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New York State Biomonitoring Program for Trace Elements

Event #2, 2020

Trace Elements in Whole Blood, Urine, and Serum

October, 2020

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

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Event #2, 2020:
Trace Elements in Whole Blood, Urine, and Serum

10/28/2020

Dear Laboratory Director,

This report summarizes performance for the second biomonitoring proficiency test (PT) event of 2020 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 #3, 2020) will be shipped September 23, 2020. Comments about this report may be directed to trel@health.ny.gov.

Sincerely,

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

Kayla Mehigan
Coordinator, Biomonitoring PT Program,
Division of Environmental Sciences
Wadsworth Center

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Event #2, 2020

Trace Elements in Whole Blood

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Trace Elements Laboratory

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Event #2, 2020:
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 homogenized overnight prior to aliquoting 2-mL into polypropylene vials. PT samples were stored at -80°C until the week of the PT event, when they were thawed at 4°C prior to circulation to laboratories for analysis.

Graded Elements

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

Additional Elements

An additional 24 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, 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 #2, 2020: Summary Statistics

Whole Blood As (µg/L)					
	BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Target (Arithmetic Mean ($\bar{x}$))	2.05	14.8	6.1	36.0	29.0
Upper Limit	8.05	20.8	12.1	43.2	35.0
Lower Limit	0.00	8.8	0.1	28.8	23.0
Arithmetic SD (s)	0.21	1.4	0.9	3.0	2.5
Arithmetic RSD (%)	10	9.5	15	8.3	8.6
Number of Sample Measurements (N)	7	8	7	8	8

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

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Results for Event #2, 2020:
Performance of Participating Laboratories

Whole Blood As (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
	Target	**2.05**	**14.8**	**6.1**	**36.0**	**29.0**
103	DRC/CC-ICP-MS	2.10	14.9	6.15	37.6	30.4
110	DRC/CC-ICP-MS	2.22	14.4	5.72	37.3	29.5
147	ICP-MS	2.11	13.6	5.88	35.0	28.6
264	ICP-MS	2.19	13.80	6.20	34.46	26.39
293	DRC/CC-ICP-MS	2.25 L	15.33 L	6.42 L	38.99 L	32.07 L
391	ICP-MS	*9.90 ↑	16.88	*10.85	33.57	27.31
597	ICP-MS	1.88	13.5	5.76	36.3	28.7
598	DRC/CC-ICP-MS	2.19	17.4	7.87	41.9	34.3
599	DRC/CC-ICP-MS	1.63	14.2	4.89	31.8	26.4

Based on the grading criteria for As in Whole Blood, 98% of results were satisfactory, with 0 of the 9 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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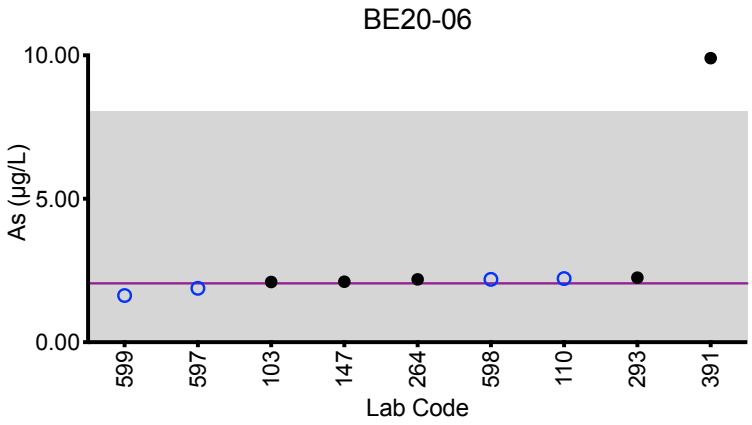
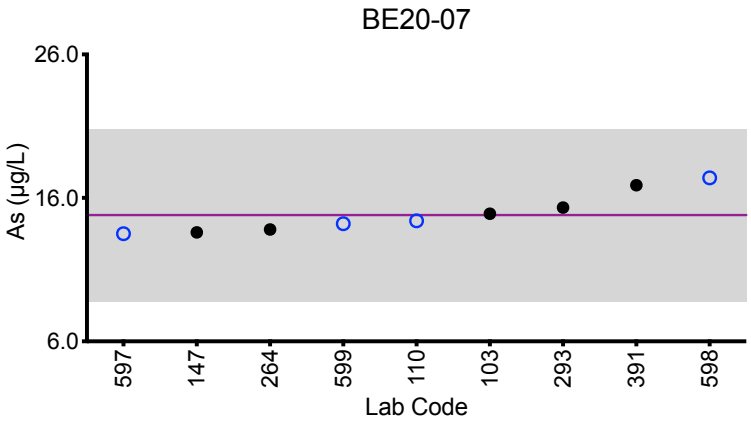
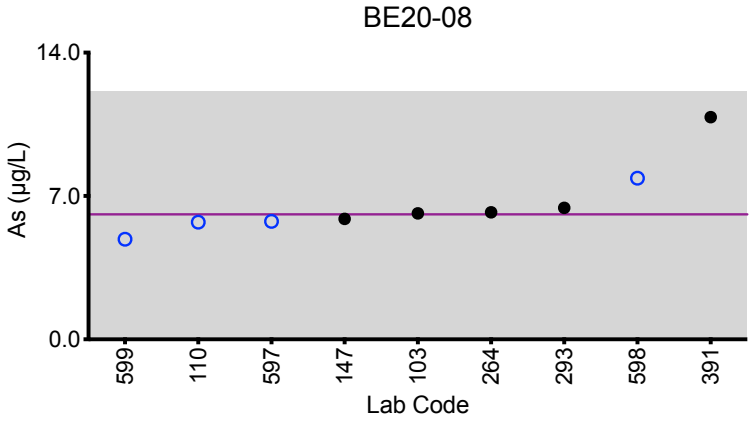
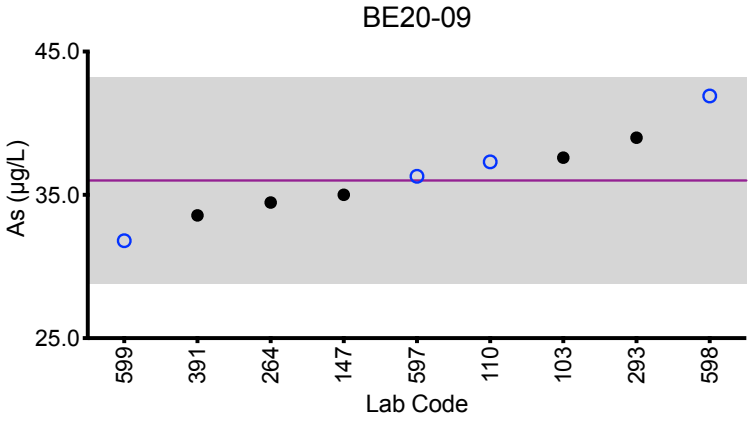
Results for Event #2, 2020: Summary Figures

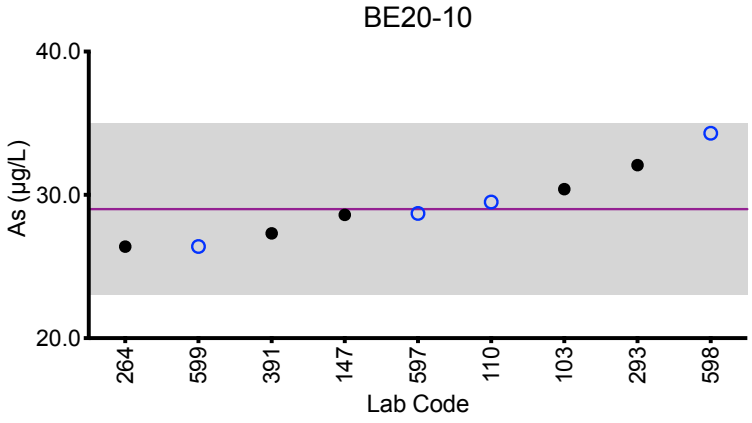
Whole Blood As











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

Whole Blood Cd (µg/L)					
	BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Target (Robust Mean (x*))	5.6	16.1	2.11	0.80	9.1
Upper Limit	6.6	18.5	3.11	1.80	10.5
Lower Limit	4.6	13.7	1.11	0.00	7.7
Robust SD (s*)	0.4	1.2	0.16	0.10	0.6
Robust RSD (%)	7.4	7.5	7.6	13	6.6
Number of Sample Measurements (N)	12	12	12	11	12
Standard Uncertainty (*u*)	0.1	0.4	0.06	0.04	0.2

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 #2, 2020:
Performance of Participating Laboratories

Whole Blood Cd (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
	Target	**5.6**	**16.1**	**2.11**	**0.80**	**9.1**
103	DRC/CC-ICP-MS	5.41	15.9	1.98	0.878	9.05
107	ICP-MS/MS	5.997	17.465	2.32	0.840	9.683
110	ICP-MS	5.61	16.2	2.07	0.74	9.16
116	ICP-MS/MS	5.75	17.67	2.07	<1.50	9.81
147	ICP-MS	5.38	15.6	2.03	0.815	8.77
264	ICP-MS	5.26	15.49	2.00	0.74	8.29
293	DRC/CC-ICP-MS	5.47 L	15.95 L	2.01 L	0.84 L	9.09 L
391	ICP-MS	4.12 ↓	11.88 ↓	1.30	0.49	6.89 ↓
597	ICP-MS	4.92	15.1	2.10	0.78	9.12
598	DRC/CC-ICP-MS	5.62	15.23	2.88	1.78	9.55
599	DRC/CC-ICP-MS	5.47	16.9	2.12	0.63	8.69
605	ICP-MS	6.18	17.2	2.32	0.845	9.93
606	ICP-MS/MS	5.97	16.4	2.23	0.852	9.19

Based on the grading criteria for Cd in Whole Blood, 95% of results were satisfactory, with 1 of the 13 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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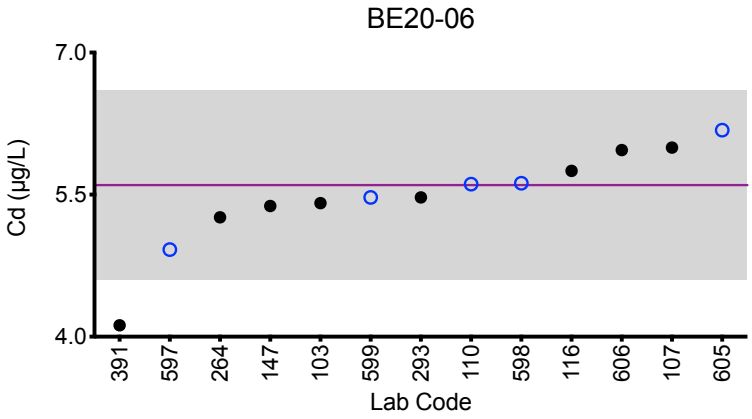
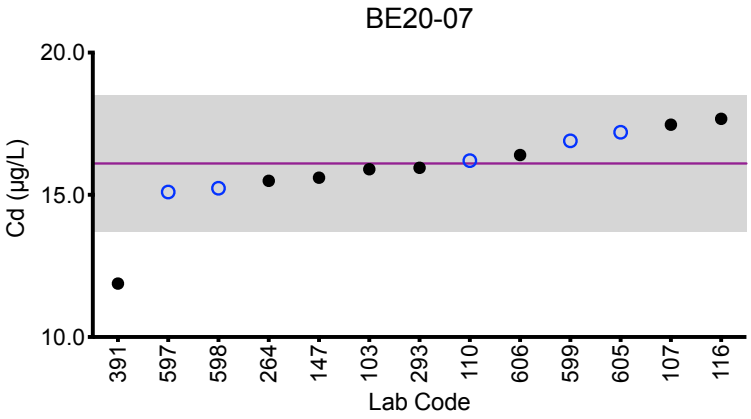
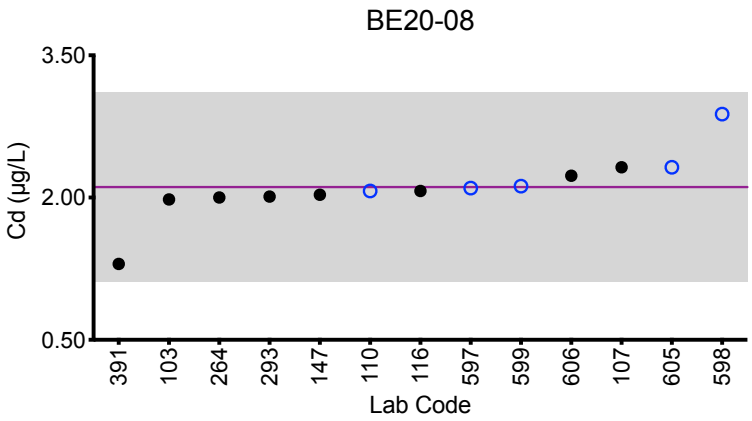
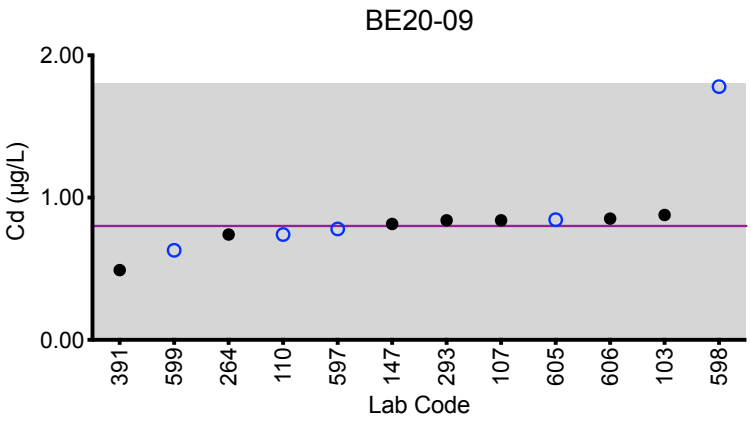
Results for Event #2, 2020: Summary Figures

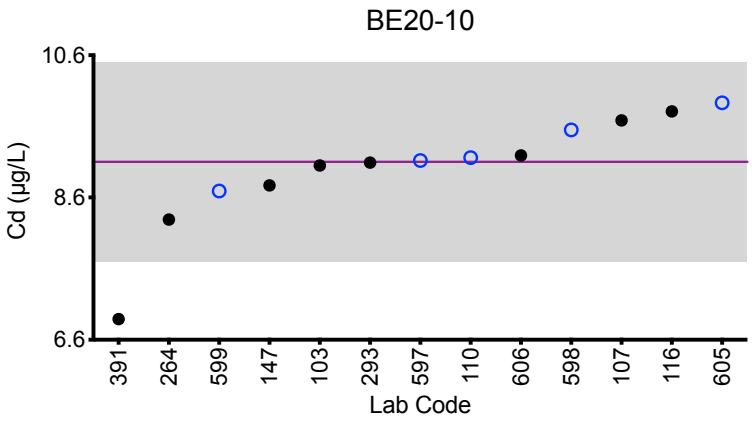
Whole Blood Cd











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

Whole Blood Co (µg/L)					
	BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Target (Arithmetic Mean ($\bar{x}$))	12.5	3.01	0.65	11.5	29.2
Upper Limit	15.0	4.51	2.15	13.8	35.0
Lower Limit	10.0	1.51	0.00	9.2	23.4
Arithmetic SD (s)	1.0	0.25	0.13	0.8	2.0
Arithmetic RSD (%)	8.0	8.3	20	7.0	6.8
Number of Sample Measurements (N)	9	9	9	9	9

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 #2, 2020:
Performance of Participating Laboratories

Whole Blood Co (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
	Target	**12.5**	**3.01**	**0.65**	**11.5**	**29.2**
103	DRC/CC-ICP-MS	12.8	3.00	0.643	11.7	29.1
110	ICP-MS	13.1	3.26	0.73	12.3	30.6
147	ICP-MS	12.7	3.02	0.754	11.7	29.1
255	ICP-MS	12	2.9	0.62	11	28
264	ICP-MS	12.13	2.98	0.66	11.40	28.30
293	DRC/CC-ICP-MS	13.37 L	3.12 L	0.69 L	12.28 L	31.73 L
391	ICP-MS	10.59	2.43	0.42	9.62	24.74
597	ICP-MS	11.9	3.01	0.74	12.7	31.2
598	ICP-MS	13.2	3.17	0.83	11.9	31.1
599	DRC/CC-ICP-MS	14.2	3.30	0.497	11.6	30.3

Based on the grading criteria for Co in Whole Blood, 100% of results were satisfactory, with 0 of the 10 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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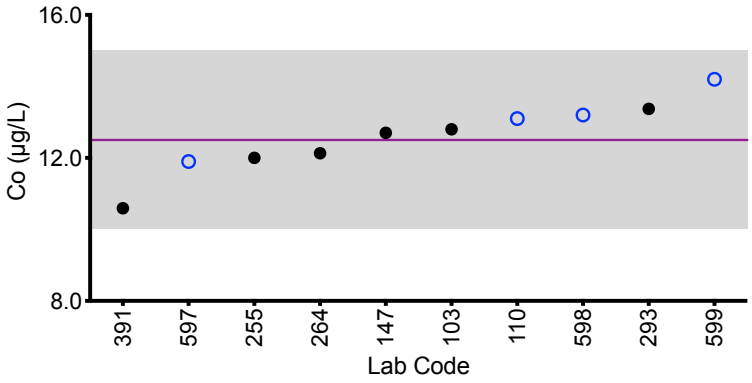
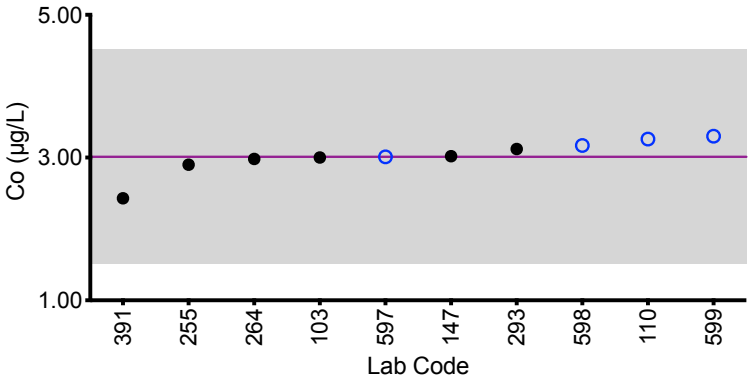
Results for Event #2, 2020: Summary Figures

Whole Blood Co

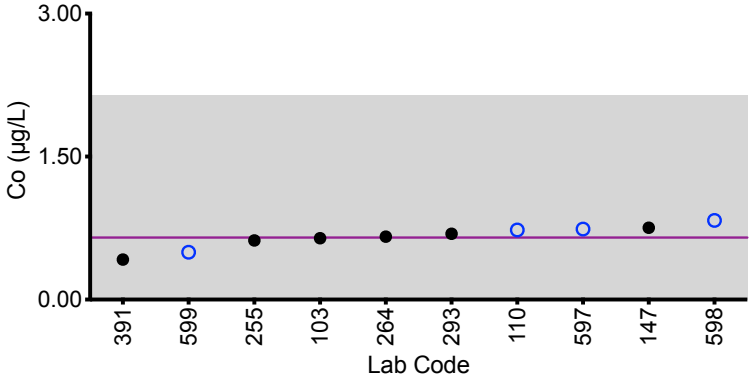
BE20-06



BE20-07



BE20-08



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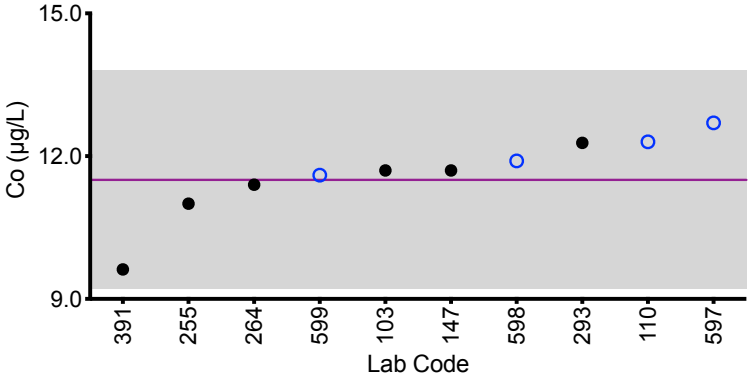
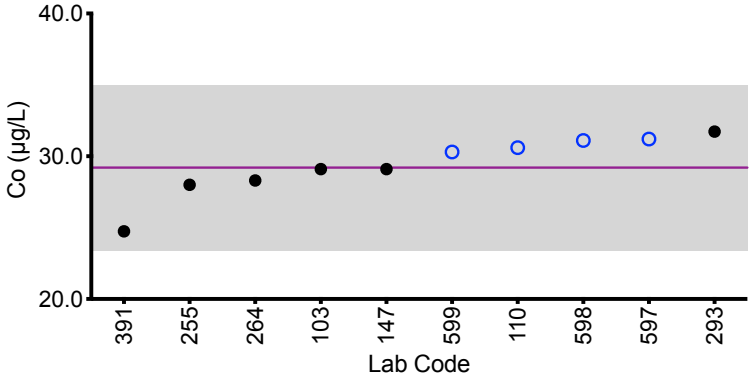


BE20-10



Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

Whole Blood Cr (µg/L)					
	BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Target (Arithmetic Mean ($\bar{x}$))	6.1	17.4	2.9	0.88	10.3
Upper Limit	8.1	20.9	4.9	2.88	12.4
Lower Limit	4.1	13.9	0.9	0.00	8.2
Arithmetic SD (s)	0.6	1.7	0.4	0.10	1.2
Arithmetic RSD (%)	9.7	9.8	13	9.0	12
Number of Sample Measurements (N)	8	7	7	5	7

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 #2, 2020:
Performance of Participating Laboratories

Whole Blood Cr (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
	Target	**6.1**	**17.4**	**2.9**	**0.88**	**10.3**
103	DRC/CC-ICP-MS	6.34	18.7	2.73	<2.50	11.0
110	DRC/CC-ICP-MS	6.41	18.1	2.72	0.937	10.0
147	DRC/CC-ICP-MS	6.80	19.1	3.33	1.16	12.0
255	ICP-MS	6	18	2.9	1	10
264	ICP-MS	5.75	14.32	3.21	1.11	8.43
293	DRC/CC-ICP-MS	6.25 L	17.83 L	3 L	1.02 L	10.75 L
391	ICP-MS	4.92	15.71	2.22	*0.33	9.29
597	ICP-MS	5.87	17.7	3.28	1.14	11.4
598	DRC/CC-ICP-MS	6.70	*6.97 ↓	*0.90	*0.45	*3.58 ↓

Based on the grading criteria for Cr in Whole Blood, 96% of results were satisfactory, with 1 of the 9 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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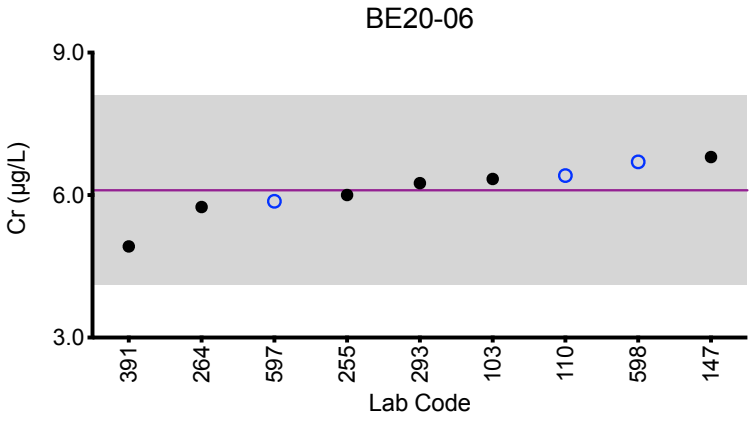
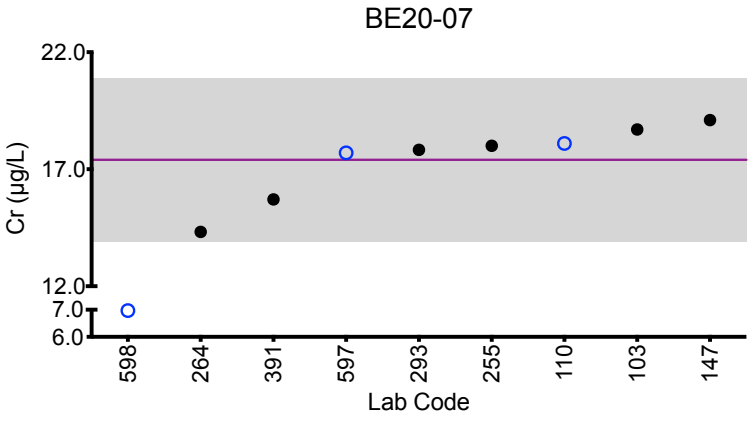
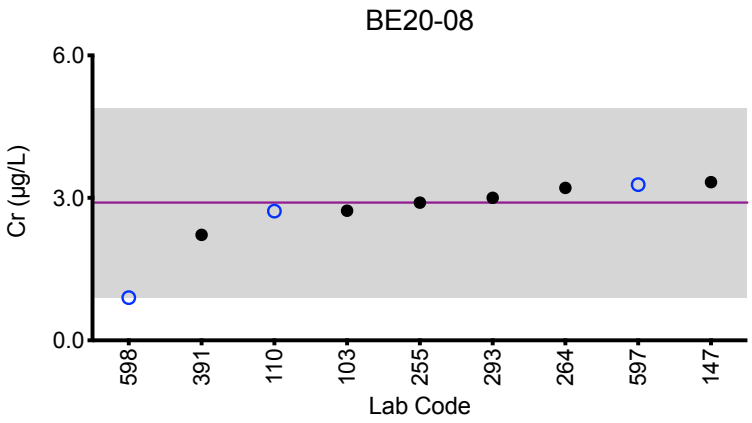
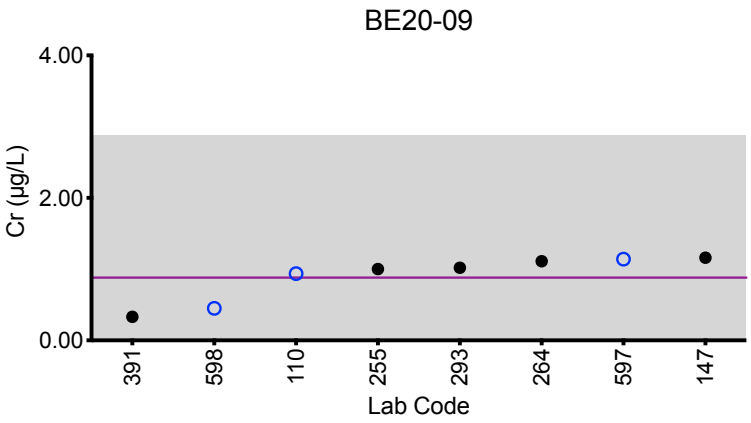
Results for Event #2, 2020: Summary Figures

