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New York State Biomonitoring Program for Trace Elements

Event #1, 2018

Trace Elements in Whole Blood, Urine, and Serum

June, 2018

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

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Event #1, 2018:
Trace Elements in Whole Blood, Urine, and Serum

6/6/2018

Dear Laboratory Director,

This report summarizes performance for the first biomonitoring proficiency test (PT) event of 2018 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.

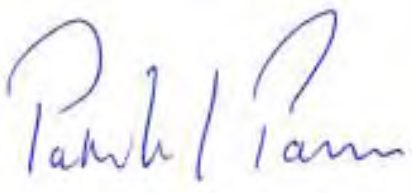
Target Value Assignment and Performance Evaluation
For these PT materials, target values have been assigned for a limited number of trace elements that are gradable under criteria set by the NYS DOH Biomonitoring PT program. See assay-specific narratives for details. Data for additional trace elements 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, 2018) will be shipped July 11, 2018. Comments about this report may be directed to trel@health.ny.gov.

Sincerely,



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Event #1, 2018

Trace Elements in Whole Blood

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

Event #1, 2018:
Trace Elements in Whole Blood

PT Materials

Human whole blood was purchased from Zen-Bio, Inc. and preserved with K_2EDTA. The company certifies that this material was "non-reactive" for HBsAg, HBV DNA, HIV-1,2 Ab, HIV-1 RNA, HCV Ab, HCV RNA, and STS. Units of whole blood were filtered into polypropylene containers through cheesecloth to remove particulates and supplemented with arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), mercury (Hg), manganese (Mn), lead (Pb), barium (Ba), beryllium (Be), copper (Cu), molybdenum (Mo), nickel (Ni), platinum (Pt), antimony (Sb), selenium (Se), tin (Sn), titanium (Ti), thallium (Tl), uranium (U), vanadium (V), tungsten (W), and zinc (Zn). Whole blood samples were placed on a rocker 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) if a robust mean is not possible, the arithmetic mean after outlier deletion.

Additional Elements

An additional 25 elements were reported by at least one participant: Ag, Al, Ba, Be, Bi, Cs, Cu, I, Li, Mg, Mo, Ni, Pt, Sb, Se, Sn, Sr, Te, Th, 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, 2018: Summary Statistics

Whole Blood As (µg/L)					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Target (Arithmetic Mean ($\bar{x}$))	43.5	11.3	27.8	40.3	3.9
Upper Limit	52.2	17.3	33.8	48.4	9.9
Lower Limit	34.8	5.3	21.8	32.2	0.0
Arithmetic SD (s)	3.4	0.9	2.3	6.6	0.5
Arithmetic RSD (%)	7.8	8.0	8.3	16.4	12.8
Number of Sample Measurements (N)	8	8	9	9	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, 2018:
Performance of Participating Laboratories

Whole Blood As (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
	Target	**43.5**	**11.3**	**27.8**	**40.3**	**3.9**
103	DRC/CC-ICP-MS	42.7	10.9	26.9	37.8	3.83
110	DRC/CC-ICP-MS	41.4	11.1	25.4	35.4	3.4
147	ICP-MS	40.4	10.5	25.2	36.0	3.32
200	ICP-MS	42.8	12.1	27.9	39.2	4.8
293	DRC/CC-ICP-MS	42.6	10.5	26.26	36.34	3.45
391	DRC/CC-ICP-MS	40.9	10.8	27.451	34.915	4.161
597	DRC/CC-ICP-MS	47.0	11.0	29.6	40.5	4.16
598	DRC/CC-ICP-MS	50.4	13.2	32.3	48.2	4.13
599	DRC/CC-ICP-MS	*61.55 ↑	*27.25 ↑	28.90	54.27 ↑	*16.44 ↑

Based on the grading criteria for As in Whole Blood, 91% of results were satisfactory, with 1 of the 9 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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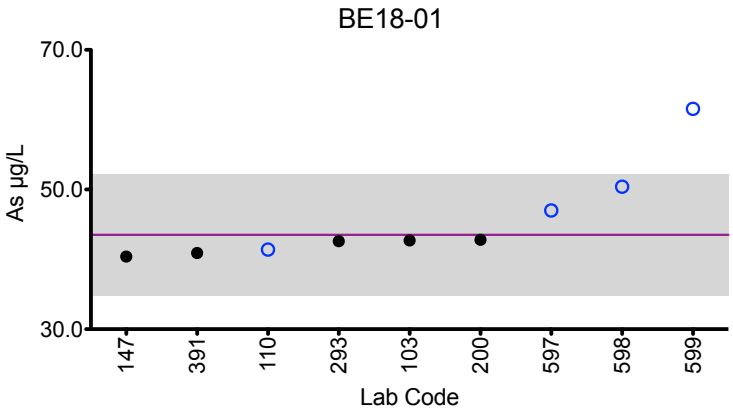
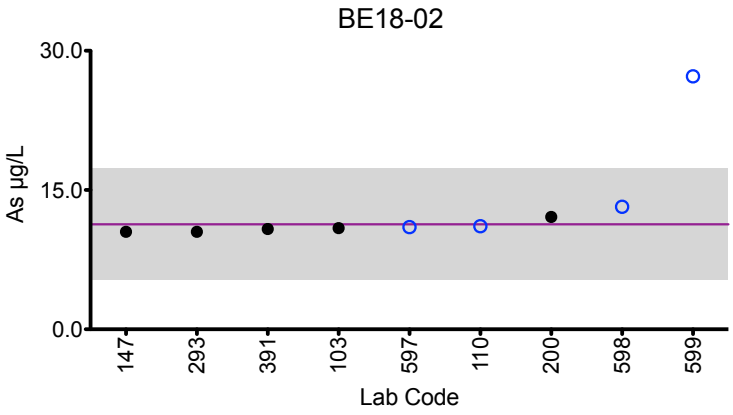
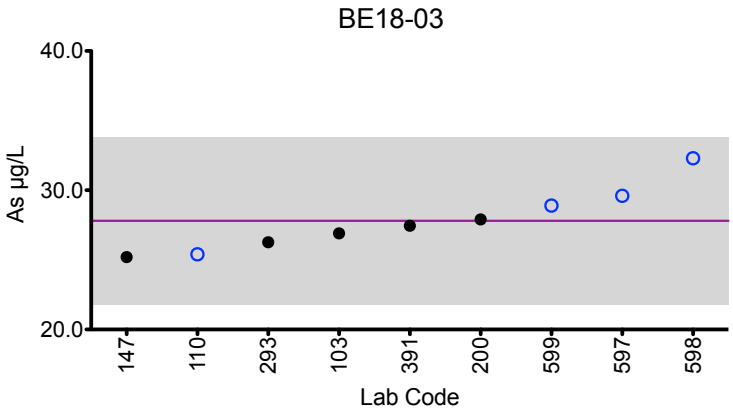
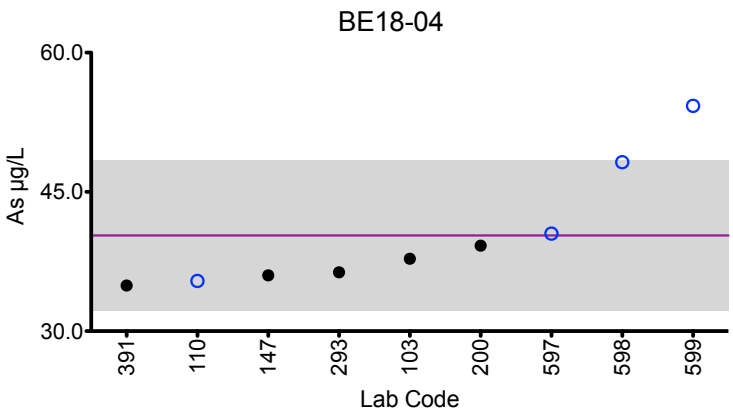
Results for Event #1, 2018: Summary Figures

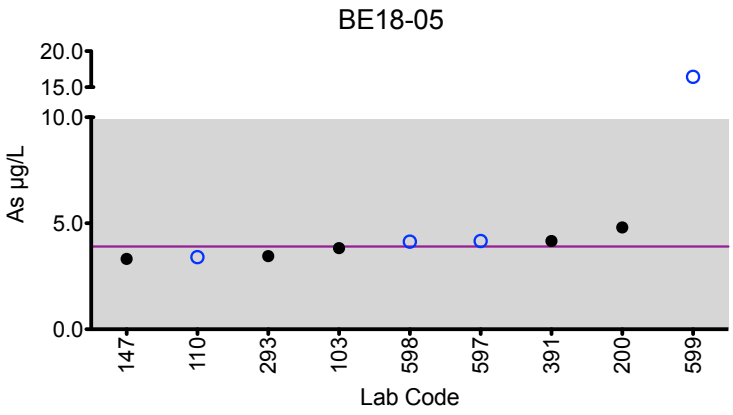
Whole Blood As











Legend:

o CHEAR Labs ● Other Labs

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, 2018: Summary Statistics

Whole Blood Cd (µg/L)					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Target (Robust Mean (x*))	2.1	6.8	12.6	3.4	9.2
Upper Limit	3.1	7.8	14.5	4.4	10.6
Lower Limit	1.1	5.8	10.7	2.4	7.8
Robust SD (s*)	0.1	0.3	0.5	0.1	0.4
Robust RSD (%)	4.8	4.4	4.0	2.9	4.3
Number of Sample Measurements (N)	14	14	14	14	14
Standard Uncertainty (*u*)	0.036	0.107	0.158	0.039	0.135

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, 2018:
Performance of Participating Laboratories

Whole Blood Cd (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
	Target	**2.1**	**6.8**	**12.6**	**3.4**	**9.2**
103	DRC/CC-ICP-MS	2.39	7.57	13.1	3.29	9.44
107	ICP-MS	2.2	6.7	13	3.4	9
110	ICP-MS	2.14	6.74	12.4	3.38	9.03
147	ICP-MS	2.07	6.95	12.7	3.43	9.49
200	ICP-MS	2.2	6.4	12.6	3.7	9.2
293	DRC/CC-ICP-MS	1.92	6.37	11.59	3.17	8.44
391	DRC/CC-ICP-MS	2.007	7.14	12.864	3.293	9.604
399	DRC/CC-ICP-MS	2.10	6.76	12.3	3.41	9.02
401	DRC/CC-ICP-MS	2.0	6.4	12.1	3.3	8.8
597	DRC/CC-ICP-MS	2.30	6.99	14.2	3.90	10.2
598	DRC/CC-ICP-MS	2.12	6.8	12.4	3.36	8.76
605	ICP-MS	2.19	6.71	12.1	3.28	9.00
606	DRC/CC-ICP-MS	2.18	7.16	12.9	3.73	10.1
686	ICP-MS	2.10	6.73	12.5	3.34	9.08

Based on the grading criteria for Cd in Whole Blood, 100% of results were satisfactory, with 0 of the 14 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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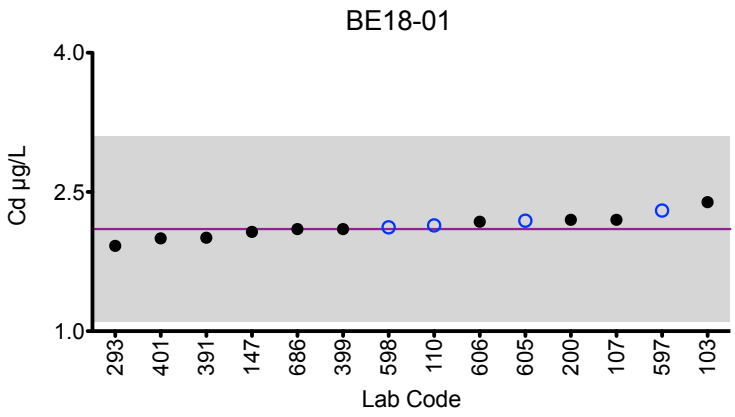
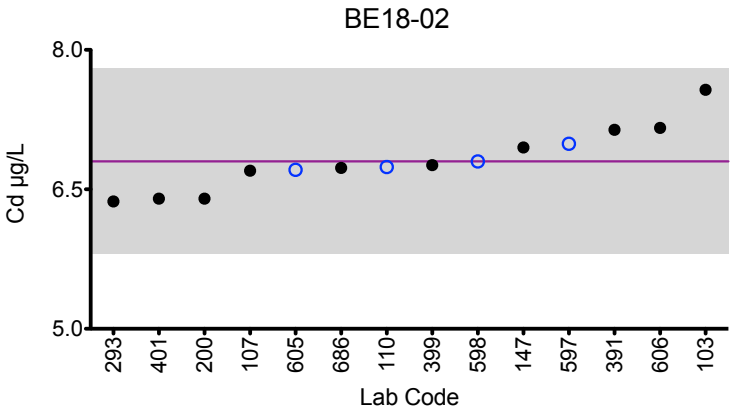
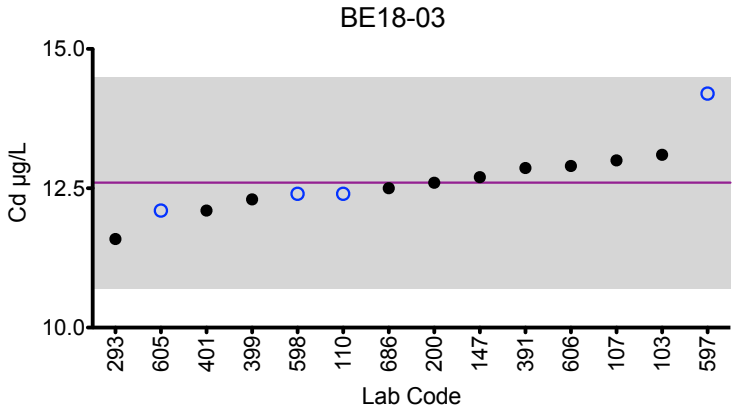
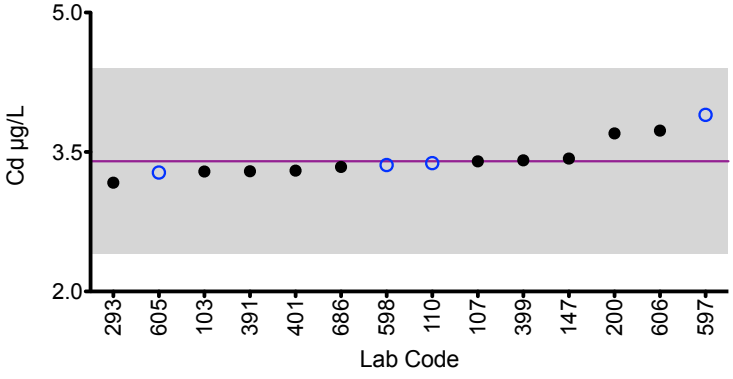
Results for Event #1, 2018: Summary Figures

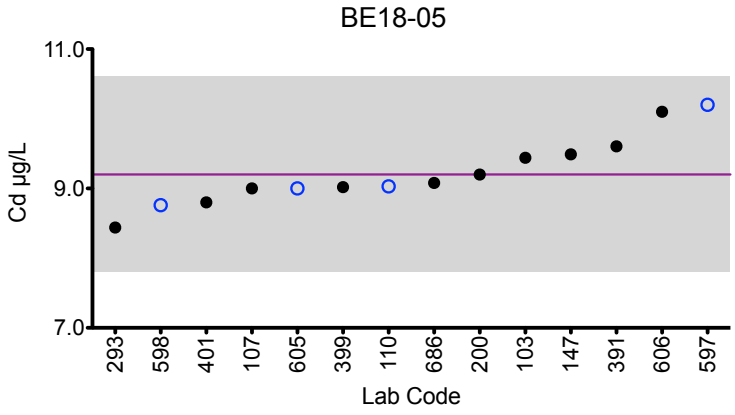
Whole Blood Cd











Legend:

o CHEAR Labs ● Other Labs

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, 2018: Summary Statistics

Whole Blood Co (µg/L)					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Target (Arithmetic Mean ($\bar{x}$))	3.7	6.0	7.9	13.6	0.7
Upper Limit	5.2	7.5	9.5	16.3	2.2
Lower Limit	2.2	4.5	6.3	10.9	0.0
Arithmetic SD (s)	0.6	0.3	0.7	1.2	0.1
Arithmetic RSD (%)	16.2	5.0	8.9	8.8	14.3
Number of Sample Measurements (N)	9	9	9	9	8

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, 2018:
Performance of Participating Laboratories

Whole Blood Co (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
	Target	**3.7**	**6.0**	**7.9**	**13.6**	**0.7**
103	DRC/CC-ICP-MS	3.40	5.93	7.66	13.4	0.649
110	ICP-MS	3.46	5.93	7.74	13.5	0.69
147	ICP-MS	4.73	5.38	6.92	12.0	0.631
293	DRC/CC-ICP-MS	3.71	5.89	7.7	13.21	0.61
391	DRC/CC-ICP-MS	3.286	5.902	7.639	13.047	0.608
401	DRC/CC-ICP-MS	3.7	6.0	7.8	14.0	0.6
597	DRC/CC-ICP-MS	4.01	6.27	8.90	15.4	0.71
598	ICP-MS	4.14	6.48	9.07	15.5	0.77
599	DRC/CC-ICP-MS	2.569	5.781	7.515	12.452	<1

Based on the grading criteria for Co in Whole Blood, 100% of results were satisfactory, with 0 of the 9 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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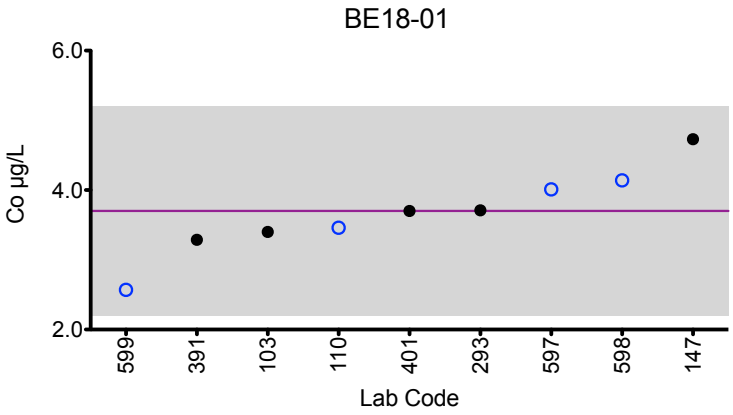
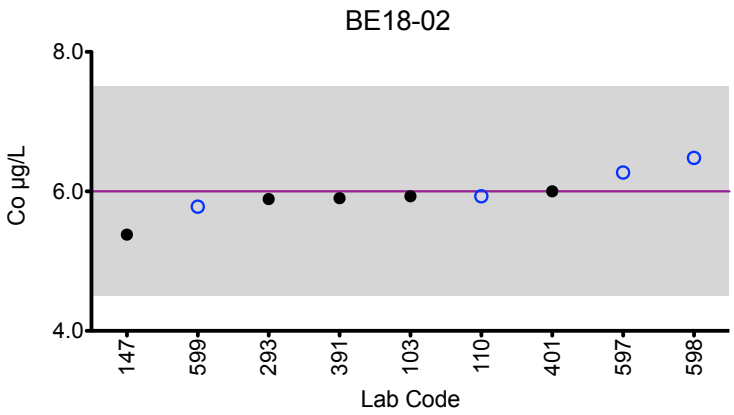
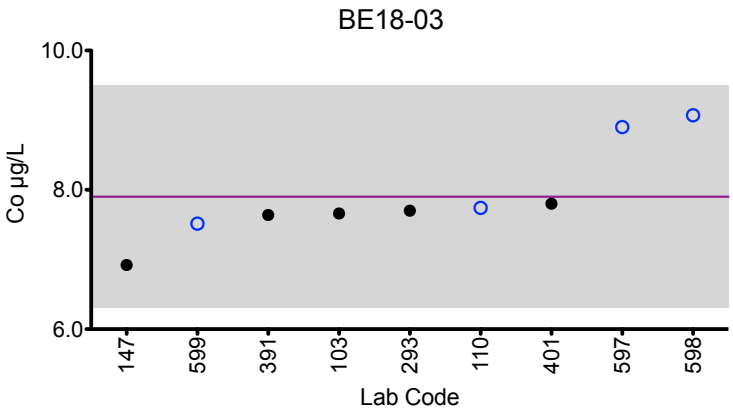
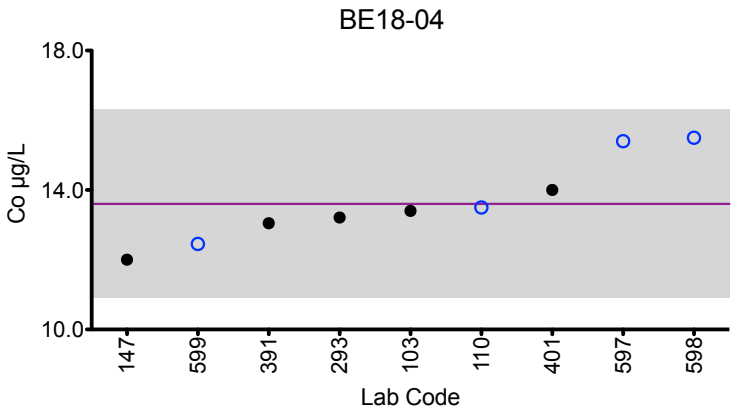
Results for Event #1, 2018: Summary Figures

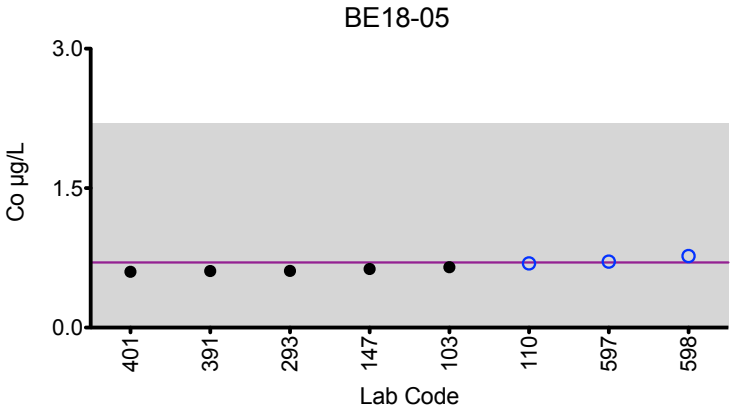
Whole Blood Co











Legend:

o CHEAR Labs ● Other Labs

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, 2018: Summary Statistics

Whole Blood Cr (µg/L)					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Target (Arithmetic Mean ($\bar{x}$))	2.3	12.3	4.6	10.1	6.7
Upper Limit	4.3	14.8	6.6	12.1	8.7
Lower Limit	0.3	9.8	2.6	8.1	4.7
Arithmetic SD (s)	1.0	0.5	0.7	1.2	0.7
Arithmetic RSD (%)	44	4.1	15.2	11.9	10.4
Number of Sample Measurements (N)	9	8	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 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, 2018:
Performance of Participating Laboratories

Whole Blood Cr (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
	Target	**2.3**	**12.3**	**4.6**	**10.1**	**6.7**
103	DRC/CC-ICP-MS	1.58	11.9	4.09	9.70	6.02
110	DRC/CC-ICP-MS	1.5	12.3	4.1	9.6	5.8
147	DRC/CC-ICP-MS	2.05	12.6	4.62	10.4	6.62
293	DRC/CC-ICP-MS	3.56	11.85	4.7	9.86	6.4
391	DRC/CC-ICP-MS	1.589	11.333	4.3	8.267	6.0
401	DRC/CC-ICP-MS	2.4	12.6	5.8	10.3	7.5
597	DRC/CC-ICP-MS	2.26	12.9	5.32	11.4	7.33
598	DRC/CC-ICP-MS	1.19	*14.5	4.6	12.3 ↑	7.6
599	DRC/CC-ICP-MS	4.330 ↑	12.67	3.588	9.028	6.622

Based on the grading criteria for Cr in Whole Blood, 96% of results were satisfactory, with 0 of the 9 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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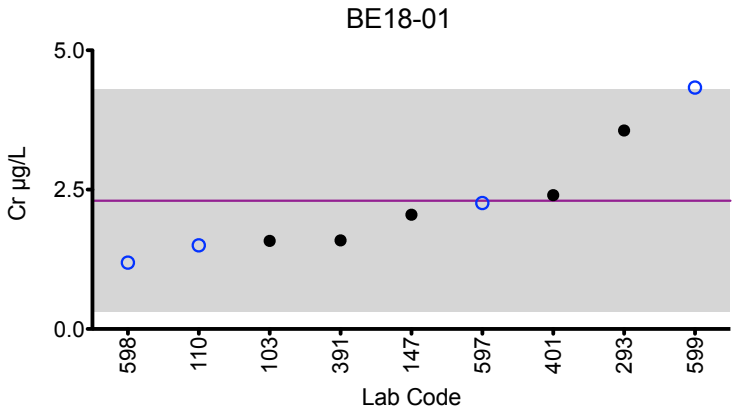
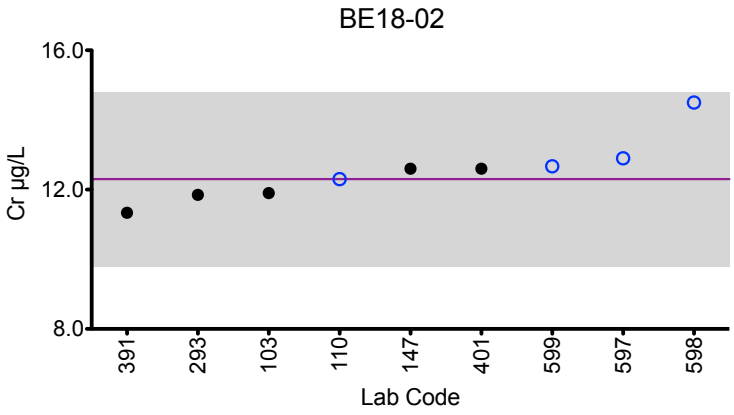
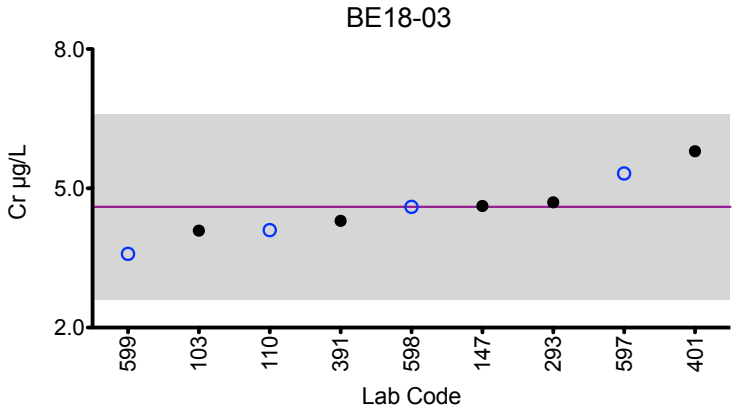
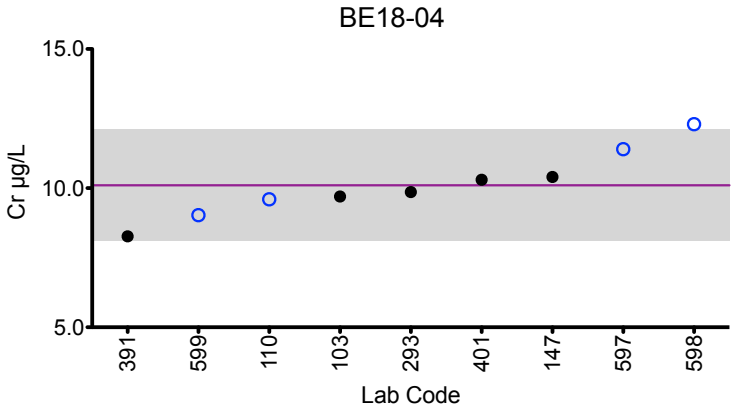
Results for Event #1, 2018: Summary Figures

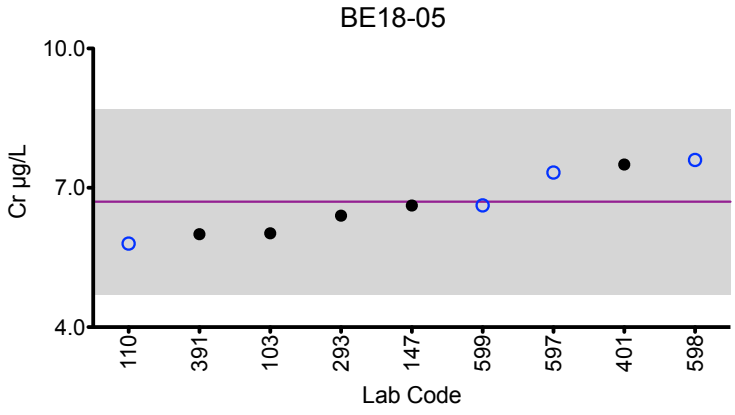
Whole Blood Cr











Legend:

o CHEAR Labs ● Other Labs

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, 2018: Summary Statistics

Whole Blood Hg (µg/L)					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Target (Robust Mean (x*))	0.98	29.7	6.5	18.5	13.2
Upper Limit	3.98	38.6	9.5	24.1	17.2
Lower Limit	0.00	20.8	3.5	13.0	9.2
Robust SD (s*)	0.06	1.0	0.3	1.3	1.0
Robust RSD (%)	6.1	3.4	4.6	7.0	7.6
Number of Sample Measurements (N)	14	14	14	13	14
Standard Uncertainty (*u*)	0.020	0.326	0.099	0.458	0.334

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, 2018:
Performance of Participating Laboratories

Whole Blood Hg (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
	Target	**0.98**	**29.7**	**6.5**	**18.5**	**13.2**
103	DRC/CC-ICP-MS	0.992	31.7	7.11	19.4	13.7
107	DRC/CC-ICP-MS	1.1	30	6.6	19	14
110	ICP-MS	0.95	27.9	6.29	17.1	12.2
147	ICP-MS	0.961	29.5	6.68	18.1	13.1
200	ICP-MS	0.9	28.5	5.8	16.6	11.4
293	DRC/CC-ICP-MS	1	29.86	6.7	19.02	13.15
391	CV-AAS	1.24	33.57	6.4	*108.1 ↑	16.11
399	DRC/CC-ICP-MS	0.958	29.9	6.48	19.4	13.3
401	DRC/CC-ICP-MS	1.0	27.3	6	16.2	11.8
597	DMA	0.75	29.3	6.6	19.1	13.4
598	ICP-MS	1.51	26.6	5.7	15.1	10.4
605	ICP-MS	0.939	30.2	6.46	18.7	13.2
606	DRC/CC-ICP-MS	0.876	30.4	6.75	20.2	14.3
686	ICP-MS	1.00	30.2	6.75	19.9	13.5

Based on the grading criteria for Hg in Whole Blood, 99% of results were satisfactory, with 0 of the 14 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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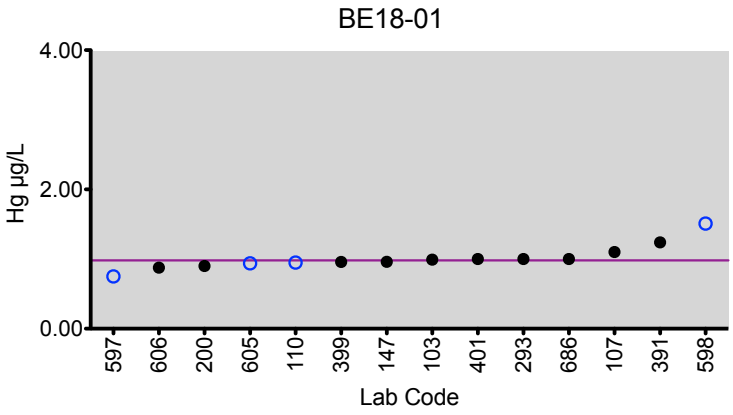
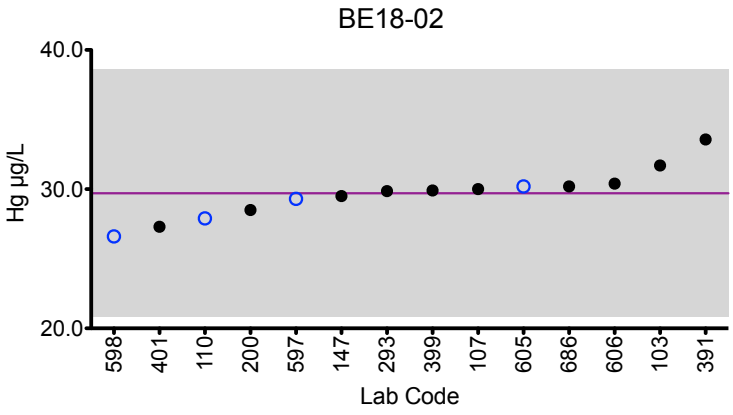
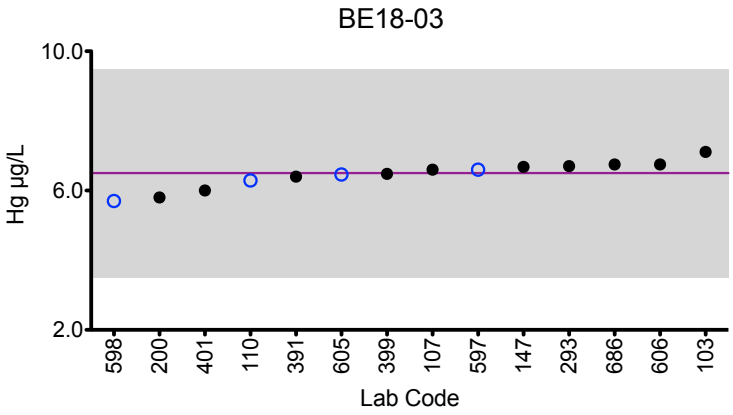
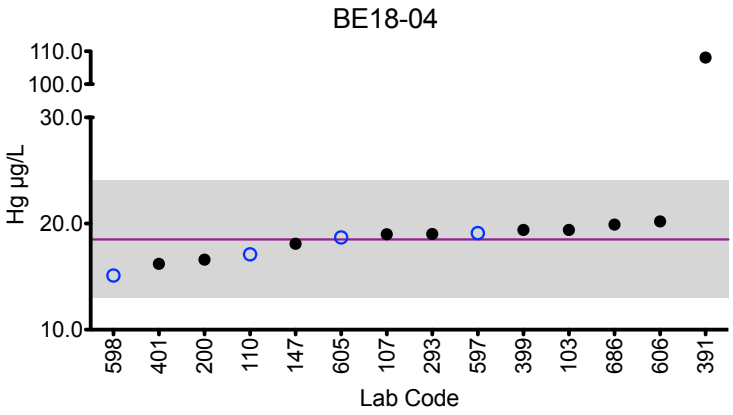
Results for Event #1, 2018: Summary Figures

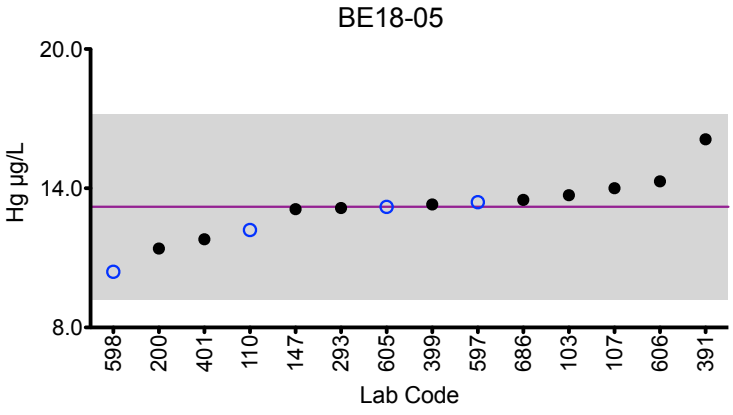
Whole Blood Hg











Legend:

o CHEAR Labs ● Other Labs

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, 2018: Summary Statistics

Whole Blood Mn (µg/L)					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Target (Robust Mean (x*))	4.6	20.9	39.1	12.4	18.4
Upper Limit	7.6	24.5	45.7	15.4	21.5
Lower Limit	1.6	17.3	32.5	9.4	15.3
Robust SD (s*)	0.7	0.6	1.9	0.6	1.2
Robust RSD (%)	15.2	2.9	4.9	4.8	6.5
Number of Sample Measurements (N)	12	12	12	11	12
Standard Uncertainty (*u*)	0.238	0.220	0.691	0.243	0.444

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 17.7 µg/L. These quality specifications were recently proposed by a network of Trace Element PT program organizers (Praamsma M, et al. An assessment of clinical laboratory 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, 2018:
Performance of Participating Laboratories

Whole Blood Mn (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
	Target	**4.6**	**20.9**	**39.1**	**12.4**	**18.4**
103	DRC/CC-ICP-MS	4.40	21.1	38.8	12.1	18.8
107	DRC/CC-ICP-MS	4.1	20	39	12	18
110	ICP-MS	4.5	20.7	37.9	11.6	17.7
147	ICP-MS	4.79	21.6	38.5	12.4	12.4 ↓
293	DRC/CC-ICP-MS	3.69	20.37	36.8	*35.83 ↑	17.81
391	DRC/CC-ICP-MS	5.868	20.481	37.7	12.744	18.438
399	DRC/CC-ICP-MS	4.07	20.4	37.4	11.6	18.0
401	DRC/CC-ICP-MS	5.1	20.5	38.8	13.1	16.9
597	DRC/CC-ICP-MS	4.95	21.4	43.6	12.8	20.1
598	ICP-MS	4.29	22.6	43.6	12.3	19.1
599	DRC/CC-ICP-MS	7.877 ↑	21.46	40.18	14.94	20.13
606	DRC/CC-ICP-MS	3.93	20.8	42.4	12.0	19.6

Based on the grading criteria for Mn in Whole Blood, 95% of results were satisfactory, with 0 of the 12 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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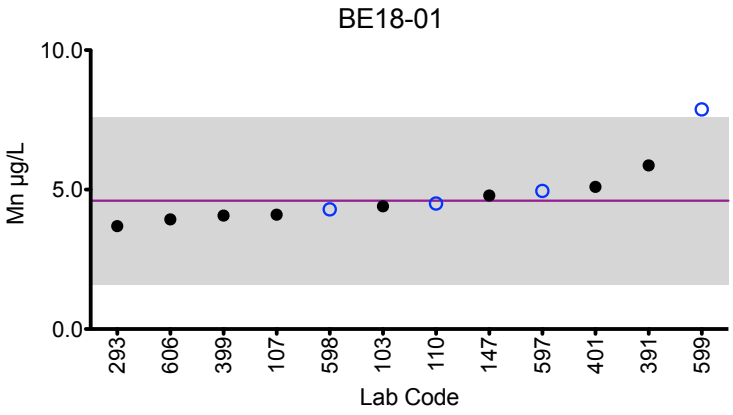
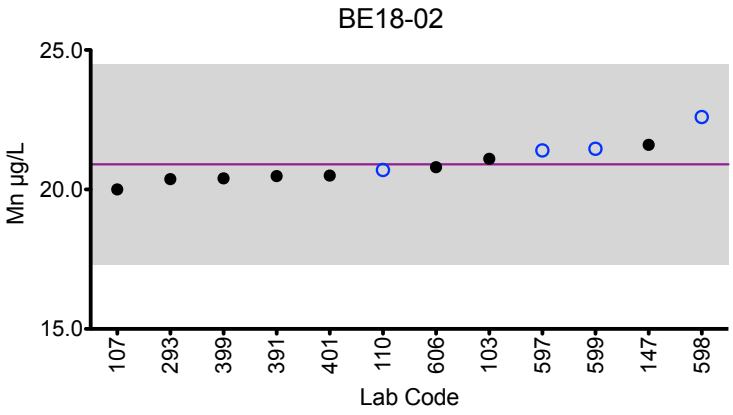
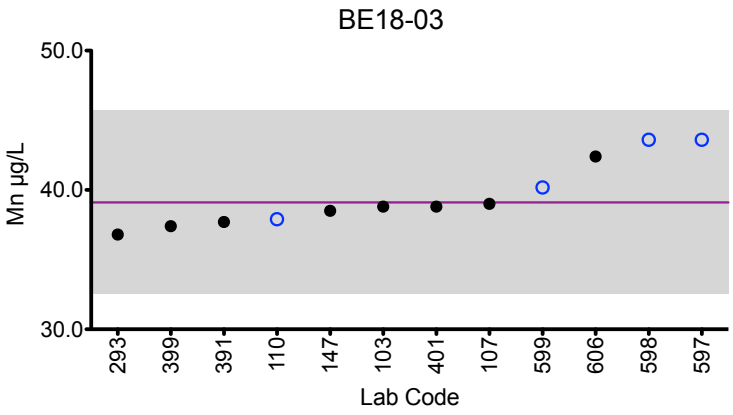
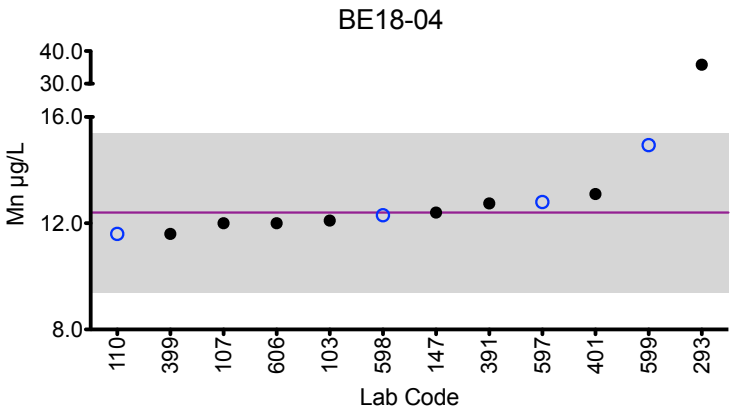
Results for Event #1, 2018: Summary Figures

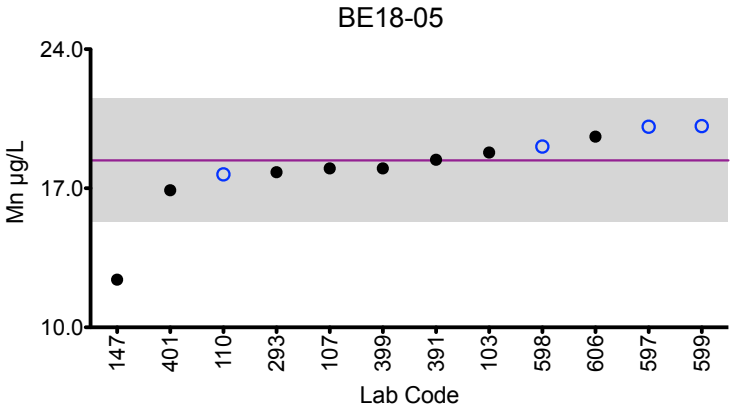
Whole Blood Mn











Legend:

o CHEAR Labs ● Other Labs

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 17.7 µg/L.

