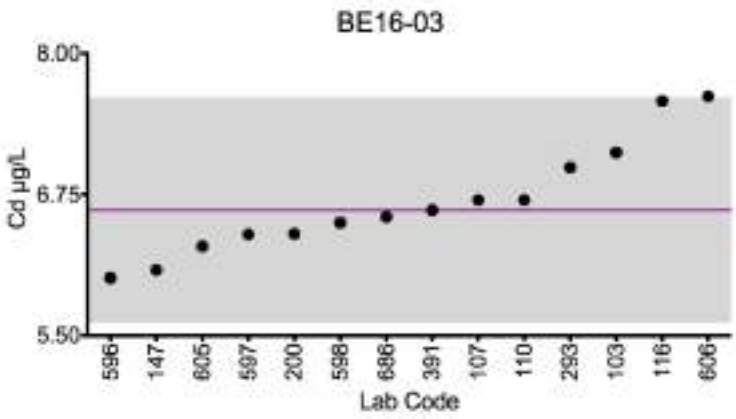
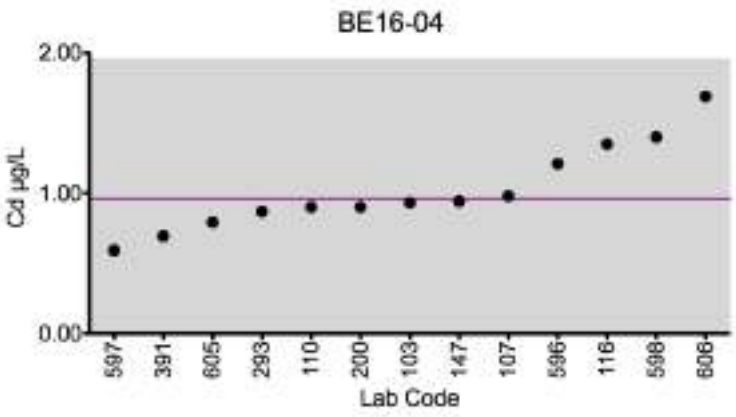
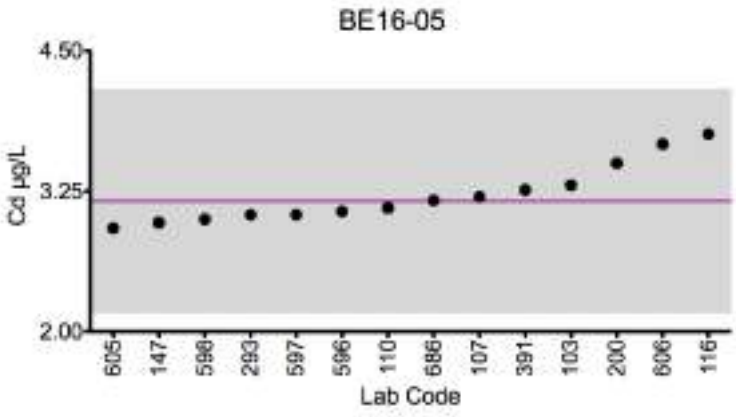
Results for Event #1, 2016: Whole Blood Cd











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±1 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 6.7 µg/L.

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Results for Event #1, 2016
Whole Blood Cobalt (Co)

Summary Statistics

	Whole Blood Co (µg/L)				
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Target (Arithmetic Mean ($\bar{x}$))	0.665	8.23	9.28	11.4	15.0
Upper Limit	2.165	9.86	11.13	13.6	18.0
Lower Limit	0	6.58	7.42	9.1	12.0
Arithmetic SD (s)	0.089	0.94	0.87	1.1	1.3
Arithmetic RSD (%)	13	11	9.3	10	8.8
Number of Sample Measurements (N)	6	7	7	7	7

The acceptable range is based on quality specifications:
±1.5 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1.5 µg/L at concentrations less than or equal to 7.5 µg/L. These quality specifications were established based on discussions with the US FDA, and represent a consensus from a network of Trace Element PT program organizers

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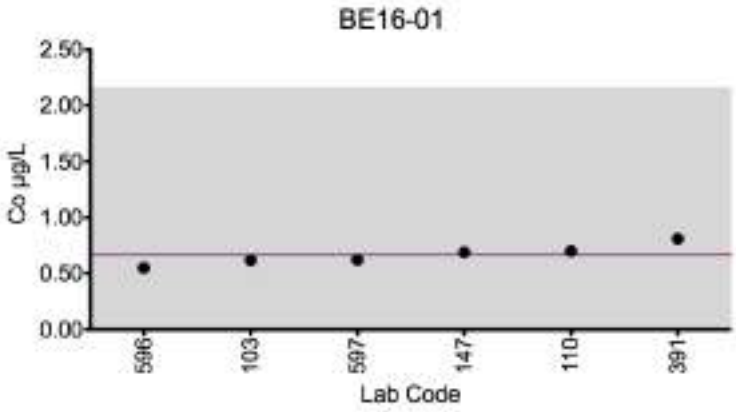
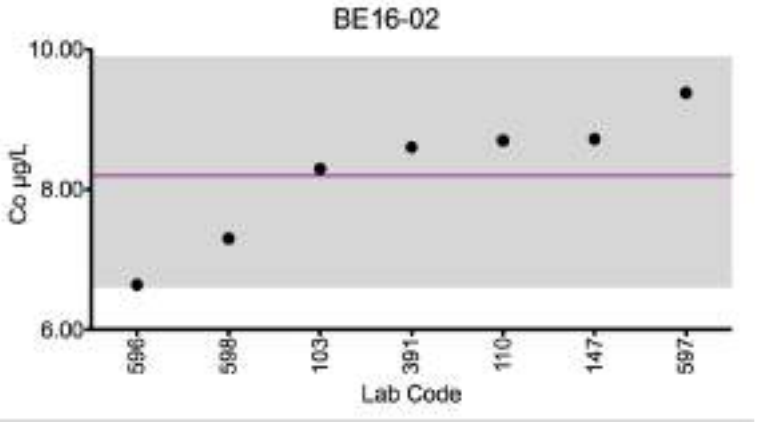
Results for Event #1, 2016
Whole Blood Cobalt (Co)
Performance of Participating Laboratories

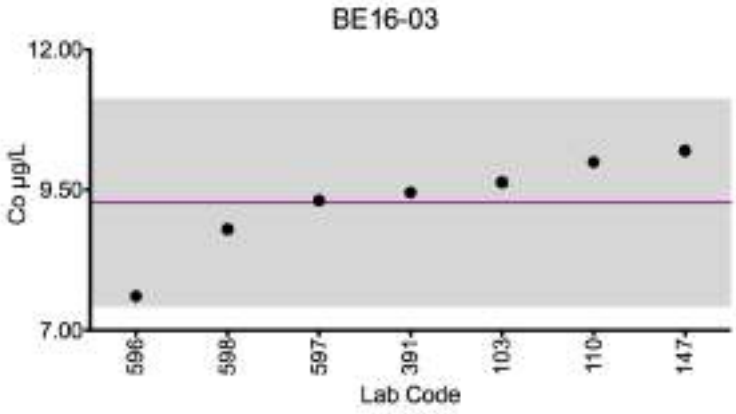
		Whole Blood Co (µg/L)				
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
	Target	**0.665**	**8.23**	**9.28**	**11.4**	**15.0**
103	DRC/CC-ICP-MS	0.618	8.30	9.64	11.7	15.8
110	ICP-MS	0.7	8.69	10.0	12.5	16.1
147	ICP-MS	0.688	8.72	10.1	12.5	15.9
391	DRC/CC-ICP-MS	0.81	8.6	9.45	11.8	15.4
596	HR-ICP-MS	0.549	6.64	7.61	9.52	12.8
597	DRC/CC-ICP-MS	0.623	9.38	9.31	12.1	15.9
598	ICP-MS	<1	7.3	8.8	10.1	13.6

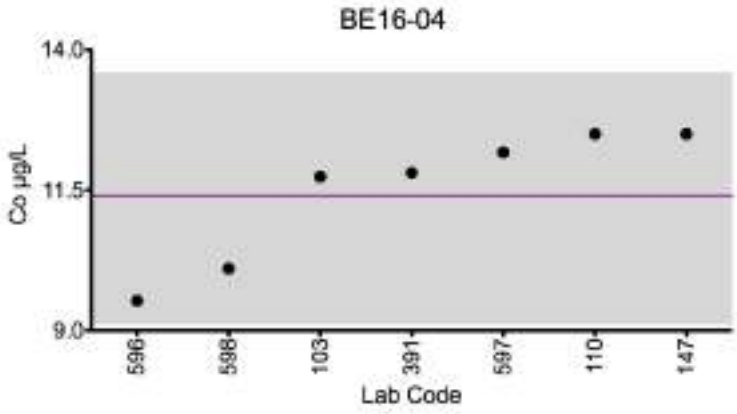
Based on the grading criteria for Co in Whole Blood, 100% of results were satisfactory, with none of the seven laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

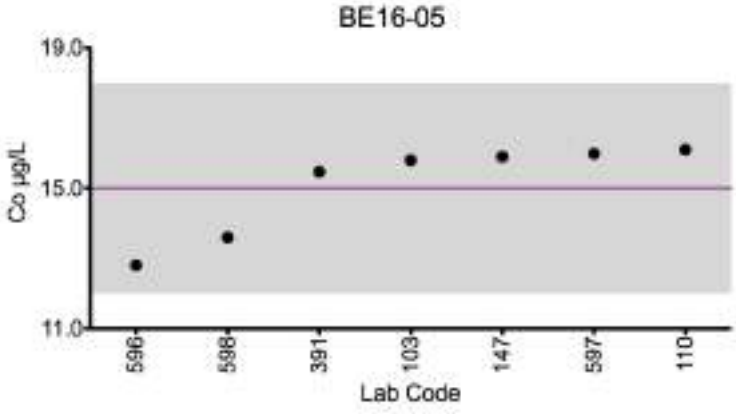
Results for Event #1, 2016: Whole Blood Co











Legend:
Horizontal purple line = assigned target value based on the arithmetic mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±1.5 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1.5 µg/L at concentrations less than or equal to 7.5 µg/L.

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Results for Event #1, 2016
Whole Blood Chromium (Cr)

Summary Statistics

	Whole Blood Cr (µg/L)				
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Target (Arithmetic Mean ($\bar{x}$))	0.370	2.79	7.23	11.6	4.33
Upper Limit	2.370	4.79	9.23	13.9	6.33
Lower Limit	0	0.79	5.23	9.1	2.33
Arithmetic SD (s)	0.030	0.40	0.88	2.1	0.46
Arithmetic RSD (%)	8.2	14	12	18	10
Number of Sample Measurements (N)	4	6	7	7	6

The acceptable range is based on quality specifications:
±2 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±2 µg/L at concentrations less than or equal to 10 µg/L. These quality specifications were established based on discussions with the US FDA, and represent a consensus from a network of Trace Element PT program organizers

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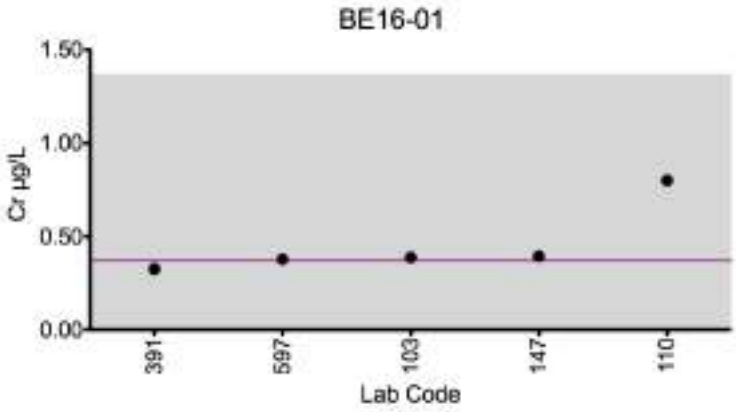
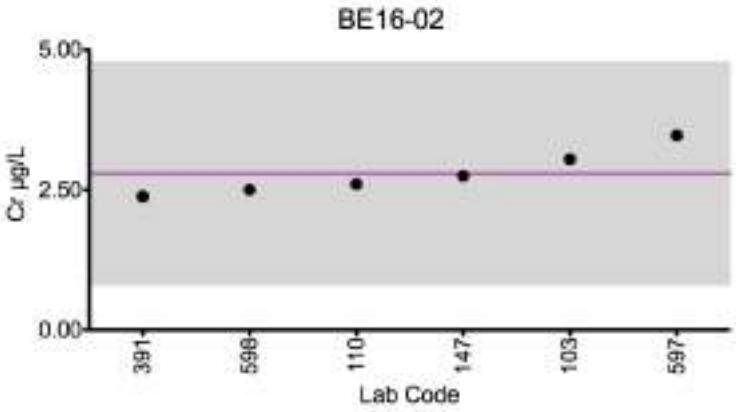
Results for Event #1, 2016
Whole Blood Chromium (Cr)
Performance of Participating Laboratories

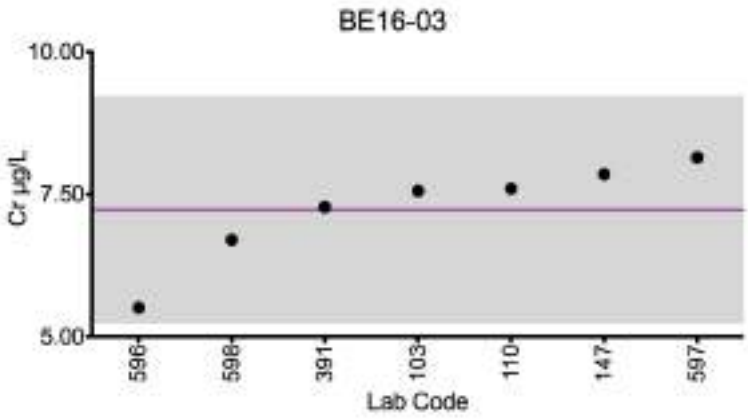
		Whole Blood Cr (µg/L)				
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
	Target	**0.370**	**2.79**	**7.23**	**11.6**	**4.33**
103	DRC/CC-ICP-MS	0.387	3.05	7.56	11.8	4.73
110	DRC/CC-ICP-MS	*0.8	2.6	7.6	11.9	4.5
147	DRC/CC-ICP-MS	0.393	2.75	7.85	12.4	4.48
391	DRC/CC-ICP-MS	0.326	2.38	7.27	14.0 ↑	3.93
596	HR-ICP-MS	<MDL	<2.63	5.51	8.17 ↓	<2.63
597	DRC/CC-ICP-MS	0.378	3.47	8.14	13.5	4.74
598	DRC/CC-ICP-MS	<2	2.5	6.7	9.4	3.6

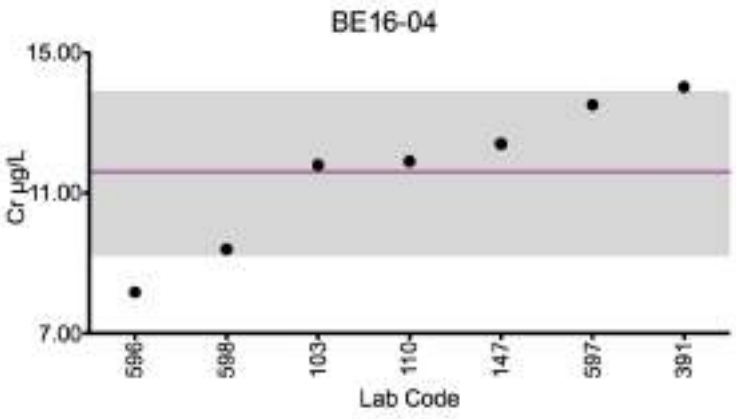
Based on the grading criteria for Cr in Whole Blood, 94% of results were satisfactory, with none of the seven laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

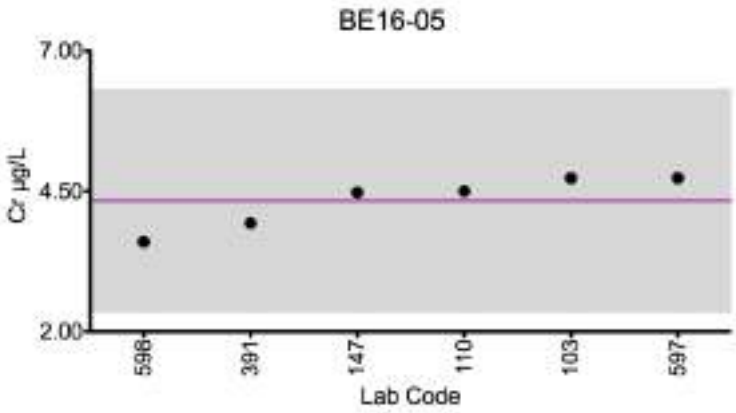
Results for Event #1, 2016: Whole Blood Cr











Legend:
Horizontal purple line = assigned target value based on the arithmetic mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±2 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±2 µg/L at concentrations less than or equal to 10 µg/L.

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Results for Event #1, 2016
Whole Blood Mercury (Hg)

Summary Statistics

Whole Blood Hg (µg/L)

	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
Target (Robust Mean (x*))	1.99	26.9	6.49	1.69	7.49
Upper Limit	4.99	34.9	9.49	4.69	10.49
Lower Limit	0	18.8	3.49	0	4.49
Robust SD (s*)	0.16	2.9	0.54	0.26	0.68
Robust RSD (%)	8.3	10	8.4	15	9
Number of Sample Measurements (N)	13	14	14	14	14
Standard Uncertainty (*u*)	0.05	0.96	0.18	0.08	0.22

The acceptable range is based on quality specifications:
±3 µg/L or ±30% around the target value, whichever is greater; thus, it is fixed at ±3 µg/L at concentrations less than or equal to 10 µg/L. These quality specifications were established by New York State Department of Health's Wadsworth Center, the PT Program organizer.

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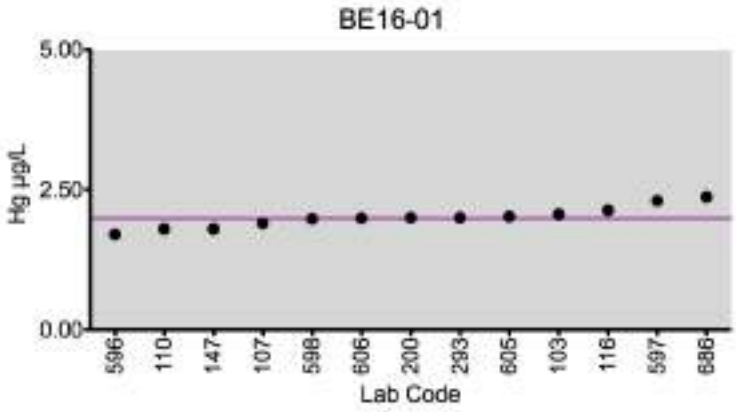
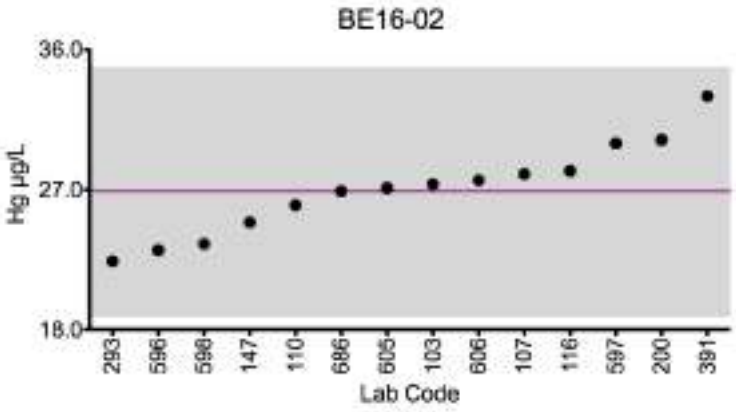
Results for Event #1, 2016
Whole Blood Mercury (Hg)
Performance of Participating Laboratories

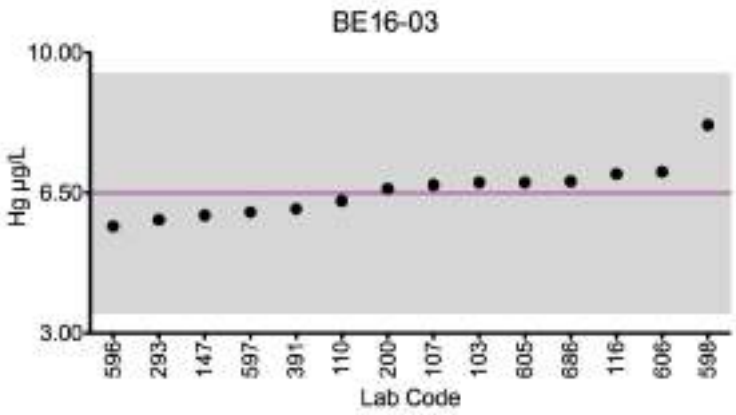
		Whole Blood Hg (µg/L)				
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
	Target	**1.99**	**26.9**	**6.49**	**1.69**	**7.49**
103	DRC/CC-ICP-MS	2.06	27.4	6.76	2.17	8.17
107	DRC/CC-ICP-MS	1.9	28	6.7	1.4	7.4
110	ICP-MS	1.8	26.0	6.3	1.6	7.5
116	DRC/CC-ICP-MS	2.13	28.2	6.97	1.47	8.00
147	ICP-MS	1.8	24.9	5.94	1.67	6.88
200	ICP-MS	2	30.2	6.6	1.4	7
293	ICP-MS	2	22.4	5.83	1.74	6.91
391	HG-AAS	NR	33	6.10	2.00	10.8 ↑
596	ICP-MS	1.7	23.1	5.67	1.54	6.46
597	DMA	2.29	29.9	6.02	1.44	7.25
598	ICP-MS	1.98	23.5	8.19	1.93	7.02
605	ICP-MS	2.02	27.1	6.76	1.82	7.89
606	ICP-MS	1.99	27.6	7.02	1.71	7.94
686	ICP-MS	2.37	26.9	6.79	1.9	8.02

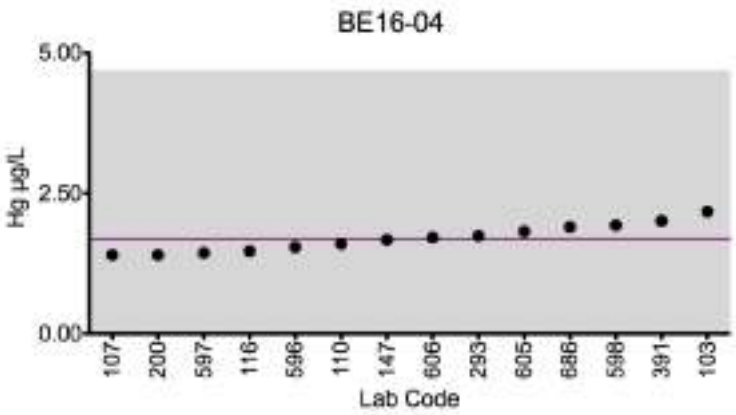
Based on the grading criteria for Hg in Whole Blood, 99% of results were satisfactory, with none of the fourteen laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

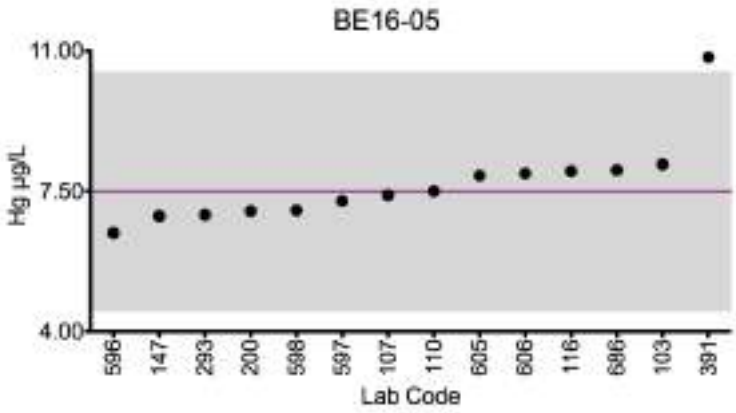
Results for Event #1, 2016: Whole Blood Hg











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±3 µg/L or ±30% around the target value, whichever is greater; thus, it is fixed at ±3 µg/L at concentrations less than or equal to 10 µg/L.

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Results for Event #1, 2016
Whole Blood Manganese (Mn)

Summary Statistics

	Whole Blood Mn (µg/L)				
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Target (Robust Mean (x*))	15.2	17.5	22.1	20.7	19.4
Upper Limit	18.2	20.3	25.8	24.2	22.6
Lower Limit	12.2	14.5	18.3	17.1	16.1
Robust SD (s*)	1.3	2.0	0.7	1.7	1.2
Robust RSD (%)	8.5	11	3.2	8.5	6.2
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (*u*)	0.51	0.80	0.28	0.69	0.48

The acceptable range is based on quality specifications:
±3 µg/L or ±17% around the target value, whichever is greater; thus, it is fixed at ±3 µg/L at concentrations less than or equal to 17 µg/L. These quality specifications were proposed by a network of Trace Element PT Program organizers (Praamsma M, et al. An assessment of clinical laboratoy performance for the determination of manganese in blood and urine. Clinical Chemistry and Laboratory Medicine. 2016 in press.)

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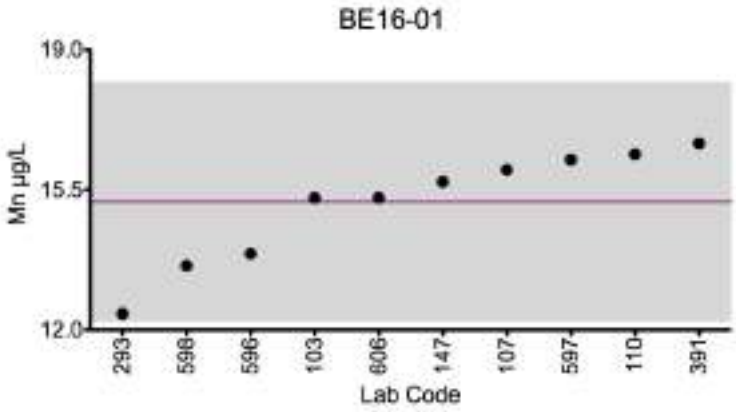
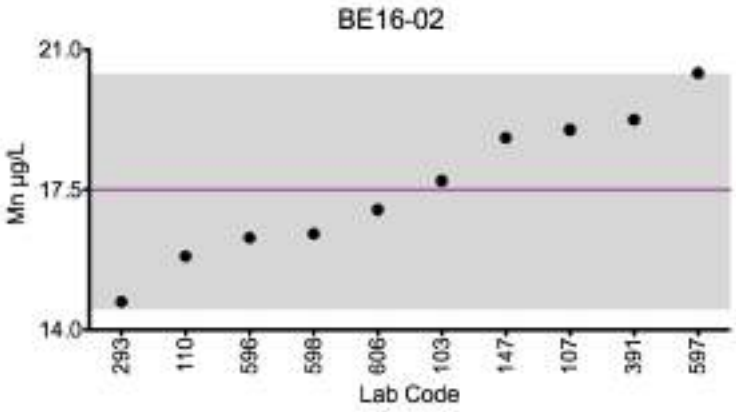
Results for Event #1, 2016
Whole Blood Manganese (Mn)
Performance of Participating Laboratories

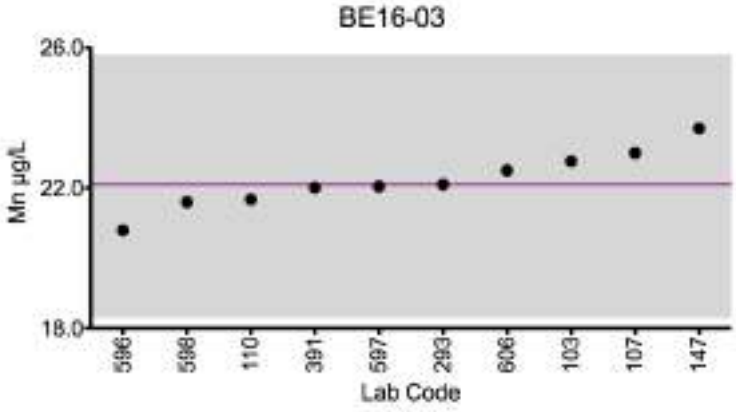
		Whole Blood Mn (µg/L)				
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
	Target	**15.2**	**17.5**	**22.1**	**20.7**	**19.4**
103	DRC/CC-ICP-MS	15.3	17.7	22.8	20.9	19.8
107	DRC/CC-ICP-MS	16	19	23	22	20
110	ICP-MS	16.3	15.8	21.7	18.8	18.2
147	ICP-MS	15.7	18.8	23.7	22.7	19.7
293	ICP-MS	12.4	14.7	22.1	19.6	24 ↑
391	DRC/CC-ICP-MS	16.6	19.2	22	22.3	20.1
596	ICP-MS	13.9	16.3	20.8	19.3	17.8
597	DRC/CC-ICP-MS	16.3	20.3	22.0	22.3	20.2
598	ICP-MS	13.6	16.3	21.6	18.6	18.2
606	ICP-MS	15.3	17.0	22.5	20.8	18.6

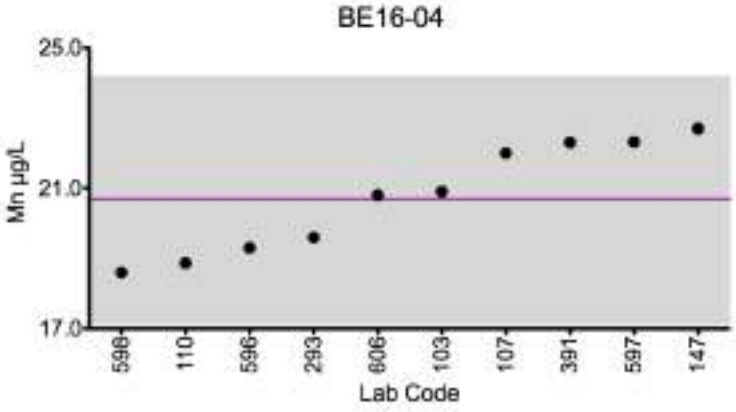
Based on the grading criteria for Mn in Whole Blood, 98% of results were satisfactory, with none of the ten laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

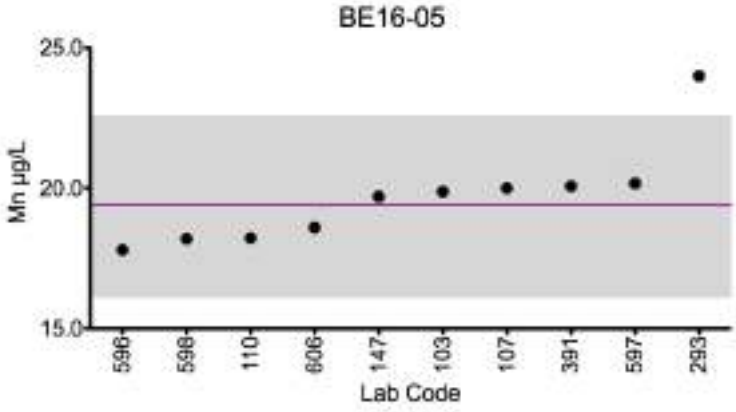
Results for Event #1, 2016: Whole Blood Mn











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±3 µg/L or ±17% around the target value, whichever is greater; thus, it is fixed at ±3 µg/L at concentrations less than or equal to 17 µg/L.

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Results for Event #1, 2016
Whole Blood Lead (Pb)

Summary Statistics

	Whole Blood Pb (µg/dL)				
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Target (Robust Mean (x*))	8.90	12.7	5.60	13.3	2.60
Upper Limit	10.90	14.7	7.60	15.3	4.60
Lower Limit	6.90	10.7	3.60	11.3	0.60
Robust SD (s*)	0.40	0.8	0.60	0.7	0.10
Robust RSD (%)	5.1	6.4	10	5.4	5.9
Number of Sample Measurements (N)	15	15	15	15	14
Standard Uncertainty (*u*)	0.14	0.26	0.19	0.23	0.05

The acceptable range is based on quality specifications:
±2 µg/dL or ±10% around the target value, whichever is greater; thus, it is fixed at ±2 µg/dL at concentrations less than or equal to 20 µg/dL. These quality specifications are recommended by the Clinical Laboratory Standards Institute (CLSI, C40-A2) and have been proposed for use in proficiency testing programs approved under CLIA by the Centers for Midicare and Medicaid Services (CMS) in the USA. (http://shop.clsi.org/C40.html)

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Results for Event #1, 2016
Whole Blood Lead (Pb)
Performance of Participating Laboratories

		Whole Blood Pb (µg/dL)				
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
	Target	**8.90**	**12.7**	**5.60**	**13.3**	**2.60**
103	DRC/CC-ICP-MS	8.9	12.6	5.5	13.2	2.6
107	ICP-MS	8.9	13	5.4	14	2.6
110	ICP-MS	8.8	12.5	5.4	13.0	2.6
116	DRC/CC-ICP-MS	9.5	13.4	5.8	14.2	2.8
147	ICP-MS	8.6	12.3	5.3	13	2.5
200	ICP-MS	9.3	14.5	6.2	14.5	2.9
293	ICP-MS	83 ↑	120 ↑	52 ↑	128 ↑	24.9 ↑
391	ETAAS-Z	8.6	12.2	6.5	12.6	3.8
596	HR-ICP-MS	70 ↑	98 ↑	42 ↑	104 ↑	20.8 ↑
597	DRC/CC-ICP-MS	8.7	13.1	4.9	12.7	2.5
598	ICP-MS	6.1 ↓	8.7 ↓	4.1	8.7 ↓	1.9
599	DRC/CC-ICP-MS	9	12.1	5.4	13	2.6
605	ICP-MS	8.5	12.3	5.4	13.4	2.5
606	ICP-MS	9.1	13.5	5.8	13.6	2.6
686	ICP-MS	8.5	11.9	5.1	13	<MDL

Based on the grading criteria for Pb in Whole Blood, 83% of results were satisfactory, with three of the fifteen laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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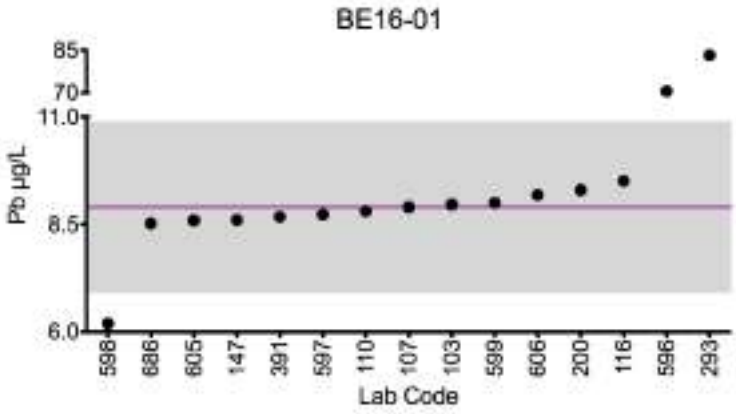
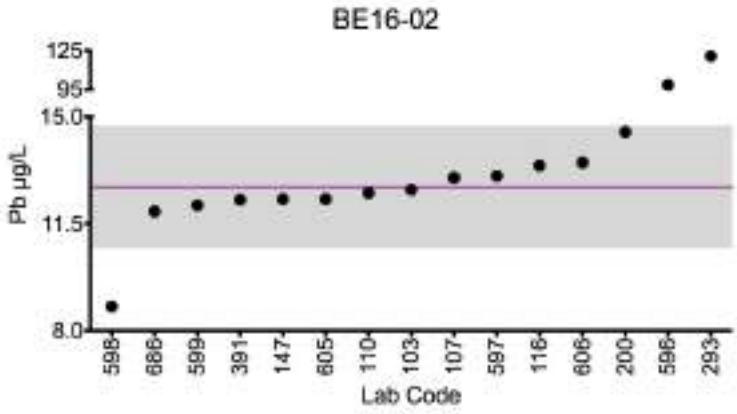
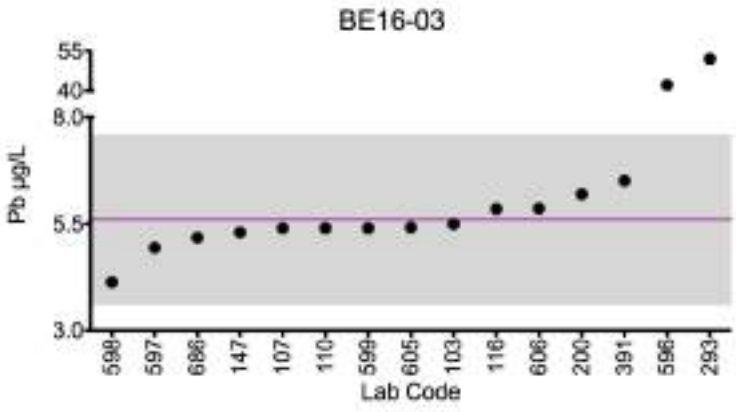
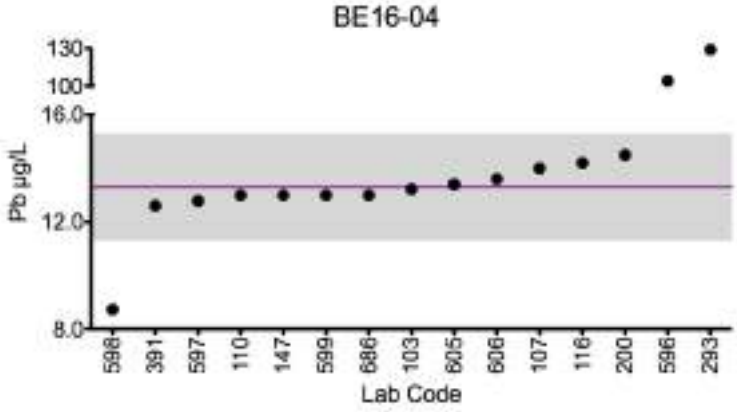
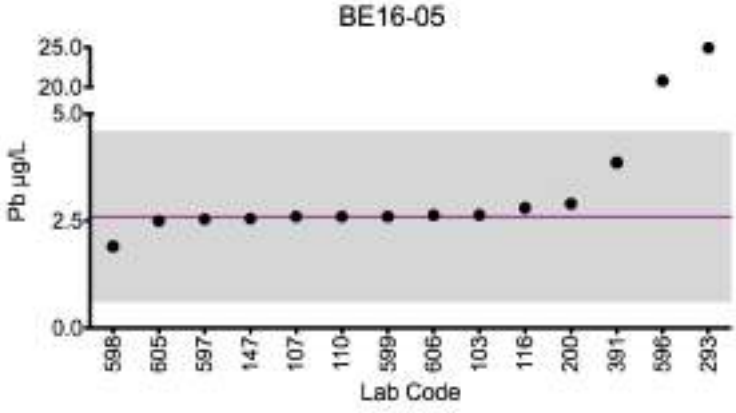
Results for Event #1, 2016: Whole Blood Pb











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±2 µg/dL or ±10% around the target value, whichever is greater; thus, it is fixed at ±2 µg/dL at concentrations less than or equal to 20 µg/dL.

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Results for Event #1, 2016
Additional Elements in Whole Blood: Copper (Cu)

Whole Blood Cu (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
110	ICP-MS	1156	1159	1140	1226	1416
147	ICP-MS	1150	1213	1188	1277	1449
596	ICP-AES/OES	1130	1160	1120	1210	1400
597	DRC/CC-ICP-MS	1207	1311	1093	1261	1432
598	ICP-MS	*859	937	982	*950	*1105

Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	1160	1155	1104	1243	1424
Arithmetic SD (s)	32	137	76	30	21
Arithmetic RSD (%)	2.8	11	6.9	2.4	1.4
Number of Sample Measurements (N)	4	5	5	4	4

*Denotes a statistical Outlier.