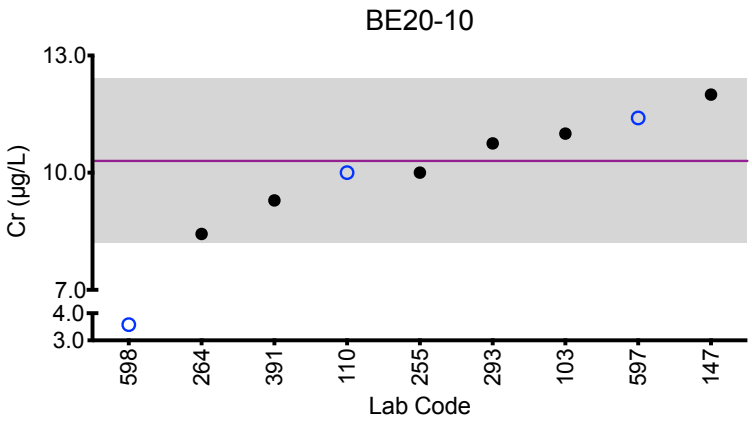
Whole Blood Cr











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

Whole Blood Hg (µg/L)					
	BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Target (Robust Mean (x*))	17.6	3.1	0.85	6.9	12.1
Upper Limit	22.9	6.1	3.85	9.9	15.7
Lower Limit	12.3	0.1	0.00	3.9	8.5
Robust SD (s*)	1.9	0.3	0.08	0.5	1.2
Robust RSD (%)	11	11	9.4	7.2	9.9
Number of Sample Measurements (N)	12	12	11	12	12
Standard Uncertainty (*u*)	0.7	0.1	0.03	0.2	0.4

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 #2, 2020:
Performance of Participating Laboratories

Whole Blood Hg (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
	Target	**17.6**	**3.1**	**0.85**	**6.9**	**12.1**
103	DRC/CC-ICP-MS	19.3	3.31	0.865	7.10	13.0
107	ICP-MS/MS	18.71	3.24	0.89	7.28	12.61
110	ICP-MS	16.0	3.00	0.84	6.01	10.9
116	ICP-MS/MS	21.3	3.33	<1.5	7.68	13.5
147	ICP-MS	16.1	2.83	0.660	6.18	11.0
264	ICP-MS	19.04	3.42	0.99	7.43	14.11
293	DRC/CC-ICP-MS	16.45 L	2.57 L	0.86 L	5.73 L	10.84 L
391	CV-AAS	15.57	2.74	0.80	6.34	10.61
597	ICP-MS	15.9	3.07	0.88	7.09	12.6
598	ICP-MS	16.8	3.79	0.92	7.05	11.2
599	DRC/CC-ICP-MS	16.4	2.47	0.788	5.64	11.5
605	ICP-MS	18.7	3.06	0.869	7.08	12.5
606	ICP-MS/MS	18.4	2.93	0.658	6.93	12.0

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

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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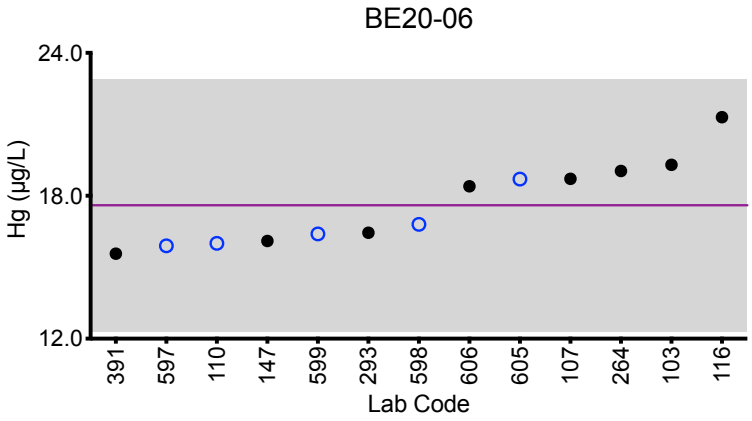
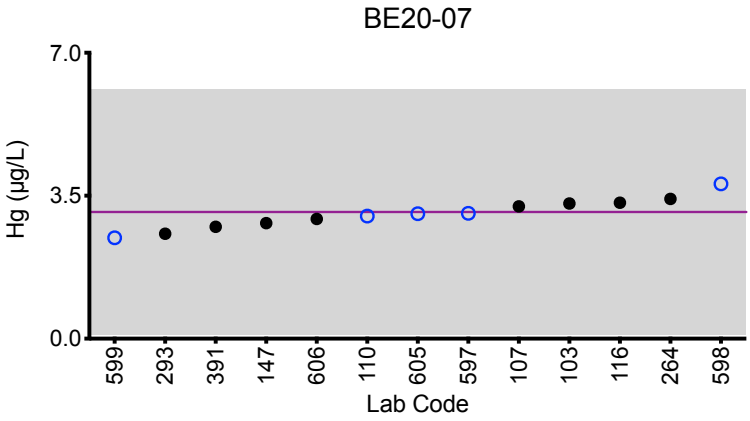
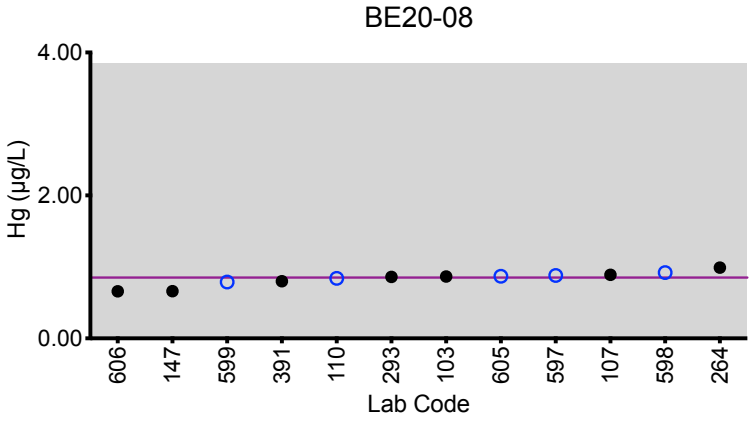
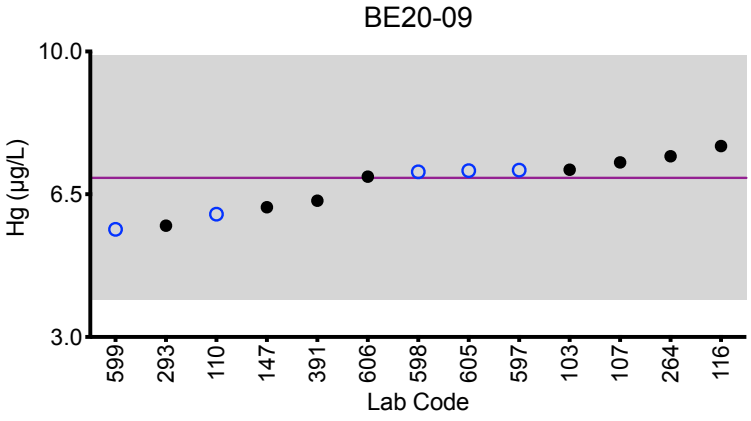
Results for Event #2, 2020: Summary Figures

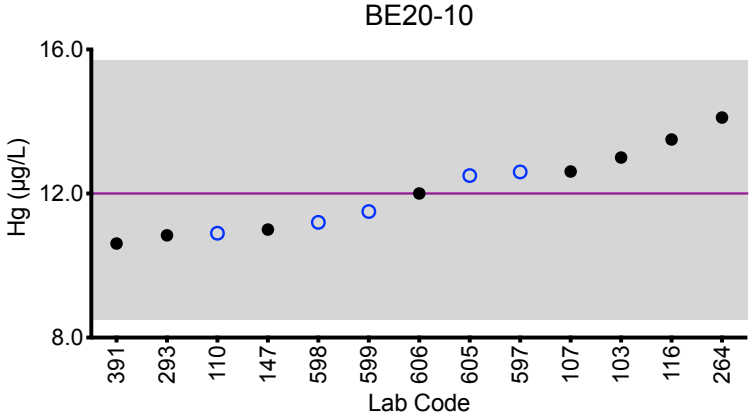
Whole Blood Hg











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

Whole Blood Mn (µg/L)					
	BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Target (Robust Mean (x*))	15.3	10.8	19.8	8.4	36.5
Upper Limit	18.3	13.8	23.2	11.4	42.7
Lower Limit	12.3	7.8	16.4	5.4	30.3
Robust SD (s*)	1.1	1.1	1.3	1.0	1.7
Robust RSD (%)	7.2	10	6.6	12	4.7
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (*u*)	0.4	0.4	0.5	0.4	0.7

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 Laboratory Medicine 2016; 54(12): 1921-1928).

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Results for Event #2, 2020:
Performance of Participating Laboratories

Whole Blood Mn (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
	Target	**15.3**	**10.8**	**19.8**	**8.4**	**36.5**
103	DRC/CC-ICP-MS	15.3	10.7	19.1	7.99	37.4
107	ICP-MS/MS	15.18	11.31	20.91	8.12	38.77
110	ICP-MS	13.6	9.5	18.1	7.0	35.4
147	ICP-MS	16.7	13.8	20.5	11.3	34.6
264	ICP-MS	15.25	10.89	19.53	8.96	34.24
293	DRC/CC-ICP-MS	12.36 L	8.46 L	16.75 L	5.6 L	34.1 L
391	ICP-MS	15.94	10.51	20.26	8.42	35.17
597	ICP-MS	12.9	9.35	18.3	7.58	37.2
598	ICP-MS	15.3	11.4	21.6	8.72	37.2
599	DRC/CC-ICP-MS	20.1 ↑	13.7	20.8	11.3	38.0
606	ICP-MS/MS	14.7	10.2	19.3	7.69	37.1

Based on the grading criteria for Mn in Whole Blood, 98% of results were satisfactory, with 0 of the 11 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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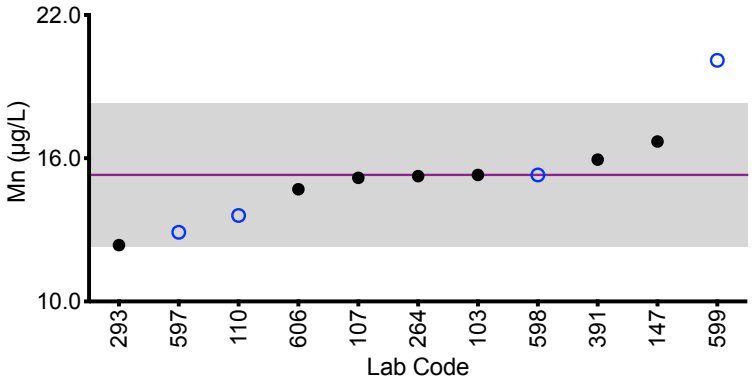
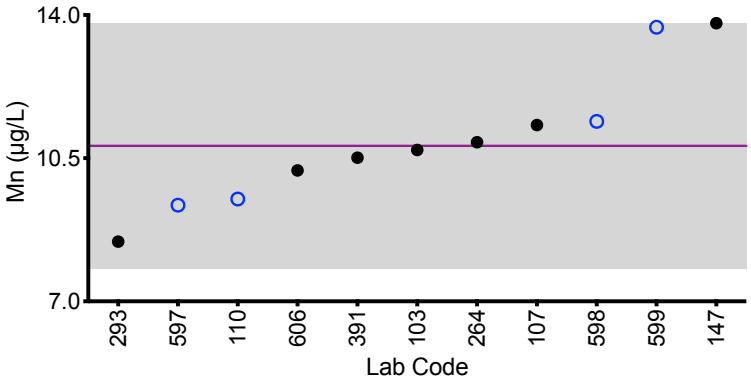
Results for Event #2, 2020: Summary Figures

Whole Blood Mn

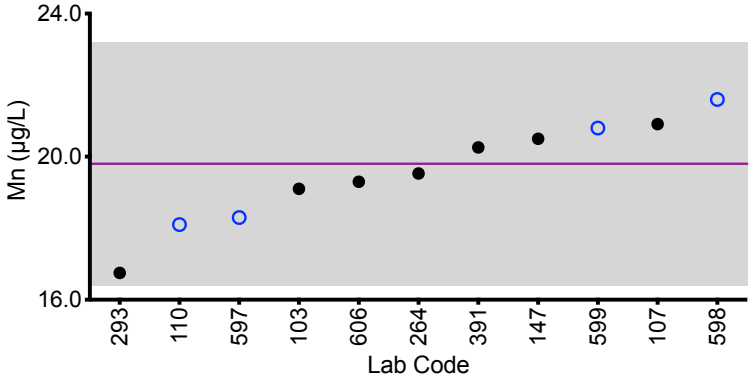
BE20-06



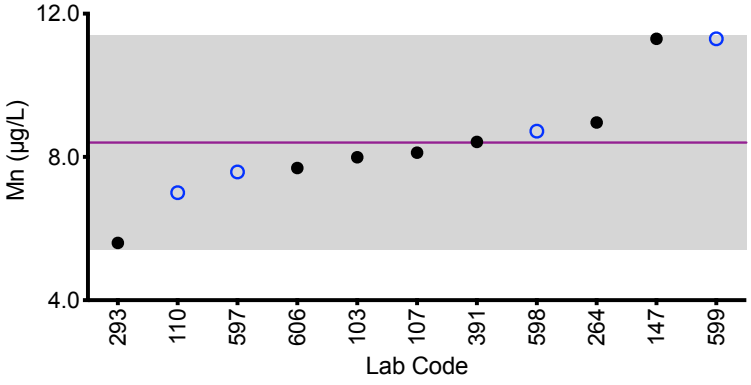
BE20-07



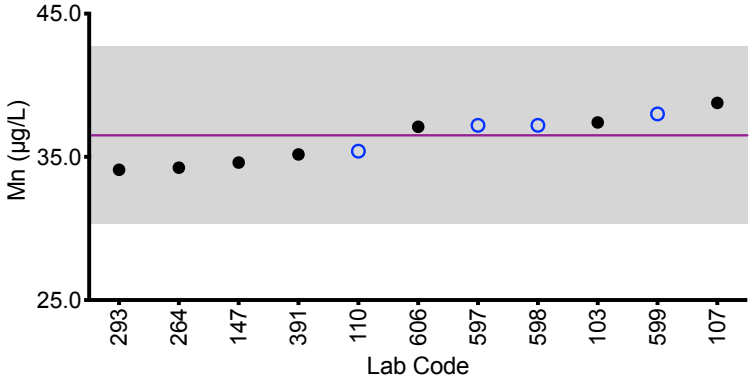
BE20-08



BE20-09



BE20-10



Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

Whole Blood Pb (µg/dL)					
	BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Target (Robust Mean (x*))	10.7	22.8	5.81	17.0	1.68
Upper Limit	12.7	25.1	7.81	19.0	3.68
Lower Limit	8.7	20.5	3.81	15.0	0.00
Robust SD (s*)	0.9	1.4	0.26	1.4	0.05
Robust RSD (%)	8.4	6.1	4.5	8.2	3.0
Number of Sample Measurements (N)	13	13	13	13	10
Standard Uncertainty (*u*)	0.3	0.5	0.09	0.5	0.02

The acceptable range is based on quality specifications:
±2 µg/dL or ±10% around the target value, whichever is greater; thus, it is fixed at ±2 µg/dL at concentrations less than or equal to 20 µg/dL. These quality specifications are recommended by the Clinical Laboratory Standards Institute (CLSI, C40-A2) and have been proposed for use in proficiency testing programs approved under CLIA by the Centers for Medicare and Medicaid Services (CMS) in the USA. (https://clsi.org/standards/products/clinical-chemistry-and-toxicology/documents/c40/)

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Results for Event #2, 2020:
Performance of Participating Laboratories

Whole Blood Pb (µg/dL)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
	Target	**10.7**	**22.8**	**5.81**	**17.0**	**1.68**
103	DRC/CC-ICP-MS	11.0	23.0	5.84	17.1	1.70
107	ICP-MS/MS	11.730	24.99	6.558	18.897	1.817
110	ICP-MS	10.6	22.5	5.77	16.8	1.69
116	ICP-MS/MS	11.6	24.4	6.23	18.43	<3.00
147	ICP-MS	10.6	22.4	5.78	17.0	1.67
264	ICP-MS	10.54	21.05	5.65	16.01	1.54
293	DRC/CC-ICP-MS	11.17 L	23.16 L	6 L	17.58 L	1.86 L
343	ASV-LeadCare	9.9	23.8	4.5	16.1	<1.9
391	ETAAS-Z	6.53 ↓	18.15 ↓	0.86 ↓	11.30 ↓	<0.50
597	ICP-MS	9.55	21.7	5.72	17.5	1.72
598	ICP-MS	11.0	22.4	5.98	16.9	1.67
599	DRC/CC-ICP-MS	10.4	22.6	5.63	15.4	1.56
605	ICP-MS	12.2	24.7	6.63	19.3 ↑	1.85
606	ICP-MS/MS	11.1	23.0	5.92	17.3	1.67

Based on the grading criteria for Pb in Whole Blood, 93% of results were satisfactory, with 1 of the 14 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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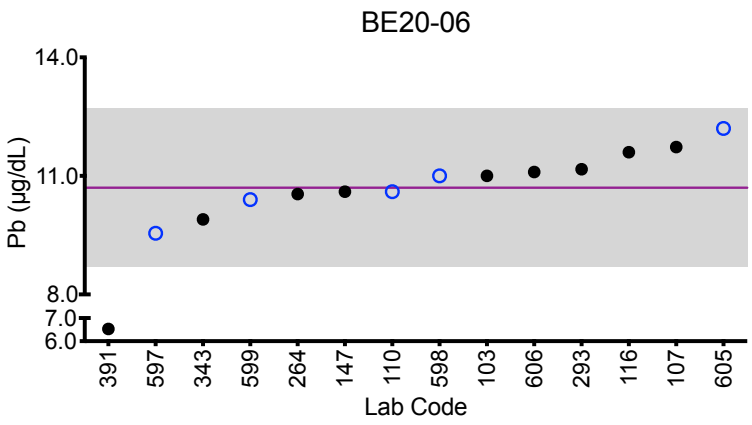
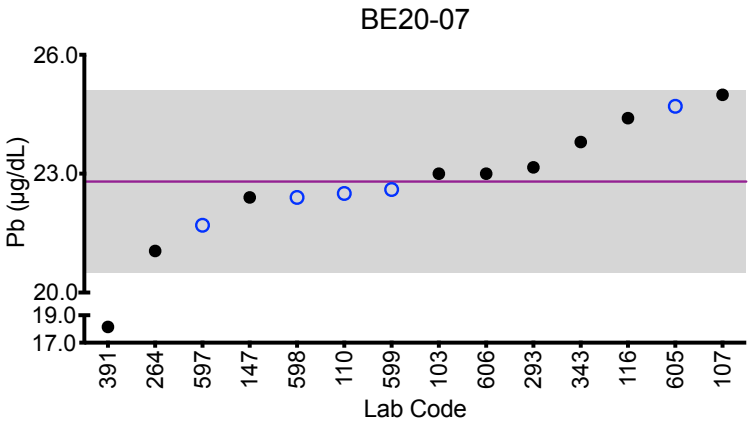
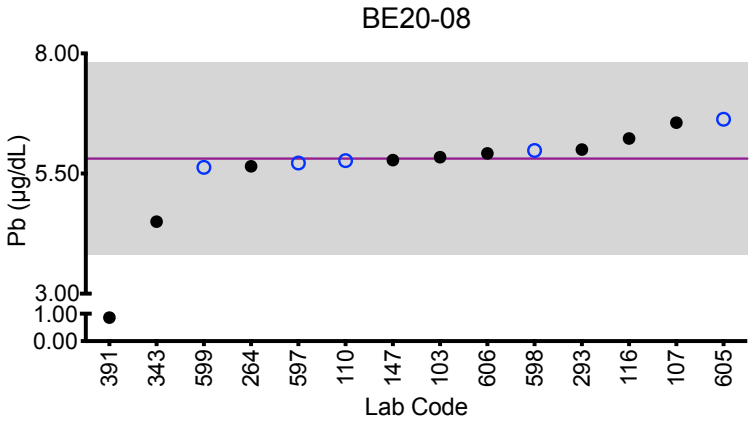
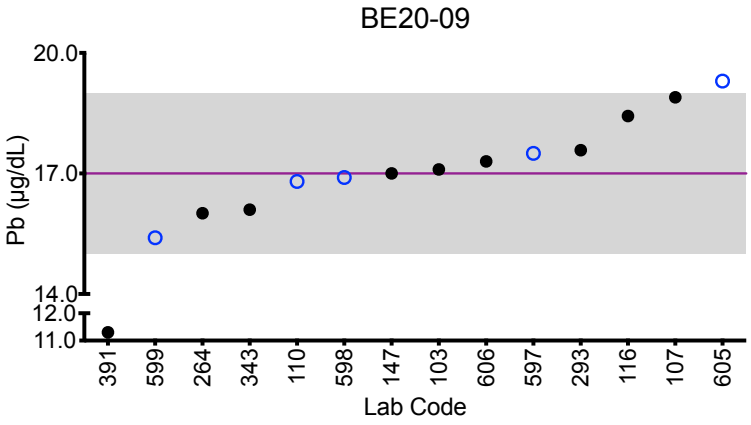
Results for Event #2, 2020: Summary Figures

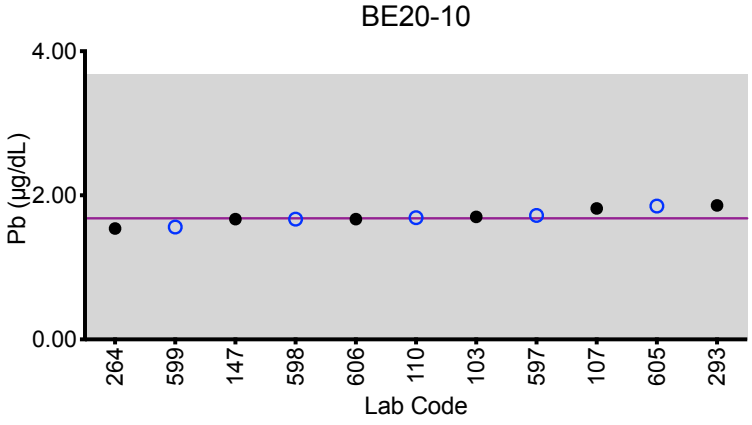
Whole Blood Pb











Legend:
o C/HHEAR 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 #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Cs (µg/L)

Lab Code	Method	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
110	ICP-MS	1.43	1.43	1.47	1.50	1.51
147	ICP-MS	1.58	1.57	1.59	1.58	1.61
597	ICP-MS	1.37	1.46	1.53	1.55	1.54
598	ICP-MS	1.51	1.52	1.62	1.60	1.73
599	DRC/CC-ICP-MS	*5.09	1.57	1.58	1.61	1.65

Summary Statistics

	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
Arithmetic Mean ($\bar{x}$)	1.47	1.51	1.56	1.57	1.61
Arithmetic SD (s)	0.08	0.06	0.06	0.04	0.08
Arithmetic RSD (%)	5.4	4.0	3.8	2.7	5.0
Number of Sample Measurements (N)	4	5	5	5	5

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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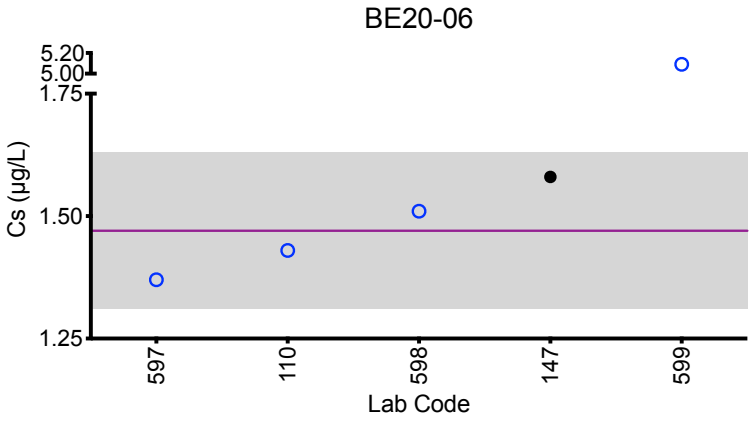
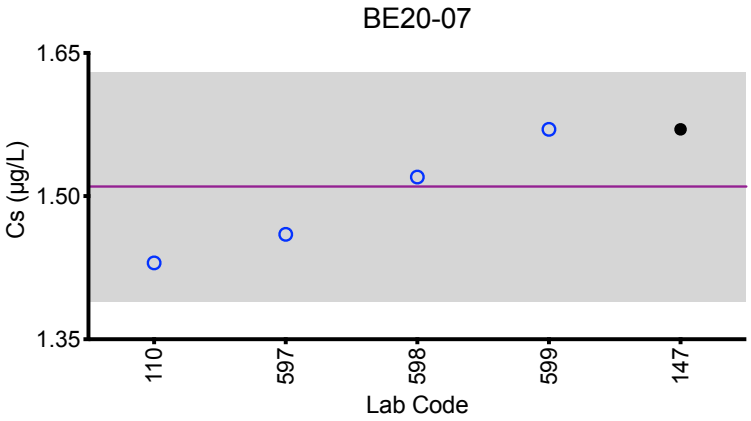
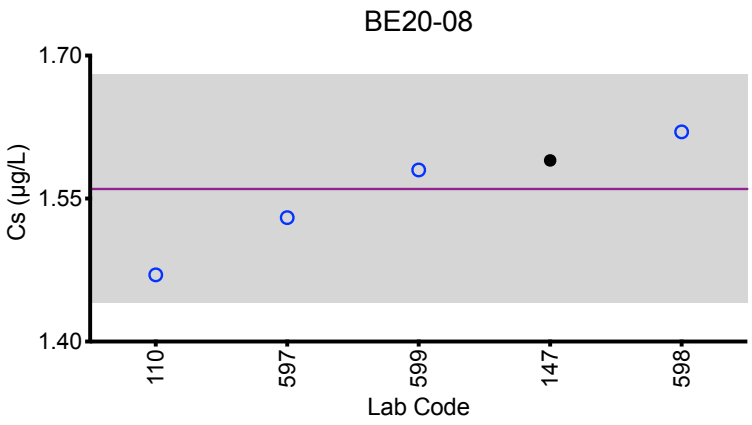
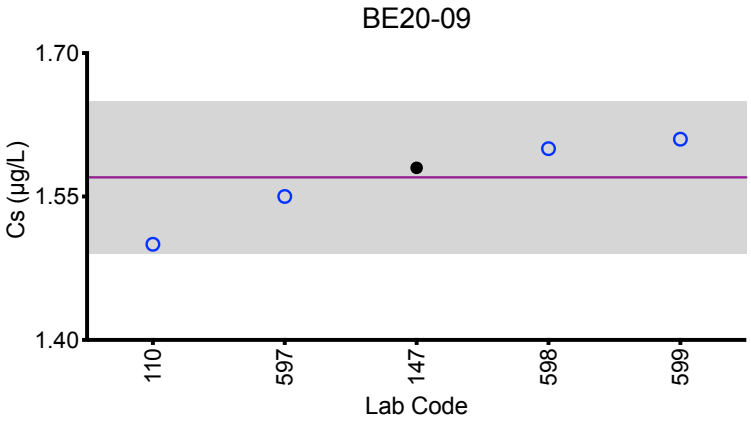
Results for Event #2, 2020: Summary Figures