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Results for Event #1, 2018: Summary Statistics

Whole Blood Pb (µg/dL)					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Target (Robust Mean (x*))	4.24	8.32	18.0	42.7	27.7
Upper Limit	6.24	10.32	20.0	47.0	30.5
Lower Limit	2.24	6.32	16.0	38.4	24.9
Robust SD (s*)	0.21	0.25	0.9	2.1	1.4
Robust RSD (%)	5.0	3.0	5.0	4.9	5.1
Number of Sample Measurements (N)	16	16	16	16	16
Standard Uncertainty (*u*)	0.065	0.078	0.283	0.657	0.433

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/L 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 Medicare and Medicaid Services (CMS) in the USA. (http://shop.clsi.org/C40.html)

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Results for Event #1, 2018:
Performance of Participating Laboratories

Whole Blood Pb (µg/dL)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
	Target	**4.24**	**8.32**	**18.0**	**42.7**	**27.7**
103	DRC/CC-ICP-MS	4.52	8.77	19.1	44.9	28.8
107	ICP-MS	4.4	8.4	18	42	28
110	ICP-MS	4.28	8.21	17.8	42.0	26.9
147	ICP-MS	4.16	8.33	18.0	42.5	27.8
200	ICP-MS	4.3	8.3	18.4	42.6	27.3
293	DRC/CC-ICP-MS	4.14	8.06	17.16	43.63	27.09
343	ASV-LeadCare	3.5	8.6	19.3	47.4 ↑	30.6 ↑
391	ETAAS-Z	3.95	7.26	15.6 ↓	36.9 ↓	23.6 ↓
399	DRC/CC-ICP-MS	4.36	8.54	18.5	44.3	28.7
401	DRC/CC-ICP-MS	4.1	8.1	17.4	40.6	26.5
597	DRC/CC-ICP-MS	4.76	8.44	20.6 ↑	47.3 ↑	30.7 ↑
598	ICP-MS	4.09	8.07	16.4	38.1 ↓	23.7 ↓
599	DRC/CC-ICP-MS	4.402	9.510	17.17	44.10	27.73
605	ICP-MS	4.32	8.25	18.1	41.5	27.6
606	DRC/CC-ICP-MS	4.12	8.26	18.4	42.9	28.9
686	ICP-MS	4.22	8.26	18.1	42.4	27.6

Based on the grading criteria for Pb in Whole Blood, 88% of results were satisfactory, with 4 of the 16 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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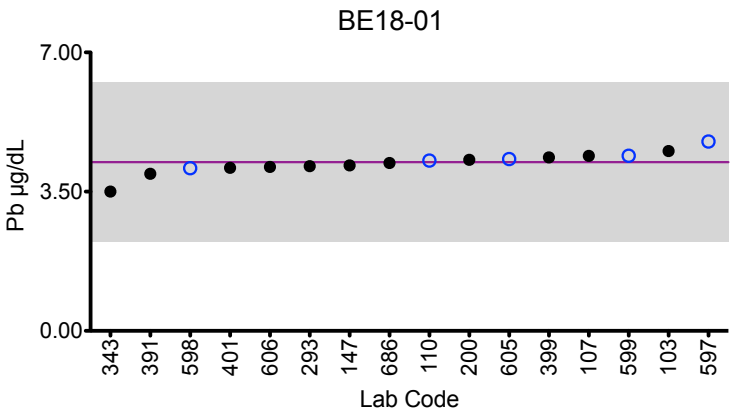
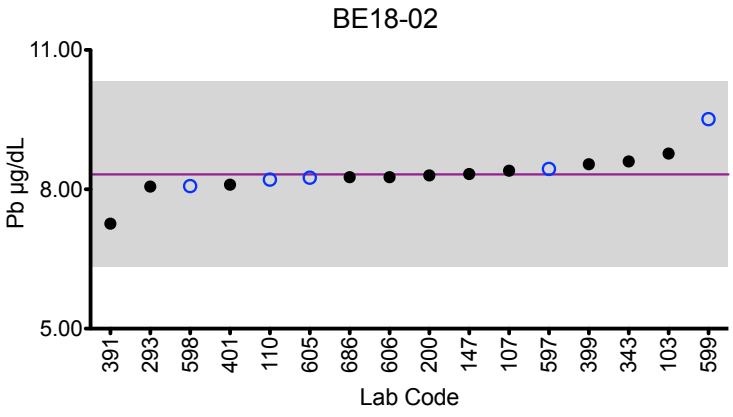
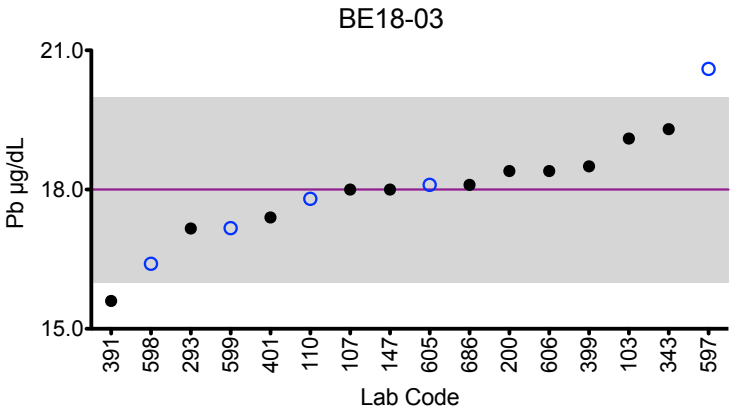
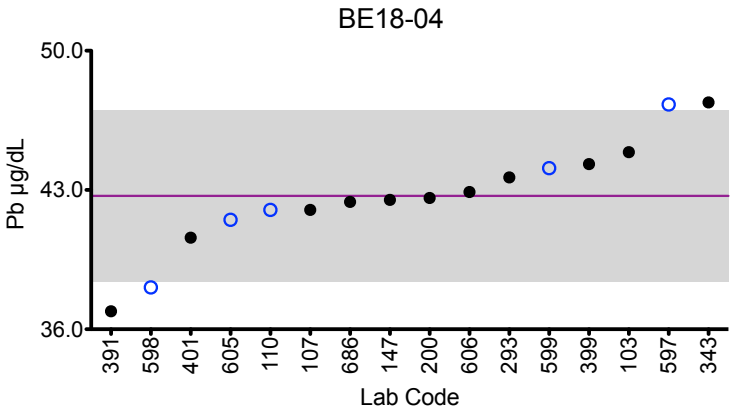
Results for Event #1, 2018: Summary Figures

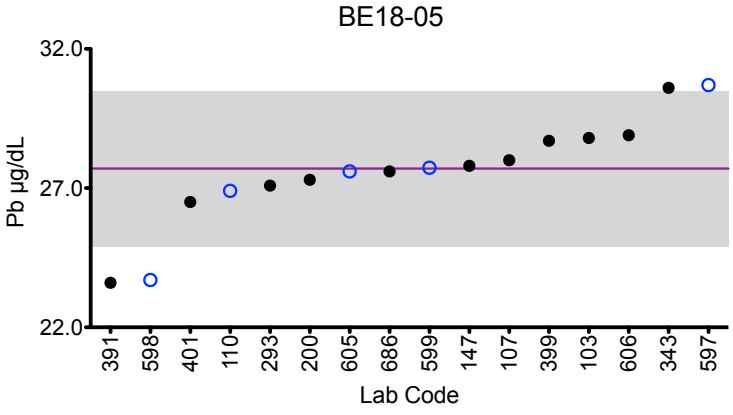
Whole Blood Pb











Legend:

o CHEAR Labs ● Other Labs

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, 2018:
Laboratory Data and Summary Statistics

Whole Blood Cu (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	ICP-MS	681	1930	1400	2900	764
147	ICP-MS	699	1963	1449	2980	820
597	DRC/CC-ICP-MS	776	1970	1620	3300	878
598	ICP-MS	645	1978	1499	3306	792
599	DRC/CC-ICP-MS	683.1	1727	1328	2860	768.3

Summary Statistics					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)	697	1914	1459	3069	804
Arithmetic SD (s)	48	106	110	218	47
Arithmetic RSD (%)	6.9	5.5	7.5	7.1	5.8
Number of Sample Measurements (N)	5	5	5	5	5

*Denotes a statistical Outlier.

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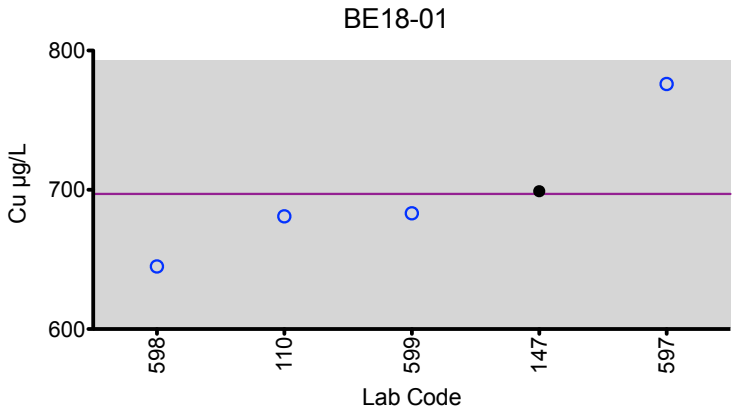
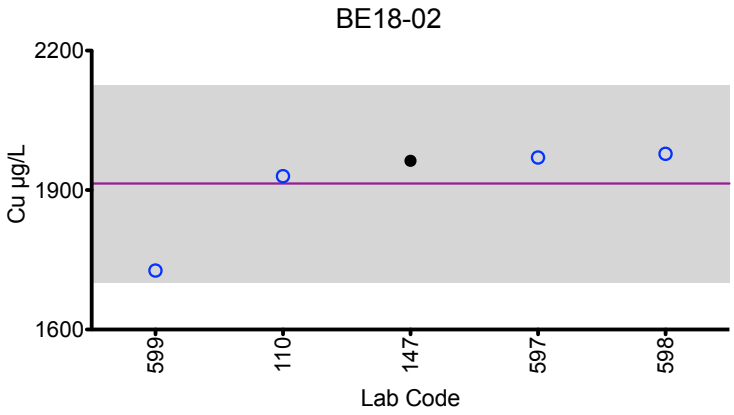
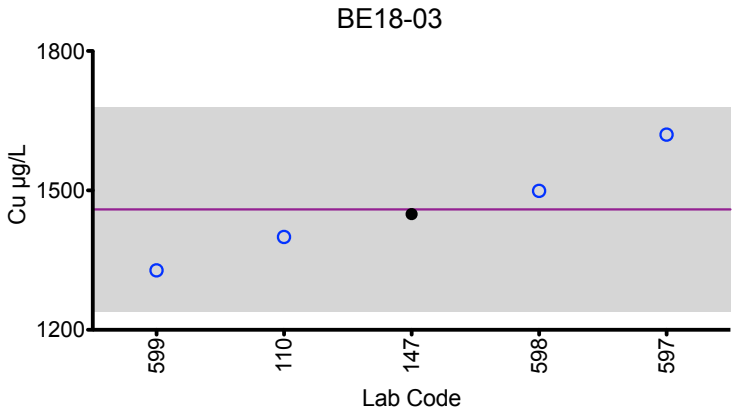
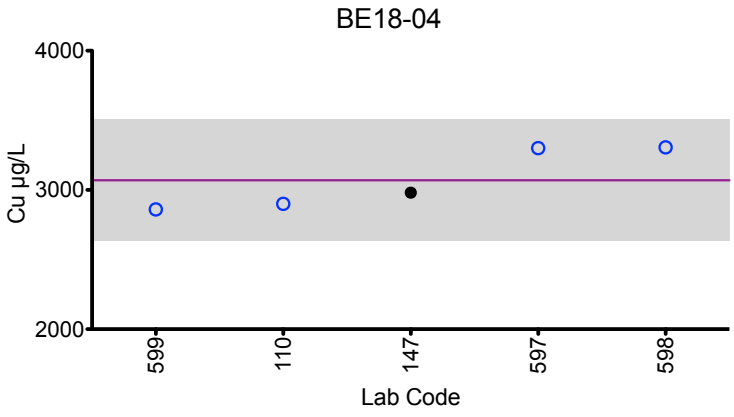
Results for Event #1, 2018: Summary Figures

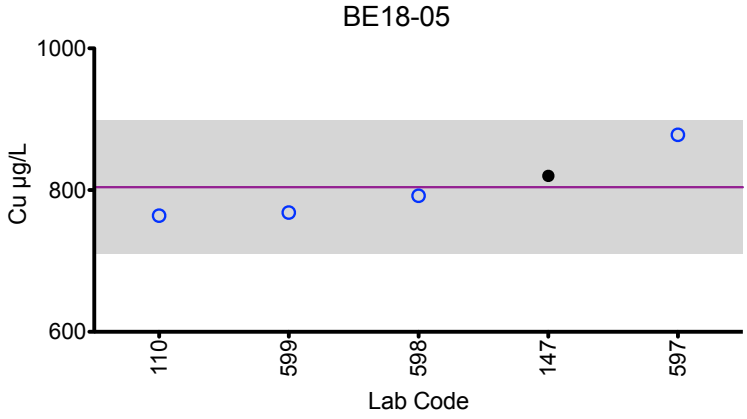
Whole Blood Cu











Legend:
o CHEAR Labs ● Other Labs
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, 2018:
Laboratory Data and Summary Statistics

Whole Blood Mo (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
103	DRC/CC-ICP-MS	5.16	6.31	11.6	8.43	<0.750
147	ICP-MS	4.74	5.95	10.9	7.74	0.744
597	DRC/CC-ICP-MS	5.69	8.00	12.83	9.20	1.20
598	DRC/CC-ICP-MS	5.33	6.73	12.78	8.89	0.75
599	DRC/CC-ICP-MS	4.335	7.752	9.788	7.626	<1
Summary Statistics						
		BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)		5.05	6.95	11.6	8.38	0.898
Arithmetic SD (s)		0.53	0.89	1.3	0.69	0.262
Arithmetic RSD (%)		10.5	12.8	11.2	8.2	29
Number of Sample Measurements (N)		5	5	5	5	3

*Denotes a statistical Outlier.

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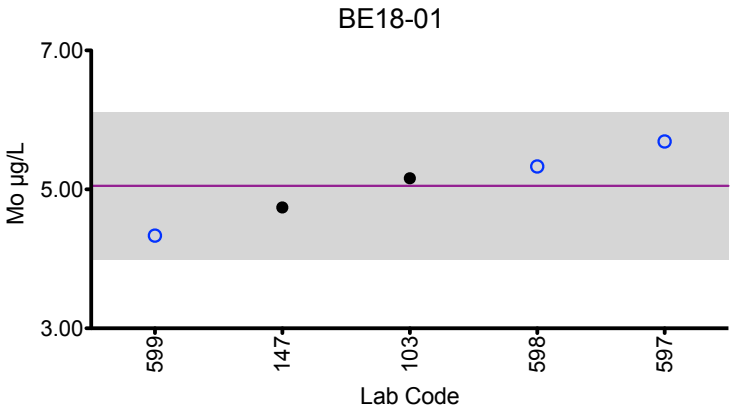
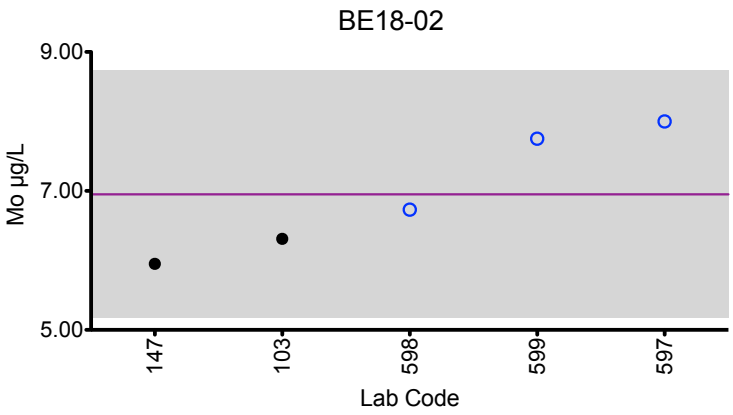
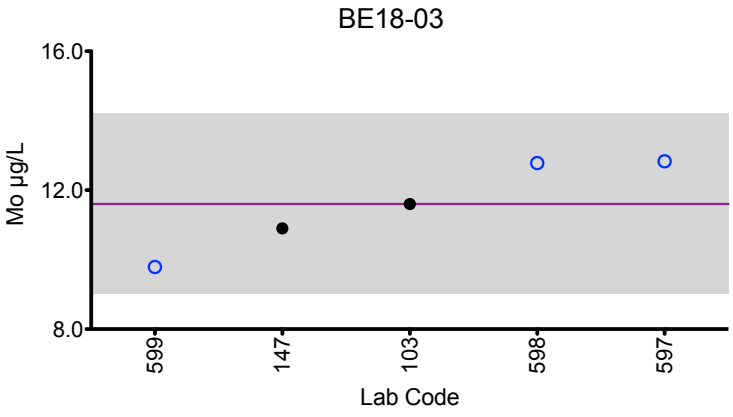
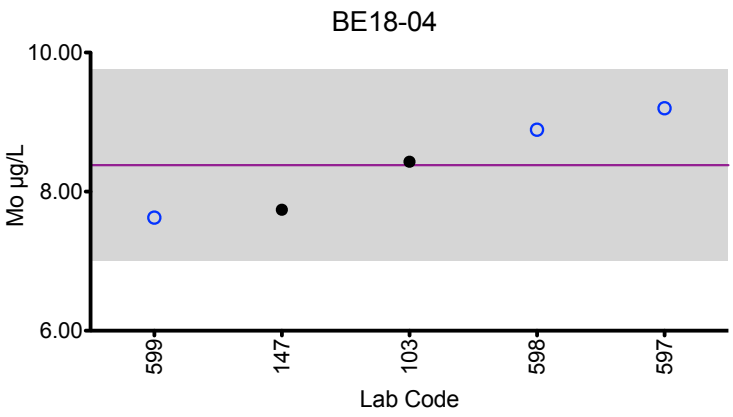
Results for Event #1, 2018: Summary Figures

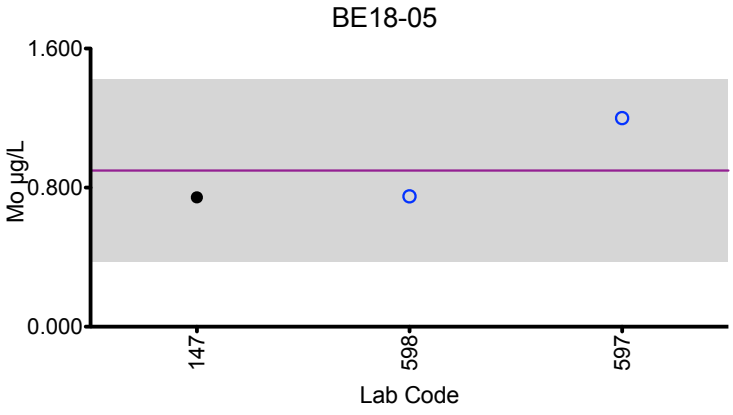
Whole Blood Mo











Legend:
o CHEAR Labs ● Other Labs
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, 2018:
Laboratory Data and Summary Statistics

Whole Blood Sb (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
103	DRC/CC-ICP-MS	8.27	2.73	0.772	1.12	0.919
110	ICP-MS	7.50	2.49	0.73	1.06	0.93
147	ICP-MS	7.49	2.42	0.678	1.14	0.789
293	DRC/CC-ICP-MS	7.26	2.23	0.69	1.14	0.78
597	DRC/CC-ICP-MS	9.11	2.71	0.931	1.33	0.958
598	ICP-MS	8.66	2.58	0.77	1.18	0.81

Summary Statistics					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)	8.05	2.53	0.76	1.16	0.86
Arithmetic SD (s)	0.75	0.19	0.09	0.09	0.08
Arithmetic RSD (%)	9.3	7.5	11.8	7.8	9.3
Number of Sample Measurements (N)	6	6	6	6	6

*Denotes a statistical Outlier.

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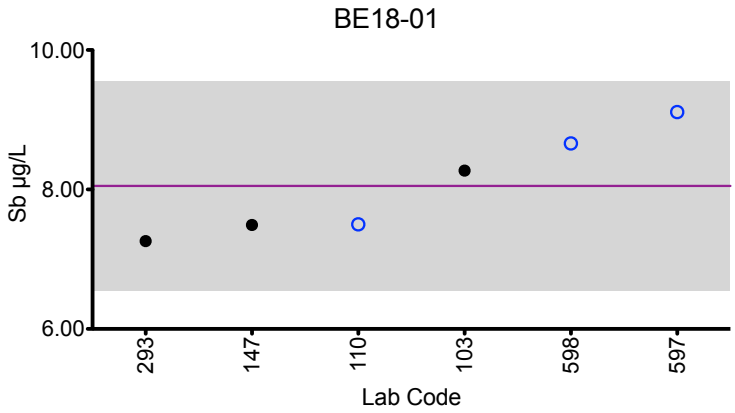
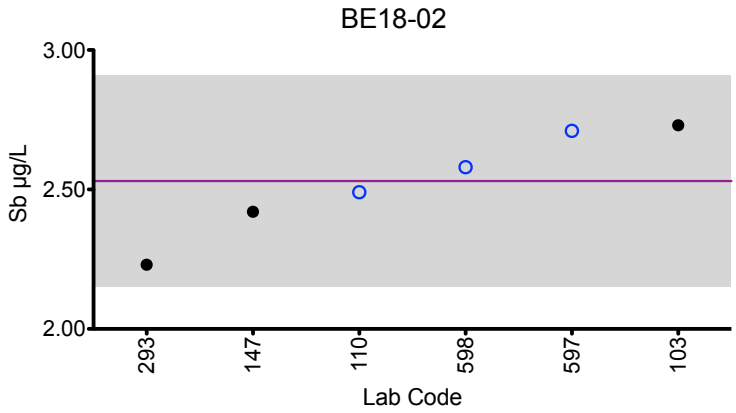
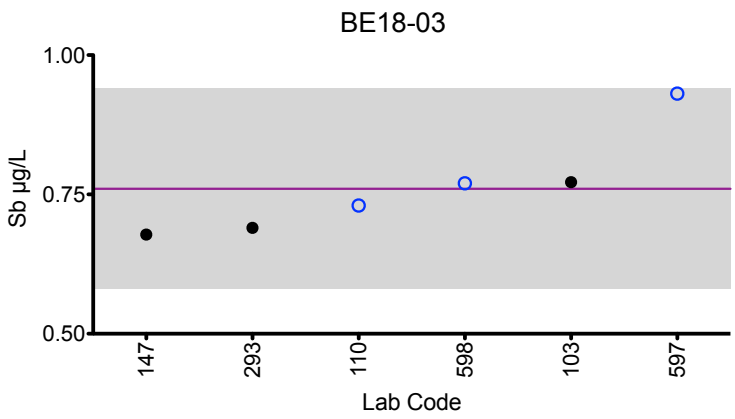
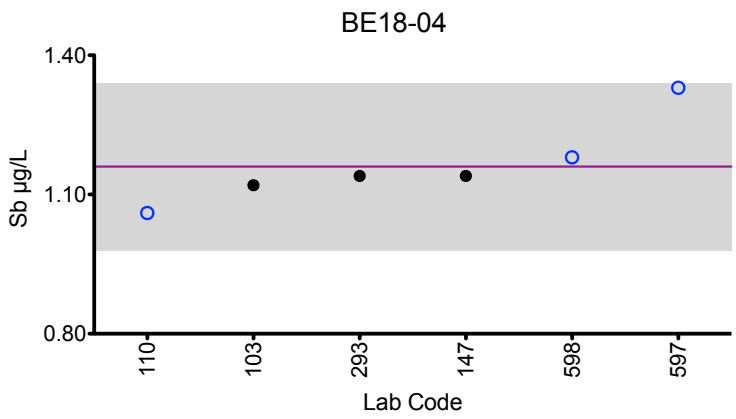
Results for Event #1, 2018: Summary Figures

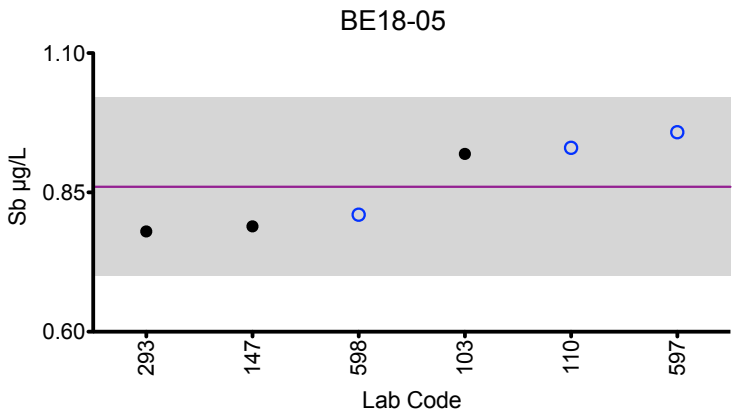
Whole Blood Sb











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood Se (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
103	DRC/CC-ICP-MS	458	269	205	142	357
107	DRC/CC-ICP-MS	440	260	200	130	340
110	DRC/CC-ICP-MS	405	243	188	131	300
147	ICP-MS	422	254	193	136	336
399	DRC/CC-ICP-MS	438	251	190	132	335
401	DRC/CC-ICP-MS	370	207	161	112	281
597	DRC/CC-ICP-MS	479	250	217	146	373
598	DRC/CC-ICP-MS	480.0	290	208	161	378
599	DRC/CC-ICP-MS	483.3	284.0	197.2	161.7	370.1

Summary Statistics

	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
Arithmetic Mean ($\bar{x}$)	442	256	195	139	341
Arithmetic SD (s)	38	24	16	16	33
Arithmetic RSD (%)	8.6	9.4	8.2	11.5	9.7
Number of Sample Measurements (N)	9	9	9	9	9

*Denotes a statistical Outlier.

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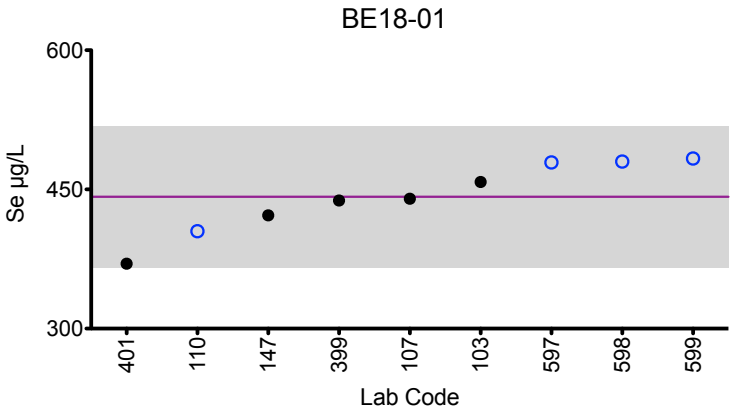
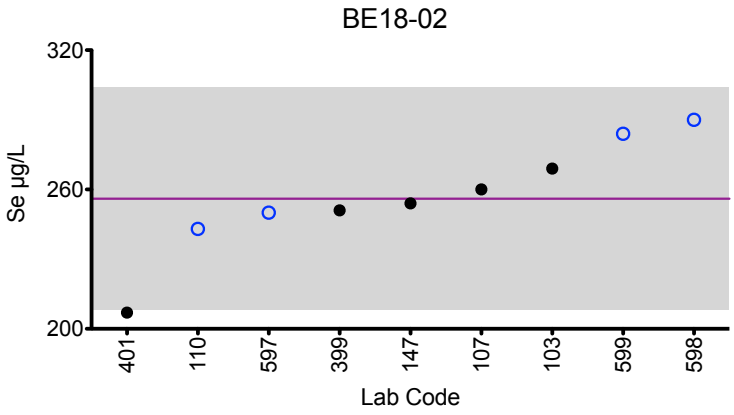
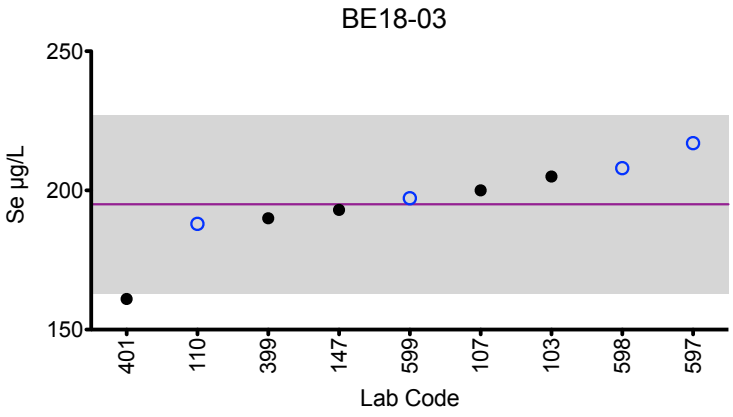
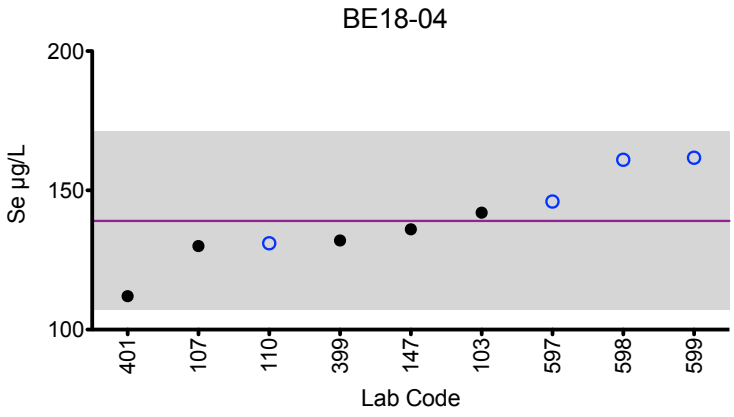
Results for Event #1, 2018: Summary Figures

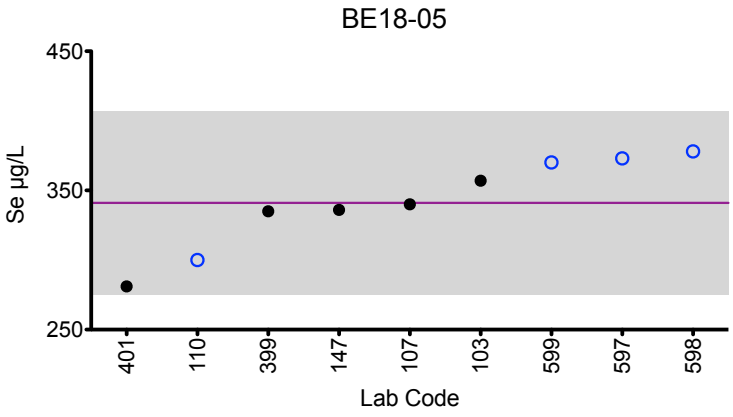
Whole Blood Se











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood Tl (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
103	DRC/CC-ICP-MS	1.96	2.58	<0.0250	0.878	0.232
110	ICP-MS	1.95	2.54	0.02	0.87	0.24
147	ICP-MS	1.86	2.49	< 0.0348	0.785	0.175
293	DRC/CC-ICP-MS	1.84	2.35	0.02	0.78	0.2
598	ICP-MS	2.48	2.16	<0.05	*0.44	<0.05

Summary Statistics

	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
Arithmetic Mean ($\bar{x}$)	2.02	2.42	NA	0.83	0.21
Arithmetic SD (s)	0.26	0.17	NA	0.05	0.03
Arithmetic RSD (%)	12.9	7.0	NA	6.0	14.3
Number of Sample Measurements (N)	5	5	NA	4	4

*Denotes a statistical Outlier.

Statistical data were not calculated for BE18-03 based on a lack of consensus among participating labs.

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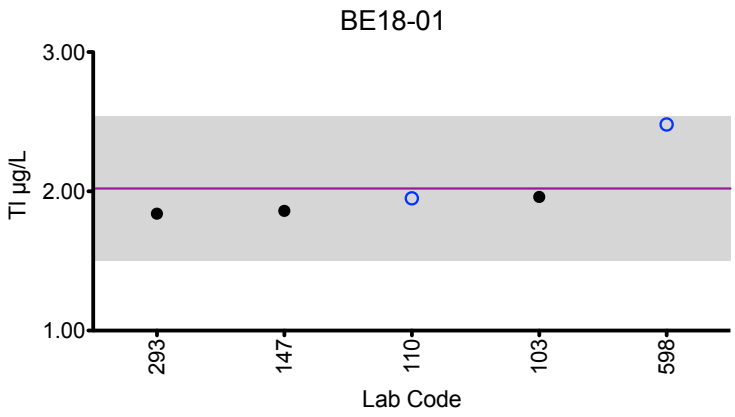
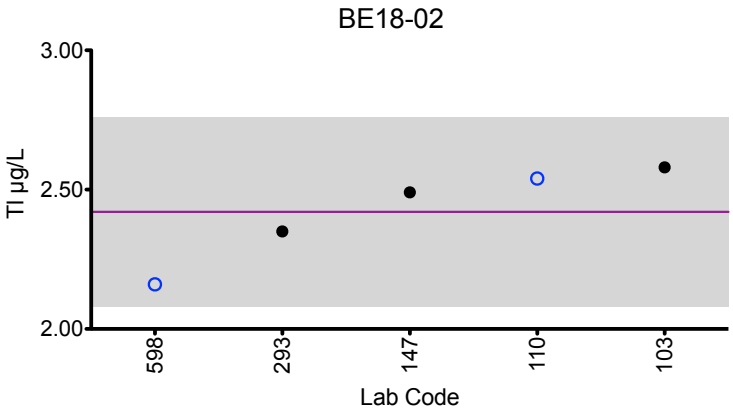
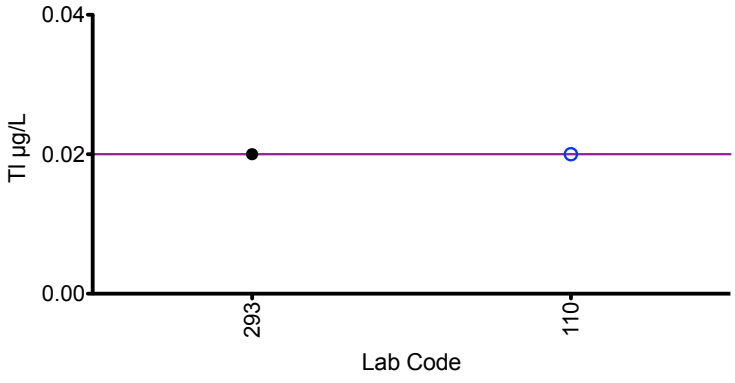
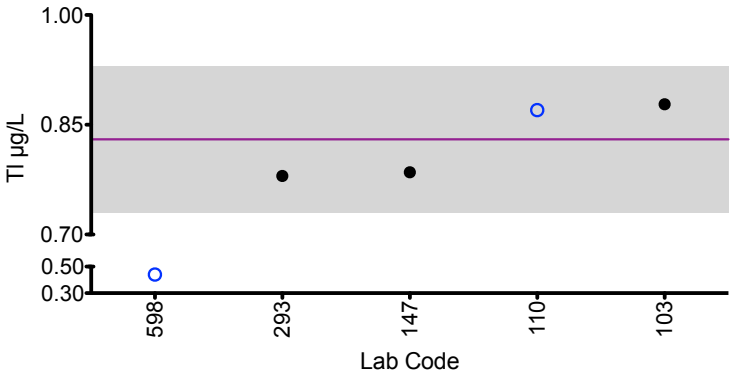
Results for Event #1, 2018: Summary Figures

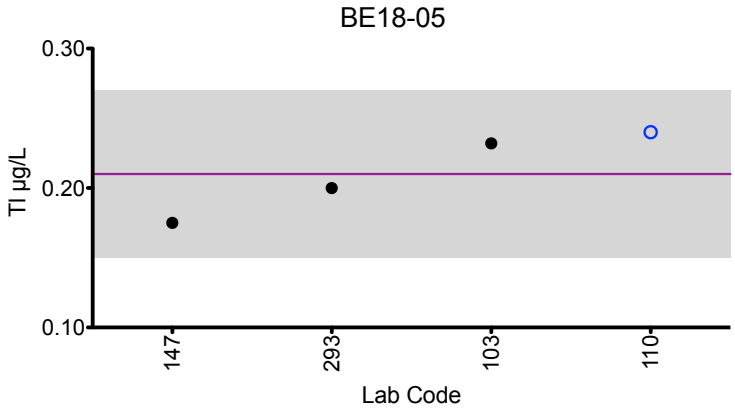
Whole Blood Tl











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood V (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	DRC/CC-ICP-MS	1.26	4.77	6.15	3.60	2.76
147	DRC/CC-ICP-MS	1.24	4.41	5.92	3.25	2.65
293	DRC/CC-ICP-MS	1.31	4.99	6.65	2.89	3.52
597	DRC/CC-ICP-MS	1.26	4.47	6.75	3.61	2.85
598	ETAAS-Other	1.5	6.06	8.29	4.77	3.66
Summary Statistics						
		BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)		1.31	4.94	6.75	3.62	3.09
Arithmetic SD (s)		0.11	0.67	0.93	0.71	0.47
Arithmetic RSD (%)		8.4	13.6	13.8	19.6	15.2
Number of Sample Measurements (N)		5	5	5	5	5

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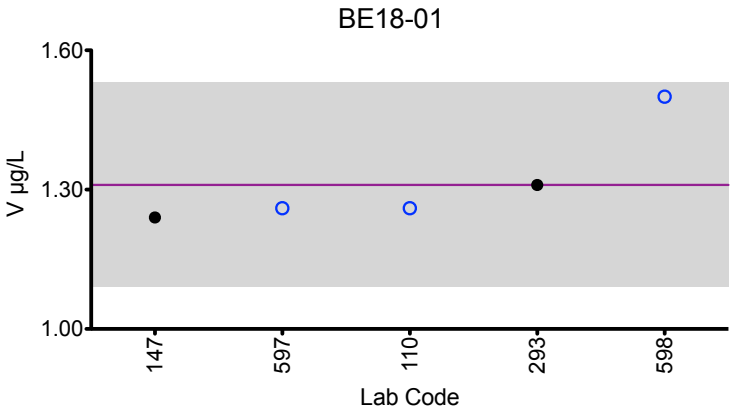
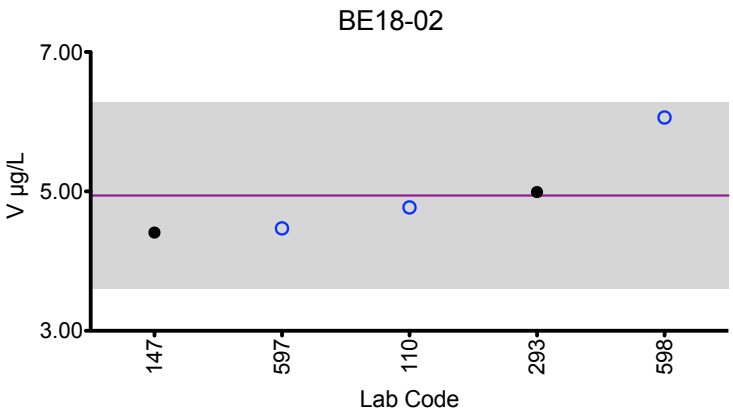
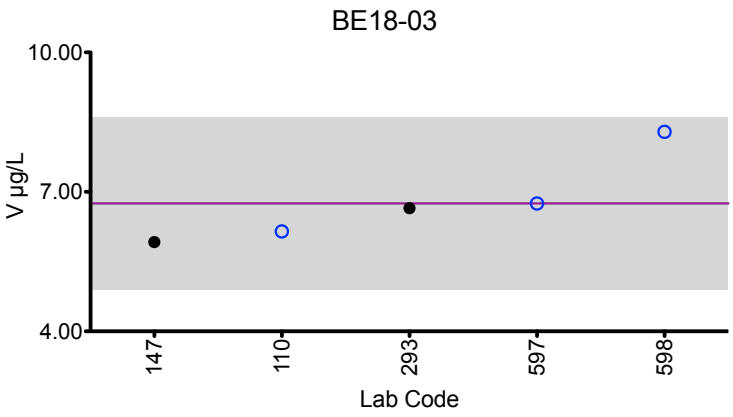
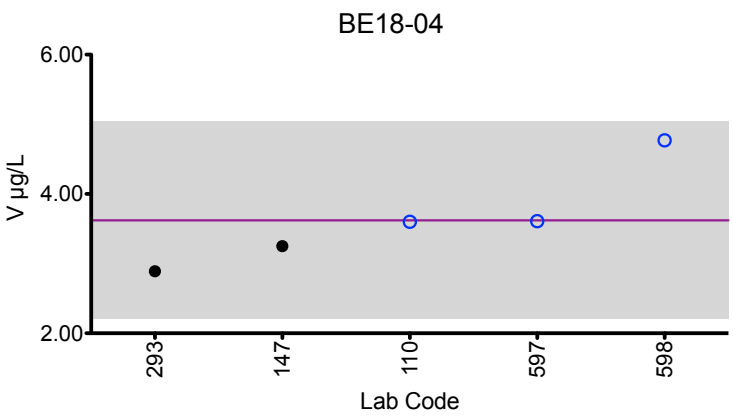
Results for Event #1, 2018: Summary Figures

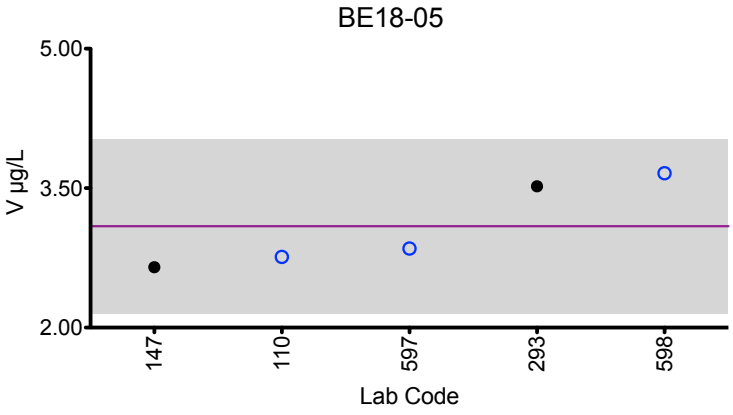
Whole Blood V











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood Zn (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	ICP-MS	6050	5240	7530	8380	4340
147	ICP-MS	6510	5693	8105	9150	4745
597	DRC/CC-ICP-MS	7040	5500	8750	9600	4970
598	ICP-MS	6242	4886	7346	8678	3887
599	DRC/CC-ICP-MS	5871	5648	6732	8184	4292