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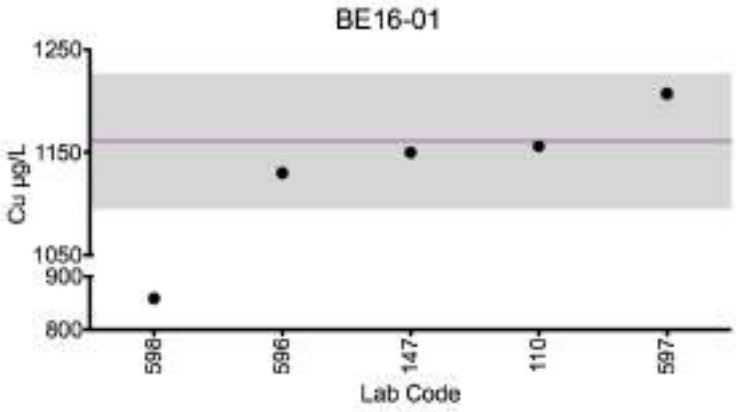
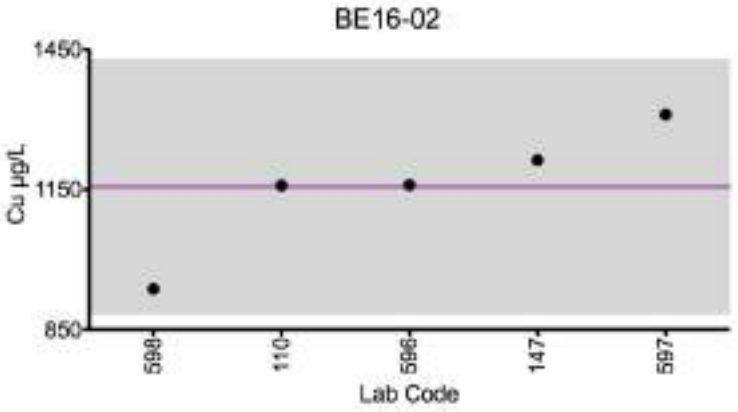
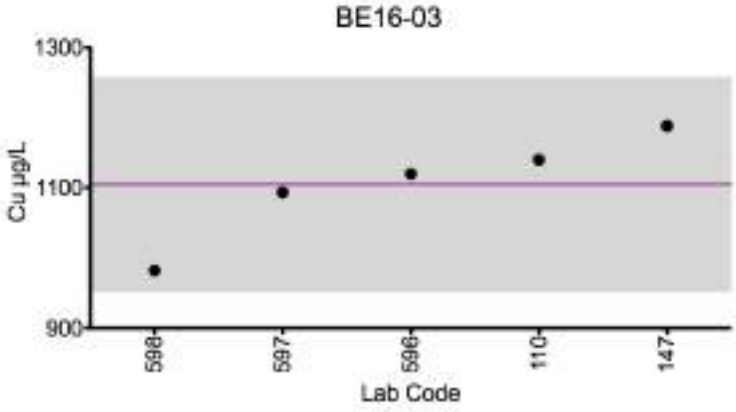
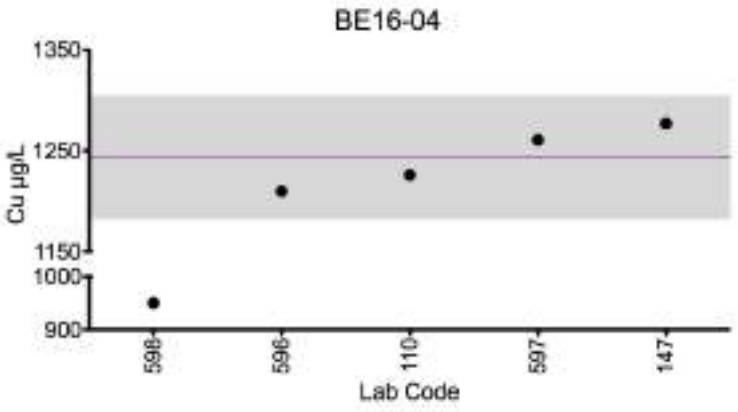
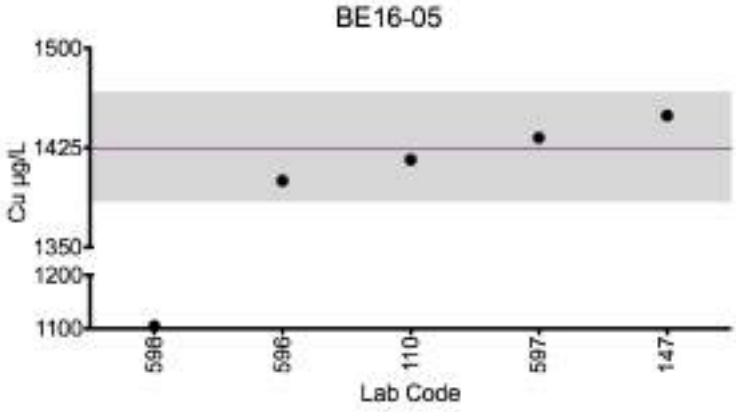
Results for Event #1, 2016: Whole Blood Cu











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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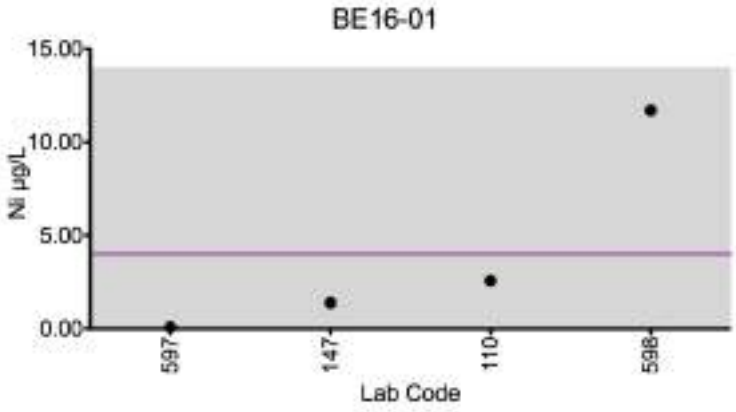
Results for Event #1, 2016
Additional Elements in Whole Blood: Nickel (Ni)

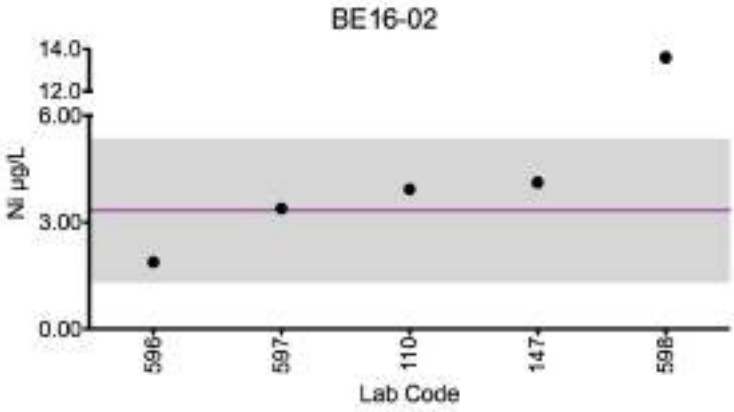
Whole Blood Ni (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
110	DRC/CC-ICP-MS	2.6	3.9	6.5	14.4	2.6
147	ICP-MS	1.39	4.12	6.34	14.1	2.61
596	HR-ICP-MS	<0.021	1.88	3.89	9.58	0.771
597	DRC/CC-ICP-MS	0.093	3.39	4.84	14.0	1.64
598	ICP-MS	11.7	*13.6	11	18.2	5.8

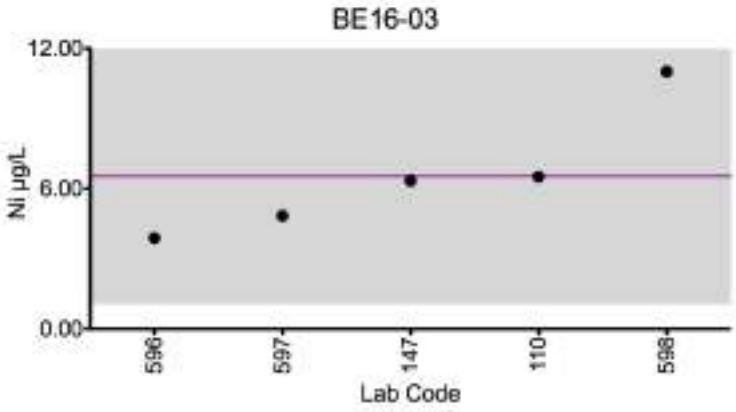
Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	3.94	3.33	6.51	14.0	2.69
Arithmetic SD (s)	5.27	1.01	2.73	3.0	1.90
Arithmetic RSD (%)	133	30	41	21	70
Number of Sample Measurements (N)	4	4	5	5	5

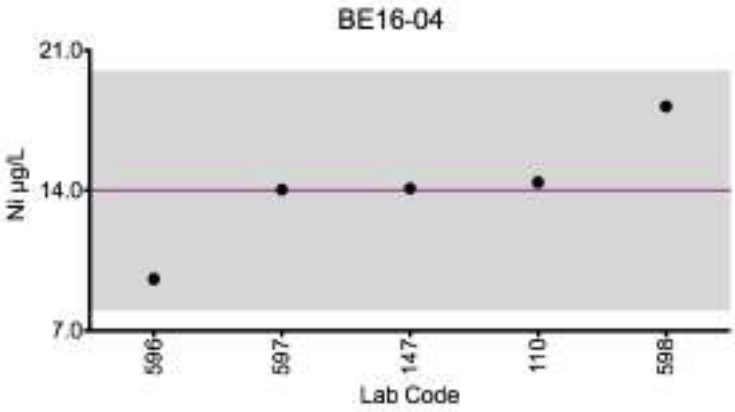
*Denotes a statistical Outlier.

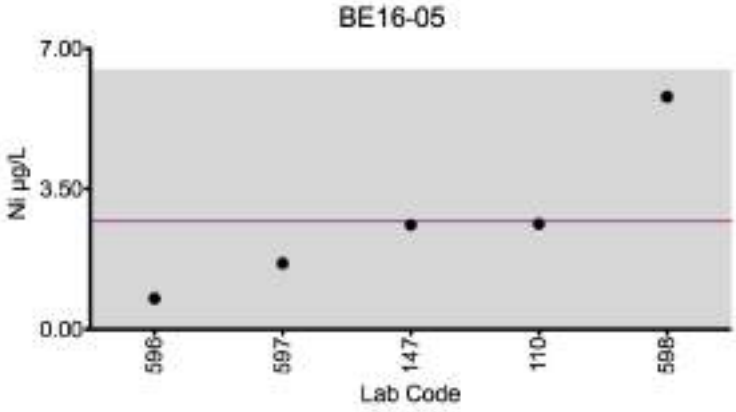
Results for Event #1, 2016:
Whole Blood Ni











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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Results for Event #1, 2016
Additional Elements in Whole Blood: Selenium (Se)

Whole Blood Se (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
103	DRC/CC-ICP-MS	266	273	313	308	325
107	DRC/CC-ICP-MS	270	280	310	310	310
110	DRC/CC-ICP-MS	281	270	308	306	334
147	ICP-MS	269	272	310	306	314
596	HR-ICP-MS	256	269	295	302	317
597	DRC/CC-ICP-MS	306	355	341	363	333
598	DRC/CC-ICP-MS	299	324	363	364	*376

Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	278	291	319	322	322
Arithmetic SD (s)	18	33	23	27	10
Arithmetic RSD (%)	6.5	11	7.3	8.6	3.1
Number of Sample Measurements (N)	7	7	7	7	6

*Denotes a statistical Outlier.

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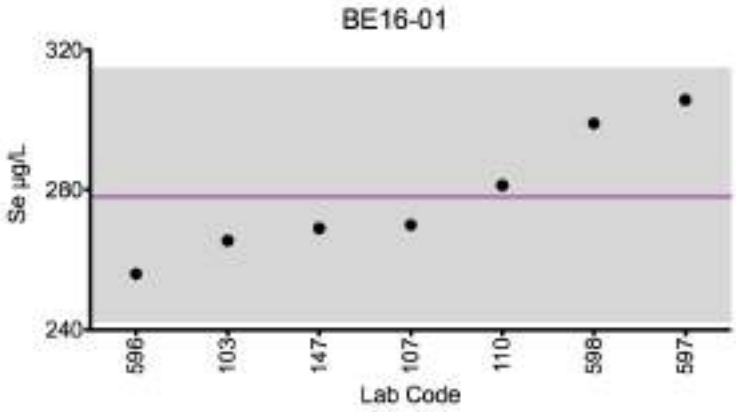
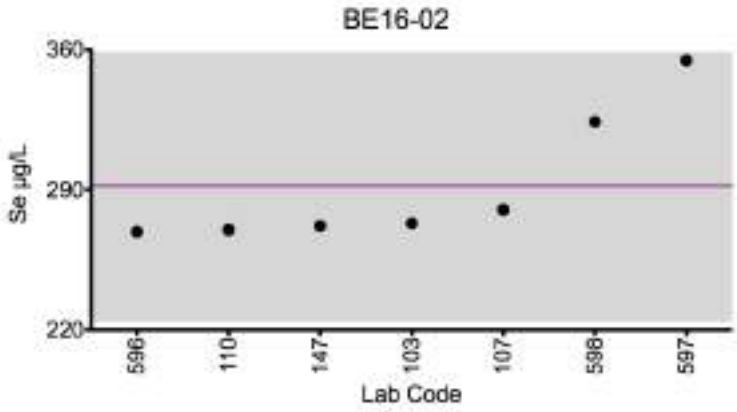
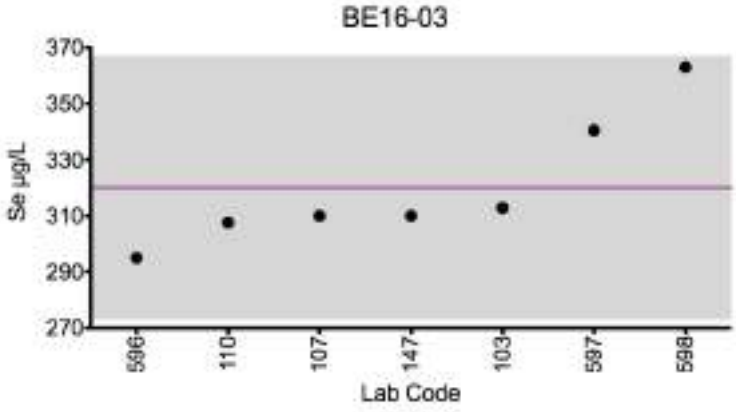
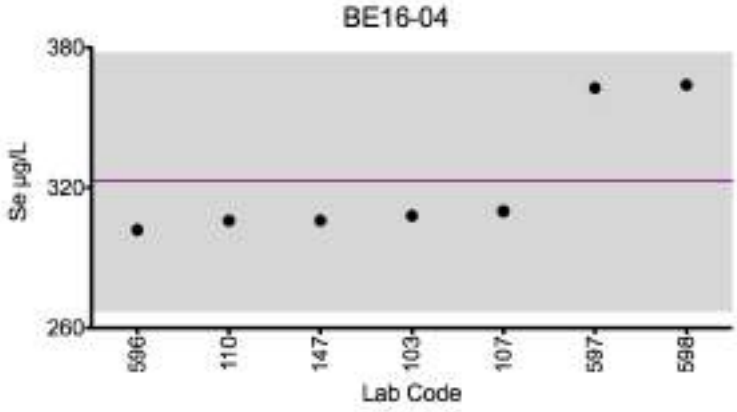
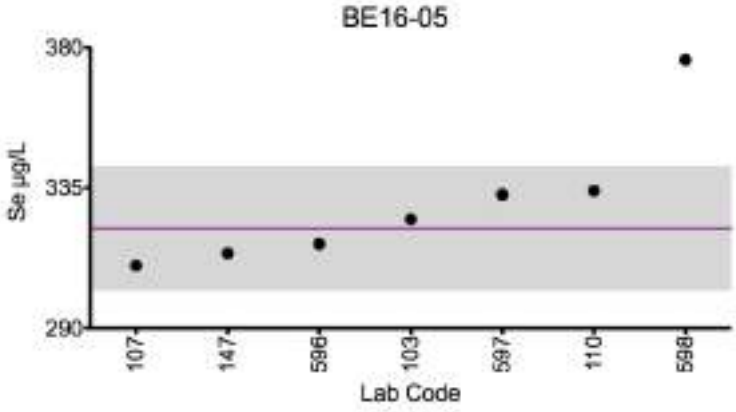
Results for Event #1, 2016: Whole Blood Se











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

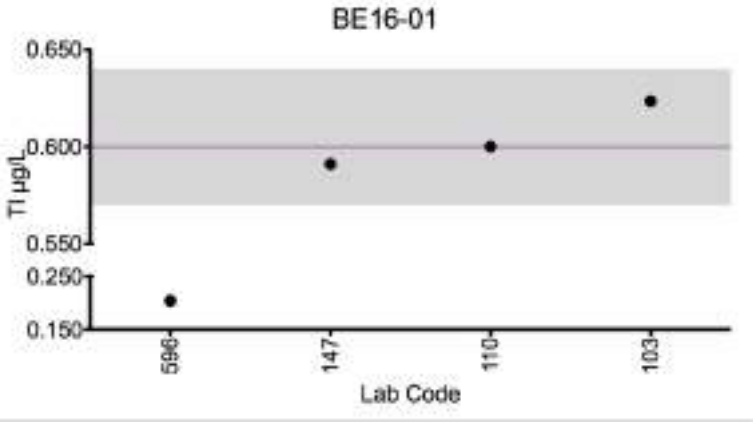
Results for Event #1, 2016
Additional Elements in Whole Blood: Thallium (Tl)

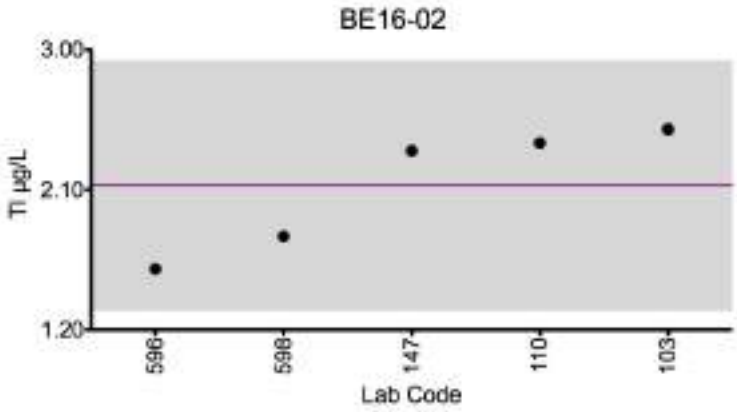
Whole Blood Tl (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
103	DRC/CC-ICP-MS	0.623	2.49	16.3	8.42	3.08
110	ICP-MS	0.6	2.4	15.9	8.19	3.0
147	ICP-MS	0.59	2.35	15.5	8.07	2.9
596	HR-ICP-MS	*0.203	1.59	12.3	6.26	2.2
598	ICP-MS	<1	1.8	10.4	6.1	1.8

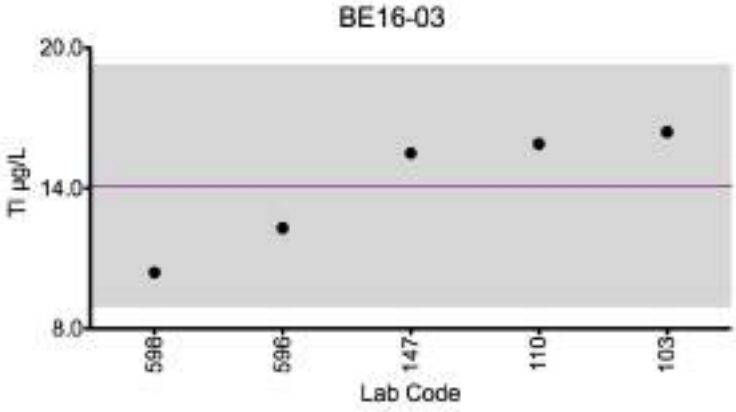
Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	0.604	2.12	14.1	7.40	2.59
Arithmetic SD (s)	0.016	0.40	2.6	1.13	0.56
Arithmetic RSD (%)	2.7	18	18	15	21
Number of Sample Measurements (N)	3	5	5	5	5

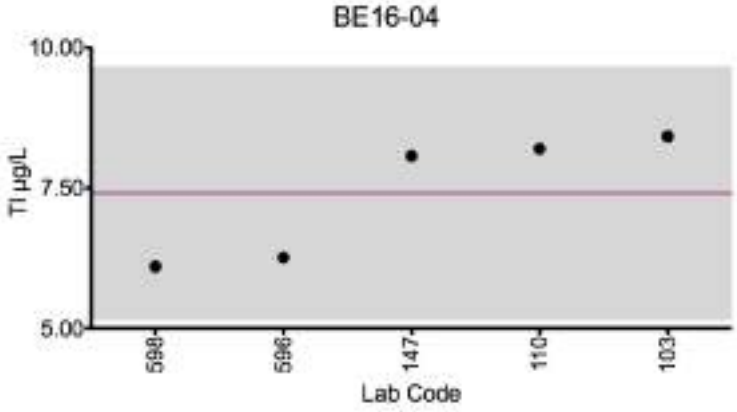
*Denotes a statistical Outlier.

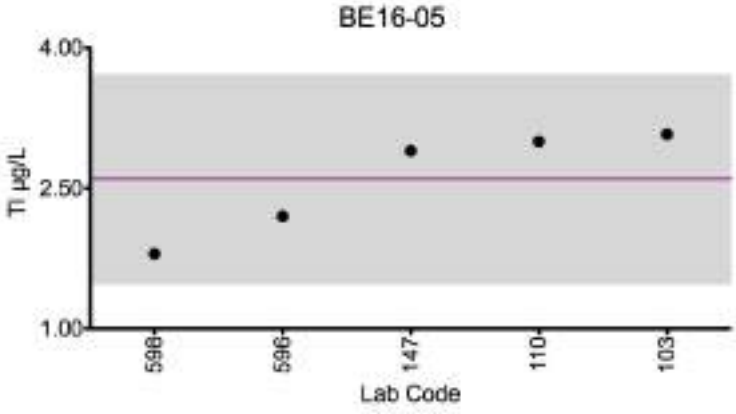
Results for Event #1, 2016: Whole Blood Tl











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

Results for Event #1, 2016
Additional Elements in Whole Blood: Zinc (Zn)

Whole Blood Zn (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
110	ICP-MS	2994	2374	1910	1942	3211
147	ICP-MS	2706	2314	1876	1889	3065
596	ICP-AES/OES	2670	2200	1780	1790	2990
597	DRC/CC-ICP-MS	2897	2566	1775	1914	3138
598	ICP-MS	1959	1692	*1374	*1327	*2226

Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	2645	2229	1835	1883	3101
Arithmetic SD (s)	406	328	68	66	95
Arithmetic RSD (%)	15	14	3.7	3.5	3.0
Number of Sample Measurements (N)	5	5	4	4	4

*Denotes a statistical Outlier.

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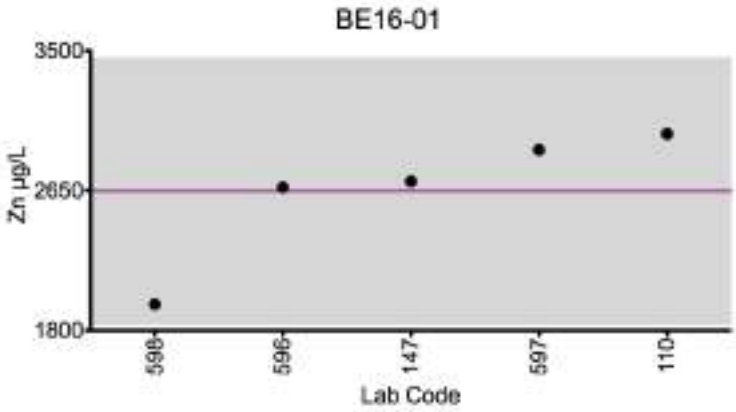
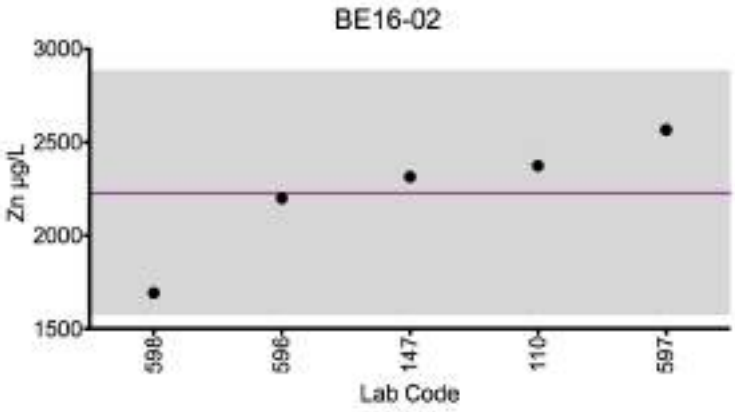
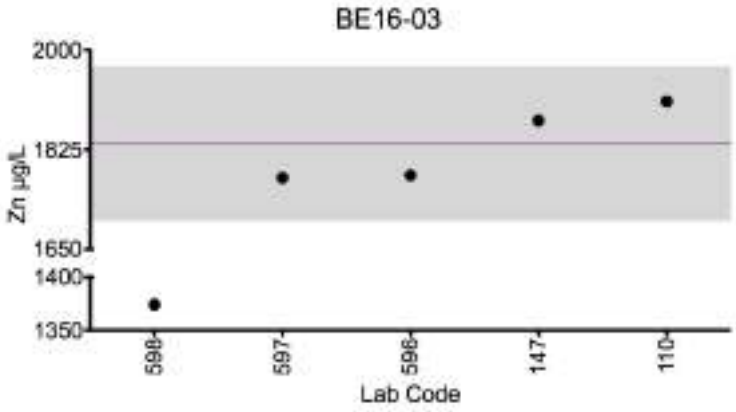
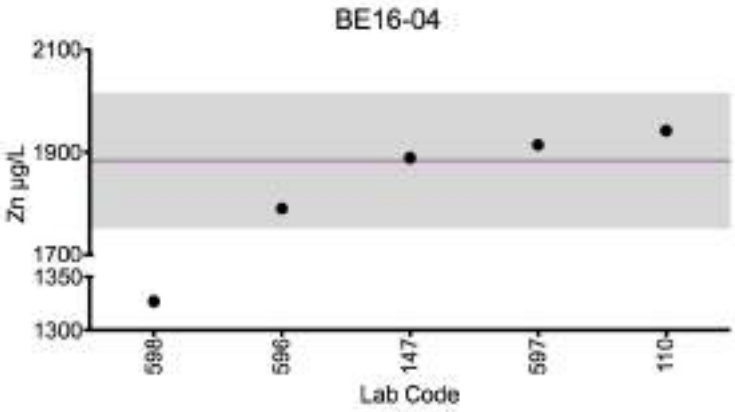
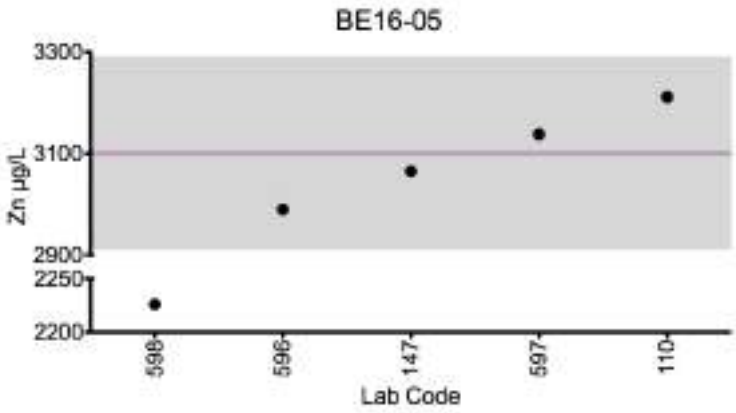
Results for Event #1, 2016: Whole Blood Zn











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

Results for Event #1, 2016
Additional Elements in Whole Blood: Barium (Ba)

Whole Blood Ba (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
110	ICP-MS	8.1	20.9	24.1	11.2	6.4
147	ICP-MS	7.62	21.3	24.6	10.7	6.09
596	HR-ICP-MS	<84.3	<84.3	<84.3	<84.3	<84.3
598	ICP-MS	8.3	22.3	25.7	11.6	6.8

Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	8.00	21.4	24.7	11.1	6.43
Arithmetic SD (s)	0.34	0.7	0.8	0.4	0.35
Arithmetic RSD (%)	4.3	3.3	3.3	4.0	5.5
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Whole Blood: Molybdenum (Mo)

Whole Blood Mo (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
103	DRC/CC-ICP-MS	41.1	7.09	4.36	72.4	33.7
147	ICP-MS	40.1	6.85	4.16	71.5	33.2
596	HR-ICP-MS	37.7	7.08	4.13	66.5	31.2
598	ICP-MS	43.4	*10.1	*5.6	75.7	36.5

Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	40.6	7.00	4.21	71.5	33.6
Arithmetic SD (s)	2.3	0.13	0.11	3.7	2.1
Arithmetic RSD (%)	5.7	1.9	2.8	5.2	6.4
Number of Sample Measurements (N)	4	3	3	4	4

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Whole Blood: Tin (Sn)

Whole Blood Sn (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
110	ICP-MS	1.8	2.1	10.3	5.6	2.1
147	ICP-MS	1.44	2.04	10.1	5.51	1.94
596	ICP-MS	1.45	1.78	9.26	4.8	1.8
598	ICP-MS	2.9	2.02	11.8	5.67	2.22

Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	1.89	1.98	10.3	5.39	2.01
Arithmetic SD (s)	0.68	0.14	1.0	0.40	0.18
Arithmetic RSD (%)	36	7.1	10	7.4	9
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Whole Blood: Vanadium (V)

Whole Blood V (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
110	DRC/CC-ICP-MS	1.1	15.4	17.5	20.7	9.1
147	DRC/CC-ICP-MS	1.09	14.8	17.3	21.1	9.34
596	HR-ICP-MS	0.801	12.7	14.9	*17.5	8.25
598	ICP-MS	*3.9	16.1	17.8	21.1	10.4

Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	0.999	14.7	16.9	20.9	9.26
Arithmetic SD (s)	0.172	1.4	1.3	0.2	0.88
Arithmetic RSD (%)	17	9.9	8.0	0.9	9.5
Number of Sample Measurements (N)	3	4	4	3	4

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Whole Blood: Tungsten (W)

Whole Blood W (µg/L)						
Lab Code	**Method**	**BE16-01**	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
110	ICP-MS	0.4	<0.3	1.2	9.5	3.2
200	ICP-MS	0.4	0.2	1.2	11.5	3.6
596	HR-ICP-MS	*1.67	<0.300	*5.3	*47	*14.4
598	ICP-MS	<2	<2	<2	8.5	3.1

Summary Statistics					
	BE16-01	**BE16-02**	**BE16-03**	**BE16-04**	**BE16-05**
Arithmetic Mean ($\bar{x}$)	0.400	0.2	1.2	9.84	3.29
Arithmetic SD (s)	0.000	NA	0.0	1.52	0.27
Arithmetic RSD (%)	0	NA	0	15	8.2
Number of Sample Measurements (N)	2	1	2	3	3

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Whole Blood

Whole Blood Ag (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
147	ICP-MS	1.21	<0.053	2.02	9.01	1.91

Whole Blood Al (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
147	ICP-MS	<5.40	<5.40	<5.40	<5.40	<5.40
596	ICP-AES/OES	43	44	40	39	37

Whole Blood Be (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
110	ICP-MS	<0.14	<0.14	<0.14	<0.14	<0.14
147	ICP-MS	<1.80	<1.80	<1.80	<1.80	<1.80
596	HR-ICP-MS	<0.136	<0.136	<0.136	<0.136	<0.136
598	ICP-MS	<1	<1	<1	<1	<1

Whole Blood Bi (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
147	ICP-MS	<0.006	<0.006	<0.006	<0.006	<0.006

Whole Blood Cs (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
110	ICP-MS	0.3	0.6	0.5	0.5	0.4

Whole Blood I (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
147	ICP-MS	29.4	43.4	39.9	41.1	30.4

Whole Blood Li (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
147	ICP-MS	1.08	5.09	5.4	2.52	1.67

Whole Blood Pt (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
110	ICP-MS	<0.1	<0.1	<0.1	<0.1	<0.1
596	HR-ICP-MS	<0.229	<0.229	<0.229	<0.229	<0.229
598	ICP-MS	<1	<1	<1	<1	<1

Results for Event #1, 2016
Additional Elements in Whole Blood

Whole Blood Sb (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
103	DRC/CC-ICP-MS	<0.258	<0.258	<0.258	<0.258	<0.258
110	ICP-MS	<0.10	<0.10	<0.10	<0.10	<0.10
147	ICP-MS	<0.036	<0.036	<0.036	<0.036	<0.036

Whole Blood Sr (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
103	DRC/CC-ICP-MS	266	273	313	308	325

Whole Blood Te (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
147	ICP-MS	<0.076	<0.076	<0.076	<0.076	<0.076
596	HR-ICP-MS	0.035	0.074	<0.021	-.0047999	-.004799
598	ICP-MS	<2	<2	<2	<2	<2

Whole Blood Ti (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
596	ICP-AES/OES	12	14	27	20	15

Whole Blood U (µg/L)

Lab Code	Method	BE16-01	BE16-02	BE16-03	BE16-04	BE16-05
103	DRC/CC-ICP-MS	<0.007	<0.007	<0.007	<0.007	<0.007
110	ICP-MS	<0.02	<0.02	<0.02	<0.02	<0.02
147	ICP-MS	<0.007	<0.007	<0.007	<0.007	<0.007
596	HR-ICP-MS	0.393	0.396	0.394	0.393	0.394
598	ICP-MS	<1	<1	<1	<1	<1

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Event #1, 2016
Trace Elements in Urine

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

2016 Event #1:
Trace Elements in Urine

PT Materials

Urine was collected from volunteer donors into polyethylene containers and stored at 4°C. Following collection, urine was acidified to 1% (v/v) with nitric acid and mixed with a sulfamic acid solution (stock solution contained 200 mg/mL sulfamic acid and 10% (v/v) Triton-X 100) to a final concentration of 1% (v/v) to stabilize Hg. Urine was stored frozen at -80°C pending further preparation. The urine was thawed at room temperature and precipitated salts removed by centrifugation. Urine supernatants were combined and subsequently separated into five pools. Each urine pool was supplemented with arsenic (As), cadmium (Cd), mercury (Hg), lead (Pb), aluminum (Al), barium (Ba), beryllium (Be), cesium (Cs), cobalt (Co), copper (Cu), chromium (Cr), manganese (Mn), molybdenum (Mo), nickel (Ni), platinum (Pt), antimony (Sb), selenium (Se), tin (Sn), tellurium (Te), thallium (Tl), uranium (U) vanadium (V), tungsten (W), and zinc (Zn) and stirred overnight to ensure thorough mixing prior to aliquoting 10-mL into polypropylene vials. PT samples were stored at -80°C until the week of the PT event, when they were thawed at 4°C prior to circulation to laboratories for analysis.

Graded Elements

Nine elements in urine are formally graded: As, Ba, Be, Cd, Hg, Mn, Pb, Tl, and U. Target values for the graded elements are assigned to these pools based on (a) the robust mean calculated from data reported by all laboratories, or (b) where a robust mean is not possible, the arithmetic mean after outlier deletion.

Additional Elements

An additional 23 elements (beyond the nine graded) were reported by at least one participant: Ag, Al, B, Bi, Co, Cr, Cs, Cu, Fe, I, Li, Mo, Ni, Pt, Sb, Se, Sn, Sr, Te, Th, V, W, Zn. These data are included here to provide a more complete characterization of the PT materials. All results reported by participant laboratories are tabulated and organized by lab code. The PT data are graphed for visual comparison purposes for all elements where at least five laboratories reported a value greater than the LOD. A statistical summary table is provided for samples where at least two comparable values were reported as above the LOD.

The summary statistics for the additional elements are provided for educational purposes only, i.e., no acceptable response is implied. However, it is expected that each laboratory would wish to investigate a potential source of bias if warranted by these data. Future events might result in additional elements becoming graded if a consensus can be reached regarding desired quality specifications.

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Results for Event #1, 2016
Urine Arsenic (As)

Summary Statistics

	Urine As (µg/L)				
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Target (Robust Mean (x*))	13.8	21.1	31.0	86.1	43.3
Upper Limit	19.8	27.1	37.2	103.3	51.9
Lower Limit	7.8	15.1	24.8	68.8	34.6
Robust SD (s*)	1.1	1.4	1.5	5.8	2.6
Robust RSD (%)	8.4	6.8	5.0	6.7	6.0
Number of Sample Measurements (N)	15	15	15	15	15
Standard Uncertainty (*u*)	0.38	0.46	0.50	1.88	0.85

The acceptable range is based on quality specifications:
±6 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±6 µg/L at concentrations less than or equal to 30 µg/L. These quality specifications are based on the same criteria used by the US Centers for Disease Control Prevention (CDC) for public health labs participating in the Laboratory Response Network (LRN) PT program for Toxic Metals.

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Results for Event #1, 2016
Urine Arsenic (As)
Performance of Participating Laboratories

		Urine As (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**13.8**	**21.1**	**31.0**	**86.1**	**43.3**
103	DRC/CC-ICP-MS	14.5	22.0	32.5	88.1	45.8
107	DRC/CC-ICP-MS	13	20	30	80	41
110	DRC/CC-ICP-MS	16	20	31	91	48
116	DRC/CC-ICP-MS	13.9	21.7	29.3	80.5	41.2
147	ICP-MS	13.6	20.1	30.6	82.4	43.1
200	ICP-MS	14	21.6	31.3	82.3	42.7
293	ICP-MS	14.4	21.8	32.9	89.9	46.4
391	DRC/CC-ICP-MS	15.1	21.8	32.7	90.3	42.4
596	HR-ICP-MS	13.7	21.3	29.9	86	42.8
597	DRC/CC-ICP-MS	19.8 ↑	31.6 ↑	46.2 ↑	124 ↑	71.2 ↑
598	DRC/CC-ICP-MS	12.6	19.8	30.2	82.9	41.2
599	DRC/CC-ICP-MS	11.8	23.7	39.4 ↑	97.6	60.8 ↑
605	ICP-MS	14.6	21.3	31.6	85	42.9
606	ICP-MS	9.89	17.0	27.1	80.5	39.5
632	DRC/CC-ICP-MS	13.4	20.2	30	82.7	42

Based on the grading criteria for As in Urine, 91% of results were satisfactory, with two of the fifteen laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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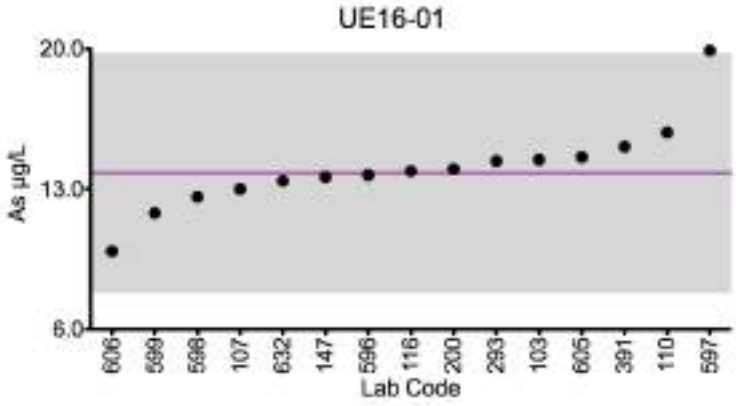
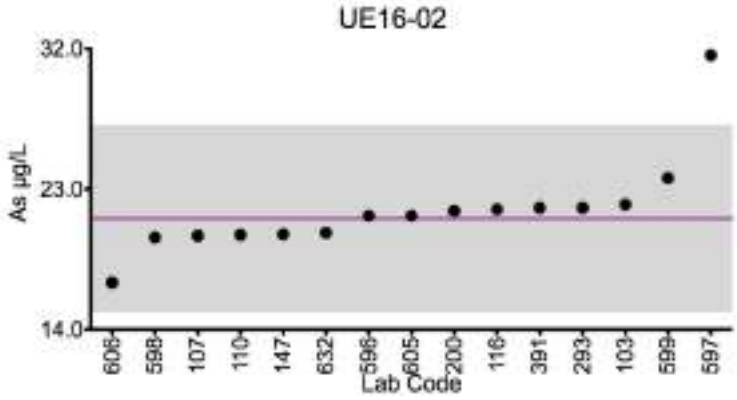
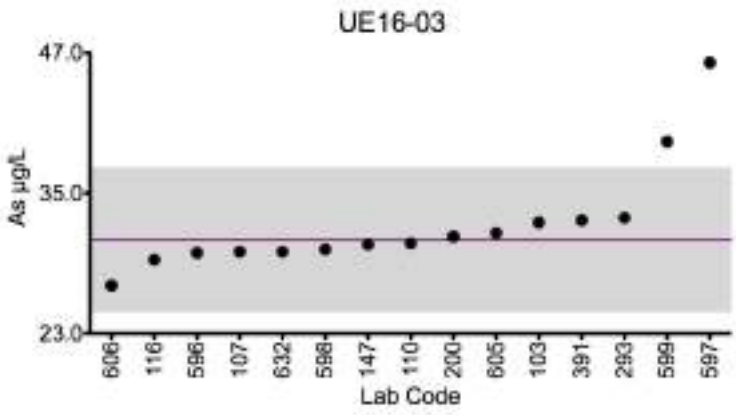
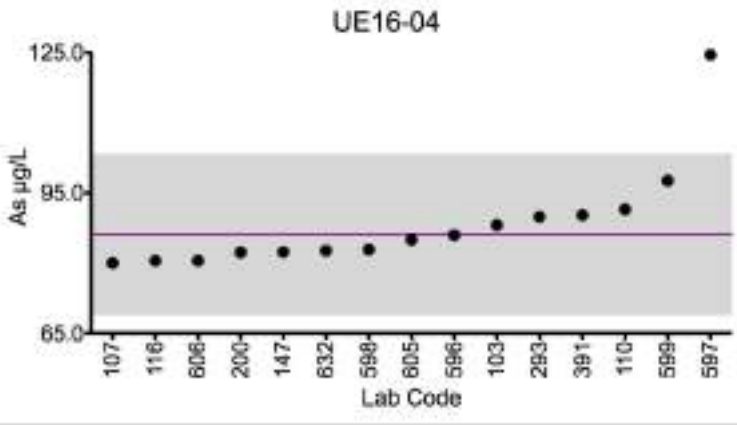
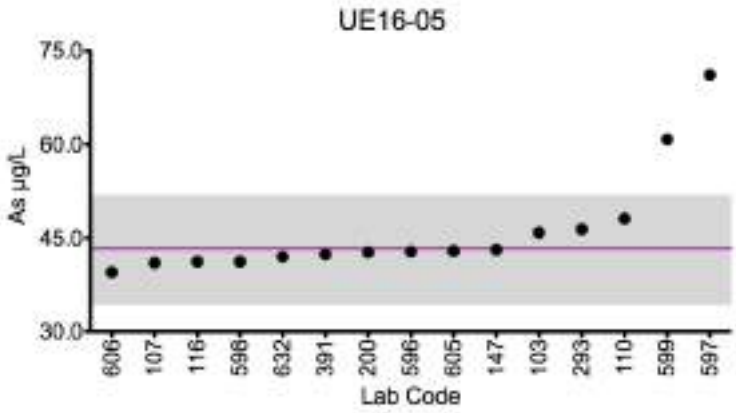
Results for Event #1, 2016: Urine As











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±6 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±6 µg/L at concentrations less than or equal to 30 µg/L.