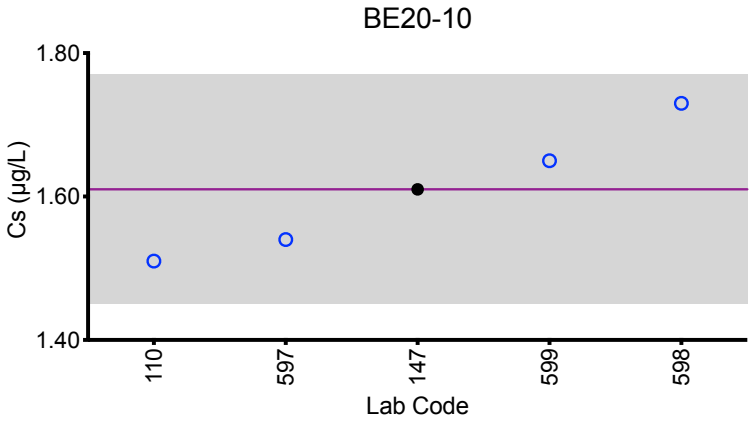
Whole Blood Cs











Legend:

o C/HHEAR 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 intended to be quality specifications and are included for informational purposes only.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Cu (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
110	ICP-MS	857	1017	1040	1068	897
147	ICP-MS	851	998	1023	1042	883
597	ICP-MS	835	1026	1110	1180	*978
598	ICP-MS	861	998	1070	1040	892
599	DRC/CC-ICP-MS	905.3	1046.89	1051.76	1011.25	882.9
Summary Statistics						
		BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Arithmetic Mean ($\bar{x}$)		862	1017	1059	1070	889
Arithmetic SD (s)		25	19	31	60	6
Arithmetic RSD (%)		2.9	1.9	2.9	5.6	0.67
Number of Sample Measurements (N)		5	5	5	5	4

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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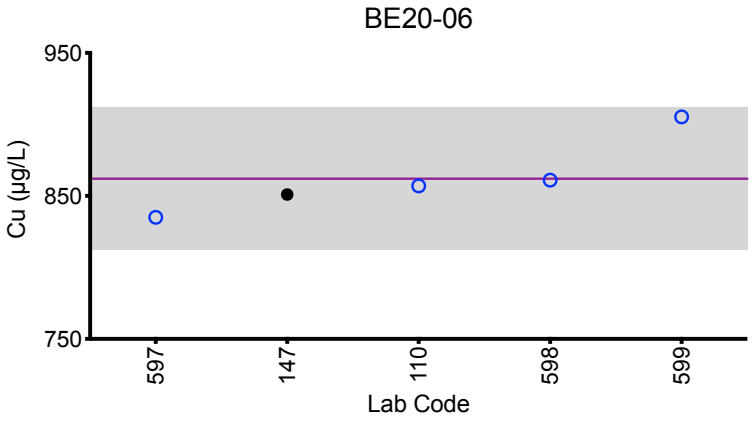
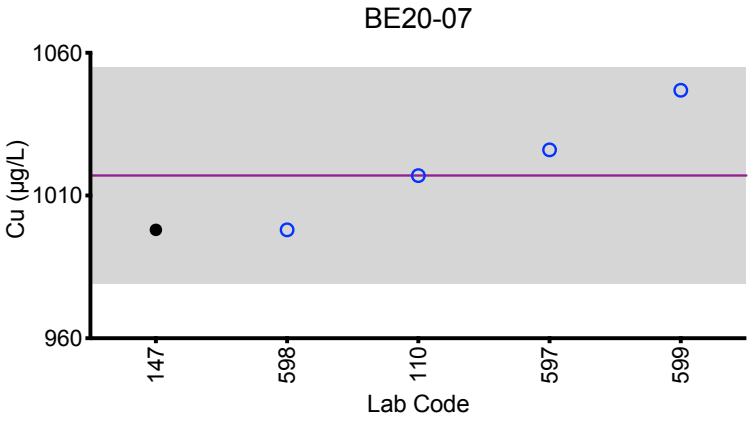
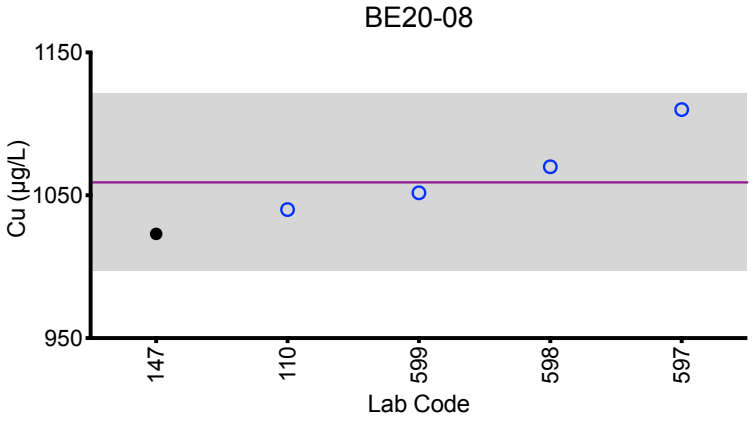
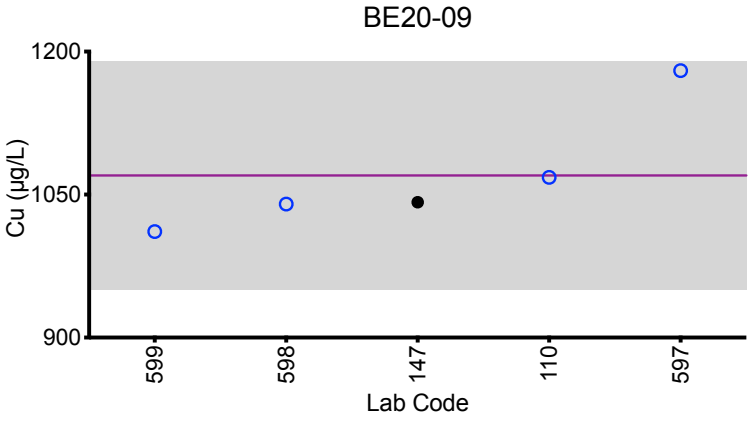
Results for Event #2, 2020: Summary Figures

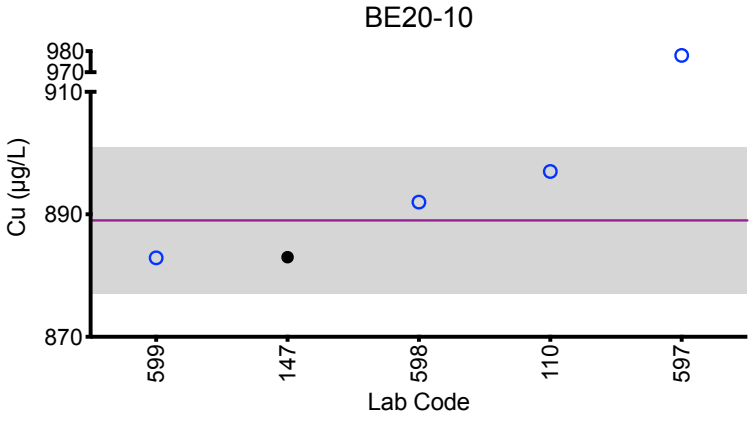
Whole Blood Cu











Legend:
o C/HHEAR 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 intended to be quality specifications and are included for informational purposes only.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Mo (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
103	DRC/CC-ICP-MS	2.34	<1.50	6.47	3.50	<1.50
147	ICP-MS	2.41	0.271	6.11	3.44	0.476
264	ICP-MS	1.73	<0.01	7.30	2.57	<0.01
597	ICP-MS	2.15	0.23	6.45	3.59	0.51
598	DRC/CC-ICP-MS	2.90	0.53	6.59	4.13	0.64
599	DRC/CC-ICP-MS	2.72	0.139	6.70	3.31	0.56
Summary Statistics						
		BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Arithmetic Mean ($\bar{x}$)		2.4	NA	6.6	3.4	0.55
Arithmetic SD (s)		0.4	NA	0.4	0.5	0.07
Arithmetic RSD (%)		17	NA	5.8	14	13
Number of Sample Measurements (N)		6	NA	6	6	4

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

Statistical data was not calculated for BE20-07 based on a lack of consensus among participating labs.

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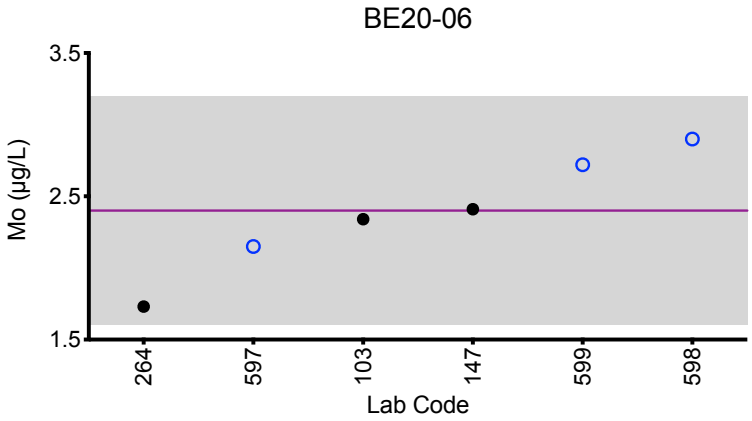
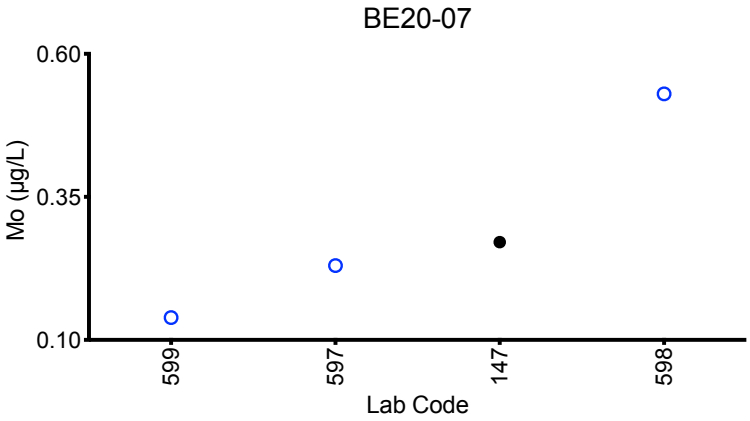
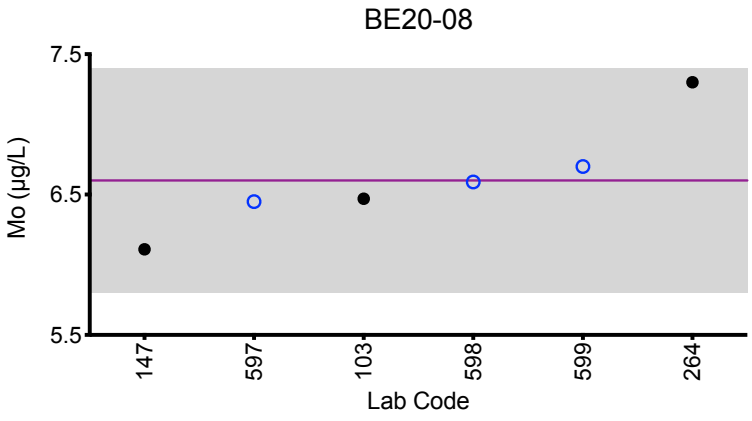
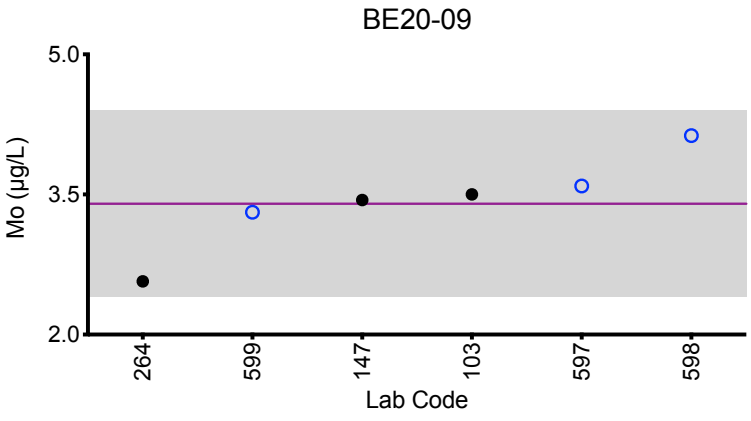
Results for Event #2, 2020: Summary Figures

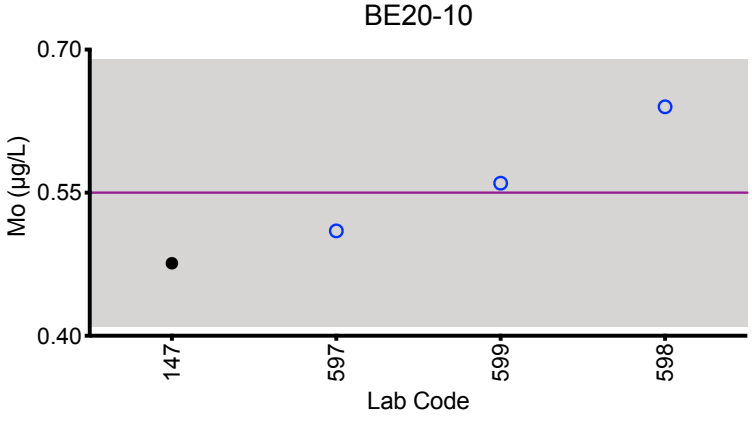
Whole Blood Mo











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

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Sb (µg/L)

Lab Code	Method	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
103	DRC/CC-ICP-MS	<0.250	1.72	2.57	<0.250	5.82
110	ICP-MS	0.019	1.67	2.67	<0.011	5.96
147	ICP-MS	<0.329	2.06	2.73	<0.329	5.95
264	ICP-MS	<0.01	1.74	2.74	<0.01	5.72
293	DRC/CC-ICP-MS	0.03 L	1.77 L	2.78 L	0 L	5.94 L
597	ICP-MS		1.71	2.74		6.20
598	ICP-MS	<0.2	1.9	2.7	<0.2	6.1

Summary Statistics

	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
Arithmetic Mean ($\bar{x}$)	NA	1.80	2.69	NA	5.96
Arithmetic SD (s)	NA	0.14	0.06	NA	0.17
Arithmetic RSD (%)	NA	7.8	2.2	NA	2.9
Number of Sample Measurements (N)	NA	6	6	NA	6

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L Denotes late submission, results not included in statistics

Statistical data was not calculated for BE20-06 and BE20-09 based on a lack of consensus among participating labs.

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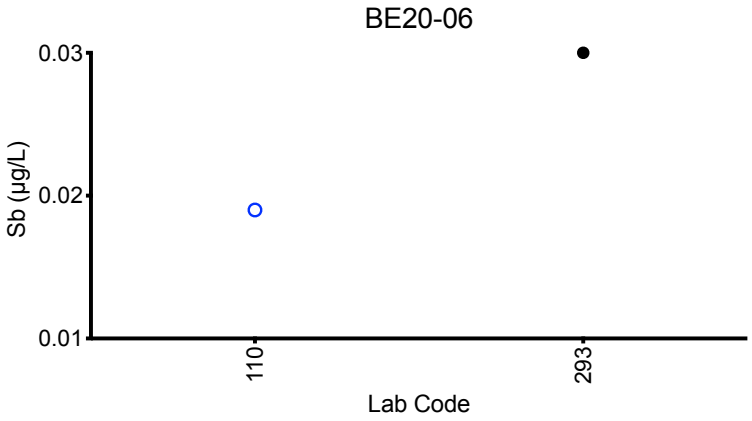
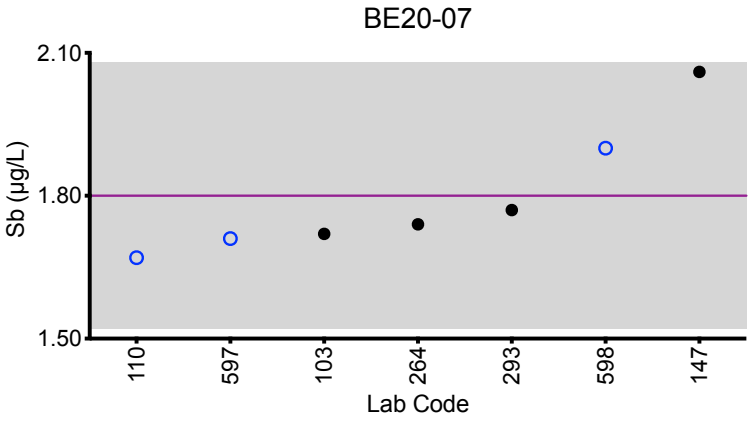
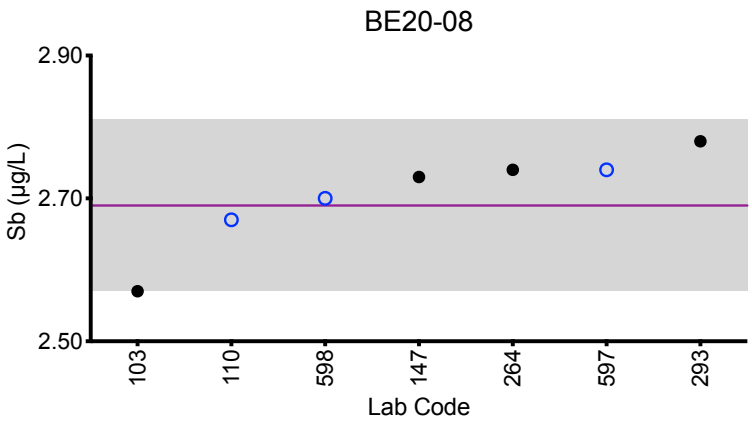
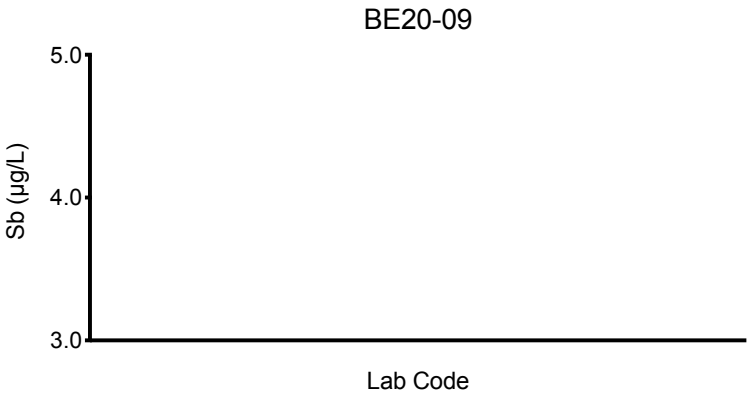
Results for Event #2, 2020: Summary Figures

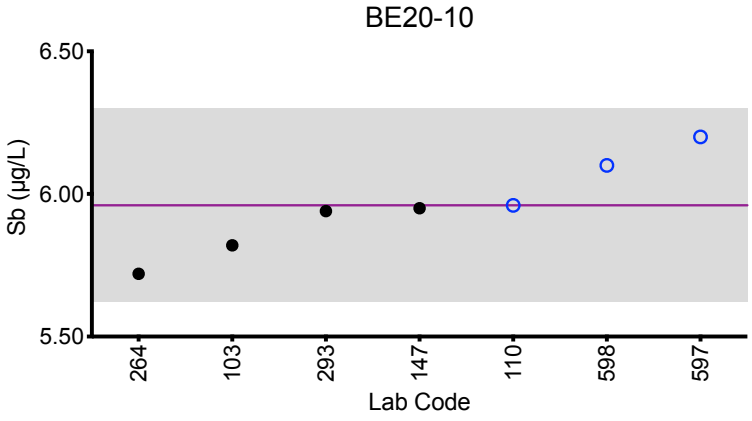
Whole Blood Sb











Legend:
o C/HHEAR Labs ● Other Labs
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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Se (µg/L)

Lab Code	Method	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
103	DRC/CC-ICP-MS	155	143	148	149	154
107	ICP-MS/MS	161.6	155.5	165.5	162.1	156.7
110	DRC/CC-ICP-MS	152	141	149	149	149
147	ICP-MS	147	140	148	150	149
264	ICP-MS	147	156	141	144	137
293	DRC/CC-ICP-MS	*124.7 L	131.81 L	134.18 L	138.12 L	134.18 L
597	ICP-MS	140	147	159	164	165
598	DRC/CC-ICP-MS	153	149	163	168	172
599	DRC/CC-ICP-MS	147.8	137	153.2	124.6	163.4

Summary Statistics

	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
Arithmetic Mean ($\bar{x}$)	150	146	153	151	156
Arithmetic SD (s)	6	7	8	13	11
Arithmetic RSD (%)	4.0	4.8	5.2	8.6	7.1
Number of Sample Measurements (N)	8	8	8	8	8

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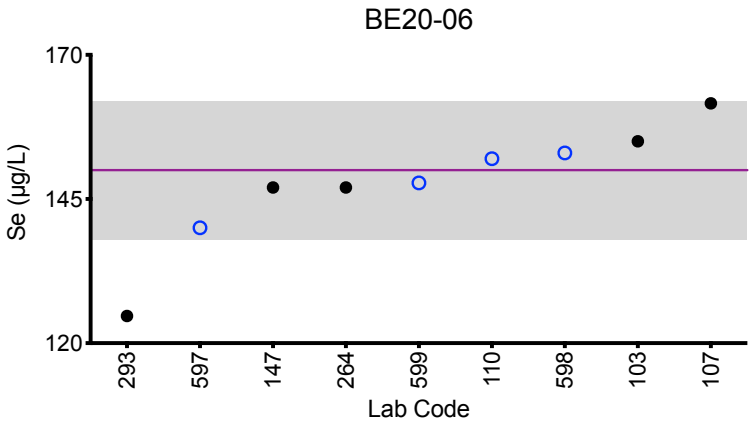
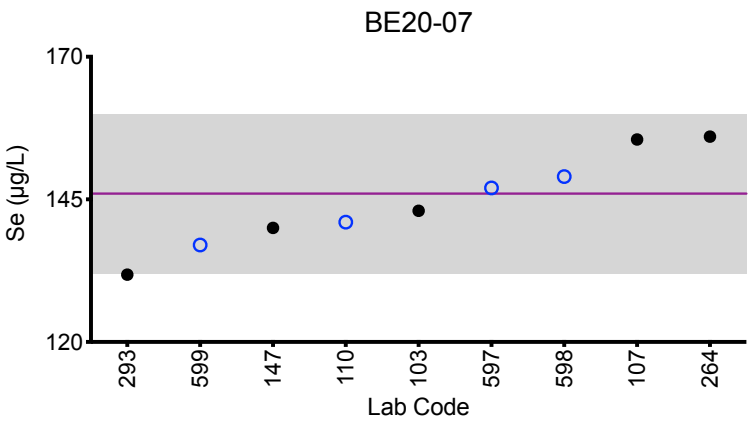
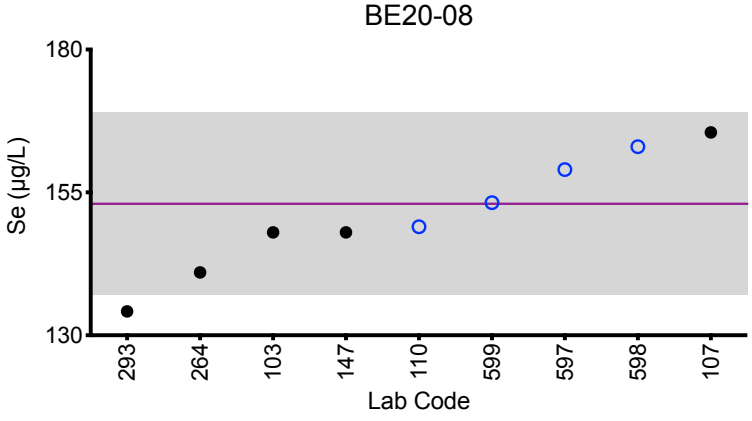
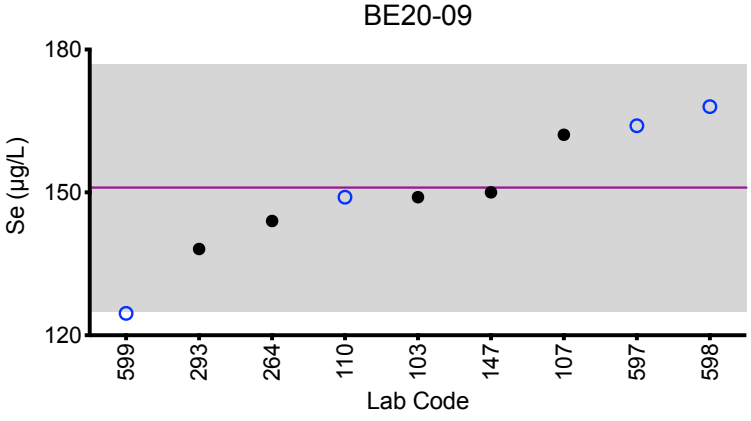
Results for Event #2, 2020: Summary Figures

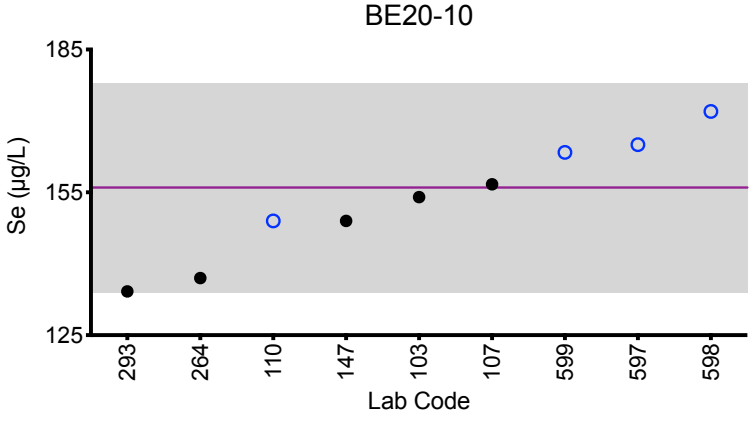
Whole Blood Se











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Tl (µg/L)

Lab Code	Method	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
103	DRC/CC-ICP-MS	1.23	0.944	2.49	1.83	0.366
110	ICP-MS	1.21	0.974	2.54	1.88	0.348
147	ICP-MS	1.19	0.938	2.49	1.84	0.325
264	ICP-MS	1.14	0.83	2.29	1.61	0.30
293	DRC/CC-ICP-MS	1.17 L	0.9 L	2.45 L	1.8 L	0.34 L
597	ICP-MS	1.07	0.91	2.45	1.82	0.34
598	ICP-MS	*2.05	*2.63	*4.26	2.36	*1.24

Summary Statistics

	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
Arithmetic Mean ($\bar{x}$)	1.17	0.92	2.45	1.89	0.336
Arithmetic SD (s)	0.06	0.05	0.09	0.24	0.023
Arithmetic RSD (%)	5.1	5.4	3.7	13	6.8
Number of Sample Measurements (N)	5	5	5	6	5

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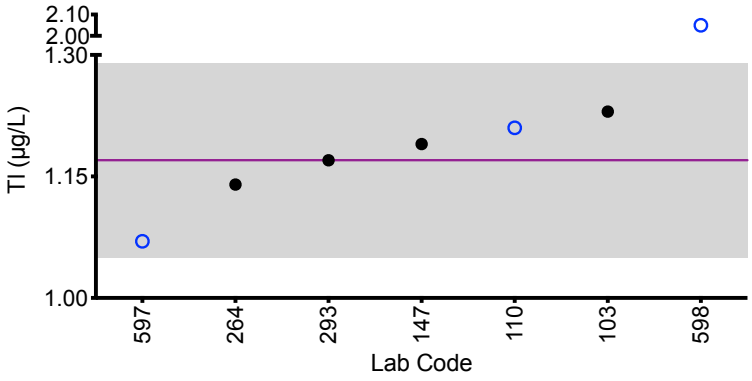
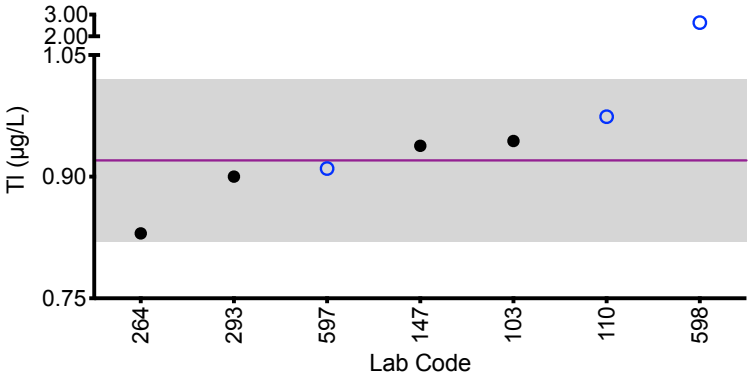
Results for Event #2, 2020: Summary Figures