Summary Statistics					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)	6343	5393	7693	8798	4447
Arithmetic SD (s)	456	334	768	577	422
Arithmetic RSD (%)	7.2	6.2	10.0	6.6	9.5
Number of Sample Measurements (N)	5	5	5	5	5

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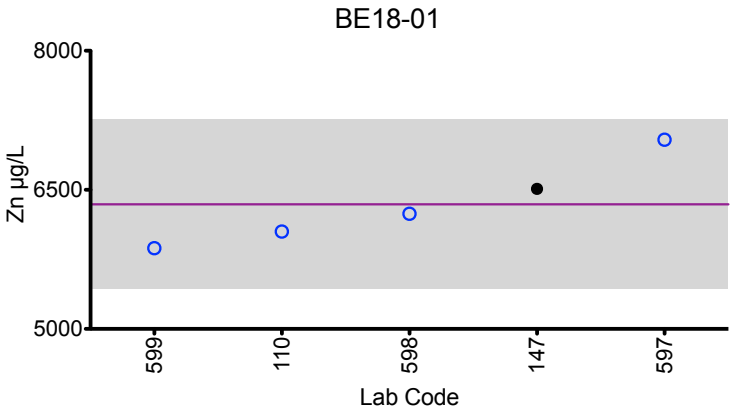
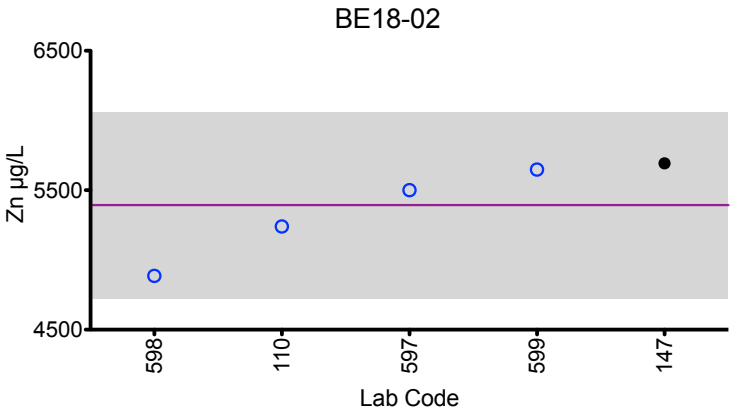
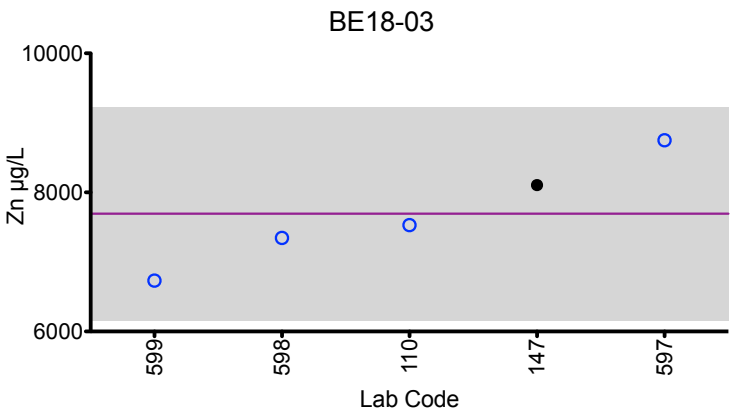
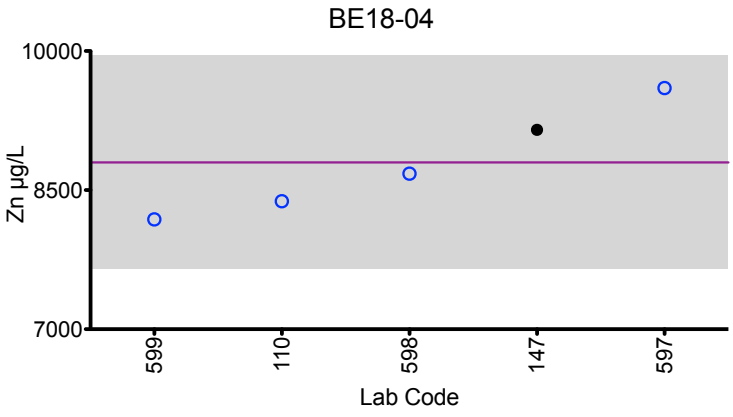
Results for Event #1, 2018: Summary Figures

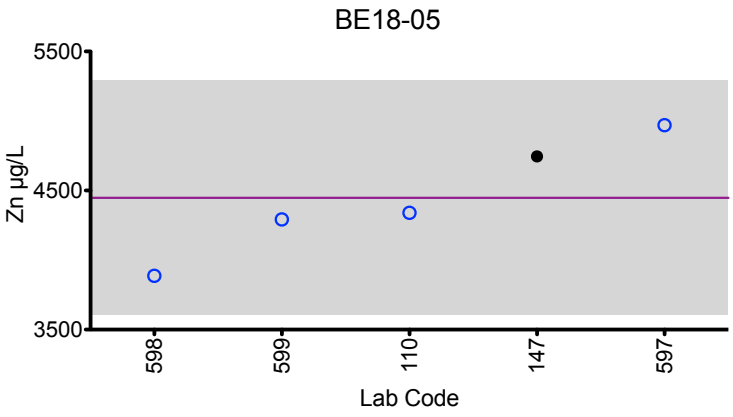
Whole Blood Zn











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood Ba (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	ICP-MS	12.5	0.3	9.1	2.4	6.5
147	ICP-MS	12.5	0.319	9.24	2.51	6.76
597	DRC/CC-ICP-MS	14.7	0.52	11.0	3.58	7.84
598	ICP-MS	14.3	0.3	10.20	2.4	6.84
Summary Statistics						
		BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)		13.5	0.4	9.9	2.7	7.0
Arithmetic SD (s)		1.2	0.1	0.9	0.6	0.6
Arithmetic RSD (%)		8.9	25	9.1	22	8.6
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood Be (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	ICP-MS	0.64	1.34	3.90	3.01	2.07
147	ICP-MS	<1.17	1.33	3.82	2.62	1.80
293	ICP-MS	0.6	1.5	4.6	2.1	3.0
598	ICP-MS	0.994	1.37	5.25	3.18	2.16
Summary Statistics						
		BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)		0.7	1.4	4.4	2.7	2.3
Arithmetic SD (s)		0.2	0.1	0.7	0.5	0.5
Arithmetic RSD (%)		29	7.1	15.9	18.5	22
Number of Sample Measurements (N)		3	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood Cs (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	ICP-MS	1.7	1.7	1.7	1.3	1.3
597	DRC/CC-ICP-MS	1.93	1.73	1.91	1.44	1.44
598	ICP-MS	3.14	1.82	1.82	1.44	1.37
Summary Statistics						
		BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)		2.3	1.8	1.8	1.4	1.4
Arithmetic SD (s)		0.8	0.1	0.1	0.1	0.1
Arithmetic RSD (%)		35	5.6	5.6	7.1	7.1
Number of Sample Measurements (N)		3	3	3	3	3

*Denotes a statistical Outlier.

Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood Ni (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	DRC/CC-ICP-MS	2.2	5.2	11.8	10.8	8.0
147	ICP-MS	1.56	4.70	11.2	10.7	7.28
598	ICP-MS	1.96	4.46	11.2	11.3	7.44
Summary Statistics						
		BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)		1.9	4.8	11.4	10.9	7.6
Arithmetic SD (s)		0.3	0.4	0.3	0.3	0.4
Arithmetic RSD (%)		15.8	8.3	2.6	2.8	5.3
Number of Sample Measurements (N)		3	3	3	3	3

*Denotes a statistical Outlier.

Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood Sn (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	ICP-MS	6.94	3.61	2.50	1.29	3.02
147	ICP-MS	7.08	3.65	2.47	1.38	3.57
597	DRC/CC-ICP-MS	8.41	3.81	3.01	1.61	3.57
598	ICP-MS	8.82	3.91	2.55	1.38	3.09
Summary Statistics						
		BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)		7.8	3.7	2.6	1.4	3.3
Arithmetic SD (s)		0.9	0.1	0.3	0.1	0.3
Arithmetic RSD (%)		11.5	2.7	11.5	7.1	9.1
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood U (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
103	DRC/CC-ICP-MS	0.0744	<0.0250	0.0542	0.103	0.0465
110	ICP-MS	0.075	0.023	0.058	0.108	0.044
147	ICP-MS	0.0700	0.0175	0.0571	0.0838	0.0374

Summary Statistics					
	BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)	0.073	0.020	0.056	0.098	0.043
Arithmetic SD (s)	0.003	0.004	0.002	0.013	0.005
Arithmetic RSD (%)	4.1	0.1	3.6	13.2	11.6
Number of Sample Measurements (N)	3	2	3	3	3

*Denotes a statistical Outlier.

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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Whole Blood W (µg/L)						
Lab Code	**Method**	**BE18-01**	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
110	ICP-MS	1.58	0.20	0.58	0.75	1.45
200	ICP-MS	1.9	0.3	0.8	1.2	1.9
598	ICP-MS	1.73	<0.1	0.16	0.35	0.81
Summary Statistics						
		BE18-01	**BE18-02**	**BE18-03**	**BE18-04**	**BE18-05**
Arithmetic Mean ($\bar{x}$)		1.7	0.25	0.5	0.8	1.4
Arithmetic SD (s)		0.2	0.07	0.3	0.4	0.6
Arithmetic RSD (%)		11.5	28	58	52	43
Number of Sample Measurements (N)		3	2	3	3	3

*Denotes a statistical Outlier.

An arithmetic mean, SD, RSD, and n are provided for sample BE18-01.

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Results for Event #1, 2018:
Additional Elements in Whole Blood

Whole Blood Ag (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
147	ICP-MS	0.362	0.339	0.319	< 0.205	< 0.205

Whole Blood Al (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
147	ICP-MS	< 9.17	< 9.17	< 9.17	< 9.17	< 9.17

Whole Blood Bi (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
147	ICP-MS	< 0.0836	< 0.0836	< 0.0836	< 0.0836	< 0.0836

Whole Blood I (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
147	ICP-MS	30.5	30.8	30.8	24.1	24.6

Whole Blood Li (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
147	ICP-MS	0.701	0.690	0.729	0.520	0.554

Whole Blood Mg (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
597	DRC/CC-ICP-MS	28600	25700	29200	32400	32600

Whole Blood Pt (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
110	ICP-MS	2.5	1.1	0.4	3.3	0.9
598	ICP-MS	2.78	1.17	0.43	2.94	0.71

Whole Blood Sr (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
103	DRC/CC-ICP-MS	16.5	16.3	16.1	16.3	16.5

Whole Blood Te (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
147	ICP-MS	< 0.128	< 0.128	< 0.128	< 0.128	< 0.128

Whole Blood Th (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
147	ICP-MS	< 0.0148	< 0.0148	< 0.0148	< 0.0148	< 0.0148

Whole Blood Ti (µg/L)

Lab Code	Method	BE18-01	BE18-02	BE18-03	BE18-04	BE18-05
200	DRC/CC-ICP-MS	12.5	3.5	7.9	4.4	5.4

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Event #1, 2018

Trace Elements in Urine

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

Event #1, 2018:
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 into five separate pools. Each urine pool was supplemented with arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), cobalt (Co),chromium (Cr), mercury (Hg), manganese (Mn), lead (Pb), thallium (Tl), uranium (U), aluminum (Al), cesium (Cs), copper (Cu), molybdenum (Mo), nickel (Ni), platinum (Pt), antimony (Sb) selenium (Se), tin (Sn), strontium (Sr), tellurium (Te), 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

Eleven elements in urine are formally graded: As, Ba, Be, Cd, Co, Cr, 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) if a robust mean is not possible, the arithmetic mean after outlier deletion.

Additional Elements

An additional 22 elements were reported by at least one participant: Ag, Al, B, Bi, Cs, Cu, Fe, I, Li, Mg, Mo, Ni, Pt, Sb, Se, Sn, Sr, Te, Th, 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, 2018: Summary Statistics

	Urine As (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	42.0	88.0	25.3	31.4	21.1
Upper Limit	50.4	105.6	31.3	37.7	27.1
Lower Limit	33.6	70.4	19.3	25.1	15.1
Robust SD (s*)	1.9	4.5	1.5	1.8	1.1
Robust RSD (%)	4.5	5.1	5.9	5.7	5.2
Number of Sample Measurements (N)	19	19	19	19	19
Standard Uncertainty (*u*)	0.556	1.28	0.426	0.515	0.303

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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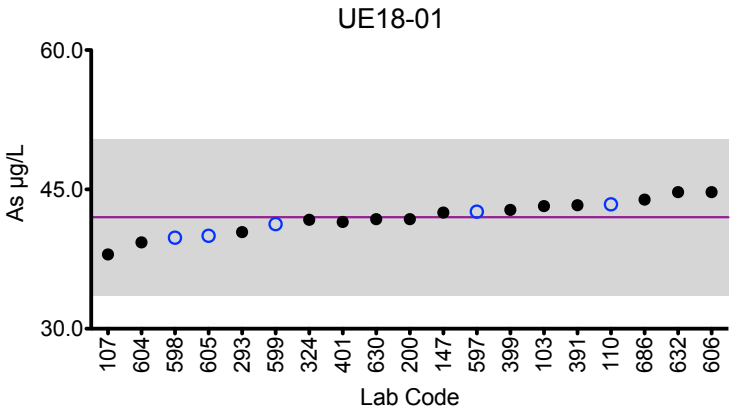
Results for Event #1, 2018:
Performance of Participating Laboratories

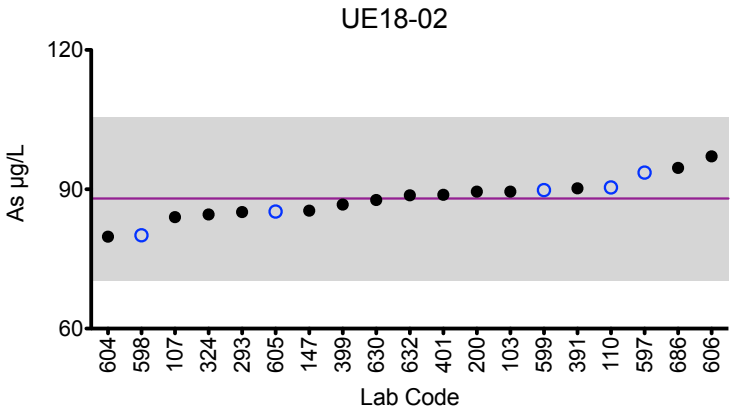
		Urine As (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**42.0**	**88.0**	**25.3**	**31.4**	**21.1**
103	DRC/CC-ICP-MS	43.2	89.5	25.6	31.9	21.4
107	DRC/CC-ICP-MS	38	84	24	29	20
110	DRC/CC-ICP-MS	43.4	90.4	26.1	32.4	21.6
147	ICP-MS	42.5	85.4	26.0	32.6	21.9
200	ICP-MS	41.8	89.5	24.3	30.2	20.7
293	DRC/CC-ICP-MS	40.4	85.1	24.5	30.5	20.2
324	ICP-MS	41.73	84.57	24.72	30.32	20.95
391	DRC/CC-ICP-MS	43.3	90.2	25.4	32.5	21.7
399	DRC/CC-ICP-MS	42.8	86.7	25.2	30.9	21.0
401	DRC/CC-ICP-MS	41.5	88.8	24.8	30.9	21.5
597	DRC/CC-ICP-MS	42.6	93.6	25.4	32.4	21.7
598	DRC/CC-ICP-MS	39.8	80.1	23.5	29.0	19.8
599	DRC/CC-ICP-MS	41.27	89.82	28.6	32.74	20.53
604	DRC/CC-ICP-MS	39.3	79.8	22.9	28.60	19.4
605	ICP-MS	40.0	85.2	22.8	29.3	18.6
606	DRC/CC-ICP-MS	44.7	97.1	27.8	34.0	23.4
630	DRC/CC-ICP-MS	41.8	87.7	26.0	31.6	21.2
632	DRC/CC-ICP-MS	44.7	88.7	28.0	34.3	24.3
686	DRC/CC-ICP-MS	43.9	94.6	26.5	32.5	21.9

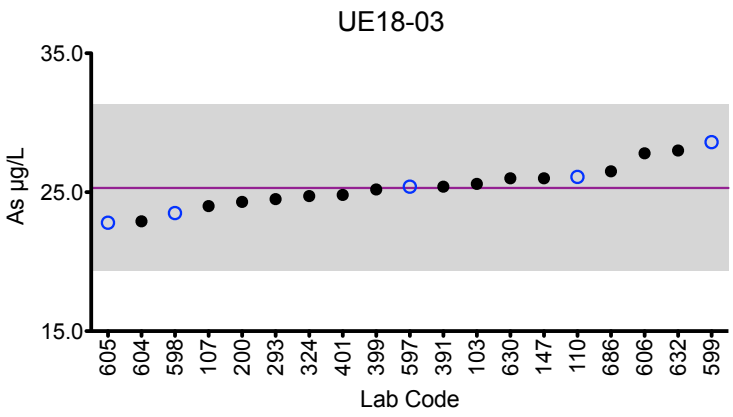
Based on the grading criteria for As in Urine, 100% of results were satisfactory, with 0 of the 19 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

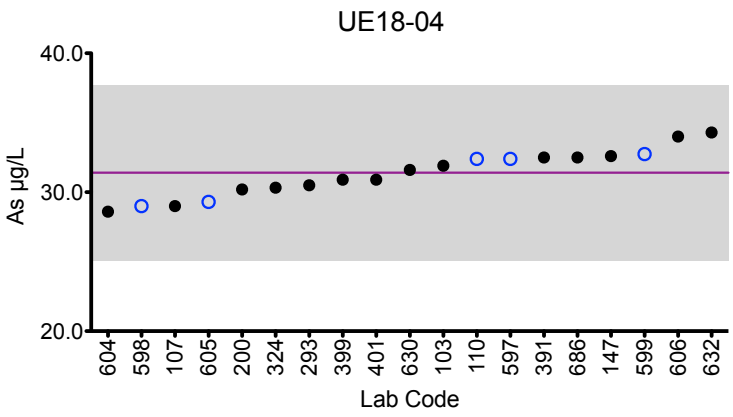
Results for Event #1, 2018: Summary Figures

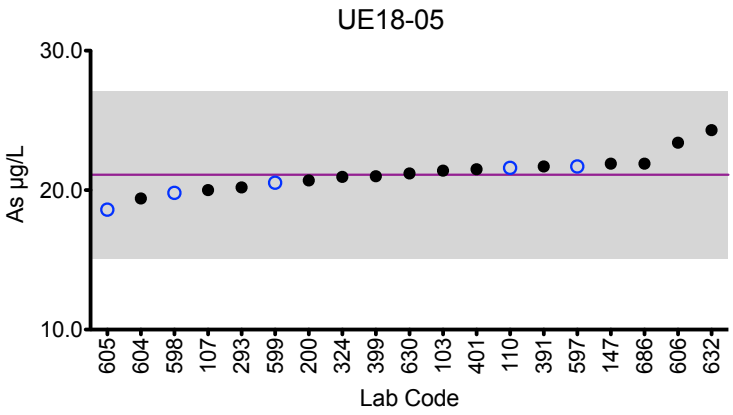
Urine As











Legend:

o CHEAR Labs ● Other Labs

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.

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Results for Event #1, 2018: Summary Statistics

	Urine Ba (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	3.2	11.1	4.6	1.9	1.4
Upper Limit	4.2	13.3	5.6	2.9	2.4
Lower Limit	2.2	8.9	3.6	0.9	0.4
Robust SD (s*)	0.1	0.4	0.2	0.1	0.1
Robust RSD (%)	3.1	3.6	4.3	5.3	7.1
Number of Sample Measurements (N)	12	12	12	12	12
Standard Uncertainty (*u*)	0.043	0.143	0.071	0.031	0.026

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.

Results for Event #1, 2018:
Performance of Participating Laboratories

		Urine Ba (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**3.2**	**11.1**	**4.6**	**1.9**	**1.4**
107	DRC/CC-ICP-MS	3.1	11	4.5	1.8	1.3
110	ICP-MS	3.15	11.0	4.56	1.88	1.36
147	ICP-MS	3.12	10.6	4.70	2.09	1.44
399	ICP-MS	3.28	11.00	4.75	1.91	1.38
597	DRC/CC-ICP-MS	3.24	12.65	4.74	1.76	1.31
598	ICP-MS	2.93	10.7	4.38	1.90	1.27
599	DRC/CC-ICP-MS	3.346	11.66	4.251	2.072	1.414
605	ICP-MS	3.12	10.9	4.49	1.89	1.31
606	DRC/CC-ICP-MS	3.27	11.2	4.82	1.81	1.56
607	ICP-MS	3.14	10.64	4.58	1.87	1.38
632	ICP-MS	3.43	11.7	4.91	2.00	1.43
686	ICP-MS	3.27	10.9	4.73	1.88	1.37

Based on the grading criteria for Ba in Urine, 100% of results were satisfactory, with 0 of the 12 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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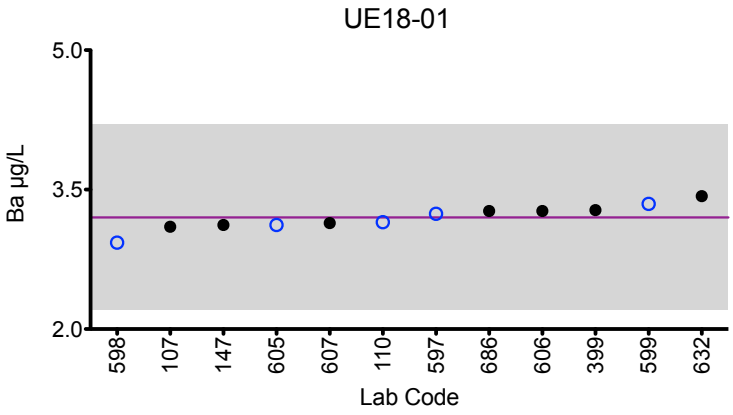
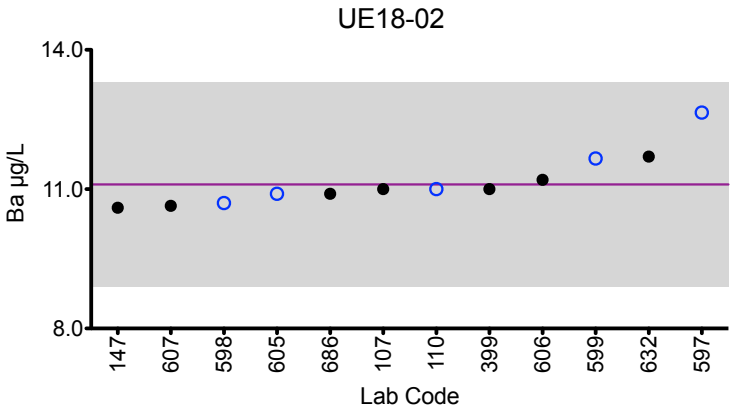
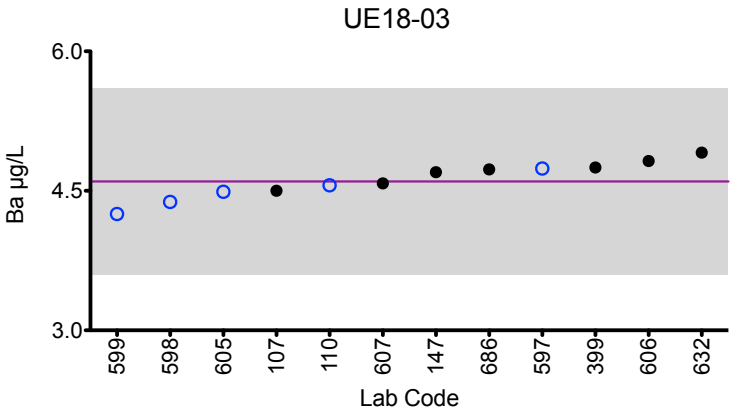
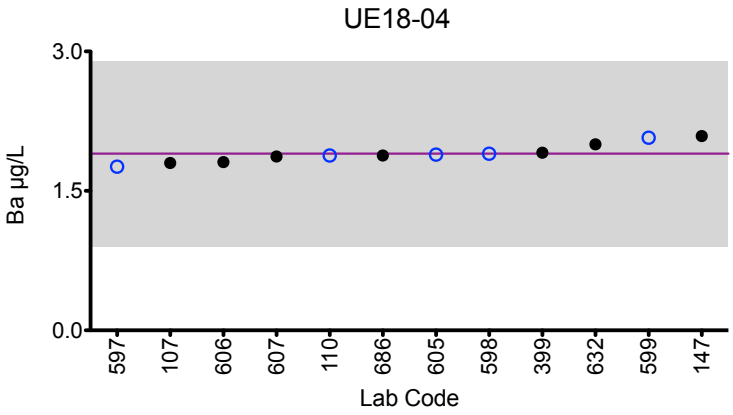
Results for Event #1, 2018: Summary Figures

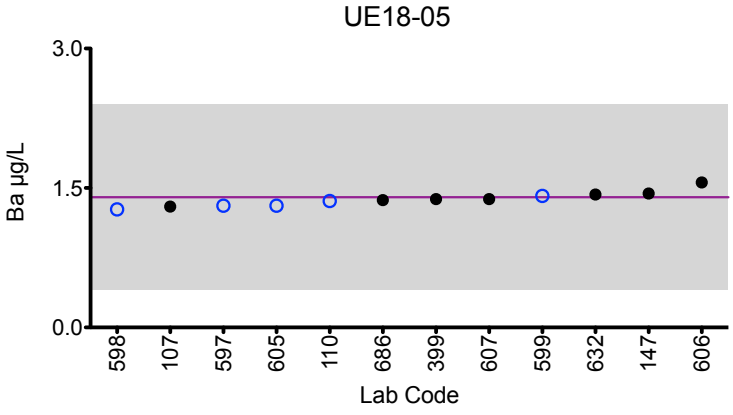
Urine Ba











Legend:
o CHEAR Labs ● Other Labs
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, 2018: Summary Statistics

	Urine Be (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	2.4	1.8	0.51	1.4	0.91
Upper Limit	3.4	2.8	1.51	2.4	1.91
Lower Limit	1.4	0.8	0.00	0.4	0.00
Robust SD (s*)	0.2	0.1	0.02	0.1	0.04
Robust RSD (%)	8.3	5.6	3.9	7.1	4.4
Number of Sample Measurements (N)	11	11	11	11	11
Standard Uncertainty (*u*)	0.058	0.033	0.0084	0.029	0.016

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, 2018:
Performance of Participating Laboratories

		Urine Be (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**2.4**	**1.8**	**0.51**	**1.4**	**0.91**
107	DRC/CC-ICP-MS	2.3	1.8	0.48	1.4	0.89
110	ICP-MS	2.29	1.69	0.474	1.37	0.839
147	ICP-MS	2.65	2.20	0.767	1.74	0.964
293	DRC/CC-ICP-MS	2.55	1.92	0.52	1.40	0.94
399	ICP-MS	2.48	1.84	0.502	1.46	0.918
598	ICP-MS	2.27	1.76	0.51	1.32	0.84
599	DRC/CC-ICP-MS	2.235	1.935	0.497	1.300	0.882
605	ICP-MS	2.48	1.78	0.469	1.43	0.901
607	ICP-MS	2.56	1.90	0.55	1.50	0.92
632	ICP-MS	2.46	1.77	0.516	1.41	0.926
686	ICP-MS	2.41	1.81	0.509	1.46	0.956

Based on the grading criteria for Be in Urine, 100% of results were satisfactory, with 0 of the 11 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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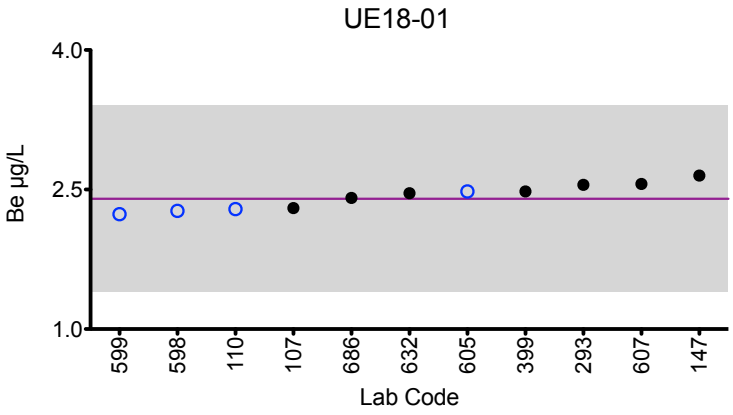
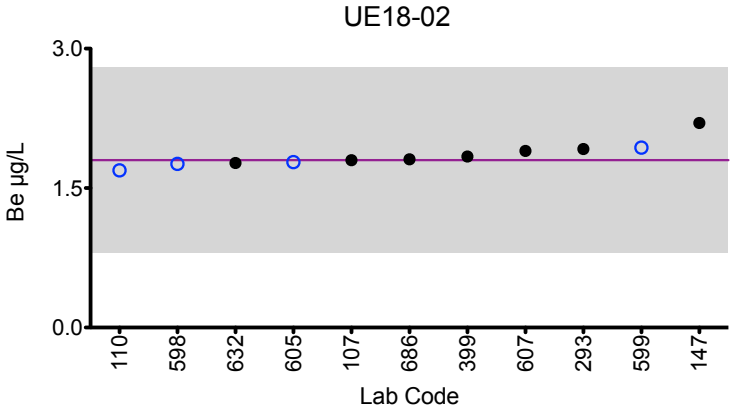
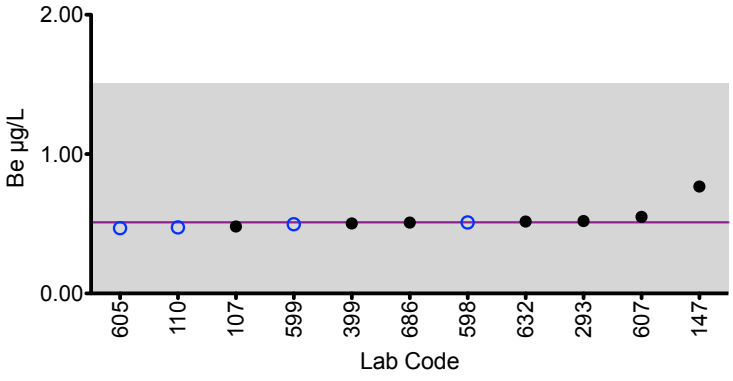
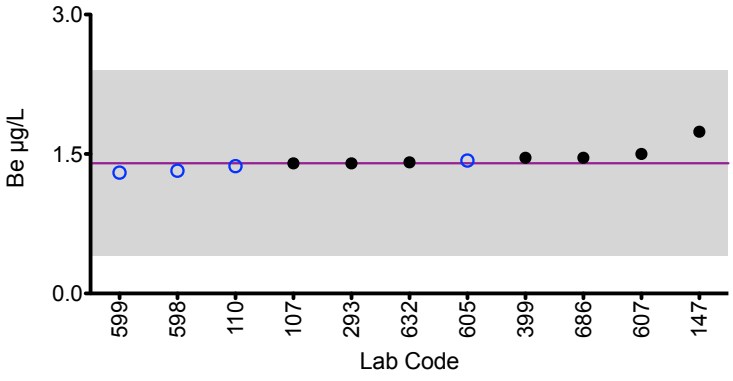
Results for Event #1, 2018: Summary Figures

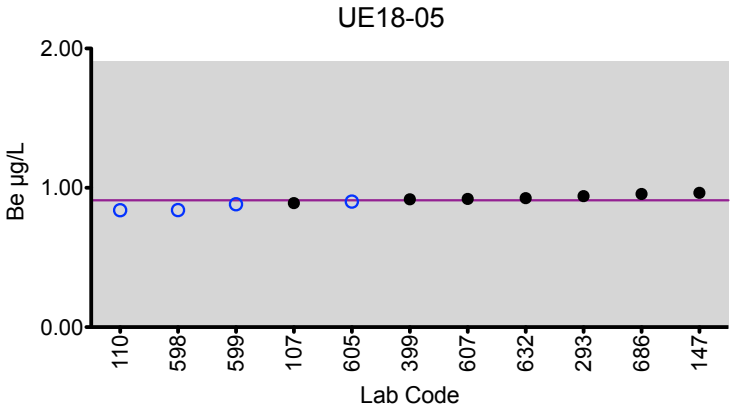
Urine Be











Legend:

o CHEAR Labs ● Other Labs

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, 2018: Summary Statistics

	Urine Cd (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	1.56	2.62	0.85	1.19	3.55
Upper Limit	2.56	3.62	1.85	2.19	4.55
Lower Limit	0.56	1.62	0.00	0.19	2.55
Robust SD (s*)	0.09	0.16	0.05	0.07	0.22
Robust RSD (%)	5.8	6.1	5.9	5.9	6.2
Number of Sample Measurements (N)	20	20	18	19	20
Standard Uncertainty (*u*)	0.025	0.043	0.016	0.020	0.061

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, 2018:
Performance of Participating Laboratories

		Urine Cd (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**1.56**	**2.62**	**0.85**	**1.19**	**3.55**
103	DRC/CC-ICP-MS	1.69	2.71	0.906	1.23	3.77
107	DRC/CC-ICP-MS	1.6	2.6	0.83	1.2	3.6
110	ICP-MS	1.53	2.48	0.781	1.16	3.32
147	ICP-MS	1.66	2.73	0.918	1.27	3.97
200	ICP-MS	1.7	2.9	0.8	1.3	3.5
293	DRC/CC-ICP-MS	1.53	2.53	0.84	1.15	3.39
324	ICP-MS	1.59	2.53	<1	1.18	3.53
391	DRC/CC-ICP-MS	1.52	2.67	0.85	1.33	3.71
399	DRC/CC-ICP-MS	1.58	2.58	0.829	1.13	3.60
401	DRC/CC-ICP-MS	1.46	2.59	0.90	1.12	3.48
597	DRC/CC-ICP-MS	1.53	2.69	0.70	1.10	3.56
598	DRC/CC-ICP-MS	1.43	2.51	0.78	1.21	3.26
599	DRC/CC-ICP-MS	1.363	2.303	<1	<1	3.196
604	DRC/CC-ICP-MS	1.61	2.73	0.897	1.25	3.84
605	ICP-MS	1.76	2.94	0.901	1.35	4.15
606	DRC/CC-ICP-MS	1.51	2.59	0.850	1.18	3.63
607	ICP-MS	1.45	2.43	0.84	1.11	3.21
630	ICP-MS	1.57	2.43	0.83	1.14	3.44
632	DRC/CC-ICP-MS	1.55	2.73	0.839	1.18	3.56
686	ICP-MS	1.65	2.76	0.888	1.18	3.56

Based on the grading criteria for Cd in Urine, 100% of results were satisfactory, with 0 of the 20 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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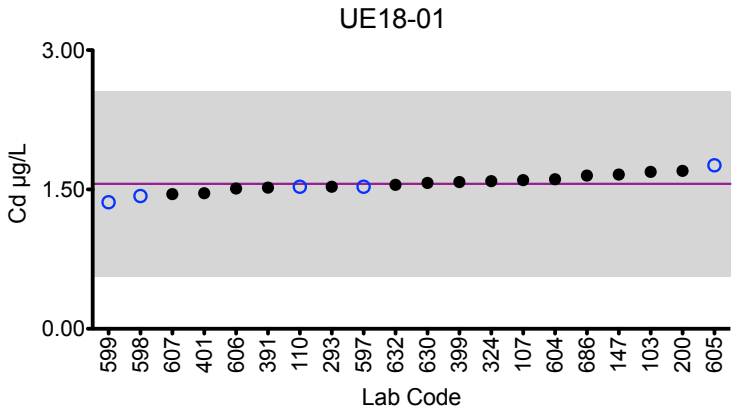
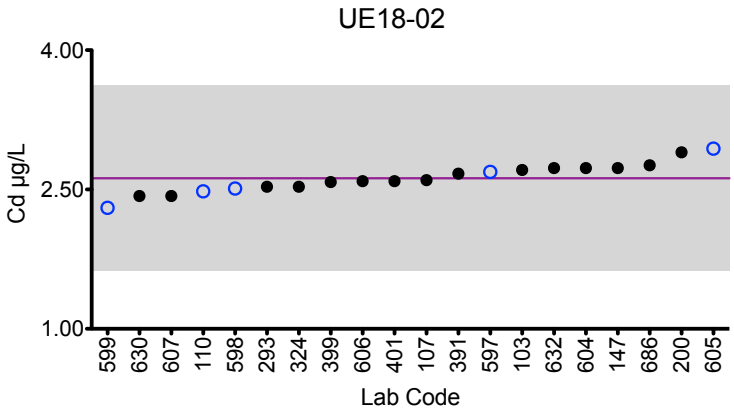
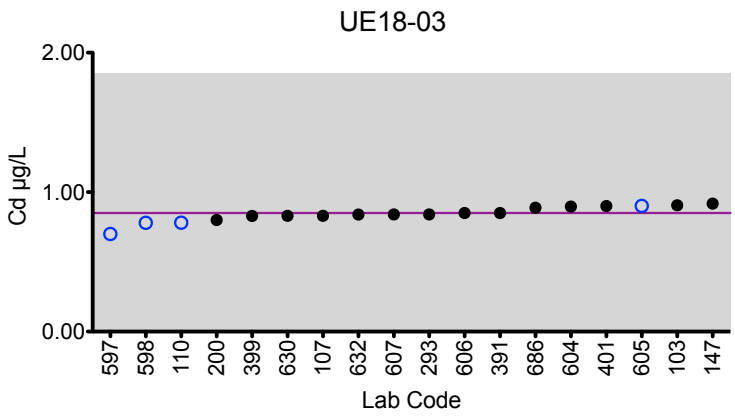
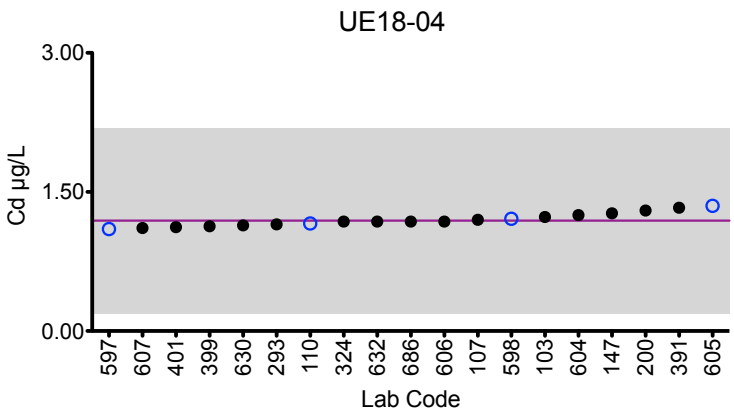
Results for Event #1, 2018: Summary Figures

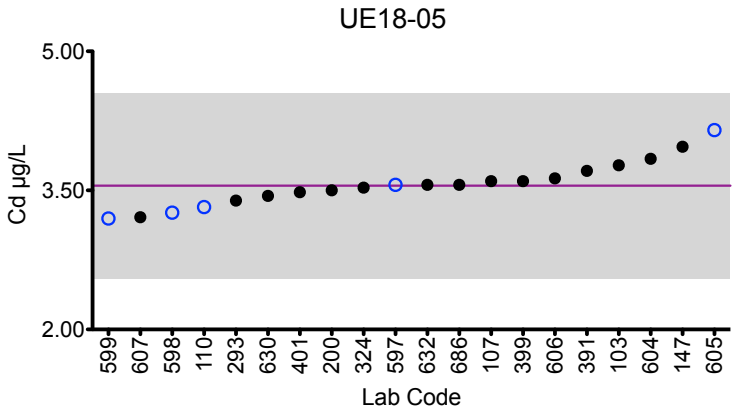
Urine Cd











Legend:

o CHEAR Labs ● Other Labs

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.

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Results for Event #1, 2018: Summary Statistics

	Urine Co (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	1.1	6.3	1.5	0.80	0.41
Upper Limit	2.6	7.8	3.0	2.30	1.91
Lower Limit	0.0	4.8	0.0	0.00	0.00
Robust SD (s*)	0.1	0.4	0.1	0.06	0.03
Robust RSD (%)	9.1	6.3	6.7	7.5	7.3
Number of Sample Measurements (N)	14	14	14	12	12
Standard Uncertainty (*u*)	0.025	0.123	0.033	0.021	0.010

The acceptable range is based on quality specifications:
±1.5 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±1.5 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.