Results for Event #1, 2016
Urine Barium (Ba)
Summary Statistics

	Urine Ba (µg/L)				
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Target (Arithmetic Mean ($\bar{x}$))	0.612	1.40	1.88	0.820	0.750
Upper Limit	1.612	2.40	2.88	1.820	1.750
Lower Limit	0	0.40	0.88	0	0
Arithmetic SD (s)	0.076	0.10	0.10	0.076	0.117
Arithmetic RSD (%)	12	7.5	5.6	9.3	15
Number of Sample Measurements (N)	7	7	7	7	7

The acceptable range is based on quality specifications:
±1 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 5 µg/L. These quality specifications are based on the same criteria used by the US Centers for Disease Control Prevention (CDC) for public health labs participating in the Laboratory Response Network (LRN) PT program for Toxic Metals.

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Results for Event #1, 2016
Urine Barium (Ba)
Performance of Participating Laboratories

		Urine Ba (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**0.612**	**1.40**	**1.88**	**0.820**	**0.750**
107	ICP-MS	0.6	1.4	1.9	0.82	0.76
110	ICP-MS	0.6	1.4	1.9	0.8	0.7
116	ICP-MS	0.467	1.26	1.72	0.682	0.612
147	ICP-MS	0.603	1.32	1.77	0.762	0.636
605	ICP-MS	0.687	1.45	1.92	0.893	0.807
607	ICP-MS	0.678	1.44	1.93	0.874	0.807
632	ICP-MS	0.667	1.59	2.04	0.888	0.95

Based on the grading criteria for Ba in Urine, 100% of results were satisfactory, with none of the seven laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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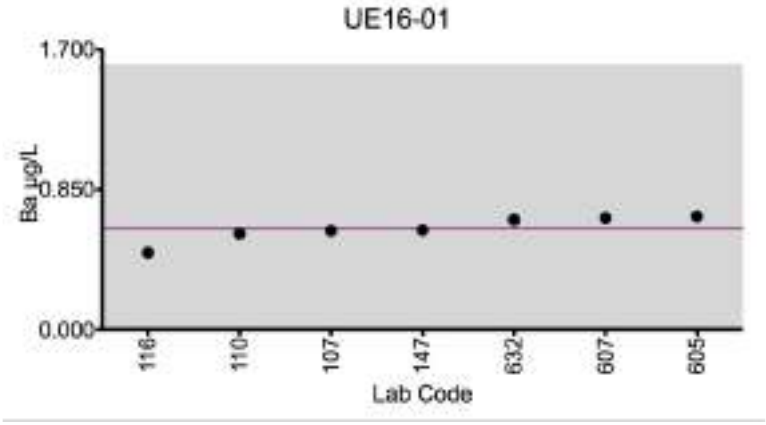
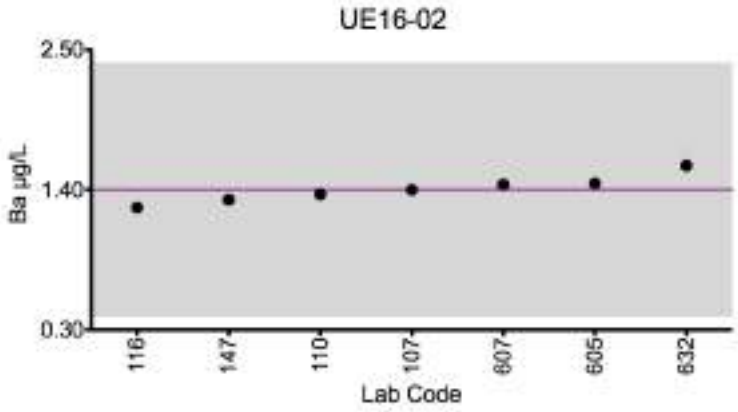
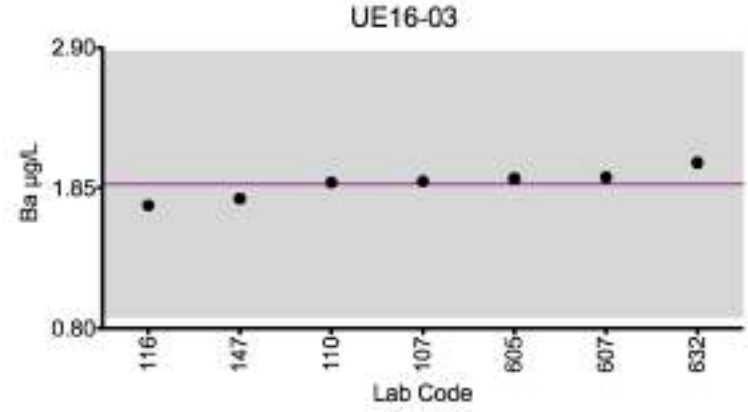
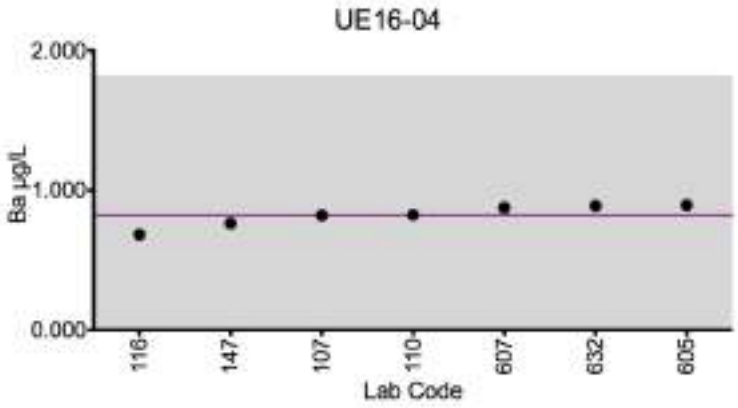
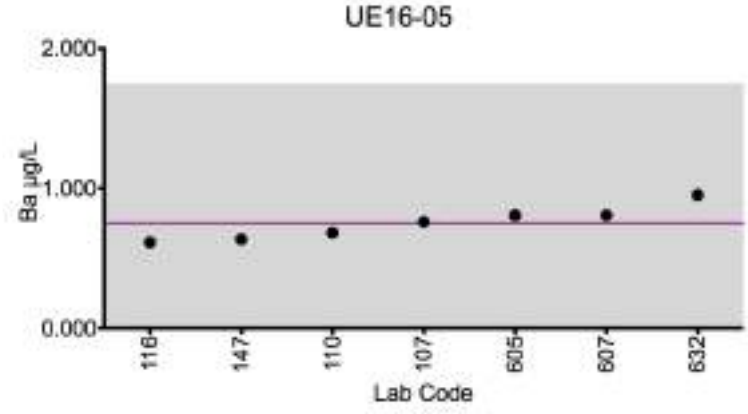
Results for Event #1, 2016: Urine Ba











Legend:
Horizontal purple line = assigned target value based on the arithmetic mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±1 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 5 µg/L.

Results for Event #1, 2016
Urine Beryllium (Be)

Summary Statistics

	Urine Be (µg/L)				
	UE16-01^	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Target (Robust Mean (x*))	0.066	0.912	1.45	0.355	0.247
Upper Limit	1.066	1.911	2.45	1.355	1.247
Lower Limit	0	0	0.45	0	0
Robust SD (s*)	0.082	0.102	0.13	0.041	0.046
Robust RSD (%)	124	11	9.3	11	18
Number of Sample Measurements (N)	4	10	10	9	6
Standard Uncertainty (*u*)	NA	0.04	0.05	0.01	0.02

The acceptable range is based on quality specifications:
±1 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 5 µg/L. These quality specifications are based on the same criteria used by the US Centers for Disease Control Prevention (CDC) for public health labs participating in the Laboratory Response Network (LRN) PT program for Toxic Metals.

^The summary statistics for sample UE16-01 are based on an arithmetic mean rather than robust statistics due to a small number of sample measurements compared to the remaining four samples.

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Results for Event #1, 2016
Urine Beryllium (Be)
Performance of Participating Laboratories

		Urine Be (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**0.066**	**0.912**	**1.45**	**0.355**	**0.247**
107	ICP-MS	0.14	0.95	1.5	0.38	0.27
110	ICP-MS	0.12	0.91	1.58	0.34	0.20
116	ICP-MS	<MDL	0.895	1.39	0.286	0.207
147	ICP-MS	<0.360	0.806	1.4	<0.360	<0.360
596	HR-ICP-MS	0.163	1.11	1.76	0.391	0.252
598	ICP-MS	<0.4	0.7	1.2	<0.4	<0.4
605	ICP-MS	PLC	1.04	1.59	0.386	PLC
606	ICP-MS	<0.300	0.88	1.43	0.312	<0.300
607	ICP-MS	<0.25	0.976	1.44	0.362	0.327
632	ICP-MS	0.104	0.86	1.33	0.325	0.237

Based on the grading criteria for Be in Urine, 100% of results were satisfactory, with none of the ten laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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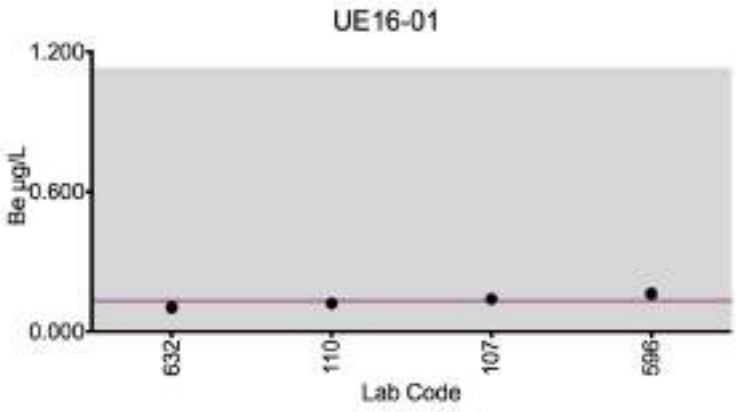
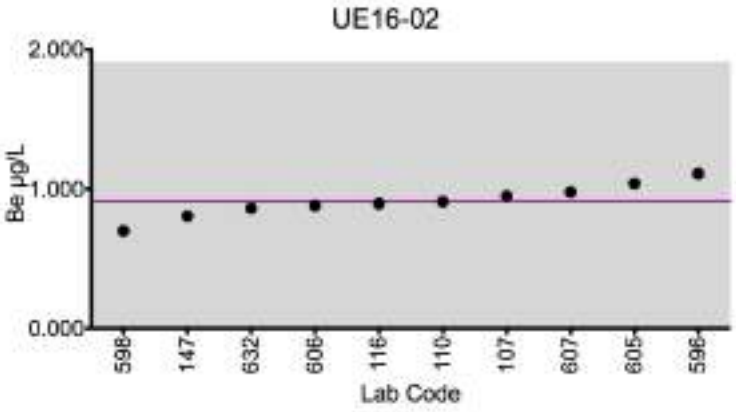
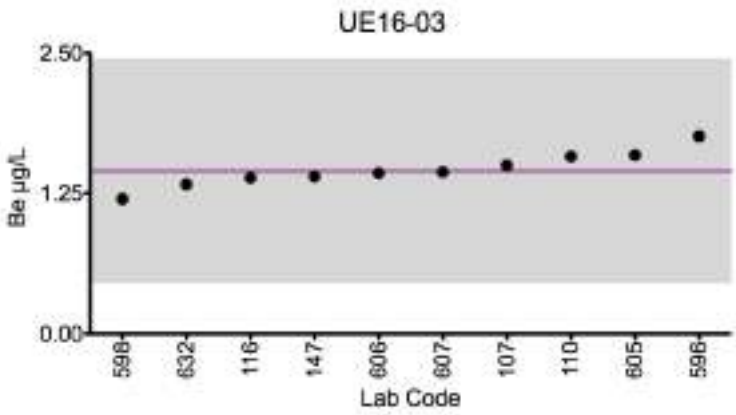
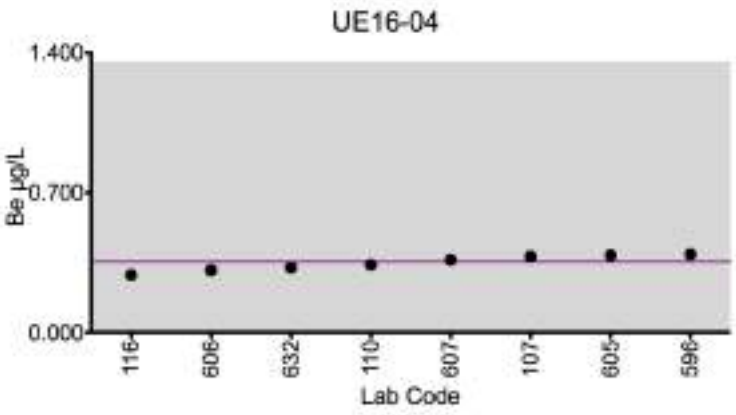
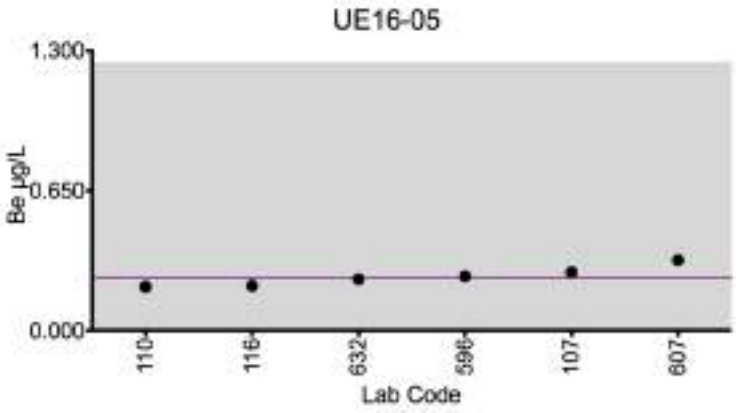
Results for Event #1, 2016: Urine Be











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±1 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 5 µg/L.

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Results for Event #1, 2016
Urine Cadmium (Cd)

Summary Statistics

	Urine Cd (µg/L)				
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Target (Robust Mean (x*))	4.66	3.57	1.24	0.330	1.96
Upper Limit	5.66	4.57	2.24	1.330	2.96
Lower Limit	3.66	2.57	0.24	0	0.96
Robust SD (s*)	0.21	0.24	0.08	0.047	0.13
Robust RSD (%)	4.6	6.7	6.6	14	6.8
Number of Sample Measurements (N)	16	16	16	15	16
Standard Uncertainty (*u*)	0.06	0.07	0.02	0.01	0.04

The acceptable range is based on quality specifications:
±1 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 6.6 µg/L. These quality specifications are based on the same criteria used by the US Centers for Disease Control Prevention (CDC) for public health labs participating in the Laboratory Response Network (LRN) PT program for Toxic Metals.

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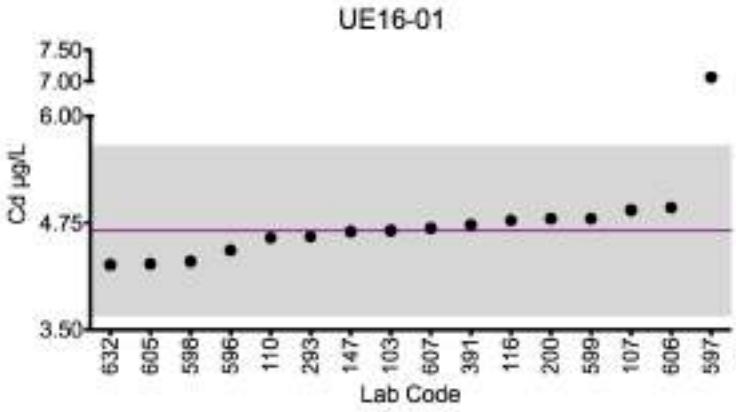
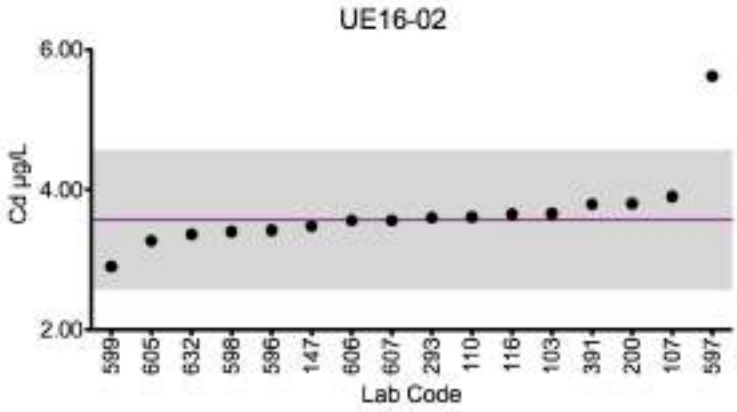
Results for Event #1, 2016
Urine Cadmium (Cd)
Performance of Participating Laboratories

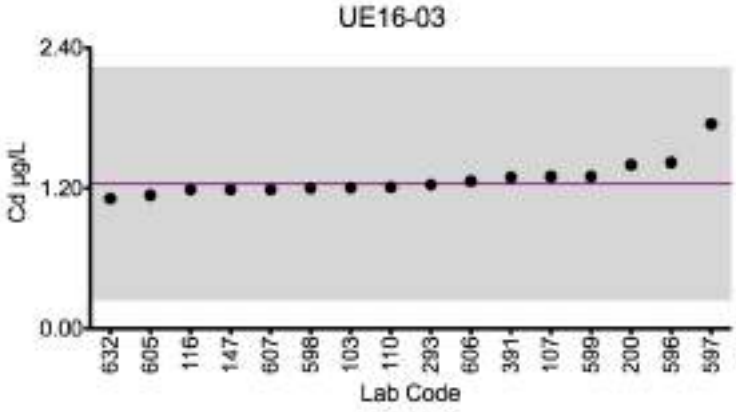
		Urine Cd (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**4.66**	**3.57**	**1.24**	**0.330**	**1.96**
103	DRC/CC-ICP-MS	4.66	3.66	1.21	0.355	2.04
107	DRC/CC-ICP-MS	4.9	3.9	1.3	0.34	2.2
110	ICP-MS	4.58	3.61	1.21	0.32	1.93
116	ICP-MS	4.78	3.65	1.19	0.277	2.02
147	ICP-MS	4.65	3.48	1.19	0.256	1.94
200	ICP-MS	4.8	3.8	1.4	0.4	2.6
293	ICP-MS	4.59	3.6	1.23	0.289	1.97
391	DRC/CC-ICP-MS	4.72	3.79	1.29	0.353	1.98
596	HR-ICP-MS	4.43	3.42	1.42	0.508	2.02
597	DRC/CC-ICP-MS	7.06 ↑	5.62 ↑	1.75	0.36	3.38 ↑
598	ICP-MS	4.3	3.4	1.2	<0.4	1.8
599	DRC/CC-ICP-MS	4.8	2.9	1.3	0.3	1.7
605	ICP-MS	4.26	3.27	1.13	0.305	1.8
606	ICP-MS	4.93	3.56	1.26	0.372	1.88
607	ICP-MS	4.69	3.56	1.19	0.338	1.95
632	DRC/CC-ICP-MS	4.26	3.36	1.11	0.309	1.85

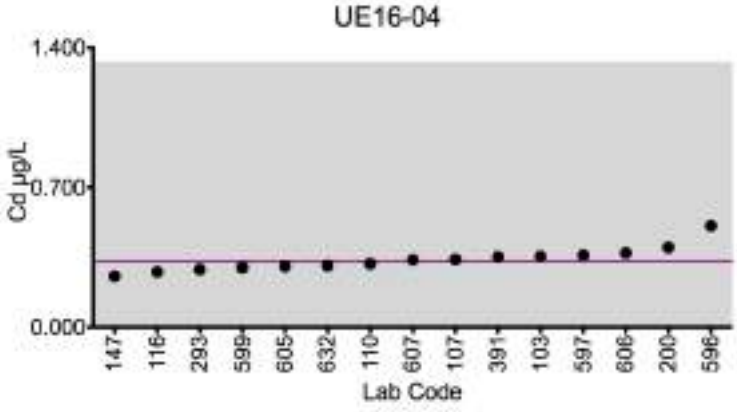
Based on the grading criteria for Cd in Urine, 96% of results were satisfactory, with one of the sixteen laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

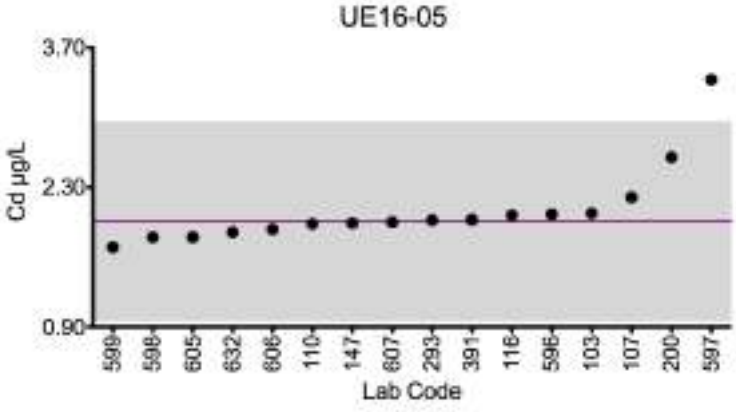
Results for Event #1, 2016: Urine Cd











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±1 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 6.6 µg/L.

Results for Event #1, 2016
Urine Mercury (Hg)

Summary Statistics

	Urine Hg (µg/L)				
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Target (Robust Mean (x*))	7.14	4.69	8.78	2.91	17.4
Upper Limit	10.14	7.69	11.78	5.91	22.6
Lower Limit	4.13	1.69	5.78	0	12.1
Robust SD (s*)	1.10	0.56	0.79	0.39	2.3
Robust RSD (%)	15	12	9	13	13
Number of Sample Measurements (N)	11	11	12	12	12
Standard Uncertainty (*u*)	0.41	0.21	0.28	0.14	0.84

The acceptable range is based on quality specifications:
±3 µg/L or ±30% around the target value, whichever is greater; thus, it is fixed at ±3 µg/L at concentrations less than or equal to 10 µg/L. These quality specifications were established by New York State Department of Health's Wadsworth Center, the PT Program organizer and are also used by the US Center for Diesease Control Prevention (CDC) for public health labs participating in the Laboratory Response Network (LRN) PT program for Toxic Metals.

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Results for Event #1, 2016
Urine Mercury (Hg)
Performance of Participating Laboratories

		Urine Hg (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**7.14**	**4.69**	**8.78**	**2.91**	**17.4**
103	DRC/CC-ICP-MS	6.94	4.65	8.84	2.86	17.3
107	DRC/CC-ICP-MS	6.7	4.5	8.5	2.7	16
110	ICP-MS	7.4	4.5	8.5	2.7	17.5
147	CV-AAS	6.63	4.36	8.25	2.52	16.1
200	ICP-MS	8.4	5.2	9.6	3.2	19.3
293	ICP-MS	5.85	4.05	7.39	2.69	15.2
391	DRC/CC-ICP-MS	8.39	5.20	9.51	3.12	19.3
596	ICP-MS	6.87	4.66	8.72	2.72	16.8
597	DMA	8.11	5.41	10.1	3.35	20.1
598	ICP-MS	5.5	3.9	7.1	2.4	12.7
605	ICP-MS	PGC	PGC	9.22	24.2 ↑	39.2 ↑
606	ICP-MS	7.78	5.16	9.06	3.23	17.0

Based on the grading criteria for Hg in Urine, 97% of results were satisfactory, with one of the twelve laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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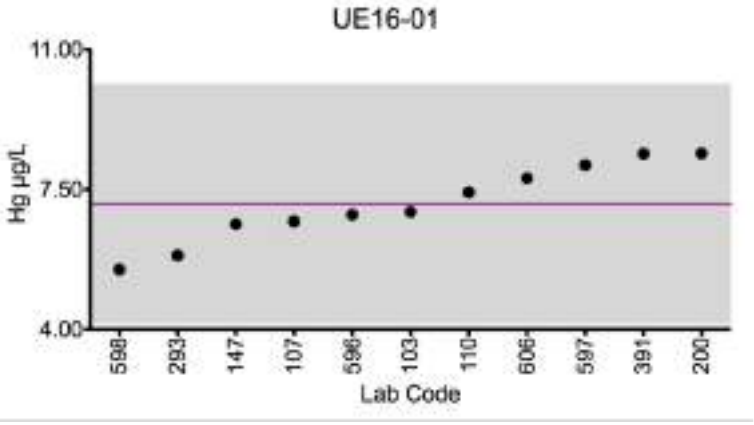
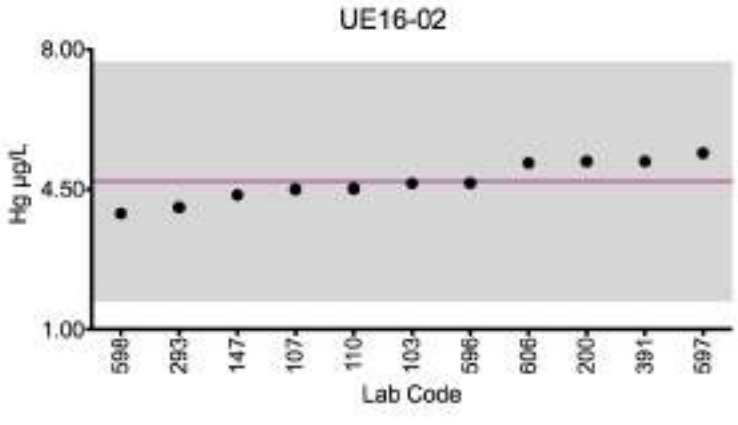
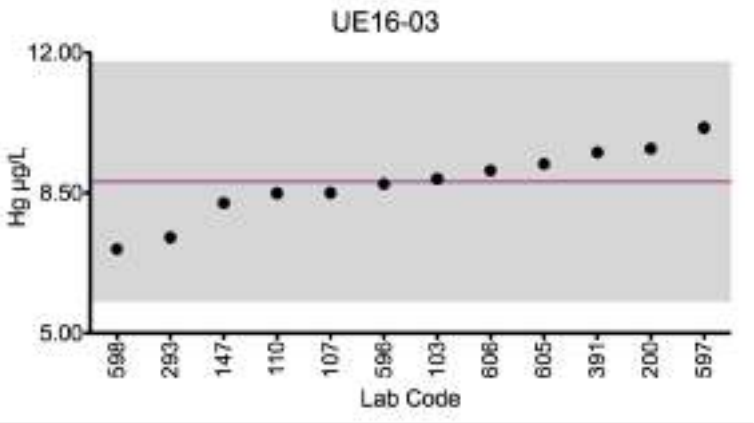
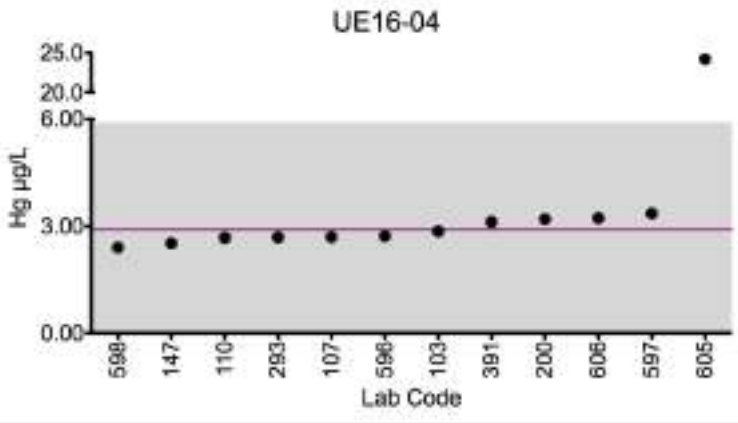
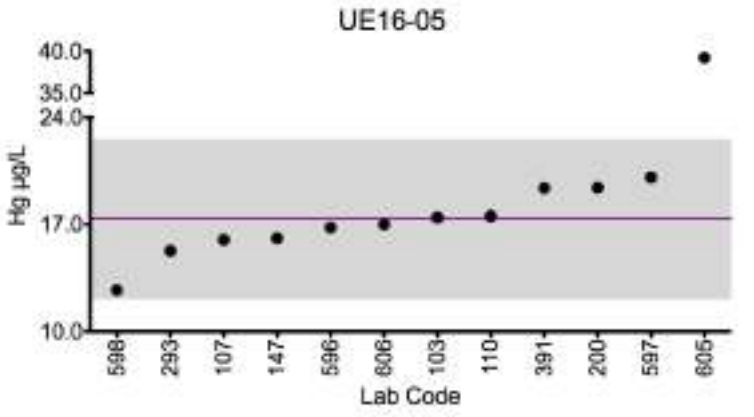
Results for Event #1, 2016: Urine Hg











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±3 µg/L or ±30% around the target value, whichever is greater; thus, it is fixed at ±3 µg/L at concentrations less than or equal to 10 µg/L.

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Results for Event #1, 2016
Urine Manganese (Mn)

Summary Statistics

	Urine Mn (µg/L)				
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Target (Robust Mean (x*))	0.219	1.10	1.55	0.567	0.459
Upper Limit	0.598	1.48	1.93	0.946	0.838
Lower Limit	0	0.72	1.17	0.187	0.079
Robust SD (s*)	0.061	0.13	0.22	0.176	0.182
Robust RSD (%)	28	12	14	31	39
Number of Sample Measurements (N)	8	10	10	9	8
Standard Uncertainty (*u*)	0.02	0.05	0.08	0.07	0.08

The acceptable range is based on quality specifications:
±0.38 µg/L or ±10% around the target value, whichever is greater; thus, it is fixed at ±0.38 µg/L at concentrations less than or equal to 3.8 µg/L. These quality specifications were proposed by a network of Trace Element PT Program organizers (Praamsma M, et al. An assessment of clinical laboratoy performance for the determination of manganese in blood and urine. Clinical Chemistry and Laboratory Medicine. 2016 in press.)

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Results for Event #1, 2016
Urine Manganese (Mn)
Performance of Participating Laboratories

		Urine Mn (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**0.219**	**1.10**	**1.55**	**0.567**	**0.459**
103	DRC/CC-ICP-MS	0.182	0.98	1.43	0.367	0.291
107	DRC/CC-ICP-MS	0.17	1.1	1.6	0.56	0.33
110	DRC/CC-ICP-MS	<MDL	1.1	1.7	0.53	<MDL
147	DRC/CC-ICP-MS	0.175	0.885	1.33	0.37	0.394
391	DRC/CC-ICP-MS	0.16	0.957	1.31	0.679	0.478
596	HR-ICP-MS	0.406	1.12	1.63	0.612	0.516
597	DRC/CC-ICP-MS	0.405	1.72 ↑	2.65 ↑	0.711	0.661
598	ICP-MS	0.5	1.4	1.9	1 ↑	0.9 ↑
606	ICP-MS	<1.00	1.12	1.5	<1.00	<1.00
632	DRC/CC-ICP-MS	0.22	1.11	1.39	0.456	0.297

Based on the grading criteria for Mn in Urine, 92% of results were satisfactory, with two of the ten laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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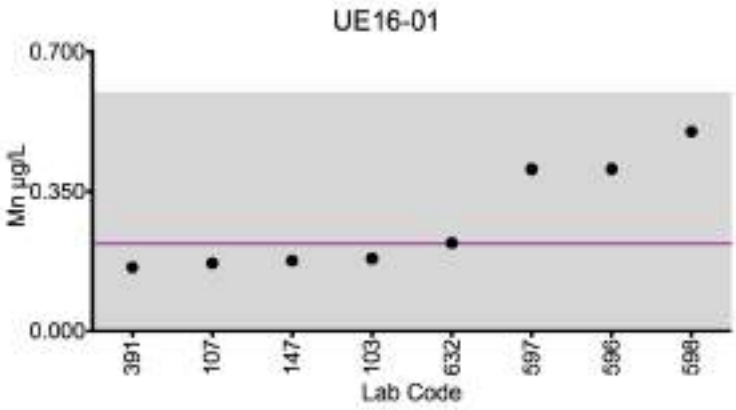
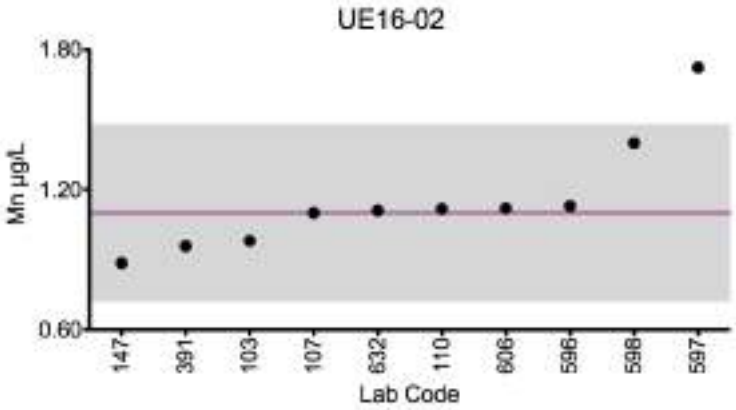
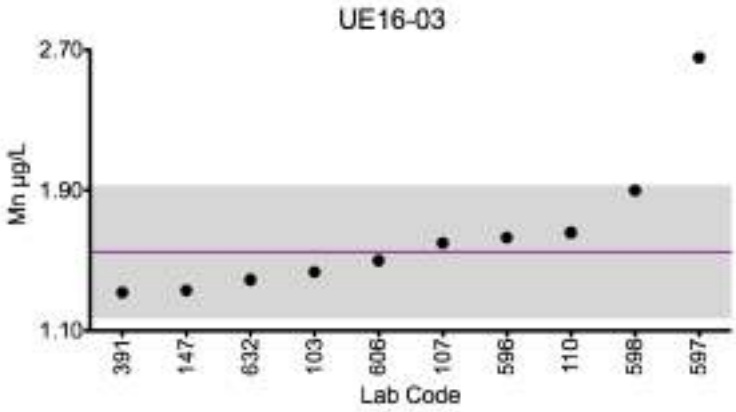
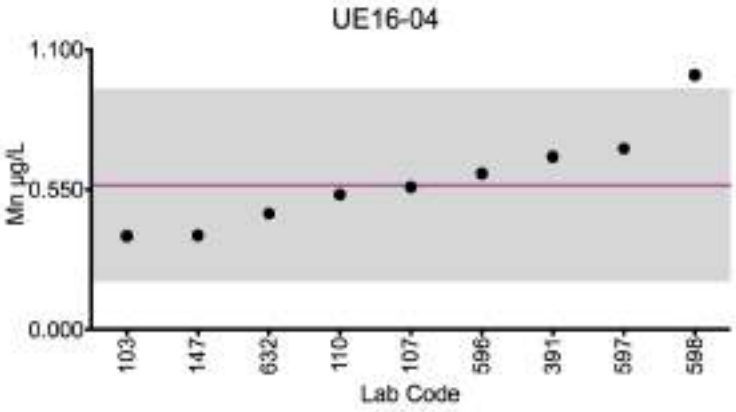
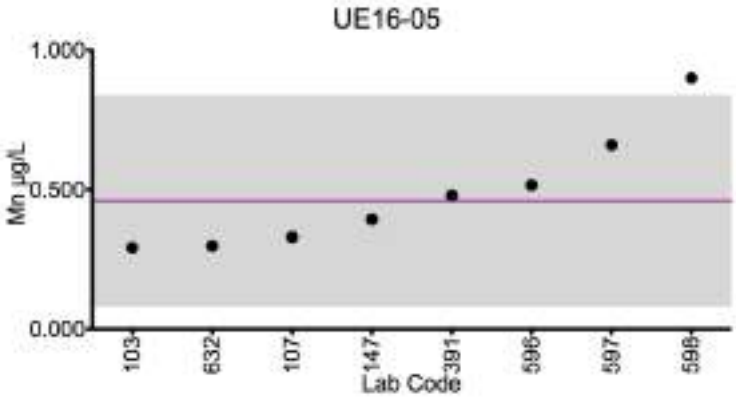
Results for Event #1, 2016: Urine Mn











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±0.38 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±0.38 µg/L at concentrations less than or equal to 5 µg/L.