Whole Blood Tl

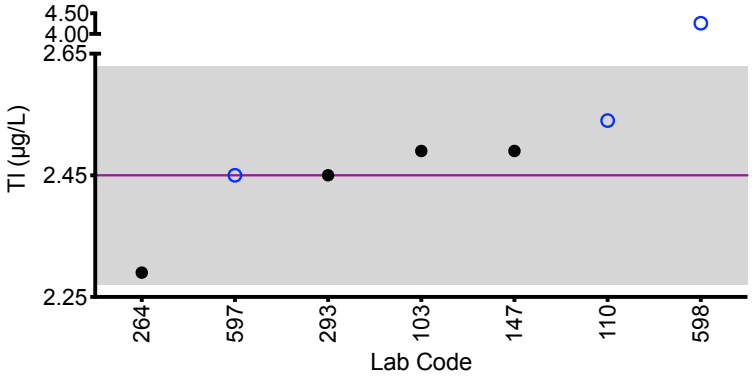
BE20-06



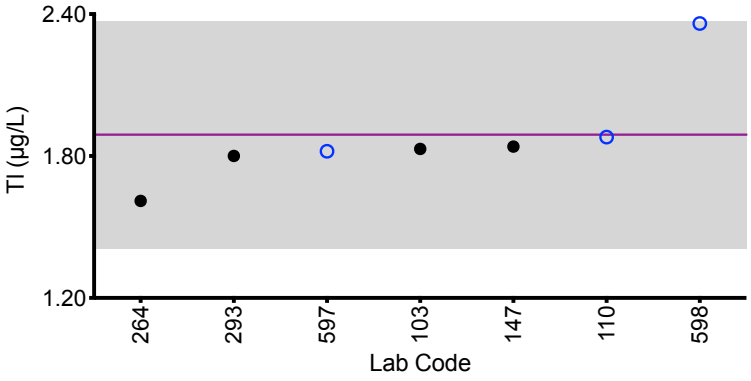
BE20-07



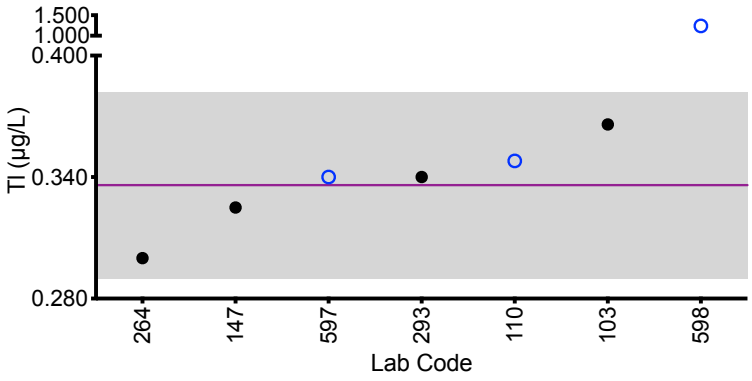
BE20-08



BE20-09



BE20-10



Legend:

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood U (µg/L)

Lab Code	Method	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
103	DRC/CC-ICP-MS	0.140	0.156	0.361	0.0839	0.319
110	ICP-MS	0.140	0.165	0.352	0.084	0.300
147	ICP-MS	0.133	0.166	0.343	0.0826	0.281
598	ICP-MS	0.14	0.18	0.37	0.08	0.27
599	DRC/CC-ICP-MS	0.109	0.141	0.480	<0.1	0.230

Summary Statistics

	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
Arithmetic Mean ($\bar{x}$)	0.132	0.162	0.38	0.0826	0.28
Arithmetic SD (s)	0.012	0.014	0.05	0.0017	0.03
Arithmetic RSD (%)	9.1	8.6	13	2.1	11
Number of Sample Measurements (N)	5	5	5	4	5

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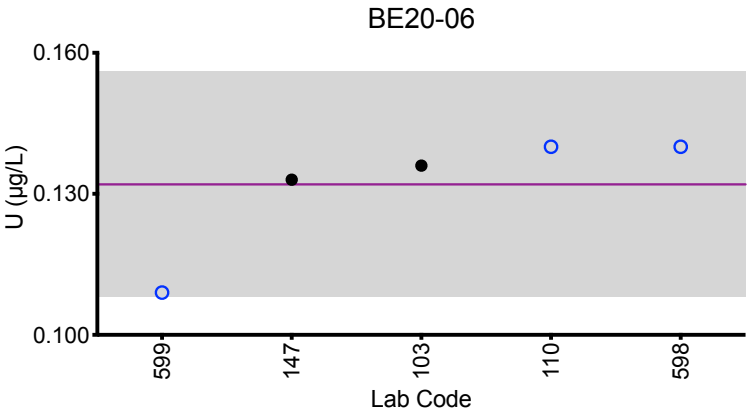
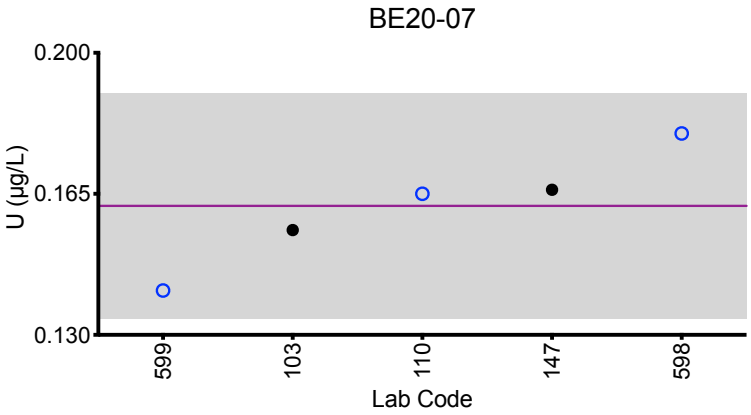
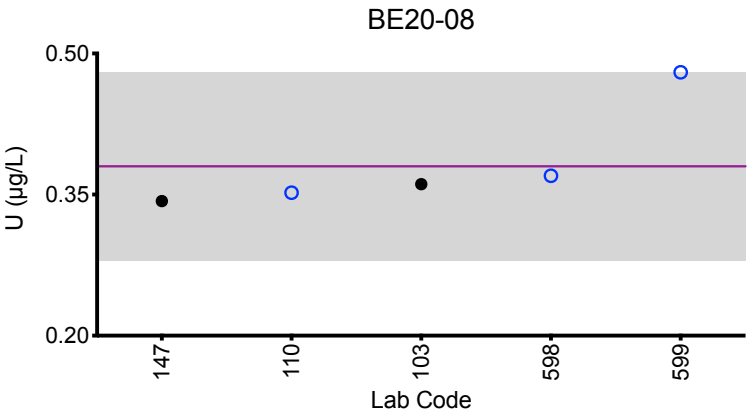
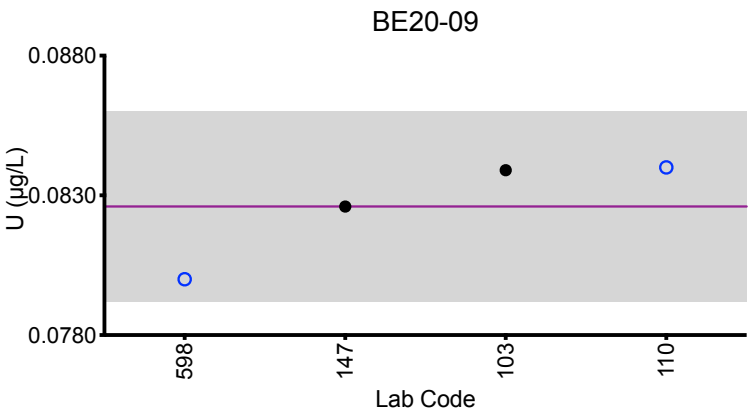
Results for Event #2, 2020: Summary Figures

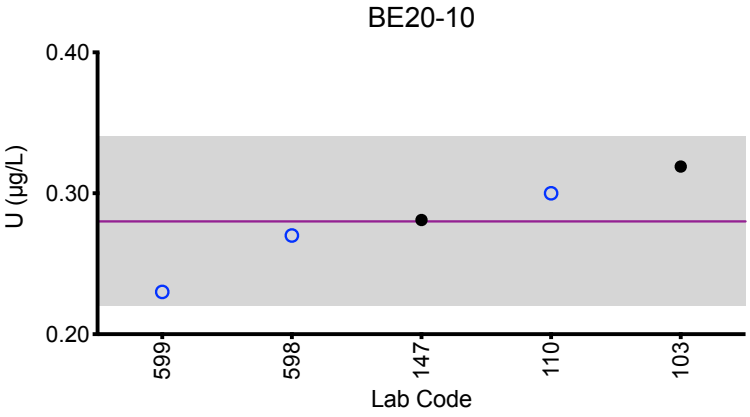
Whole Blood U











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Zn (µg/L)

Lab Code	Method	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
110	ICP-MS	7090	5460	7520	5280	7350
147	ICP-MS	6235	4830	6667	4693	6536
597	ICP-MS	6330	5140	7480	5430	7440
598	ICP-MS	6830	5210	7530	4970	7030
599	DRC/CC-ICP-MS	6326	4934	6842	4348	6491

Summary Statistics

	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
Arithmetic Mean ($\bar{x}$)	6560	5110	7210	4940	6970
Arithmetic SD (s)	350	230	390	410	420
Arithmetic RSD (%)	5.3	4.5	5.4	8.3	6.0
Number of Sample Measurements (N)	5	5	5	5	5

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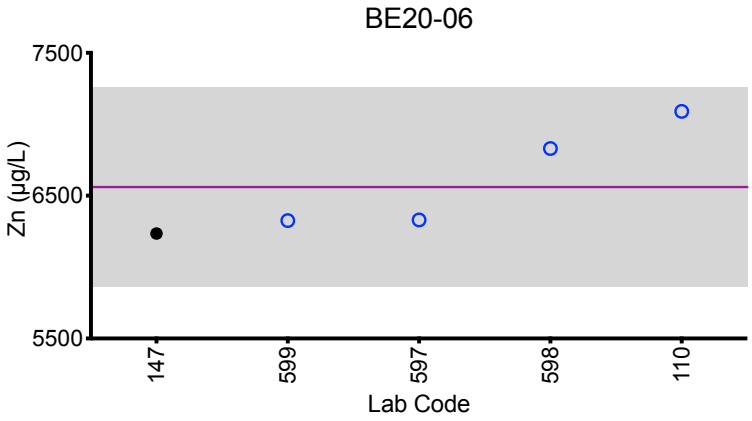
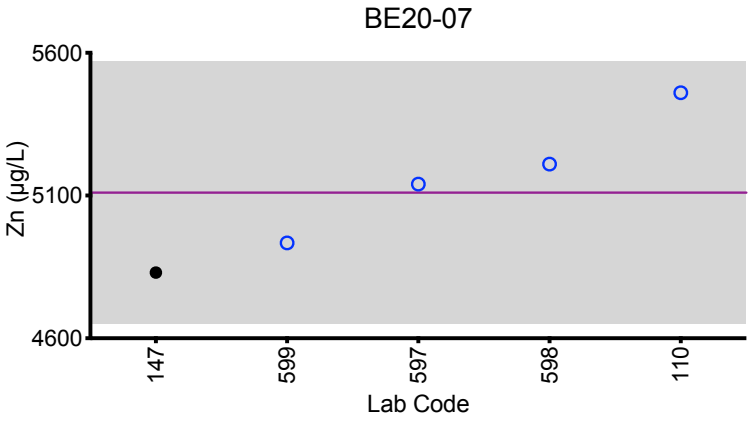
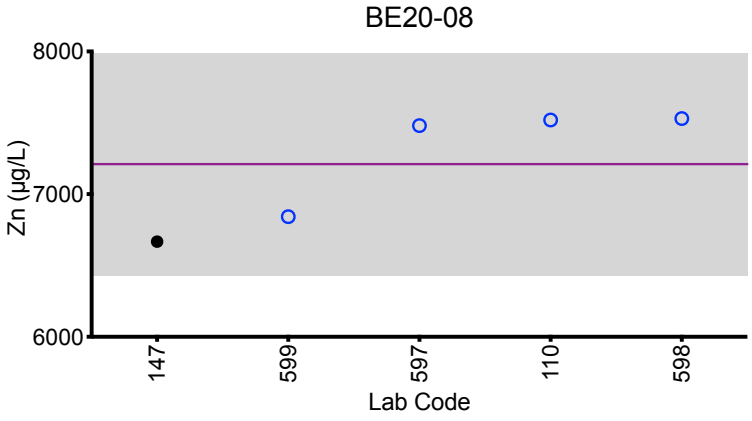
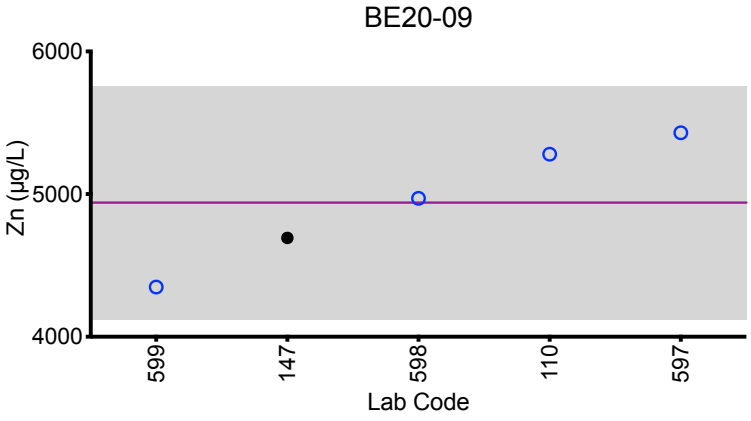
Results for Event #2, 2020: Summary Figures

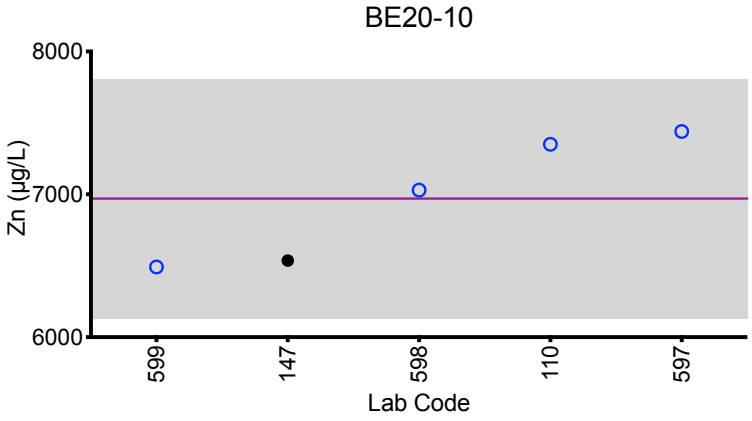
Whole Blood Zn











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Ba (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
110	ICP-MS	<3.1	5.2	10.6	13.4	4.3
147	ICP-MS	2.31	5.22	10.0	13.7	4.29
597	ICP-MS	2.47	5.05	10.4	13.8	4.56
598	ICP-MS	*4.5	7.6	12.9	15.6	6.3
Summary Statistics						
		BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Arithmetic Mean ($\bar{x}$)		2.4	5.8	11.0	14.1	4.9
Arithmetic SD (s)		0.1	1.1	1.2	0.9	0.9
Arithmetic RSD (%)		4.7	19	11	6.4	18
Number of Sample Measurements (N)		2	4	4	4	4

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Be (µg/L)

Lab Code	Method	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
110	ICP-MS	1.88	3.94	0.504	2.47	5.11
147	ICP-MS	1.75	3.32	<1.17	2.41	4.69
598	ICP-MS	1.89	5.02	1.56	*4.18	5.73
599	DRC/CC-ICP-MS	2.09	3.69	1.39	2.45	4.25

Summary Statistics

	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
Arithmetic Mean ($\bar{x}$)	1.90	4.0	NA	2.44	4.9
Arithmetic SD (s)	0.13	0.7	NA	0.03	0.6
Arithmetic RSD (%)	6.8	18	NA	1.3	12
Number of Sample Measurements (N)	4	4	NA	3	4

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L Denotes late submission, results not included in statistics

Statistical data was not calculated for BE20-08 based on a lack of consensus among participating labs.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Ni (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
110	DRC/CC-ICP-MS	3.64	5.44	3.63	11.3	10.0
147	ICP-MS	2.98	4.90	3.07	11.000	10.3
597	ICP-MS	2.98	4.94	3.33	11.4	10.8
598	ICP-MS	<0.2	2.9	*0.8	7.7	6.7
Summary Statistics						
		BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Arithmetic Mean ($\bar{x}$)		3.2	4.5	3.3	10.4	9.4
Arithmetic SD (s)		0.3	1.0	0.3	1.6	1.7
Arithmetic RSD (%)		11	22	7.5	15	18
Number of Sample Measurements (N)		3	4	3	4	4

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Pt (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
110	ICP-MS	4.71	0.752	2.80	1.57	7.26
293	DRC/CC-ICP-MS	4.21 L	0.74 L	2.58 L	1.48 L	6.73 L
598	ICP-MS	4.5	0.8	2.7	1.5	6.5
599	DRC/CC-ICP-MS	5.03	0.782	2.92	1.40	6.87
Summary Statistics						
		BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Arithmetic Mean ($\bar{x}$)		4.8	0.778	2.81	1.49	6.9
Arithmetic SD (s)		0.2	0.022	0.10	0.08	0.3
Arithmetic RSD (%)		5.1	2.8	3.6	5.4	4.9
Number of Sample Measurements (N)		3	3	3	3	3

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Sn (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
110	ICP-MS	0.193	8.29	2.69	1.04	5.86
147	ICP-MS	<0.368	7.55	2.73	0.967	6.64
293	DRC/CC-ICP-MS	0.48 L	7.89 L	2.99 L	1.07 L	6.11 L
597	ICP-MS	0.24	7.25	2.73	1.12	6.11
598	ICP-MS	0.12	7.53	2.88	0.96	5.92
Summary Statistics						
		BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Arithmetic Mean ($\bar{x}$)		NA	7.7	2.76	1.02	6.1
Arithmetic SD (s)		NA	0.4	0.08	0.07	0.3
Arithmetic RSD (%)		NA	5.4	2.9	6.9	5.4
Number of Sample Measurements (N)		NA	4	4	4	4

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Statistical data was not calculated for BE20-06 based on a lack of consensus among participating labs.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood Sr (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
103	DRC/CC-ICP-MS	23.3	20.8	23.1	20.4	23.6
147	ICP-MS	23.9	21.7	23.8	21.0	23.9
597	ICP-MS	21.0	20.5	24.1	21.4	25.0
Summary Statistics						
		BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Arithmetic Mean ($\bar{x}$)		22.7	21.0	23.7	20.9	24.2
Arithmetic SD (s)		1.4	0.6	0.5	0.5	0.7
Arithmetic RSD (%)		6.2	2.9	2.1	2.4	2.9
Number of Sample Measurements (N)		3	3	3	3	3

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood V (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
110	DRC/CC-ICP-MS	1.89	7.16	0.900	0.413	3.41
147	DRC/CC-ICP-MS	1.80	6.94	0.821	0.360	3.58
597	ICP-MS	1.29	5.52	0.65	0.34	2.85
598	DRC/CC-ICP-MS	1.72	6.97	0.90	0.45	3.58
Summary Statistics						
		BE20-06	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
Arithmetic Mean ($\bar{x}$)		1.68	6.6	0.82	0.39	3.4
Arithmetic SD (s)		0.25	0.7	0.11	0.05	0.3
Arithmetic RSD (%)		15	11	13	13	9.5
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Whole Blood W (µg/L)

Lab Code	Method	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
110	ICP-MS	2.93	0.783	1.26	0.256	1.99
200	ICP-MS	3.2	0.8	1.3	0.3	2.1
598	ICP-MS	3.3	0.9	1.4	0.3	2.2

Summary Statistics

	BE20-06	BE20-07	BE20-08	BE20-09	BE20-10
Arithmetic Mean ($\bar{x}$)	3.14	0.83	1.32	0.285	2.10
Arithmetic SD (s)	0.17	0.06	0.06	0.023	0.09
Arithmetic RSD (%)	5.4	7.2	4.5	8.1	4.3
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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Results for Event #2, 2020:
Additional Elements in Whole Blood

Whole Blood Ag (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
147	ICP-MS	<0.302	<0.302	<0.302	<0.302	<0.302

Whole Blood Al (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
147	ICP-MS	<5.13	<5.13	<5.13	<5.13	<5.13

Whole Blood Bi (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
147	ICP-MS	<0.0334	<0.0334	<0.0334	<0.0334	<0.0334

Whole Blood I (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
147	ICP-MS	29.2	26.3	29.6	25.9	28.9

Whole Blood Li (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
147	ICP-MS	0.311	0.348	0.287	0.359	0.313

Whole Blood Mg (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
597	ICP-MS	26900	29700	29700	33200	31100

Whole Blood Te (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
147	ICP-MS	<0.117	<0.117	<0.117	<0.117	<0.117

Whole Blood Th (µg/L)						
Lab Code	**Method**	**BE20-06**	**BE20-07**	**BE20-08**	**BE20-09**	**BE20-10**
147	ICP-MS	<0.0278	<0.0278	<0.0278	<0.0278	<0.0278

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Event #2, 2020

Trace Elements in Urine

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Trace Elements Laboratory

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Event #2, 2020:
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). Urine samples were homogenized overnight 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 21 elements were reported by at least one participant: Ag, Al, B, Bi, Cs, Cu, 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 #2, 2020: Summary Statistics

	Urine As (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	61	8.1	21.0	164	101
Upper Limit	73	14.1	27.0	197	121
Lower Limit	49	2.1	15.0	131	81
Robust SD (s*)	4	0.6	1.8	17	4
Robust RSD (%)	5.7	7.4	8.6	10	4.1
Number of Sample Measurements (N)	15	15	15	15	15
Standard Uncertainty (*u*)	1	0.2	0.6	5	1

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 #2, 2020:
Performance of Participating Laboratories

		Urine As (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**61**	**8.1**	**21.0**	**164**	**101**
103	DRC/CC-ICP-MS	60.6	7.77	20.0	162	101
107	DRC/CC-ICP-MS	48.77 ↓	5.55	14.02 ↓	139.74	73.56 ↓
110	DRC/CC-ICP-MS	63.1	8.74	22.5	180	104
116	ICP-MS/MS	65.0	8.82	23.3	176	106
147	ICP-MS	59.6	7.94	21.3	172	98.4
220	DRC/CC-ICP-MS	64.1	8.99	23.3	186	111
264	ICP-MS	64.69	8.45	21.92	173.72	103.57
293	DRC/CC-ICP-MS	58.64 L	8.24 L	21.43 L	168.07 L	100.21 L
391	ICP-MS	56.57	7.79	20.13	148.95	89.54
399	DRC/CC-ICP-MS	60.9	5.12	13.1 ↓	81.6 ↓	102
597	ICP-MS	58.9	7.8	20.7	165	97.6
598	DRC/CC-ICP-MS	57.6	8.57	22.5	171	103
599	DRC/CC-ICP-MS	58.4	8.14	20.5	159.8	100.8
605	ICP-MS	61.5	6.57	14.8 ↓	97.0 ↓	101
606	ICP-MS/MS	64.6	8.42	22.2	176	105
676	DRC/CC-ICP-MS	61.6	8.22	21.4	164	98.7

Based on the grading criteria for As in Urine, 91% of results were satisfactory, with 3 of the 16 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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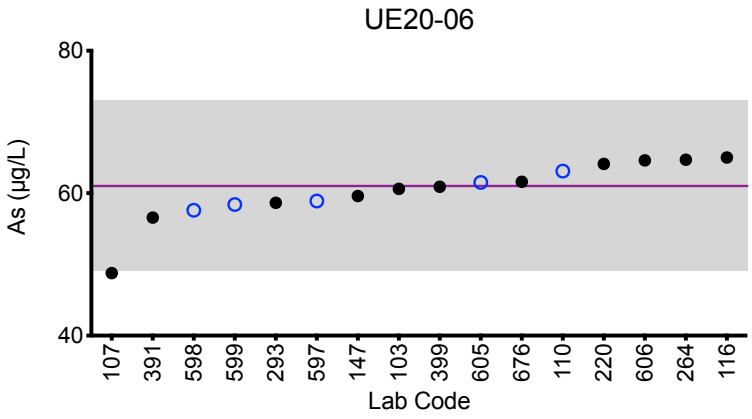
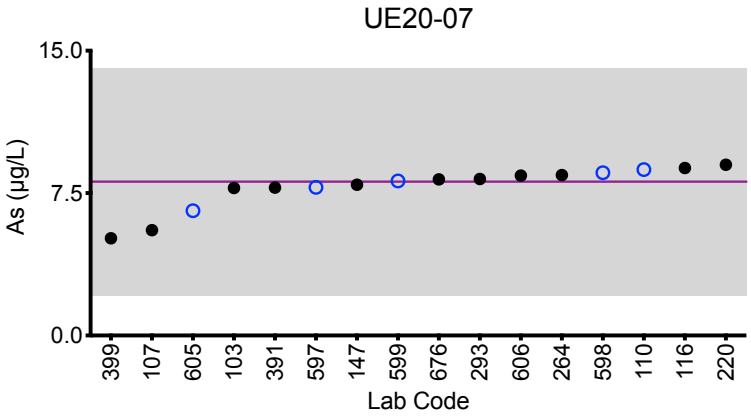
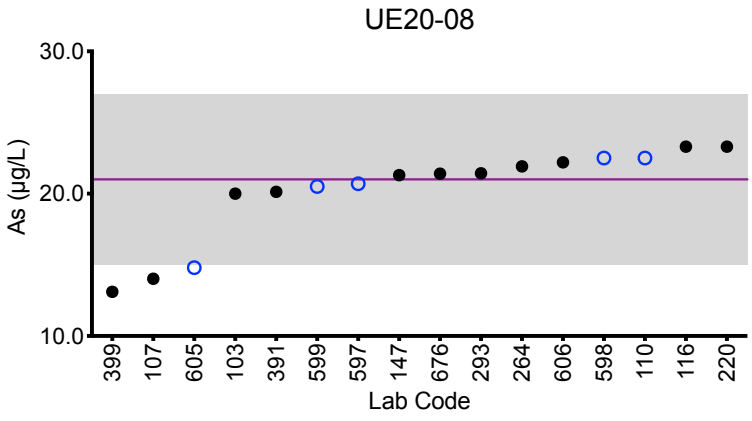
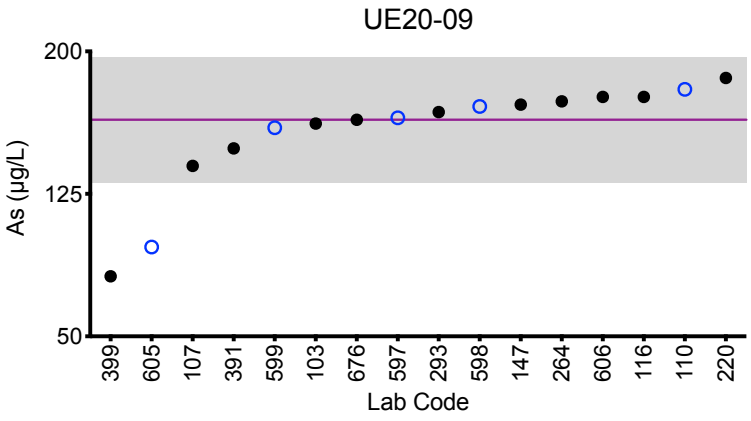
Results for Event #2, 2020: Summary Figures