Results for Event #1, 2018:
Performance of Participating Laboratories

		Urine Co (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**1.1**	**6.3**	**1.5**	**0.80**	**0.41**
103	DRC/CC-ICP-MS	1.18	6.54	1.61	0.838	0.412
107	DRC/CC-ICP-MS	1.10	6.3	1.5	0.78	0.43
110	ICP-MS	1.19	6.48	1.6	0.866	0.477
147	ICP-MS	1.21	6.25	1.61	0.837	0.428
324	ICP-MS	1.16	6.23	1.54	1	1
391	DRC/CC-ICP-MS	1.10	6.08	1.5	0.79	0.4
399	DRC/CC-ICP-MS	1.11	6.32	1.50	0.77	0.394
401	DRC/CC-ICP-MS	1.1	6.14	1.48	0.74	0.41
597	DRC/CC-ICP-MS	1.07	7.01	1.48	0.81	0.36
598	ICP-MS	0.98	5.52	1.47	0.72	0.40
599	DRC/CC-ICP-MS	1.136	5.746	1.316	<1	<1
605	ICP-MS	1.04	5.96	1.38	0.710	0.376
606	DRC/CC-ICP-MS	1.20	6.64	1.64	0.830	0.413
632	ICP-MS	1.23	6.66	1.64	0.844	0.460

Based on the grading criteria for Co in Urine, 100% of results were satisfactory, with 0 of the 14 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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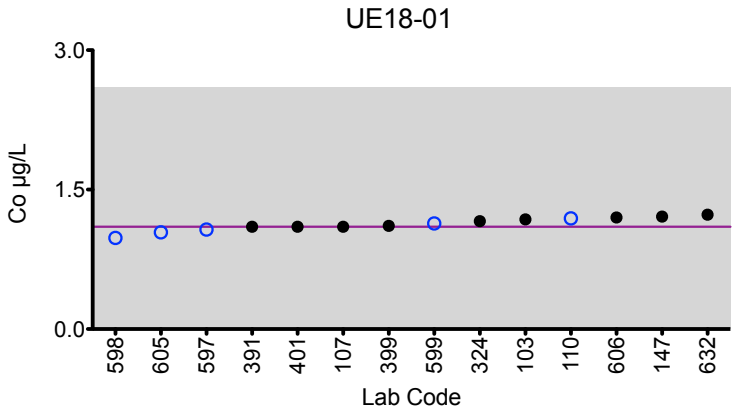
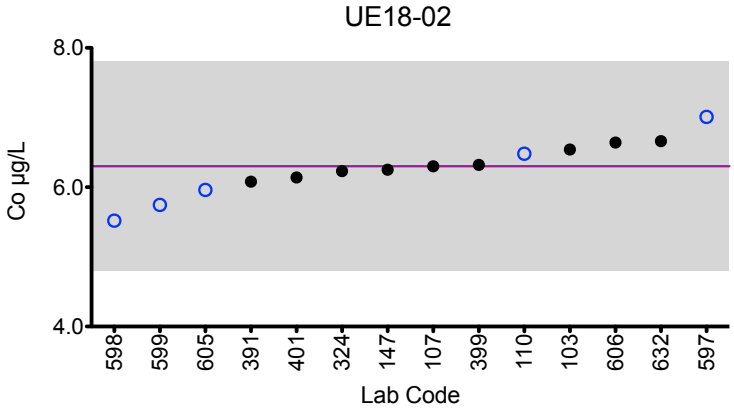
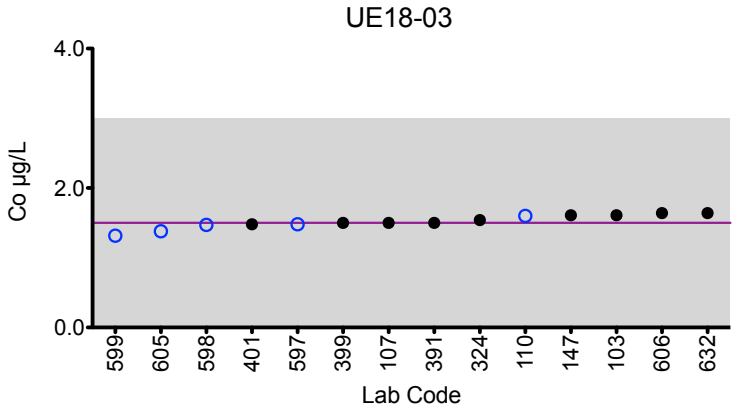
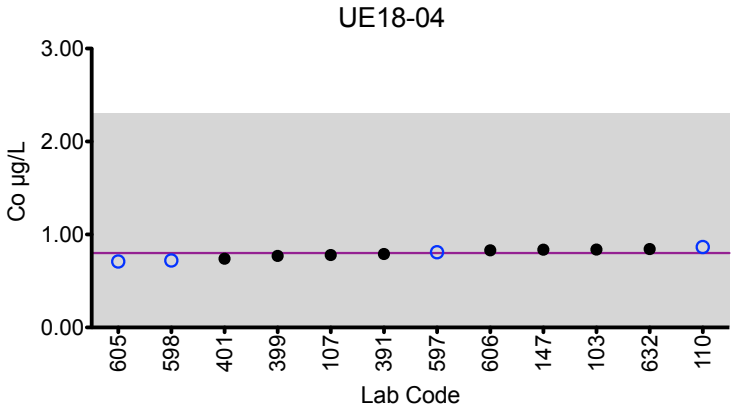
Results for Event #1, 2018: Summary Figures

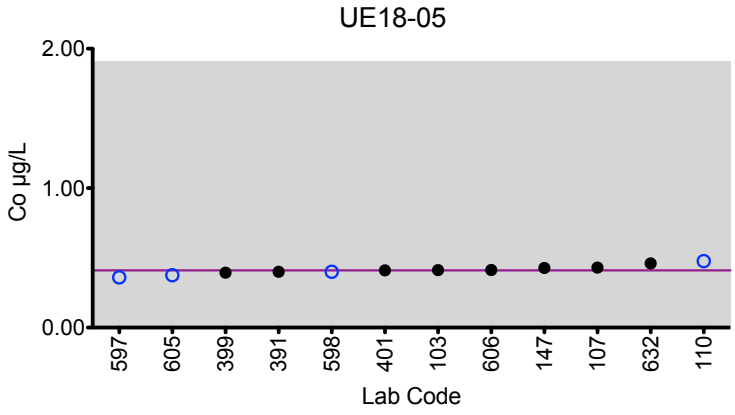
Urine Co











Legend:

o CHEAR Labs ● Other Labs

Horizontal purple line = assigned target value based on the robust mean of all laboratories.

Gray area = acceptable range based on quality specifications:

±1.5 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±1.5 µg/L at concentrations less than or equal to 10 µg/L.

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Results for Event #1, 2018: Summary Statistics

	Urine Cr (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	6.4	17.4	0.72	3.0	2.0
Upper Limit	9.4	20.9	3.72	6.0	5.0
Lower Limit	3.4	13.9	0.00	0.0	0.0
Robust SD (s*)	0.2	0.6	0.10	0.1	0.2
Robust RSD (%)	3.1	3.4	13.9	3.3	10.0
Number of Sample Measurements (N)	11	11	9	11	11
Standard Uncertainty (*u*)	0.069	0.230	0.044	0.042	0.070

The acceptable range is based on quality specifications:
±3 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±3 µg/L at concentrations less than or equal to 15 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.

An arithmetic mean, SD, RSD, and n are provided for sample UE18-03.

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Results for Event #1, 2018:
Performance of Participating Laboratories

		Urine Cr (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**6.4**	**17.4**	**0.72**	**3.0**	**2.0**
103	DRC/CC-ICP-MS	6.51	17.9	0.652	3.01	1.89
107	DRC/CC-ICP-MS	6	18	0.84	2.8	2
110	DRC/CC-ICP-MS	6.53	17.7	0.83	3.04	2.09
147	DRC/CC-ICP-MS	6.34	17.2	0.686	2.94	2.09
324	ICP-MS	6.76	17.31	<1	3.13	2.17
391	DRC/CC-ICP-MS	6.40	17.17	0.60	2.99	1.88
401	DRC/CC-ICP-MS	6.43	17.4	0.70	3.03	2.01
597	DRC/CC-ICP-MS	6.48	18.05	0.61	2.93	2.25
598	DRC/CC-ICP-MS	6.19	16.6	0.76	2.73	1.77
599	DRC/CC-ICP-MS	5.534	16.07	<1	2.230	1.392
632	DRC/CC-ICP-MS	6.38	17.9	0.808	3.11	2.11

Based on the grading criteria for Cr in Urine, 100% of results were satisfactory, with 0 of the 11 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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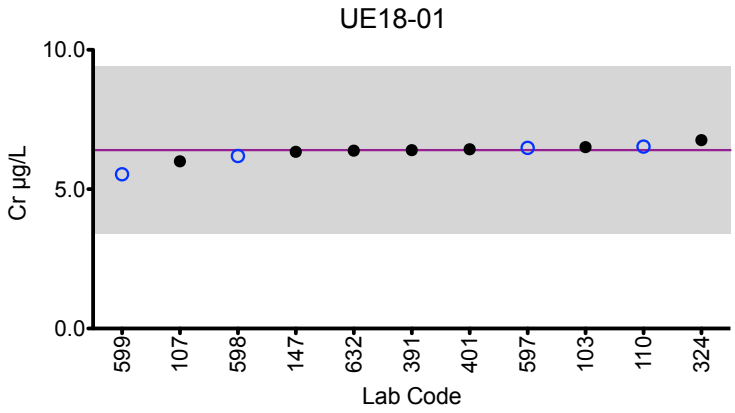
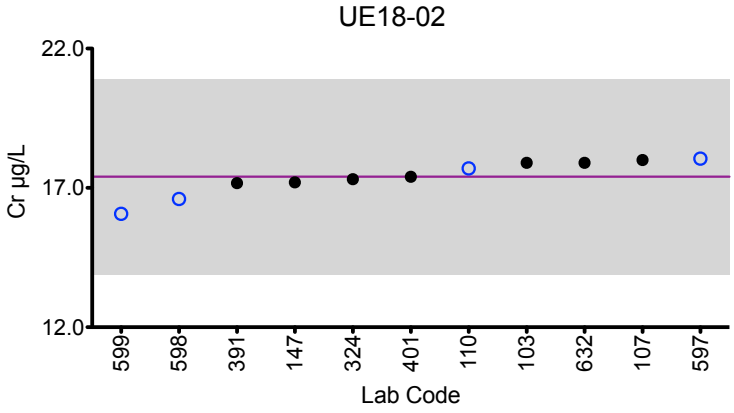
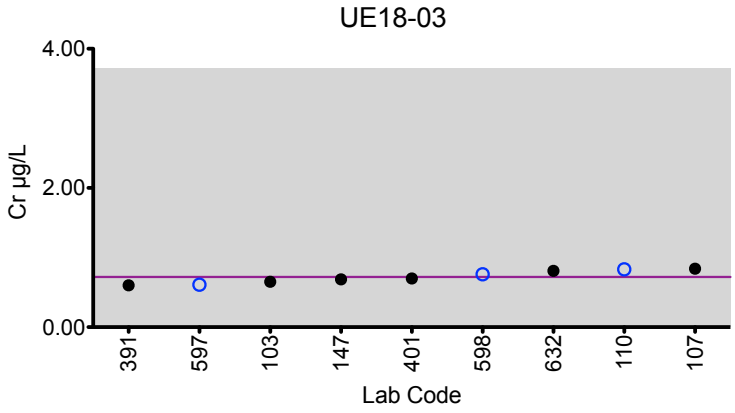
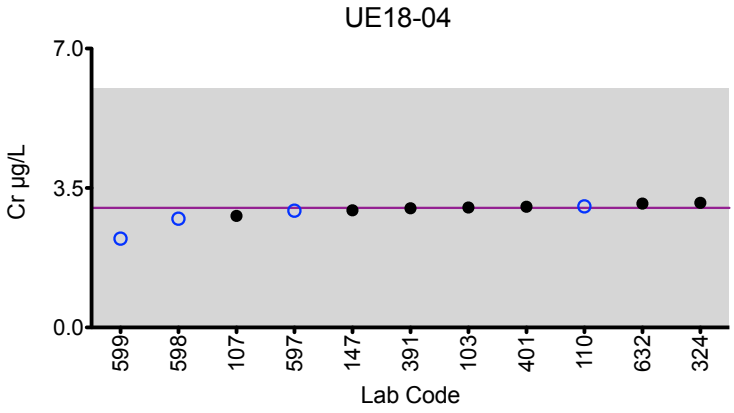
Results for Event #1, 2018: Summary Figures

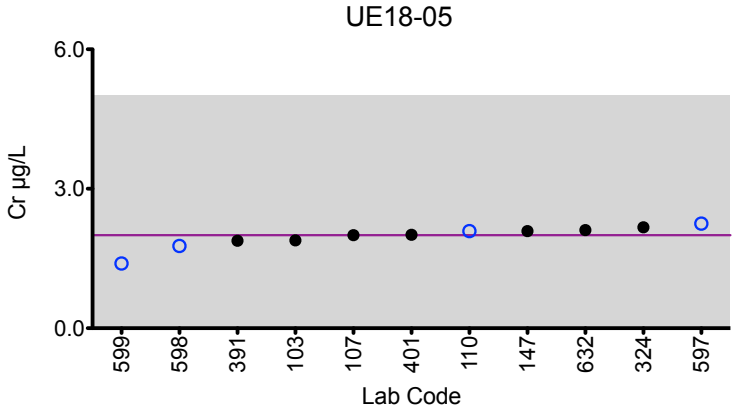
Urine Cr











Legend:

o CHEAR Labs ● Other Labs

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 ±20% around the target value, whichever is greater; thus, it is fixed at ±3 µg/L at concentrations less than or equal to 15 µg/L.

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Results for Event #1, 2018: Summary Statistics

	Urine Hg (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	6.7	34.8	15.7	8.6	4.6
Upper Limit	9.7	45.2	20.4	11.6	7.6
Lower Limit	3.7	24.4	11.0	5.6	1.6
Robust SD (s*)	0.8	4.5	2.2	1.0	0.4
Robust RSD (%)	11.9	12.9	14.0	11.6	8.7
Number of Sample Measurements (N)	16	16	16	16	16
Standard Uncertainty (*u*)	0.258	1.39	0.686	0.309	0.138

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, 2018:
Performance of Participating Laboratories

		Urine Hg (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**6.7**	**34.8**	**15.7**	**8.6**	**4.6**
103	DRC/CC-ICP-MS	7.10	36.9	16.1	8.86	4.82
107	DRC/CC-ICP-MS	6.7	30	16	8.7	4.6
110	ICP-MS	7.33	36.5	16.7	8.89	4.72
147	CV-AAS	6.79	35.6	16.0	8.84	4.75
200	ICP-MS	5.2	30.5	14.0	7.6	4.4
293	DRC/CC-ICP-MS	6.17	32.93	14.2	7.74	4.1
391	DRC/CC-ICP-MS	6.85	37.34	15.5	8.48	4.7
401	DRC/CC-ICP-MS	8.08	42.2	19.3	10.3	5.72
589	CV-AAS	5.293	32.278	11.93	7.848	4.08
597	DMA	7.26	35.45	15.21	8.93	3.80
598	ICP-MS	5.23	27.7	12.0	6.95	3.7
599	DRC/CC-ICP-MS	7.219	48.90 ↑	19.89	10.03	3.627
604	DRC/CC-ICP-MS	7.88	31.8	17.6	9.56	5.10
605	ICP-MS	7.16	37.3	17.1	9.25	4.96
606	DRC/CC-ICP-MS	6.57	37.8	15.6	8.39	4.68
632	ICP-MS	5.58	30.6	14.1	6.99	4.70

Based on the grading criteria for Hg in Urine, 99% of results were satisfactory, with 0 of the 16 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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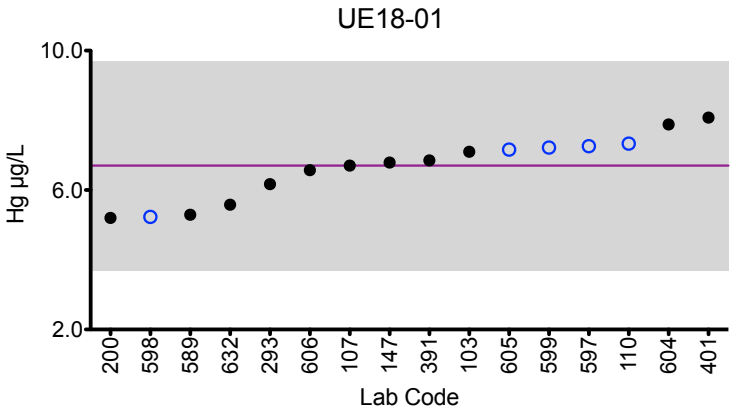
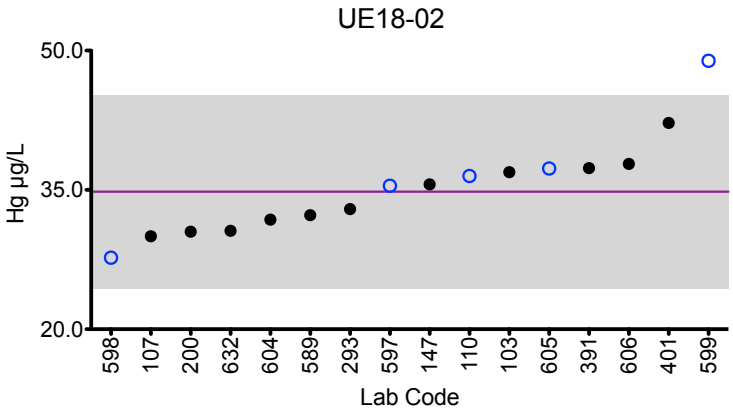
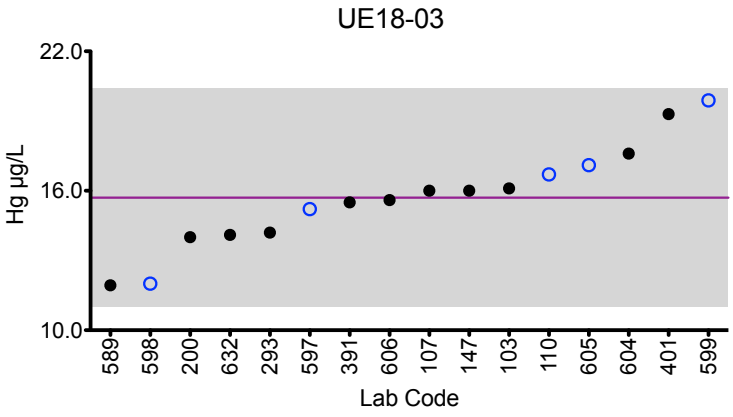
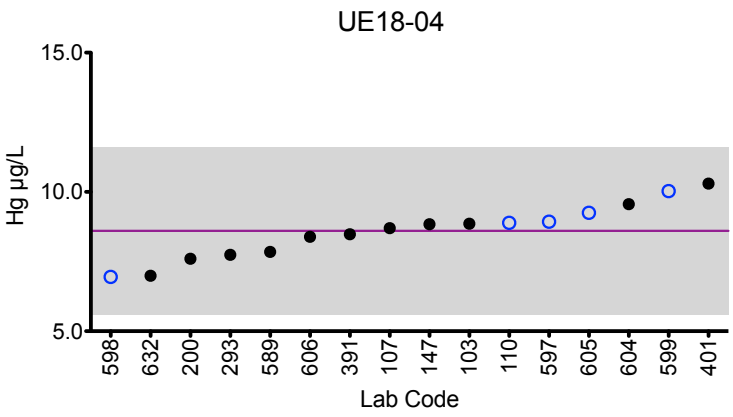
Results for Event #1, 2018: Summary Figures

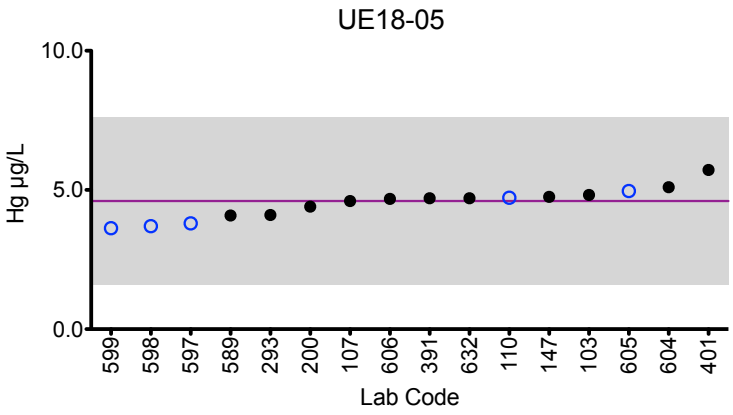
Urine Hg











Legend:

o CHEAR Labs ● Other Labs

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, 2018: Summary Statistics

	Urine Mn (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	1.5	2.8	0.48	1.5	0.99
Upper Limit	2.1	3.5	1.03	2.1	1.54
Lower Limit	0.9	2.1	0.00	0.9	0.44
Robust SD (s*)	0.1	0.1	0.04	0.1	0.06
Robust RSD (%)	6.7	3.6	8.3	6.7	6.1
Number of Sample Measurements (N)	15	15	13	15	14
Standard Uncertainty (*u*)	0.025	0.036	0.015	0.027	0.021

The acceptable range is based on quality specifications:
±0.55 µg/L or ±25% around the target value, whichever is greater; thus, it is fixed at ±0.55 µg/L at concentrations less than or equal to 2.2 µg/L. Quality specifications for Mn are consistent with those used by other External Quality Assessment Schemes for trace elements. (Praamsma M, et al. Clinical Chemistry and Laboratory Medicine.2016; 54(12): 1921-1928)

Results for Event #1, 2018:
Performance of Participating Laboratories

		Urine Mn (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**1.5**	**2.8**	**0.48**	**1.5**	**0.99**
103	DRC/CC-ICP-MS	1.56	2.78	0.470	1.49	0.979
107	DRC/CC-ICP-MS	1.5	2.7	0.47	1.5	1
110	DRC/CC-ICP-MS	1.43	2.69	0.43	1.45	0.925
147	DRC/CC-ICP-MS	1.47	2.73	0.505	1.57	0.945
324	ICP-MS	1.59	2.83	<1	1.49	1.02
391	DRC/CC-ICP-MS	1.37	2.90	0.46	1.49	1.20
399	DRC/CC-ICP-MS	1.50	2.75	0.50	1.48	0.975
597	DRC/CC-ICP-MS	1.20	2.89	0.55	1.37	0.77
598	ICP-MS	1.42	2.82	0.56	1.57	1.20
599	DRC/CC-ICP-MS	1.447	2.376	<1	1.386	<1
604	DRC/CC-ICP-MS	1.46	2.64	0.484	1.46	0.968
605	ICP-MS	1.49	2.87	0.438	1.56	1.05
606	DRC/CC-ICP-MS	1.38	2.81	0.392	1.40	0.914
630	DRC/CC-ICP-MS	1.52	3.25	0.49	1.59	1.01
632	DRC/CC-ICP-MS	1.55	2.86	0.744	1.61	1.02

Based on the grading criteria for Mn in Urine, 100% of results were satisfactory, with 0 of the 15 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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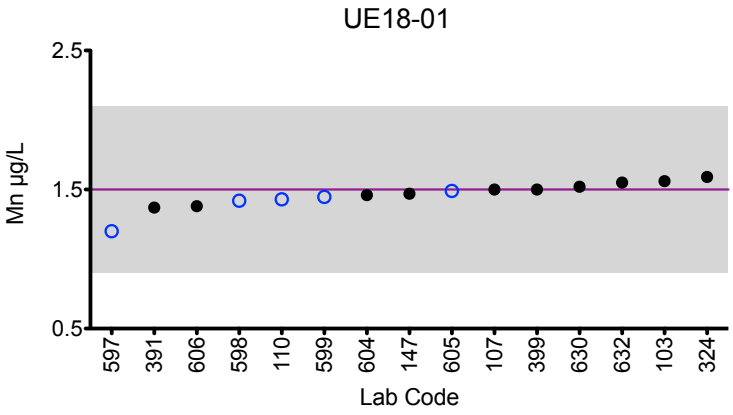
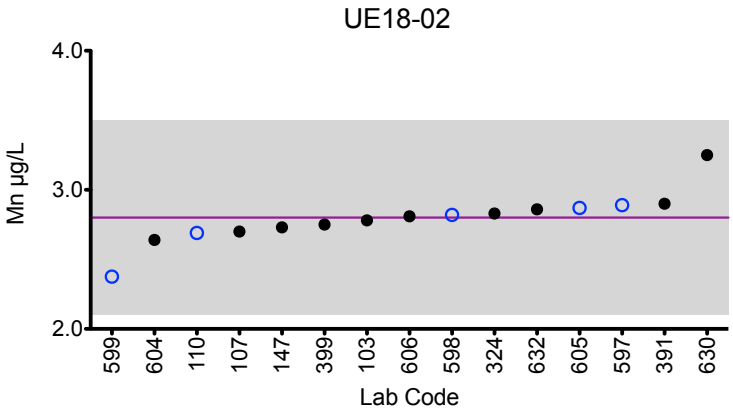
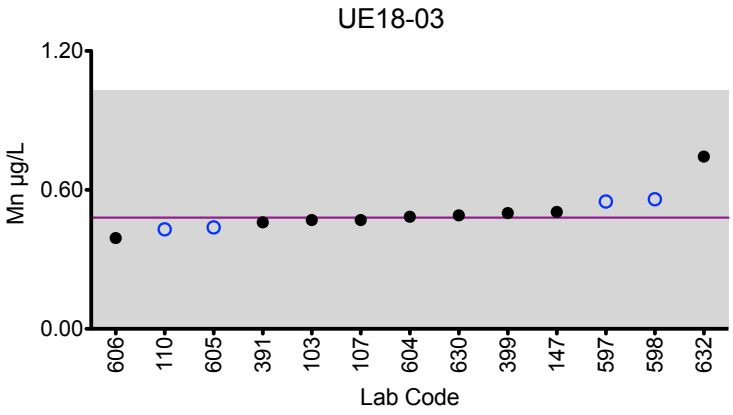
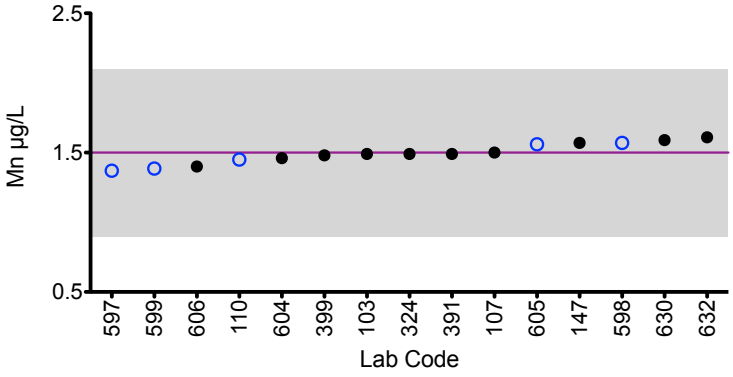
Results for Event #1, 2018: Summary Figures

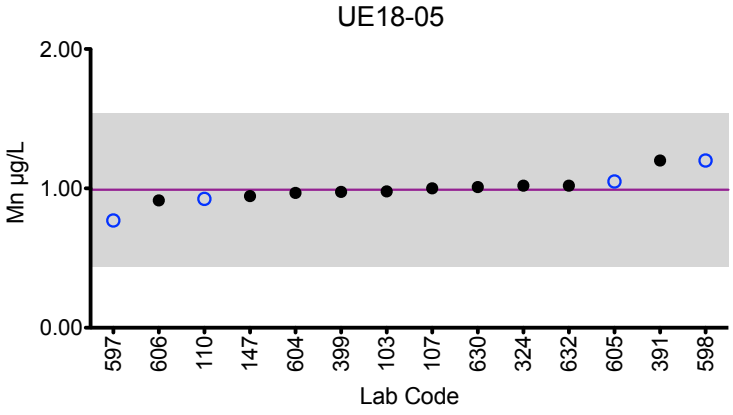
Urine Mn











Legend:

o CHEAR Labs ● Other Labs

Horizontal purple line = assigned target value based on the robust mean of all laboratories.

Gray area = acceptable range based on quality specifications:

±0.55 µg/L or ±25% around the target value, whichever is greater; thus, it is fixed at ±0.55 µg/L at concentrations less than or equal to 2.2 µg/L.

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Results for Event #1, 2018: Summary Statistics

	Urine Pb (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	0.98	7.0	4.0	17.4	11.1
Upper Limit	1.98	8.4	5.0	20.9	13.3
Lower Limit	0.00	5.6	3.0	13.9	8.9
Robust SD (s*)	0.02	0.4	0.2	0.9	0.7
Robust RSD (%)	2.5	5.7	5.0	5.2	6.3
Number of Sample Measurements (N)	16	16	16	16	16
Standard Uncertainty (*u*)	0.0078	0.115	0.055	0.267	0.209

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, 2018:
Performance of Participating Laboratories

		Urine Pb (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**0.98**	**7.0**	**4.0**	**17.4**	**11.1**
103	DRC/CC-ICP-MS	1.06	7.53	4.17	18.0	11.7
107	DRC/CC-ICP-MS	0.98	7.1	4	18	12
110	ICP-MS	0.965	6.76	4.02	17.1	11.1
147	ICP-MS	0.995	7.21	4.12	17.7	11.6
293	DRC/CC-ICP-MS	1.0	7.1	4.5	17.5	10.9
324	ICP-MS	1.00	6.52	3.87	16.48	10.86
391	DRC/CC-ICP-MS	0.8	6.7	3.8	16.8	10.9
399	ICP-MS	0.947	6.98	3.93	17.2	11.2
597	DRC/CC-ICP-MS	0.99	8.1	4.04	18.10	11.51
598	ICP-MS	0.93	6.23	3.46	16.10	9.95
599	DRC/CC-ICP-MS	1.001	7.021	3.770	17.81	9.686
605	ICP-MS	1.08	7.62	4.22	18.8	11.8
606	ICP-MS	0.938	6.74	3.80	16.2	10.3
607	ICP-MS	1.0	7.1	3.9	18.2	11.4
632	ICP-MS	0.975	7.03	3.91	16.8	10.6
686	ICP-MS	0.983	7.12	3.92	17.2	11.1

Based on the grading criteria for Pb in Urine, 100% of results were satisfactory, with 0 of the 16 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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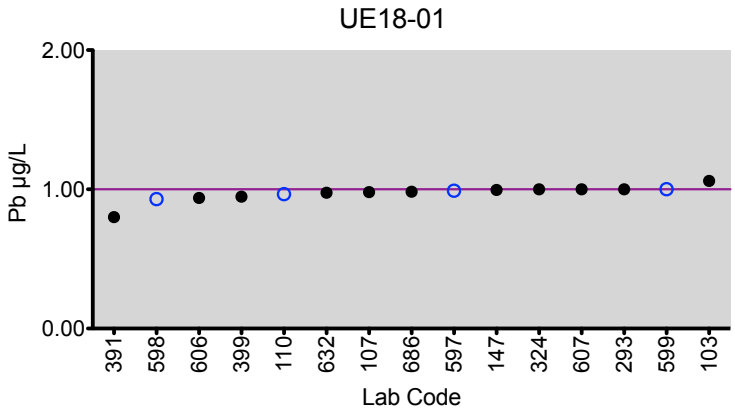
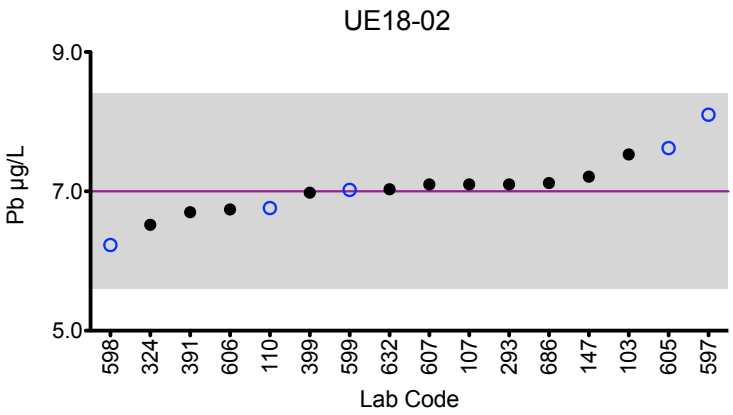
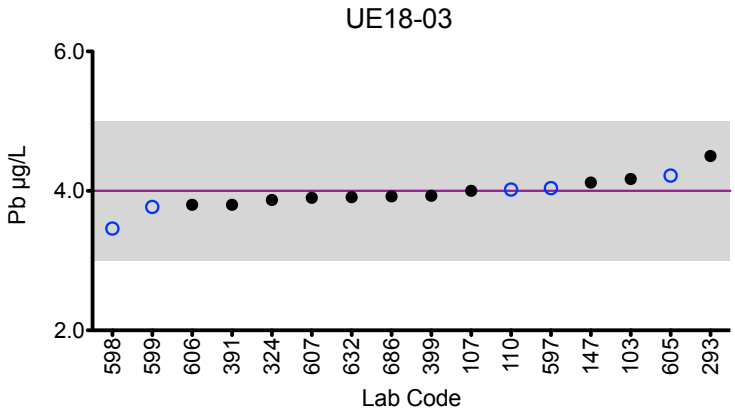
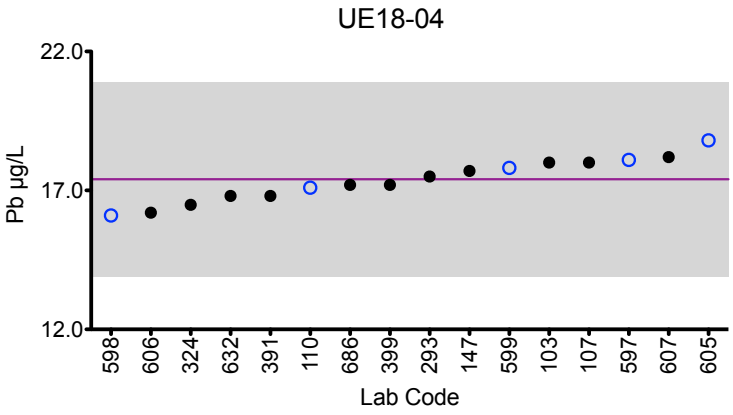
Results for Event #1, 2018: Summary Figures

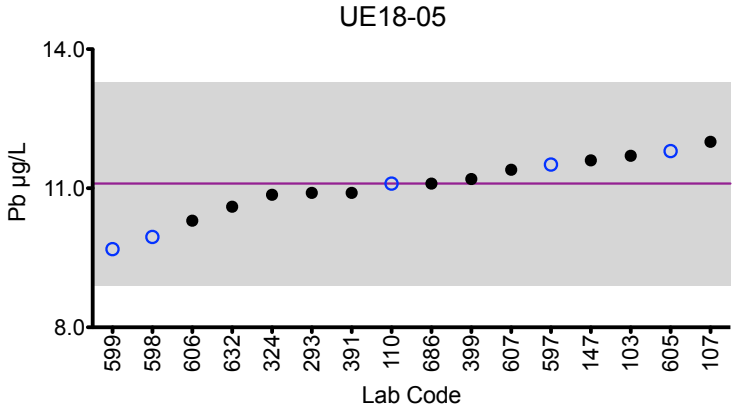
Urine Pb











Legend:

o CHEAR Labs ● Other Labs

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, 2018: Summary Statistics

Urine Tl (µg/L)					
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	1.67	1.10	0.22	2.92	1.89
Upper Limit	2.00	1.32	0.42	3.50	2.27
Lower Limit	1.34	0.88	0.02	2.34	1.51
Robust SD (s*)	0.06	0.05	0.01	0.12	0.06
Robust RSD (%)	3.6	4.5	4.5	4.1	3.2
Number of Sample Measurements (N)	13	13	13	13	13
Standard Uncertainty (*u*)	0.022	0.017	0.0033	0.040	0.020

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, 2018:
Performance of Participating Laboratories

		Urine Tl (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**1.67**	**1.10**	**0.22**	**2.92**	**1.89**
103	DRC/CC-ICP-MS	1.73	1.13	0.231	2.91	1.92
107	DRC/CC-ICP-MS	1.7	1.1	0.23	3	1.9
110	ICP-MS	1.69	1.12	0.231	2.95	1.90
147	ICP-MS	1.68	1.08	0.227	3.03	1.96
293	DRC/CC-ICP-MS	1.66	1.08	0.22	2.88	1.90
399	ICP-MS	1.64	1.07	0.217	2.87	1.85
597	DRC/CC-ICP-MS	1.63	1.24	0.22	3.04	1.94
598	ICP-MS	1.43	0.95	0.18	2.67	1.64
605	ICP-MS	1.71	1.15	0.214	2.99	1.94
606	ICP-MS	1.61	1.04	0.212	2.73	1.76
607	ICP-MS	1.61	1.08	0.22	2.84	1.83
632	ICP-MS	1.76	1.16	0.222	3.03	1.91
686	ICP-MS	1.73	1.10	0.208	2.89	1.92

Based on the grading criteria for Tl in Urine, 100% of results were satisfactory, with 0 of the 13 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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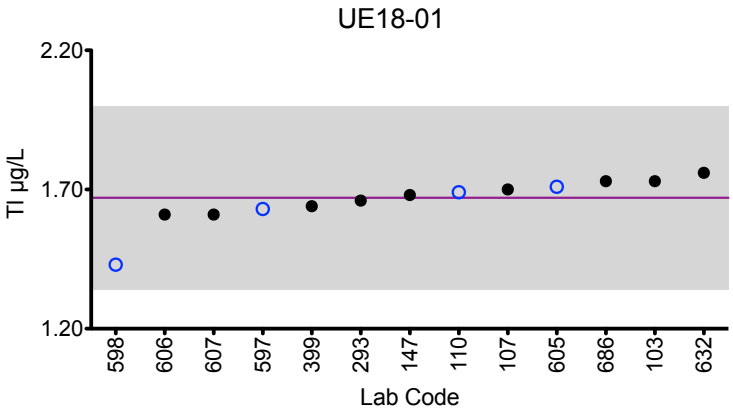
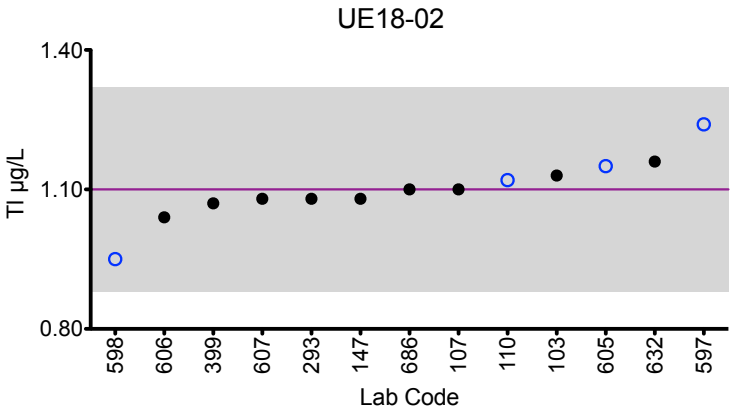
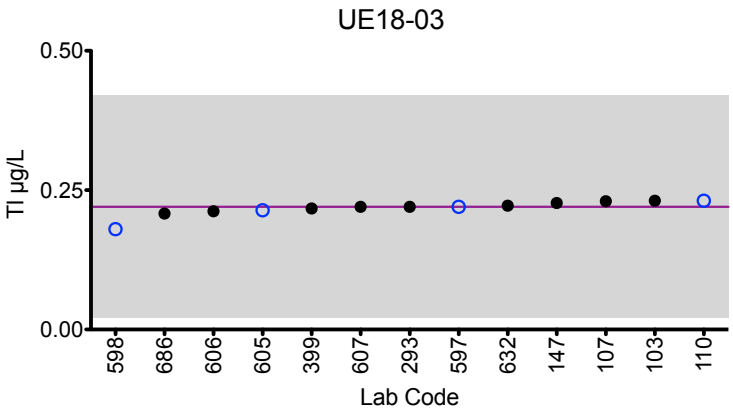
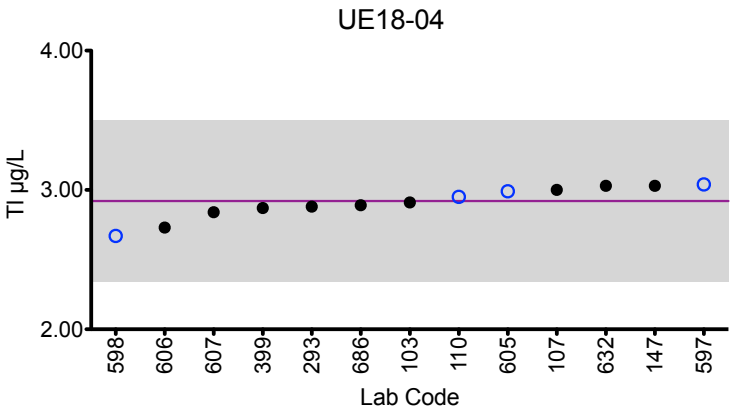
Results for Event #1, 2018: Summary Figures

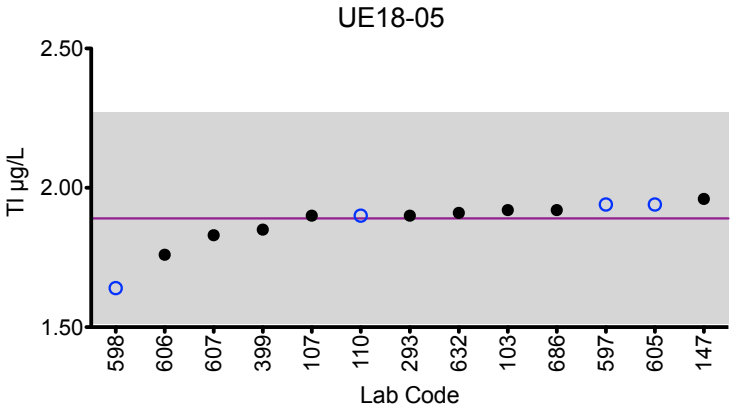
Urine Tl











Legend:
o CHEAR Labs ● Other Labs
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, 2018: Summary Statistics

	Urine U (µg/L)				
	UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Target (Robust Mean (x*))	0.067	0.058	0.037	0.144	0.094
Upper Limit	0.097	0.088	0.067	0.174	0.124
Lower Limit	0.037	0.028	0.007	0.114	0.064
Robust SD (s*)	0.003	0.004	0.003	0.011	0.005
Robust RSD (%)	4.5	6.9	8.1	7.6	5.3
Number of Sample Measurements (N)	14	14	14	14	14
Standard Uncertainty (*u*)	0.0011	0.0012	0.00095	0.0036	0.0017

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.