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Results for Event #1, 2016
Urine Lead (Pb)
Performance of Participating Laboratories

		Urine Pb (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**1.60**	**11.4**	**17.5**	**4.30**	**3.30**
632	ICP-MS	2.3	10.9	16.7	4.1	3.1
103	DRC/CC-ICP-MS	1.58	11.2	17.2	4.27	3.23
107	ICP-MS	1.7	12	18	4.3	3.3
110	ICP-MS	1.8	11.3	17.5	4.3	3.5
116	ICP-MS	1.55	11.5	17.8	4.27	3.28
147	ICP-MS	1.5	11	17.1	4.1	3.09
200	ICP-MS	1	10.8	17.8	4.8	4.3 ↑
293	ICP-MS	1	10.9	17	3.9	2.8
324	HR-ICP-MS	1.8	12.9	19.9	4.8	3.6
391	DRC/CC-ICP-MS	1.7	13.8 ↑	19.6	4.8	3.6
596	HR-ICP-MS	1.22	9.67	15.6	3.7	2.68
597	DRC/CC-ICP-MS	2.2	16.4 ↑	25.4 ↑	5.9 ↑	4.9 ↑
598	ICP-MS	1.2	8.5 ↓	13.7 ↓	3.6	2.4
599	DRC/CC-ICP-MS	2.6 ↑	12.5	17.3	5	4.2
605	ICP-MS	1.7	11.3	17.5	4.42	3.27
606	ICP-MS	1.61	11.8	18.1	4.48	3.36
607	ICP-MS	1.6	11.2	17.3	4.2	3.2

Based on the grading criteria for Pb in Urine, 89% of results were satisfactory, with two of the seventeen laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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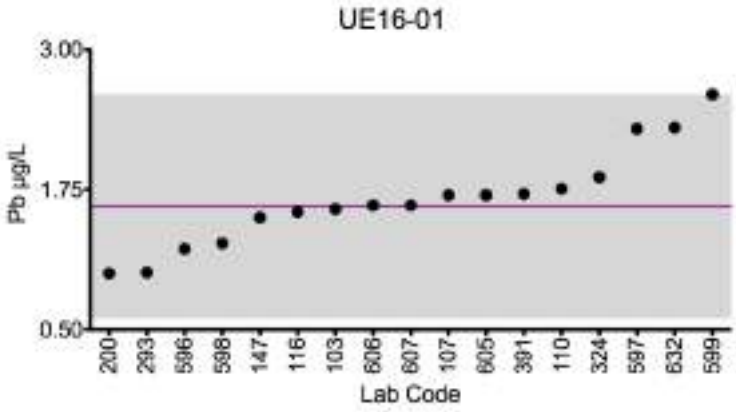
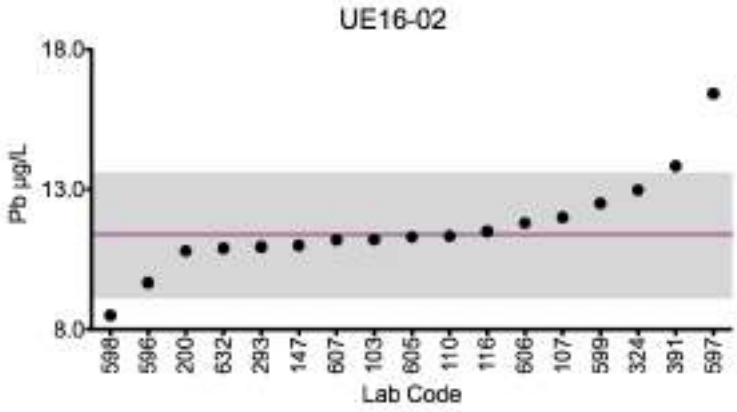
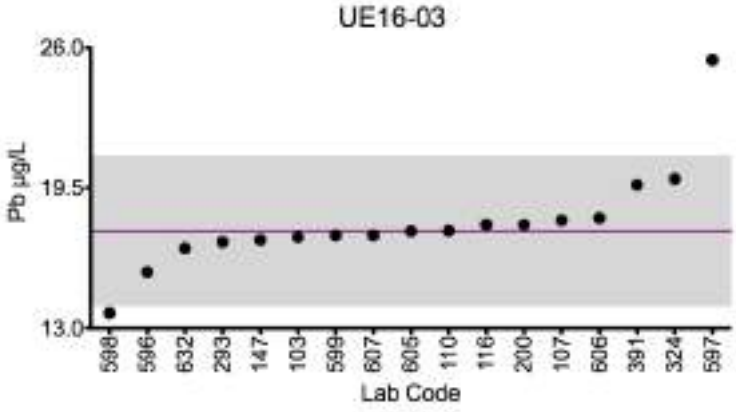
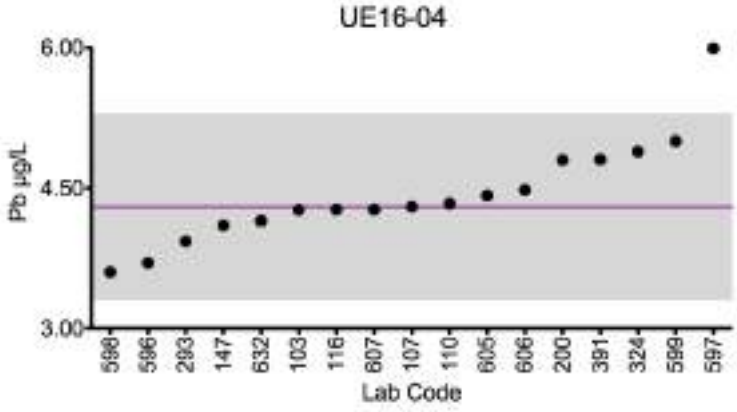
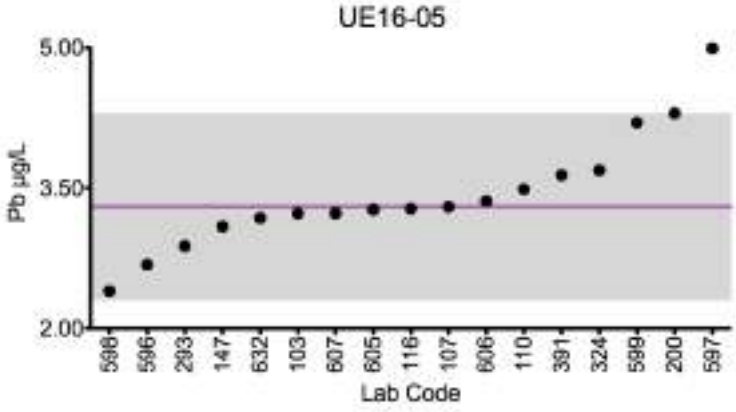
Results for Event #1, 2016: Urine Pb











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±1 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 5 µg/L.

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Results for Event #1, 2016
Urine Thallium (Tl)

Summary Statistics

	Urine Tl (µg/L)				
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Target (Robust Mean (x*))	0.287	1.85	2.85	0.720	0.548
Upper Limit	0.486	2.22	3.42	0.92	0.748
Lower Limit	0.086	1.48	2.27	0.52	0.347
Robust SD (s*)	0.022	0.06	0.08	0.03	0.014
Robust RSD (%)	7.7	3.2	2.9	3.6	2.7
Number of Sample Measurements (N)	11	11	11	11	11
Standard Uncertainty (*u*)	0.01	0.02	0.03	0.01	0.01

The acceptable range is based on quality specifications:
±0.2 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±0.2 µg/L at concentrations less than or equal to 1 µg/L. These quality specifications are based on the same criteria used by the US Centers for Disease Control Prevention (CDC) for public health labs participating in the Laboratory Response Network (LRN) PT program for Toxic Metals.

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Results for Event #1, 2016
Urine Thallium (Tl)
Performance of Participating Laboratories

		Urine Tl (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**0.287**	**1.85**	**2.85**	**0.720**	**0.548**
103	DRC/CC-ICP-MS	0.273	1.86	2.88	0.717	0.553
107	ICP-MS	0.3	2	3	0.77	0.579
110	ICP-MS	0.3	1.93	2.91	0.73	0.56
116	ICP-MS	0.265	1.88	2.92	0.705	0.54
147	ICP-MS	0.26	1.81	2.8	0.704	0.542
596	HR-ICP-MS	0.351	1.81	2.78	0.74	0.59
598	ICP-MS	<0.4	1.6	2.5	0.5 ↓	0.5
605	ICP-MS	0.292	1.88	2.86	0.743	0.539
606	ICP-MS	0.283	1.86	2.90	0.74	0.558
607	ICP-MS	0.273	1.82	2.85	0.71	0.545
632	ICP-MS	0.28	1.82	2.79	0.7	0.536

Based on the grading criteria for Tl in Urine, 98% of results were satisfactory, with none of the eleven laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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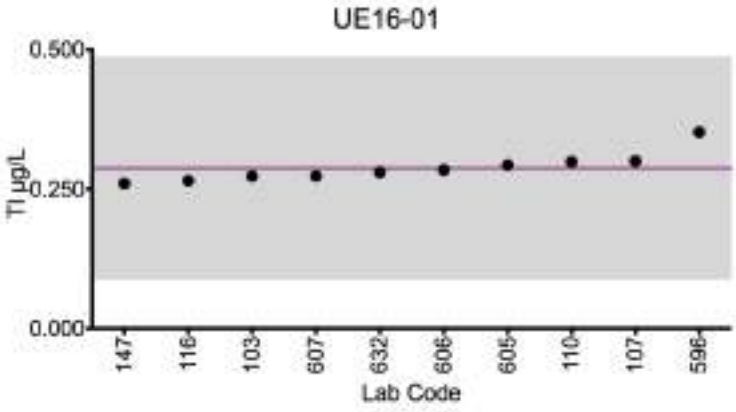
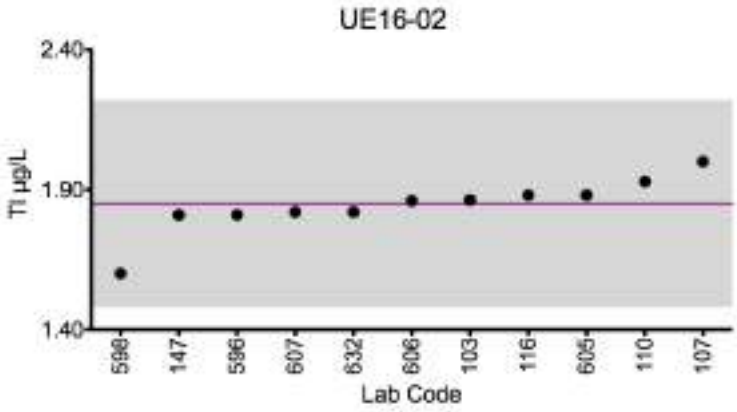
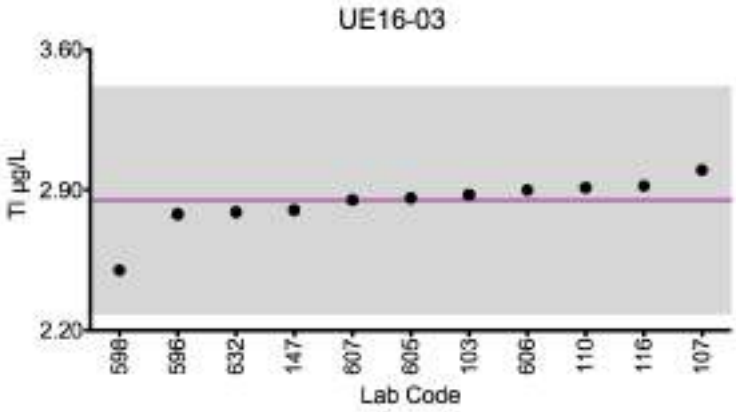
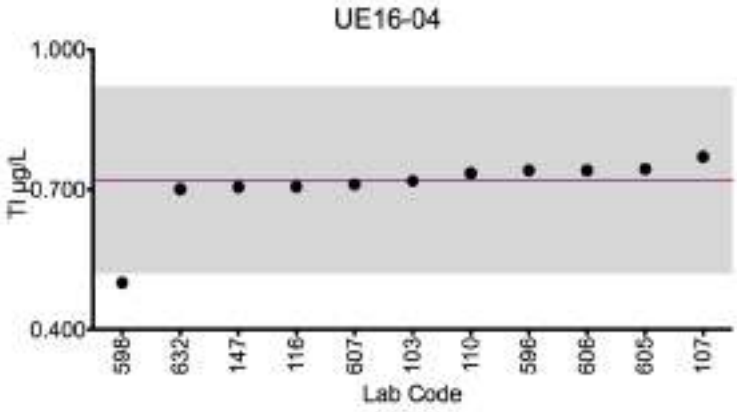
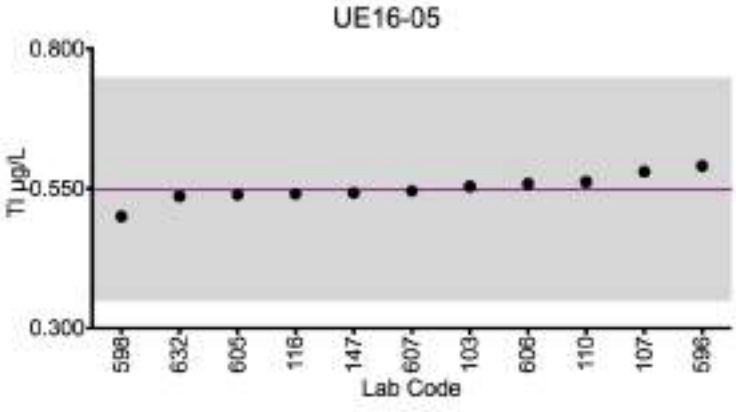
Results for Event #1, 2016: Urine Tl











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±0.2 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±0.2 µg/L at concentrations less than or equal to 1 µg/L.

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Results for Event #1, 2016
Urine Uranium (U)

Summary Statistics

	Urine U (µg/L)				
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Target (Robust Mean (x*))	0.013	0.093	0.145	0.035	0.025
Upper Limit	0.042	0.123	0.174	0.065	0.055
Lower Limit	0	0.063	0.115	0.005	0
Robust SD (s*)	0.001	0.006	0.007	0.003	0.004
Robust RSD (%)	7.8	7.3	5.2	9.3	16
Number of Sample Measurements (N)	10	11	11	11	11
Standard Uncertainty (*u*)	0.01	0.01	0.01	0.01	0.01

The acceptable range is based on quality specifications:
±0.03 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±0.03 µg/L at concentrations less than or equal to 0.15 µg/L. These quality specifications are based on the same criteria used by the US Centers for Disease Control Prevention (CDC) for public health labs participating in the Laboratory Response Network (LRN) PT program for Toxic Metals.

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Results for Event #1, 2016
Urine Uranium (U)
Performance of Participating Laboratories

		Urine U (µg/L)				
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
	Target	**0.013**	**0.093**	**0.145**	**0.035**	**0.025**
103	DRC/CC-ICP-MS	0.012	0.093	0.144	0.032	0.025
107	ICP-MS	0.014	0.1	0.16	0.039	0.03
110	ICP-MS	0.012	0.092	0.151	0.035	0.029
116	ICP-MS	0.009	0.085	0.138	0.031	0.021
147	ICP-MS	0.013	0.088	0.142	0.034	0.222 ↑
324	ICP-MS	0.014	0.101	0.154	0.037	0.028
596	HR-ICP-MS	0.014	0.102	0.155	0.039	0.031
598	ICP-MS	<0.4	<0.4	<0.4	<0.4	<0.4
605	ICP-MS	<0.015	0.093	0.141	0.036	0.027
606	ICP-MS	0.015	0.092	0.14	0.034	0.025
607	ICP-MS	0.014	0.085	0.141	0.034	0.025
632	ICP-MS	0.012	0.087	0.136	0.03	0.025

Based on the grading criteria for U in Urine, 98% of results were satisfactory, with none of the twelve laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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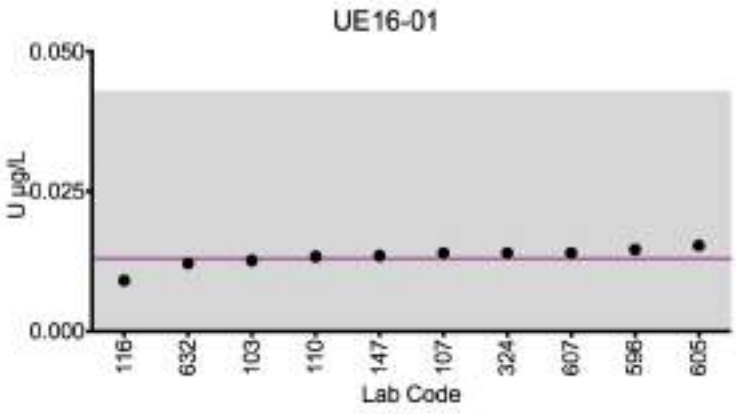
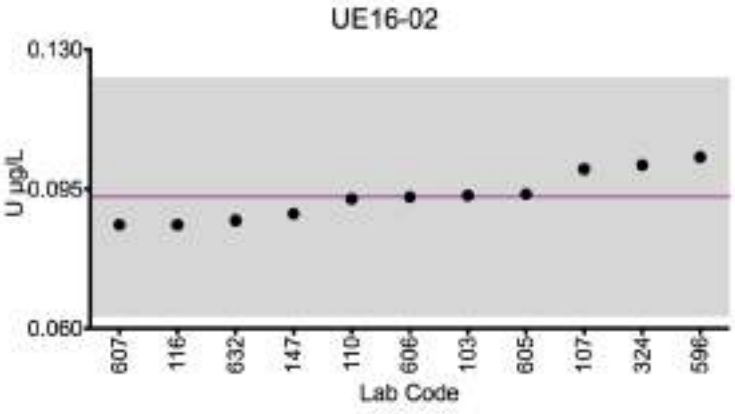
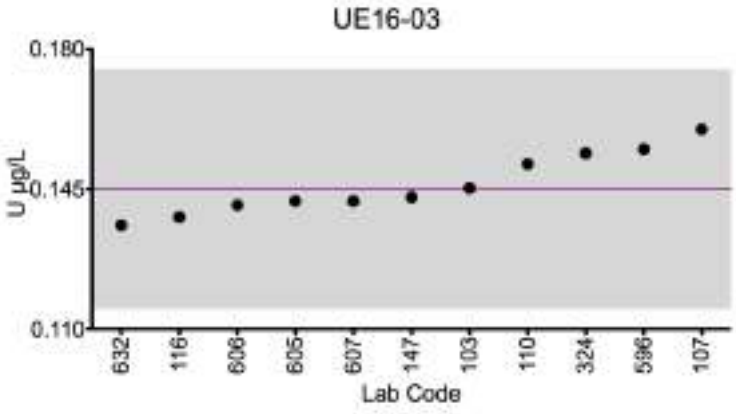
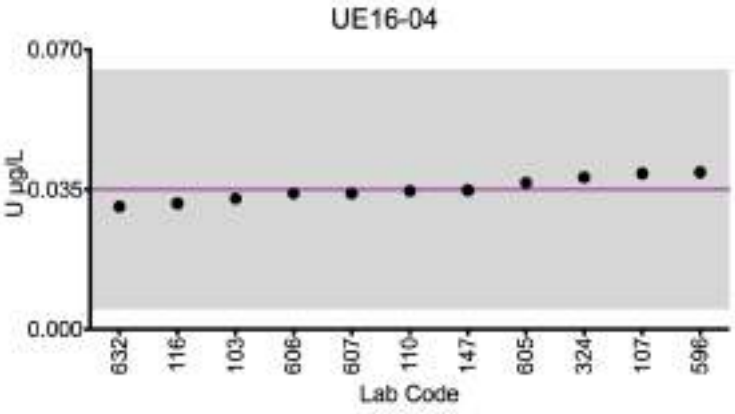
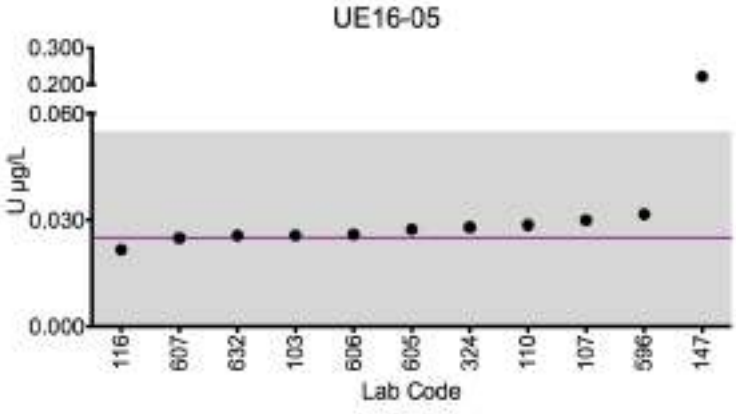
Results for Event #1, 2016: Urine U











Legend:
Horizontal purple line = assigned target value based on the robust mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±0.03 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±0.03 µg/L at concentrations less than or equal to 0.15 µg/L.

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Results for Event #1, 2016
Additional Elements in Urine: Cobalt (Co)

Urine Co (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
103	DRC/CC-ICP-MS	6.05	0.422	0.812	10.1	12.9
107	ICP-MS	6	0.46	0.85	10	13
110	ICP-MS	5.89	0.43	0.8	9.98	12.3
147	ICP-MS	5.83	0.379	0.784	9.84	12.2
391	DRC/CC-ICP-MS	5.30	0.376	0.743	10.2	11.9
485	HR-ICP-MS	5.81	0.42	0.79	9.56	12.2
596	HR-ICP-MS	6.36	0.418	0.84	10.9	13.6
597	DRC/CC-ICP-MS	8.78	0.61	1.32	15.2	21.3
598	ICP-MS	5.5	0.45	0.75	9.1	11.6
599	DRC/CC-ICP-MS	5.8	1.1	1.4	10.1	11.9
605	ICP-MS	6.39	0.477	0.84	10.6	13.1
606	ICP-MS	5.85	0.411	0.809	10.0	12.4
632	ICP-MS	5.8	0.437	0.788	9.68	12.2

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Robust Mean (x*)	6.1	0.492	0.887	10.4	13.1
Robust SD (s*)	0.85	0.191	0.213	1.5	2.5
Robust RSD (%)	14	38	24	14	19
Number of Sample Measurements (N)	13	13	13	13	13

*Denotes a statistical Outlier.

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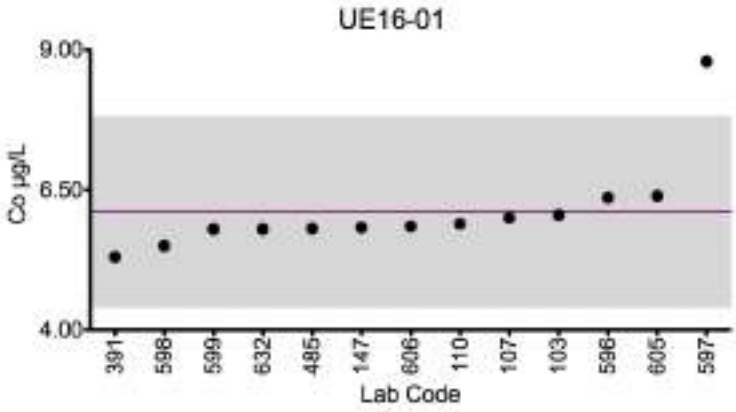
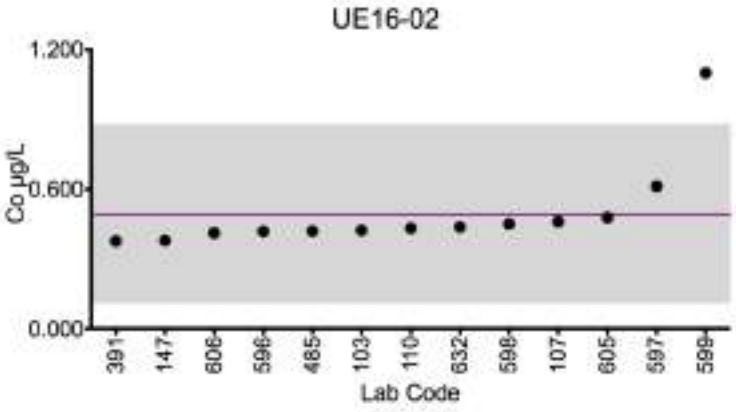
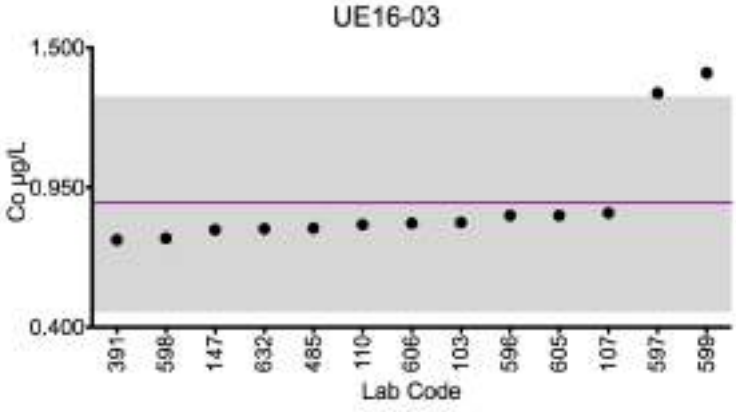
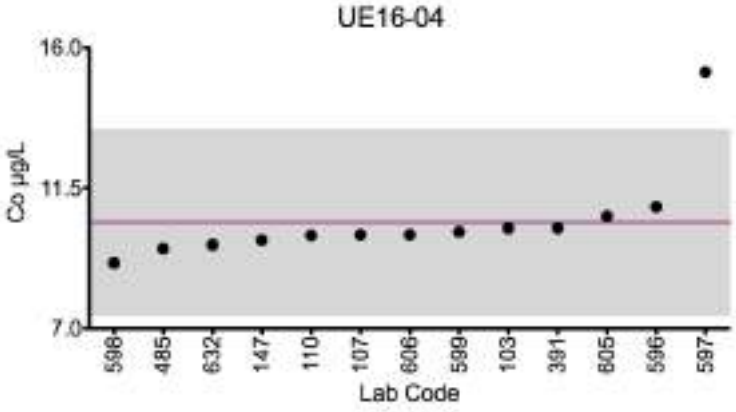
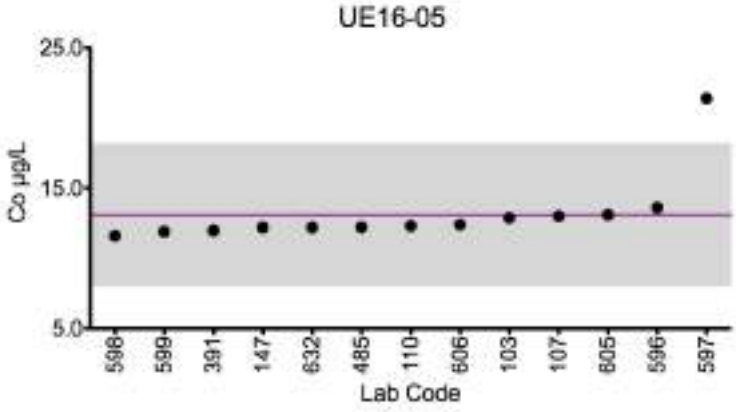
Results for Event #1, 2016: Urine Co











Legend:
Horizontal purple line = robust mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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Results for Event #1, 2016
Additional Elements in Urine: Chromium (Cr)

Urine Cr (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
103	DRC/CC-ICP-MS	0.347	2.02	3.10	0.84	0.657
107	DRC/CC-ICP-MS	0.39	2.1	2.8	1.3	0.74
110	DRC/CC-ICP-MS	<MDL	2.4	3.5	1.2	0.97
147	DRC/CC-ICP-MS	0.394	1.77	2.69	0.785	0.64
324	HR-ICP-MS	0.41	2.47	3.1	0.84	1
391	DRC/CC-ICP-MS	<0.000	1.12	1.93	<0.000	<0.000
485	HR-ICP-MS	0.38	2.06	2.98	0.82	0.69
596	HR-ICP-MS	0.406	1.88	2.97	0.818	1.21
597	DRC/CC-ICP-MS	0.601	3.55	5.31	1.21	1.17
598	DRC/CC-ICP-MS	<0.4	1.8	3	1.4	0.7
632	DRC/CC-ICP-MS	0.43	2	2.76	1.31	0.573

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Robust Mean (x*)	0.42	2.1	3.1	1.05	0.835
Robust SD (s*)	0.077	0.59	0.82	0.25	0.232
Robust RSD (%)	18	28	26	23	27
Number of Sample Measurements (N)	8	11	11	10	10

*Denotes a statistical Outlier.

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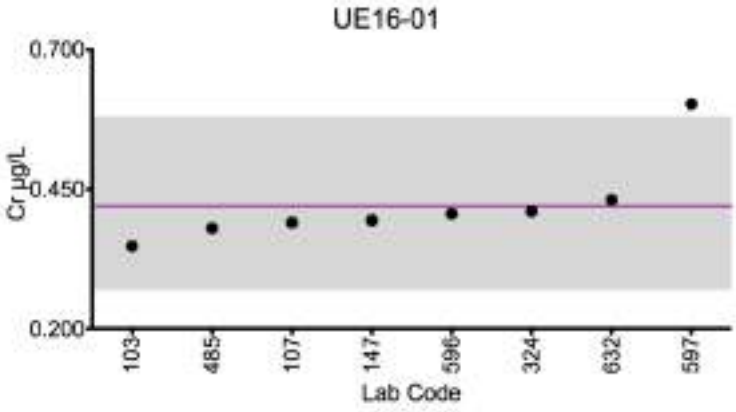
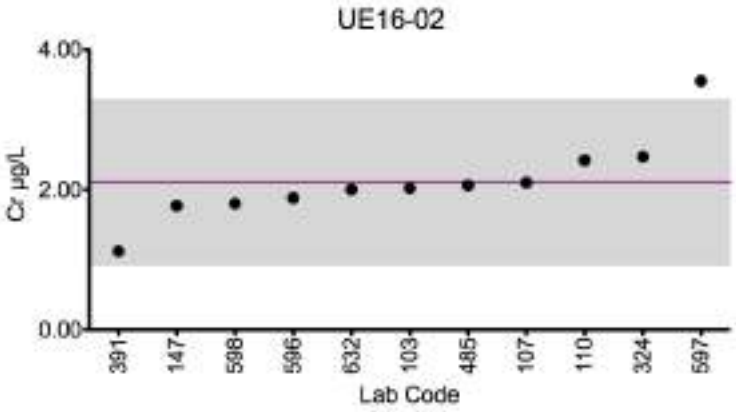
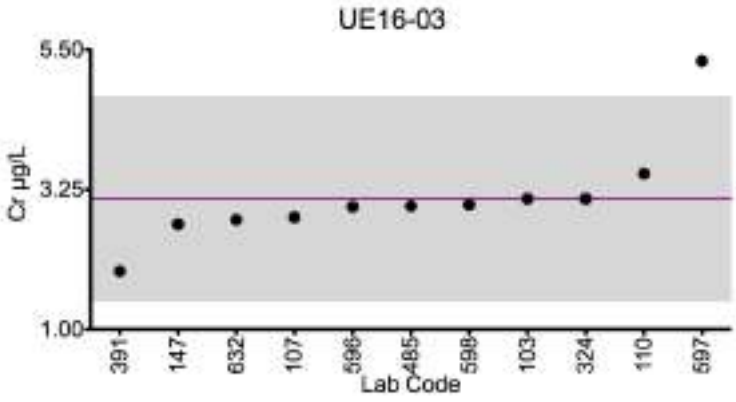
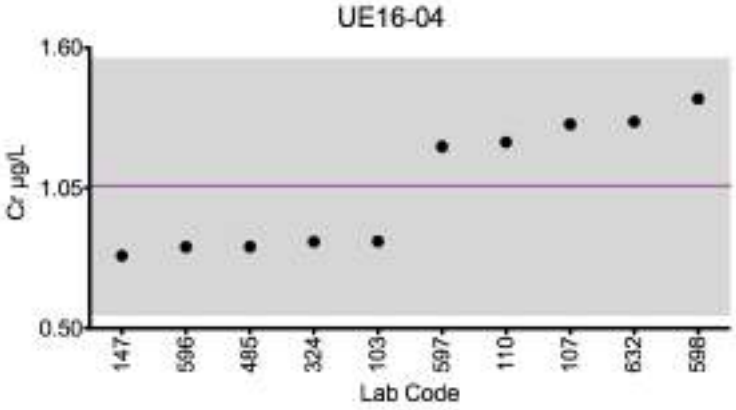
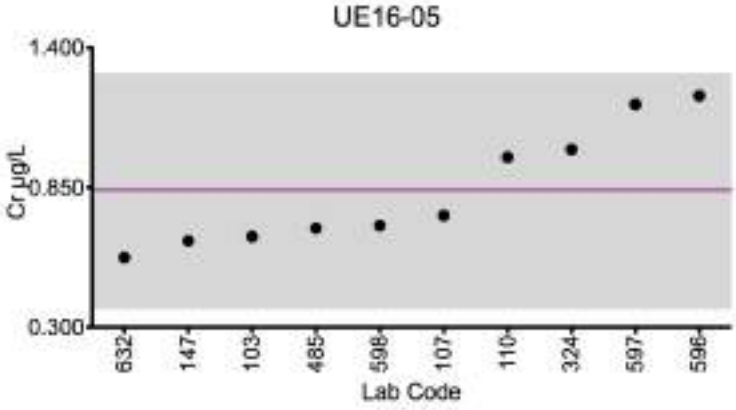
Results for Event #1, 2016:
Urine Cr











Legend:
Horizontal purple line = robust mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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Results for Event #1, 2016
Additional Elements in Urine: Cesium (Cs)

Urine Cs (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
107	ICP-MS	1.5	4.59	6.6	2.4	2
110	ICP-MS	1.5	4.9	6.9	2.4	2.1
147	ICP-MS	1.34	4.37	6.23	2.17	1.87
605	ICP-MS	1.4	4.44	6.37	2.24	1.86
606	ICP-MS	1.45	4.47	6.46	2.30	1.92
632	ICP-MS	1.42	4.49	6.44	2.33	1.97

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	1.43	4.53	6.5	2.31	1.95
Arithmetic SD (s)	0.06	0.17	0.23	0.10	0.08
Arithmetic RSD (%)	4.7	3.7	3.6	4.4	4.5
Number of Sample Measurements (N)	6	6	6	6	6

*Denotes a statistical Outlier.

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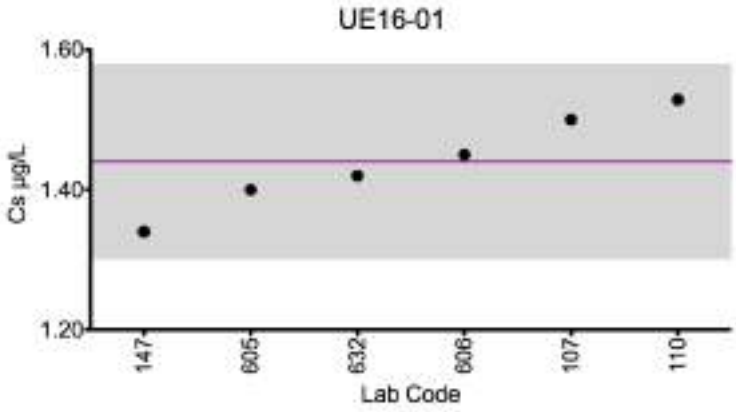
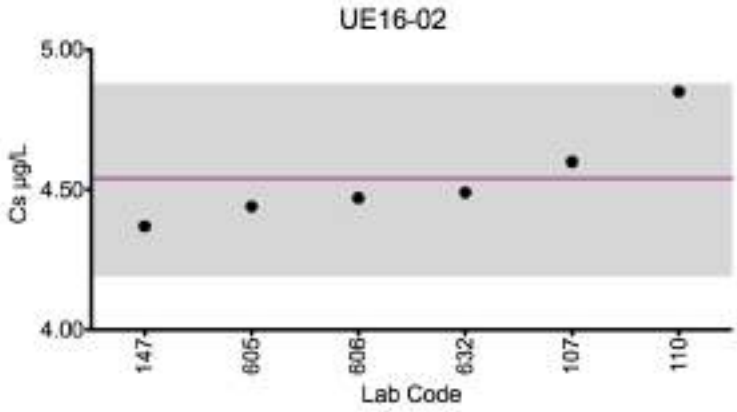
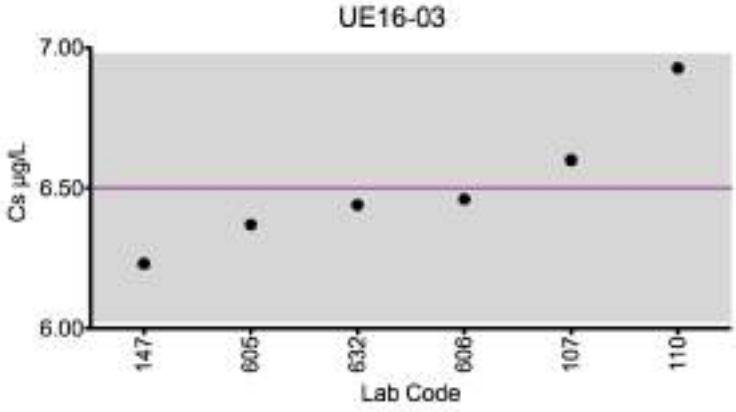
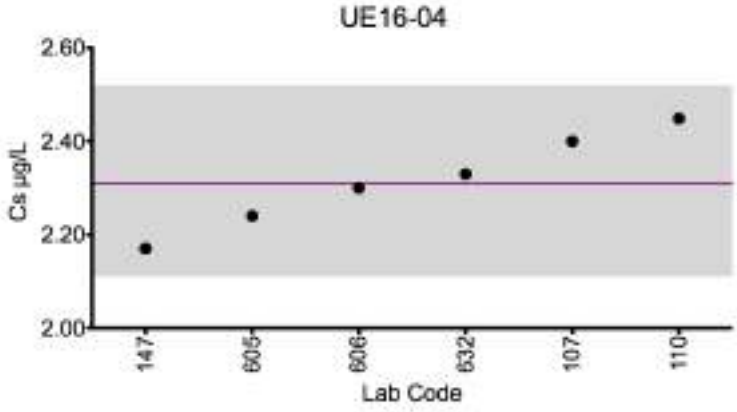
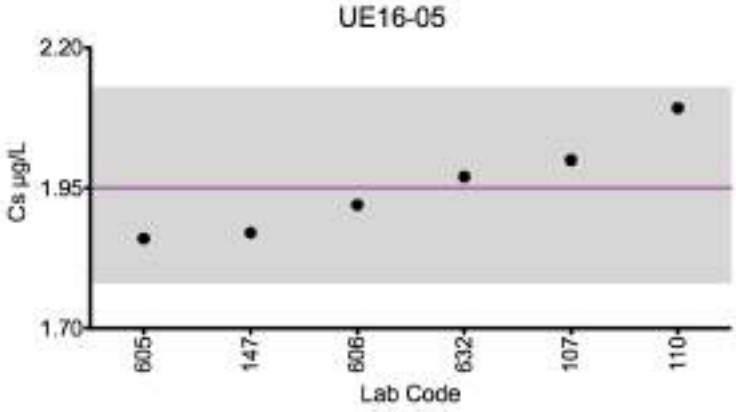
Results for Event #1, 2016: Urine Cs











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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Results for Event #1, 2016
Additional Elements in Urine: Copper (Cu)

Urine Cu (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
110	ICP-MS	8	41	61	17	13
147	ICP-MS	8.44	40.9	61.6	17	13.5
324	HR-ICP-MS	6.49	36.5	55.9	14.6	11.2
391	DRC/CC-ICP-MS	7.91	50.9	53.4	16.2	10.3
596	ICP-AES/OES	7.8	35.7	72.8	17.8	11.8
597	DRC/CC-ICP-MS	11.2	*62.8	*94.9	24.5	*21.2
598	ICP-MS	9.06	36.7	55.9	22	13
599	DRC/CC-ICP-MS	7.9	42.6	57.9	19.1	13.4
632	ICP-MS	11.9	42.4	62.5	19.7	16.2

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	8.78	40.8	60.1	18.6	12.8
Arithmetic SD (s)	1.72	4.9	6.0	3.0	1.7
Arithmetic RSD (%)	19	12	10	16	13
Number of Sample Measurements (N)	9	8	8	9	8

*Denotes a statistical Outlier.