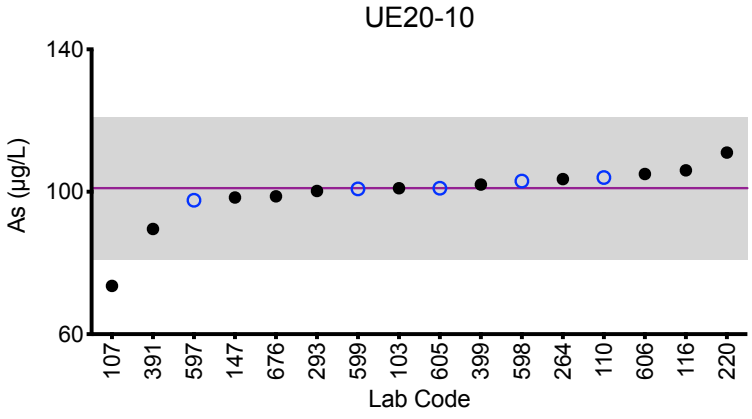
Urine As











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine Ba (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	17.8	3.61	6.40	9.5	1.81
Upper Limit	21.4	4.61	7.68	11.4	2.81
Lower Limit	14.2	2.61	5.12	7.6	0.81
Robust SD (s*)	0.7	0.21	0.20	0.4	0.13
Robust RSD (%)	3.9	5.8	3.1	3.8	7.2
Number of Sample Measurements (N)	14	14	14	14	14
Standard Uncertainty (*u*)	0.2	0.07	0.07	0.1	0.04

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 #2, 2020:
Performance of Participating Laboratories

		Urine Ba (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**17.8**	**3.61**	**6.40**	**9.5**	**1.81**
107	ICP-MS	17.060	3.371	6.201	8.720	1.649
110	ICP-MS	19.5	3.91	6.86	10.1	1.91
116	ICP-MS/MS	18.0	3.66	6.46	9.43	1.87
147	ICP-MS	17.4	3.54	6.30	9.33	1.71
220	ICP-MS	19.7	3.92	6.90	10.3	2.00
264	ICP-MS	18.02	3.45	6.44	9.93	1.92
399	ICP-MS/MS	18.3	3.65	6.54	9.65	1.72
597	ICP-MS	17.2	3.74	6.31	9.58	1.85
598	ICP-MS	17.9	3.58	6.64	9.78	1.88
599	DRC/CC-ICP-MS	17.2	3.15	5.63	9.05	1.73
605	ICP-MS	18.0	3.61	6.37	9.41	1.71
606	ICP-MS/MS	18.2	3.85	6.40	9.56	1.98
607	ICP-MS	17.5	3.48	6.38	9.39	1.71
676	ICP-MS	17.4	3.47	6.16	9.23	1.75

Based on the grading criteria for Ba 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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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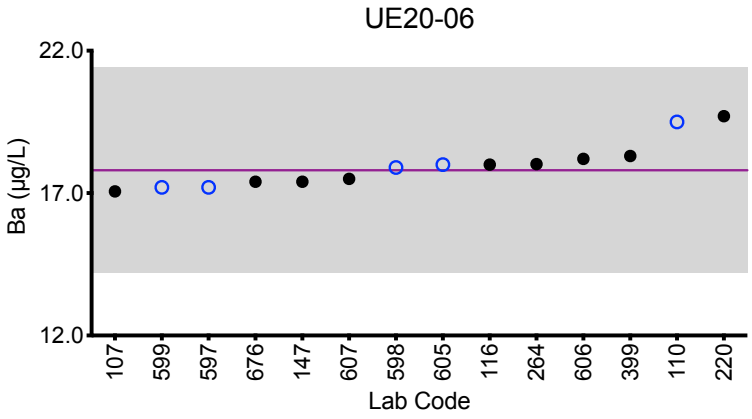
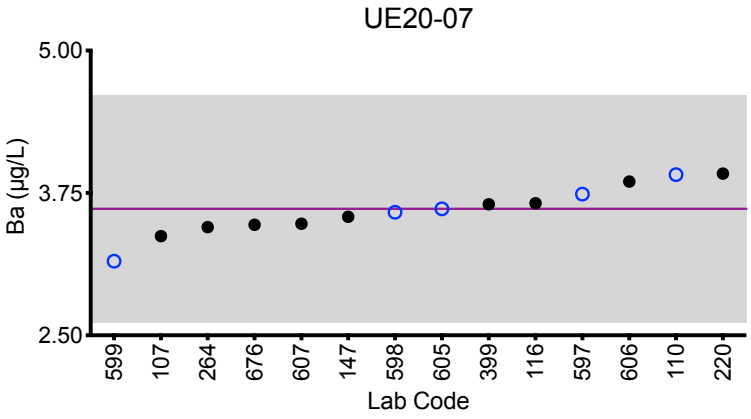
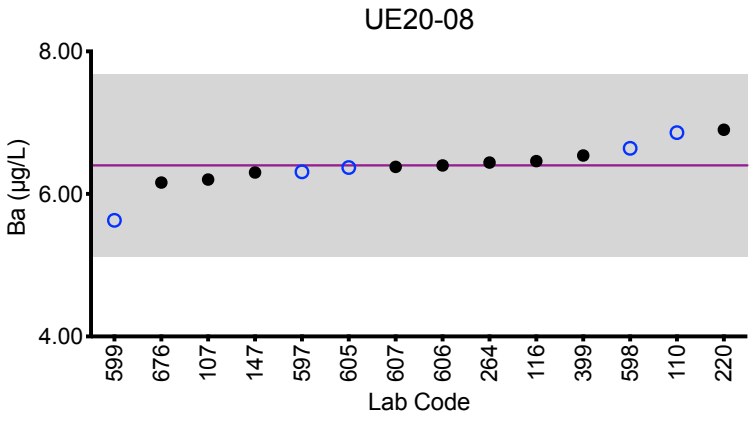
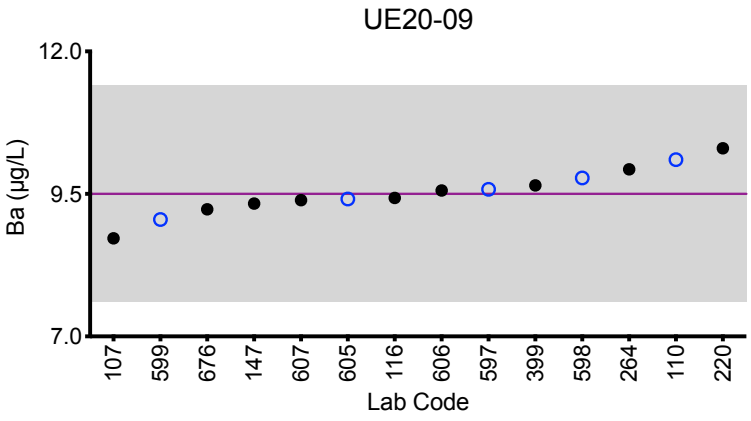
Results for Event #2, 2020: Summary Figures

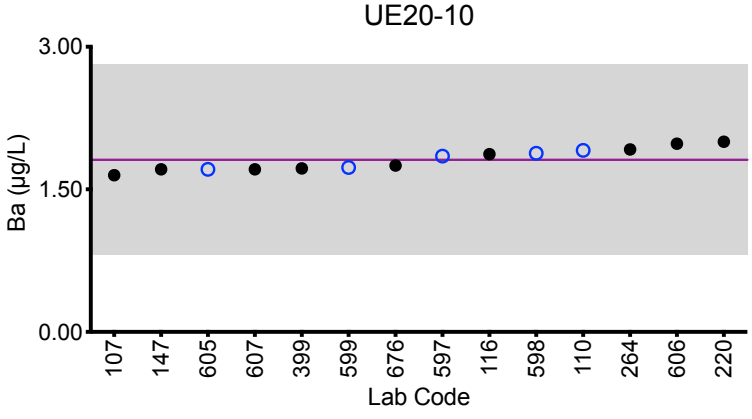
Urine Ba











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine Be (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	1.53	2.35	0.78	6.14	3.74
Upper Limit	2.53	3.35	1.78	7.37	4.74
Lower Limit	0.53	1.35	0.00	4.91	2.74
Robust SD (s*)	0.05	0.13	0.04	0.20	0.13
Robust RSD (%)	3.3	5.5	5.1	3.3	3.5
Number of Sample Measurements (N)	12	12	12	12	12
Standard Uncertainty (*u*)	0.02	0.05	0.02	0.07	0.05

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 #2, 2020:
Performance of Participating Laboratories

		Urine Be (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**1.53**	**2.35**	**0.78**	**6.14**	**3.74**
107	ICP-MS	1.534	2.227	0.776	5.912	3.673
110	ICP-MS	1.51	2.33	0.745	5.99	3.62
116	ICP-MS/MS	1.54	2.30	0.723	6.04	3.64
147	ICP-MS	1.57	2.46	0.811	6.64	3.77
220	ICP-MS	1.55	2.42	0.80	6.26	3.81
264	ICP-MS	1.50	2.20	0.77	6.24	3.94
293	ICP-MS	1.56 L	2.37 L	0.83 L	6.29 L	3.9 L
399	ICP-MS/MS	1.52	2.36	0.779	6.22	3.82
598	ICP-MS	1.71	2.46	0.89	6.21	3.76
599	DRC/CC-ICP-MS	1.60	2.53	0.820	6.75	4.23
605	ICP-MS	1.48	2.33	0.753	6.02	3.71
607	ICP-MS	1.43	2.09	0.738	5.64	3.41
676	ICP-MS	1.54	2.38	0.81	6.08	3.67

Based on the grading criteria for Be 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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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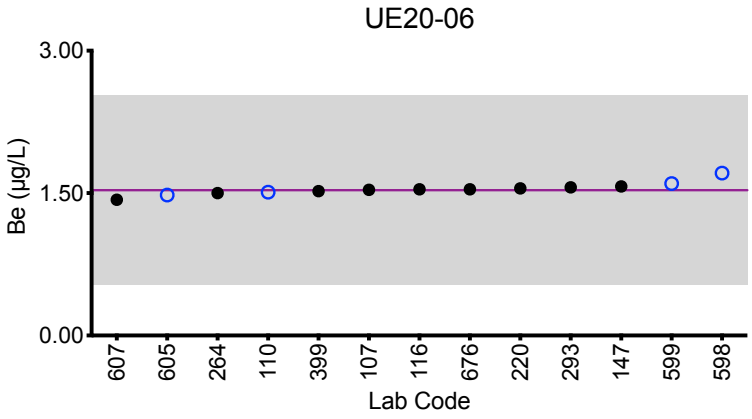
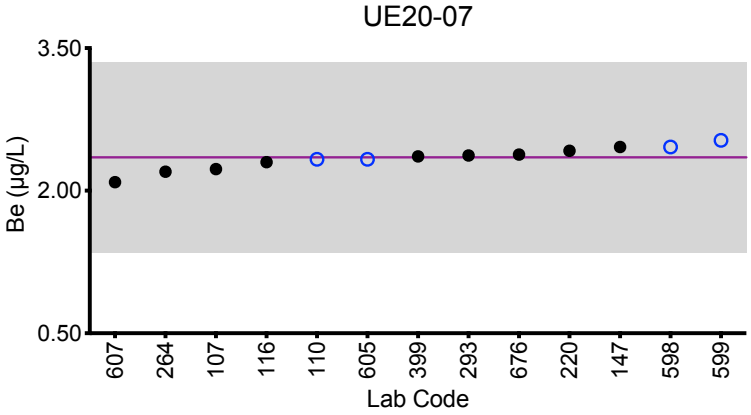
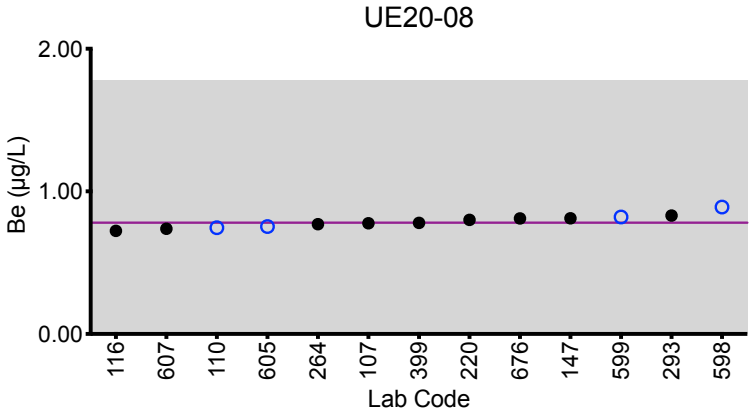
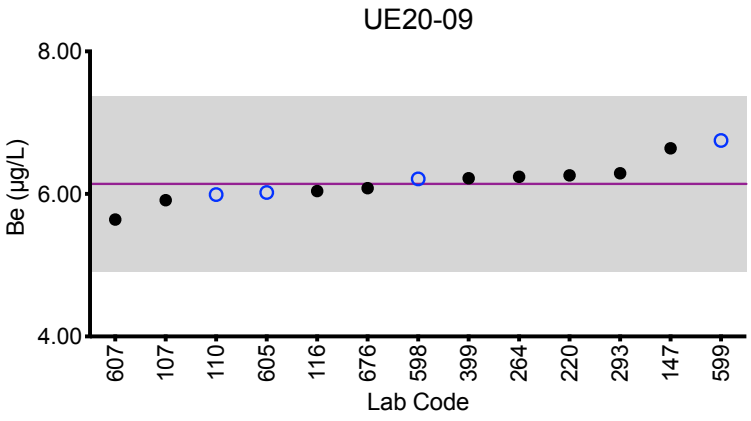
Results for Event #2, 2020: Summary Figures

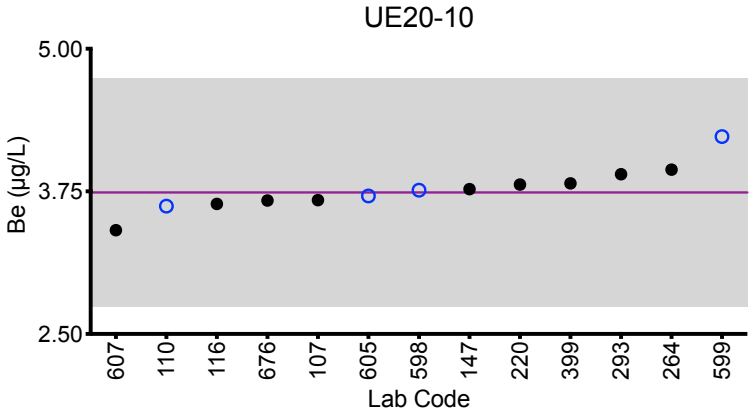
Urine Be











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine Cd (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	4.32	0.326	1.68	0.74	3.05
Upper Limit	5.32	1.326	2.68	1.74	4.05
Lower Limit	3.32	0.000	0.68	0.00	2.05
Robust SD (s*)	0.21	0.021	0.08	0.04	0.14
Robust RSD (%)	4.9	6.4	4.8	5.6	4.6
Number of Sample Measurements (N)	16	16	16	16	16
Standard Uncertainty (*u*)	0.07	0.007	0.02	0.01	0.04

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

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Results for Event #2, 2020:
Performance of Participating Laboratories

		Urine Cd (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**4.32**	**0.326**	**1.68**	**0.74**	**3.05**
103	DRC/CC-ICP-MS	4.53	0.328	1.76	0.734	3.17
107	DRC/CC-ICP-MS	4.318	0.333	1.637	0.734	3.144
110	ICP-MS	4.40	0.352	1.70	0.755	3.12
116	ICP-MS/MS	4.31	0.369	1.75	0.778	3.20
147	ICP-MS	4.5	0.312	1.74	0.781	3.05
220	ICP-MS	4.32	0.32	1.66	0.74	2.98
264	ICP-MS	4.44	0.32	1.82	0.78	3.18
293	DRC/CC-ICP-MS	4.48 L	0.31 L	1.72 L	0.74 L	2.95 L
391	ICP-MS	3.56	0.30	1.35	0.58	2.56
399	DRC/CC-ICP-MS	4.50	0.312	1.69	0.744	3.11
597	ICP-MS	4.34	0.36	1.73	0.80	3.18
598	DRC/CC-ICP-MS	4.49	0.32	1.65	0.76	3.06
599	DRC/CC-ICP-MS	4.33	0.306	1.72	0.751	2.99
605	ICP-MS	4.02	0.338	1.54	0.717	2.8
606	ICP-MS/MS	4.48	0.329	1.70	0.775	3.11
607	ICP-MS	3.64	0.345	1.53	0.640	2.71
676	DRC/CC-ICP-MS	4.12	0.296	1.55	0.654	2.78

Based on the grading criteria for Cd in Urine, 100% of results were satisfactory, with 0 of the 17 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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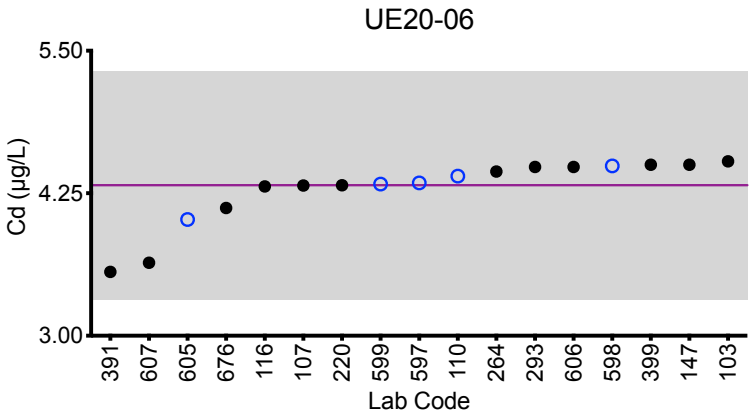
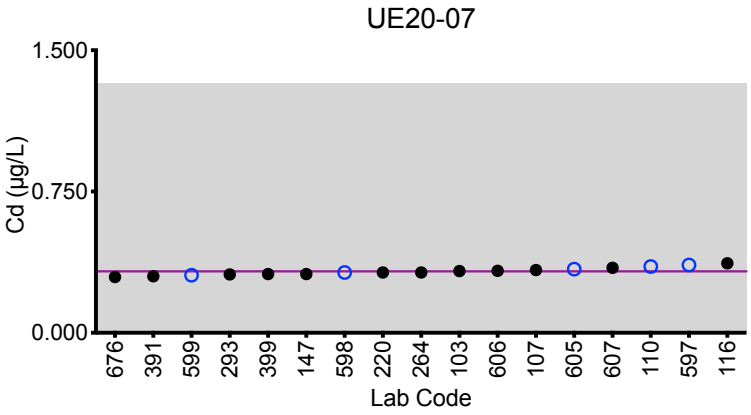
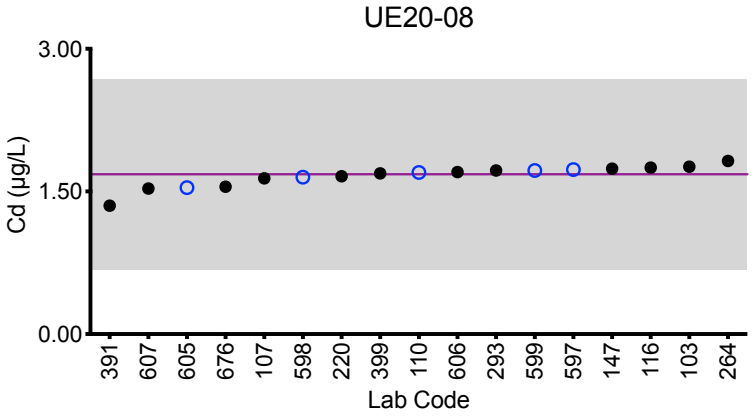
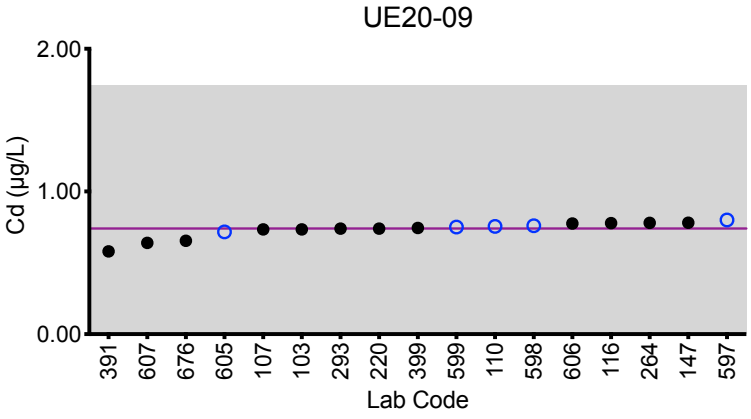
Results for Event #2, 2020: Summary Figures

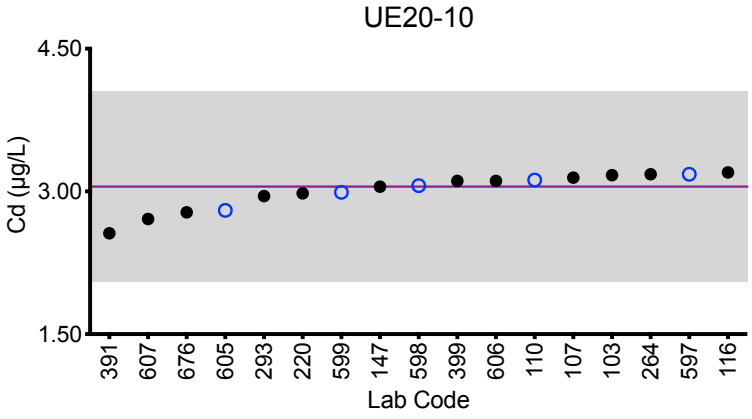
Urine Cd











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine Co (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	6.31	0.38	1.96	4.65	8.3
Upper Limit	7.81	1.88	3.46	6.15	9.8
Lower Limit	4.81	0.00	0.46	3.15	6.8
Robust SD (s*)	0.23	0.05	0.08	0.12	0.4
Robust RSD (%)	3.6	13	4.1	2.6	4.2
Number of Sample Measurements (N)	15	15	15	15	15
Standard Uncertainty (*u*)	0.07	0.02	0.02	0.04	0.1

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 #2, 2020:
Performance of Participating Laboratories

		Urine Co (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**6.31**	**0.38**	**1.96**	**4.65**	**8.3**
103	DRC/CC-ICP-MS	6.39	0.350	1.97	4.77	8.43
107	ICP-MS	6.100	0.332	1.906	4.420	7.902
110	ICP-MS	6.52	0.416	2.02	4.73	8.60
116	ICP-MS/MS	6.44	0.395	2.01	4.70	8.50
147	ICP-MS	6.3	0.360	2.00	4.69	7.99
220	ICP-MS	6.76	0.44	2.10	4.81	8.99
264	ICP-MS	6.11	0.34	1.84	4.37	7.89
293	DRC/CC-ICP-MS	6.41 L	0.36 L	2.02 L	4.91 L	8.73 L
391	ICP-MS	5.52	0.31	1.73	3.87	7.01
399	DRC/CC-ICP-MS	6.55	0.365	2.03	4.80	8.40
597	ICP-MS	6.04	0.51	2.04	4.69	8.03
598	ICP-MS	6.38	0.43	1.94	4.51	8.16
599	DRC/CC-ICP-MS	6.21	0.364	1.95	4.64	8.63
605	ICP-MS	6.48	0.410	1.99	4.72	8.43
606	ICP-MS/MS	6.31	0.319	1.89	4.62	8.23
676	ICP-MS	6.23	0.42	1.92	4.59	8.24

Based on the grading criteria for Co 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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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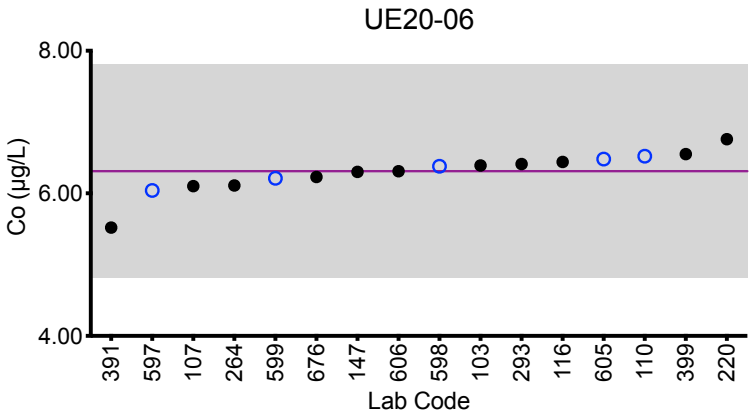
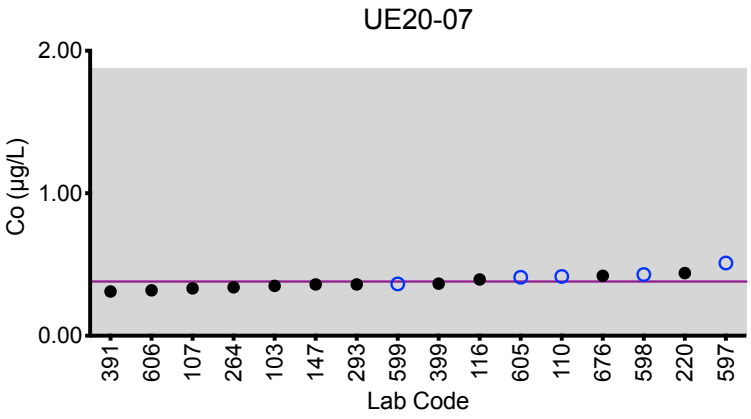
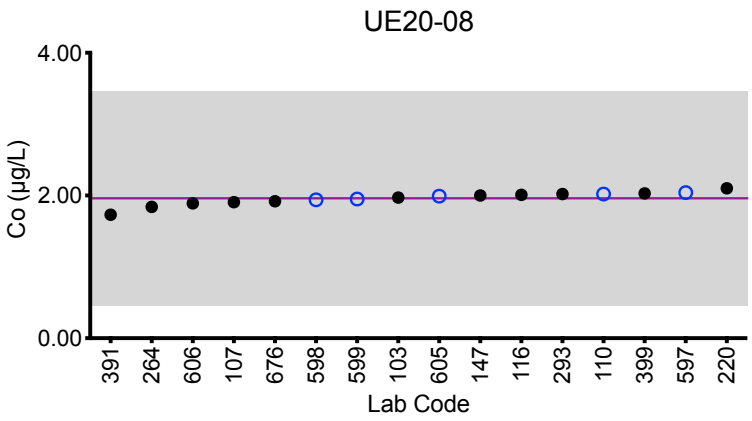
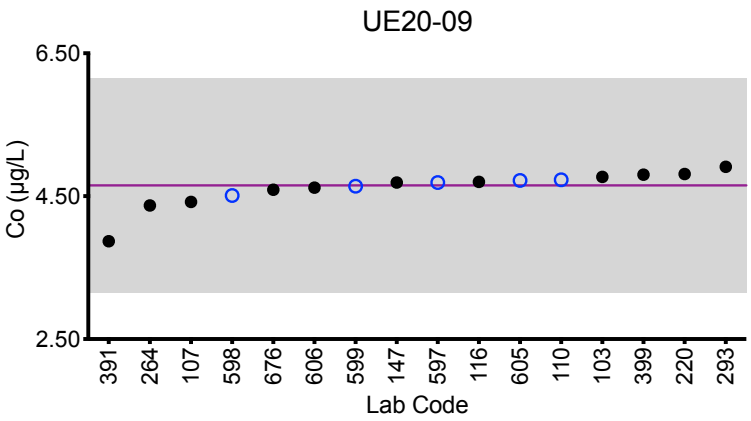
Results for Event #2, 2020: Summary Figures

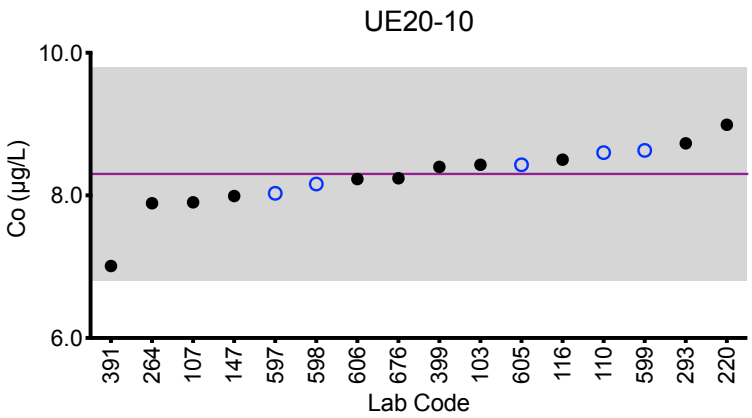
Urine Co











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine Cr (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	19.1	0.58	4.4	1.70	10.3
Upper Limit	22.9	3.58	7.4	4.70	13.3
Lower Limit	15.3	0.00	1.4	0.00	7.3
Robust SD (s*)	0.8	0.14	0.3	0.17	0.4
Robust RSD (%)	4.2	24	5.7	10	3.9
Number of Sample Measurements (N)	10	8	10	10	10
Standard Uncertainty (*u*)	0.3	NA	0.1	0.07	0.2

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 samples UE20-07.