Results for Event #1, 2018:
Performance of Participating Laboratories

		Urine U (µg/L)				
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
	Target	**0.067**	**0.058**	**0.037**	**0.144**	**0.094**
103	DRC/CC-ICP-MS	0.0668	0.0538	0.0370	0.146	0.0988
107	DRC/CC-ICP-MS	0.069	0.062	0.04	0.16	0.1
110	ICP-MS	0.0693	0.0606	0.0395	0.144	0.0955
147	ICP-MS	0.0693	0.0552	0.0348	0.143	0.0933
324	ICP-MS	0.073	0.061	0.041	0.162	0.104
399	ICP-MS	0.060	0.052	0.035	0.137	0.088
598	ICP-MS	0.071	0.059	0.035	0.133	0.089
604	ICP-MS	0.060	0.054	0.034	0.130	0.089
605	ICP-MS	0.067	0.061	0.038	0.149	0.094
606	ICP-MS	0.065	0.056	0.034	0.135	0.090
607	ICP-MS	0.064	0.059	0.036	0.137	0.090
630	ICP-MS	0.067	0.061	0.040	0.152	0.098
632	ICP-MS	0.0663	0.0623	0.0400	0.150	0.0939
686	ICP-MS	0.0681	0.0578	0.0367	0.145	0.0920

Based on the grading criteria for U in Urine, 100% of results were satisfactory, with 0 of the 14 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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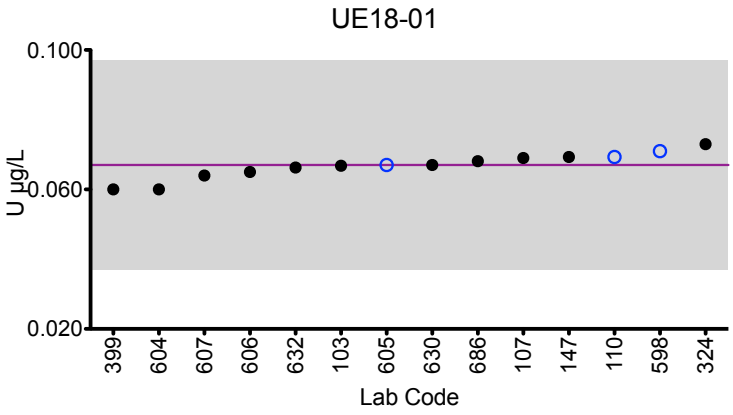
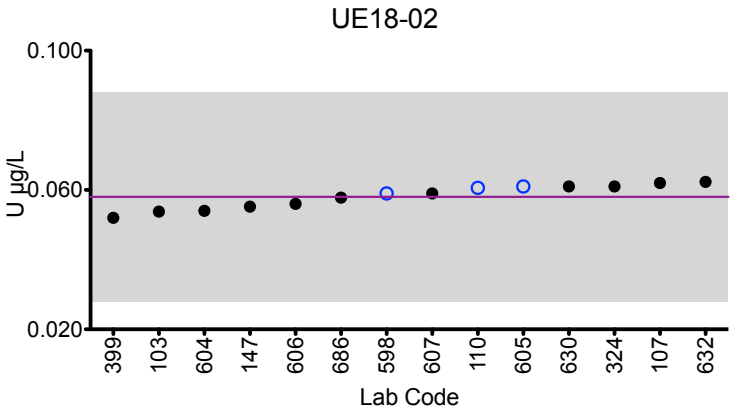
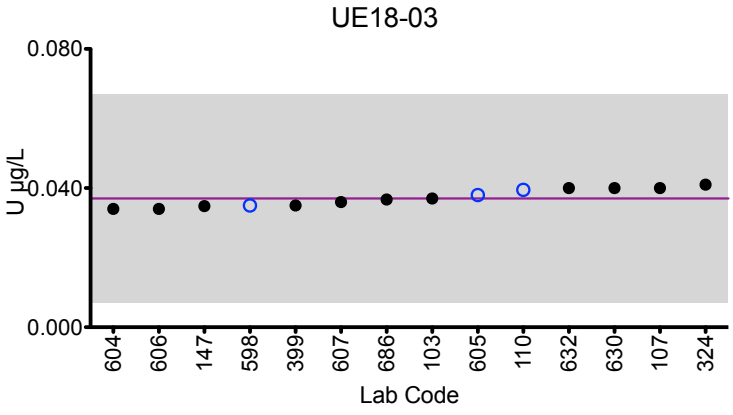
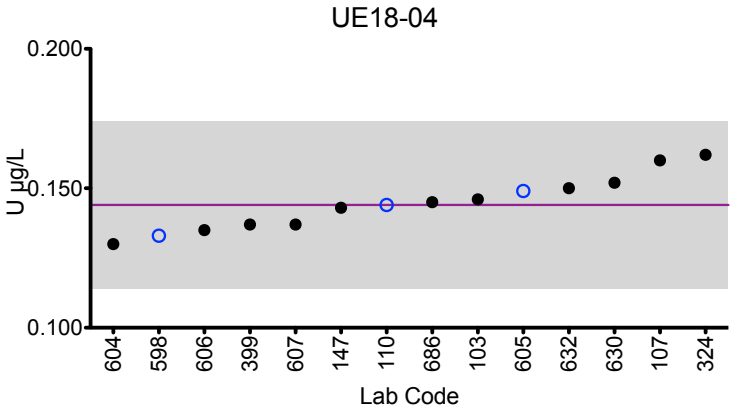
Results for Event #1, 2018: Summary Figures

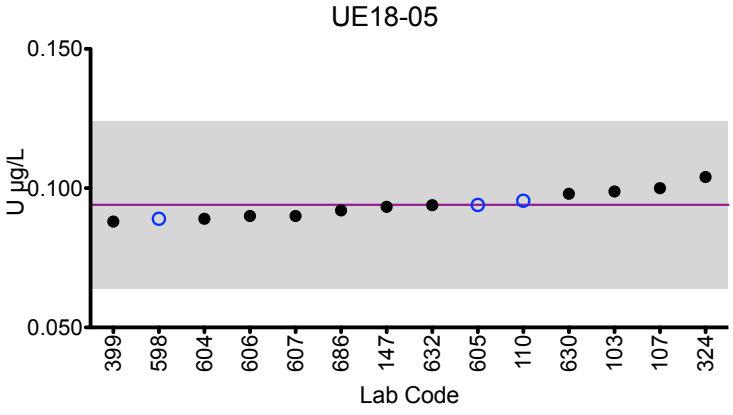
Urine U











Legend:

o CHEAR Labs ● Other Labs

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, 2018:
Laboratory Data and Summary Statistics

Urine Cs (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
107	DRC/CC-ICP-MS	5	5.5	2.6	6.3	4.4
110	ICP-MS	5.07	5.54	2.62	6.45	4.53
147	ICP-MS	5.29	5.74	2.84	6.95	4.86
399	ICP-MS	5.23	5.65	2.71	6.64	4.57
597	DRC/CC-ICP-MS	4.95	6.08	2.66	6.75	4.59
598	ICP-MS	4.70	5.42	2.53	6.50	4.50
599	DRC/CC-ICP-MS	4.925	5.475	2.636	6.243	4.398
605	ICP-MS	4.98	5.44	2.43	6.52	4.40
606	DRC/CC-ICP-MS	5.17	5.64	2.80	6.49	4.54
632	ICP-MS	5.40	6.04	2.90	6.86	4.89

Summary Statistics

	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Robust Mean (x*)	5.1	5.6	2.7	6.6	4.5
Robust SD (s*)	0.2	0.2	0.1	0.2	0.1
Robust RSD (%)	3.9	3.6	3.7	3.0	2.2
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (*u*)	0.079	0.078	0.059	0.098	0.058

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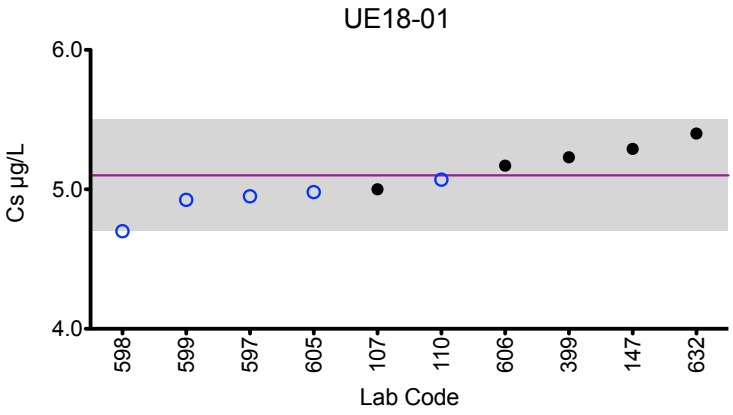
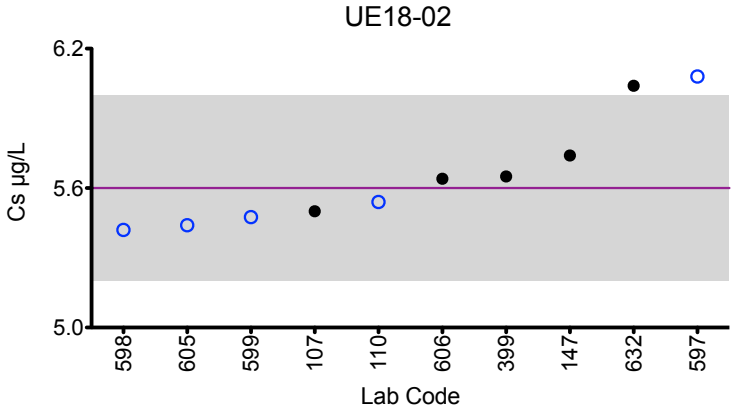
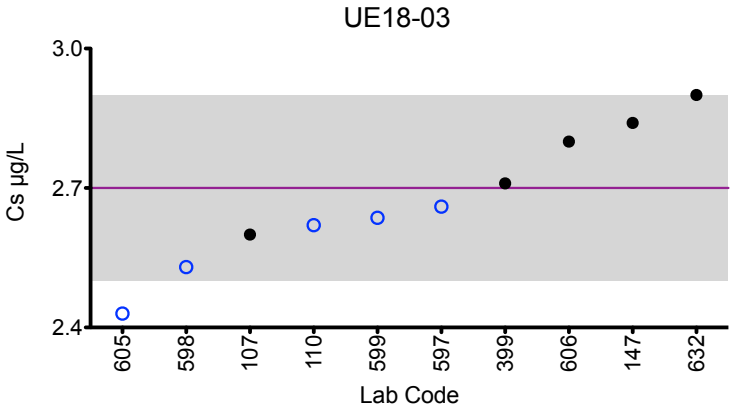
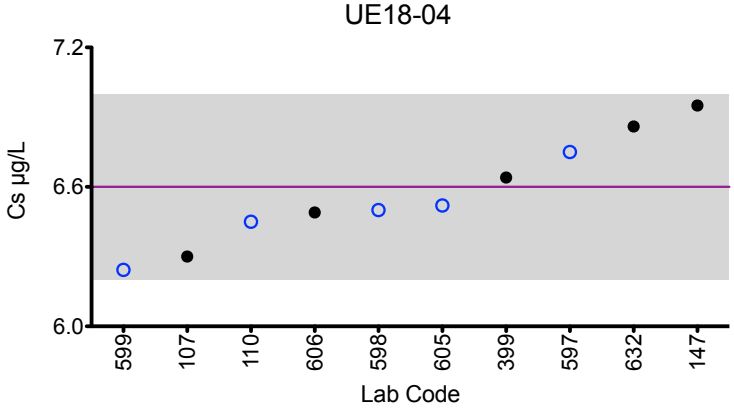
Results for Event #1, 2018: Summary Figures

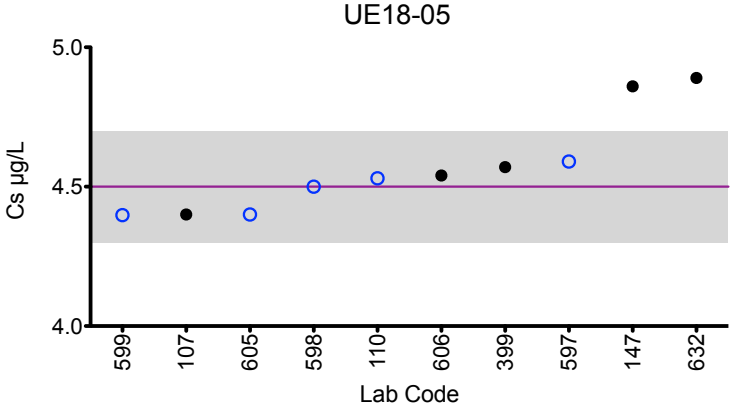
Urine Cs











Legend:
o CHEAR Labs ● Other Labs
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.

Results for Event #1, 2018: Laboratory Data and Summary Statistics

Urine Cu (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
110	ICP-MS	16.9	27.6	8.65	59.7	39.6
147	ICP-MS	17.8	27.8	9.47	62.8	41.2
293	DRC/CC-ICP-MS	21.6	26	7.6	57.9	38.1
324	ICP-MS	15.97	24.87	8.25	56.89	38.01
391	DRC/CC-ICP-MS	16.6	25.3	7.8	62.9	39.6
401	DRC/CC-ICP-MS	15.9	24.1	7.63	57.2	36.9
597	DRC/CC-ICP-MS	16.2	28.9	8.14	61.4	39.8
598	ICP-MS	14.1	22.7	7.9	55.2	36.4
599	DRC/CC-ICP-MS	14.12	22.38	<10	54.55	35.44
632	ICP-MS	18.0	29.7	9.79	61.6	43.0

Summary Statistics

	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Robust Mean (x*)	16.4	25.9	8.3	59.0	38.7
Robust SD (s*)	1.6	2.9	0.7	3.5	2.4
Robust RSD (%)	9.8	11.2	8.4	5.9	6.2
Number of Sample Measurements (N)	10	10	9	10	10
Standard Uncertainty (*u*)	0.645	1.13	0.308	1.38	0.937

An arithmetic mean, SD, RSD, and n are provided for sample UE18-03.

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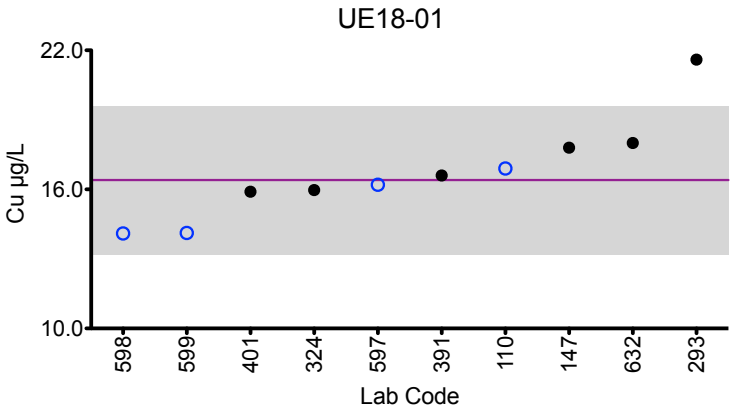
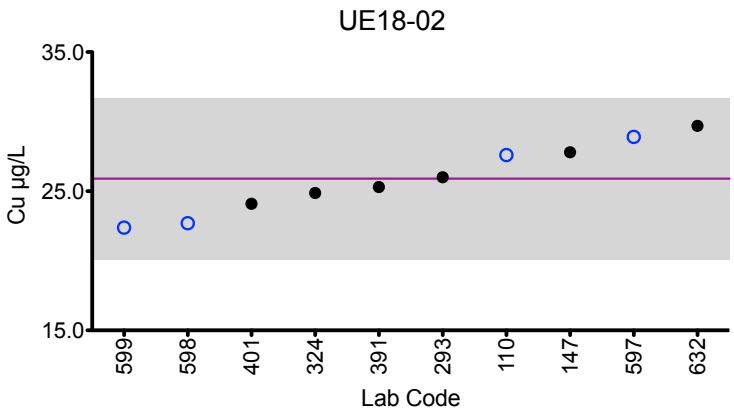
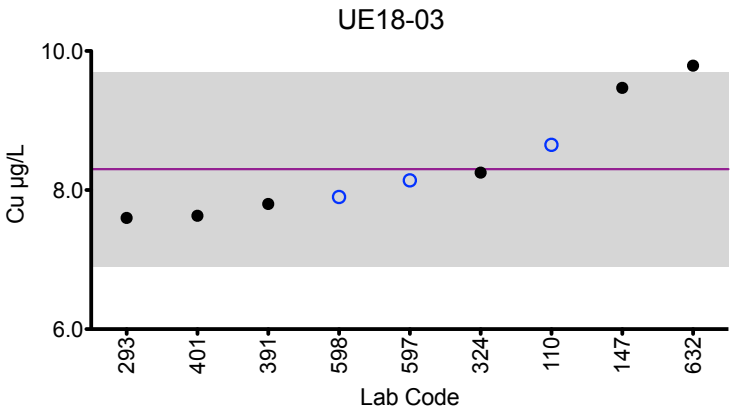
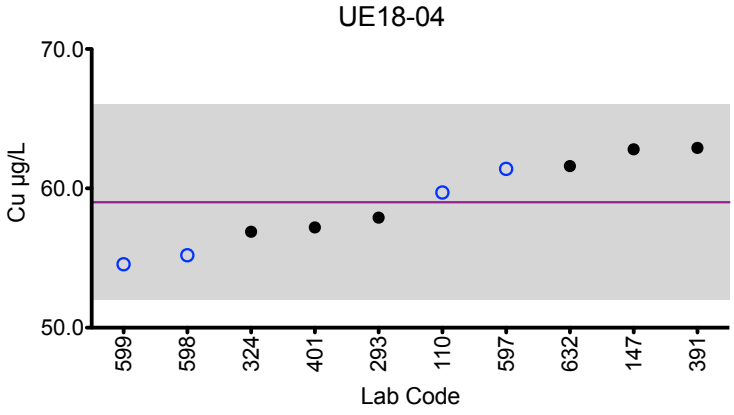
Results for Event #1, 2018: Summary Figures

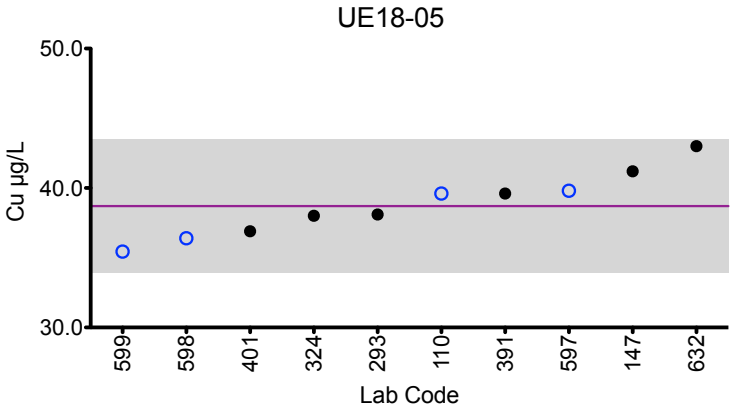
Urine Cu











Legend:
o CHEAR Labs ● Other Labs
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, 2018:
Laboratory Data and Summary Statistics

Urine Mo (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
103	DRC/CC-ICP-MS	27.9	50.9	44.0	21.9	16.5
107	DRC/CC-ICP-MS	27	51	43	21	16
110	ICP-MS	27.4	52.0	44.0	22.1	16.6
147	ICP-MS	27.3	49.3	42.8	21.2	16.1
293	DRC/CC-ICP-MS	29.3	47.4	41.5	20.6	16.9
324	ICP-MS	28.11	51.12	43.35	21.61	16.83
399	ICP-MS	28.0	51.6	43.8	21.7	16.6
597	DRC/CC-ICP-MS	24.7	51.8	38.8	19.3	14.1
598	DRC/CC-ICP-MS	27.4	50.7	41.7	20.7	16.0
599	DRC/CC-ICP-MS	26.59	50.42	43.32	21.21	15.68
605	ICP-MS	26.5	49.5	40.5	21.0	15.6
606	DRC/CC-ICP-MS	27.7	52.2	44.6	21.9	16.5
632	ICP-MS	29.2	55.0	47.3	23.3	17.9

Summary Statistics

	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Robust Mean (x*)	27.5	51.0	43.1	21.3	16.3
Robust SD (s*)	0.9	1.3	1.2	0.7	0.6
Robust RSD (%)	3.3	2.5	2.8	3.3	3.7
Number of Sample Measurements (N)	13	13	13	13	13
Standard Uncertainty (*u*)	0.319	0.445	0.428	0.248	0.205

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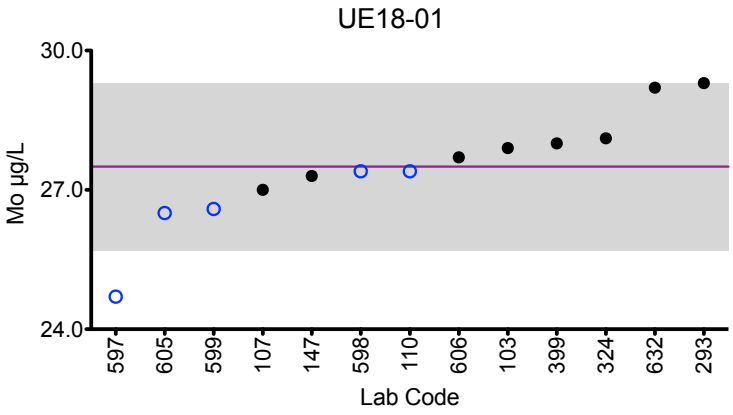
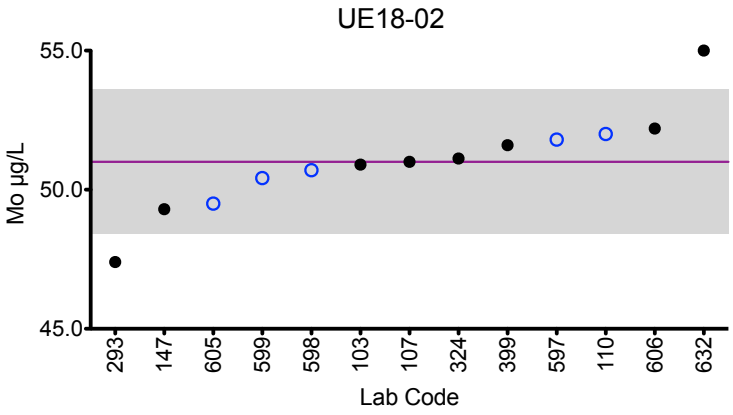
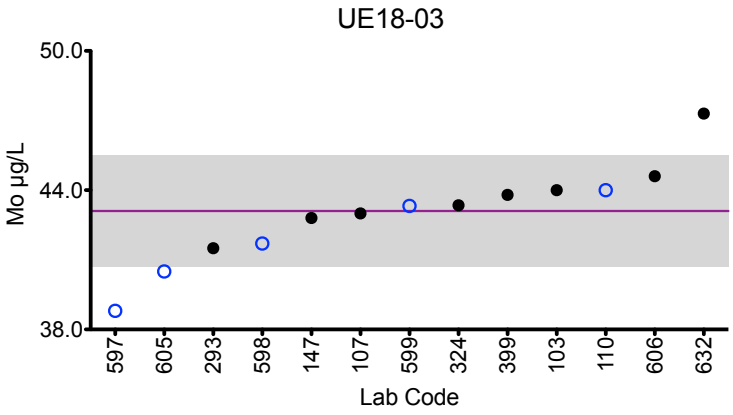
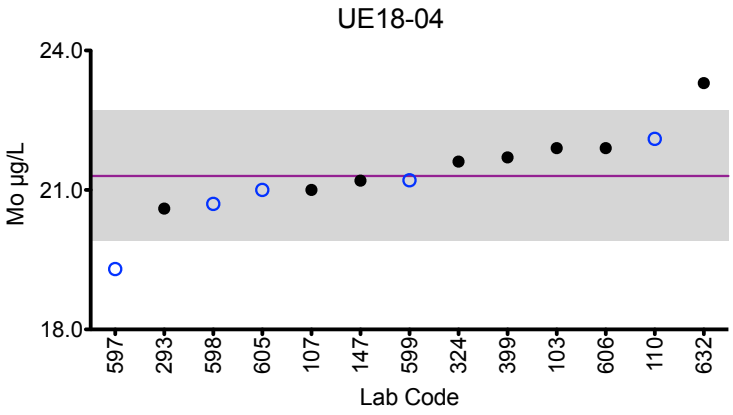
Results for Event #1, 2018: Summary Figures

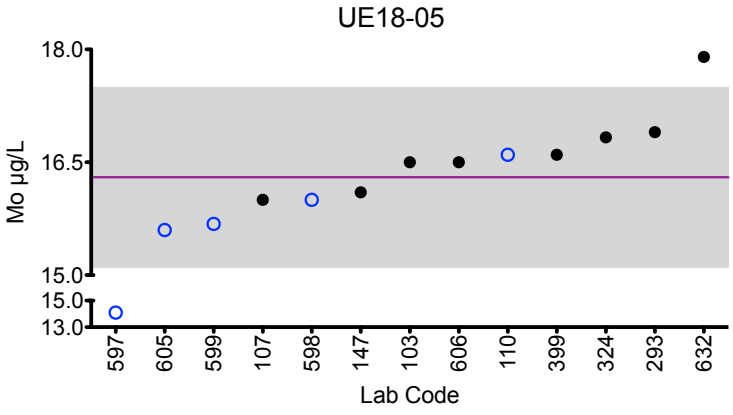
Urine Mo











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Results for Event #1, 2018: Laboratory Data and Summary Statistics

Urine Ni (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
107	DRC/CC-ICP-MS	3.5	4.6	1.9	1.8	1.3
110	ICP-MS	3.36	4.47	1.68	1.55	1.00
147	DRC/CC-ICP-MS	3.67	4.82	2.08	1.84	1.32
293	DRC/CC-ICP-MS	3.71	4.80	2.07	1.97	1.53
324	ICP-MS	3.85	5.49	2.29	2.11	1.60
391	DRC/CC-ICP-MS	8.4	8	5.9	5.9	*4.8
401	DRC/CC-ICP-MS	2.93	3.76	1.12	1.12	0.65
598	ICP-MS	2.92	3.96	1.70	1.63	1.21
599	DRC/CC-ICP-MS	3.647	3.969	1.478	1.245	<1
605	ICP-MS	3.44	4.69	1.88	1.84	1.21

Summary Statistics

	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Robust Mean (x*)	3.6	4.6	1.9	1.8	1.3
Robust SD (s*)	0.3	0.7	0.4	0.4	0.3
Robust RSD (%)	8.3	15.2	21.1	22.2	23.1
Number of Sample Measurements (N)	10	10	10	10	8
Standard Uncertainty (*u*)	0.118	0.276	0.140	0.147	0.119

An arithmetic mean, SD, RSD, and n are provided for sample UE18-05.

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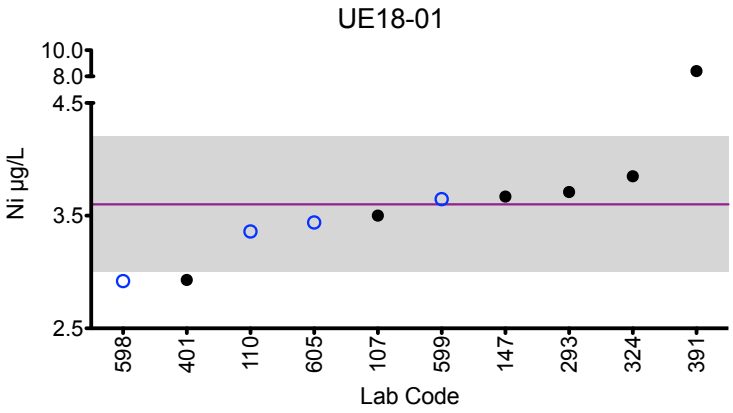
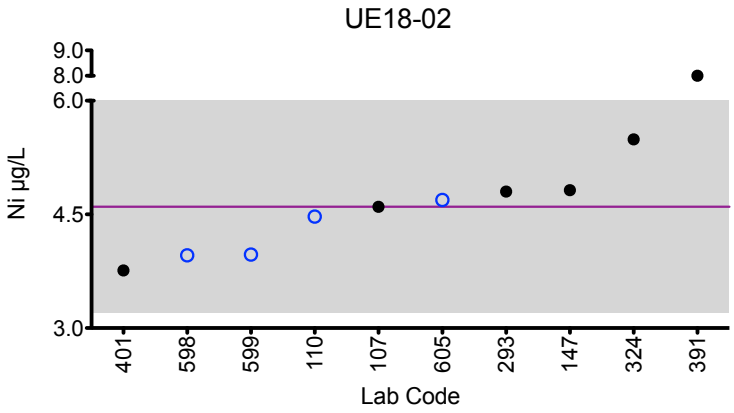
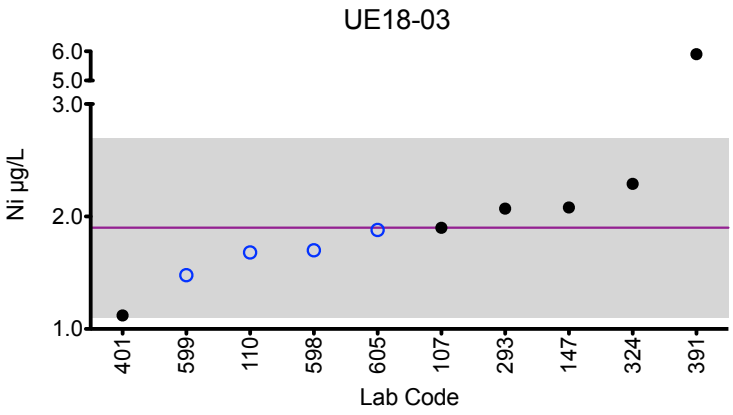
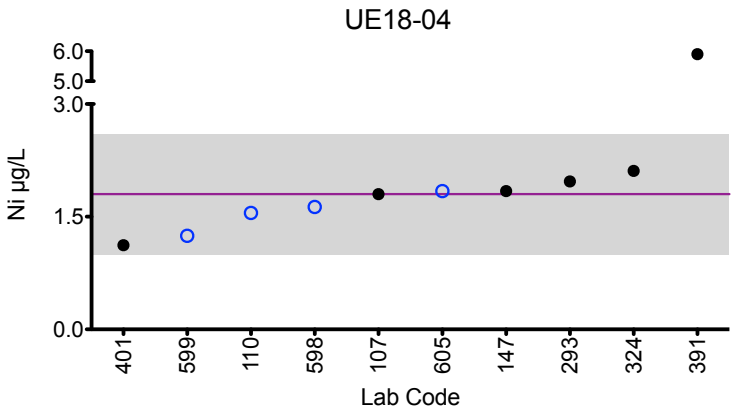
Results for Event #1, 2018: Summary Figures

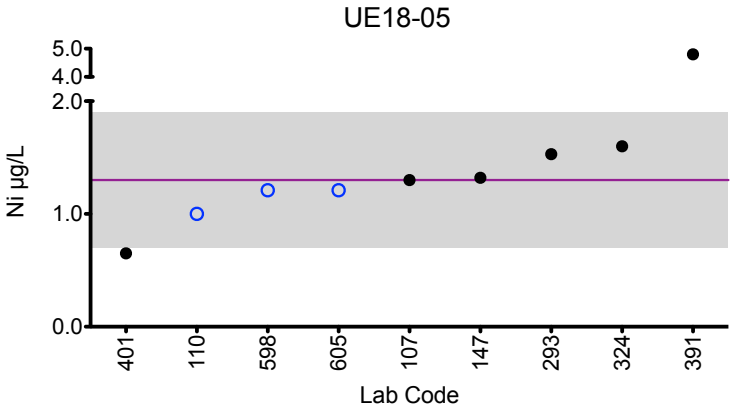
Urine Ni











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Urine Pt (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
107	DRC/CC-ICP-MS	0.44	2.1	0.58	0.56	0.38
110	ICP-MS	0.425	2.13	0.546	0.538	0.334
147	ICP-MS	0.416	2.01	0.521	0.517	0.316
399	ICP-MS	0.440	2.15	0.585	0.565	0.357
598	ICP-MS	*0.38	*1.77	0.48	0.51	0.33
605	ICP-MS	0.439	2.20	0.579	0.563	0.356
632	ICP-MS	0.426	2.16	0.573	0.541	0.339

Summary Statistics

	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Arithmetic Mean ($\bar{x}$)	0.43	2.13	0.55	0.54	0.34
Arithmetic SD (s)	0.01	0.07	0.04	0.02	0.02
Arithmetic RSD (%)	2.3	3.3	7.3	3.7	5.9
Number of Sample Measurements (N)	6	6	7	7	7

*Denotes a statistical Outlier.

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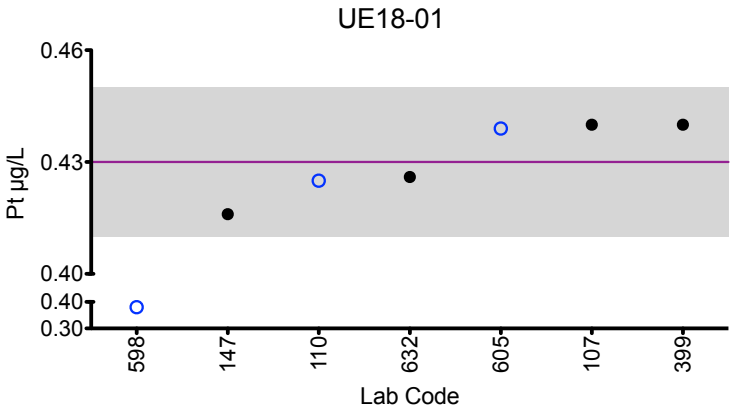
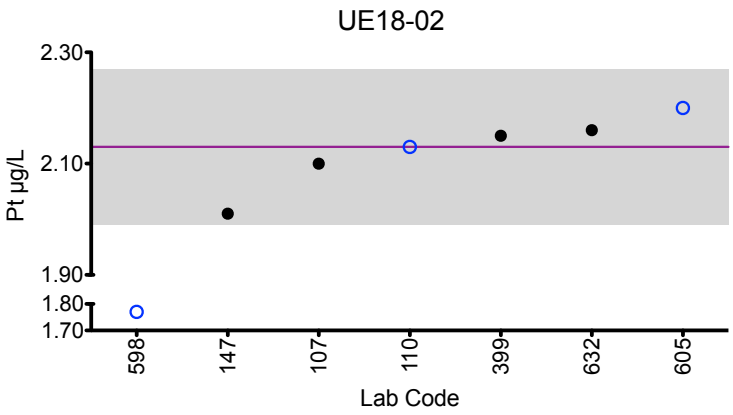
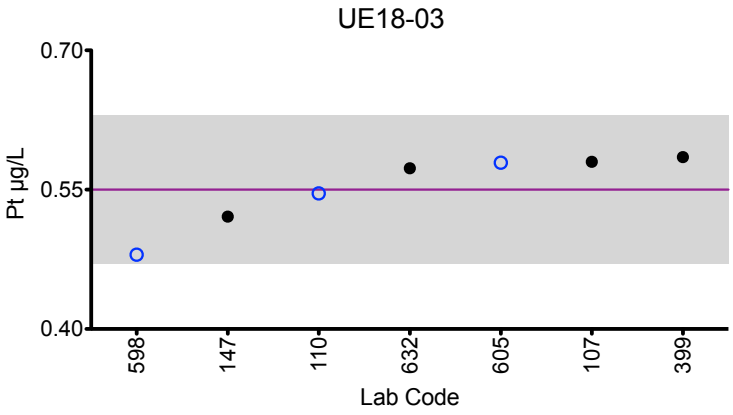
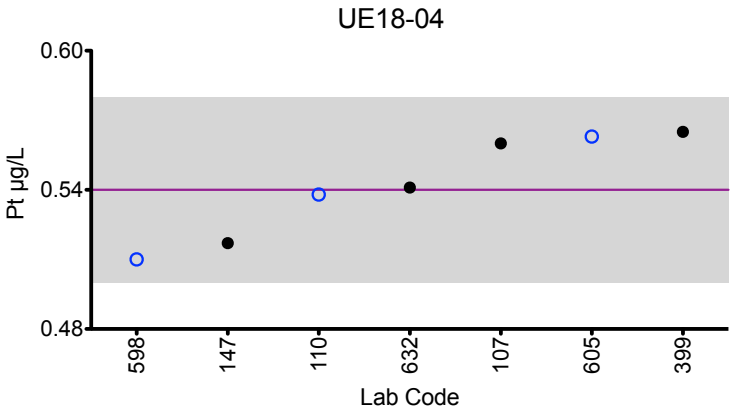
Results for Event #1, 2018: Summary Figures

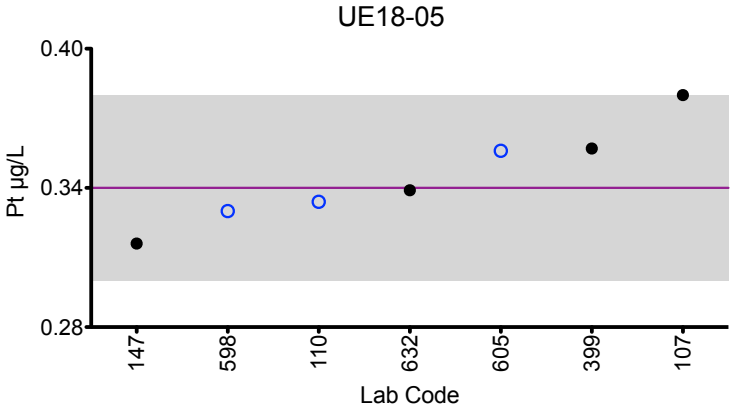
Urine Pt











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Urine Sb (µg/L)

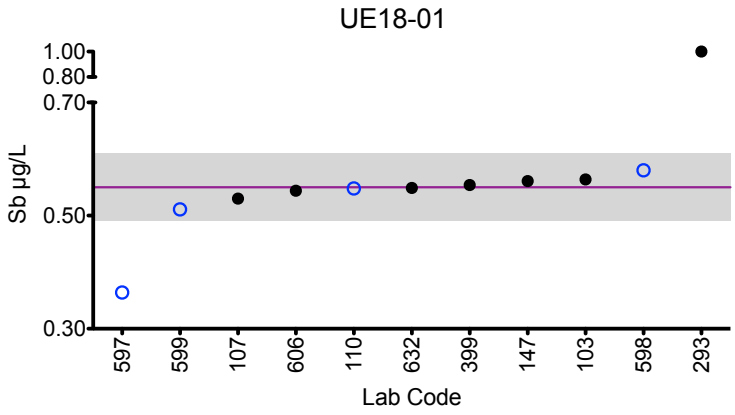
Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
103	DRC/CC-ICP-MS	0.564	0.307	0.838	1.07	0.696
107	DRC/CC-ICP-MS	0.53	0.35	0.8	1.1	0.73
110	ICP-MS	0.548	0.324	0.801	1.09	0.731
147	ICP-MS	0.561	0.329	0.884	1.14	0.810
293	DRC/CC-ICP-MS	1	0.4	0.9	1.2	0.9
399	ICP-MS	0.554	0.349	0.853	1.20	0.736
597	DRC/CC-ICP-MS	0.364	0.148	0.734	1.101	0.617
598	ICP-MS	0.58	0.4	0.89	1.18	0.77
599	DRC/CC-ICP-MS	0.511	0.287	0.843	1.156	0.584
606	DRC/CC-ICP-MS	0.544	0.332	0.872	1.11	0.745
632	ICP-MS	0.549	0.363	0.869	1.17	0.737

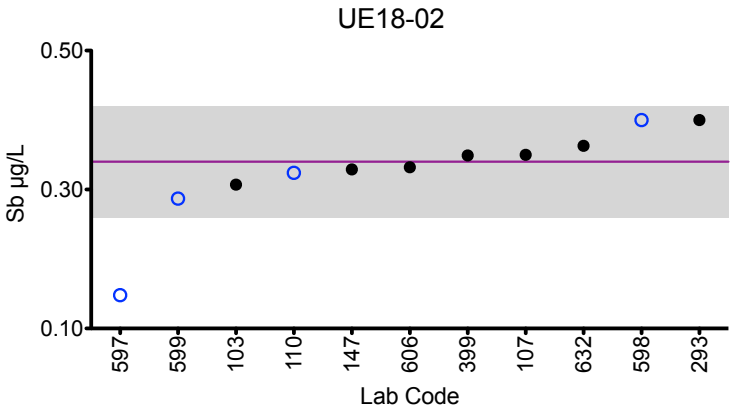
Summary Statistics

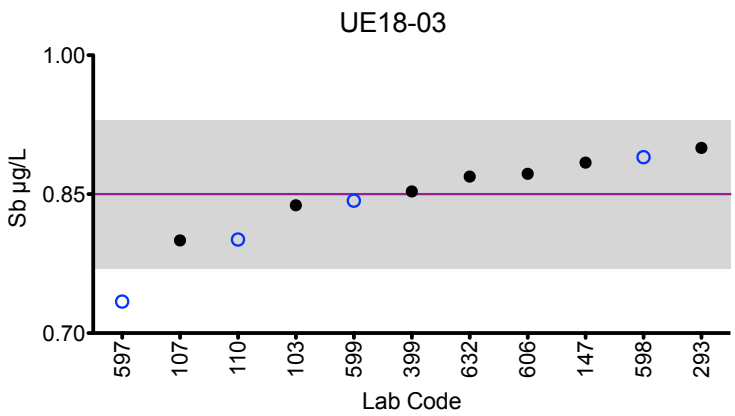
	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Robust Mean (x*)	0.55	0.34	0.85	1.14	0.74
Robust SD (s*)	0.03	0.04	0.04	0.05	0.06
Robust RSD (%)	5.5	11.8	4.7	4.4	8.1
Number of Sample Measurements (N)	11	11	11	11	11
Standard Uncertainty (*u*)	0.0096	0.016	0.017	0.020	0.022

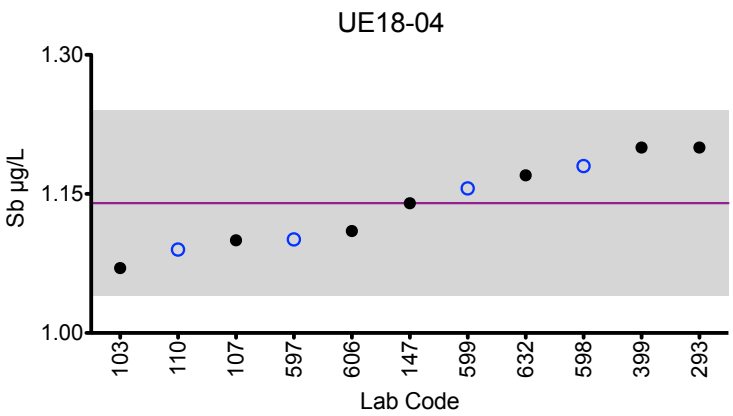
Results for Event #1, 2018: Summary Figures

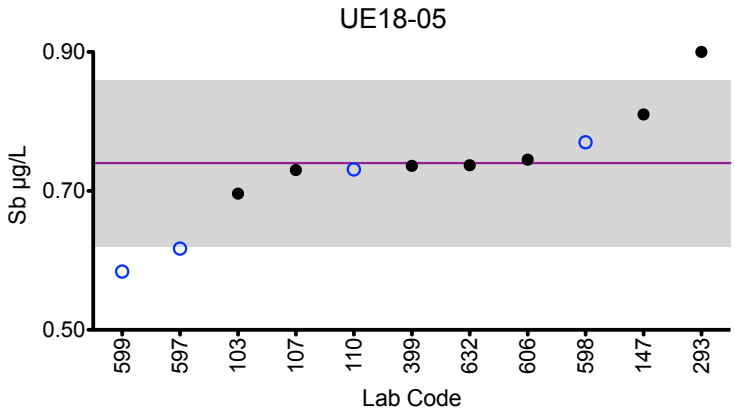
Urine Sb











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Urine Se (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
103	DRC/CC-ICP-MS	39.6	77.1	112	22.4	16.8
110	ICP-MS	18.5	69.9	89.6	21.1	16.6
147	ICP-MS	22.4	83.7	94.8	25.2	18.7
597	DRC/CC-ICP-MS	21.5	88.8	94.3	24.6	18.6
598	DRC/CC-ICP-MS	55.5	51.9	104.4	20.9	15.2
599	DRC/CC-ICP-MS	23.37	64.77	107.7	14.85	18.20
632	DRC/CC-ICP-MS	31.1	74.7	102	23.8	18.8

Summary Statistics

	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Arithmetic Mean ($\bar{x}$)	30.3	73.0	101	21.8	17.6
Arithmetic SD (s)	13.2	12.3	8	3.5	1.4
Arithmetic RSD (%)	44	16.8	7.9	16.1	8.0
Number of Sample Measurements (N)	7	7	7	7	7

*Denotes a statistical Outlier.