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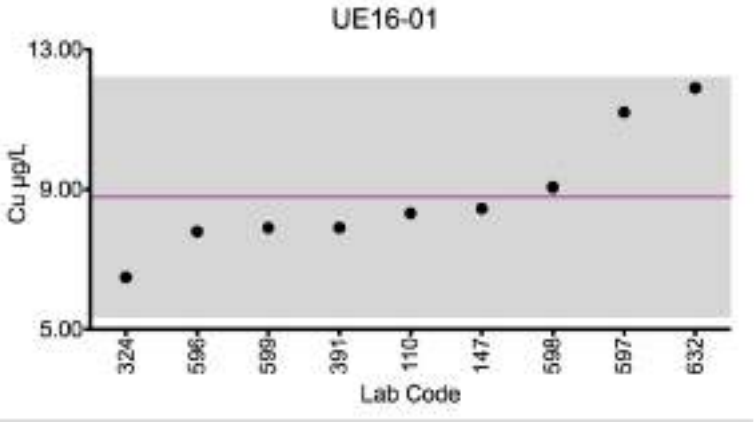
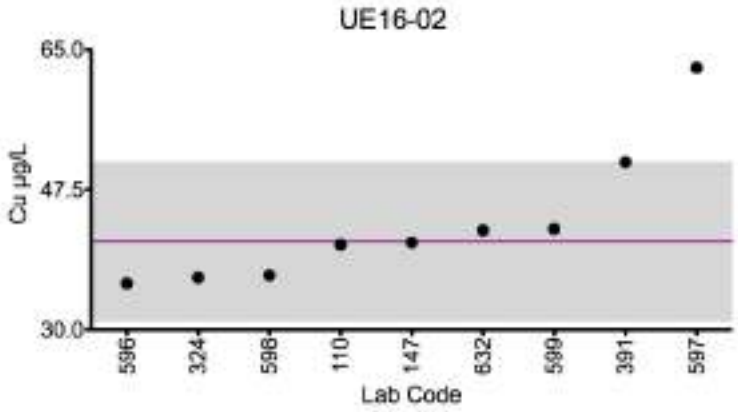
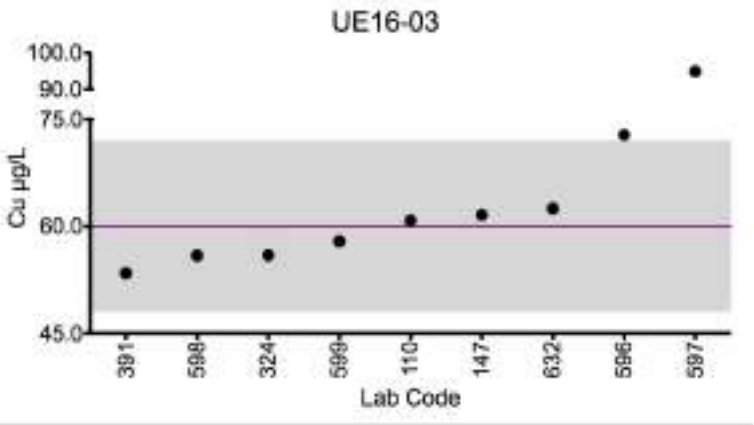
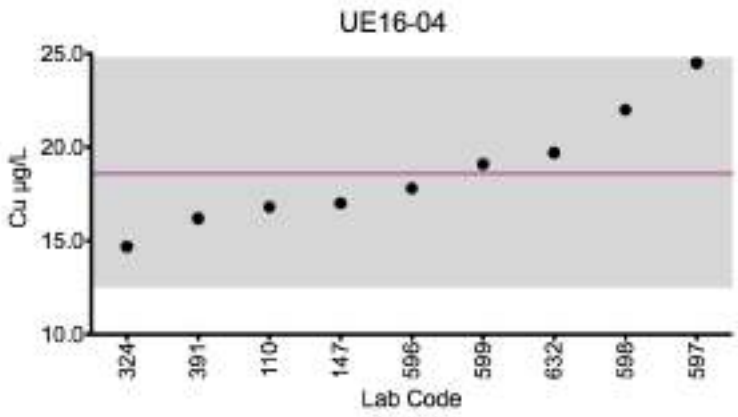
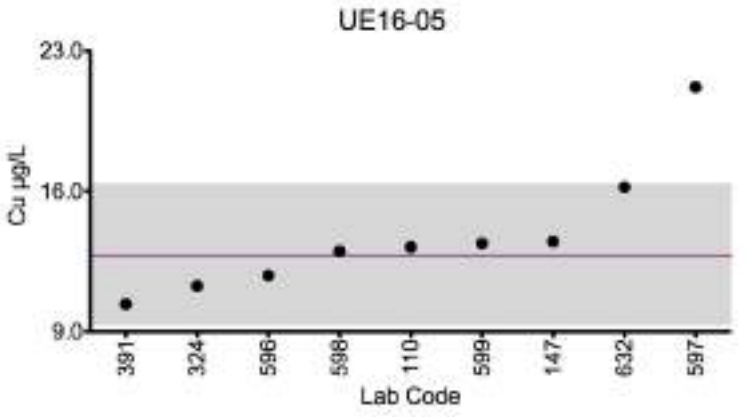
Results for Event #1, 2016:
Urine Cu











Legend:
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Results for Event #1, 2016
Additional Elements in Urine: Molybdenum (Mo)

Urine Mo (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
103	DRC/CC-ICP-MS	8.27	15.8	20.5	10.1	9.53
107	ICP-MS	8.9	17	22	11	10
110	ICP-MS	10	17	22	11	10
147	ICP-MS	8.83	15.7	20.3	10.3	9.47
324	HR-ICP-MS	9.19	17.2	22.6	11.4	10.4
485	HR-ICP-MS	7.75	16.5	21.8	10.4	9.68
596	HR-ICP-MS	8.84	16.7	21.9	10.8	9.97
598	ICP-MS	9.36	17.8	23.6	11.6	10.8
605	ICP-MS	PLC	15.6	20.6	10.3	9.22
606	ICP-MS	<9.00	10.9	15.7	<9.00	<9.00
632	ICP-MS	8.11	15.8	20.3	10	9.33

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Robust Mean (x*)	8.83	16.0	21.0	10.6	9.80
Robust SD (s*)	0.74	1.8	2.0	0.5	0.49
Robust RSD (%)	8.4	11	9.7	5	5
Number of Sample Measurements (N)	9	11	11	10	10

*Denotes a statistical Outlier.

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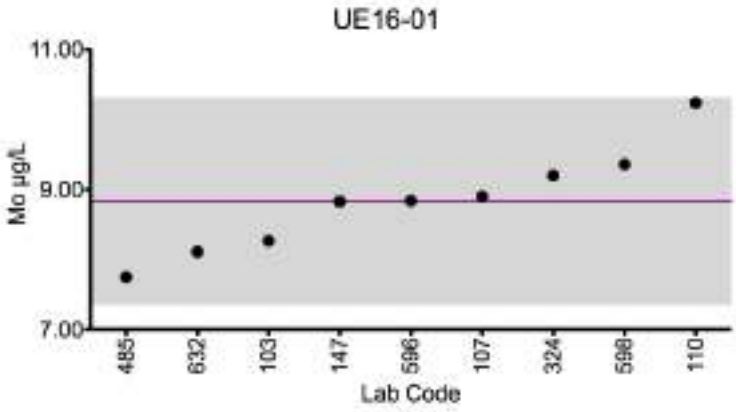
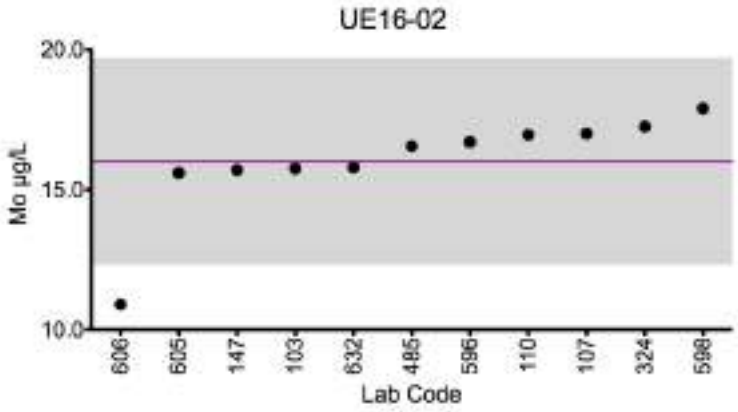
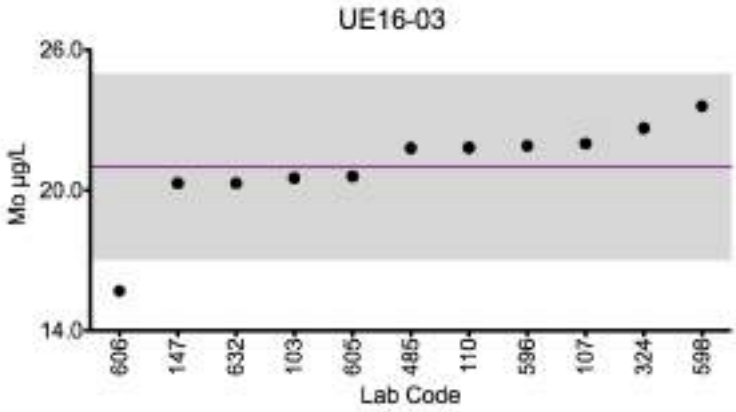
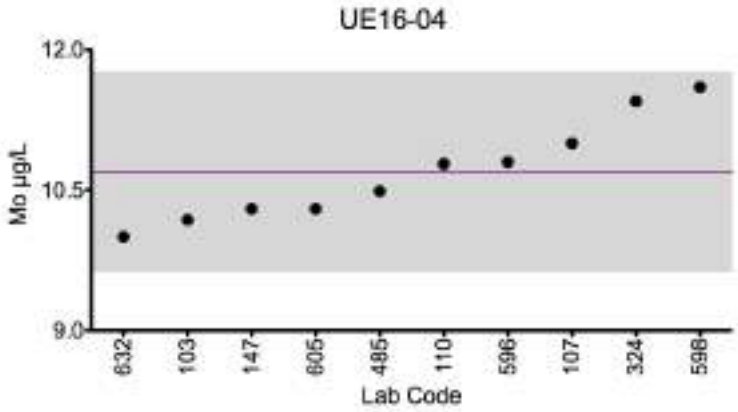
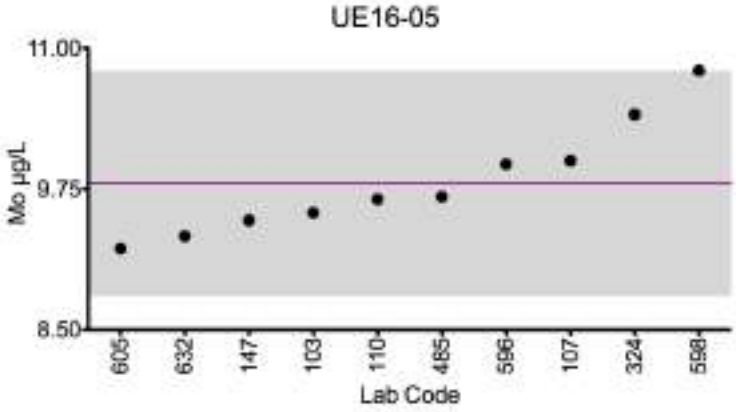
Results for Event #1, 2016:
Urine Mo











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Results for Event #1, 2016
Additional Elements in Urine: Nickel (Ni)

Urine Ni (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
107	DRC/CC-ICP-MS	2	1.8	2.2	6.4	5.8
110	ICP-MS	<MDL	<MDL	<MDL	5	6
147	DRC/CC-ICP-MS	2.29	1.23	1.91	4.99	5.68
391	DRC/CC-ICP-MS	1.25	0.762	1.34	2.57	5.90
485	HR-ICP-MS	1.67	1.2	1.79	4.63	5.34
596	HR-ICP-MS	2.46	1.69	2.31	4.98	5.53
597	DRC/CC-ICP-MS	2.40	1.75	2.60	7.26	8.97
598	ICP-MS	2.9	2.29	*5.3	11.6	8
599	DRC/CC-ICP-MS	*8.1	3.5	3.3	*20.3	6.6

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	2.13	1.77	2.20	5.92	6.39
Arithmetic SD (s)	0.54	0.83	0.62	2.66	1.25
Arithmetic RSD (%)	25	47	28	44	19
Number of Sample Measurements (N)	7	8	7	8	9

*Denotes a statistical Outlier.

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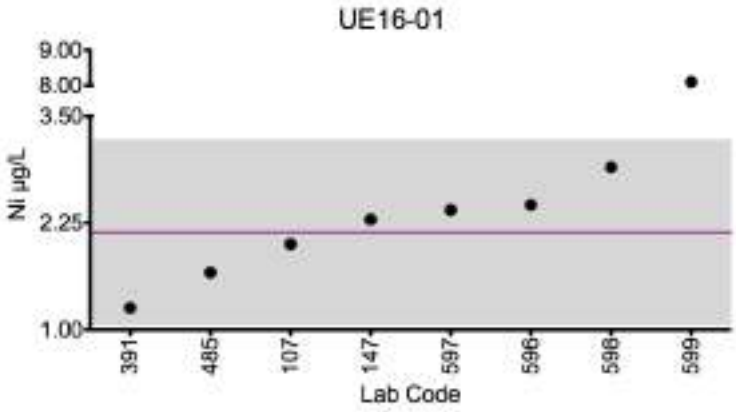
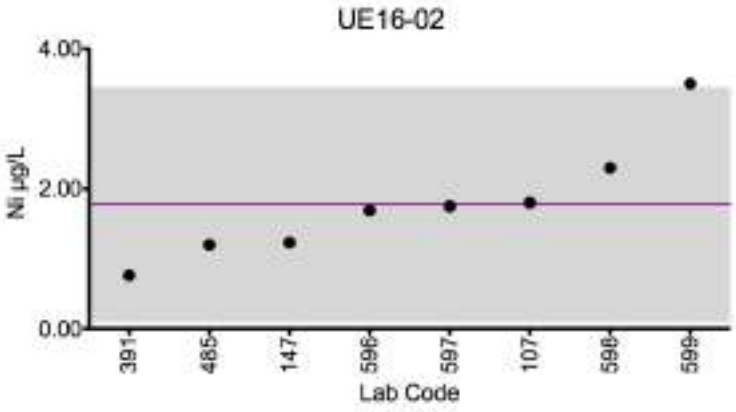
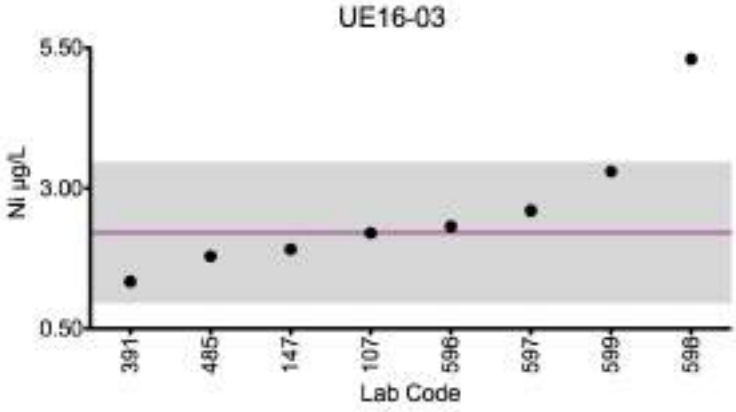
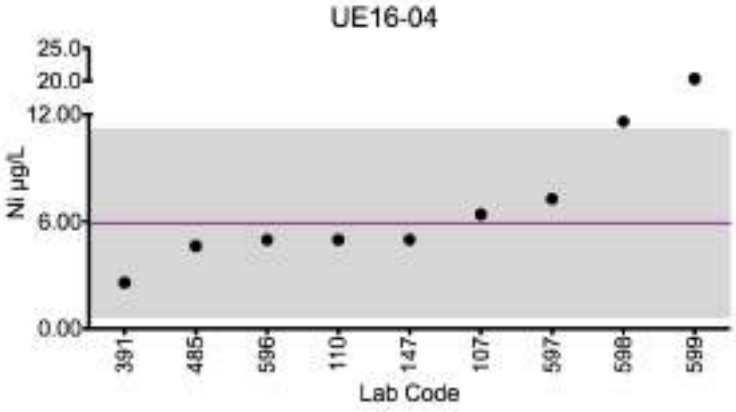
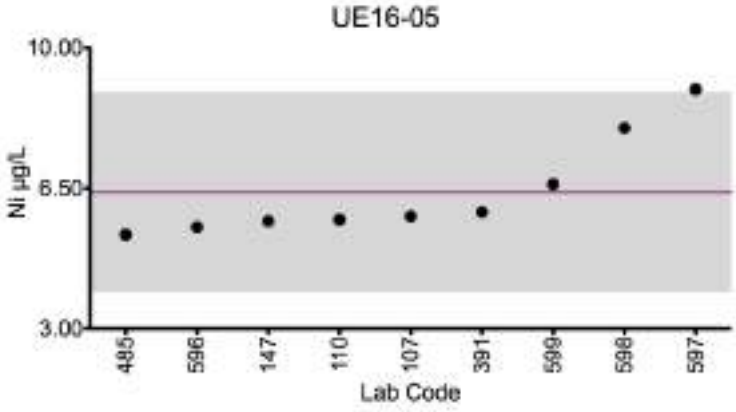
Results for Event #1, 2016:
Urine Ni











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Results for Event #1, 2016
Additional Elements in Urine: Platinum (Pt)

Urine Pt (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
107	ICP-MS	0.064	0.38	0.6	0.15	0.12
110	ICP-MS	0.07	0.36	0.569	0.12	0.06
147	ICP-MS	<0.117	0.318	0.481	0.147	0.097
596	HR-ICP-MS	0.138	0.403	0.628	0.189	0.135
598	ICP-MS	<0.4	0.45	0.67	<0.4	<0.4
605	ICP-MS	0.079	0.393	0.597	0.168	0.131
606	ICP-MS	<0.250	0.368	0.543	<0.250	<0.250
632	ICP-MS	0.288	*0.673	*0.853	*0.405	*0.378

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	0.127	0.381	0.585	0.155	0.108
Arithmetic SD (s)	0.094	0.040	0.060	0.024	0.030
Arithmetic RSD (%)	74	10	10	16	28
Number of Sample Measurements (N)	5	7	7	5	5

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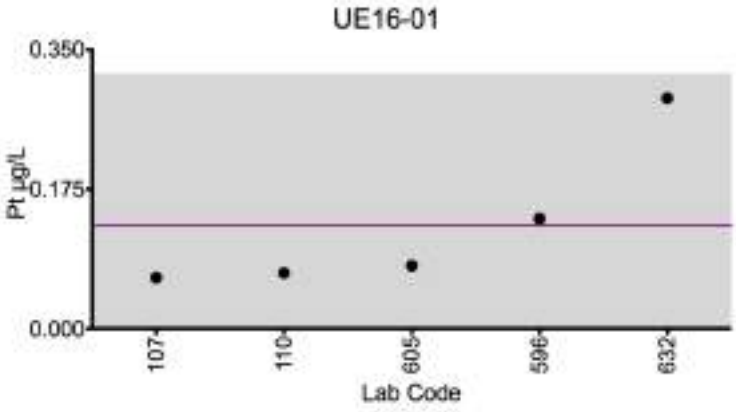
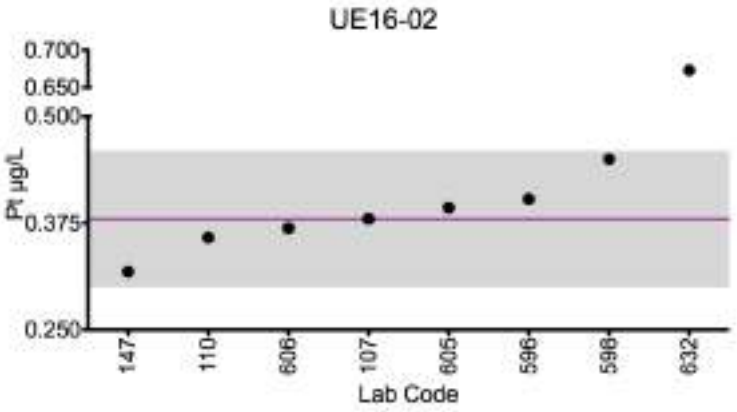
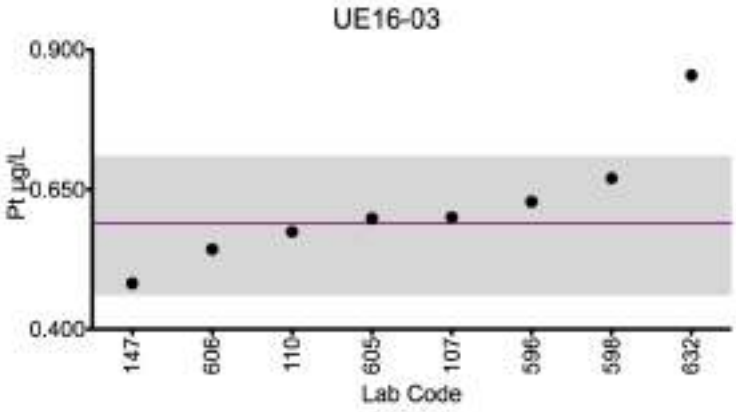
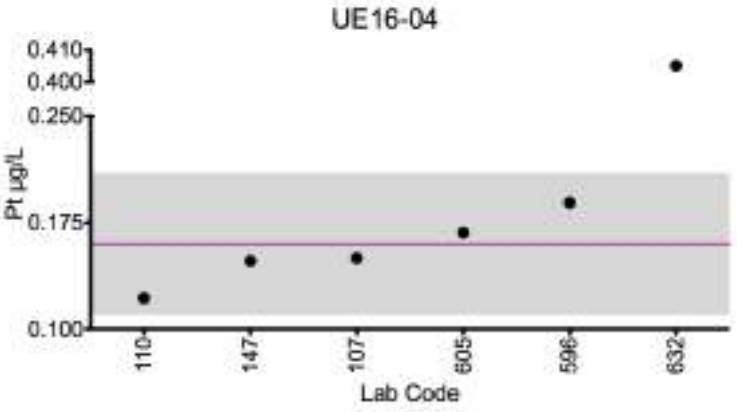
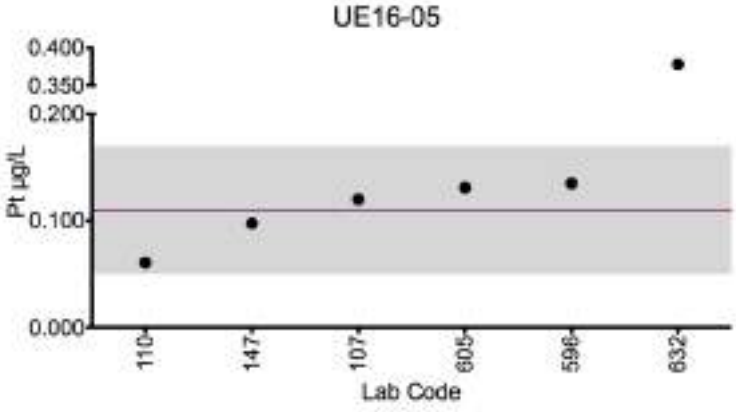
Results for Event #1, 2016: Urine Pt











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Results for Event #1, 2016
Additional Elements in Urine: Antimony (Sb)

Urine Sb (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
103	DRC/CC-ICP-MS	0.127	0.826	1.29	0.319	0.235
107	ICP-MS	0.13	0.76	1.1	0.3	0.24
110	ICP-MS	<MDL	0.78	1.22	0.30	0.22
147	ICP-MS	0.13	0.752	1.13	0.291	0.218
605	ICP-MS	PLC	0.731	1.12	0.294	PLC
606	ICP-MS	<0.240	0.659	1.12	*0.236	<0.240
632	ICP-MS	*0.104	0.711	1.09	0.303	0.202

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	0.128	0.745	1.15	0.302	0.223
Arithmetic SD (s)	0.001	0.052	0.07	0.009	0.015
Arithmetic RSD (%)	1.4	7	6.2	3.1	6.8
Number of Sample Measurements (N)	3	7	7	6	5

*Denotes a statistical Outlier.

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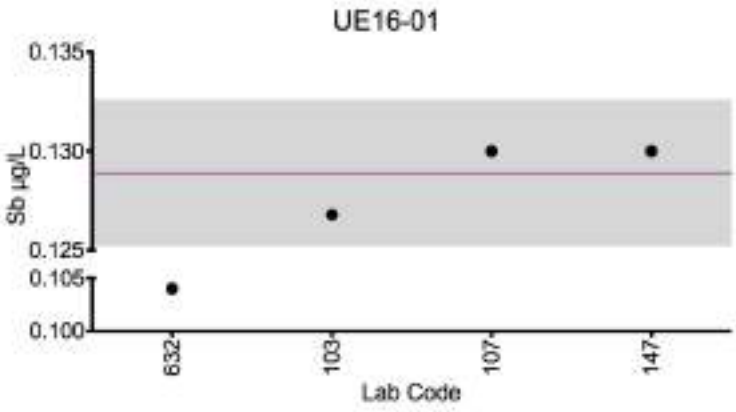
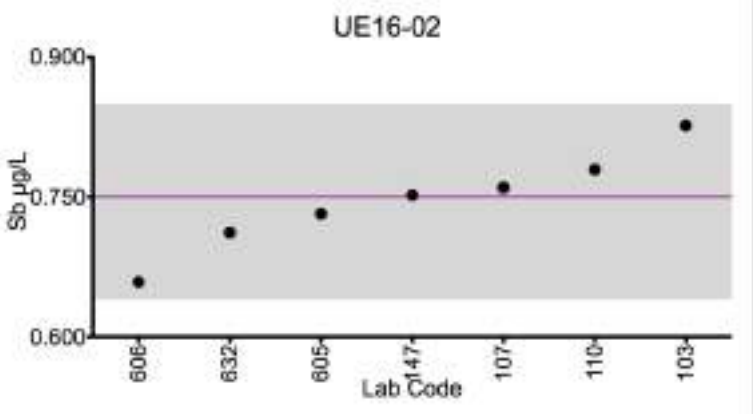
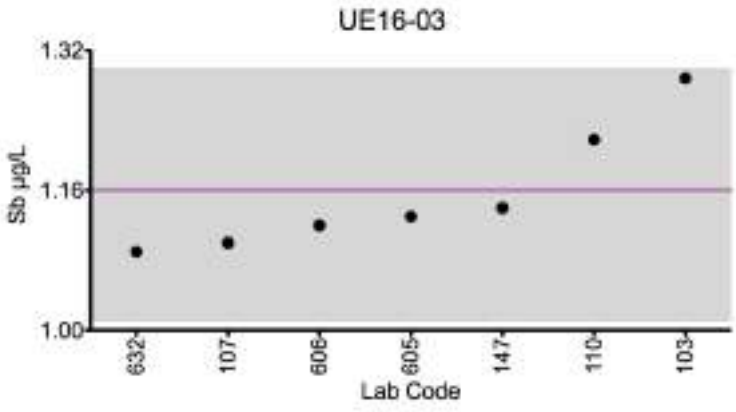
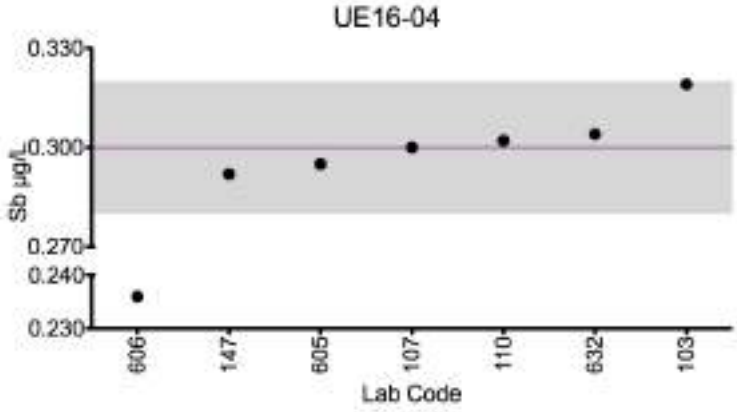
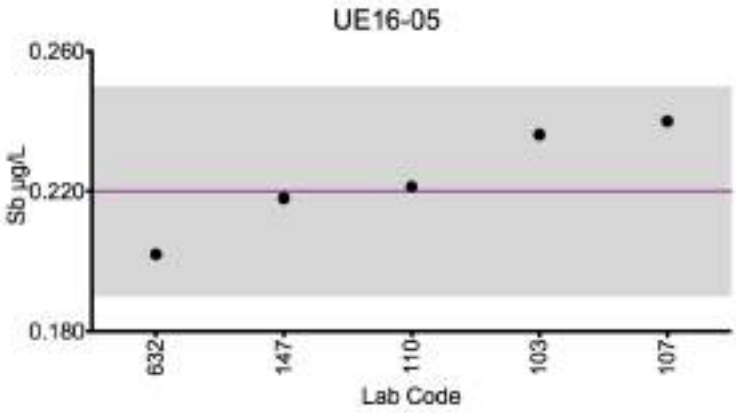
Results for Event #1, 2016: Urine Sb











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Results for Event #1, 2016
Additional Elements in Urine: Selenium (Se)

Urine Se (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
103	DRC/CC-ICP-MS	9.13	17.3	21.5	10.9	10.1
110	DRC/CC-ICP-MS	13	19	23	13	11
147	ICP-MS	10.9	17.3	22.2	12.5	11.3
596	HR-ICP-MS	10.1	16.6	22	11.7	10.1
597	DRC/CC-ICP-MS	19	39.5	48.9	29.7	31.4
598	DRC/CC-ICP-MS	10.1	17.5	21.8	13	11.4
599	DRC/CC-ICP-MS	*167	*134	*120	*125	*107
632	DRC/CC-ICP-MS	9.02	16.2	20.2	10.3	9.69

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	11.6	20.5	25.6	14.4	13.6
Arithmetic SD (s)	3.5	8.4	10.2	6.7	7.9
Arithmetic RSD (%)	30	40	40	46	58
Number of Sample Measurements (N)	7	7	7	7	7

*Denotes a statistical Outlier.

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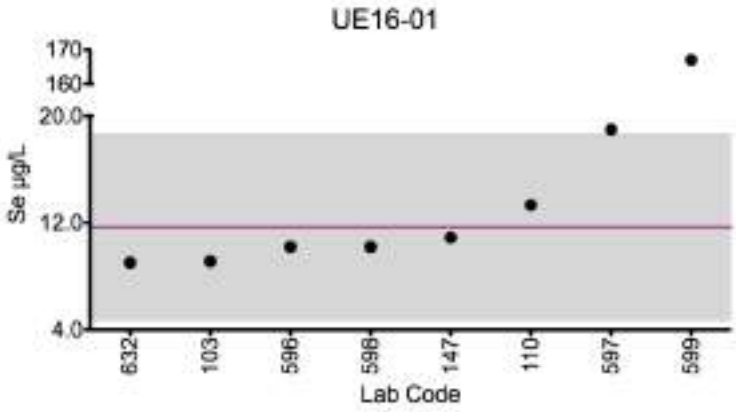
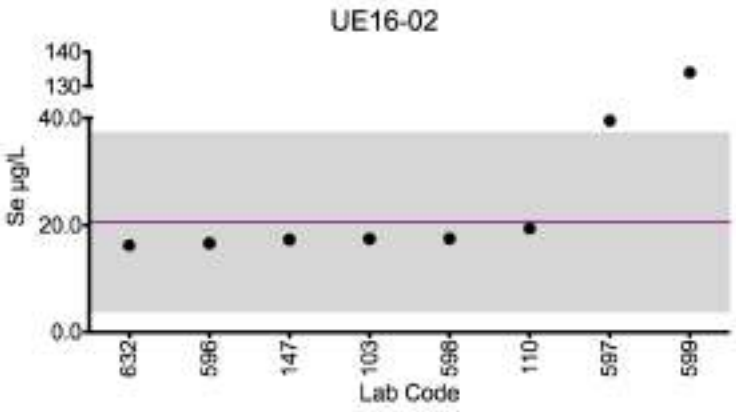
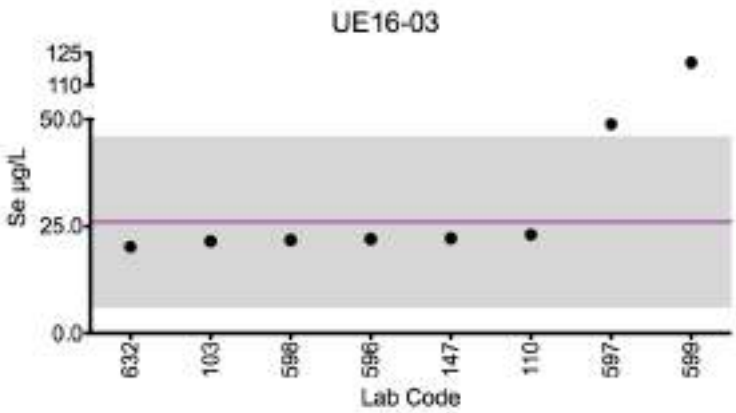
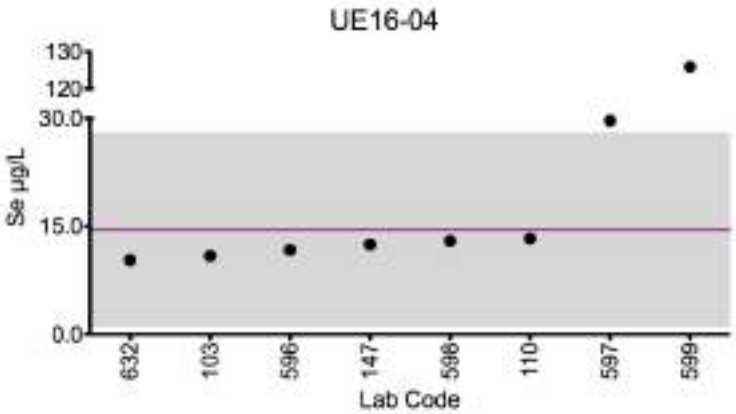
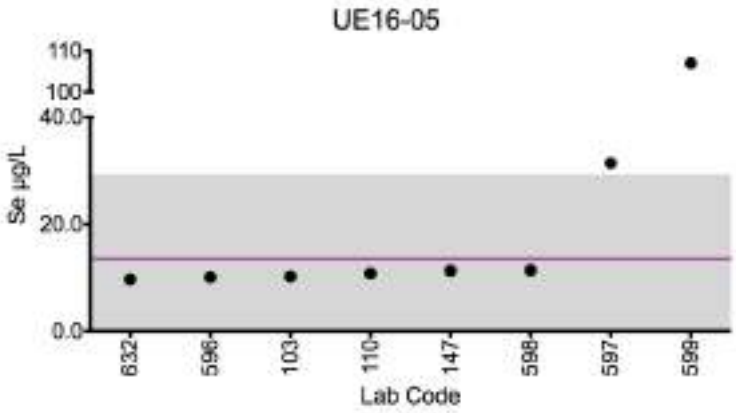
Results for Event #1, 2016: Urine Se











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Results for Event #1, 2016
Additional Elements in Urine: Tin (Sn)

Urine Sn (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
107	ICP-MS	0.96	2.6	3.6	1.4	1.2
110	ICP-MS	0.99	2.5	3.6	1.3	1.2
147	ICP-MS	0.815	2.31	3.56	1.24	1.05
596	HR-ICP-MS	0.806	2.35	3.35	1.35	1.12
598	ICP-MS	1.3	2.6	3.6	1.8	1.3
605	ICP-MS	1.33	2.84	3.79	1.73	1.58

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	1.03	2.53	3.58	1.47	1.23
Arithmetic SD (s)	0.23	0.19	0.14	0.22	0.18
Arithmetic RSD (%)	22	7.5	3.9	15	15
Number of Sample Measurements (N)	6	6	6	6	6

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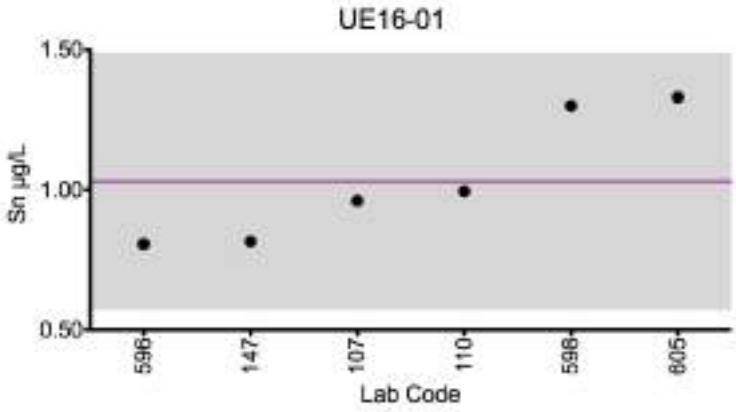
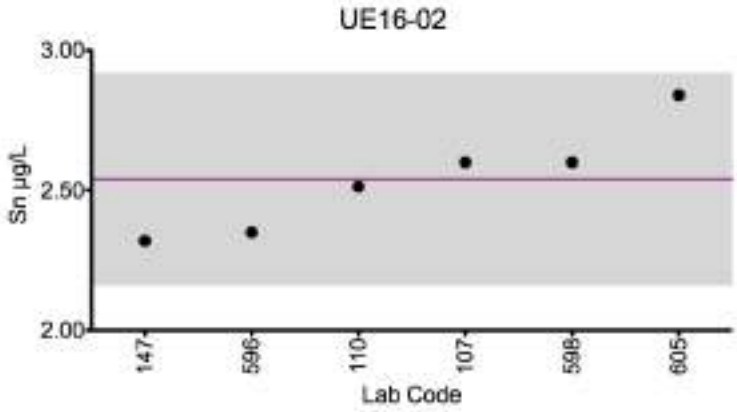
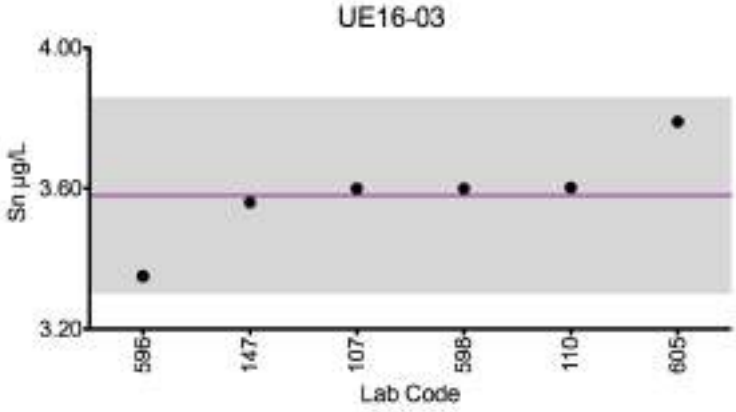
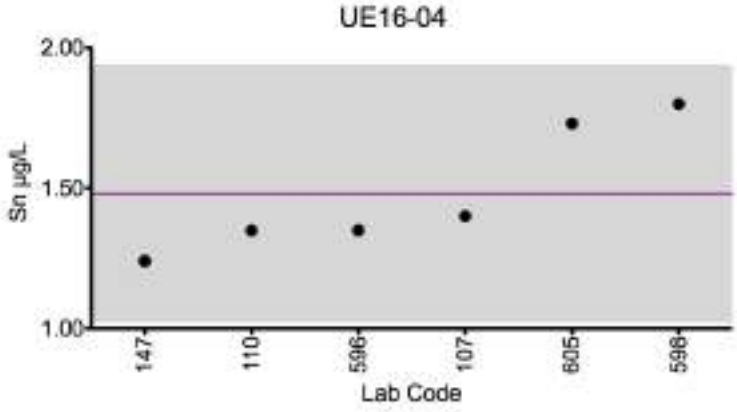
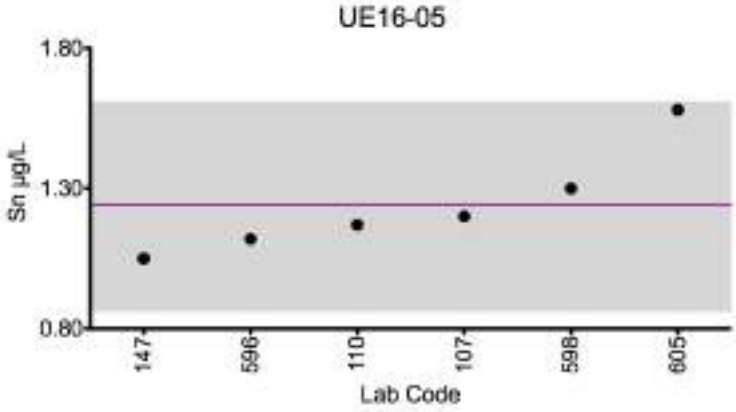
Results for Event #1, 2016: Urine Sn











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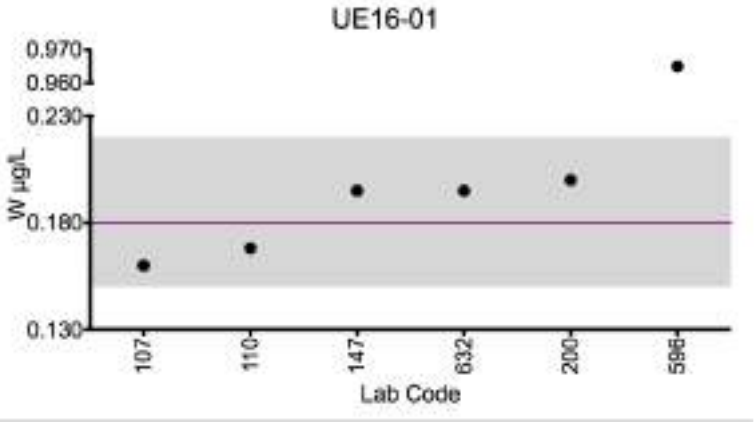
Results for Event #1, 2016
Additional Elements in Urine: Tungsten (W)

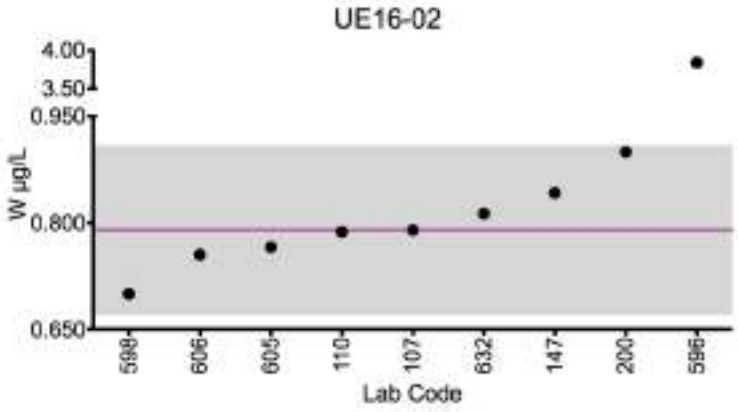
Urine W (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
107	ICP-MS	0.16	0.79	1.2	0.32	0.27
110	ICP-MS	0.17	0.79	1.12	0.289	0.24
147	ICP-MS	0.195	0.841	1.22	0.325	0.265
200	ICP-MS	0.2	0.9	1.2	0.4	0.3
596	HR-ICP-MS	*0.964	*3.84	*5.83	*1.64	*1.38
598	ICP-MS	<0.4	0.7	1.2	<0.4	<0.4
605	ICP-MS	PLC	0.766	1.12	0.301	0.256
606	ICP-MS	<0.600	0.755	1.12	<0.600	<0.600
632	ICP-MS	0.195	0.812	1.18	0.351	0.259

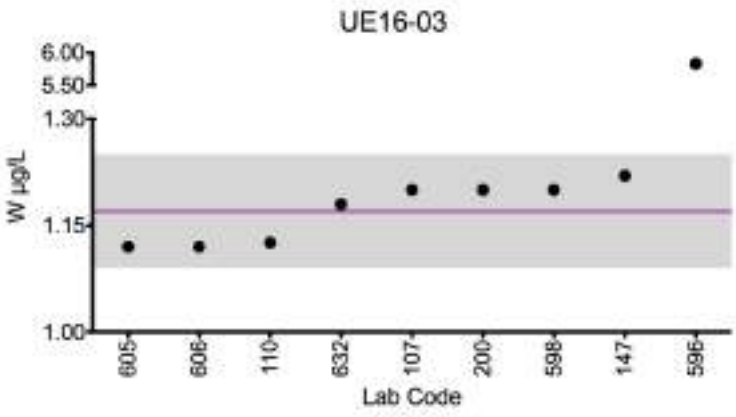
Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	0.183	0.794	1.17	0.331	0.265
Arithmetic SD (s)	0.018	0.059	0.04	0.039	0.019
Arithmetic RSD (%)	9.9	7.5	3.5	11	7.4
Number of Sample Measurements (N)	5	8	8	6	6

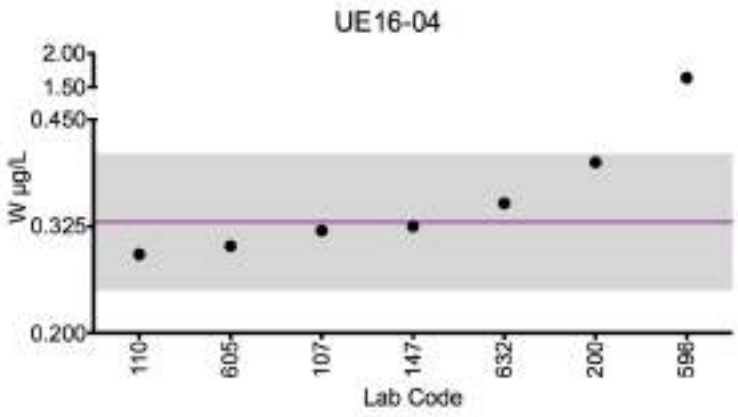
*Denotes a statistical Outlier.