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Results for Event #2, 2020:
Performance of Participating Laboratories

		Urine Cr (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**19.1**	**0.58**	**4.4**	**1.70**	**10.3**
103	DRC/CC-ICP-MS	18.9	<1.00	4.14	1.76	10.3
107	DRC/CC-ICP-MS	18.72	0.40	4.12	1.44	10.02
110	DRC/CC-ICP-MS	20.5	0.88	4.68	1.90	11.2
116	ICP-MS/MS	18.48	0.476	4.22	1.51	9.75
147	DRC/CC-ICP-MS	20.0	0.566	4.59	1.7	10.4
264	ICP-MS	19.59	0.68	4.45	1.72	10.13
293	DRC/CC-ICP-MS	19.9 L	0.57 L	4.57 L	1.74 L	11 L
391	ICP-MS	17.65	0.58	4.11	1.56	9.39
597	ICP-MS	18.7		4.59	1.72	10.2
598	DRC/CC-ICP-MS	19.1	0.53	4.56	1.96	10.5
605	ICP-MS	19.7	0.550	4.47	1.69	11.0

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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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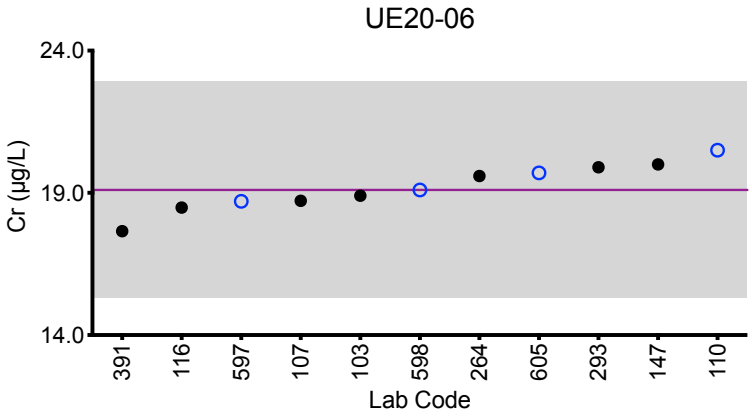
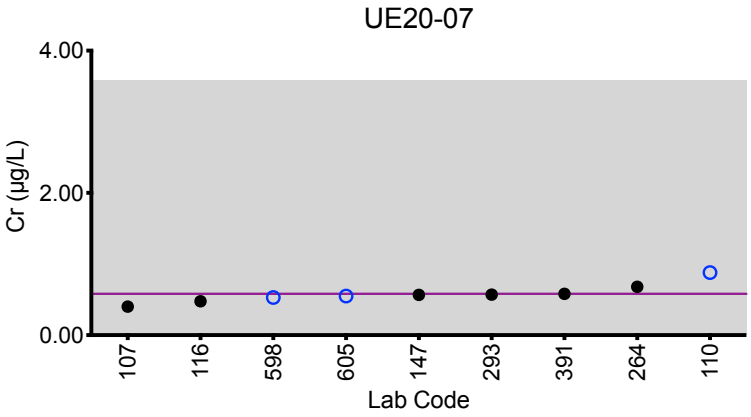
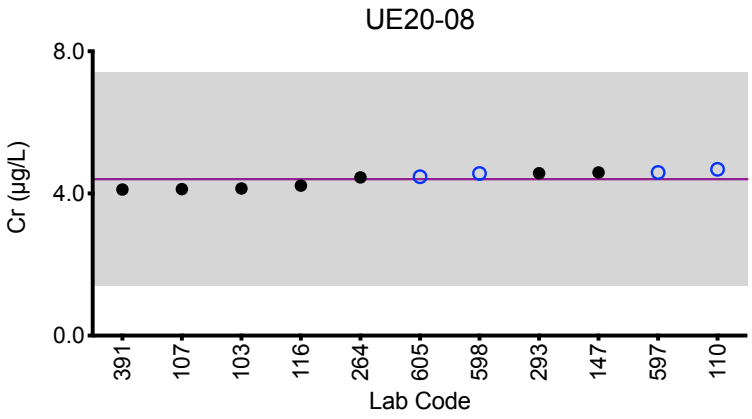
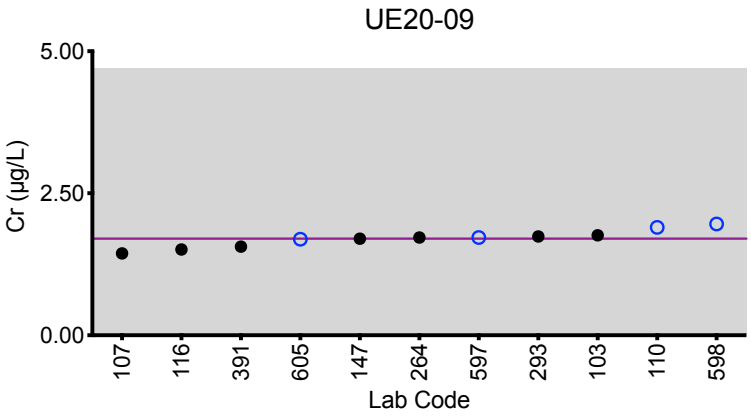
Results for Event #2, 2020: Summary Figures

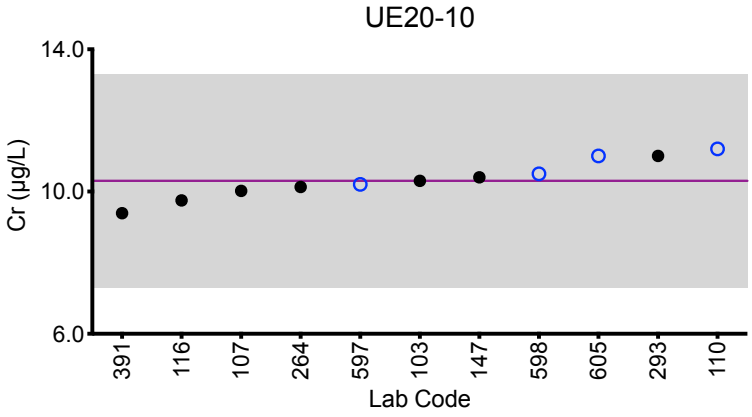
Urine Cr











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine Hg (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	5.5	0.96	15.0	2.7	33
Upper Limit	8.5	3.96	19.5	5.7	43
Lower Limit	2.5	0.00	10.5	0.0	23
Robust SD (s*)	0.7	0.22	1.7	0.5	3
Robust RSD (%)	13	23	11	19	9.8
Number of Sample Measurements (N)	13	11	13	13	13
Standard Uncertainty (*u*)	0.2	0.08	0.6	0.2	1

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 #2, 2020:
Performance of Participating Laboratories

		Urine Hg (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**5.5**	**0.96**	**15.0**	**2.7**	**33**
103	DRC/CC-ICP-MS	5.36	0.952	15.1	2.66	32.2
107	DRC/CC-ICP-MS	5.27	0.93	15.53	2.72	34.48
110	ICP-MS	6.20	1.02	16.7	3.01	35.9
116	ICP-MS/MS	6.21	1.78	16.4	3.75	32.7
147	ICP-MS	5.62	0.939	14.0	2.55	32.2
200	ICP-MS	4.2	0.8	14.2	2.4	28.1
264	ICP-MS	7.36	1.12	21.16 ↑	3.72	45.00 ↑
293	DRC/CC-ICP-MS	5.29 L	0.93 L	15.74 L	2.75 L	32.46 L
391	ICP-MS	3.29	0.18	10.64	1.34	22.03 ↓
597	ICP-MS	5.46	0.93	15.7	2.83	34.2
598	ICP-MS	4.64	0.74	13.5	2.29	28.9
605	ICP-MS	5.64	<1.00	14.8	2.33	36.5
606	ICP-MS/MS	5.45	<1.00	13.1	2.75	31.4
676	ICP-MS	5.84	1.42	16.3	3.31	32.7

Based on the grading criteria for Hg in Urine, 96% of results were satisfactory, with 1 of the 14 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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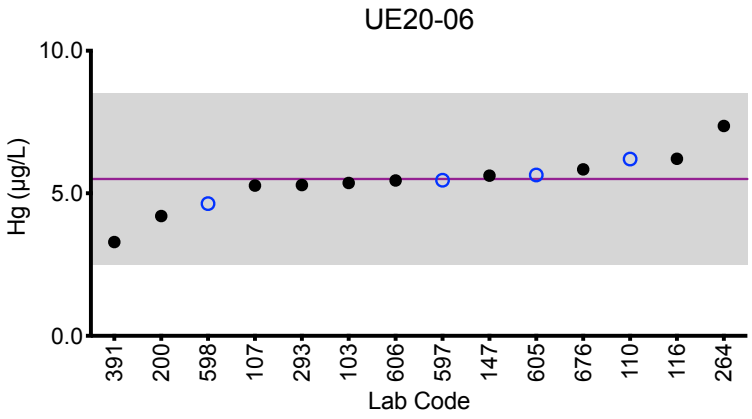
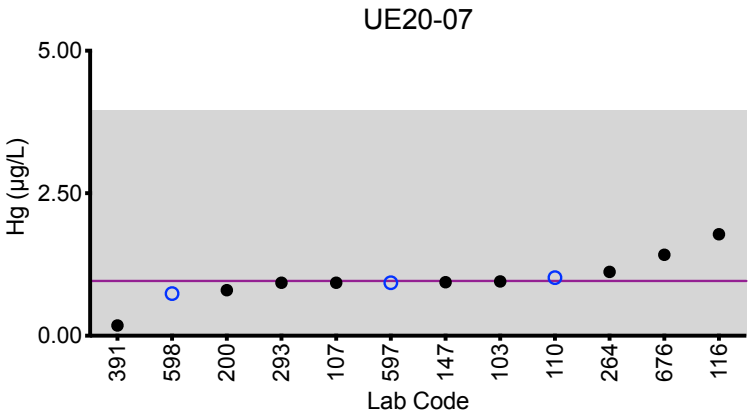
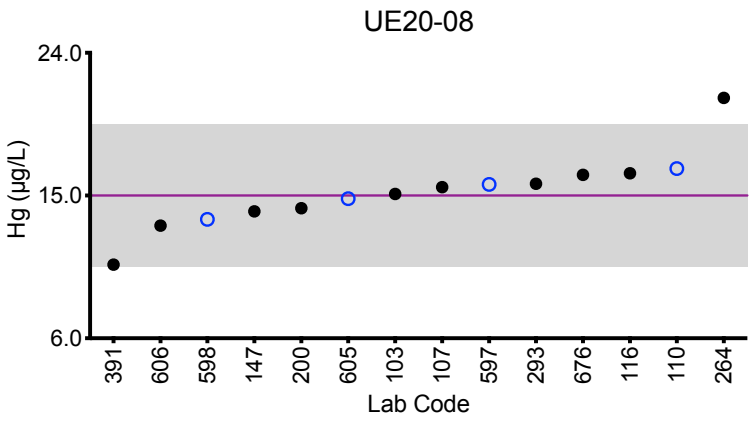
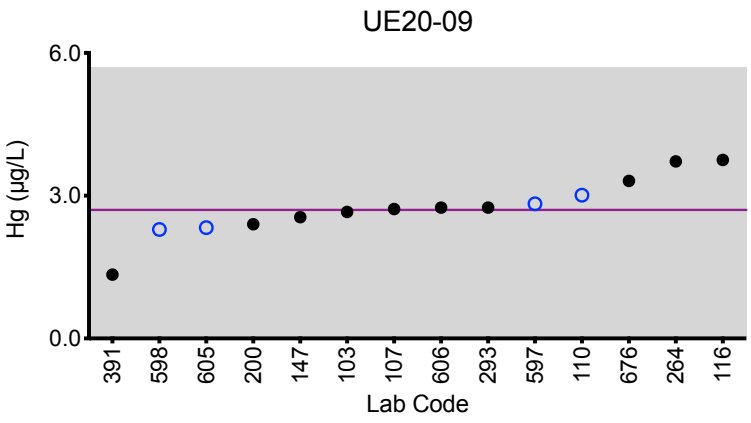
Results for Event #2, 2020: Summary Figures

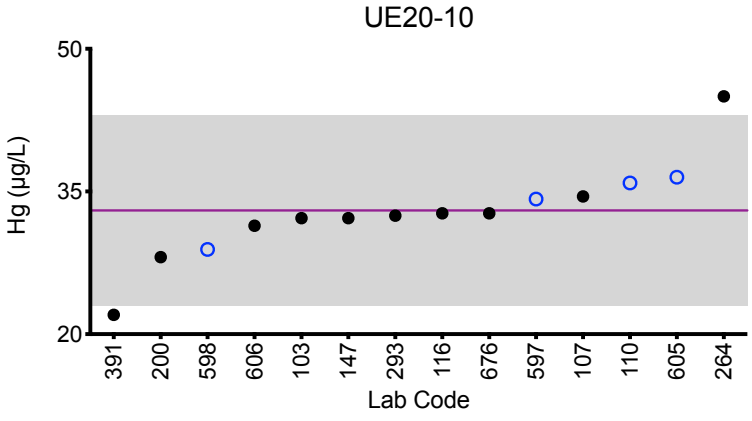
Urine Hg











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine Mn (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	0.70	4.35	7.6	2.17	9.3
Upper Limit	1.25	5.44	9.5	2.72	11.6
Lower Limit	0.15	3.26	5.7	1.62	7.0
Robust SD (s*)	0.10	0.21	0.3	0.12	0.7
Robust RSD (%)	14	4.8	4.5	5.5	7.5
Number of Sample Measurements (N)	15	15	15	15	15
Standard Uncertainty (*u*)	0.03	0.07	0.1	0.04	0.2

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. An assessment of clinical laboratory performance for the determination of manganese in blood and urine. Clinical Chemistry and Laboratory Medicine.2016; 54(12): 1921-1928).

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Results for Event #2, 2020:
Performance of Participating Laboratories

		Urine Mn (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**0.70**	**4.35**	**7.6**	**2.17**	**9.3**
103	DRC/CC-ICP-MS	0.606	4.62	7.68	2.22	9.39
107	DRC/CC-ICP-MS	0.658	4.401	7.704	2.132	9.894
110	DRC/CC-ICP-MS	0.692	4.62	8.04	2.29	9.85
116	ICP-MS/MS	0.603	3.76	6.59	1.84	8.02
147	DRC/CC-ICP-MS	0.923	4.22	7.47	2.19	9.64
220	DRC/CC-ICP-MS	0.99	4.49	7.77	2.35	9.56
264	ICP-MS	0.63	4.19	7.17	2.01	8.87
293	DRC/CC-ICP-MS	0.67 L	4.24 L	7.4 L	2.15 L	9.08 L
391	ICP-MS	0.60	3.81	7.08	1.86	8.20
399	DRC/CC-ICP-MS	0.664	4.46	7.93	2.24	9.57
597	ICP-MS	0.95	4.27	7.52	2.13	8.43
598	ICP-MS	0.73	4.04	7.28	2.11	8.70
599	DRC/CC-ICP-MS	0.579	4.54	8.34	2.10	10.7
605	ICP-MS	0.674	4.40	7.47	2.20	9.35
606	ICP-MS/MS	0.716	4.46	7.82	2.30	9.70
676	DRC/CC-ICP-MS	1.36 ↑	4.36	7.67	2.21	9.26

Based on the grading criteria for Mn 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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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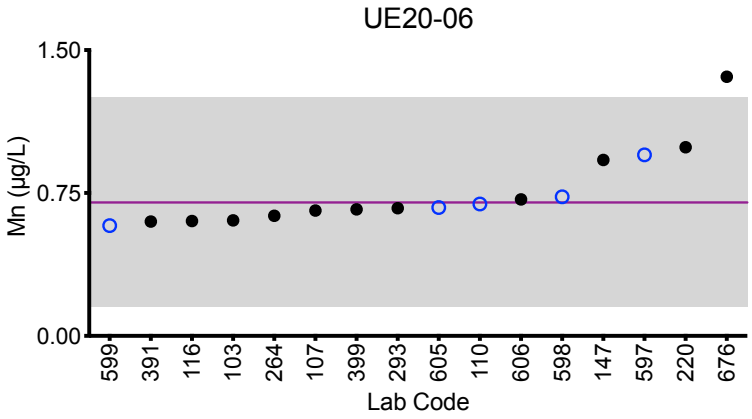
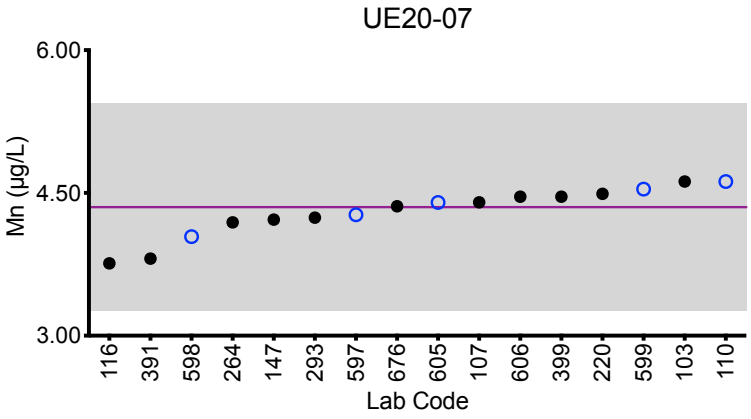
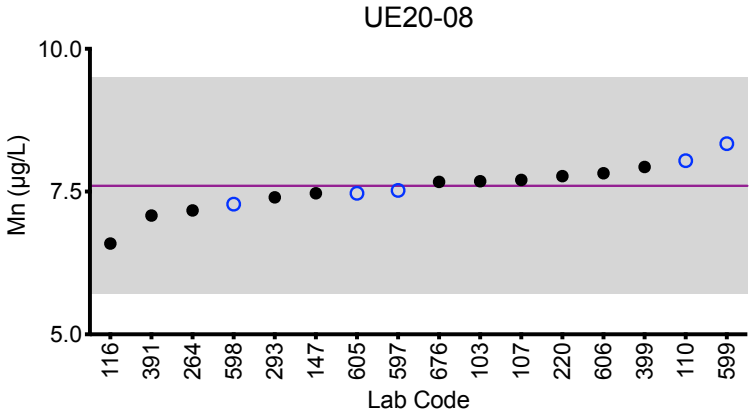
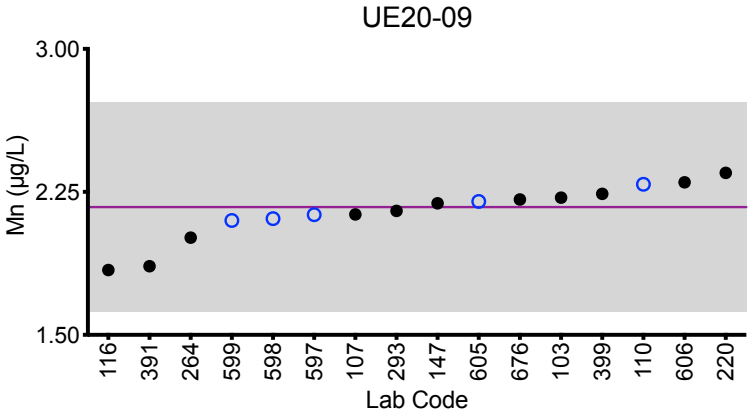
Results for Event #2, 2020: Summary Figures

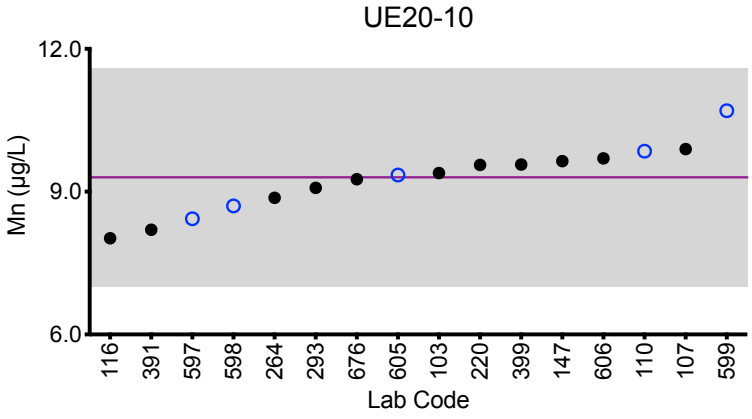
Urine Mn











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine Pb (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	4.27	2.57	16.3	0.880	7.9
Upper Limit	5.27	3.57	19.6	1.880	9.5
Lower Limit	3.27	1.57	13.0	0.000	6.3
Robust SD (s*)	0.18	0.12	0.7	0.021	0.4
Robust RSD (%)	4.2	4.7	4.3	2.4	4.6
Number of Sample Measurements (N)	16	16	16	16	16
Standard Uncertainty (*u*)	0.06	0.04	0.2	0.007	0.1

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 #2, 2020:
Performance of Participating Laboratories

		Urine Pb (µg/L)				
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**4.27**	**2.57**	**16.3**	**0.880**	**7.9**
103	DRC/CC-ICP-MS	4.41	2.70	17.0	0.912	8.32
107	ICP-MS	4.298	2.485	16.879	0.844	7.941
110	ICP-MS	4.44	2.66	17.0	0.89	8.11
116	ICP-MS/MS	4.30	2.61	17.0	0.891	8.27
147	ICP-MS	4.56	2.88	16.5	0.885	8.29
220	ICP-MS	4.05	2.48	16	0.81	7.72
264	ICP-MS	4.44	2.52	16.08	0.88	7.74
293	DRC/CC-ICP-MS	4.39 L	2.54 L	16.57 L	0.93 L	7.56 L
391	ICP-MS	3.49	2.04	13.19	0.65	6.48
399	ICP-MS/MS	4.33	2.60	17.2	0.878	8.11
597	ICP-MS	4.35	2.69	17.0	0.87	8.26
598	ICP-MS	4.08	2.45	15.4	0.89	7.30
599	DRC/CC-ICP-MS	4.24	2.63	15.7	0.885	7.70
605	ICP-MS	4.17	2.51	16.2	0.773	7.87
606	ICP-MS/MS	4.19	2.54	16.3	0.905	7.90
607	ICP-MS	3.97	2.44	15.8	0.871	7.47
676	ICP-MS	4.36	2.65	16.2	0.94	7.71

Based on the grading criteria for Pb in Urine, 100% of results were satisfactory, with 0 of the 17 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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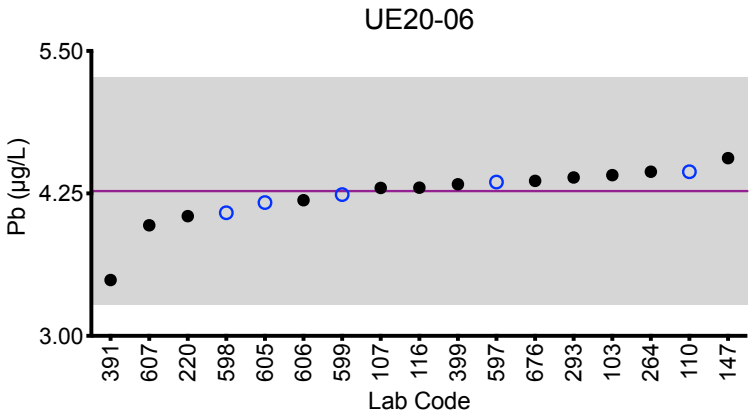
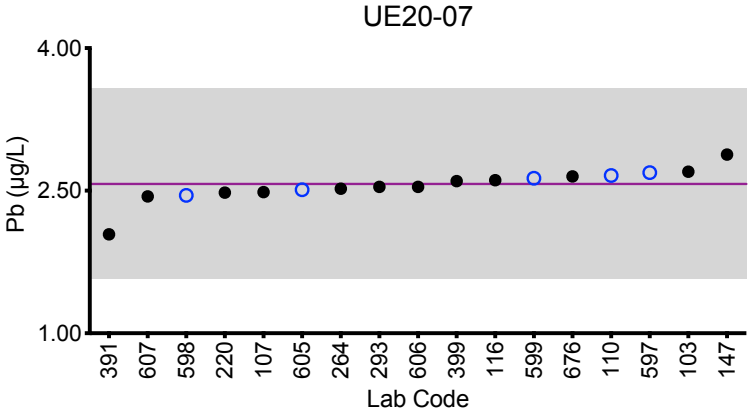
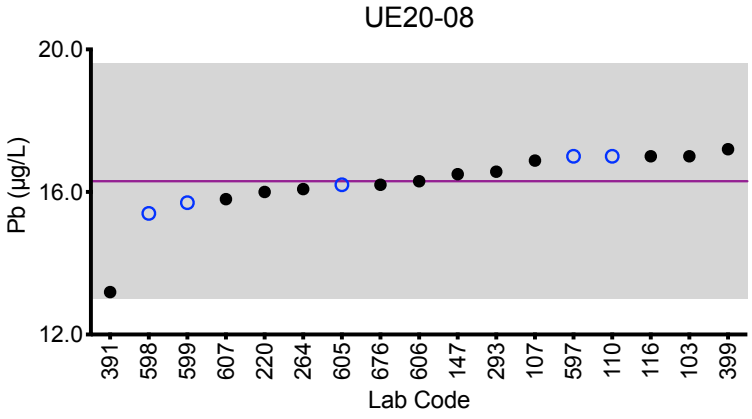
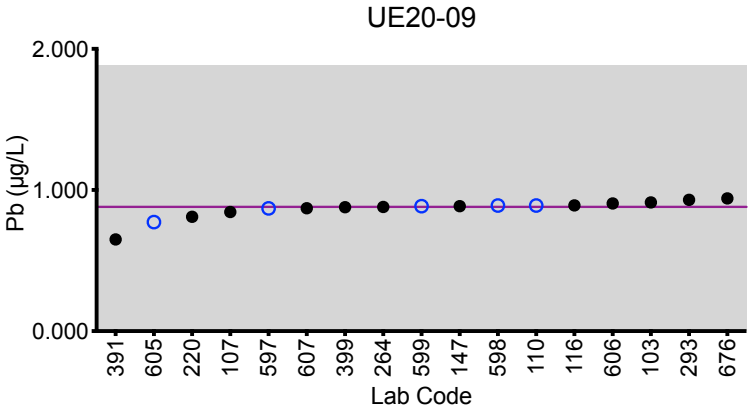
Results for Event #2, 2020: Summary Figures