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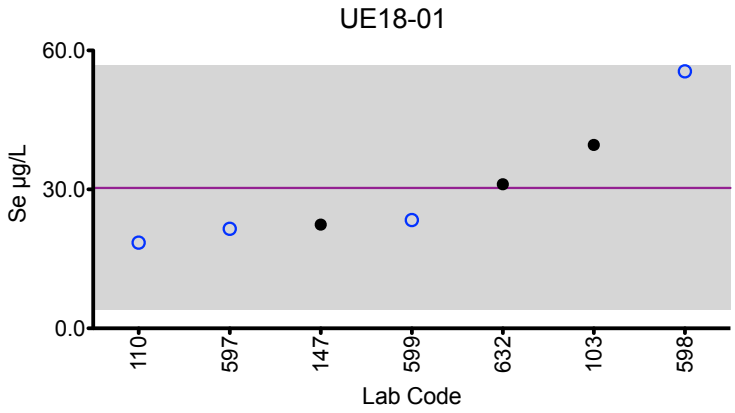
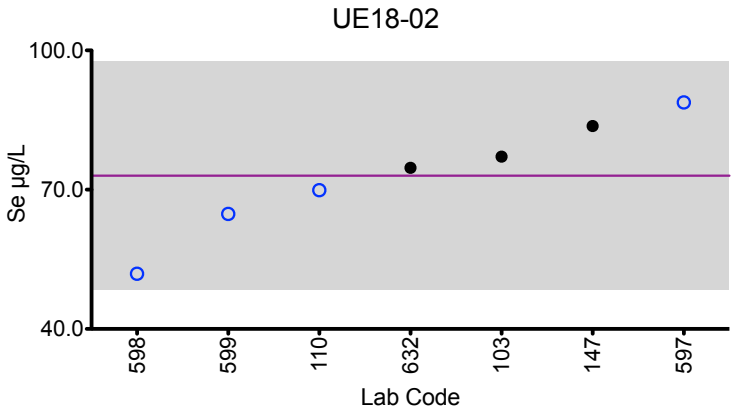
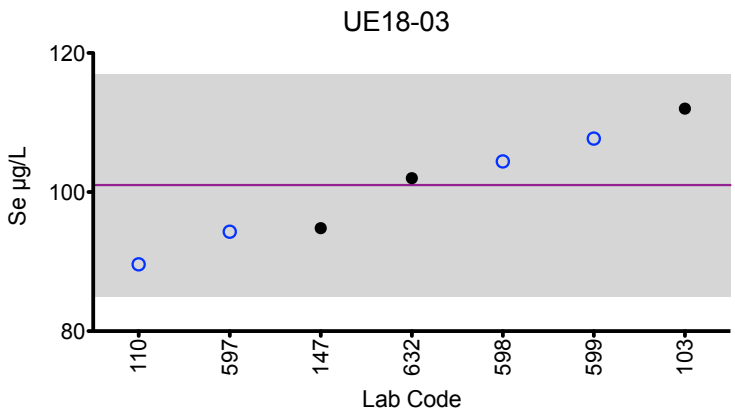
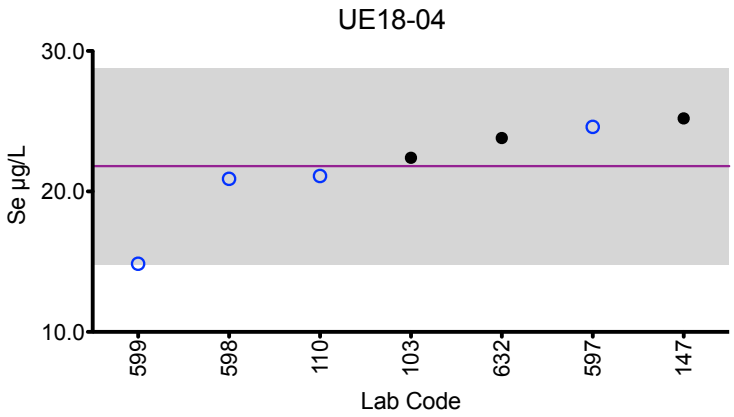
Results for Event #1, 2018: Summary Figures

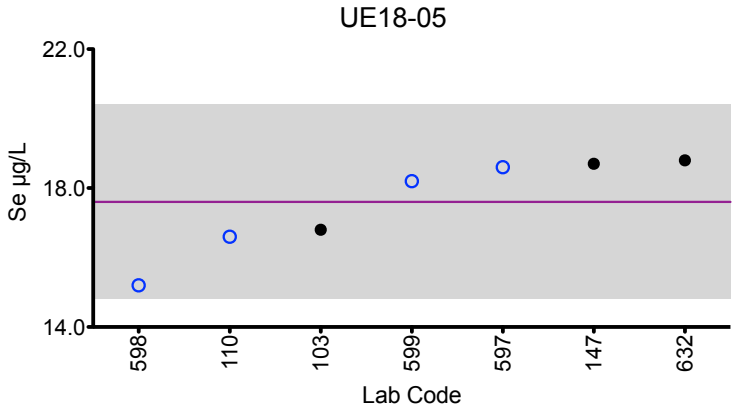
Urine Se











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Urine Sn (µg/L)						
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
107	DRC/CC-ICP-MS	6.7	1.7	1	3.6	2.6
110	ICP-MS	6.37	1.60	0.90	3.34	2.41
147	ICP-MS	6.50	1.69	0.969	3.52	2.54
399	ICP-MS	6.68	1.65	1.01	3.53	2.51
598	ICP-MS	6.42	1.69	0.87	3.59	2.53
599	DRC/CC-ICP-MS	6.739	1.670	1.024	3.346	2.559
Summary Statistics						
		UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Arithmetic Mean ($\bar{x}$)		6.57	1.67	0.96	3.49	2.52
Arithmetic SD (s)		0.16	0.04	0.06	0.12	0.06
Arithmetic RSD (%)		2.4	2.4	6.3	3.4	2.4
Number of Sample Measurements (N)		6	6	6	6	6

*Denotes a statistical Outlier.

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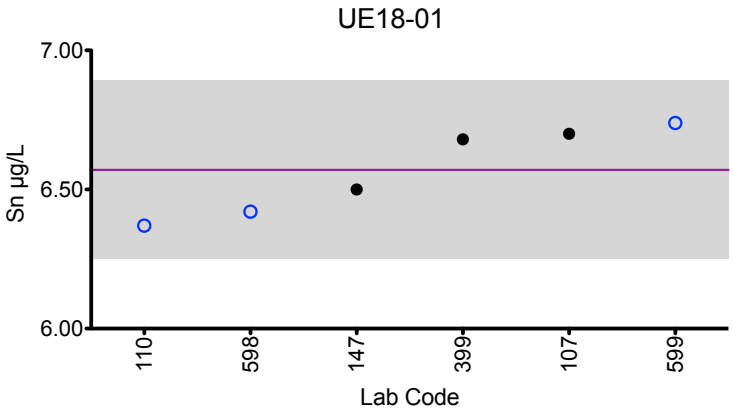
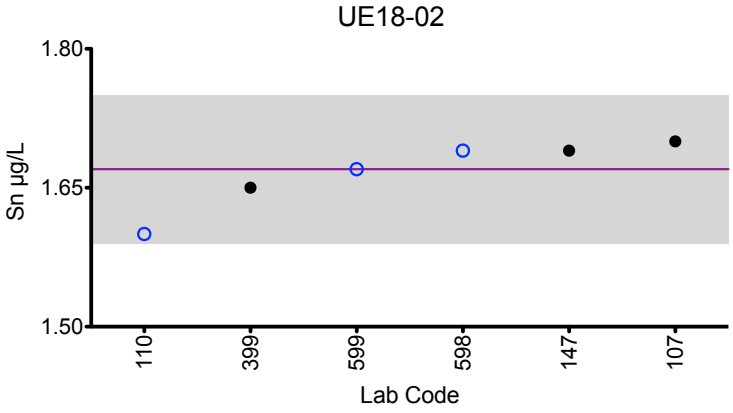
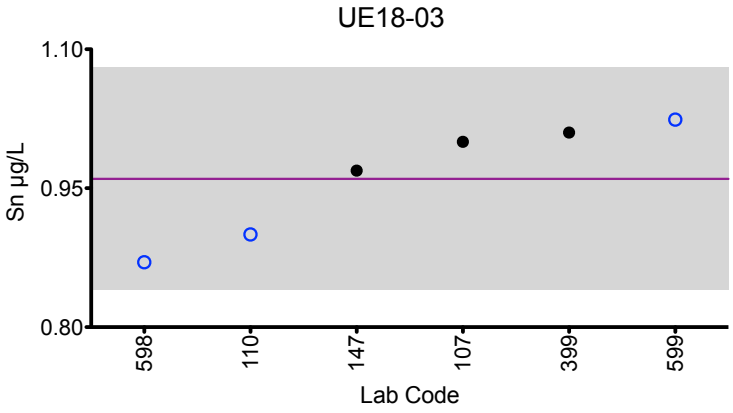
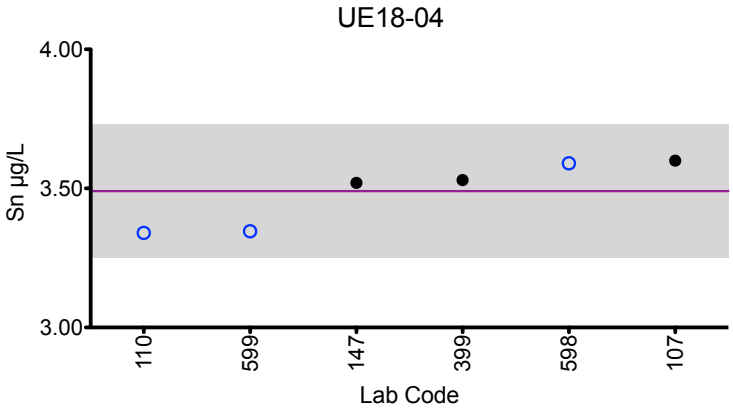
Results for Event #1, 2018: Summary Figures

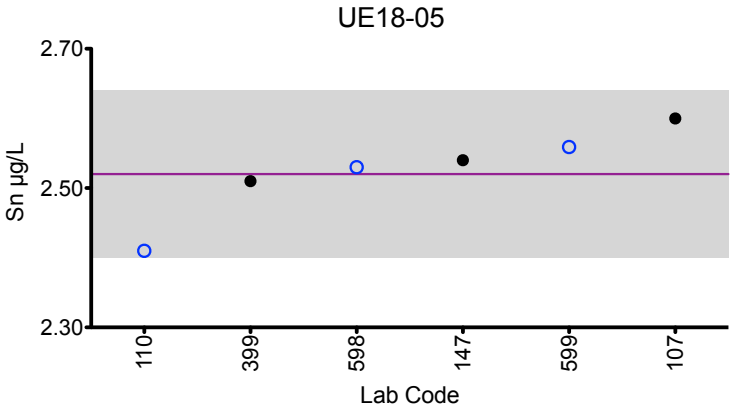
Urine Sn











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Urine Sr (µg/L)						
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
103	DRC/CC-ICP-MS	27.7	134	28.3	21.3	20.7
107	DRC/CC-ICP-MS	28	140	29	23	23
200	ICP-MS	28.0	140.0	28.9	22.8	23.7
399	DRC/CC-ICP-MS	28.3	138	28.6	21.8	22.0
605	ICP-MS	24.0	134	24.4	18.7	<18
Summary Statistics						
		UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Arithmetic Mean ($\bar{x}$)		27.2	137	27.8	21.5	22.4
Arithmetic SD (s)		1.8	3	1.9	1.7	1.3
Arithmetic RSD (%)		6.6	2.2	6.8	7.9	5.8
Number of Sample Measurements (N)		5	5	5	5	4

*Denotes a statistical Outlier.

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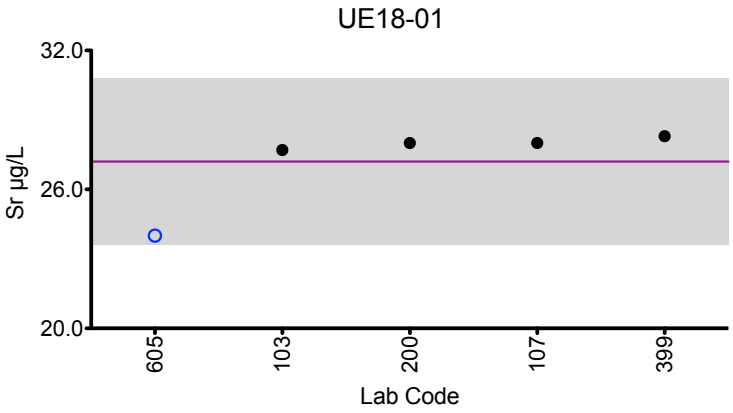
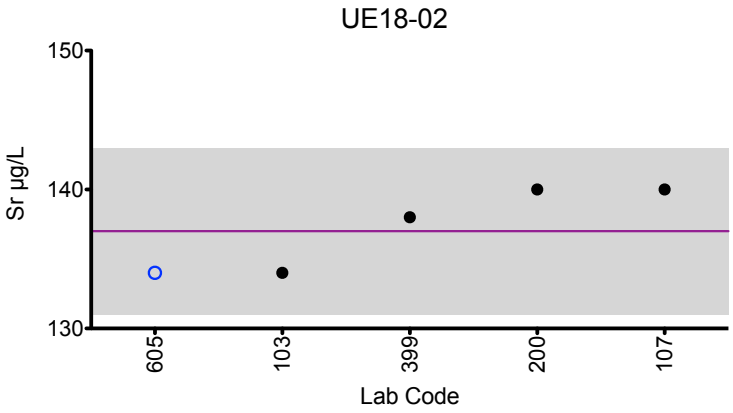
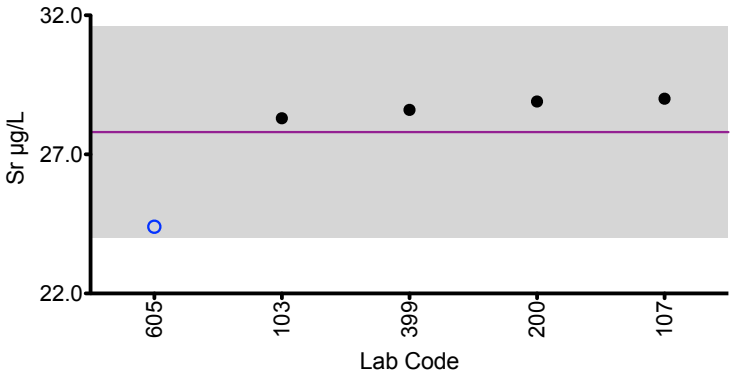
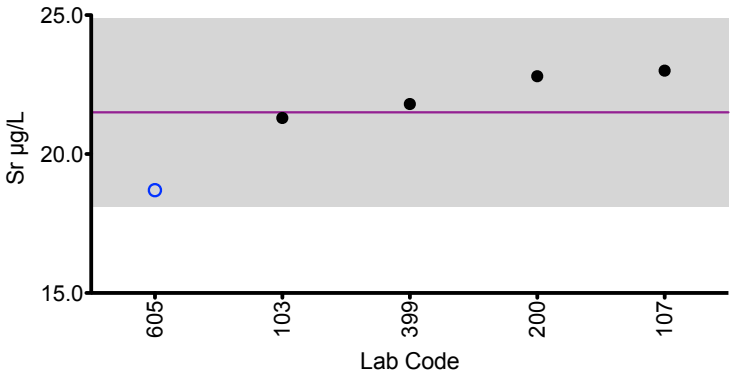
Results for Event #1, 2018: Summary Figures

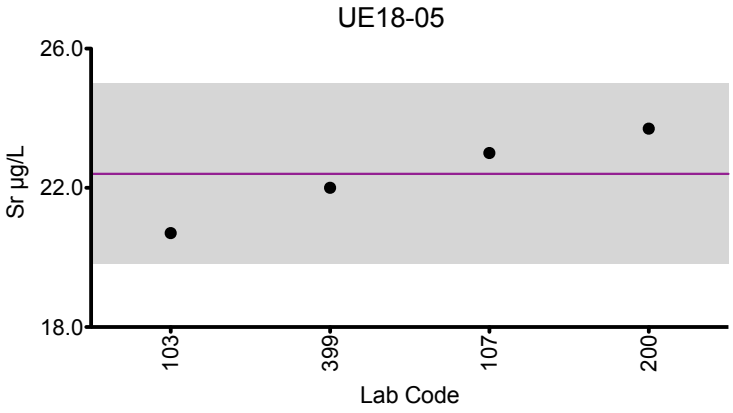
Urine Sr











Legend:
o CHEAR Labs ● Other Labs
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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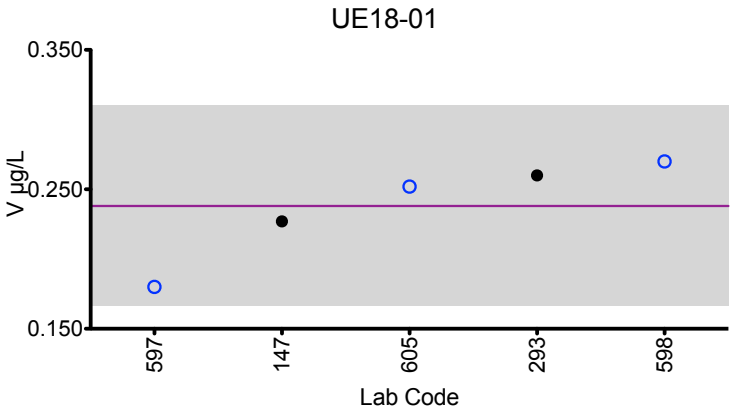
Results for Event #1, 2018:
Laboratory Data and Summary Statistics

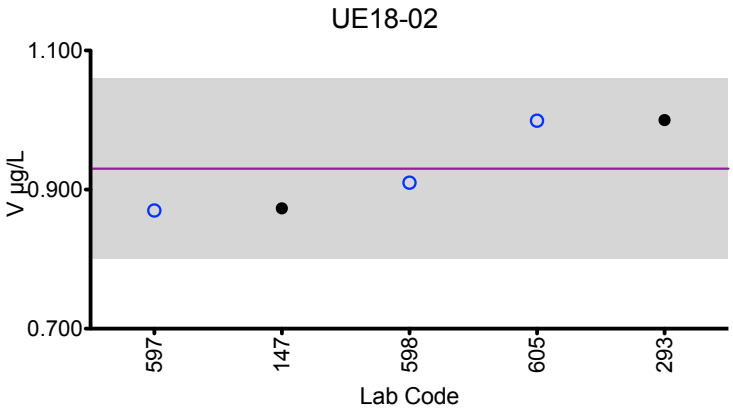
Urine V (µg/L)						
Lab Code	**Method**	**UE18-01**	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
147	DRC/CC-ICP-MS	0.227	0.873	0.868	1.22	0.802
293	DRC/CC-ICP-MS	0.26	1.0	0.89	1.18	0.97
597	DRC/CC-ICP-MS	0.180	0.870	0.780	1.06	0.704
598	DRC/CC-ICP-MS	0.27	0.91	0.83	1.06	0.75
605	ICP-MS	0.252	0.999	0.798	1.12	0.760
Summary Statistics						
		UE18-01	**UE18-02**	**UE18-03**	**UE18-04**	**UE18-05**
Arithmetic Mean ($\bar{x}$)		0.238	0.930	0.833	1.13	0.797
Arithmetic SD (s)		0.036	0.065	0.046	0.07	0.103
Arithmetic RSD (%)		15.1	7.0	5.5	6.2	12.9
Number of Sample Measurements (N)		5	5	5	5	5

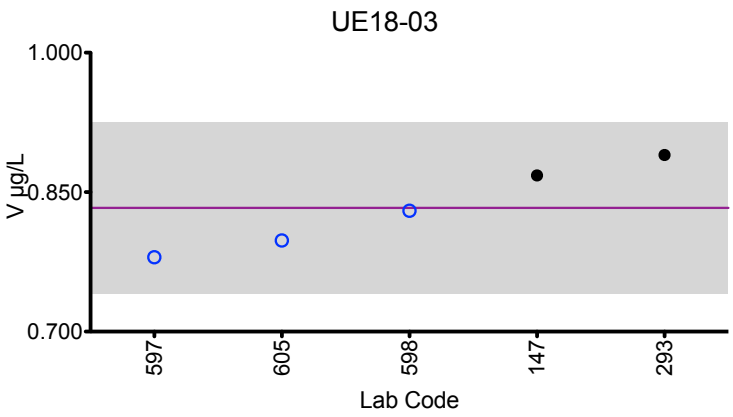
*Denotes a statistical Outlier.

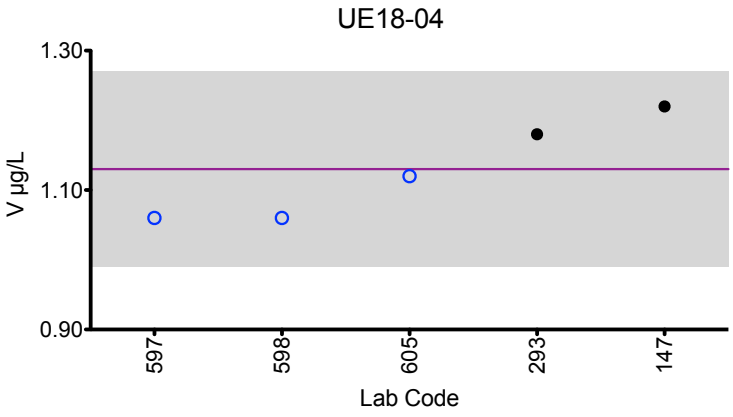
Results for Event #1, 2018:
Summary Figures

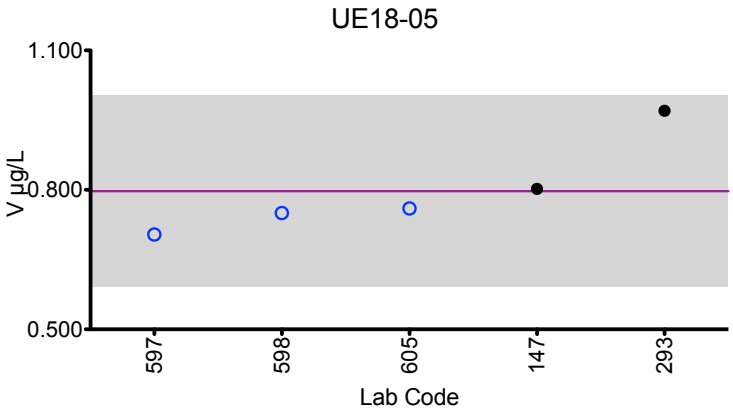
Urine V











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o CHEAR Labs ● Other Labs
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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Urine W (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
107	DRC/CC-ICP-MS	0.55	0.34	0.31	1.2	0.77
110	ICP-MS	0.662	0.493	0.350	1.26	0.823
147	ICP-MS	0.530	0.305	0.342	1.22	0.787
200	ICP-MS	*0.20	*0.70	*0.10	0.6	*0.40
324	ICP-MS	<1	<1	<1	1.11	<1
399	ICP-MS	0.567	0.314	0.299	1.19	0.8
598	ICP-MS	0.49	0.35	0.31	1.27	0.77
605	ICP-MS	0.550	0.299	0.343	1.25	0.791
606	DRC/CC-ICP-MS	0.578	0.315	0.349	1.22	0.793
632	ICP-MS	0.582	0.323	0.327	1.22	0.807

Summary Statistics

	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Arithmetic Mean ($\bar{x}$)	0.56	0.34	0.33	1.15	0.79
Arithmetic SD (s)	0.05	0.06	0.02	0.20	0.02
Arithmetic RSD (%)	8.9	17.6	6.1	17.4	2.5
Number of Sample Measurements (N)	8	8	8	10	8

*Denotes a statistical Outlier.

A robust mean, SD, RSD, and n are provided for sample UE18-04.

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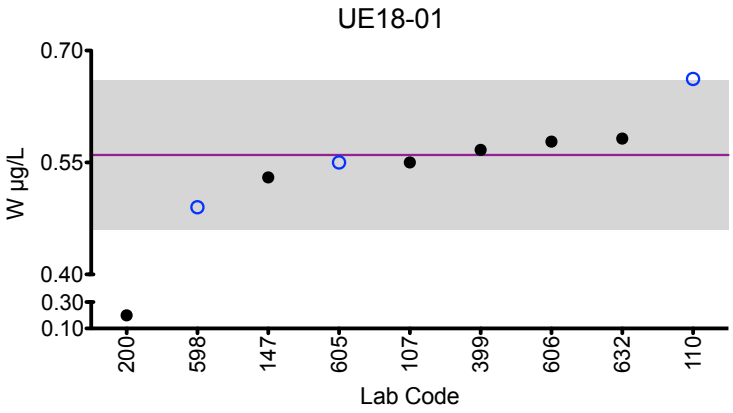
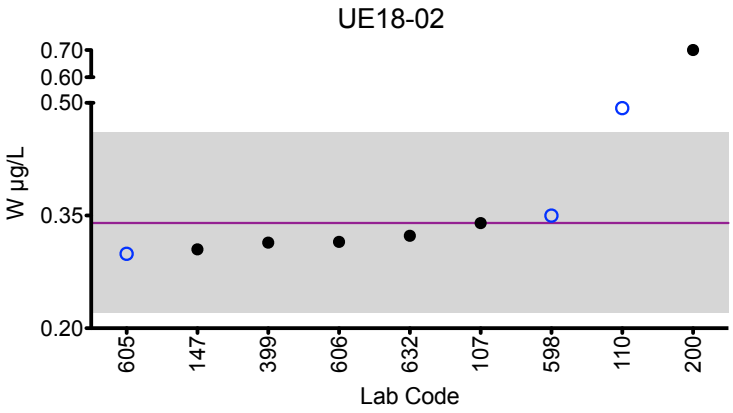
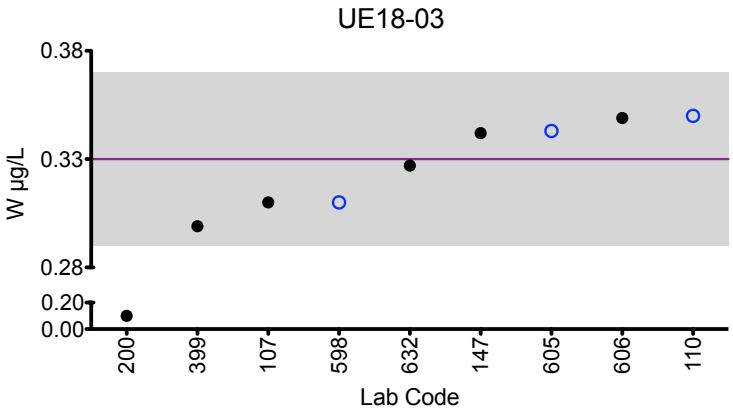
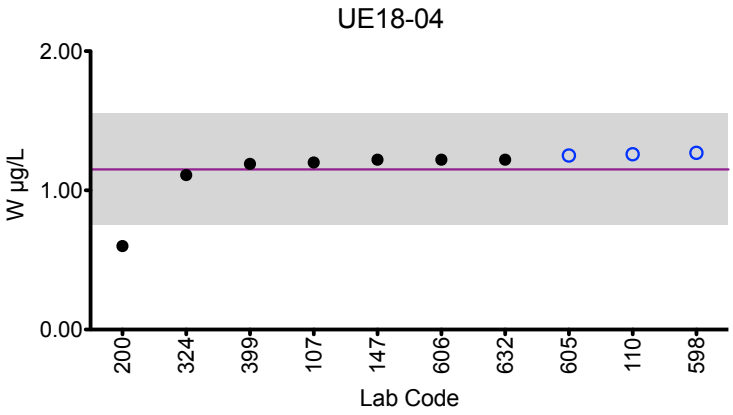
Results for Event #1, 2018: Summary Figures

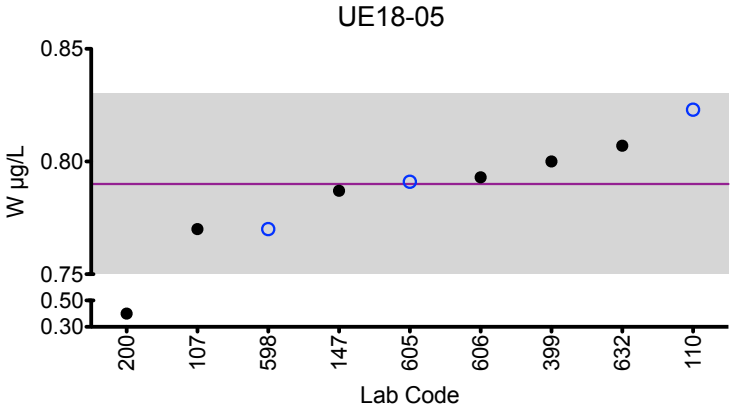
Urine W











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Gray area = ±2SD of the mean.

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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Urine Zn (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
110	ICP-MS	731	338	129	127	109
147	ICP-MS	835	367	149	141	118
293	DRC/CC-ICP-MS	769	345.8	115.0	127.5	118.3
324	ICP-MS	692.02	317.81	125.56	118.95	101.43
401	DRC/CC-ICP-MS	752	347	124	118	98
597	DRC/CC-ICP-MS	744	394	132	129	115
598	ICP-MS	569	245	104	105	87.2
599	DRC/CC-ICP-MS	688.1	311.9	87.68	*76.26	*50.83
632	ICP-MS	760	368	140	131	112

Summary Statistics

	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
Arithmetic Mean ($\bar{x}$)	727	337	123	125	107
Arithmetic SD (s)	73	43	19	11	11
Arithmetic RSD (%)	10.0	12.8	15.4	8.8	10.3
Number of Sample Measurements (N)	9	9	9	8	8

*Denotes a statistical Outlier.

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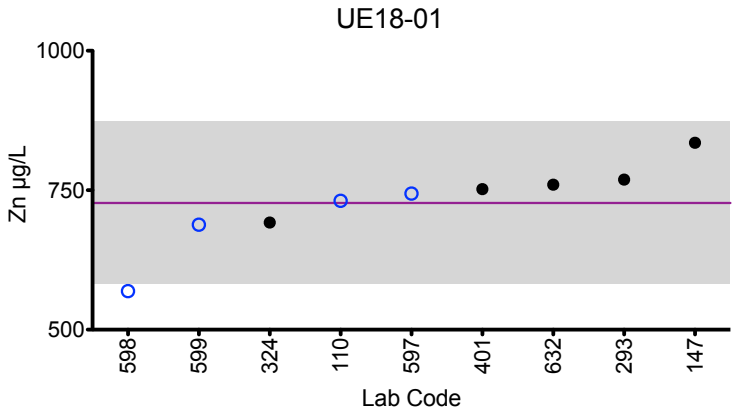
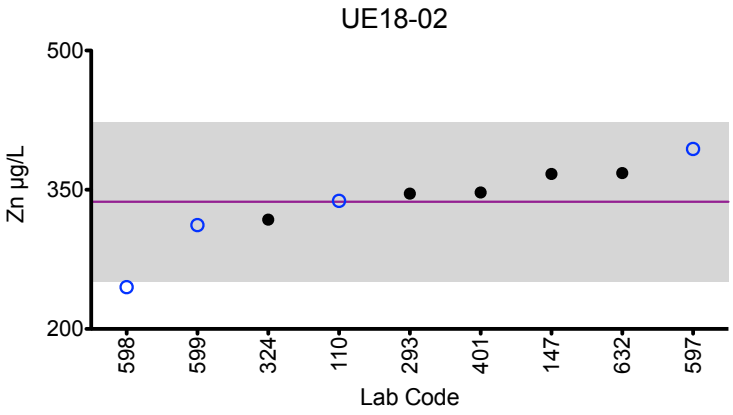
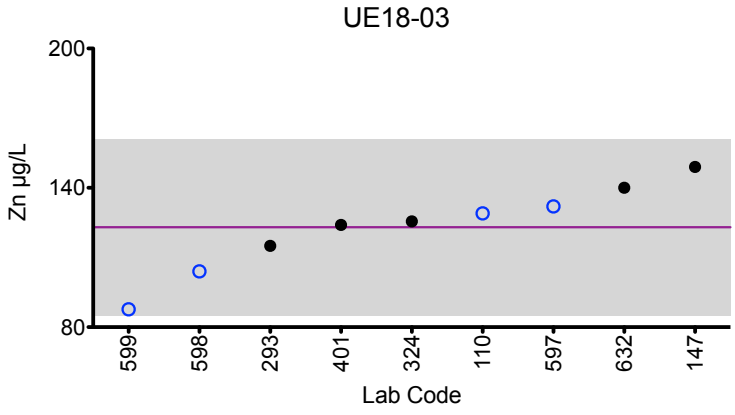
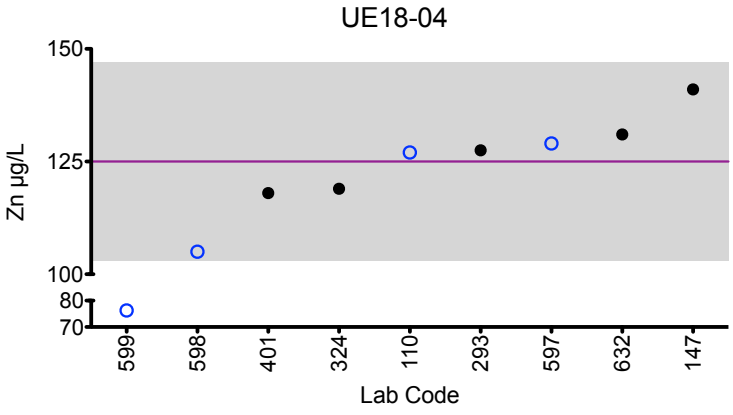
Results for Event #1, 2018: Summary Figures

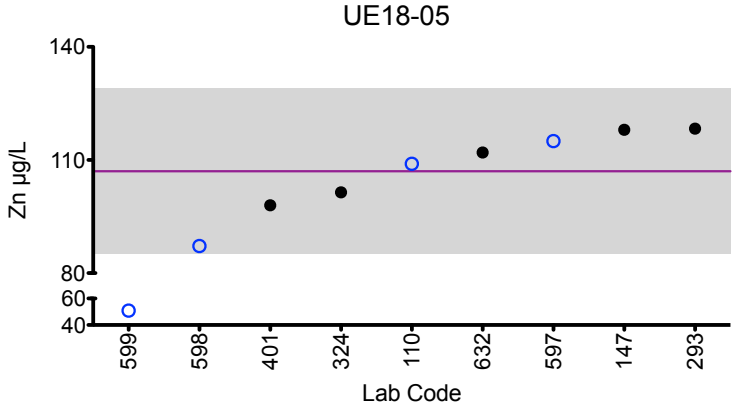
Urine Zn











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Results for Event #1, 2018: Additional Elements in Urine

Urine Ag (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
147	ICP-MS	< 0.302	< 0.302	< 0.302	< 0.302	< 0.302

Urine Al (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
147	DRC/CC-ICP-MS	<13.8	<13.8	<13.8	<13.8	<13.8
324	ICP-MS	7.54	8.44	12.30	10.18	8.35
597	DRC/CC-ICP-MS	6.97	9.16	19.8	15.28	9.43

Urine B (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
200	ICP-MS	187	1069	187	162	162

Urine Bi (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
147	ICP-MS	< 0.230	< 0.230	< 0.230	< 0.230	< 0.230

Urine Fe (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
324	ICP-MS	11.07	7.89	3.72	2.73	2.87
598	DRC/CC-ICP-MS	3.6	5.6	3.6	2.7	2.5

Urine I (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
107	DRC/CC-ICP-MS	54	43	54	26	26

Urine Li (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
147	ICP-MS	8.26	38.7	8.26	5.88	5.91

Urine Mg (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
597	DRC/CC-ICP-MS	17300	51700	18000	16000	15600

Urine Te (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
110	ICP-MS	0.752	0.997	0.300	1.02	0.652

Urine Th (µg/L)

Lab Code	Method	UE18-01	UE18-02	UE18-03	UE18-04	UE18-05
147	ICP-MS	< 0.00557	< 0.00557	< 0.00557	< 0.0057	< 0.0057

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Event #1, 2018

Trace Elements in Serum

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

Event #1, 2018:
Trace Elements in Serum

PT Materials

Test materials were prepared from human serum obtained from Zen-Bio, 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), cobalt (Co), chromium (Cr), copper (Cu), selenium (Se), zinc, (Zn), arsenic (As), beryllium (Be), cadmium (Cd), mercury (Hg), manganese (Mn), molybdenum (Mo), nickel (Ni), lead (Pb), platinum (Pt), antimony (Sb), tin (Sn), strontium (Sr), titanium (Ti), thallium (Tl), uranium (U), vanadium (V) and tungsten (W). 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 thawed at 4°C prior to circulation to laboratories for analysis.

Graded Elements

Six elements in serum are formally graded: Al, Co, Cr, Cu, Se, and Zn. 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) if a robust mean is not possible, the arithmetic mean after outlier deletion.

Additional Elements

An additional 29 were reported by at least one participant: Ag, As, B, Ba, Be, Bi, Ca, Cd, Cs, Fe, Hg, I, Li, Mg, 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.

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Results for Event #1, 2018: Summary Statistics

	Serum Al (µg/L)				
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Target (Arithmetic Mean ($\bar{x}$))	150	36.5	86.2	201	11.8
Upper Limit	180	43.8	103.4	241	16.8
Lower Limit	120	29.2	69.0	161	6.8
Arithmetic SD (s)	16	3.0	7.2	27	2.5
Arithmetic RSD (%)	10.7	8.2	8.4	13.4	21.2
Number of Sample Measurements (N)	7	6	6	7	6

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.

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Results for Event #1, 2018:
Performance of Participating Laboratories

		Serum Al (µg/L)				
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
	Target	**150**	**36.5**	**86.2**	**201**	**11.8**
147	ETAAS-Z	128	32.1	80.1	167	9.04
200	DRC/CC-ICP-MS	135	37	79	180	13
293	DRC/CC-ICP-MS	144.35	34.41	84.41	188.98	12.63
391	ETAAS-Z	156.30	40.69	90.57	202.5	15.44
485	HR-ICP-MS	151	38.5	85.0	196	11.8
597	DRC/CC-ICP-MS	163	36.4	98.4	230	8.90
598	ICP-MS	173	*65.498↑	*160 ↑	243 ↑	*28 ↑

Based on the grading criteria for Al in Serum, 89% of results were satisfactory, with 1 of the 7 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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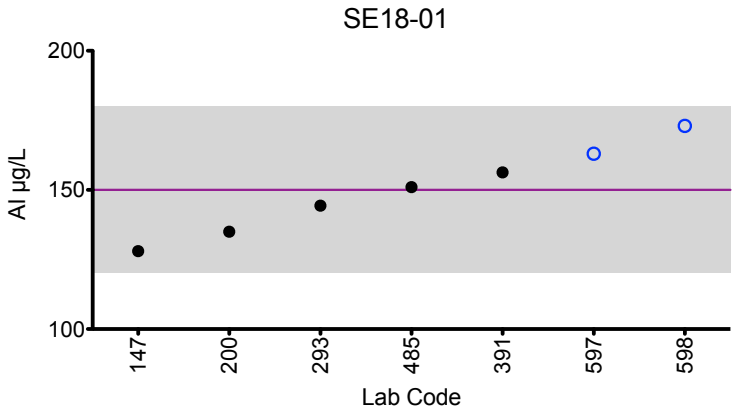
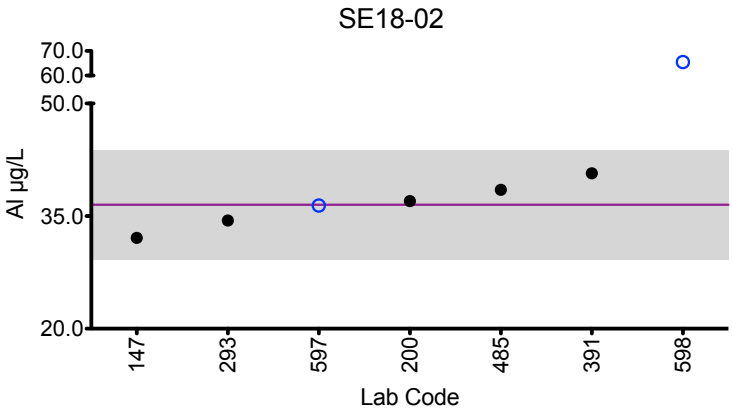
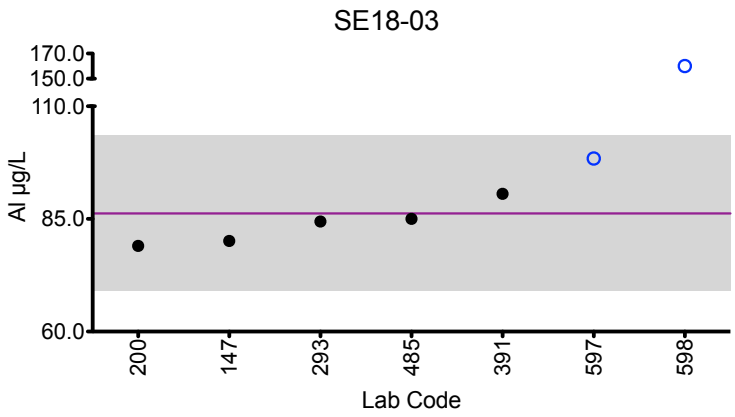
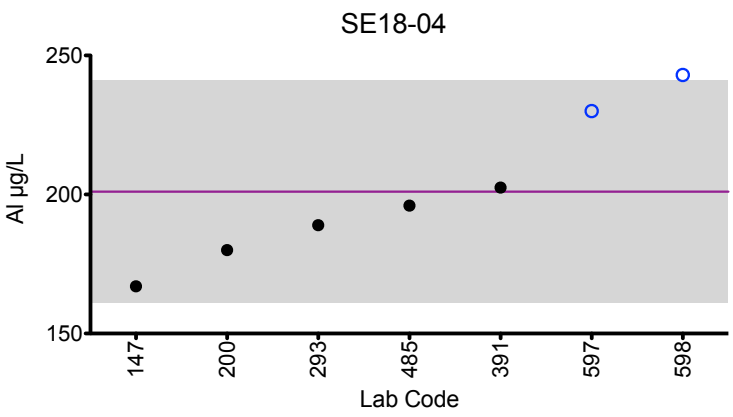
Results for Event #1, 2018: Summary Figures

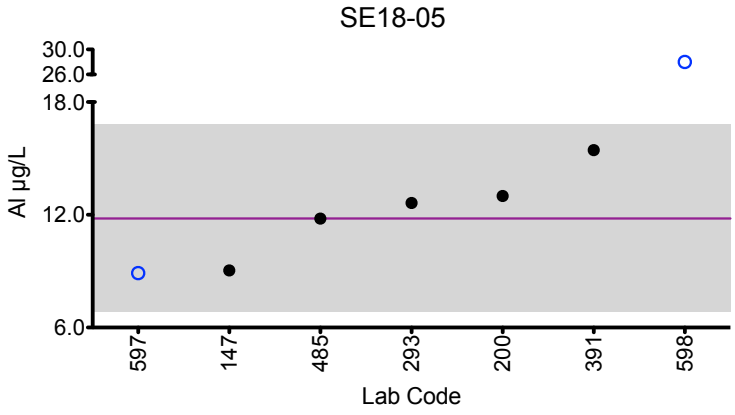
Serum Al











Legend:

o CHEAR Labs ● Other Labs

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.