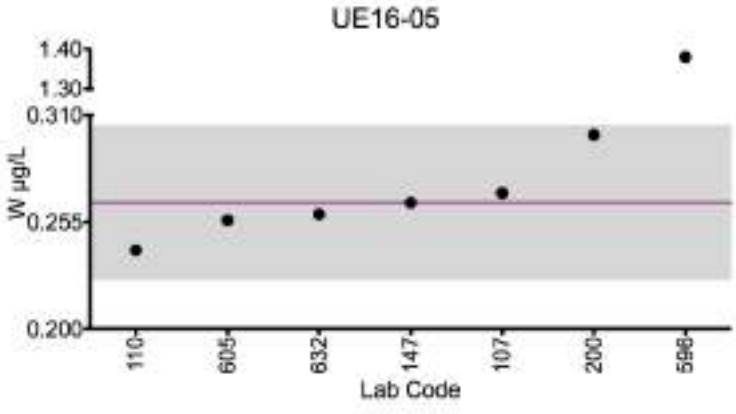
Results for Event #1, 2016:
Urine W











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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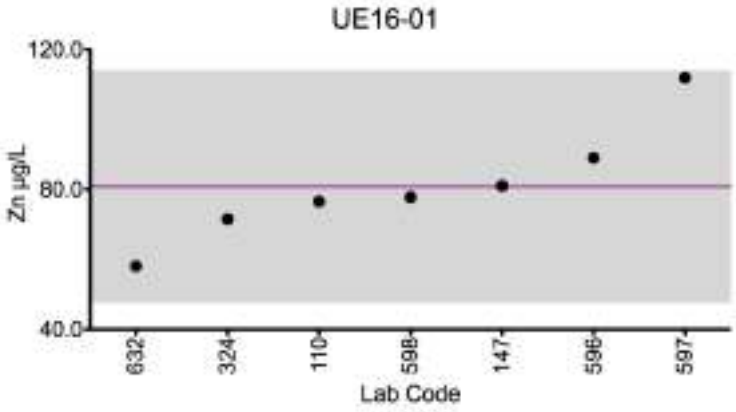
Results for Event #1, 2016
Additional Elements in Urine: Zinc (Zn)

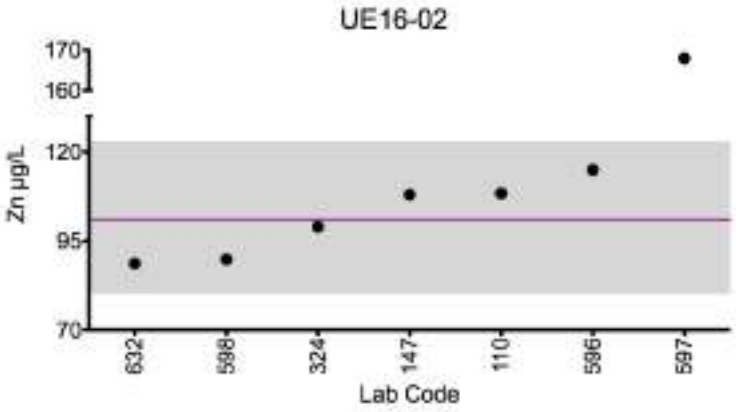
Urine Zn (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
110	ICP-MS	77	108	128	85	82
147	ICP-MS	81	108	184	86.3	86.3
324	HR-ICP-MS	71.5	98.9	119	78.2	73.9
596	ICP-AES/OES	89	115	141	127	92
597	DRC/CC-ICP-MS	112	*168	196	125	*133
598	ICP-MS	77.8	89.8	106	97.6	69.9
632	ICP-MS	58.1	88.7	108	65.5	63.4

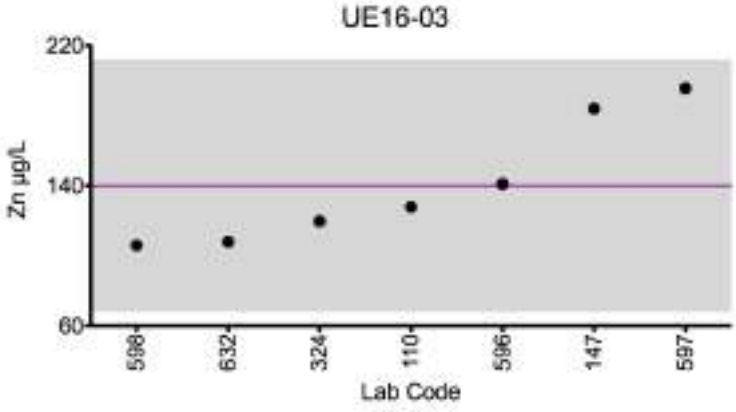
Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	80.8	101	140	94.9	77.8
Arithmetic SD (s)	16.6	10	35	23.3	10.6
Arithmetic RSD (%)	20	10	25	24	13
Number of Sample Measurements (N)	7	6	7	7	6

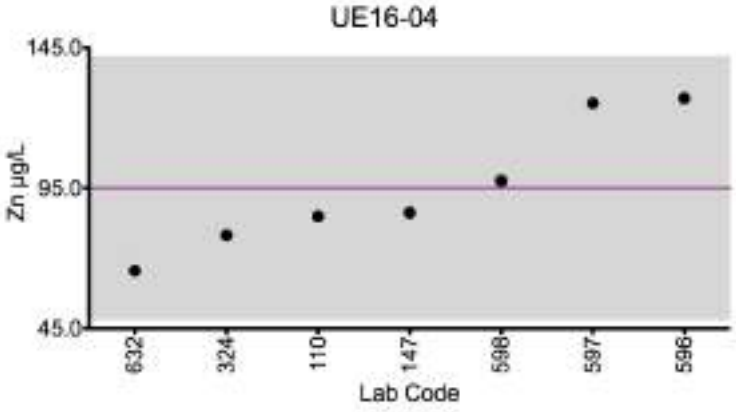
*Denotes a statistical Outlier.

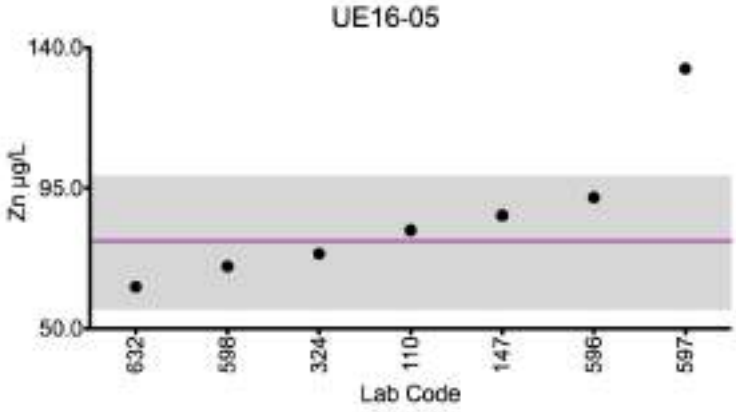
Results for Event #1, 2016:
Urine Zn











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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Results for Event #1, 2016
Additional Elements in Urine: Strontium (Sr)

Urine Sr (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
103	DRC/CC-ICP-MS	20.3	20.7	20.7	20.3	20.6
107	ICP-MS	23	23	23	23	*23
200	ICP-MS	20.1	20.1	20.1	20.1	20.1
605	ICP-MS	20.8	20.5	20.7	20.8	20.3

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	21.0	21.0	21.1	21.0	20.3
Arithmetic SD (s)	1.3	1.3	1.2	1.3	0.2
Arithmetic RSD (%)	6.2	6.2	6.0	6.2	1.1
Number of Sample Measurements (N)	4	4	4	4	3

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Urine: Vanadium (V)

Urine V (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
147	DRC/CC-ICP-MS	0.113	0.596	1.02	0.228	0.195
485	HR-ICP-MS	0.1	0.8	1.15	0.28	0.22
596	HR-ICP-MS	0.1	0.766	1.13	0.303	0.217
598	ICP-MS	*1.6	*1.5	1.7	*2	*1.6

Summary Statistics					
	UE16-01	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
Arithmetic Mean ($\bar{x}$)	0.104	0.720	1.25	0.270	0.21
Arithmetic SD (s)	0.007	0.108	0.30	0.038	0.013
Arithmetic RSD (%)	7.1	15	24	14	6.4
Number of Sample Measurements (N)	3	3	4	3	3

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Urine

Urine Ag (µg/L)

Lab Code	Method	UE16-01	UE16-02	UE16-03	UE16-04	UE16-05
147	ICP-MS	<0.108	<0.108	<0.108	<0.108	<0.108
596	ICP-MS	<0.027	<0.027	<0.027	<0.027	<0.027
598	ICP-MS	<0.4	<0.4	<0.4	<0.4	<0.4

Urine Al (µg/L)

Lab Code	Method	UE16-01	UE16-02	UE16-03	UE16-04	UE16-05
147	DRC/CC-ICP-MS	<13.5	<13.5	<13.5	<13.5	<13.5
324	HR-ICP-MS	2.83	6.78	9.52	3.97	4.73

Urine B (µg/L)

Lab Code	Method	UE16-01	UE16-02	UE16-03	UE16-04	UE16-05
200	ICP-MS	227	226	185	185	187

Urine Bi (µg/L)

Lab Code	Method	UE16-01	UE16-02	UE16-03	UE16-04	UE16-05
147	ICP-MS	<0.104	<0.104	<0.104	<0.104	<0.104

Urine Fe (µg/L)

Lab Code	Method	UE16-01	UE16-02	UE16-03	UE16-04	UE16-05
324	HR-ICP-MS	11.7	3.18	0.33	14.1	25.8

Urine I (µg/L)

Lab Code	Method	UE16-01	UE16-02	UE16-03	UE16-04	UE16-05
107	ICP-MS	28	28	28	28	29

Urine Li (µg/L)

Lab Code	Method	UE16-01	UE16-02	UE16-03	UE16-04	UE16-05
147	ICP-MS	5.4	5.16	5.54	5.32	5.31

Urine Te (µg/L)

Lab Code	Method	UE16-01	UE16-02	UE16-03	UE16-04	UE16-05
110	ICP-MS	<MDL	0.8	1.2	<MDL	<MDL
596	HR-ICP-MS	<0.023	0.758	0.965	0.275	0.112
598	ICP-MS	<2	<2	<2	<2	<2

Results for Event #1, 2016
Additional Elements in Urine

Urine Th (µg/L)						
Lab Code	**Method**	**UE16-01**	**UE16-02**	**UE16-03**	**UE16-04**	**UE16-05**
147	ICP-MS	0.004	0.004	0.004	0.004	0.004

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Event #1, 2016
Trace Elements in Serum

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

2016 Event #1:
Trace Elements in Serum

PT Materials

Test materials were prepared from human serum obtained from Tennessee Blood Services, Inc. The company certifies that these materials were tested by FDA approved methods and found to be negative for HIV 1Ž2 and HIV-1 RNA, and non-reactive to HBsAg, HCV3 and STS. Units of serum were filtered into polypropylene containers through cheesecloth to remove particulates and supplemented with aluminum (Al), copper (Cu), selenium (Se), zinc (Zn), arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), thallium (Tl), tin (Sn), titanium (Ti), tungsten (W) and vanadium (V). Serum units were homogenized overnight prior to aliquoting 2-mL into polypropylene vials. PT samples were stored at -80°C until the week of the PT event, when they were thawd at 4°C prior to circulation to laboratories for analysis.

Graded Elements

Four elements in serum are formally graded: Al, Cu, Se, and Zn. Target values for the graded elements are assigned to these pools based on (a) the arithmetic mean calculated from data reported by all laboratories, or (b) in the case of Al the target value has been set as the arithmetic mean of three reference laboratories that have a long history of successful PT in this scheme.

Additional Elements

An additional 28 elements (beyond the four graded) were reported by at least one participant: Ag, As, Ba, Be, Bi, Cd, Co, Cr, Cs, Fe, Hg, I, Li, Mn, Mo, Ni, Pb, Pt, Sb, Sn, Sr, Te, Th, Ti, Tl, U, V, and W. These data are included here to provide a more complete characterization of the PT materials. All results reported by participant laboratories are tabulated and organized by lab code. The PT data are graphed for visual comparison purposes for all elements where at least five laboratories reported a value greater than the LOD. A statistical summary table is provided for samples where at least two comparable values were reported as above the LOD.

The summary statistics for the additional elements are provided for educational purposes only, i.e., no acceptable response is implied. However, it is expected that each laboratory would wish to investigate a potential source of bias if warranted by these data. Future events might result in additional elements becoming graded if a consensus can be reached regarding desired quality specifications.

Results for Event #1, 2016
Serum Aluminum (Al)

Summary Statistics

	Serum Al (µg/L)				
	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
Target (Arithmetic Mean ($\bar{x}$))	NA	22.0	14.8	65.9	36.4
Upper Limit	NA	27.0	19.8	79.0	43.6
Lower Limit	NA	17.0	9.8	52.7	29.1
Arithmetic SD (s)	NA	0.6	2.6	6.6	1.5
Arithmetic RSD (%)	NA	2.5	18	10	4.2
Number of Sample Measurements (N)	NA	3	3	3	3

The acceptable range is based on quality specifications:
±5 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±5 µg/L at concentrations less than or equal to 25 µg/L. These quality specifications were established by New York State Department of Health's Wadsworth Center, the PT Program organizer.

The target value for Al in serum has been set as the arithmetic mean of three reference laboratories (147, 200, and 293) that have a long history of successful proficiency testing in this scheme. A consensus value for sample SE16-01 could not be reached and is therefore not graded in this event.

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Results for Event #1, 2016
Serum Aluminum (Al)
Performance of Participating Laboratories

		Serum Al (µg/L)				
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
	Target	**NA**	**22.0**	**14.8**	**65.9**	**36.4**
147	ETAAS-Z	4.8	21.7	11.8	69.8	35.2
200	DRC/CC-ICP-MS	3	21.6	15.9	58.3	38.1
293	ICP-MS	15.3	22.6	16.7	69.6	35.8
485	HR-ICP-MS	7.31	24.1	14.5	73.9	38.3
596	ICP-AES/OES	55	71 ↑	*54 ↑	130 ↑	83 ↑
598	ICP-MS	*234	57.6 ↑	14	226 ↑	55.3 ↑

Based on the grading criteria for Al in Serum, 77% of results were satisfactory, with two of the six laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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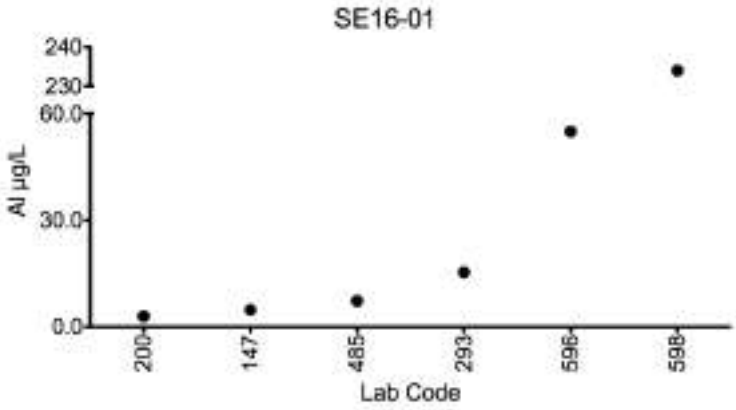
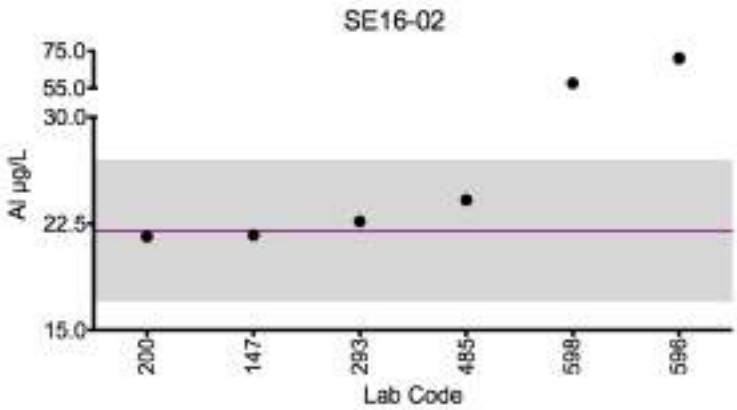
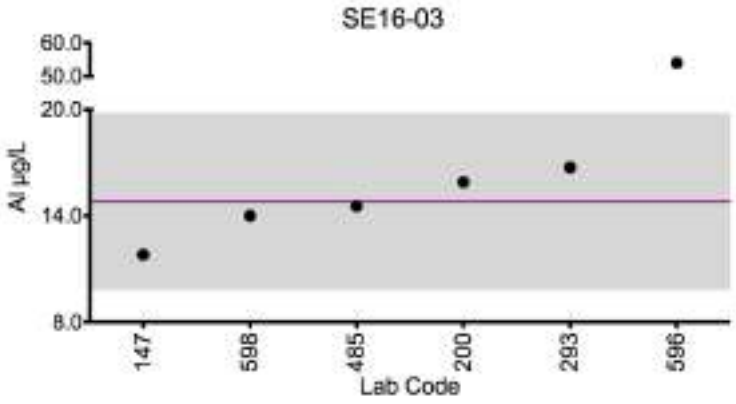
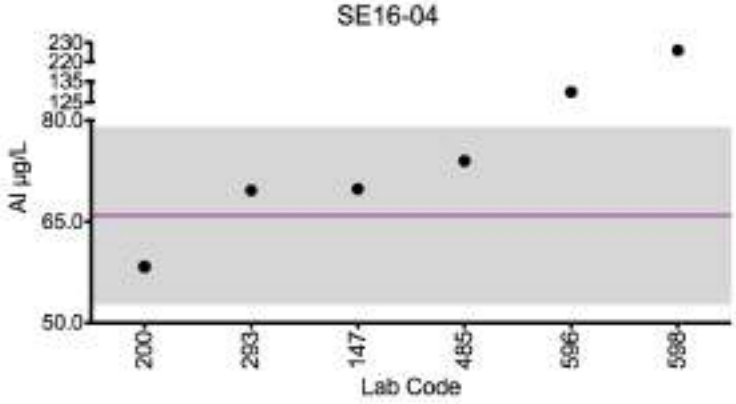
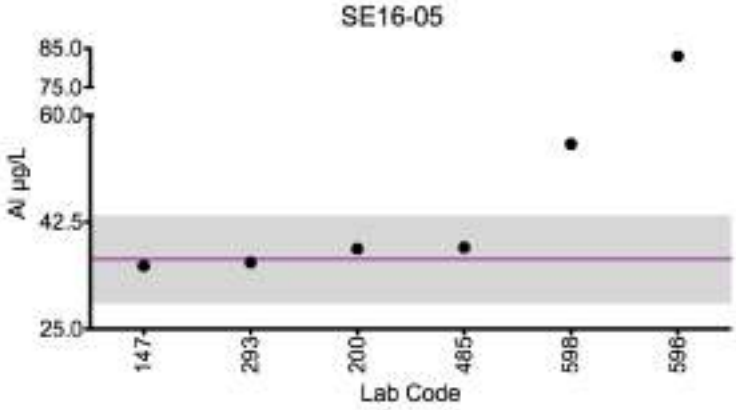
Results for Event #1, 2016: Serum Al











Legend:
Horizontal purple line = assigned target value based on the arithmetic mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±5 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±5 µg/L at concentrations less than or equal to 25 µg/L.

Results for Event #1, 2016
Serum Copper (Cu)

Summary Statistics

	Serum Cu (µg/L)				
	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
Target (Arithmetic Mean ($\bar{x}$))	1400	1098	2405	1781	1922
Upper Limit	1610	1262	2765	2048	2210
Lower Limit	1190	933	2044	1513	1633
Arithmetic SD (s)	142	106	263	188	183
Arithmetic RSD (%)	10	9.7	10	10	9.5
Number of Sample Measurements (N)	9	9	9	9	9

The acceptable range is based on quality specifications:
±95 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±95 µg/L at concentrations less than or equal to 635 µg/L. These quality specifications were established by New York State Department of Health's Wadsworth Center, the PT Program organizer.

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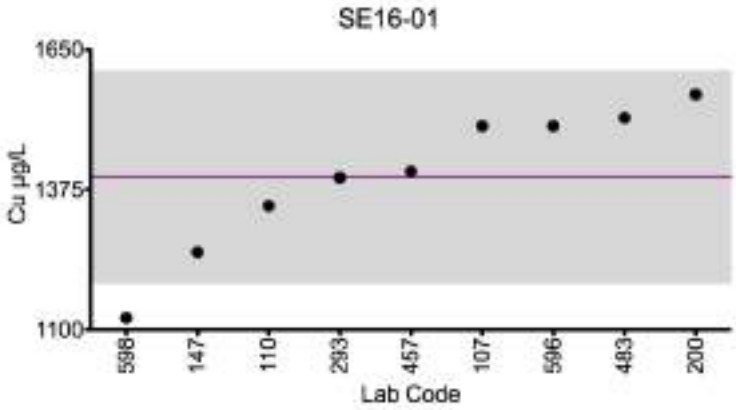
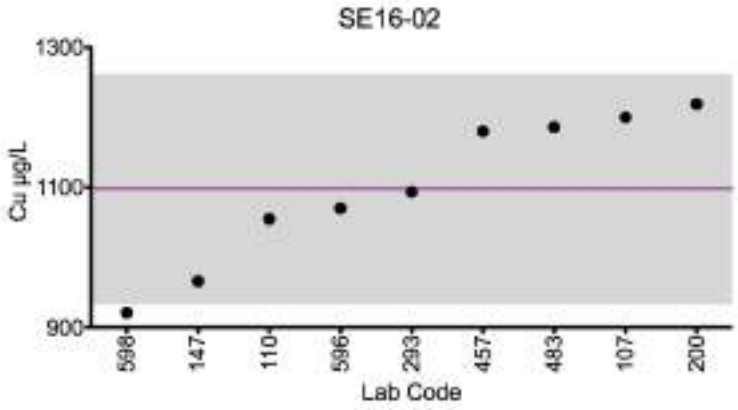
Results for Event #1, 2016
Serum Copper (Cu)
Performance of Participating Laboratories

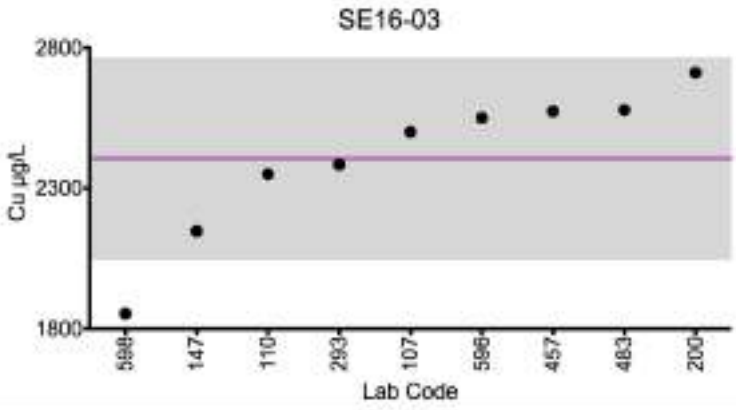
		Serum Cu (µg/L)				
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
	Target	**1400**	**1098**	**2405**	**1781**	**1922**
107	DRC/CC-ICP-MS	1500	1200	2500	1900	2000
110	ICP-MS	1343	1055	2351	1531	1832
147	ICP-MS	1252	966	2147	1762	1703
200	ICP-MS	1562	1219	2711	1994	2178
293	ICP-MS	1398	1093	2384	1780	1862
457	ICP-AES/OES	1411	1180	2574	1897	2066
483	DRC/CC-ICP-MS	1516	1186	2579	1891	2036
596	ICP-AES/OES	1500	1070	2550	1860	2010
598	ICP-MS	1123 ↓	921 ↓	1854 ↓	1421 ↓	1612 ↓

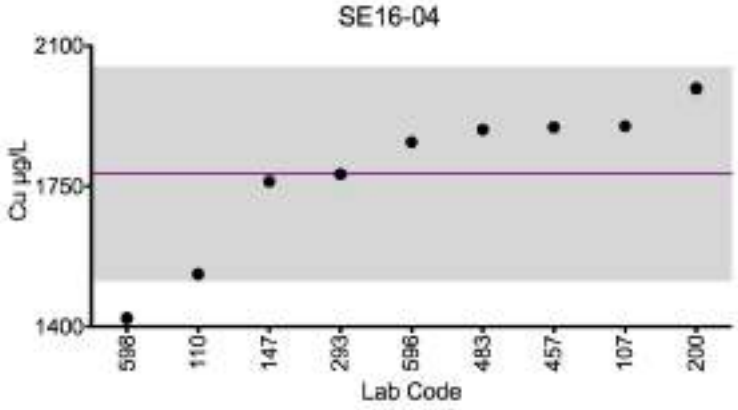
Based on the grading criteria for Cu in Serum, 89% of results were satisfactory, with one of the nine laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

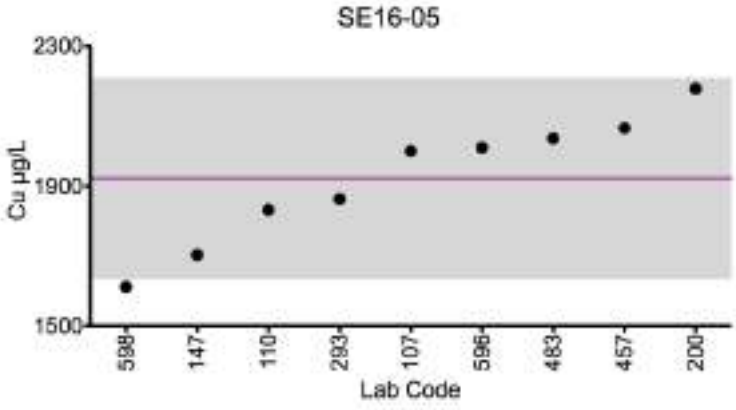
Results for Event #1, 2016: Serum Cu











Legend:
Horizontal purple line = assigned target value based on the arithmetic mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±95 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±5 µg/L at concentrations less than or equal to 635 µg/L.

Results for Event #1, 2016
Serum Selenium (Se)

Summary Statistics

	Serum Se (µg/L)				
	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
Target (Arithmetic Mean ($\bar{x}$))	107	85.5	184	136	231
Upper Limit	128	102.6	220	163	277
Lower Limit	85	68.4	147	108	184
Arithmetic SD (s)	6	9	13	11	20
Arithmetic RSD (%)	5.6	10	7.2	8.8	8.7
Number of Sample Measurements (N)	9	9	9	9	9

The acceptable range is based on quality specifications:
±2 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±2 µg/L at concentrations less than or equal to 10 µg/L. These quality specifications were established by New York State Department of Health's Wadsworth Center, the PT Program organizer.

Results for Event #1, 2016
Serum Selenium (Se)
Performance of Participating Laboratories

		Serum Se (µg/L)				
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
	Target	**107**	**85.5**	**184**	**136**	**231**
103	DRC/CC-ICP-MS	111	90.6	192	143	244
107	DRC/CC-ICP-MS	110	87	190	140	240
110	DRC/CC-ICP-MS	101	82	177	115	211
147	ICP-MS	97.2	78.3	163	124	196
200	DRC/CC-ICP-MS	108	87	191	145	231
293	ICP-MS	111	86.9	194	142	248
483	DRC/CC-ICP-MS	116	96.2	201	150	250
596	HR-ICP-MS	102	66.8 ↓	164	124	212
598	DRC/CC-ICP-MS	110	94.9	188	142	250

Based on the grading criteria for Se in Serum, 98% of results were satisfactory, with none of the nine laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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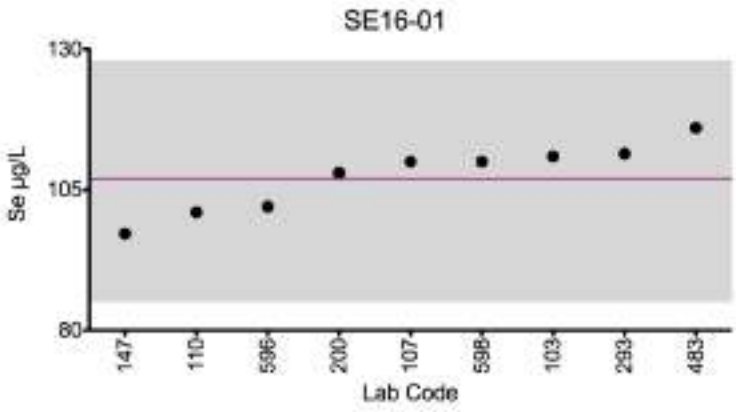
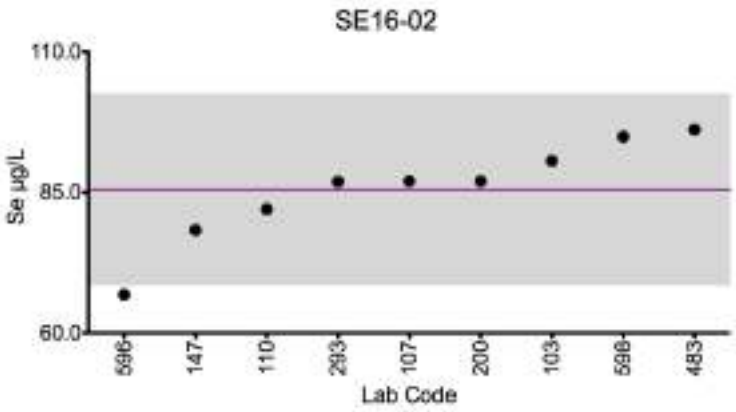
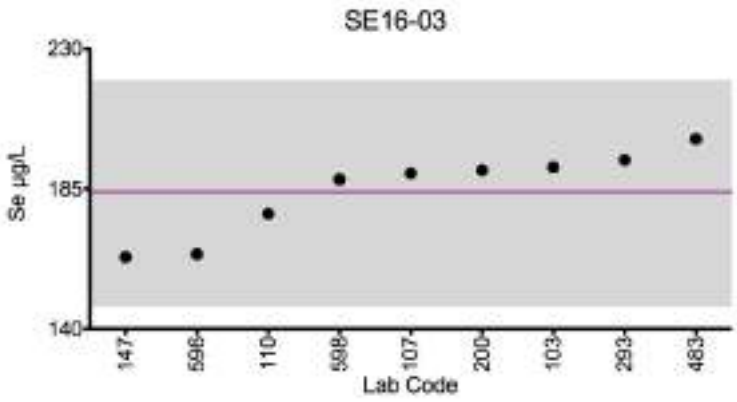
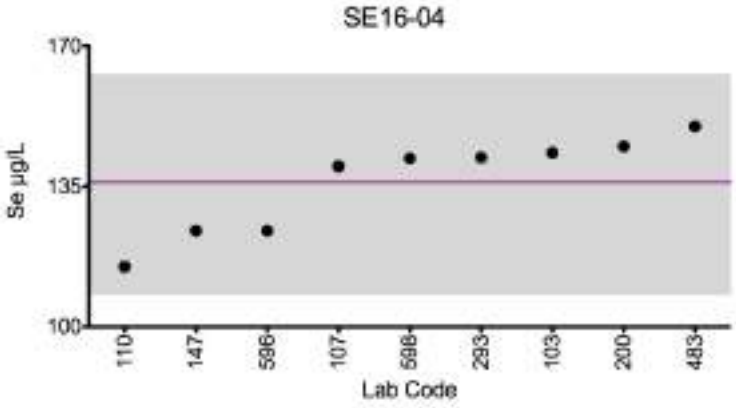
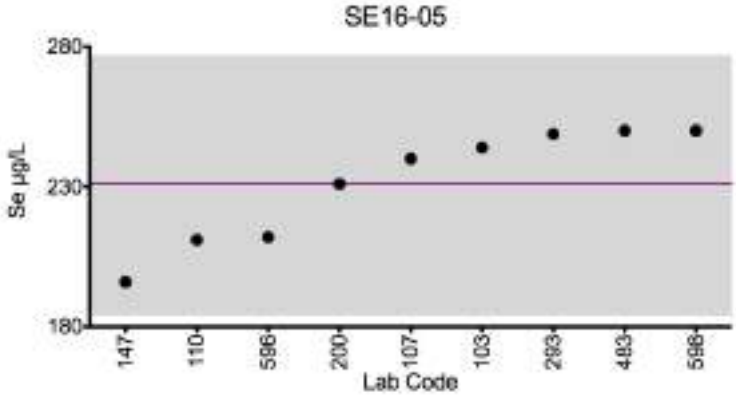
Results for Event #1, 2016: Serum Se











Legend:
Horizontal purple line = assigned target value based on the arithmetic mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±2 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±2 µg/L at concentrations less than or equal to 10 µg/L.

Results for Event #1, 2016
Serum Zinc (Zn)

Summary Statistics

	Serum Zn (µg/L)				
	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
Target (Arithmetic Mean ($\bar{x}$))	1658	1338	959	747	545
Upper Limit	1906	1538	1102	859	626
Lower Limit	1409	1137	815	634	463
Arithmetic SD (s)	175	163	63	91	68
Arithmetic RSD (%)	10	12	6.5	12	12
Number of Sample Measurements (N)	9	9	8	9	9

The acceptable range is based on quality specifications:
±15 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±15 µg/L at concentrations less than or equal to 100 µg/L. These quality specifications were established by New York State Department of Health's Wadsworth Center, the PT Program organizer.

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Results for Event #1, 2016
Serum Zinc (Zn)
Performance of Participating Laboratories

		Serum Zn (µg/L)				
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
	Target	**1658**	**1338**	**959**	**747**	**545**
107	DRC/CC-ICP-MS	1900	1500	1000	840	610
110	ICP-MS	1663	1384	938	677	541
147	ICP-MS	1529	1222	869	699	507
200	ICP-MS	1844	1504	1059	856	634 ↑
293	ICP-MS	1601	1320	895	738	510
457	ICP-AES/OES	1586	1381	951	764	554
483	DRC/CC-ICP-MS	1800	1489	1017	838	606
596	ICP-AES/OES	1670	1240	943	748	538
598	ICP-MS	1331 ↓	1008 ↓	*686 ↓	571 ↓	409 ↓

Based on the grading criteria for Zn in Serum, 87% of results were satisfactory, with one of the nine laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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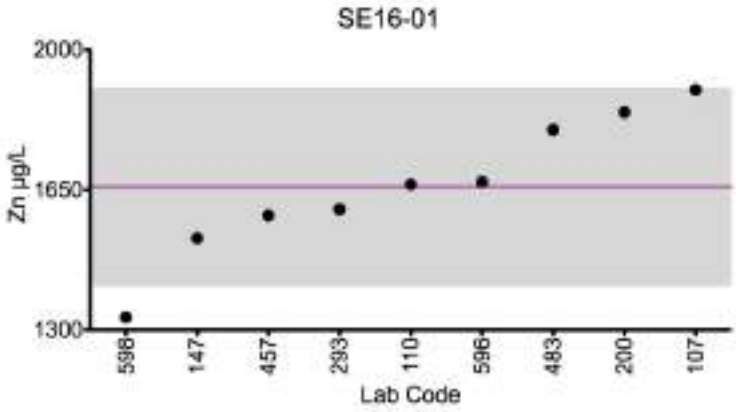
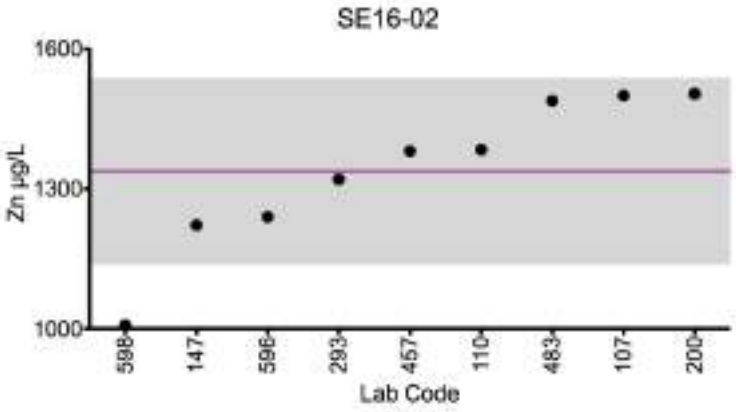
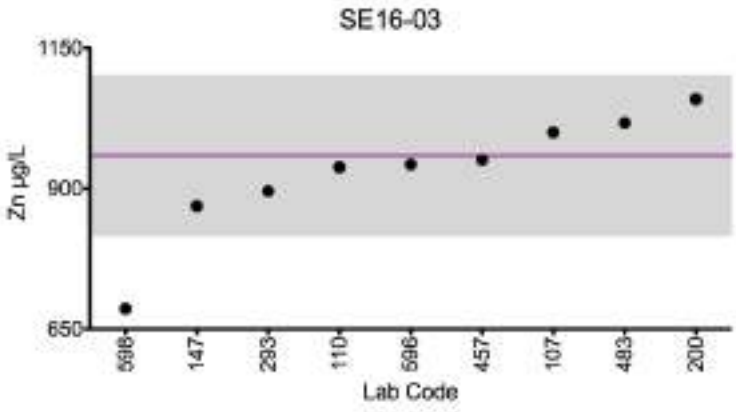
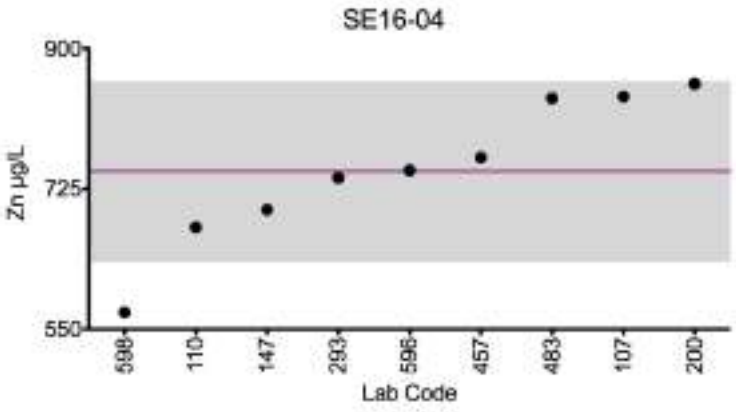
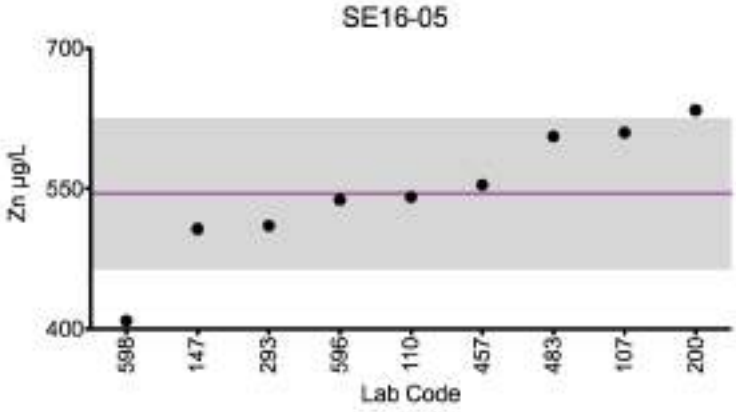
Results for Event #1, 2016: Serum Zn











Legend:
Horizontal purple line = assigned target value based on the arithmetic mean of all laboratories.
Gray area = acceptable range based on quality specifications:
±15 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±15 µg/L at concentrations less than or equal to 100 µg/L.