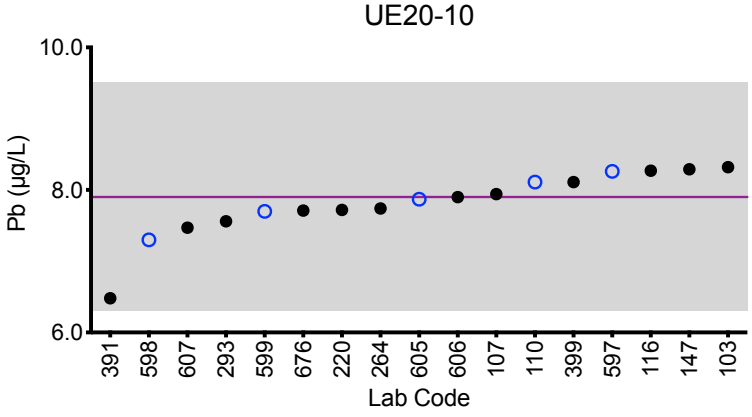
Urine Pb











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

Urine Tl (µg/L)					
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	1.79	1.04	0.369	3.31	5.16
Upper Limit	2.15	1.25	0.569	3.97	6.19
Lower Limit	1.43	0.83	0.169	2.65	4.13
Robust SD (s*)	0.05	0.05	0.016	0.10	0.19
Robust RSD (%)	2.8	4.8	4.3	3.0	3.7
Number of Sample Measurements (N)	14	14	14	14	14
Standard Uncertainty (*u*)	0.02	0.02	0.005	0.03	0.06

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 #2, 2020:
Performance of Participating Laboratories

Urine Tl (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**1.79**	**1.04**	**0.369**	**3.31**	**5.16**
103	DRC/CC-ICP-MS	1.85	1.11	0.377	3.39	5.38
107	ICP-MS	1.821	1.009	0.370	3.232	5.270
110	ICP-MS	1.81	1.06	0.381	3.40	5.26
116	ICP-MS/MS	1.88	1.10	0.401	3.50	5.41
147	ICP-MS	1.83	1.07	0.370	3.41	5.23
220	ICP-MS	1.76	1.00	0.36	3.20	5.03
264	ICP-MS	1.75	1.02	0.36	3.29	5.01
293	DRC/CC-ICP-MS	1.83 L	1.09 L	0.39 L	3.44 L	5.27 L
399	ICP-MS/MS	1.78	1.04	0.374	3.33	5.20
597	ICP-MS	1.83	1.08	0.42	3.39	5.34
598	ICP-MS	1.72	0.93	0.33	2.92	4.63
605	ICP-MS	1.75	1.03	0.358	3.29	5.19
606	ICP-MS/MS	1.76	1.01	0.354	3.30	5.11
607	ICP-MS	1.74	1.00	0.357	3.26	5.02
676	ICP-MS	1.78	1.04	0.373	3.23	4.94

Based on the grading criteria for Tl 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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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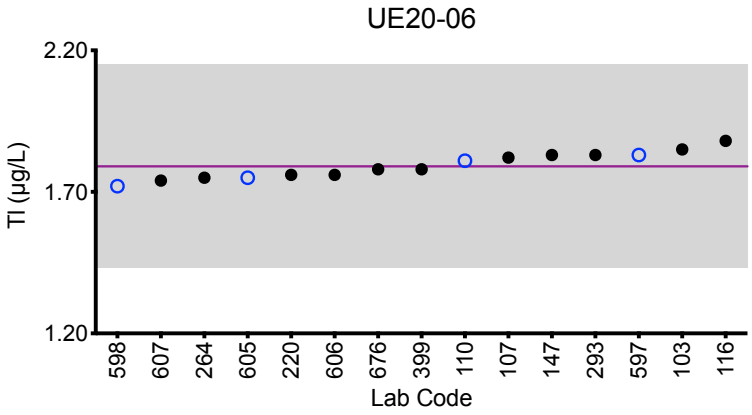
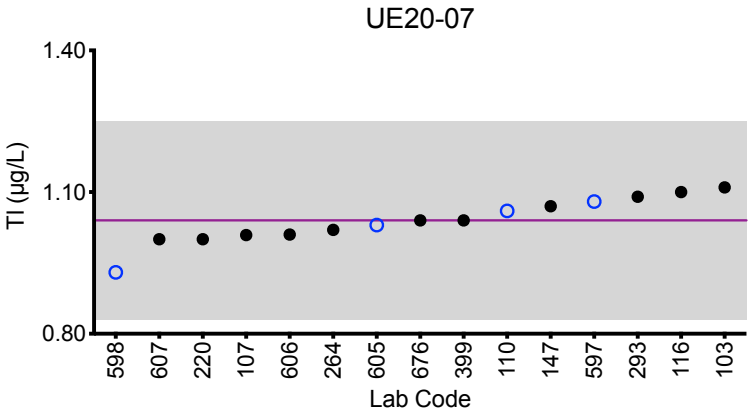
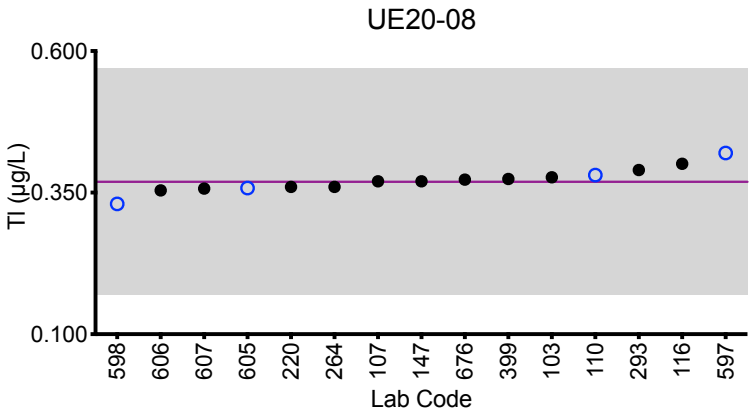
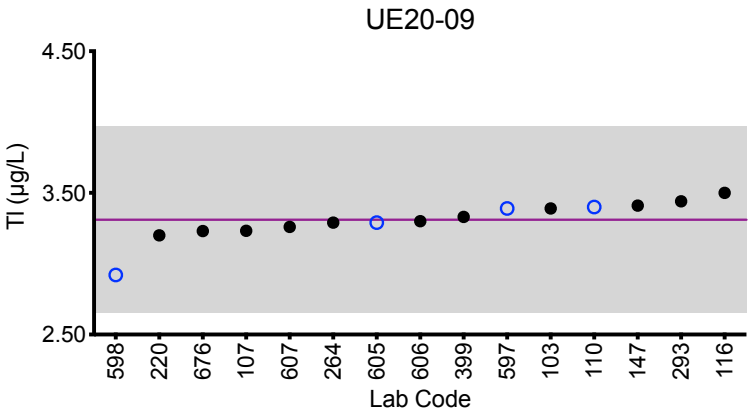
Results for Event #2, 2020: Summary Figures

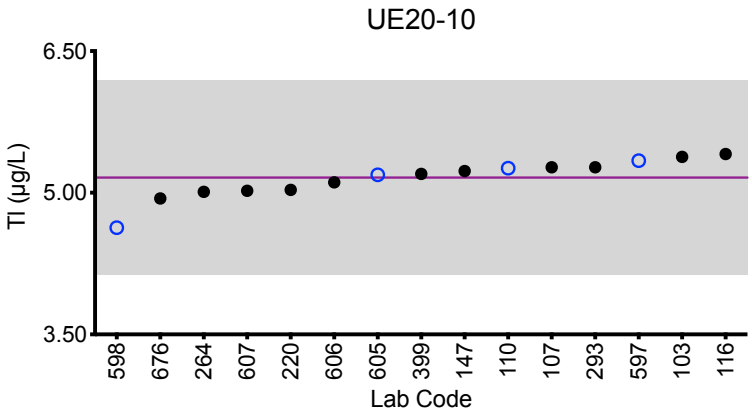
Urine Tl











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Urine U (µg/L)				
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Target (Robust Mean (x*))	0.019	0.159	0.317	0.108	0.049
Upper Limit	0.049	0.191	0.380	0.138	0.079
Lower Limit	0.000	0.127	0.254	0.078	0.019
Robust SD (s*)	0.004	0.005	0.016	0.004	0.003
Robust RSD (%)	20	3.1	5.0	4.0	6.3
Number of Sample Measurements (N)	13	14	14	14	14
Standard Uncertainty (*u*)	0.001	0.002	0.005	0.001	0.001

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

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Results for Event #2, 2020:
Performance of Participating Laboratories

Urine U (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
	Target	**0.019**	**0.159**	**0.317**	**0.108**	**0.049**
103	DRC/CC-ICP-MS	<0.0200	0.160	0.300	0.108	0.0508
107	ICP-MS	0.0195	0.1572	0.3275	0.1054	0.0519
110	ICP-MS	0.0216	0.176	0.341	0.114	0.0527
116	ICP-MS/MS	0.0201	0.147	0.315	0.106	0.0525
147	ICP-MS	0.0221	0.164	0.334	0.105	0.0476
220	ICP-MS	0.021	0.16	0.33	0.11	0.052
264	ICP-MS	0.01	0.14	0.30	0.10	0.04
399	ICP-MS/MS	0.019	0.160	0.311	0.109	0.049
598	ICP-MS	0.03	0.16	0.33	0.11	0.04
599	DRC/CC-ICP-MS	0.010	0.134	0.286	0.092	0.046
605	ICP-MS	0.017	0.159	0.310	0.103	0.049
606	ICP-MS/MS	0.017	0.148	0.314	0.109	0.048
607	ICP-MS	0.0181	0.160	0.325	0.110	0.0506
676	ICP-MS	0.023	0.164	0.313	0.113	0.05

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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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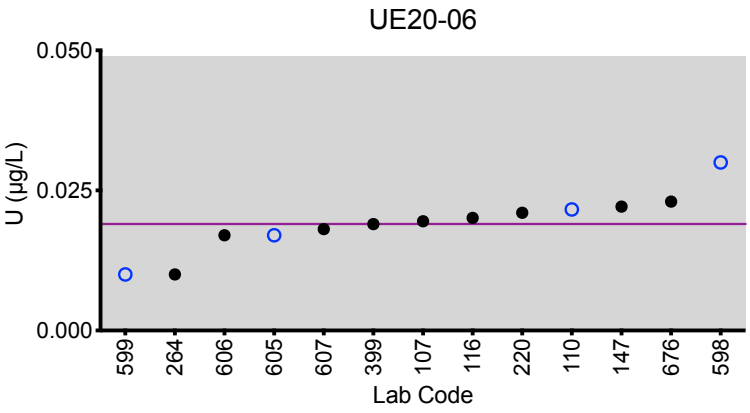
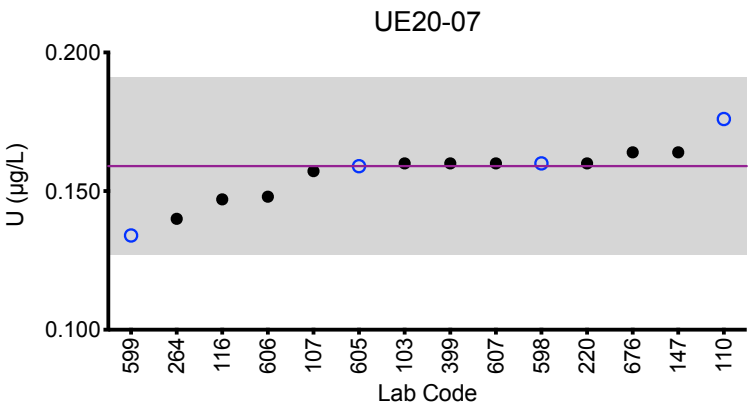
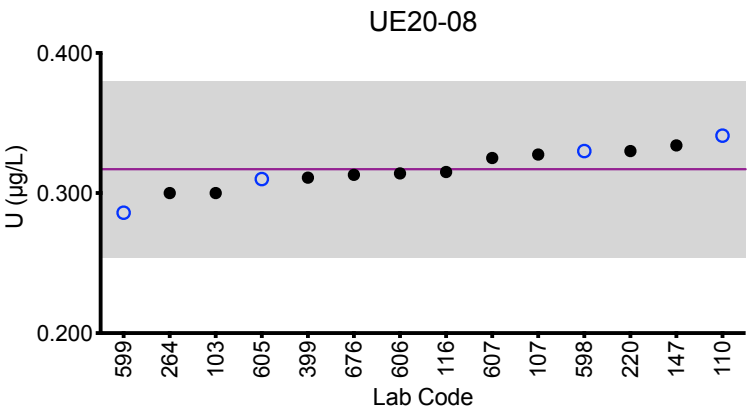
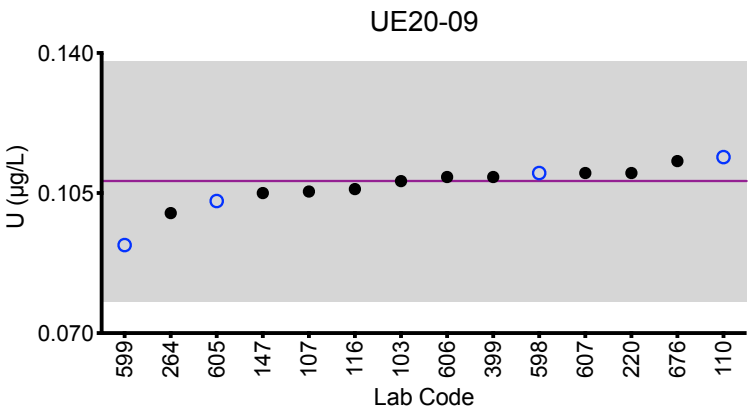
Results for Event #2, 2020: Summary Figures

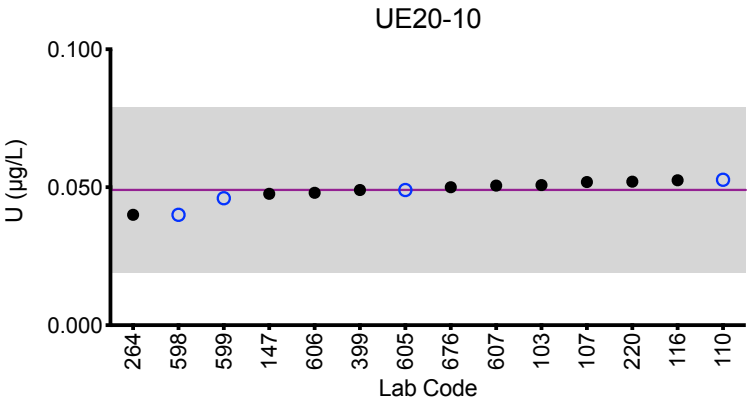
Urine U











Legend:

○ C/HHEAR 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 #2, 2020:
Laboratory Data and Summary Statistics

Urine Cs (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
107	ICP-MS	11.47	1.08	11.22	2.23	13.85
110	ICP-MS	12.9	1.15	12.4	2.54	16.3
147	ICP-MS	12.0	1.09	11.8	2.40	14.5
220	ICP-MS	13.1	1.17	12.3	2.50	15.8
264	ICP-MS	11.71	1.02	11.62	2.45	15.47
399	ICP-MS/MS	12.1	1.10	11.9	2.39	14.8
597	ICP-MS	11.3	1.10	11.2	2.30	14.2
598	ICP-MS	11.9	1.05	11.2	2.33	14.1
599	DRC/CC-ICP-MS	11.3	1.04	10.9	2.20	13.9
605	ICP-MS	12.0	1.13	11.5	2.33	14.7
606	ICP-MS/MS	12.0	1.05	11.1	2.28	14.0
676	ICP-MS	11.3	1.03	10.8	2.23	13.7

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Robust Mean (x*)	11.9	1.08	11.5	2.35	14.5
Robust SD (s*)	0.6	0.05	0.5	0.12	0.7
Robust RSD (%)	5.0	4.6	4.3	5.1	4.8
Number of Sample Measurements (N)	12	12	12	12	12
Standard Uncertainty (*u*)	0.2	0.02	0.2	0.04	0.3

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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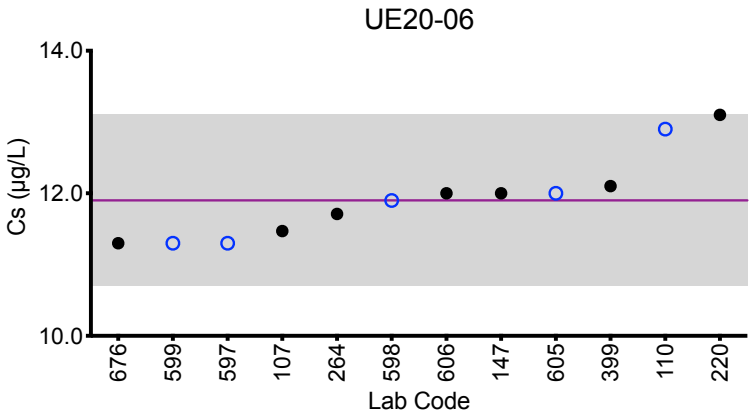
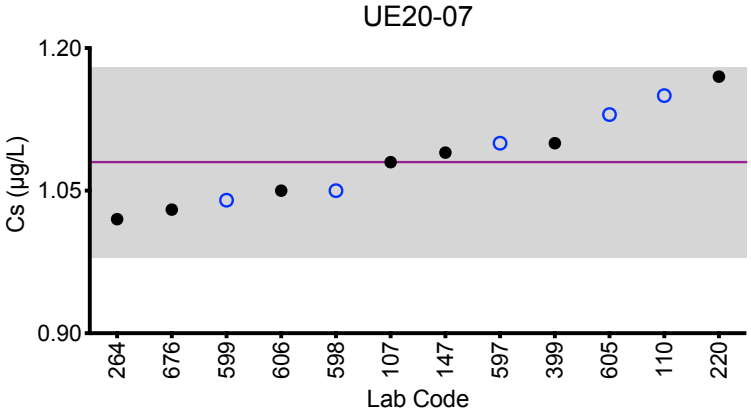
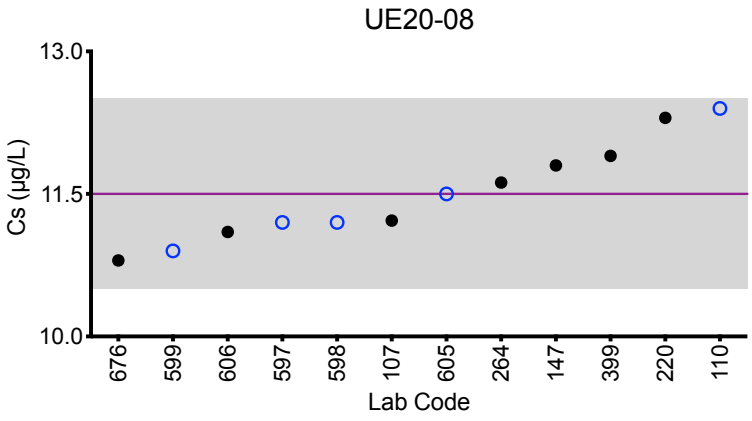
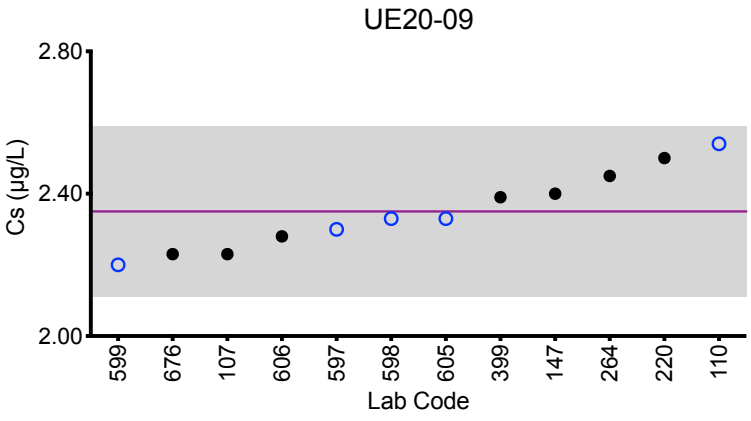
Results for Event #2, 2020: Summary Figures

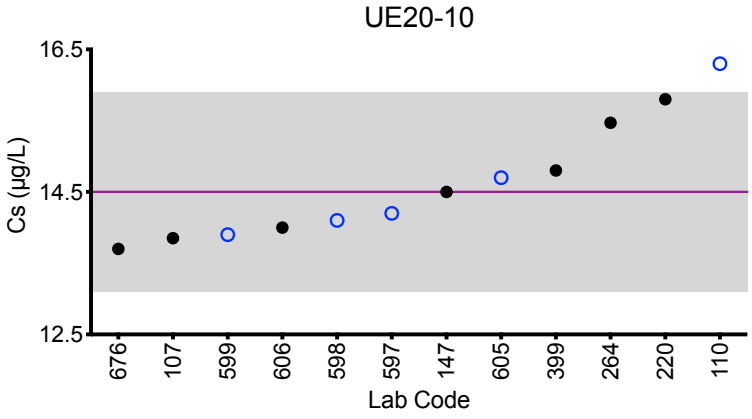
Urine Cs











Legend:
o C/HHEAR 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 intended to be quality specifications and are included for informational purposes only.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Cu (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
110	ICP-MS	11.5	17.9	8.0	12.8	17.9
116	ICP-MS/MS	8.82	12.62	5.17	9.66	16.22
147	ICP-MS	*19.1	21.5	*12.9	*16.8	*24.3
264	ICP-MS	8.77	14.56	5.58	9.75	15.02
293	DRC/CC-ICP-MS	*20.34 L	15.26 L	5.72 L	9.54 L	15.89 L
391	ICP-MS	7.18	13.01	5.07	8.11	12.84
597	ICP-MS	6.41	13.7	4.33	8.21	13.7
598	ICP-MS	10.1	14.9	7.03	10.6	16.0

Summary Statistics					
	UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Arithmetic Mean ($\bar{x}$)	8.8	15.5	5.9	9.9	15.3
Arithmetic SD (s)	1.8	3.1	1.3	1.7	1.7
Arithmetic RSD (%)	20	20	22	18	11
Number of Sample Measurements (N)	6	7	6	6	6

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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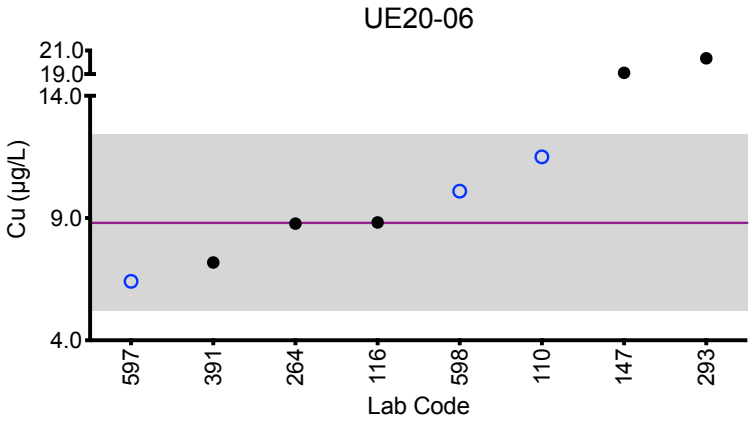
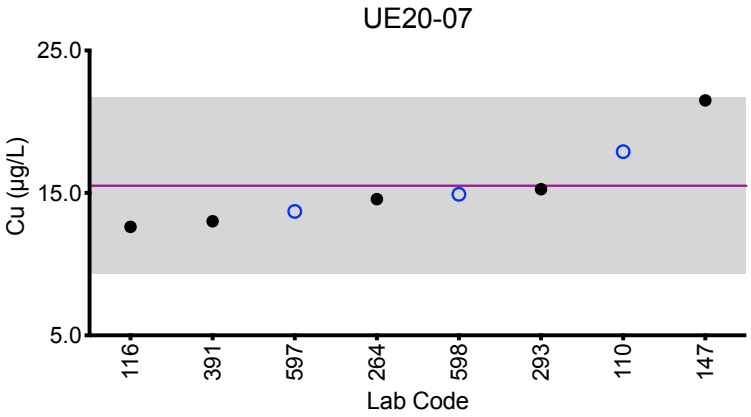
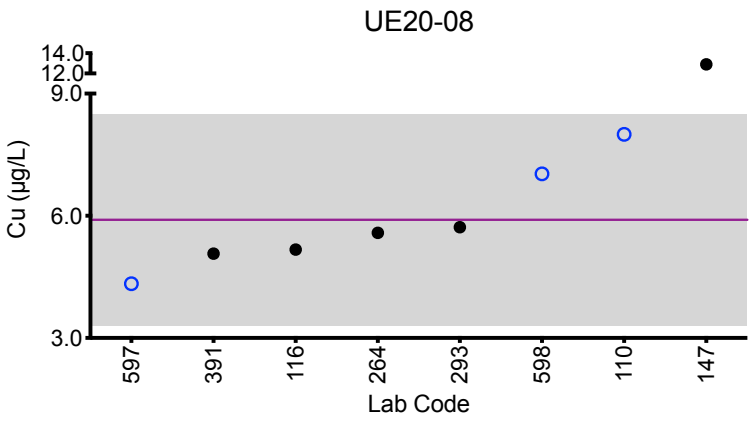
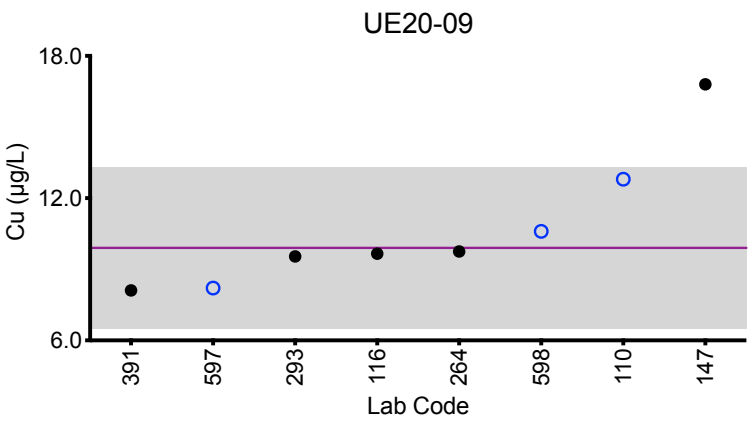
Results for Event #2, 2020: Summary Figures