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Results for Event #1, 2018: Summary Statistics

Serum Co (µg/L)					
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Target (Arithmetic Mean ($\bar{x}$))	11.3	1.2	8.6	5.9	2.5
Upper Limit	13.0	2.7	10.1	7.4	4.0
Lower Limit	9.6	0.0	7.1	4.4	1.0
Arithmetic SD (s)	0.5	0.1	0.6	0.8	0.2
Arithmetic RSD (%)	4.4	8.3	7.0	13.6	8.0
Number of Sample Measurements (N)	8	7	8	8	8

The acceptable range is based on quality specifications:
±1.5 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±1.5 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, 2018:
Performance of Participating Laboratories

Serum Co (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
	Target	**11.3**	**1.2**	**8.6**	**5.9**	**2.5**
103	DRC/CC-ICP-MS	11.1	1.15	8.49	5.92	2.53
110	ICP-MS	11.4	1.21	8.51	6.03	2.62
147	ICP-MS	10.5	1.05	7.90	5.50	2.21
293	DRC/CC-ICP-MS	11.16	1.18	8.45	6.12	2.44
485	HR-ICP-MS	11.2	1.19	8.27	5.75	2.46
597	DRC/CC-ICP-MS	12.21	1.38	9.78	7.30	2.72
598	ICP-MS	11.8	1.06	8.09	5.8	2.4
599	DRC/CC-ICP-MS	11.22	<1	9.207	4.421	2.281

Based on the grading criteria for Co in Serum, 100% of results were satisfactory, with 0 of the 8 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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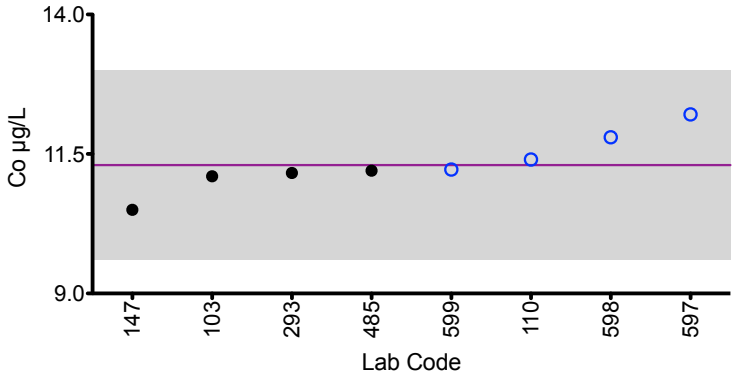
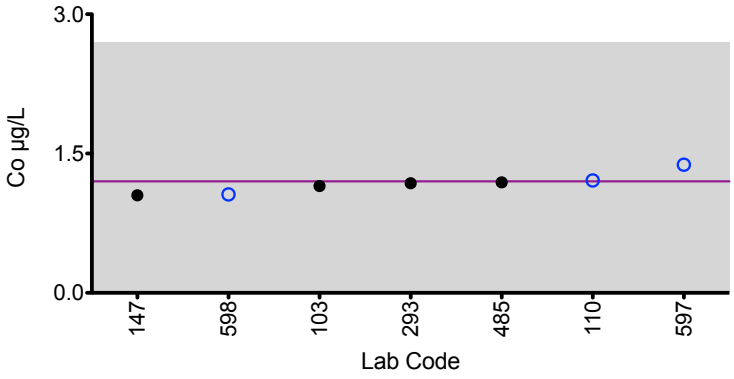
Results for Event #1, 2018: Summary Figures

Serum Co

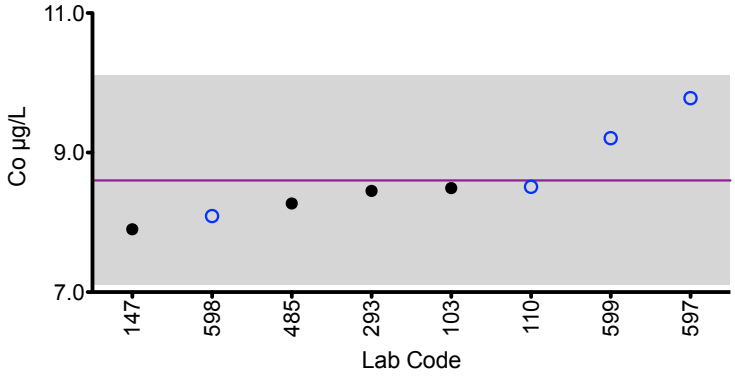
SE18-01



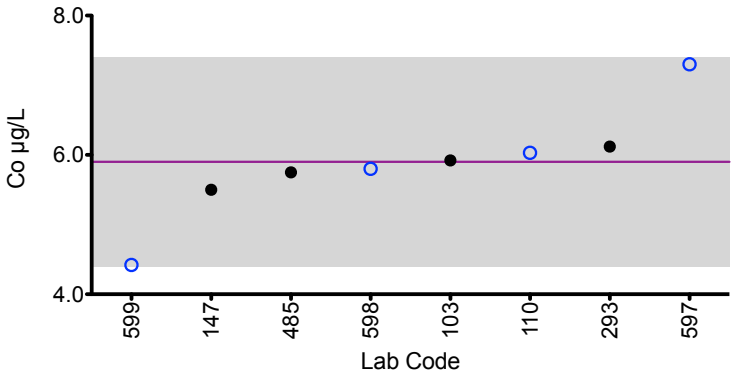
SE18-02



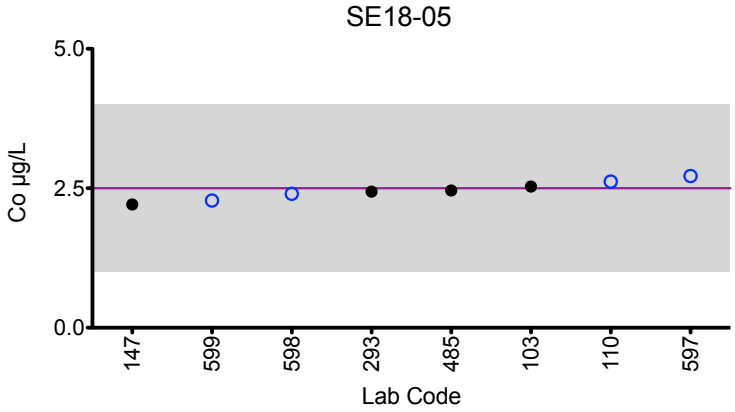
SE18-03



SE18-04



SE18-05



Legend:

o CHEAR Labs ● Other Labs

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 ±15% around the target value, whichever is greater; thus, it is fixed at ±1.5 µg/L at concentrations less than or equal to 10 µg/L.

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Results for Event #1, 2018: Summary Statistics

	Serum Cr (µg/L)				
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Target (Arithmetic Mean ($\bar{x}$))	1.3	9.2	4.8	7.9	0.73
Upper Limit	3.3	11.2	6.8	9.9	2.73
Lower Limit	0.0	7.2	2.8	5.9	0.00
Arithmetic SD (s)	0.2	0.3	0.5	1.1	0.07
Arithmetic RSD (%)	15.4	3.3	10.4	13.9	9.6
Number of Sample Measurements (N)	8	7	8	8	5

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, 2018:
Performance of Participating Laboratories

		Serum Cr (µg/L)				
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
	Target	**1.3**	**9.2**	**4.8**	**7.9**	**0.73**
103	DRC/CC-ICP-MS	1.35	9.56	4.58	7.91	0.633
110	DRC/CC-ICP-MS	1.4	9.2	4.7	8.1	0.8
147	DRC/CC-ICP-MS	1.36	9.00	4.54	7.23	0.790
293	DRC/CC-ICP-MS	1.49	9.24	5.84	9.75	*1.69
485	HR-ICP-MS	1.28	9.55	4.34	7.65	0.690
597	DRC/CC-ICP-MS	1.52	*11	5.11	9.14	0.74
598	DRC/CC-ICP-MS	0.923	8.896	4.241	7.04	*0.116
599	DRC/CC-ICP-MS	1.160	8.995	5.155	6.205	<1

Based on the grading criteria for Cr in Serum, 100% of results were satisfactory, with 0 of the 8 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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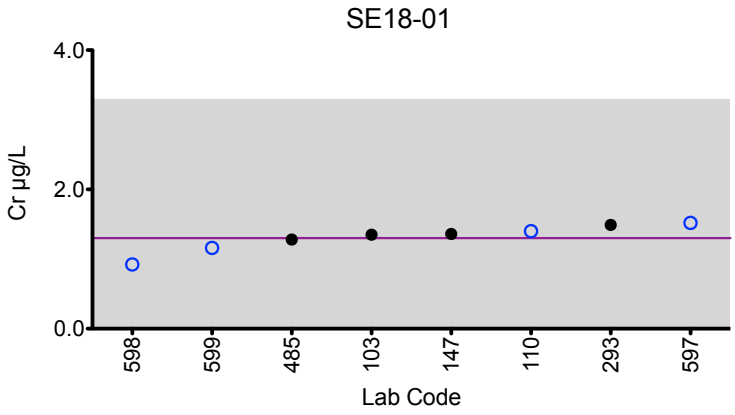
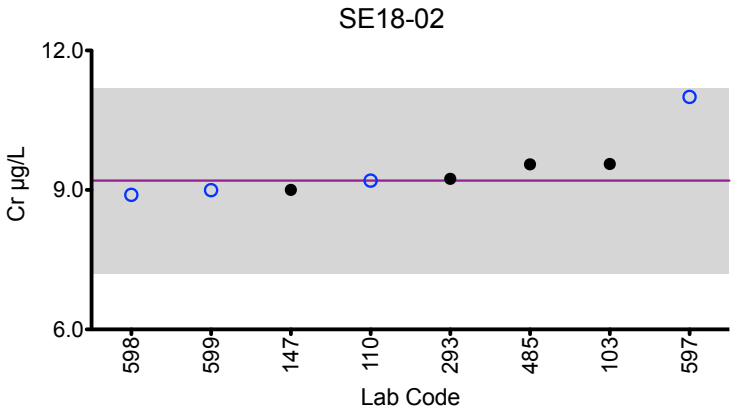
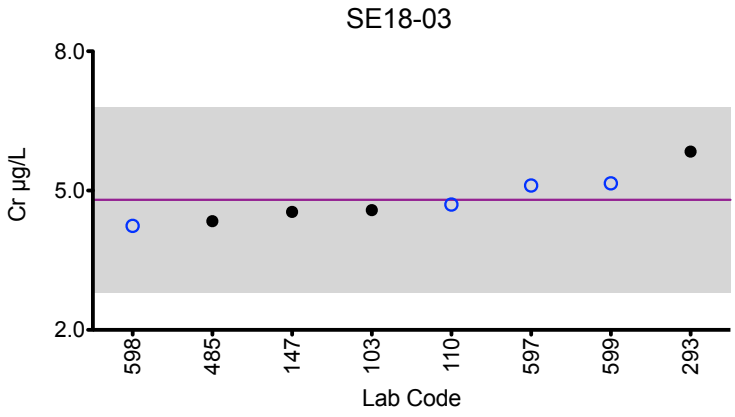
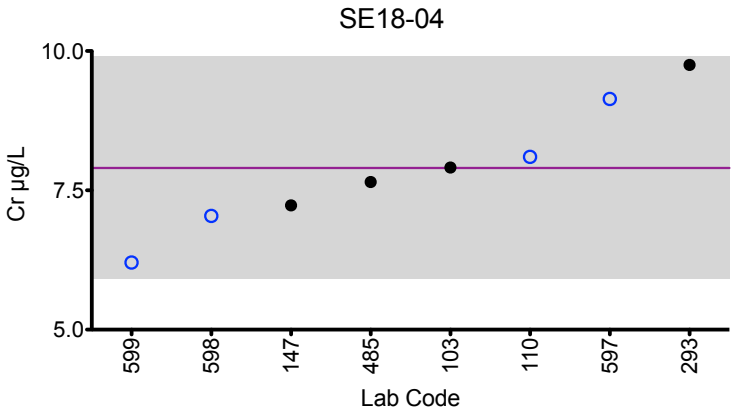
Results for Event #1, 2018: Summary Figures

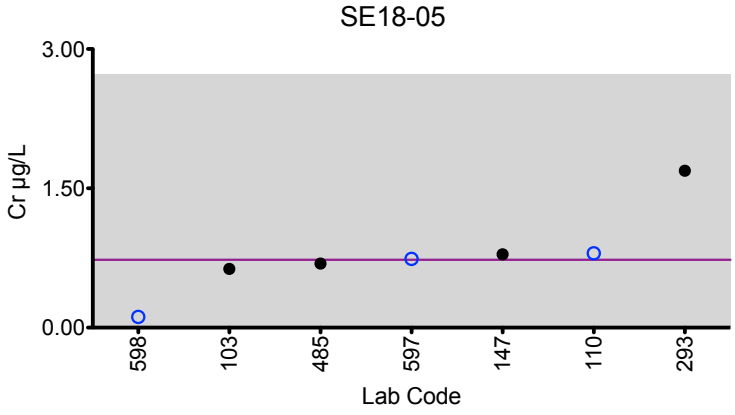
Serum Cr











Legend:
o CHEAR Labs ● Other Labs
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, 2018: Summary Statistics

Serum Cu (µg/L)					
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Target (Robust Mean (x*))	3027	2011	938	1435	2411
Upper Limit	3481	2313	1079	1650	2773
Lower Limit	2573	1709	797	1220	2049
Robust SD (s*)	232	149	61	92	174
Robust RSD (%)	7.7	7.4	6.5	6.4	7.2
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (*u*)	91.7	58.9	24.2	36.2	69.0

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, 2018:
Performance of Participating Laboratories

Serum Cu (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
	Target	**3027**	**2011**	**938**	**1435**	**2411**
107	DRC/CC-ICP-MS	2900	1900	930	1400	2400
110	ICP-MS	3090	2020	971	1440	2470
147	ICP-MS	2808	1874	858	1321	2154
200	ICP-MS	3194	2096	965	1492	2496
293	DRC/CC-ICP-MS	2887.5	1926.3	881.8	1351.6	2237.8
457	ICP-AES/OES	2882	1973	952	1426	2384
483	DRC/CC-ICP-MS	3100	2040	922	1510	2530
597	DRC/CC-ICP-MS	3360	2400 ↑	1060	1730 ↑	2610
598	ICP-MS	2774	1853	880	1350	2235
599	DRC/CC-ICP-MS	3309	2295	990	1484	2579

Based on the grading criteria for Cu in Serum, 96% of results were satisfactory, with 1 of the 10 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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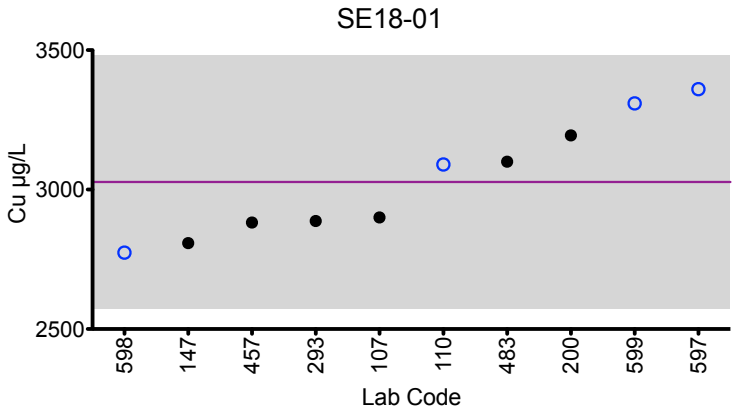
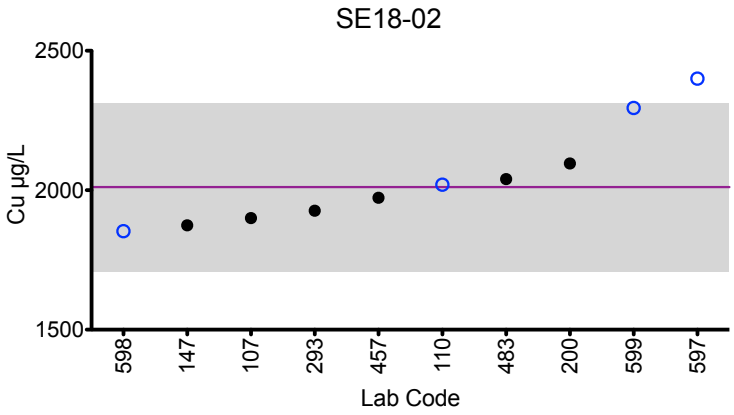
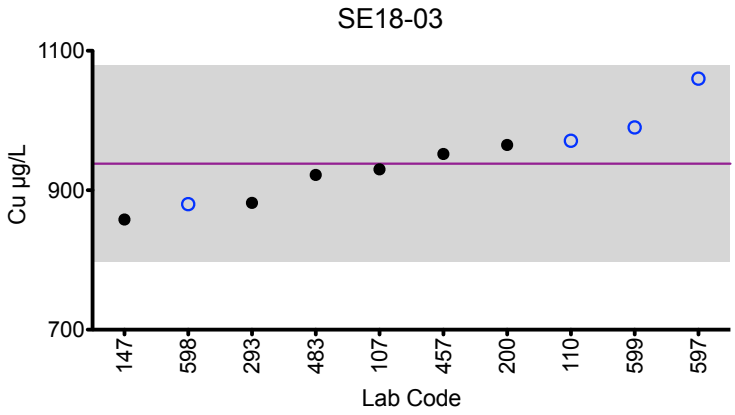
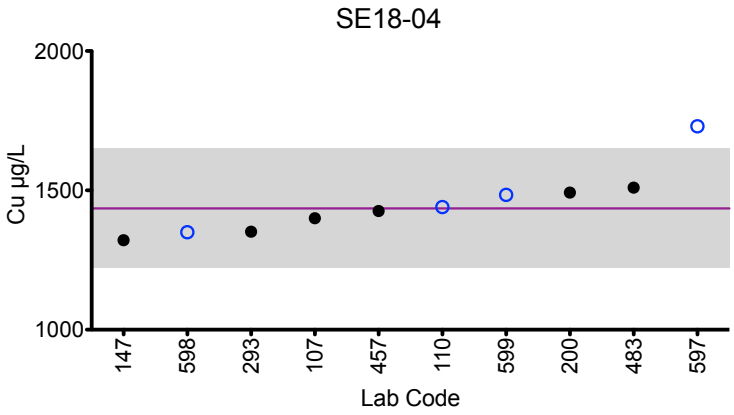
Results for Event #1, 2018: Summary Figures

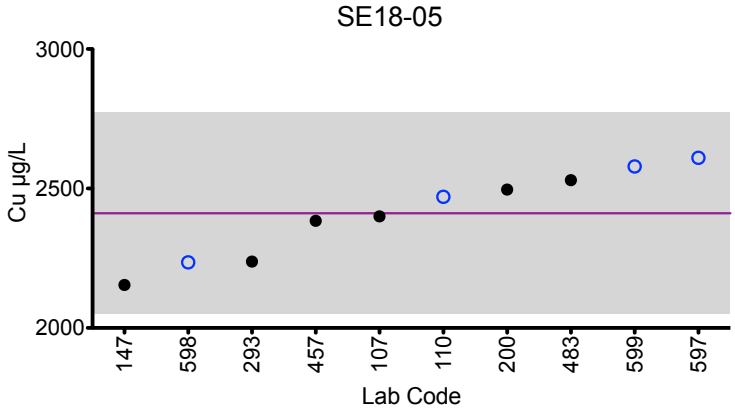
Serum Cu











Legend:
o CHEAR Labs ● Other Labs
Horizontal purple line = assigned target value based on the robust 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 ±95 µg/L at concentrations less than or equal to 635 µg/L.

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Results for Event #1, 2018: Summary Statistics

	Serum Se (µg/L)				
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Target (Robust Mean (x*))	99.5	310	111	243	182
Upper Limit	119.4	372	133	292	218
Lower Limit	79.6	248	89	194	146
Robust SD (s*)	3.8	22	4	18	13
Robust RSD (%)	3.8	7.1	3.6	7.4	7.1
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (*u*)	1.48	8.88	1.57	7.15	5.04

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.

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Results for Event #1, 2018:
Performance of Participating Laboratories

		Serum Se (µg/L)				
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
	Target	**99.5**	**310**	**111**	**243**	**182**
103	DRC/CC-ICP-MS	103	323	113	253	184
107	DRC/CC-ICP-MS	97	300	110	240	180
110	DRC/CC-ICP-MS	100	297	110	233	181
147	ICP-MS	96.4	286	104	221	160
200	DRC/CC-ICP-MS	91	277	103	226	170
293	DRC/CC-ICP-MS	100.24	313.3	110.5	245.5	174.4
483	DRC/CC-ICP-MS	102	311	111	258	190
597	DRC/CC-ICP-MS	121 ↑	397 ↑	139 ↑	324 ↑	210
598	DRC/CC-ICP-MS	98.3	309	113	228	180
599	DRC/CC-ICP-MS	99.14	339.8	140.4 ↑	254.1	202.5

Based on the grading criteria for Se in Serum, 90% of results were satisfactory, with 1 of the 10 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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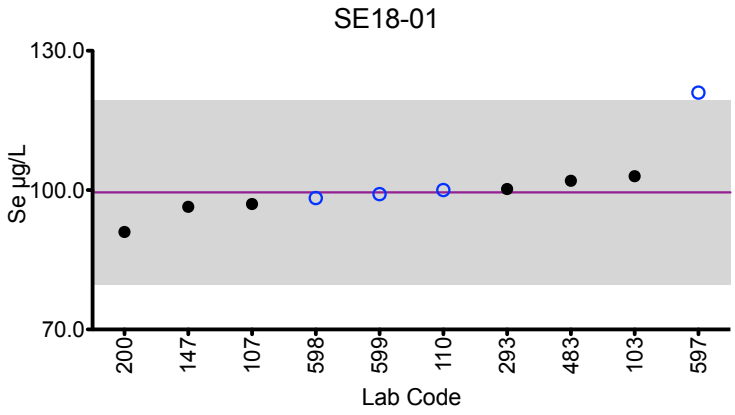
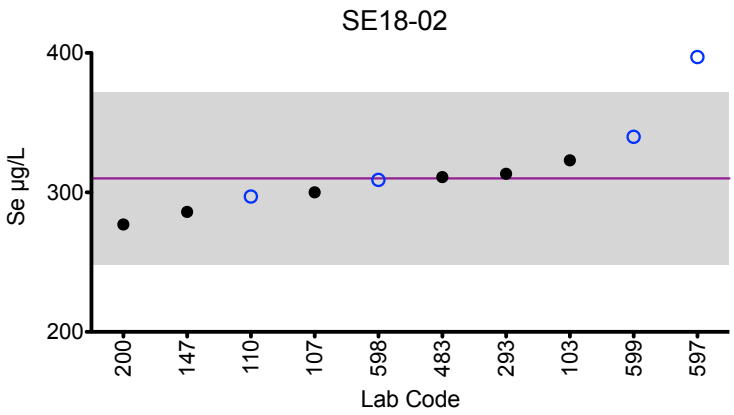
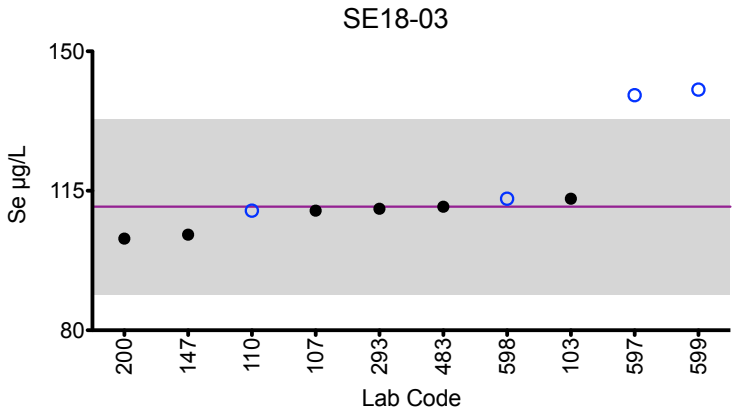
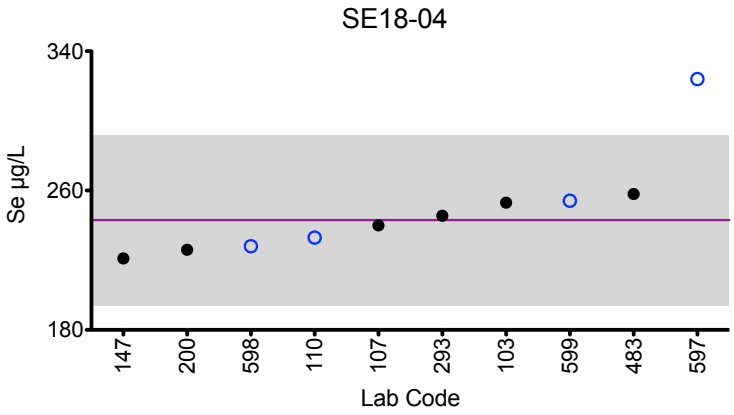
Results for Event #1, 2018: Summary Figures

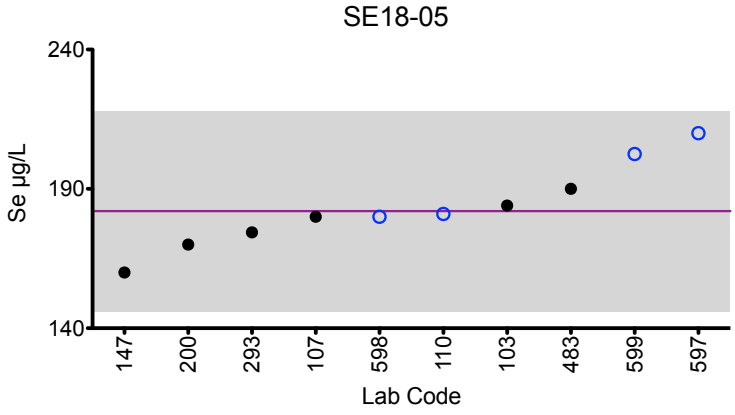
Serum Se











Legend:

o CHEAR Labs ● Other Labs

Horizontal purple line = assigned target value based on the robust 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, 2018: Summary Statistics

	Serum Zn (µg/L)				
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Target (Robust Mean (x*))	2362	1691	997	723	1928
Upper Limit	2716	1945	1147	831	2217
Lower Limit	2008	1437	847	615	1639
Robust SD (s*)	216	136	58	67	169
Robust RSD (%)	9.1	8.0	5.8	9.3	8.8
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (*u*)	85.3	53.9	22.8	26.5	66.7

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, 2018:
Performance of Participating Laboratories

Serum Zn (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
	Target	**2362**	**1691**	**997**	**723**	**1928**
107	DRC/CC-ICP-MS	2500	1800	1000	730	2000
110	ICP-MS	2410	1680	995	707	1940
147	ICP-MS	2163	1542	902	660	1693
200	ICP-MS	2577	1831	1079	818	2132
293	DRC/CC-ICP-MS	2216.3	1574.5	939.9	652.9	1765.4
457	ICP-AES/OES	2336	1642	978	710	1947
483	DRC/CC-ICP-MS	2420	1660	982	795	1940
597	DRC/CC-ICP-MS	2700	1990 ↑	1130	986 ↑	2230 ↑
598	ICP-MS	2111	1561	972	698	1794
599	DRC/CC-ICP-MS	2203	1720	1169 ↑	670	1885

Based on the grading criteria for Zn in Serum, 92% of results were satisfactory, with 1 of the 10 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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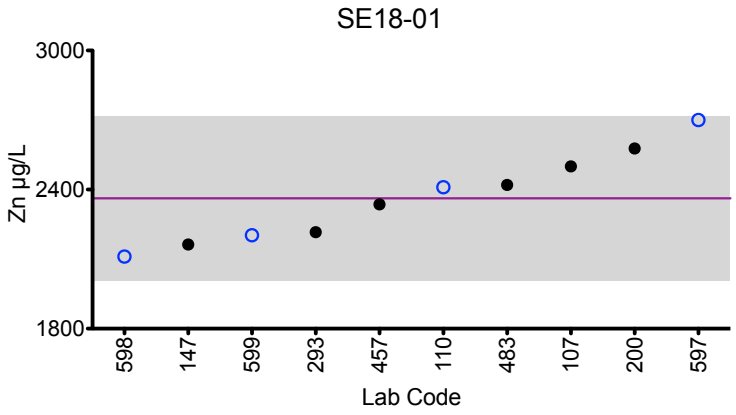
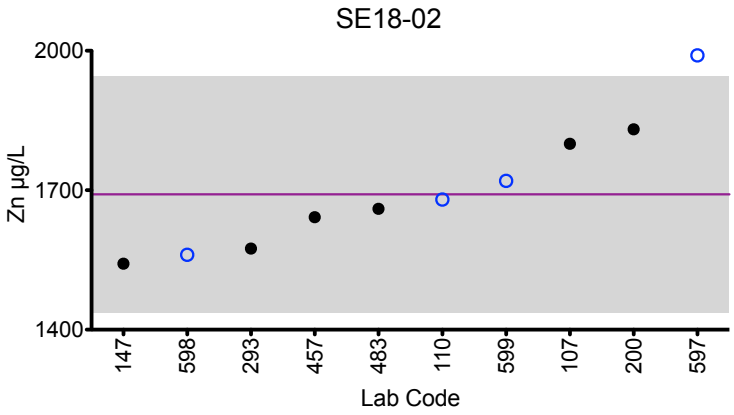
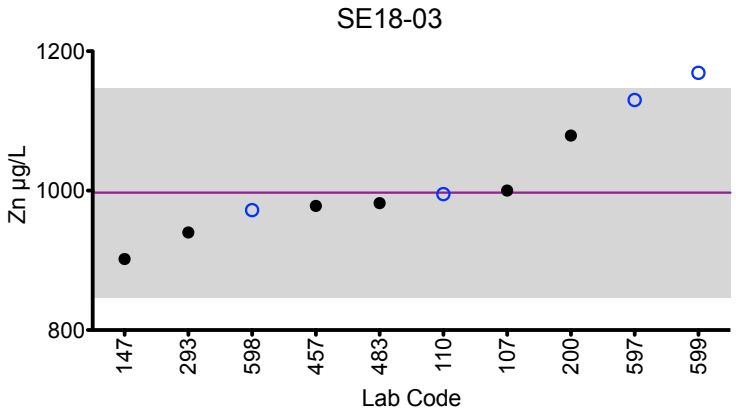
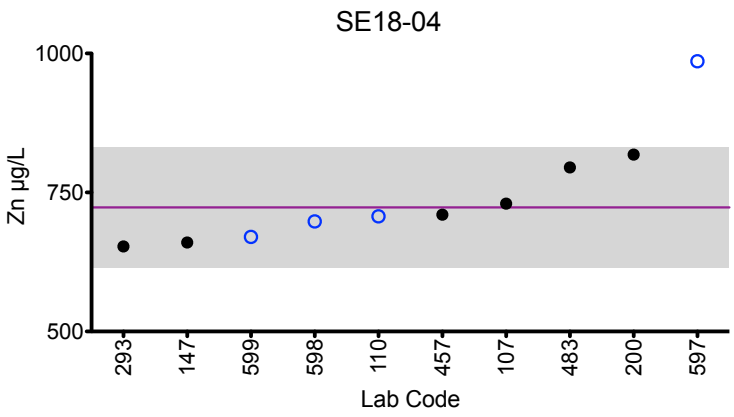
Results for Event #1, 2018: Summary Figures

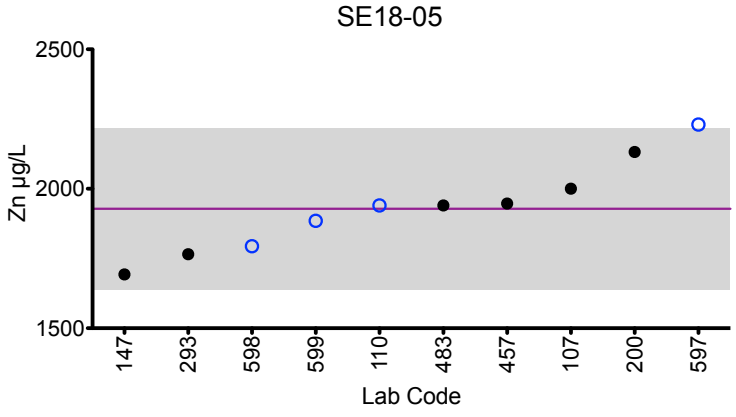
Serum Zn











Legend:
o CHEAR Labs ● Other Labs
Horizontal purple line = assigned target value based on the robust 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.

Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum As (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
103	DRC/CC-ICP-MS	4.34	22.9	12.2	7.42	1.02
110	DRC/CC-ICP-MS	4.2	22.1	10.9	7.2	1.2
147	ICP-MS	3.94	19.4	10.0	6.34	0.988
597	DRC/CC-ICP-MS	4.74	25.7	13.4	9.13	1.14
598	DRC/CC-ICP-MS	4.05	22.2	11.7	6.68	0.592
599	DRC/CC-ICP-MS	<5	30.70	*24.70	12.13	<5
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		4.3	24	11.6	8.2	0.99
Arithmetic SD (s)		0.3	4	1.3	2.2	0.24
Arithmetic RSD (%)		7.0	16.7	11.2	27	24
Number of Sample Measurements (N)		5	6	5	6	5

*Denotes a statistical Outlier.

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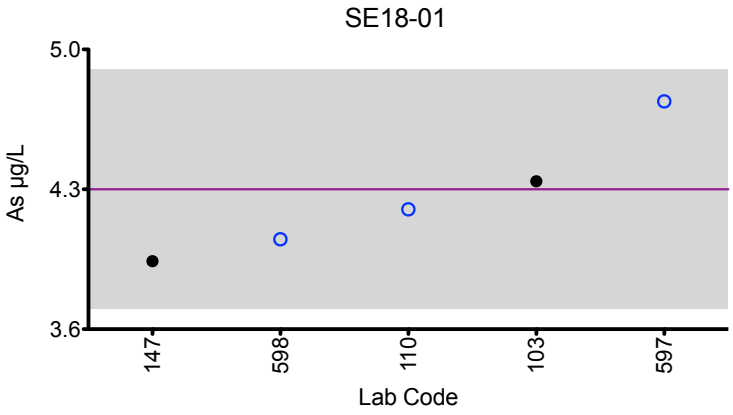
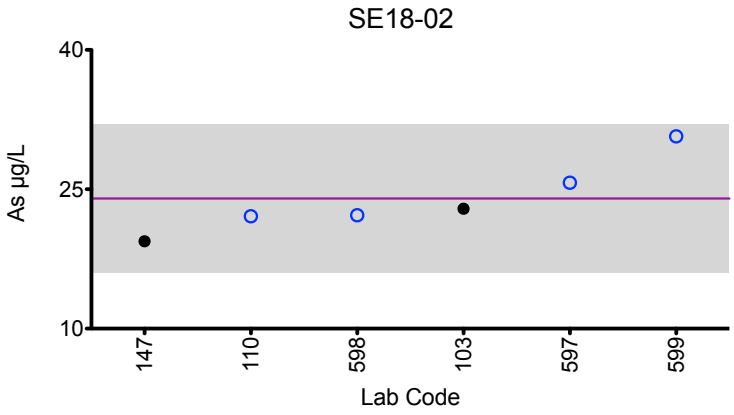
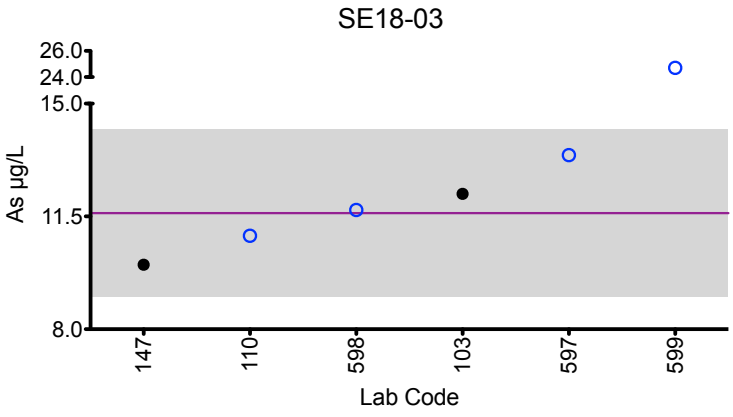
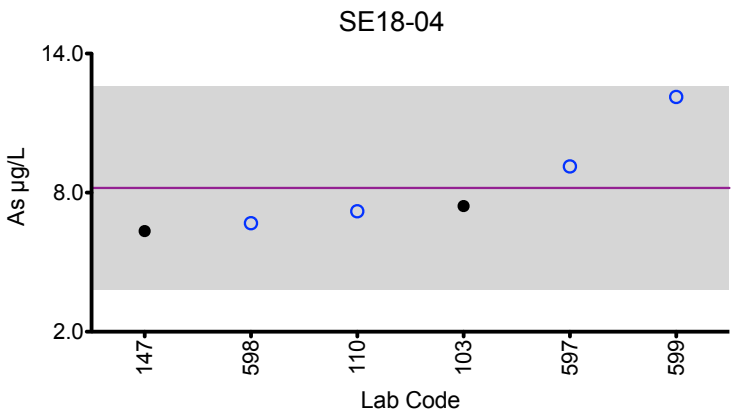
Results for Event #1, 2018: Summary Figures

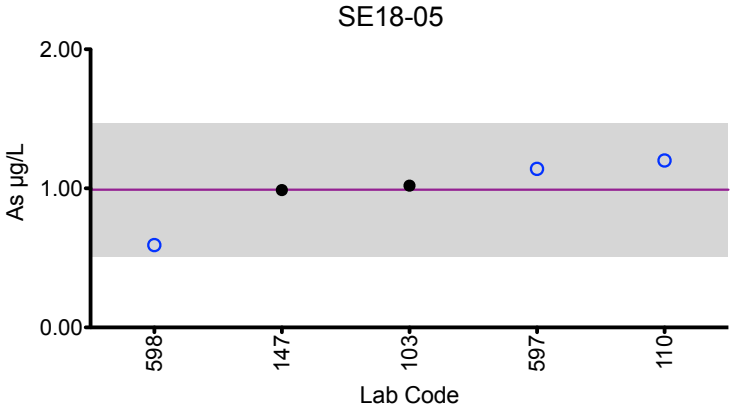
Serum As











Legend:
o CHEAR Labs ● Other Labs
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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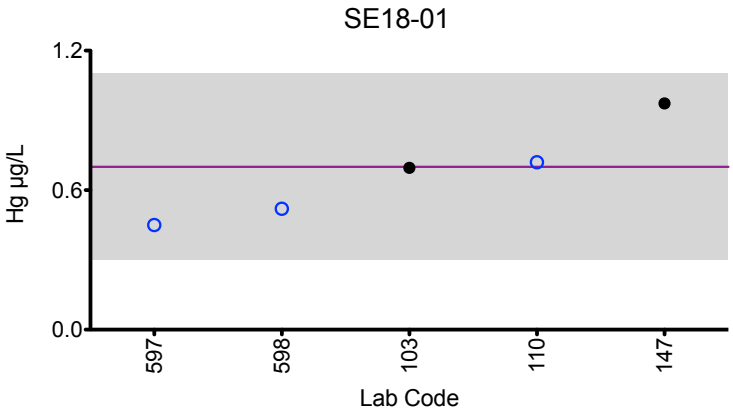
Results for Event #1, 2018:
Laboratory Data and Summary Statistics

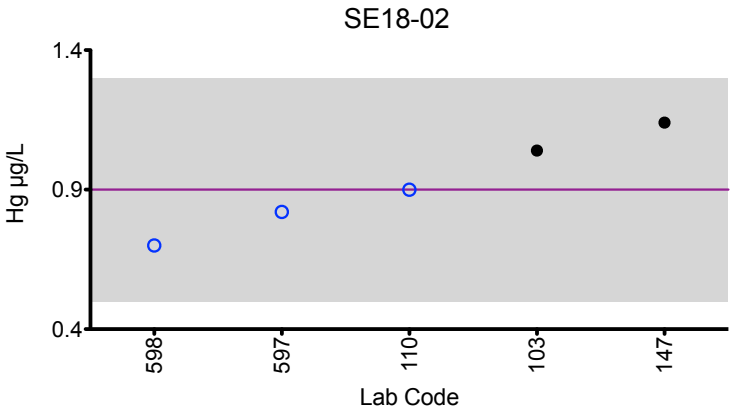
Serum Hg (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
103	DRC/CC-ICP-MS	0.696	1.04	8.55	4.48	2.91
110	ICP-MS	0.72	0.90	8.10	4.24	2.54
147	ICP-MS	0.973	1.14	7.38	3.81	2.59
597	DMA	0.45	0.82	7.87	3.98	2.48
598	ICP-MS	0.52	0.70	6.35	3.51	2.12
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		0.7	0.9	7.7	4.0	2.5
Arithmetic SD (s)		0.2	0.2	0.8	0.4	0.3
Arithmetic RSD (%)		29	22	10.4	10.0	12.0
Number of Sample Measurements (N)		5	5	5	5	5

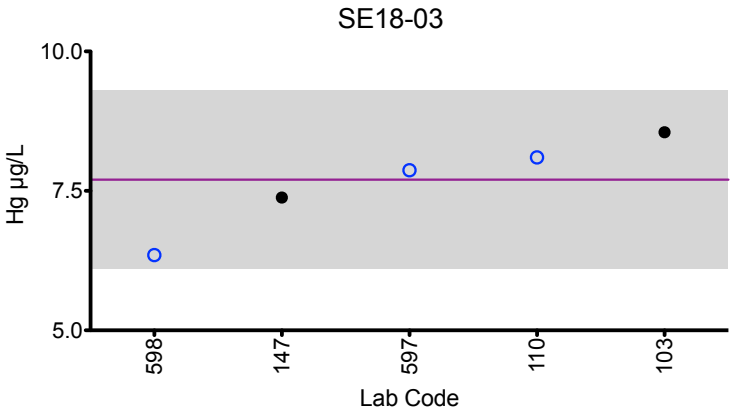
*Denotes a statistical Outlier.