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Results for Event #1, 2016
Additional Elements in Serum: Arsenic (As)

Serum As (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	3.32	10.5	8.99	15.8	5.20
110	DRC/CC-ICP-MS	2.9	9.0	8.0	12.3	4.59
147	ICP-MS	*2105	*8285	*7610	*13064	*4142
596	HR-ICP-MS	<5.26	5.31	<5.26	12.2	<5.26
598	DRC/CC-ICP-MS	3.1	9.6	7.5	14.4	4.8

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	3.12	8.60	8.17	13.6	4.87
Arithmetic SD (s)	0.18	2.27	0.75	1.7	0.29
Arithmetic RSD (%)	6	26	9.2	12	6.1
Number of Sample Measurements (N)	3	4	3	4	3

*Denotes a statistical Outlier.

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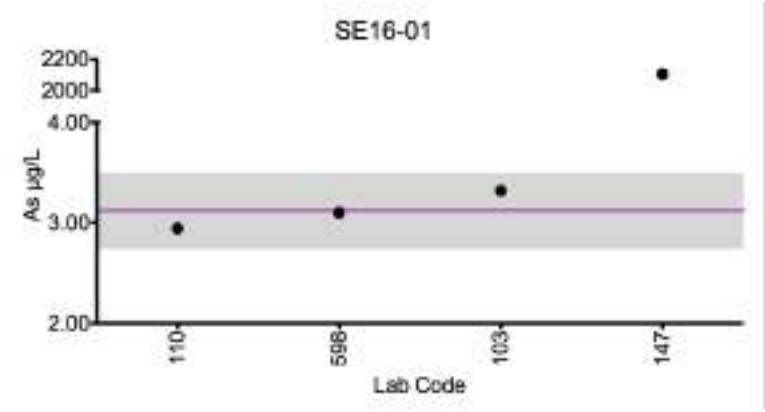
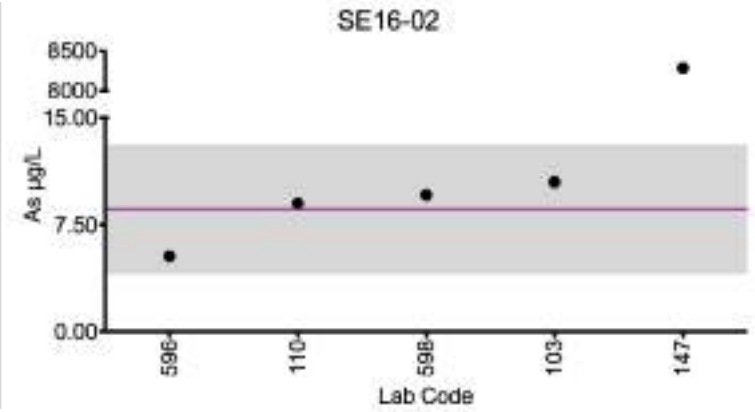
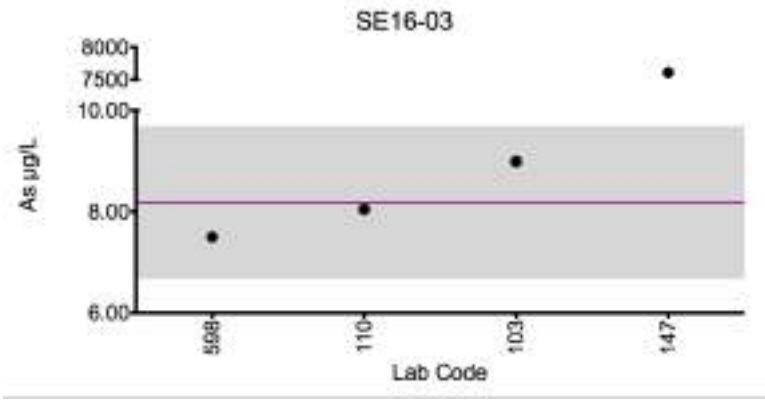
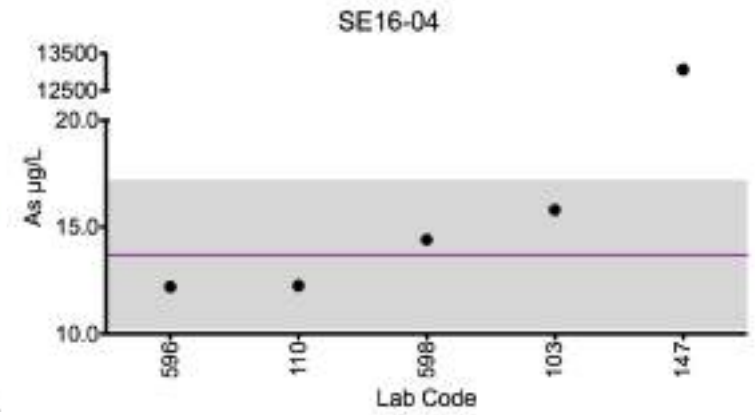
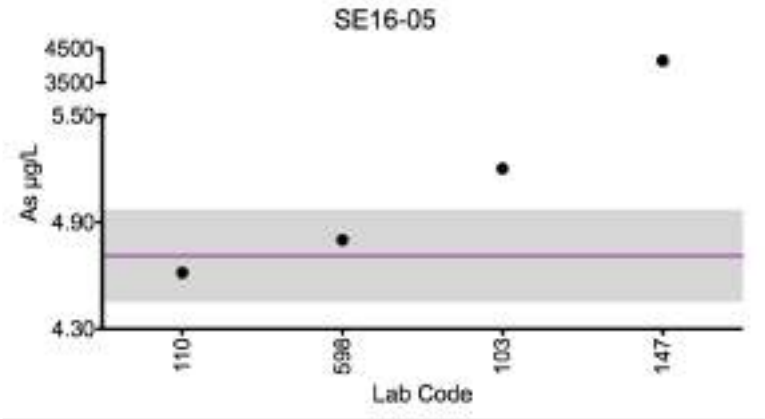
Results for Event #1, 2016: Serum As











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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Results for Event #1, 2016
Additional Elements in Serum: Cadmium (Cd)

Serum Cd (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	1.20	0.378	3.83	1.44	7.21
110	ICP-MS	1.2	0.4	3.7	1.2	7.1
147	ICP-MS	1.17	0.36	3.73	1.44	7.07
596	HR-ICP-MS	1.18	0.324	3.4	1.34	6.67
598	DRC/CC-ICP-MS	1.6	*1	3.4	1.3	6.7
599	DRC/CC-ICP-MS	1.5	0.68	4.59	*0.78	7.9

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	1.31	0.362	3.78	1.35	7.11
Arithmetic SD (s)	0.18	0.027	0.44	0.08	0.44
Arithmetic RSD (%)	14	7.7	11	6.3	6.2
Number of Sample Measurements (N)	6	4	6	5	6

*Denotes a statistical Outlier.

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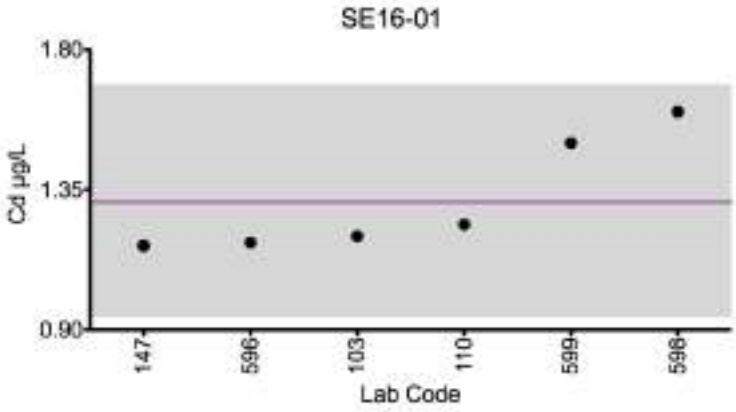
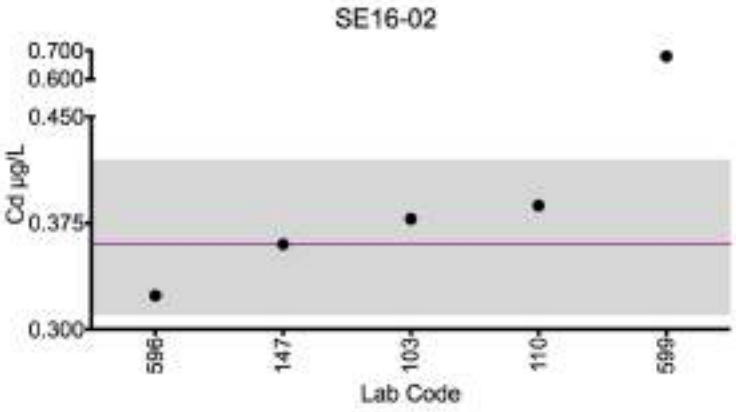
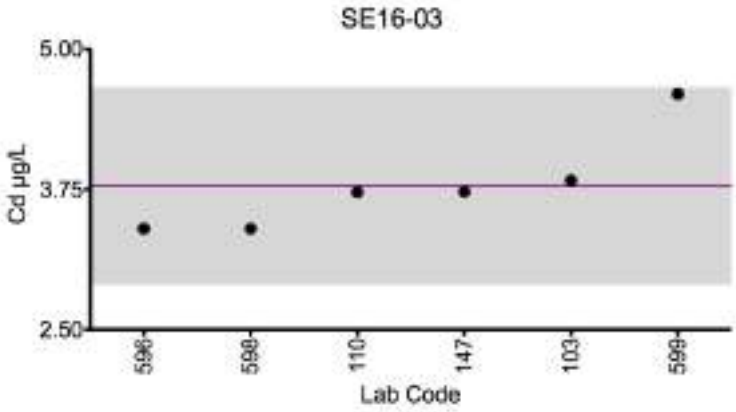
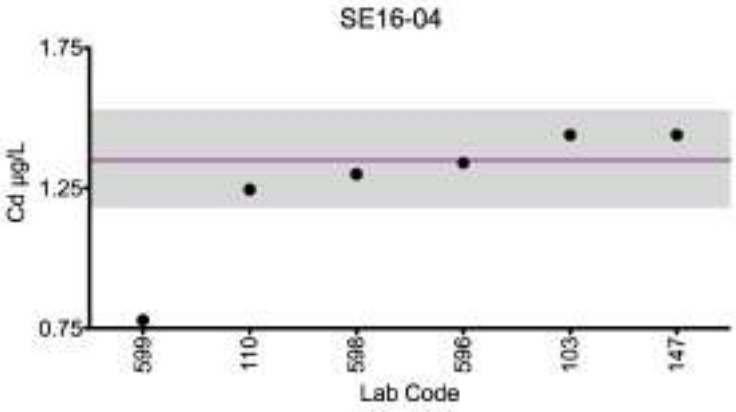
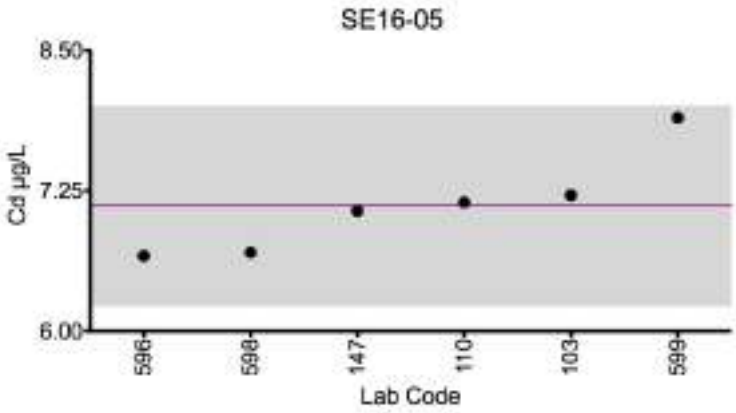
Results for Event #1, 2016: Serum Cd











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Gray area = ±2SD of the mean.

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Results for Event #1, 2016
Additional Elements in Serum: Cobalt (Co)

Serum Co (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	2.12	6.82	1.21	3.34	8.88
110	ICP-MS	2.1	6.6	1.2	3.0	8.69
147	ICP-MS	1.92	5.85	1.11	2.93	7.6
485	HR-ICP-MS	2.15	7.09	1.15	3.28	9.35
596	HR-ICP-MS	1.83	5.09	<1	2.76	7.15
598	ICP-MS	2.7	5.7	1.1	*5.8	7.4

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	2.14	6.19	1.13	3.06	8.17
Arithmetic SD (s)	0.30	0.76	0.08	0.24	0.90
Arithmetic RSD (%)	14	12	7.6	7.9	11
Number of Sample Measurements (N)	6	6	6	5	6

*Denotes a statistical Outlier.

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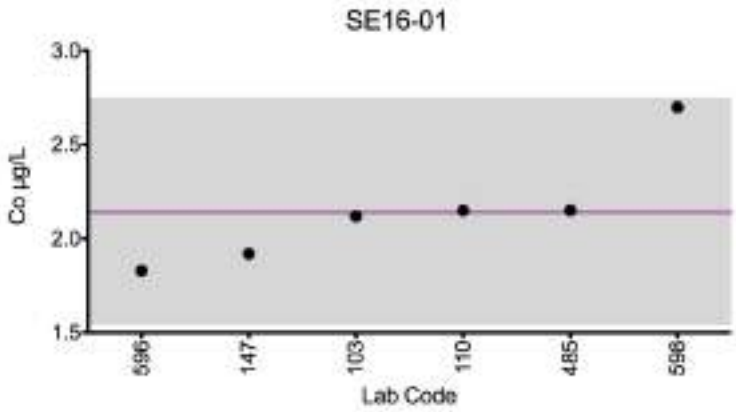
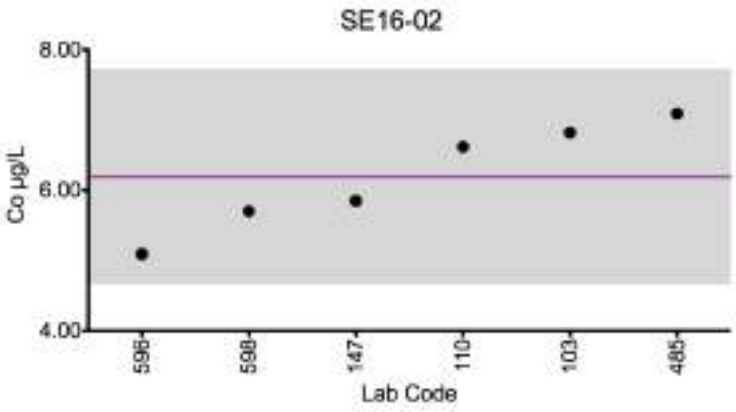
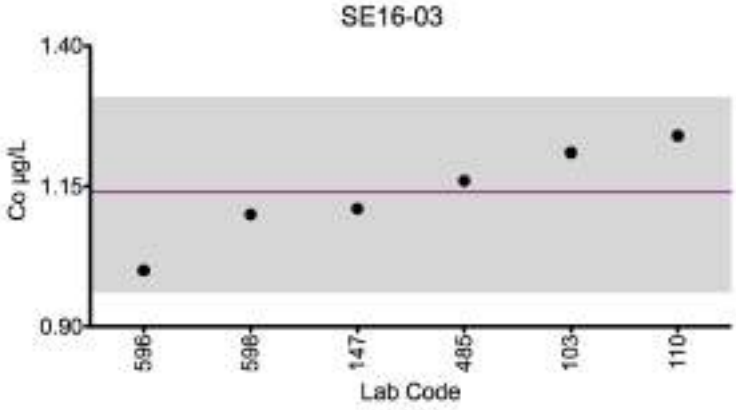
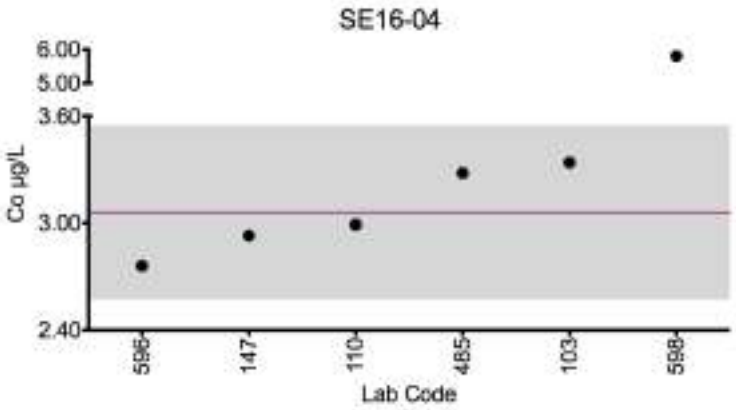
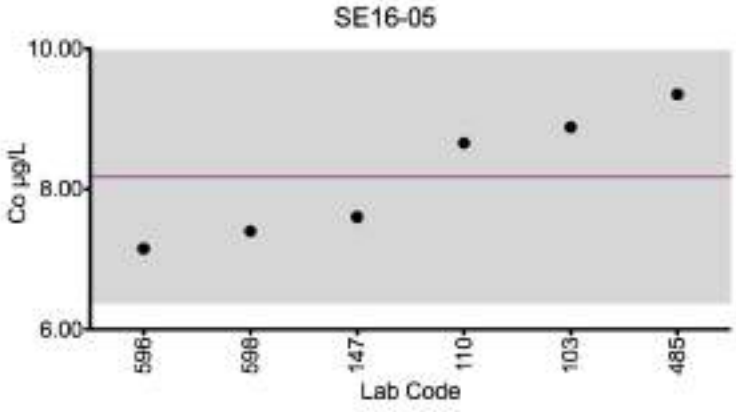
Results for Event #1, 2016:
Serum Co











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Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

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Results for Event #1, 2016
Additional Elements in Serum: Chromium (Cr)

Serum Cr (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	1.41	3.91	<0.089	5.20	7.90
110	DRC/CC-ICP-MS	1.6	3.5	<0.4	4.09	6.9
147	DRC/CC-ICP-MS	1.29	3.33	<0.156	5.12	7.38
485	HR-ICP-MS	1.32	3.9	<0.1	4.86	7.84
596	HR-ICP-MS	0.708	2.29	<0.087	5.03	*4.95
598	DRC/CC-ICP-MS	*3.2	4.2	<2	6.2	7.3

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	1.25	3.52	NA	5.09	7.45
Arithmetic SD (s)	0.32	0.67	NA	0.66	0.42
Arithmetic RSD (%)	25	19	NA	12	5.7
Number of Sample Measurements (N)	5	6	NA	6	5

*Denotes a statistical Outlier.
Results for sample SE16-03 were not graphed due to all of the reported values being <MDL.

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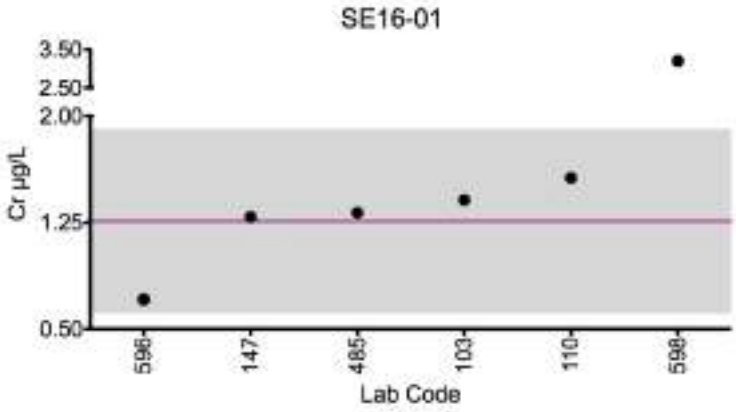
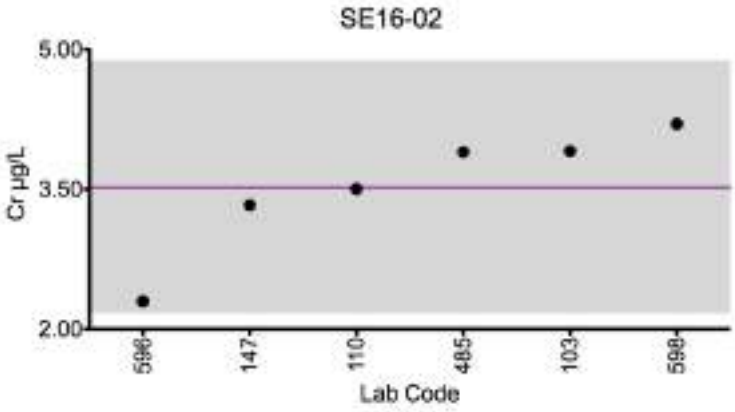
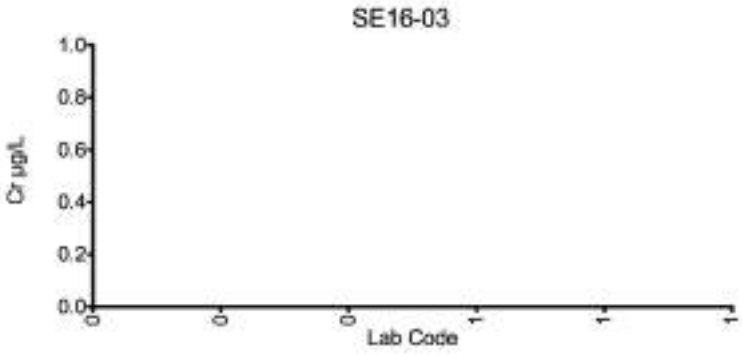
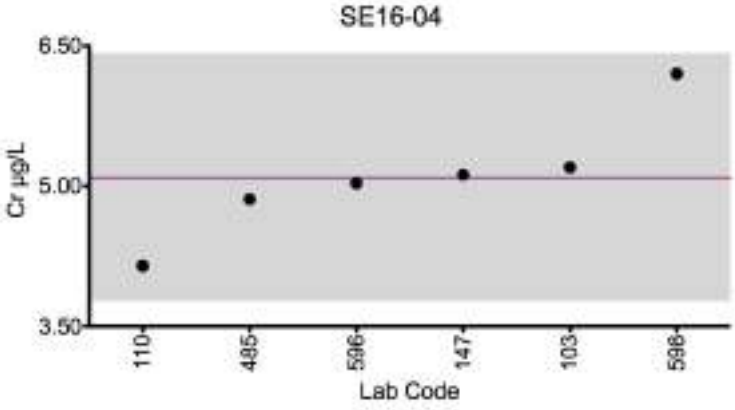
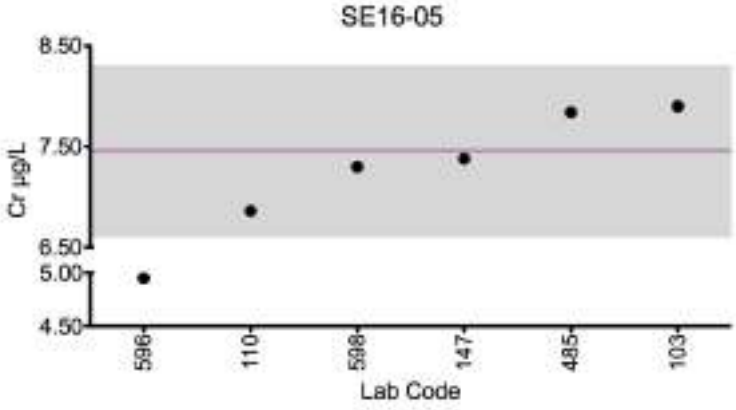
Results for Event #1, 2016: Serum Cr











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

Results for Event #1, 2016
Additional Elements in Serum: Mercury (Hg)

Serum Hg (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	2.17	1.21	6.93	1.96	3.95
110	ICP-MS	1.9	1.0	6.5	1.4	3.4
147	ICP-MS	1.93	0.972	5.68	1.57	3.21
596	ICP-MS	1.88	0.893	5.72	1.51	3.11
598	ICP-MS	1.8	1.5	6.25	1.8	4.5

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	1.93	1.11	6.21	1.64	3.64
Arithmetic SD (s)	0.13	0.24	0.52	0.23	0.57
Arithmetic RSD (%)	7.2	22	8.4	14	15
Number of Sample Measurements (N)	5	5	5	5	5

*Denotes a statistical Outlier.

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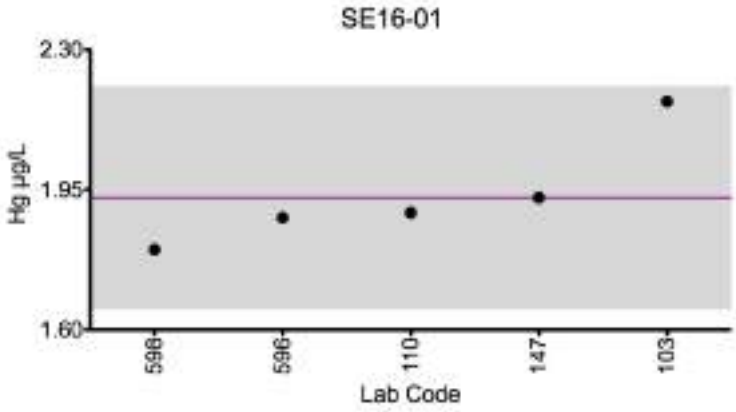
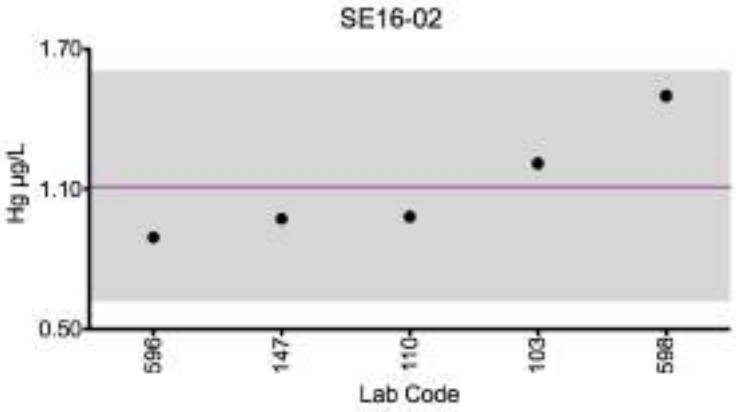
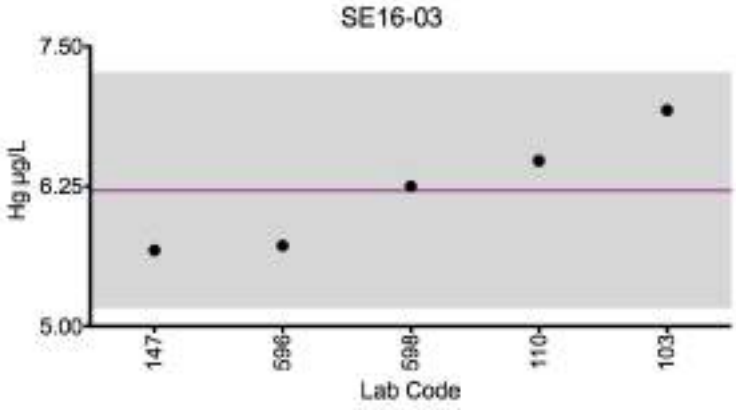
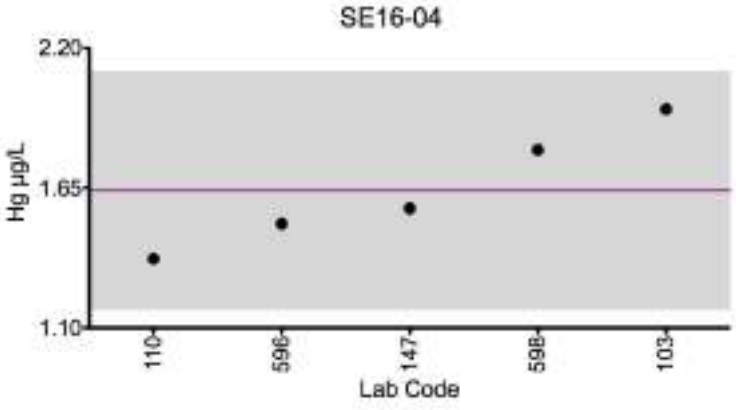
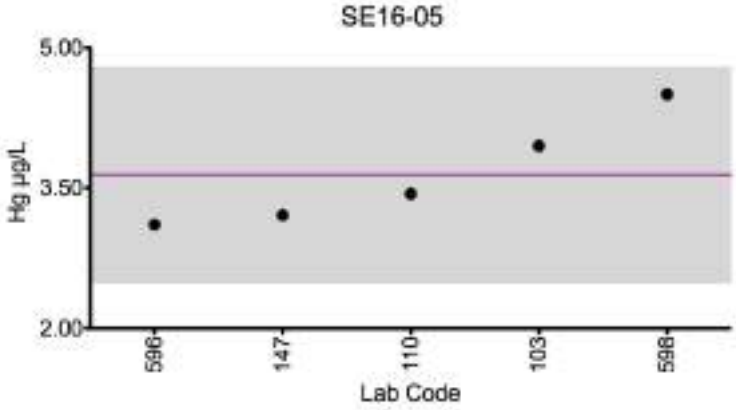
Results for Event #1, 2016: Serum Hg











Legend:
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Gray area = ±2SD of the mean.

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Results for Event #1, 2016
Additional Elements in Serum: Manganese (Mn)

Serum Mn (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	4.3	7.07	19.3	13.4	20.8
110	ICP-MS	4.59	6.9	19.0	11.8	20.3
147	ICP-MS	3.74	6.1	17	11.6	17.7
596	ICP-MS	4.22	5.99	18.2	12.9	19.3
598	ICP-MS	5.8	6.6	18.7	11.9	17.8

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	4.53	6.53	18.4	12.3	19.1
Arithmetic SD (s)	0.77	0.47	0.9	0.7	1.4
Arithmetic RSD (%)	17	7.3	4.8	6.3	7.3
Number of Sample Measurements (N)	5	5	5	5	5

*Denotes a statistical Outlier.

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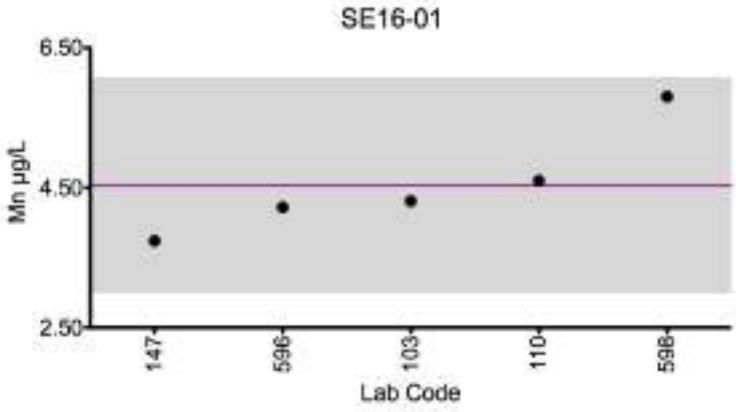
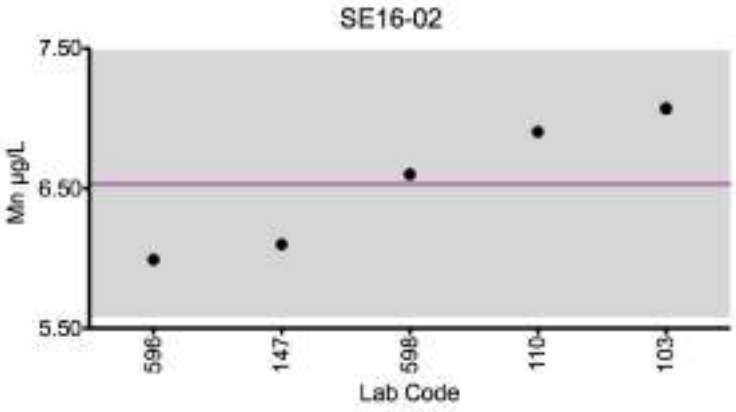
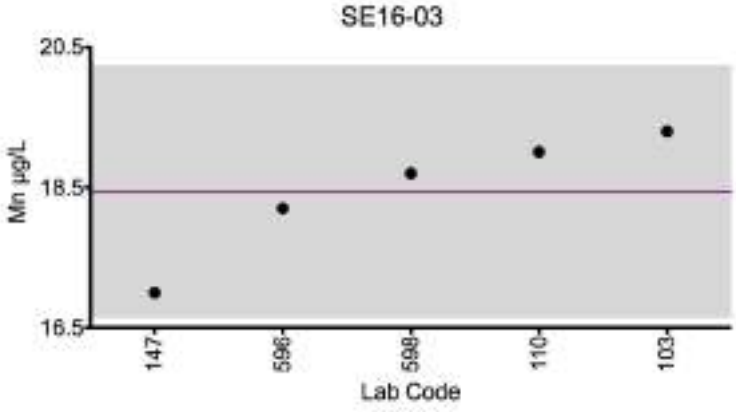
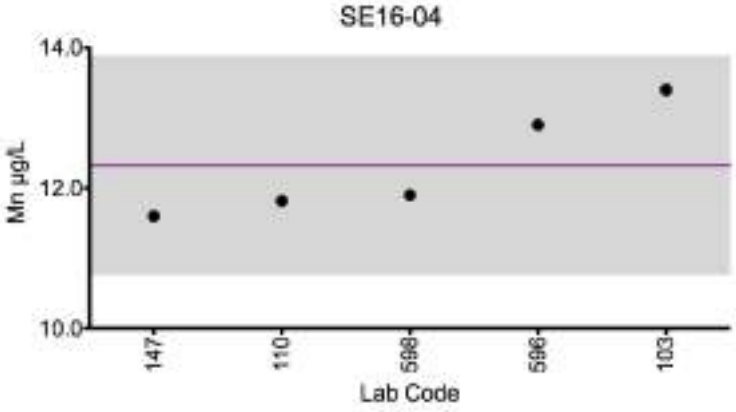
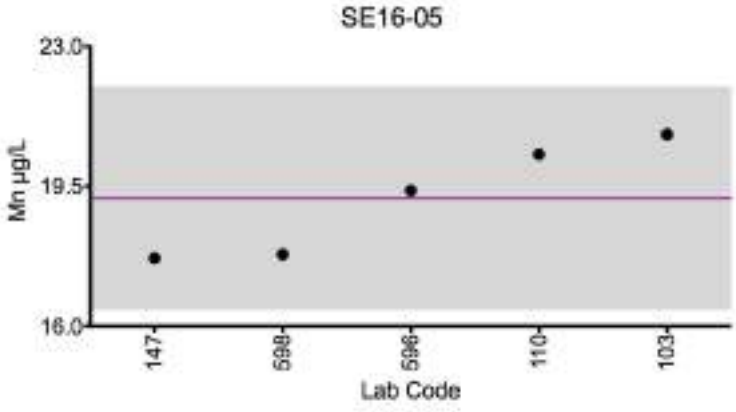
Results for Event #1, 2016: Serum Mn











Legend:
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Gray area = ±2SD of the mean.

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Results for Event #1, 2016
Additional Elements in Serum: Molybdenum (Mo)

Serum Mo (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	3.74	1.62	5.11	4.34	9.61
110	ICP-MS	4.09	1.8	5.09	3.9	9.6
147	ICP-MS	3.71	1.55	5.05	4.13	9.39
485	HR-ICP-MS	3.84	1.64	5.27	4.28	11.1
596	HR-ICP-MS	3.61	1.5	5.32	4.34	9.24
598	ICP-MS	4.4	*2.5	5.8	5.09	10.3

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	3.89	1.61	5.27	4.34	9.88
Arithmetic SD (s)	0.29	0.09	0.28	0.40	0.73
Arithmetic RSD (%)	7.5	6.1	5.3	9.3	7.4
Number of Sample Measurements (N)	6	5	6	6	6

*Denotes a statistical Outlier.

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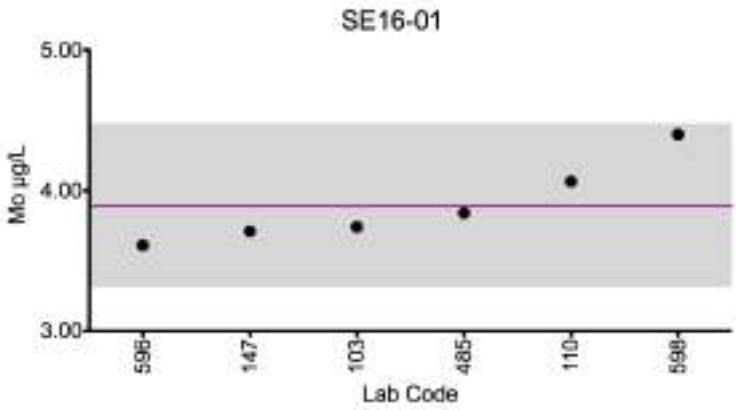
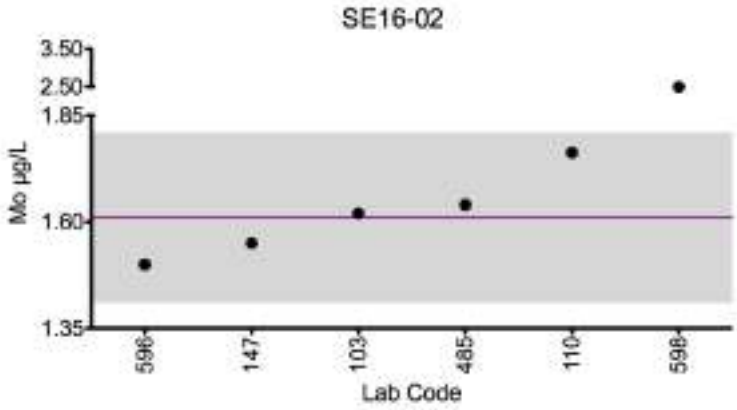
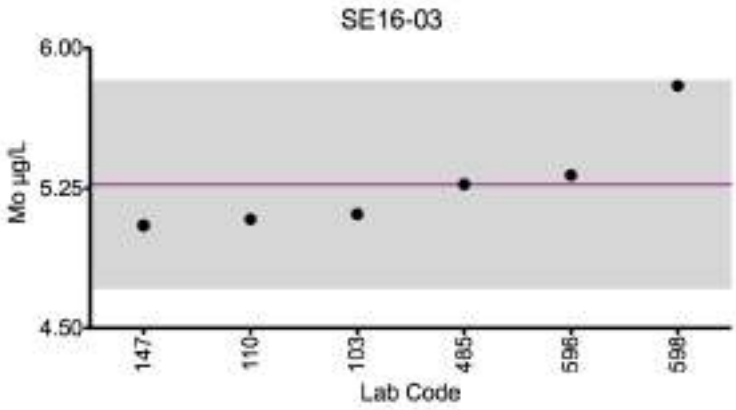
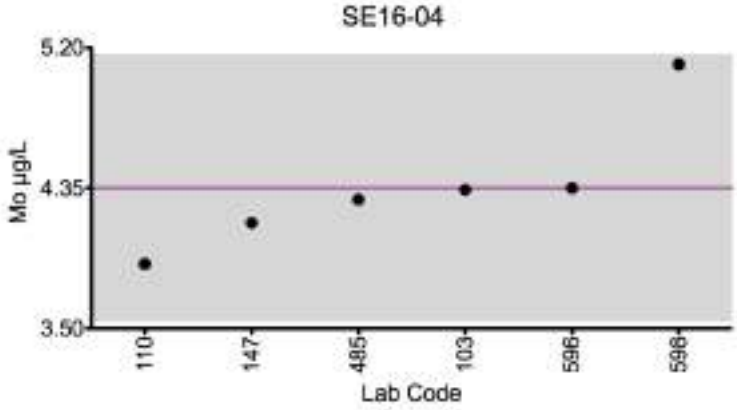
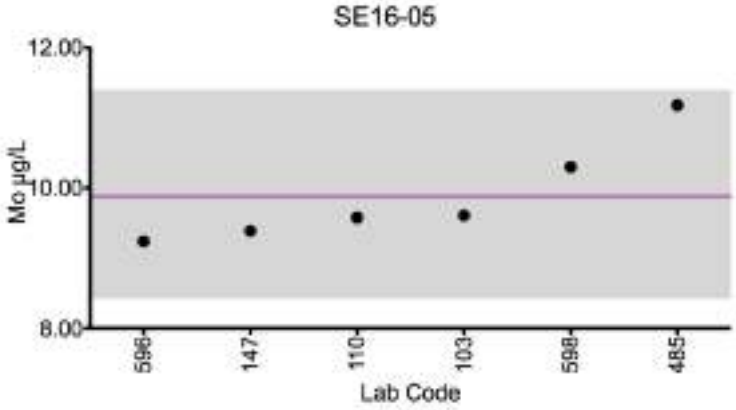
Results for Event #1, 2016: Serum Mo











Legend:
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Results for Event #1, 2016
Additional Elements in Serum: Nickel (Ni)

Serum Ni (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
110	DRC/CC-ICP-MS	15.1	4.5	1.9	5.7	2.29
147	ICP-MS	9.34	2.84	1.28	5.64	2.25
485	HR-ICP-MS	10.2	3.06	1.19	6.41	2.66
596	ICP-MS	9.23	2.72	1.36	5.89	2.62
598	ICP-MS	*74	*13	*3.5	*21.3	*8.5

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	10.9	3.26	1.42	5.89	2.44
Arithmetic SD (s)	2.7	0.80	0.30	0.35	0.22
Arithmetic RSD (%)	25	24	21	6.1	9
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.