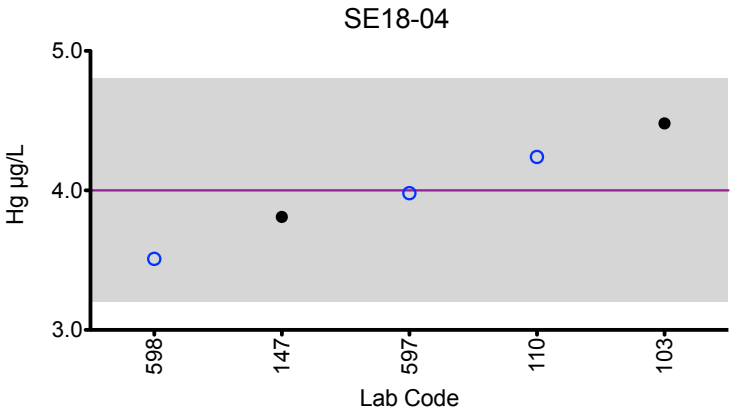
Results for Event #1, 2018:
Summary Figures

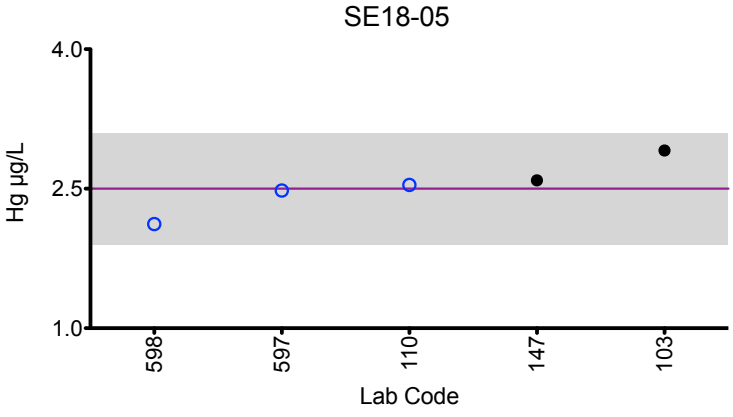
Serum Hg











Legend:
o CHEAR Labs ● Other Labs
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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Mn (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
103	DRC/CC-ICP-MS	2.39	2.39	10.5	17.3	5.89
110	ICP-MS	2.56	2.45	10.4	16.9	5.97
147	ICP-MS	2.30	2.13	9.40	15.1	5.29
293	DRC/CC-ICP-MS	2.3	2.01	11.43	17.94	*11.4
597	DRC/CC-ICP-MS	2.87	2.33	11.0	20.4	6.20
598	ICP-MS	3.02	2.26	10.2	16.9	5.88
599	DRC/CC-ICP-MS	3.782	*4.127	11.70	18.12	7.656

Summary Statistics

	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
Arithmetic Mean ($\bar{x}$)	2.7	2.3	10.7	17.5	6.1
Arithmetic SD (s)	0.5	0.2	0.8	1.6	0.8
Arithmetic RSD (%)	18.5	8.7	7.5	9.1	13.1
Number of Sample Measurements (N)	7	6	7	7	6

*Denotes a statistical Outlier.

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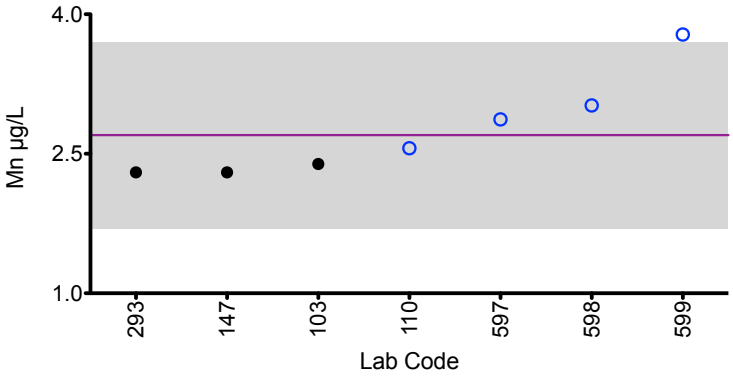
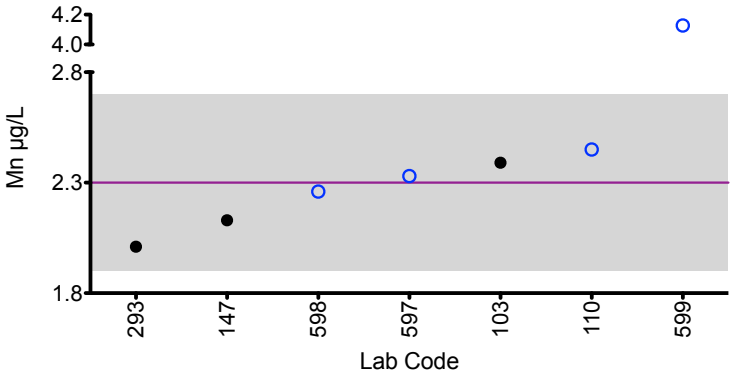
Results for Event #1, 2018: Summary Figures

Serum Mn

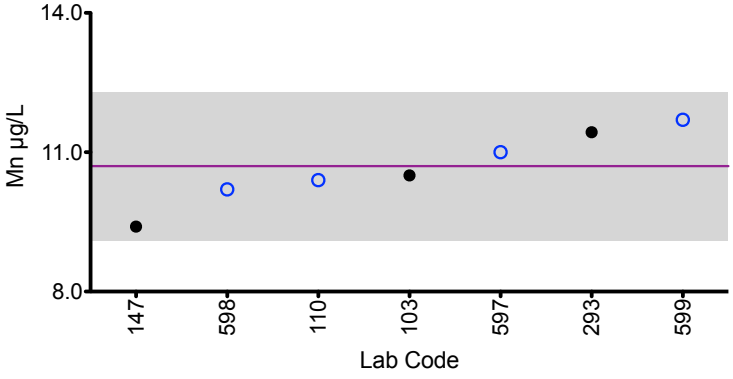
SE18-01



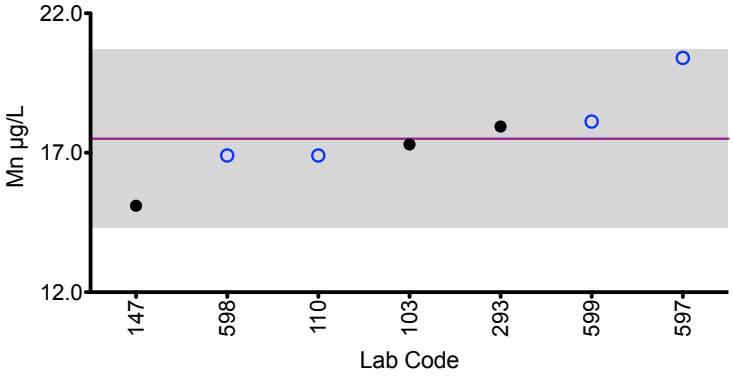
SE18-02



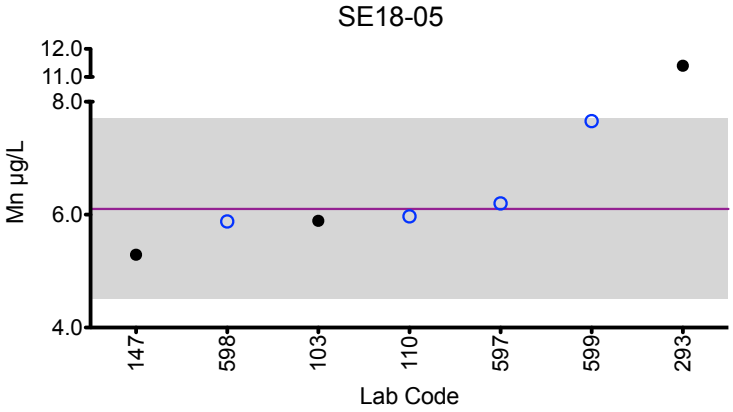
SE18-03



SE18-04



SE18-05



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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Mo (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
103	DRC/CC-ICP-MS	6.12	3.98	1.19	2.92	2.47
110	ICP-MS	6.1	4.0	1.2	2.9	2.5
147	ICP-MS	5.52	3.59	1.10	2.71	2.23
293	DRC/CC-ICP-MS	6.21	4.72	1.36	2.95	2.44
485	HR-ICP-MS	6.06	3.92	1.16	3.20	2.57
597	DRC/CC-ICP-MS	6.38	4.64	1.53	3.54	2.83
598	DRC/CC-ICP-MS	6.78	4.16	1.31	3.1	2.56
599	DRC/CC-ICP-MS	5.311	4.478	<1	2.077	1.863

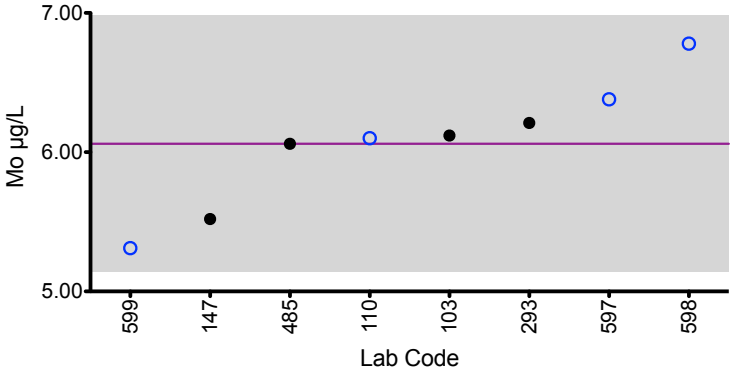
Summary Statistics					
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)	6.06	4.19	1.26	2.92	2.43
Arithmetic SD (s)	0.46	0.39	0.15	0.42	0.28
Arithmetic RSD (%)	7.6	9.3	11.9	14.4	11.5
Number of Sample Measurements (N)	8	8	7	8	8

*Denotes a statistical Outlier.

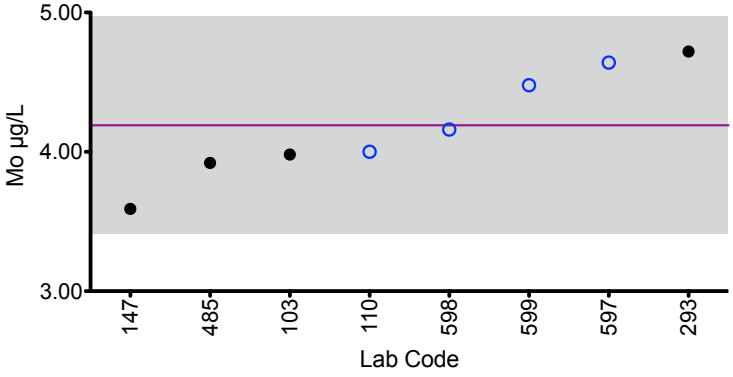
Results for Event #1, 2018:
Summary Figures

Serum Mo

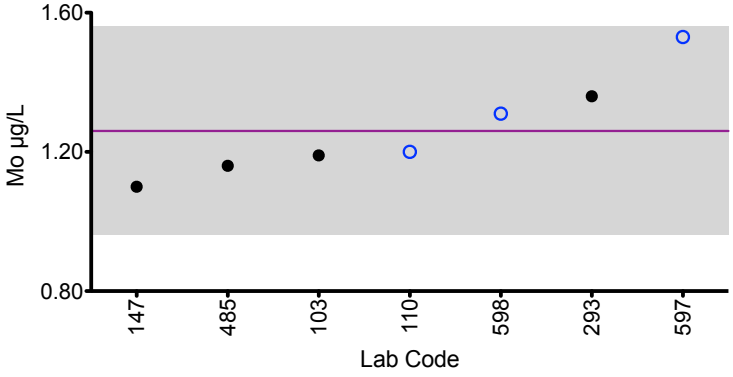
SE18-01



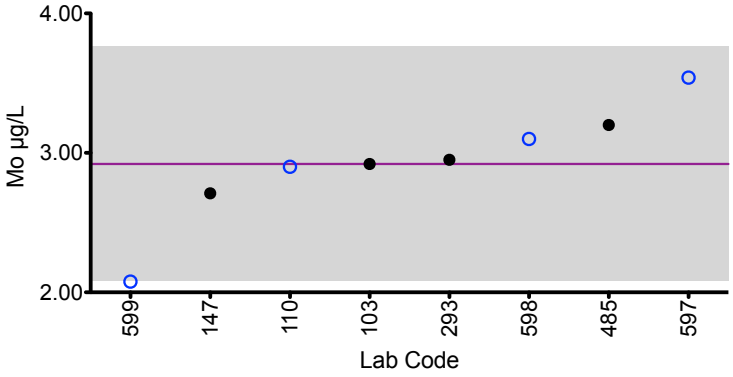
SE18-02



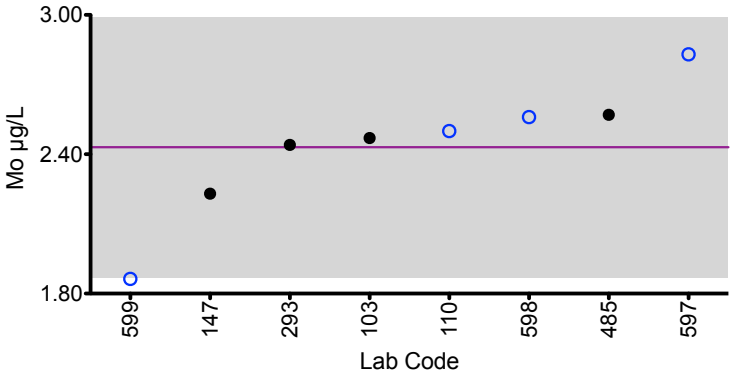
SE18-03



SE18-04



SE18-05



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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Ni (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
110	DRC/CC-ICP-MS	2.6	11.8	5.8	9.7	7.9
147	ICP-MS	1.57	10.6	5.14	8.46	6.17
293	DRC/CC-ICP-MS	2.01	11.84	5.37	8.83	7.1
485	HR-ICP-MS	1.62	11.5	6.83	9.44	6.72
598	ICP-MS	2.99	12.7	7.88	*13.47	8.79

Summary Statistics					
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)	2.2	11.7	6.2	9.1	7.3
Arithmetic SD (s)	0.6	0.8	1.1	0.6	1.0
Arithmetic RSD (%)	27	6.8	17.7	6.6	13.7
Number of Sample Measurements (N)	5	5	5	4	5

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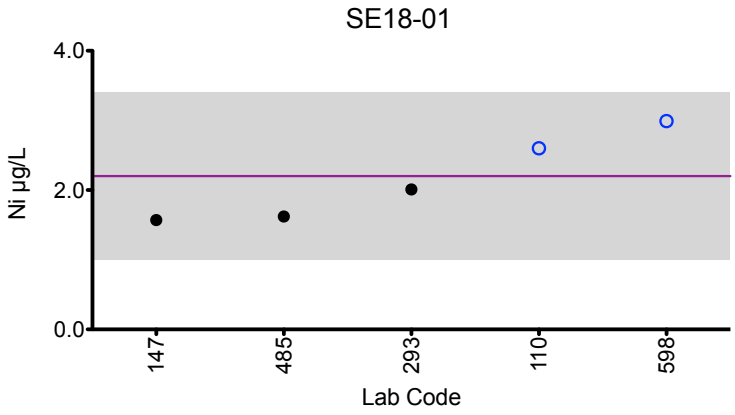
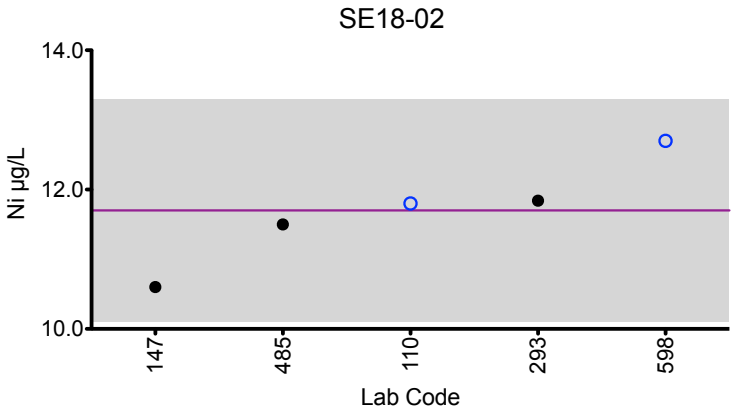
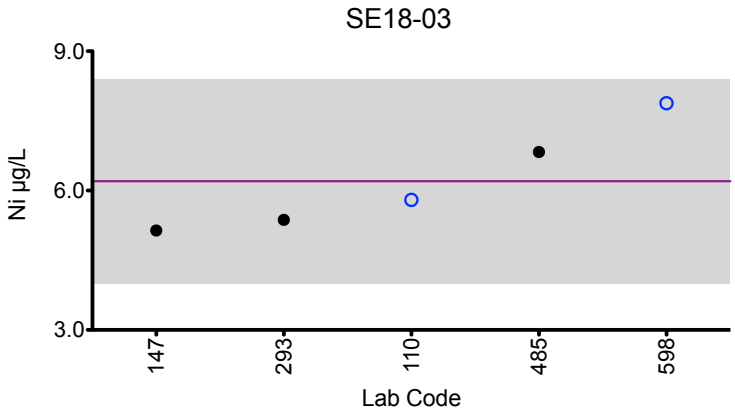
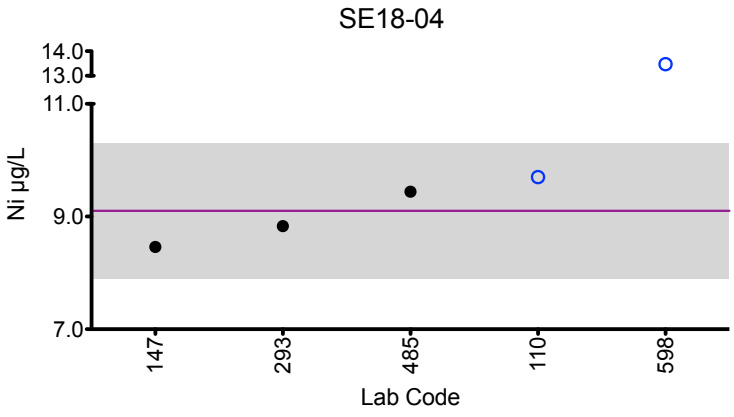
Results for Event #1, 2018: Summary Figures

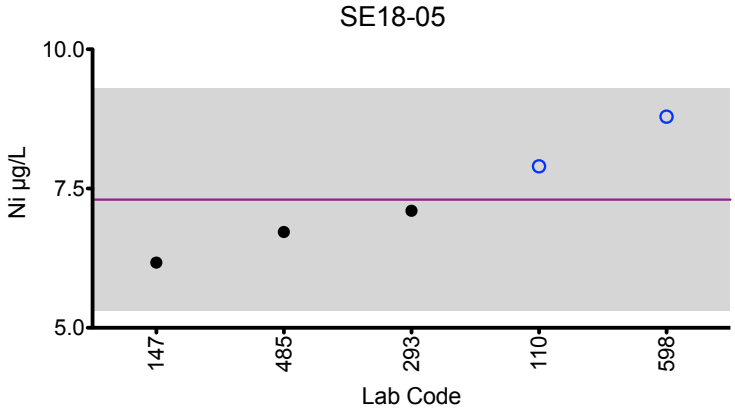
Serum Ni











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Pb (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
103	DRC/CC-ICP-MS	1.44	8.75	2.67	3.87	6.42
110	ICP-MS	1.46	8.77	2.75	3.96	6.52
147	ICP-MS	1.36	8.39	2.57	3.81	5.93
597	DRC/CC-ICP-MS	1.74	10.1	2.98	4.67	6.83
598	ICP-MS	1.65	6.66	2.11	3.04	4.73
599	DRC/CC-ICP-MS	1.288	9.639	3.330	3.799	7.815
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		1.5	8.7	2.7	3.9	6.4
Arithmetic SD (s)		0.2	1.2	0.4	0.5	1.0
Arithmetic RSD (%)		13.3	13.8	14.8	12.8	15.6
Number of Sample Measurements (N)		6	6	6	6	6

*Denotes a statistical Outlier.

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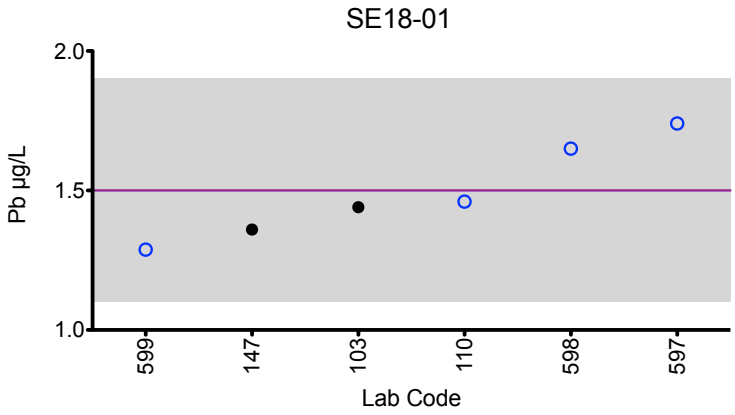
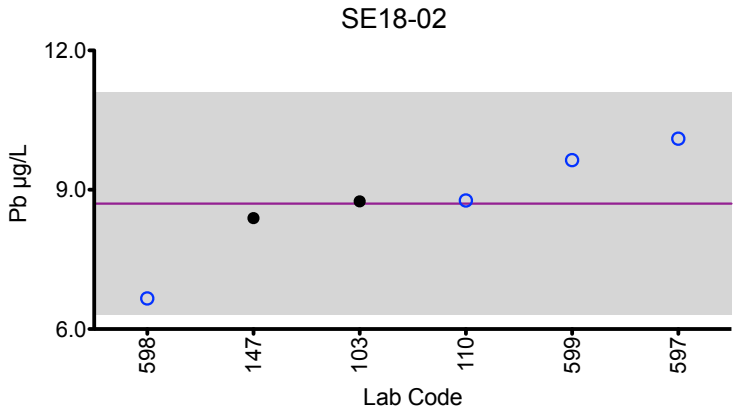
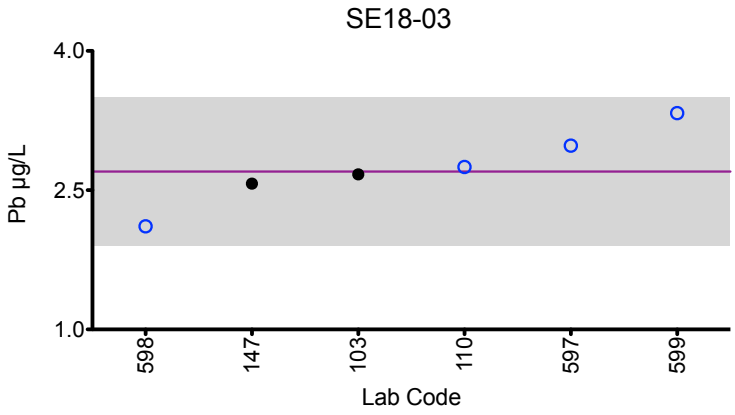
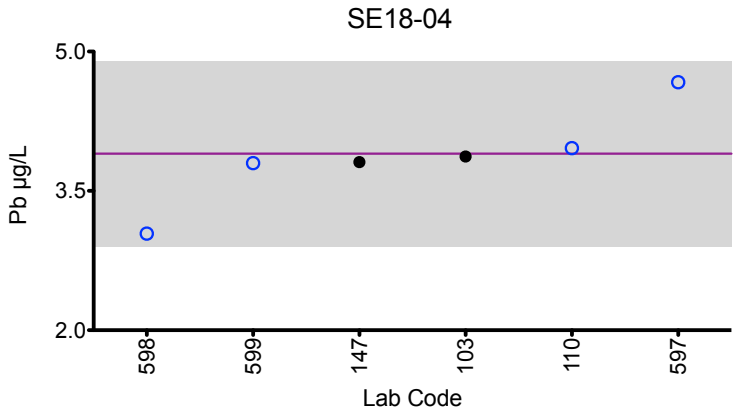
Results for Event #1, 2018: Summary Figures

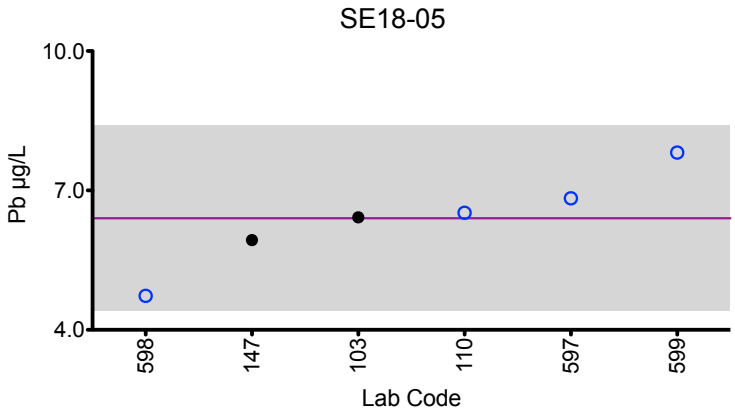
Serum Pb











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Sb (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
103	DRC/CC-ICP-MS	6.56	0.905	1.50	2.88	0.335
110	ICP-MS	6.56	0.87	1.36	2.79	0.43
147	ICP-MS	5.94	0.818	1.31	2.54	0.290
597	DRC/CC-ICP-MS	7.03	0.96	1.52	3.28	0.29
598	ICP-MS	7.13	0.97	1.62	3.26	0.31
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		6.6	0.90	1.5	3.0	0.33
Arithmetic SD (s)		0.5	0.06	0.1	0.3	0.06
Arithmetic RSD (%)		7.6	6.7	6.7	10.0	18.2
Number of Sample Measurements (N)		5	5	5	5	5

*Denotes a statistical Outlier.

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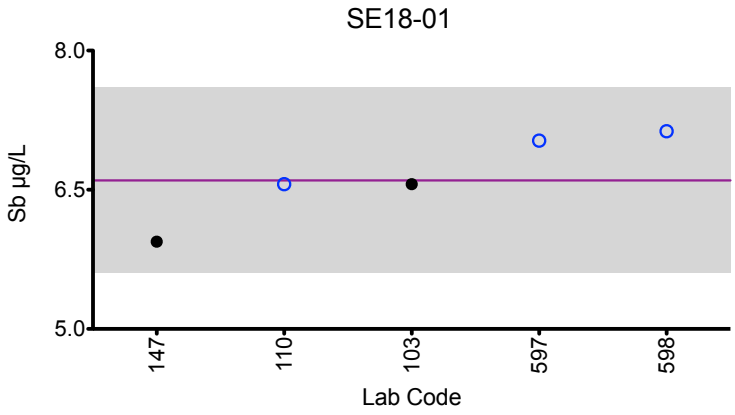
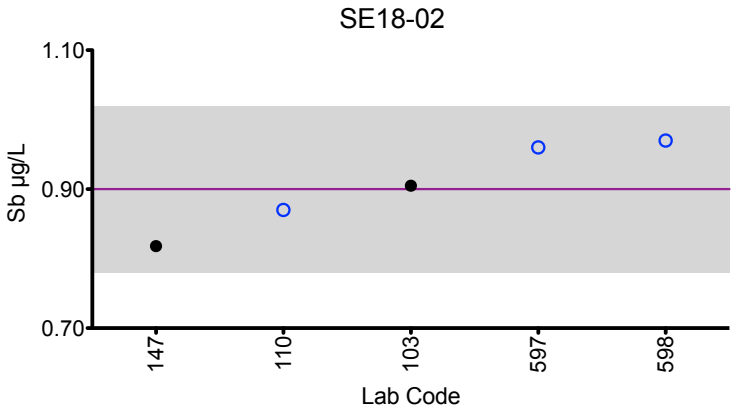
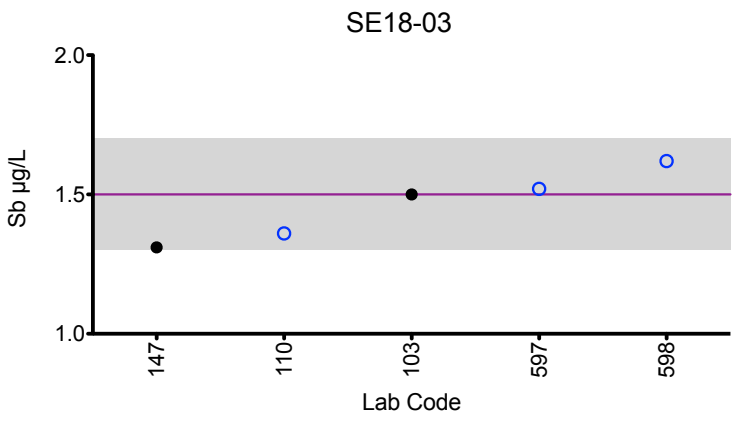
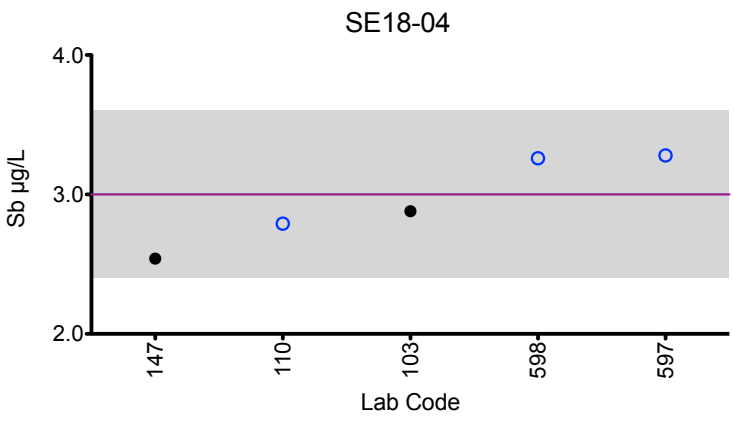
Results for Event #1, 2018: Summary Figures

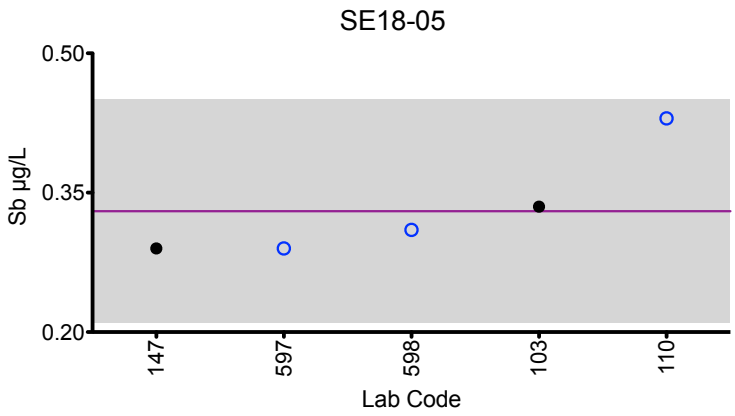
Serum Sb











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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum V (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
110	DRC/CC-ICP-MS	1.2	1.7	9.9	6.8	4.3
147	DRC/CC-ICP-MS	0.842	1.17	9.39	6.12	3.84
485	HR-ICP-MS	0.906	1.27	9.43	6.77	4.20
597	DRC/CC-ICP-MS	1.15	1.49	10.2	7.34	4.24
598	DRC/CC-ICP-MS	1.013	1.5	11.5	7.14	4.7
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		1.0	1.4	10.1	6.8	4.3
Arithmetic SD (s)		0.2	0.2	0.9	0.5	0.3
Arithmetic RSD (%)		20	14.3	8.9	7.4	7.0
Number of Sample Measurements (N)		5	5	5	5	5

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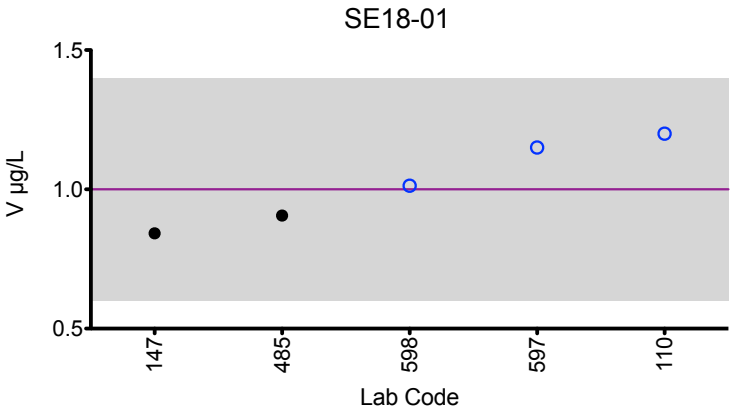
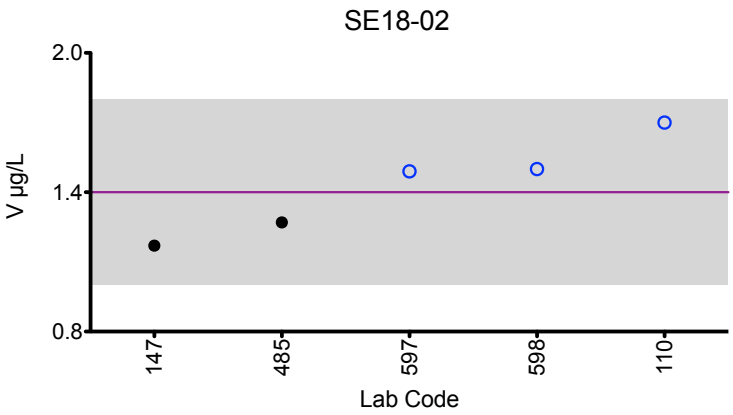
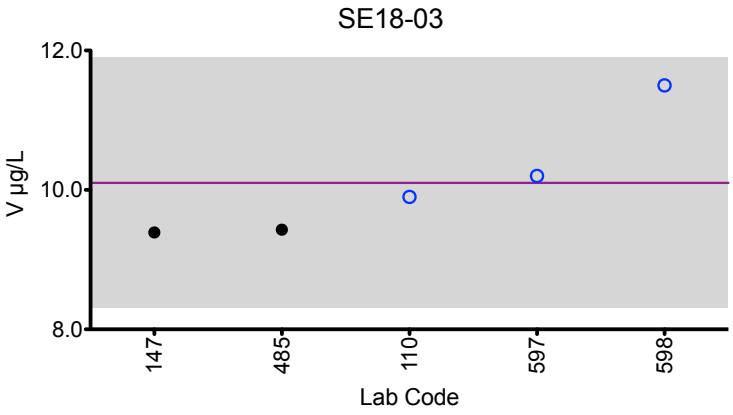
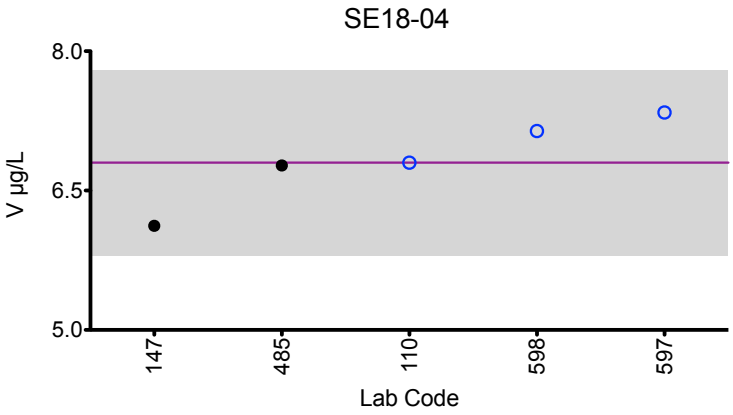
Results for Event #1, 2018: Summary Figures

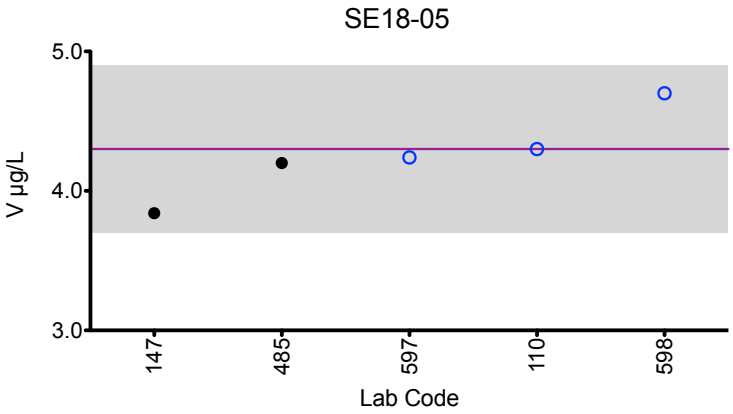
Serum V











Legend:
o CHEAR Labs ● Other Labs
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, 2018:
Laboratory Data and Summary Statistics

Serum Ba (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
110	ICP-MS	0.62	0.70	0.85	0.84	0.86
147	ICP-MS	0.835	0.549	0.769	0.747	0.813
598	ICP-MS	0.93	0.46	*1.88	0.64	0.58
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		0.80	0.57	NA	0.74	0.75
Arithmetic SD (s)		0.16	0.12	NA	0.10	0.15
Arithmetic RSD (%)		20	21	NA	13.5	20
Number of Sample Measurements (N)		3	3	NA	3	3

*Denotes a statistical Outlier.

Statistical data were not calculated for SE18-03 based on a lack of consensus among participating labs.

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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Be (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
110	ICP-MS	3.09	0.92	0.07	0.76	2.30
147	ICP-MS	2.58	0.706	< 0.441	0.671	2.00
598	ICP-MS	3.60	1.22	<0.1	0.88	2.80
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		3.1	0.9	NA	0.8	2.4
Arithmetic SD (s)		0.5	0.3	NA	0.1	0.4
Arithmetic RSD (%)		16.1	33	NA	12.5	16.7
Number of Sample Measurements (N)		3	3	NA	3	3

*Denotes a statistical Outlier.

Statistical data were not calculated for SE18-03 based on a lack of consensus among participating labs.

Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Cd (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
103	DRC/CC-ICP-MS	0.316	1.59	0.505	5.89	3.54
110	ICP-MS	0.24	1.64	0.52	5.92	3.70
147	ICP-MS	0.297	1.63	0.395	5.40	3.20
598	DRC/CC-ICP-MS	0.12	1.48	0.5	5.15	2.96

Summary Statistics					
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)	0.24	1.6	0.48	5.6	3.4
Arithmetic SD (s)	0.09	0.1	0.06	0.4	0.3
Arithmetic RSD (%)	38	6.3	12.5	7.1	8.8
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Sn (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
110	ICP-MS	3.40	6.01	8.90	1.12	4.96
147	ICP-MS	3.08	5.78	8.66	0.960	4.41
597	DRC/CC-ICP-MS	3.40	6.76	9.26	1.15	4.97
598	ICP-MS	3.31	5.52	7.91	0.76	4.32
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		3.3	6.0	8.7	1.0	4.7
Arithmetic SD (s)		0.2	0.5	0.6	0.2	0.3
Arithmetic RSD (%)		6.1	8.3	6.9	20	6.4
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum Tl (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
103	DRC/CC-ICP-MS	1.56	2.94	2.14	4.18	5.09
110	ICP-MS	1.60	3.04	2.09	4.21	5.08
147	ICP-MS	1.47	2.70	1.92	3.86	4.50
598	ICP-MS	1.91	2.10	1.42	3.15	3.74

Summary Statistics

	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
Arithmetic Mean ($\bar{x}$)	1.6	2.7	1.9	3.9	4.6
Arithmetic SD (s)	0.2	0.4	0.3	0.5	0.6
Arithmetic RSD (%)	12.5	14.8	15.8	12.8	13.0
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.

Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum U (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
103	DRC/CC-ICP-MS	<0.0300	0.0572	0.0931	0.144	0.0351
110	ICP-MS	0.011	0.058	0.086	0.145	0.045
147	ICP-MS	< 0.0145	0.0440	0.00698	0.122	0.0271

Summary Statistics					
	SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)	NA	0.053	0.062	0.137	0.036
Arithmetic SD (s)	NA	0.008	0.048	0.013	0.009
Arithmetic RSD (%)	NA	15.1	77	9.5	25
Number of Sample Measurements (N)	NA	3	3	3	3

*Denotes a statistical Outlier.

Statistical data were not calculated for SE18-01 based on a lack of consensus among participating labs.

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Results for Event #1, 2018:
Laboratory Data and Summary Statistics

Serum W (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
110	ICP-MS	4.38	0.89	0.66	2.54	0.87
147	ICP-MS	4.62	0.888	0.671	2.72	0.907
200	ICP-MS	4.3	0.8	0.7	2.9	0.9
598	ICP-MS	4.43	0.789	0.591	2.58	0.793
Summary Statistics						
		SE18-01	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
Arithmetic Mean ($\bar{x}$)		4.4	0.8	0.65	2.7	0.9
Arithmetic SD (s)		0.1	0.1	0.05	0.2	0.1
Arithmetic RSD (%)		2.3	12.5	7.7	7.4	11.1
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #1, 2018: Additional Elements in Serum

Serum Ag (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
147	ICP-MS	< 0.248	< 0.248	< 0.248	< 0.248	< 0.248

Serum B (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
200	ICP-MS	36.7	36.7	24.8	23.8	19.4

Serum Bi (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
147	ICP-MS	< 0.201	< 0.201	< 0.201	< 0.201	< 0.201

Serum Ca (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
457	ICP-AES/OES	77535	78410	81330	80450	80830

Serum Cs (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
110	ICP-MS	0.52	0.52	0.43	0.44	0.30
597	DRC/CC-ICP-MS	0.650	0.672	0.536	0.557	0.385
598	ICP-MS	*1.1	*0.27	*0.20	*0.16	<0.1

Serum Fe (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
457	ICP-AES/OES	355	349	1605	1578	174
483	DRC/CC-ICP-MS	397	388	1500	1670	199

Serum I (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
147	ICP-MS	61.9	61.5	55.3	53.2	67.6

Serum Li (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
147	ICP-MS	0.352	0.303	0.444	0.416	0.473

Serum Mg (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
457	ICP-AES/OES	14495	14370	17780	17360	15900

Serum Pt (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
110	ICP-MS	0.39	1.73	0.09	0.99	0.08
598	ICP-MS	0.371	1.701	<0.1	1.034	<0.1

Serum Sr (µg/L)

Lab Code	Method	SE18-01	SE18-02	SE18-03	SE18-04	SE18-05
103	DRC/CC-ICP-MS	20.8	78.7	30.4	57.6	46.5
200	ICP-MS	21.9	78.8	29.8	60.4	48.2

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Results for Event #1, 2018: Additional Elements in Serum

Serum Te (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
147	ICP-MS	< 0.0880	< 0.0880	< 0.0880	< 0.0880	< 0.0880

Serum Th (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
147	ICP-MS	< 0.00789	< 0.00789	< 0.00789	< 0.00789	< 0.00789

Serum Ti (µg/L)						
Lab Code	**Method**	**SE18-01**	**SE18-02**	**SE18-03**	**SE18-04**	**SE18-05**
200	DRC/CC-ICP-MS	6.0	0.6	3.6	3.1	3.4
485	HR-ICP-MS	11.4	<0.5	8.06	3.09	6.87

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.