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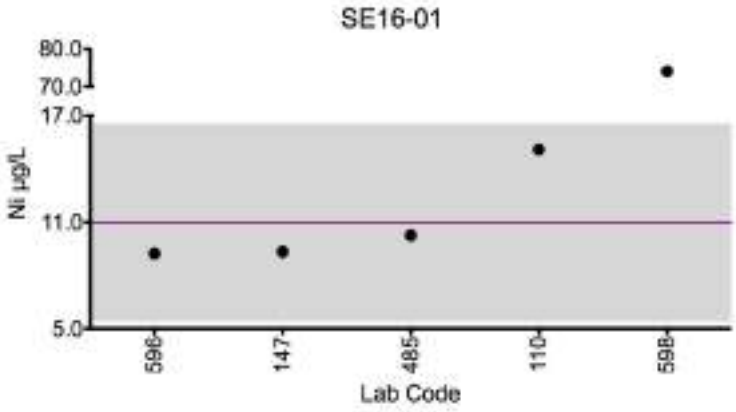
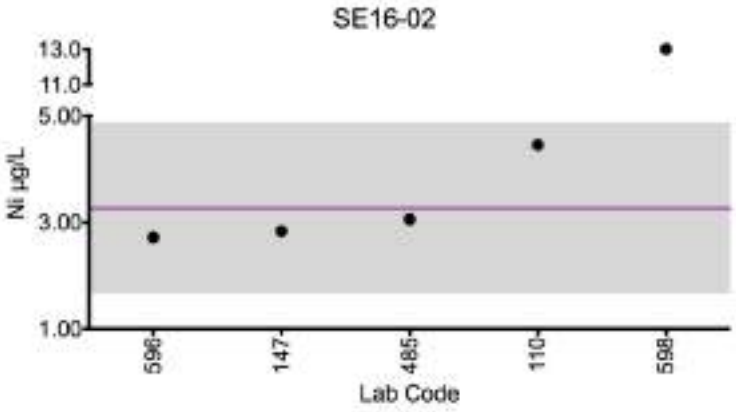
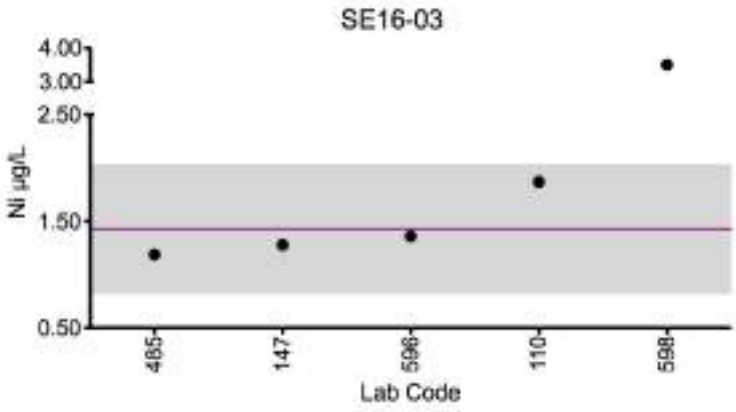
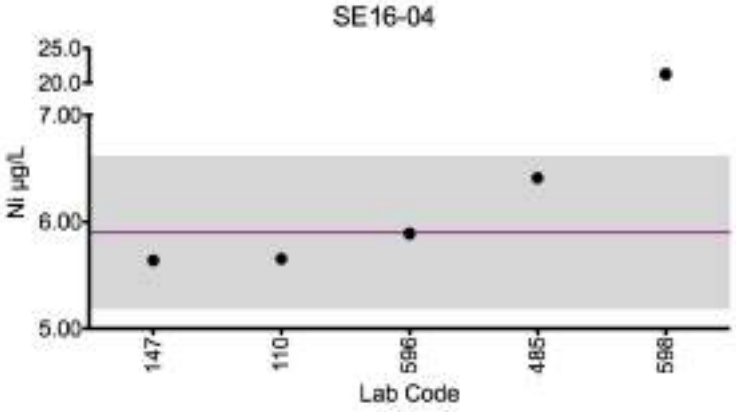
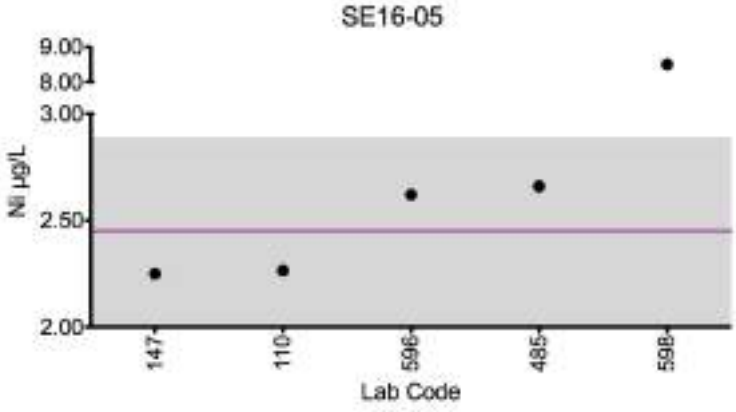
Results for Event #1, 2016: Serum Ni











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Results for Event #1, 2016
Additional Elements in Serum: Lead (Pb)

Serum Pb (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	6.30	1.98	16.1	8.16	1.51
110	ICP-MS	8.4	2.0	15.3	7.0	1.3
147	ICP-MS	8.02	2.3	16.8	8.52	1.7
596	HR-ICP-MS	4.53	0.867	12.3	6.01	0.749
598	ICP-MS	14.9	2.2	12	7.3	1.3
599	DRC/CC-ICP-MS	0.67	0.3	*1.7	*0.81	0.27

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	7.13	1.61	14.5	7.39	1.13
Arithmetic SD (s)	4.73	0.82	2.2	0.99	0.53
Arithmetic RSD (%)	66	51	15	13	46
Number of Sample Measurements (N)	6	6	5	5	6

*Denotes a statistical Outlier.

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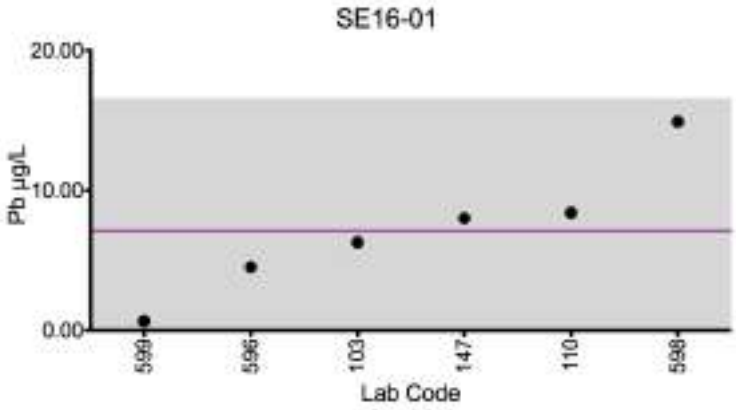
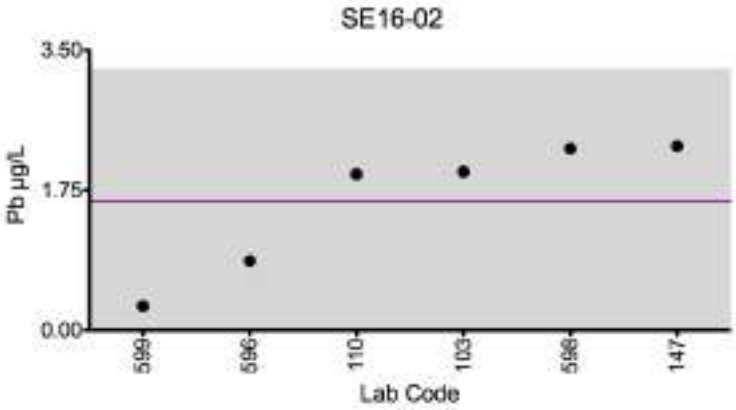
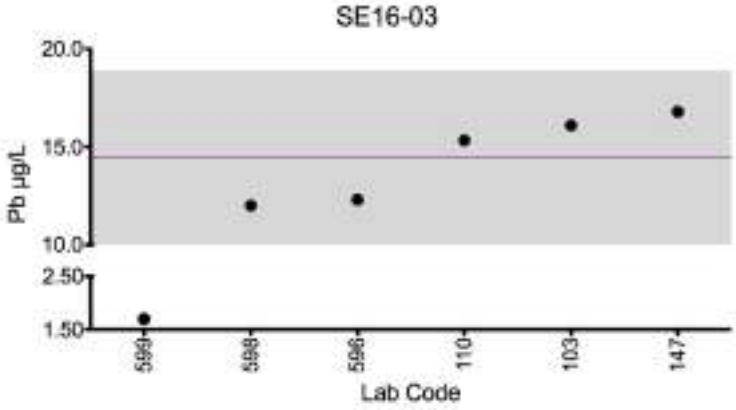
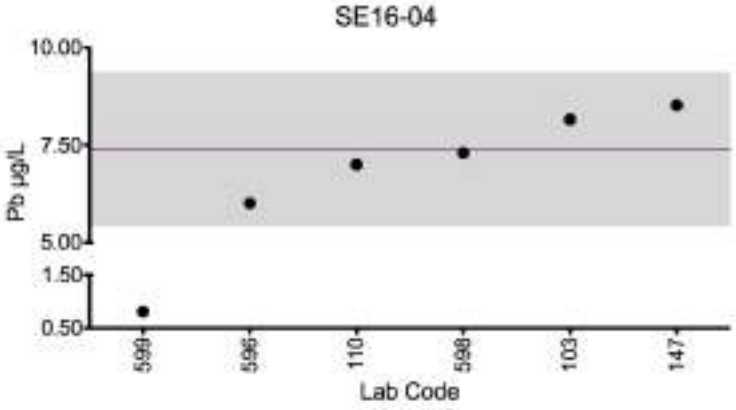
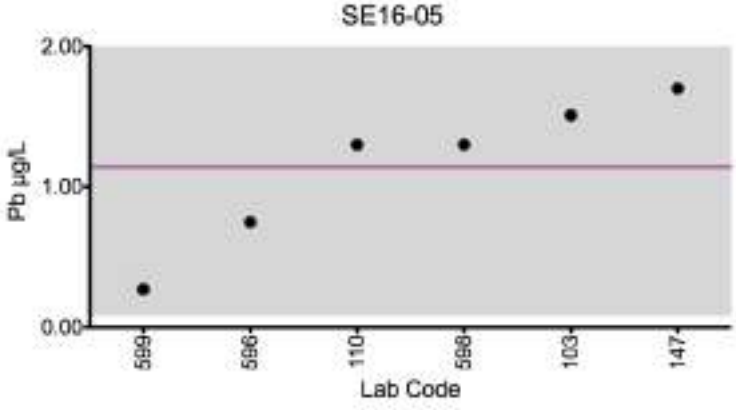
Results for Event #1, 2016: Serum Pb











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Results for Event #1, 2016
Additional Elements in Serum: Thallium (Tl)

Serum Tl (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	3.08	1.72	0.648	4.90	7.51
110	ICP-MS	3.1	1.7	0.6	4.4	7.4
147	ICP-MS	2.64	1.41	0.558	4.13	6.32
596	HR-ICP-MS	2.2	0.935	0.237	3.7	5.72
598	ICP-MS	2.5	1.4	<1	3.8	5.9

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	2.71	1.43	0.514	4.17	6.57
Arithmetic SD (s)	0.39	0.32	0.188	0.48	0.84
Arithmetic RSD (%)	14	22	36	11	12
Number of Sample Measurements (N)	5	5	4	5	5

*Denotes a statistical Outlier.

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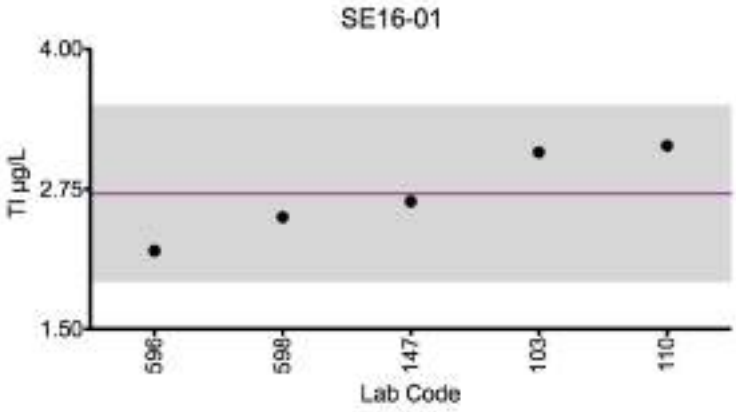
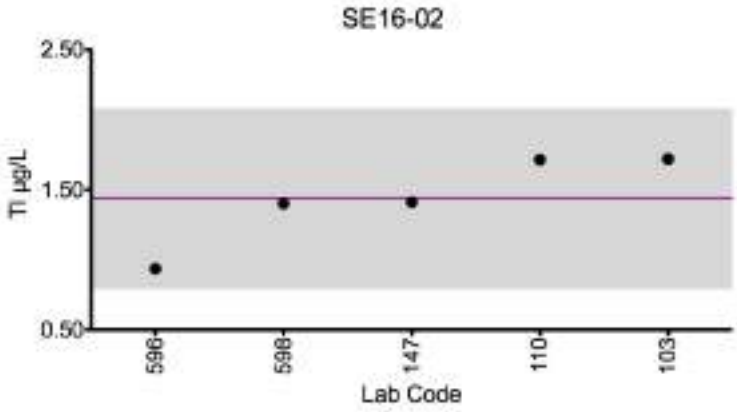
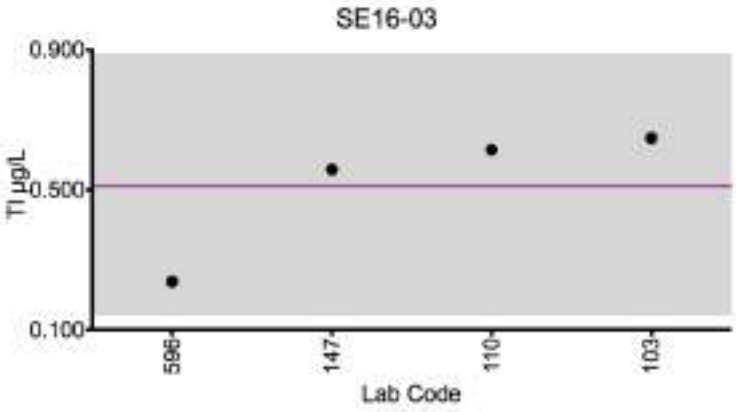
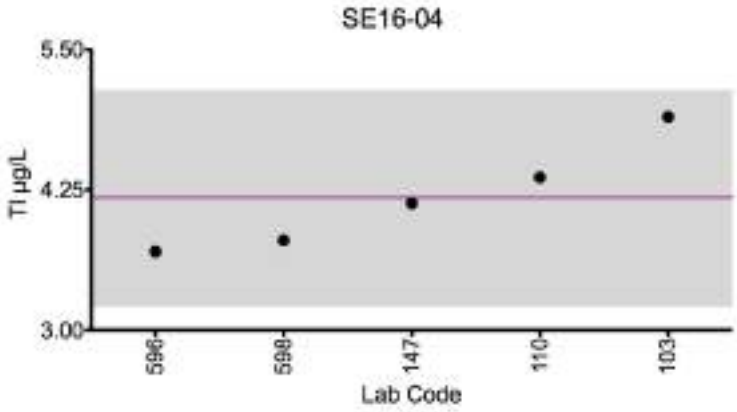
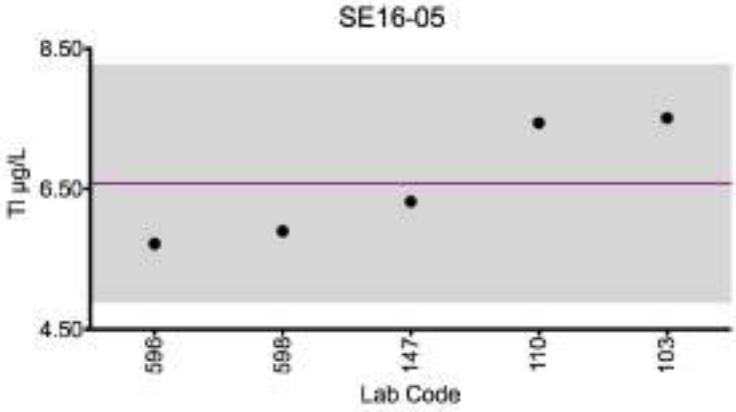
Results for Event #1, 2016: Serum Tl











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Results for Event #1, 2016
Additional Elements in Serum: Uranium (U)

Serum U (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	0.019	0.054	0.094	0.107	0.468
110	ICP-MS	0.019	0.053	0.091	0.092	0.416
147	ICP-MS	0.017	0.044	0.084	0.089	0.4
596	HR-ICP-MS	*0.415	*0.445	*0.517	*0.515	*0.884
598	ICP-MS	<1	<1	<1	<1	<1

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	0.018	0.050	0.090	0.096	0.428
Arithmetic SD (s)	0.001	0.005	0.005	0.009	0.035
Arithmetic RSD (%)	4.2	10	5.9	9.6	8.3
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.

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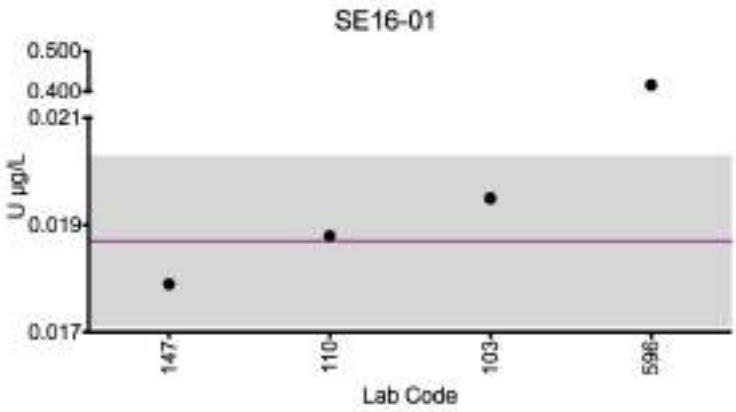
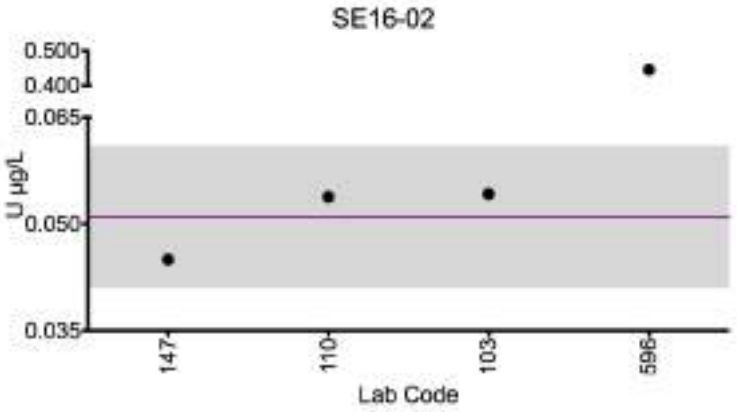
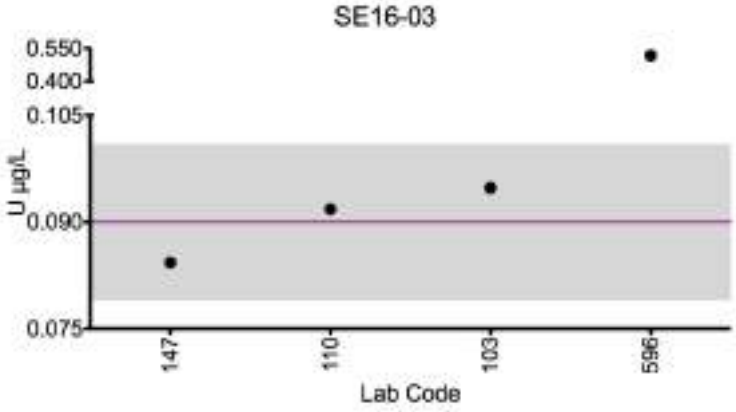
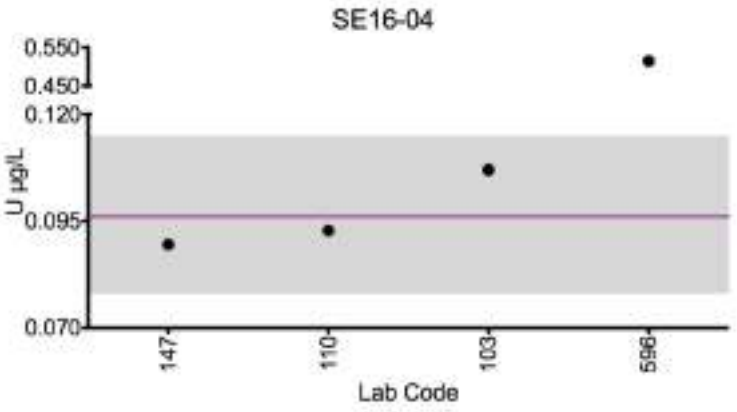
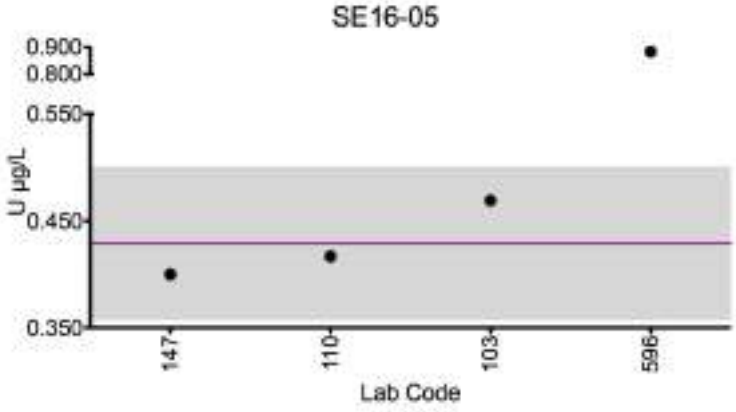
Results for Event #1, 2016: Serum U











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Results for Event #1, 2016
Additional Elements in Serum: Vanadium (V)

Serum V (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
110	DRC/CC-ICP-MS	2.1	3.6	0.9	1.1	5.4
147	DRC/CC-ICP-MS	1.69	3.21	0.638	1.14	4.67
485	HR-ICP-MS	2.04	3.98	0.84	1.28	6.09
596	HR-ICP-MS	1.75	3.04	0.677	1.14	5
598	ICP-MS	*6.4	*7.9	*4.9	*6	*9.6

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	1.89	3.44	0.766	1.16	5.28
Arithmetic SD (s)	0.20	0.41	0.130	0.07	0.61
Arithmetic RSD (%)	10	12	16	6.6	11
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.

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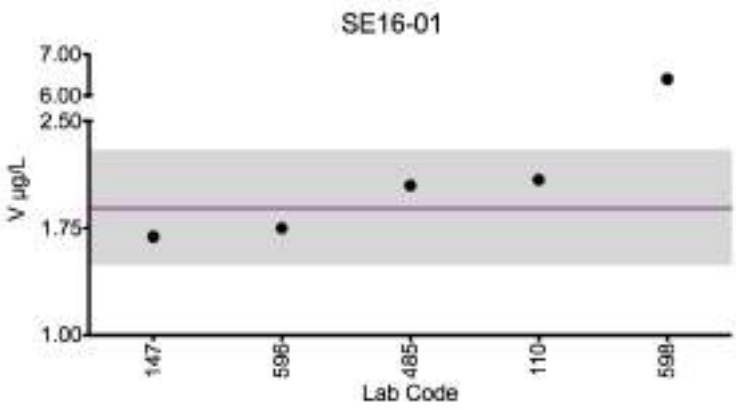
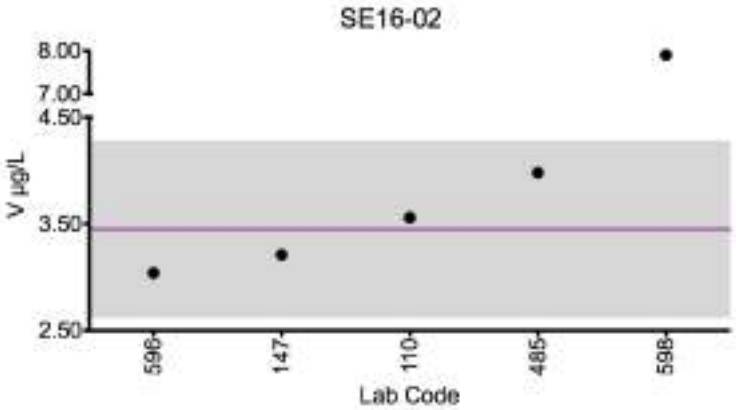
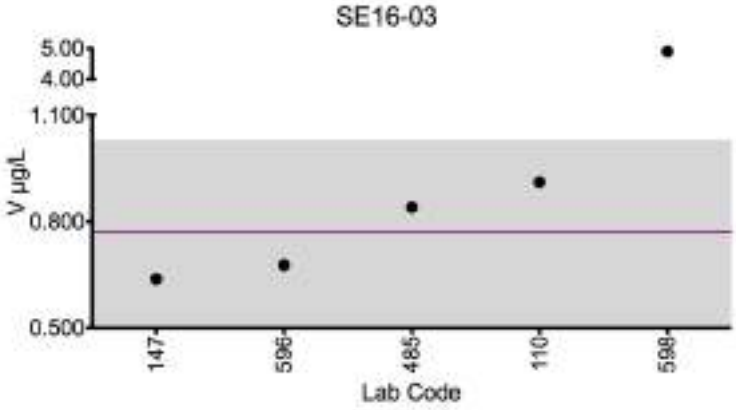
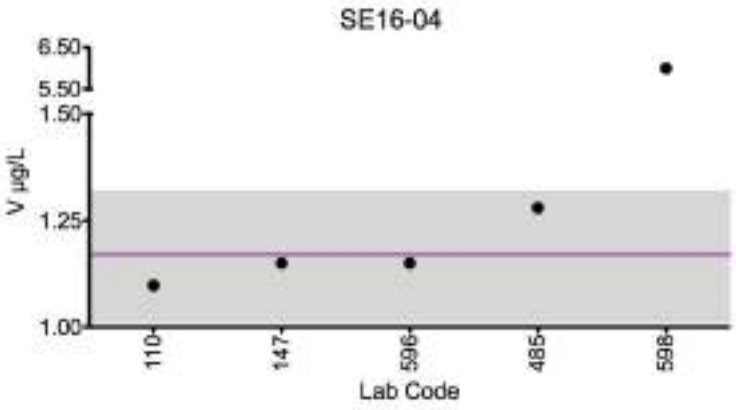
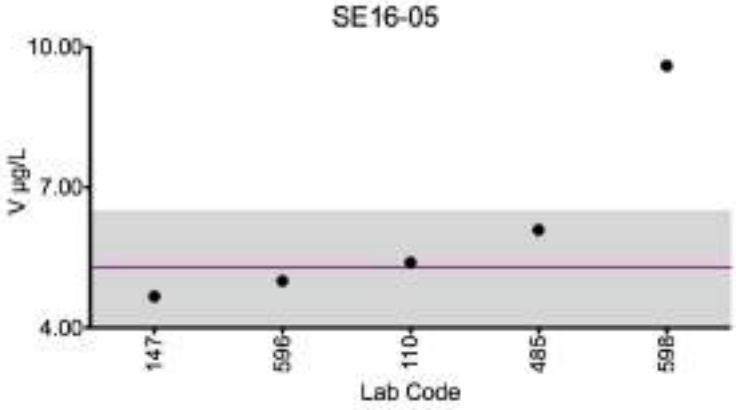
Results for Event #1, 2016: Serum V











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Results for Event #1, 2016
Additional Elements in Serum: Tungsten (W)

Serum W (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
110	ICP-MS	0.5	1.9	2.9	4.5	3.8
147	ICP-MS	0.555	1.95	2.94	4.87	3.75
200	ICP-MS	0.7	2.4	3.5	5.9	4.5
596	HR-ICP-MS	*2.25	*8.58	*15.1	*24.1	*18.3
598	ICP-MS	<2	2.1	3.2	4.5	3.8

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	0.597	2.08	3.12	4.94	3.95
Arithmetic SD (s)	0.089	0.22	0.28	0.66	0.36
Arithmetic RSD (%)	14	10	9.1	13	9.2
Number of Sample Measurements (N)	3	4	4	4	4

*Denotes a statistical Outlier.

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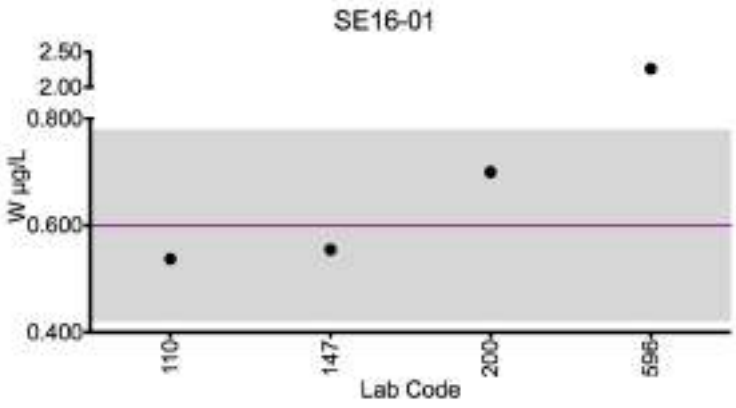
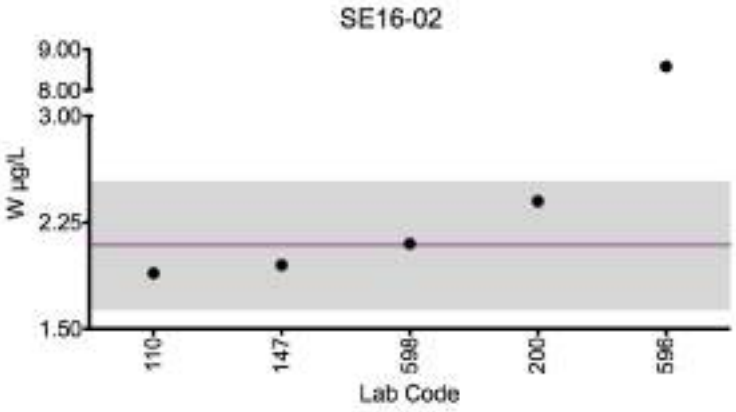
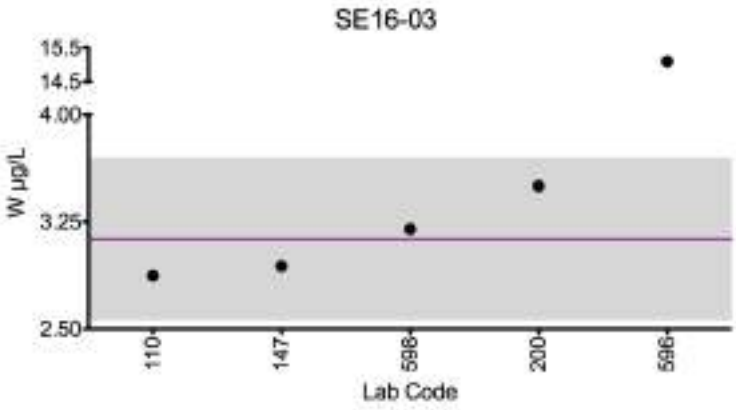
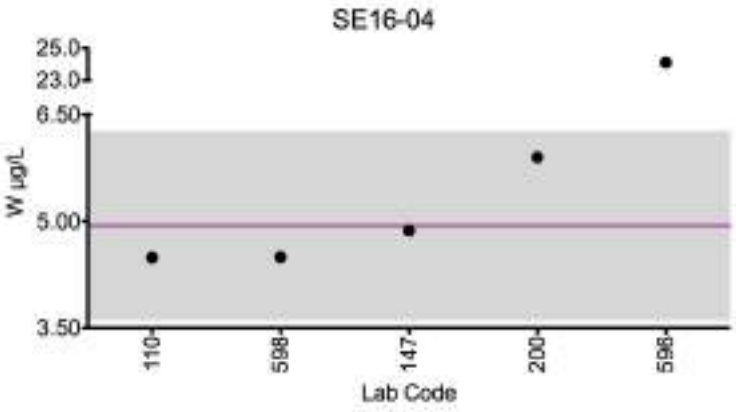
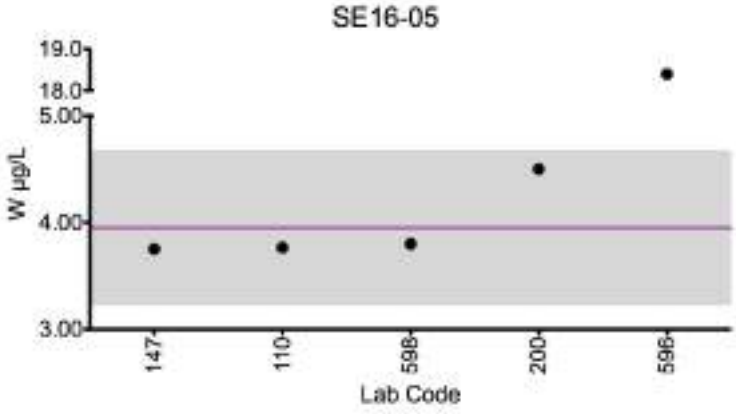
Results for Event #1, 2016: Serum W











Legend:
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

The mean and ±2SD of all laboratories are not not intended to be quality specifications and are included for informational purposes only.

Results for Event #1, 2016
Additional Elements in Serum: Beryllium (Be)

Serum Be (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
110	ICP-MS	2.8	1.6	5.3	3.4	8.1
147	ICP-MS	3.1	1.5	4.34	3.74	7.88
596	HR-ICP-MS	2.73	1.31	4.58	3.45	7.13
598	ICP-MS	2.5	1.2	3.9	2.9	6.2

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	2.79	1.39	4.53	3.36	7.33
Arithmetic SD (s)	0.24	0.16	0.58	0.34	0.86
Arithmetic RSD (%)	8.9	12	12	10	11
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Serum: Antimony (Sb)

Serum Sb (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	3.48	4.23	9.22	11.5	5.30
110	ICP-MS	3.1	3.6	7.9	8.9	4.5
147	ICP-MS	2.98	3.87	7.46	10.3	4.61

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	3.18	3.90	8.19	10.2	4.80
Arithmetic SD (s)	0.26	0.31	0.91	1.3	0.43
Arithmetic RSD (%)	8.1	8.1	11	12	9
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Serum: Tin (Sn)

Serum Sn (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
110	ICP-MS	0.6	2.0	1.1	2.29	4.5
147	ICP-MS	0.468	1.89	1.15	2.35	4.5
596	HR-ICP-MS	0.258	1.41	0.97	1.91	3.67
598	ICP-MS	*3.4	4.2	<2	*7.2	4.59

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	0.433	2.38	1.08	2.19	4.30
Arithmetic SD (s)	0.16	1.24	0.09	0.24	0.42
Arithmetic RSD (%)	37	52	9.1	11	9.9
Number of Sample Measurements (N)	3	4	3	3	4

*Denotes a statistical Outlier.

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Results for Event #1, 2016
Additional Elements in Serum: Strontium (Sr)

Serum Sr (µg/L)						
Lab Code	**Method**	**SE16-01**	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
103	DRC/CC-ICP-MS	28.2	33.2	27.5	30.8	41.6
200	ICP-MS	28.9	33.2	28.9	32.4	43.8

Summary Statistics					
	SE16-01	**SE16-02**	**SE16-03**	**SE16-04**	**SE16-05**
Arithmetic Mean ($\bar{x}$)	28.5	33.2	28.2	31.6	42.7
Arithmetic SD (s)	0.4	0	0.9	1.1	1.5
Arithmetic RSD (%)	1.7	0	3.5	3.5	3.6
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.

Results for Event #1, 2016
Additional Elements in Serum

Serum Ag (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
147	ICP-MS	1.82	0.519	2.61	0.806	2.92

Serum Bi (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
147	ICP-MS	<0.041	<0.041	<0.041	<0.041	<0.041

Serum Cs (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
110	ICP-MS	0.3	0.2	0.2	0.3	0.6

Serum Fe (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
457	ICP-AES/OES	1127	484	503	2888	650

Serum I (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
147	ICP-MS	51.6	46.5	52.2	50.5	75

Serum Li (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
147	ICP-MS	0.405	0.505	0.282	0.314	1.19

Serum Pt (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
110	ICP-MS	<0.05	<0.05	<0.21	<0.51	<1.35
596	HR-ICP-MS	<0.229	<0.229	<0.229	<0.439	<1.07
598	ICP-MS	<1	<1	<1	<1	<1

Serum Te (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
147	ICP-MS	0.078	<0.076	<0.076	<0.076	<0.076
596	HR-ICP-MS	<0.021	0.033	0.112	-.0047999	0.034
598	ICP-MS	<2	<2	<2	<2	<2

Results for Event #1, 2016
Additional Elements in Serum

Serum Th (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
147	ICP-MS	<0.007	<0.007	<0.007	<0.007	<0.007

Serum Ti (µg/L)

Lab Code	Method	SE16-01	SE16-02	SE16-03	SE16-04	SE16-05
485	HR-ICP-MS	6.2	0.75	2.97	1.9	5.05
596	ICP-AES/OES	<2.51	<2.51	<2.51	<2.51	<2.51
598	ICP-MS	70.5	62.7	65.9	77	74

References:

1. ISO/FDIS-13528 (2005) Statistical methods for use in proficiency testing by interlaboratory comparisons. International Organization for Standardization, Geneva.

2. Taylor A, Angerer J, Arnaud J, Claeys F, Jones RL, Mazarrasa O, Mairiaux E, Menditto A, Parsons PJ, Patriarca M, Pineau A, Valkonen S, Weber J-P, Weykamp C. Occupational and environmental laboratory medicine: A network of EQAS organisers. Accreditation and Quality Assurance. 2006;11(8-9):435-9. PubMed PMID: 086NJ-0011.