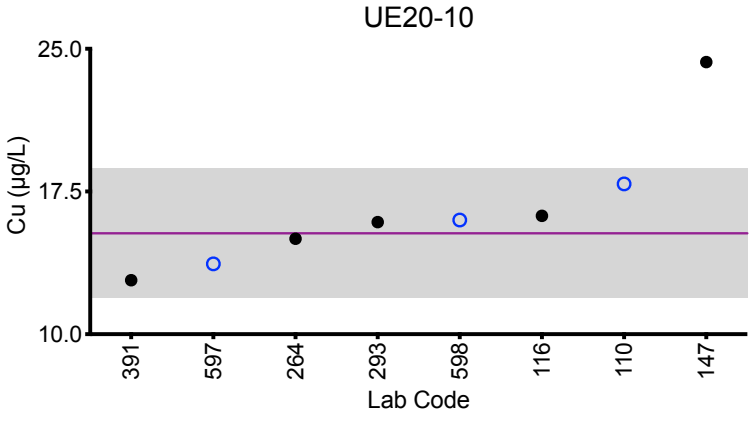
Urine Cu











Legend:
o C/HHEAR 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 intended to be quality specifications and are included for informational purposes only.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Mo (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
103	DRC/CC-ICP-MS	92.9	5.99	26.8	12.4	59.1
107	ICP-MS	90.86	4.97	25.32	10.61	57.41
110	ICP-MS	96.5	6.83	28.5	13.4	61.0
147	ICP-MS	83.3	5.56	23.4	10.8	52.0
220	ICP-MS	100	6.64	28.0	13.1	62.4
264	ICP-MS	85.99	5.22	23.44	10.76	52.40
293	DRC/CC-ICP-MS	87.85 L	6.64 L	25.02 L	11.82 L	55.8 L
399	ICP-MS/MS	92.9	3.72	25.0	10.6	59.1
597	ICP-MS	88.6	6.03	26.4	12.2	57.6
598	DRC/CC-ICP-MS	96.6	6.73	29.0	12.9	61.7
605	ICP-MS	89.2	<9.00	23.5	9.79	56.3
606	ICP-MS/MS	91.5	6.00	26.4	12.0	57.5
676	ICP-MS	92.4	6.24	26	12.2	57.9

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Robust Mean (x*)	92	5.9	26.0	11.7	58.1
Robust SD (s*)	5	0.8	2.2	1.3	2.5
Robust RSD (%)	5.4	14	8.5	11	4.3
Number of Sample Measurements (N)	12	11	12	12	12
Standard Uncertainty (*u*)	2	0.3	0.8	0.5	0.9

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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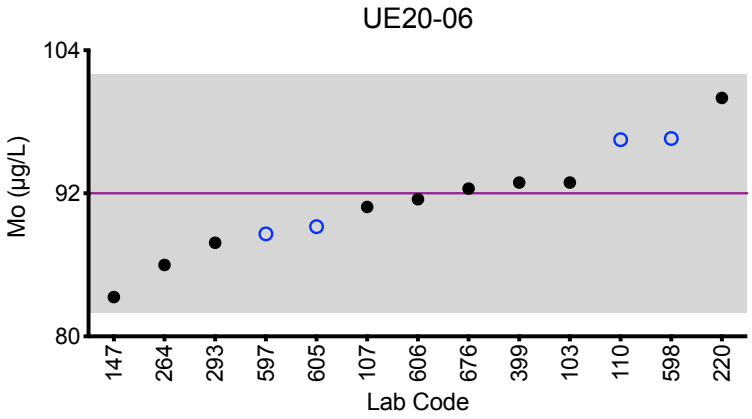
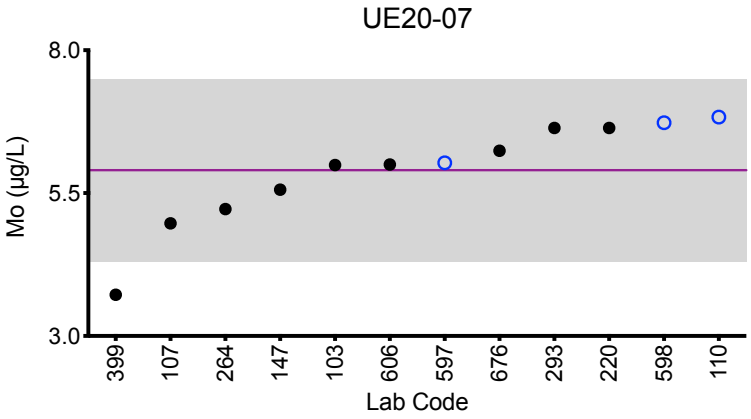
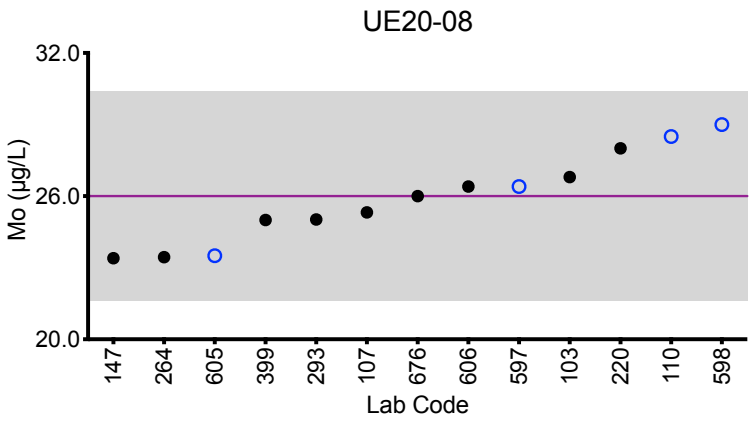
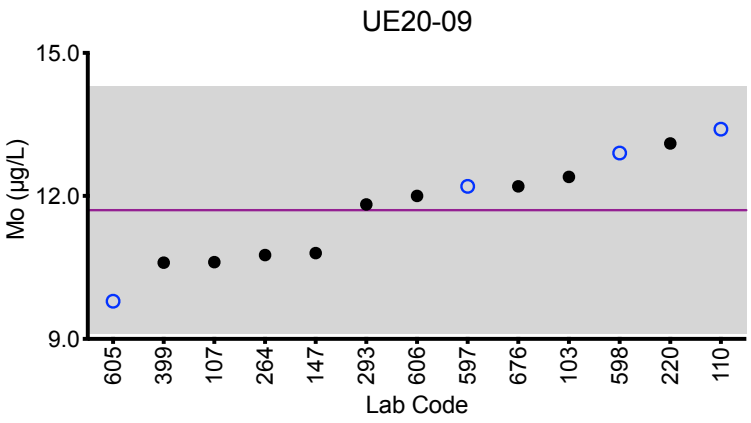
Results for Event #2, 2020: Summary Figures

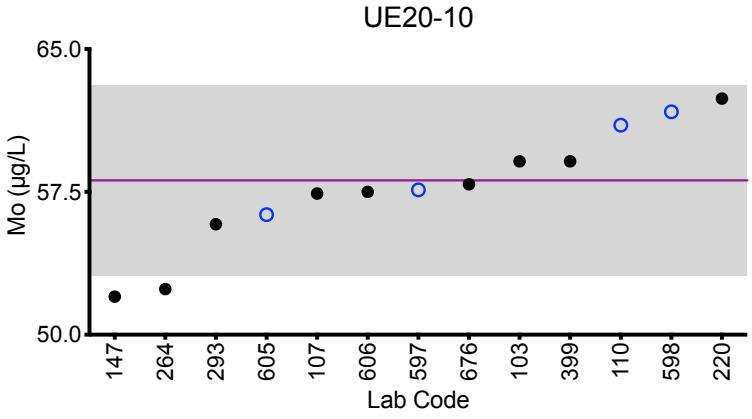
Urine Mo











Legend:
o C/HHEAR Labs ● Other Labs
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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Ni (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
107	DRC/CC-ICP-MS	2.90	9.45	0.78	2.71	4.65
110	ICP-MS	*4.88	10.2	1.22	4.23	7.31
147	ICP-MS	2.93	10.4	0.843	3.78	5.23
264	ICP-MS	3.54	10.29	1.09	3.89	6.16
293	DRC/CC-ICP-MS	3.26 L	9.7 L	1.34 L	3.92 L	6.08 L
391	ICP-MS	3.00	8.32	0.83	3.55	5.19
597	ICP-MS	3.86	10.2	1.43	3.81	5.91
598	ICP-MS	3.62	8.34	0.44	3.08	6.08
599	DRC/CC-ICP-MS	2.88	9.79	0.417	3.28	6.07
605	ICP-MS	3.23	9.86	0.759	3.63	5.76

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Arithmetic Mean ($\bar{x}$)	3.25	9.7	NA	3.6	5.8
Arithmetic SD (s)	0.37	0.8	NA	0.5	0.7
Arithmetic RSD (%)	11	8.2	NA	13	12
Number of Sample Measurements (N)	8	9	NA	9	9

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

Statistical data was not calculated for UE20-08 based on a lack of consensus among participating labs.

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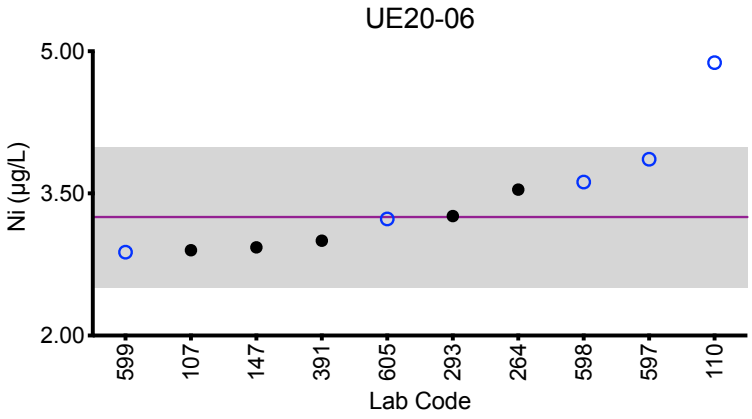
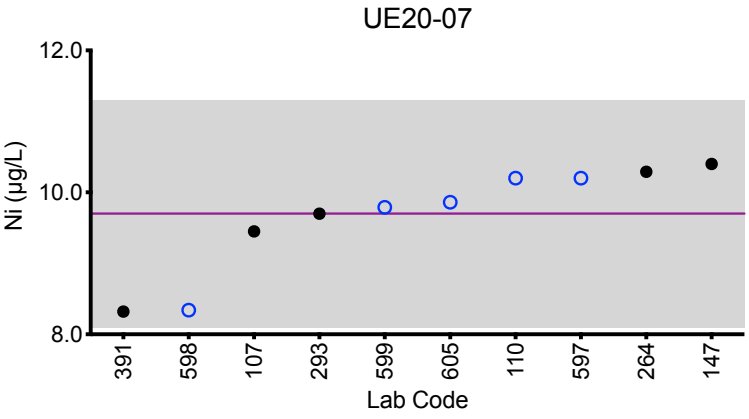
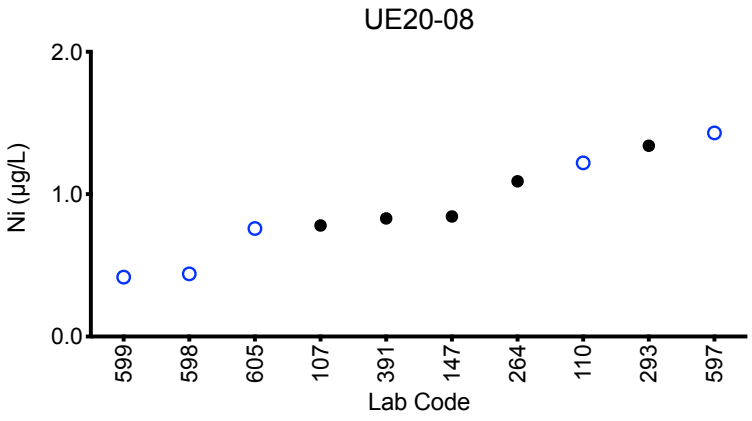
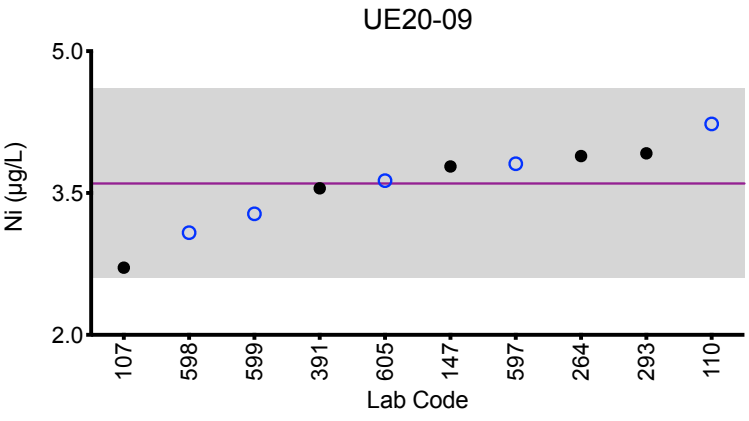
Results for Event #2, 2020: Summary Figures

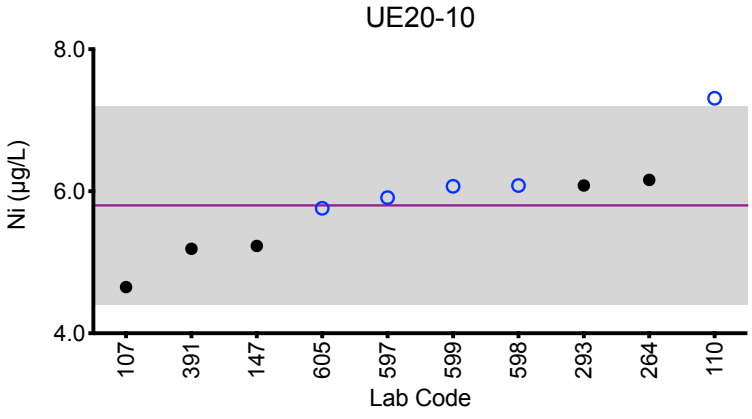
Urine Ni











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Pt (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
107	ICP-MS	0.5475	1.9878	0.1655	3.5342	0.9427
110	ICP-MS	0.569	2.52	0.186	4.46	1.04
220	ICP-MS	0.52	2.21	0.17	4.14	0.98
264	ICP-MS	0.53	2.18	0.16	3.88	0.94
293	DRC/CC-ICP-MS	0.59 L	2.49 L	0.22 L	4.36 L	1.07 L
399	ICP-MS/MS	0.574	1.83	0.158	3.35	0.991
598	ICP-MS	0.48	2.06	0.16	3.70	0.81
605	ICP-MS	0.513	1.86	0.131	2.91	0.918
676	ICP-MS	0.569	2.31	0.19	4.04	0.915

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Arithmetic Mean ($\bar{x}$)	0.538	2.12	0.165	3.8	0.94
Arithmetic SD (s)	0.032	0.23	0.018	0.5	0.07
Arithmetic RSD (%)	5.9	11	11	13	7.4
Number of Sample Measurements (N)	8	8	8	8	8

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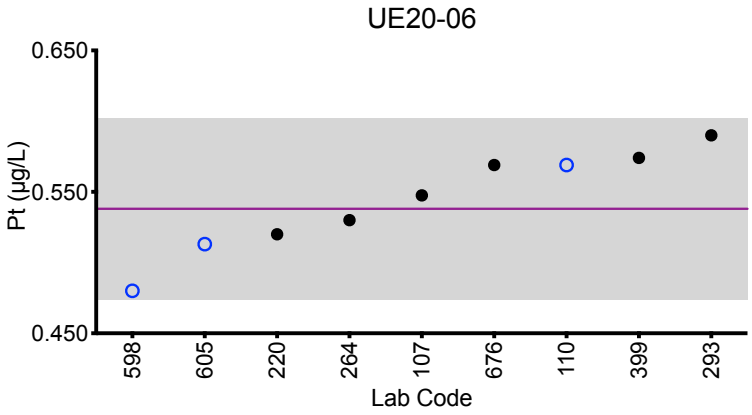
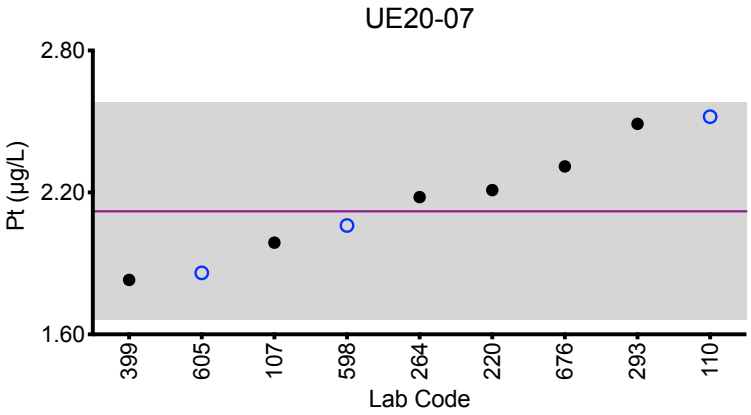
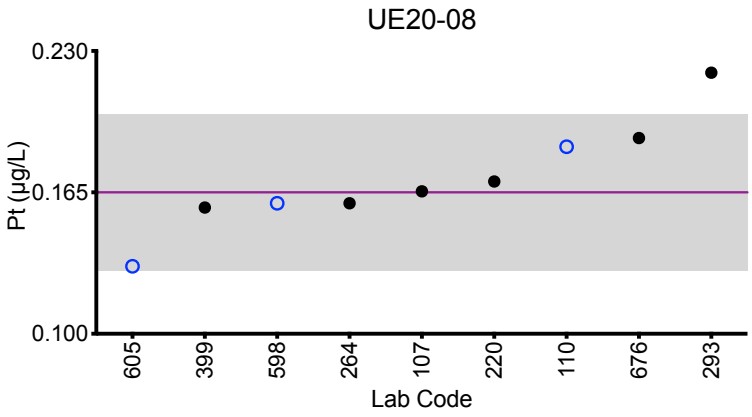
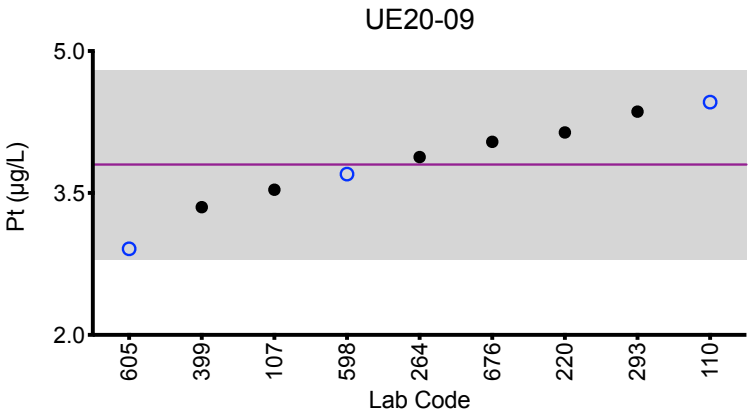
Results for Event #2, 2020: Summary Figures

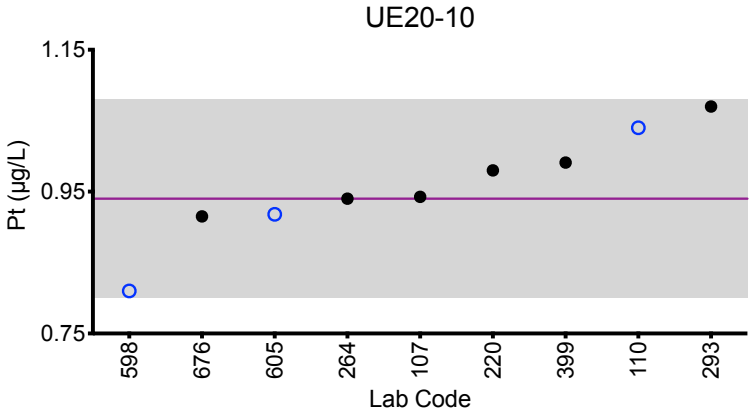
Urine Pt











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Sb (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
103	DRC/CC-ICP-MS	1.35	0.512	2.31	0.719	0.412
107	ICP-MS	1.327	0.393	1.514	0.508	0.415
110	ICP-MS	1.48	0.560	2.70	0.825	0.470
147	ICP-MS	1.57	0.553	2.56	0.813	0.503
220	ICP-MS	1.47	0.53	2.61	0.79	0.45
264	ICP-MS	1.39	0.47	2.28	0.70	0.44
293	DRC/CC-ICP-MS	1.55 L	0.56 L	2.79 L	0.75 L	0.47 L
399	ICP-MS/MS	1.43	0.318	1.49	0.446	0.467
597	ICP-MS	1.35	0.55	2.42	0.82	0.50
598	ICP-MS	1.30	0.42	2.42	0.70	0.41
605	ICP-MS	1.28	<0.800	1.90	<0.800	<0.800
606	ICP-MS/MS	1.32	0.500	2.33	0.736	0.435
676	ICP-MS	1.32	0.476	2.32	0.741	0.423

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Robust Mean (x*)	1.37	0.49	2.3	0.73	0.45
Robust SD (s*)	0.07	0.07	0.3	0.08	0.04
Robust RSD (%)	5.1	14	13	11	8.5
Number of Sample Measurements (N)	12	11	12	11	11
Standard Uncertainty (*u*)	0.03	0.03	0.1	0.03	0.01

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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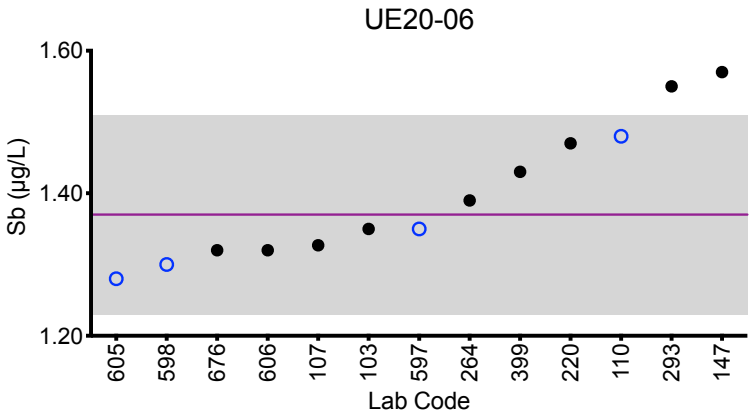
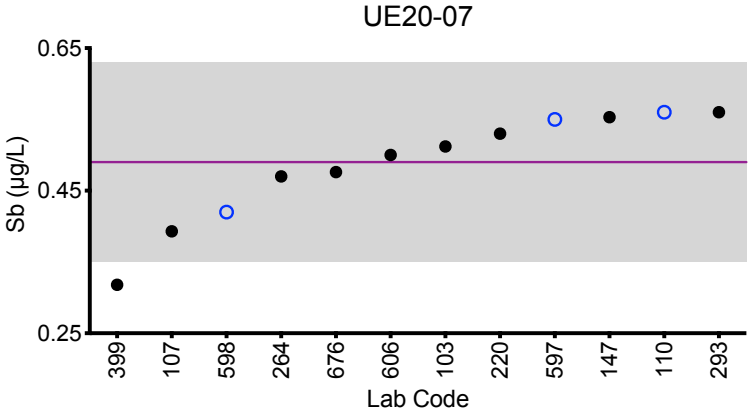
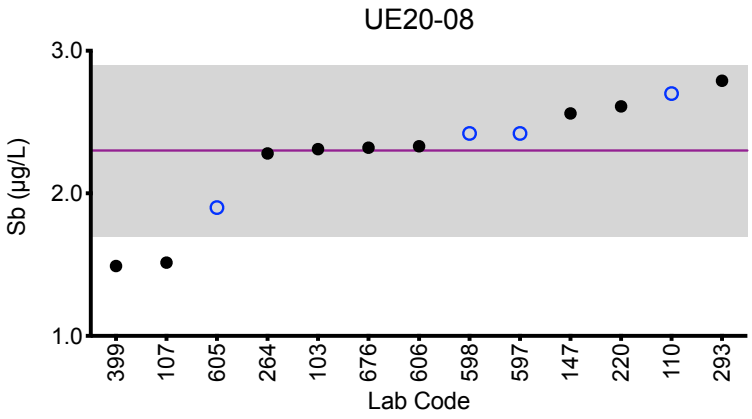
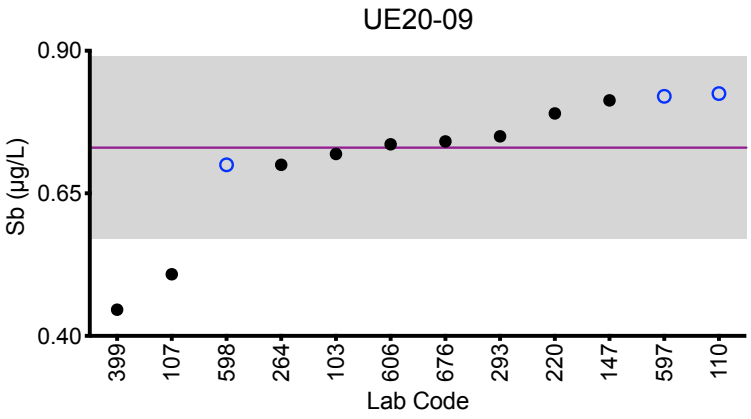
Results for Event #2, 2020: Summary Figures

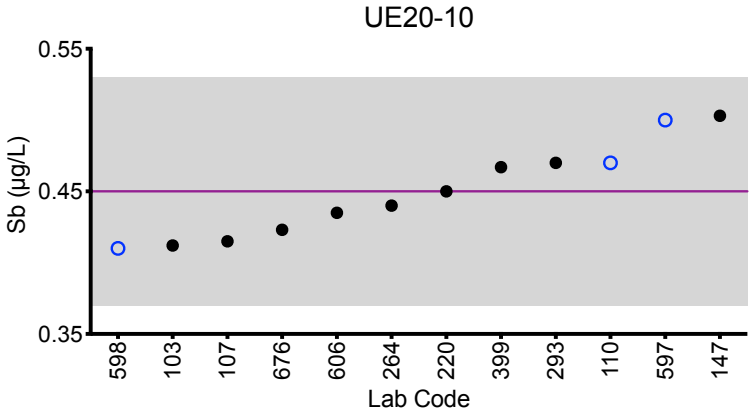
Urine Sb











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Se (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
103	DRC/CC-ICP-MS	60.5	26.2	30.0	13.9	76.9
110	DRC/CC-ICP-MS	51.6	27.0	28.9	13.6	77.0
147	ICP-MS	52.9	28.2	31.2	14.2	75.3
293	DRC/CC-ICP-MS	52.88 L	27.62 L	31.57 L	13.42 L	74.19 L
597	ICP-MS	45.7	24.6	27.0	12.0	67.1
598	DRC/CC-ICP-MS	44.3	25.4	25.5	11.7	66.7
599	DRC/CC-ICP-MS	48.0	27.4	25.9	11.4	66.0

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Arithmetic Mean ($\bar{x}$)	51	26.5	28.1	12.8	72
Arithmetic SD (s)	6	1.3	2.2	1.2	5
Arithmetic RSD (%)	12	4.9	7.8	9.4	7.3
Number of Sample Measurements (N)	6	6	6	6	6

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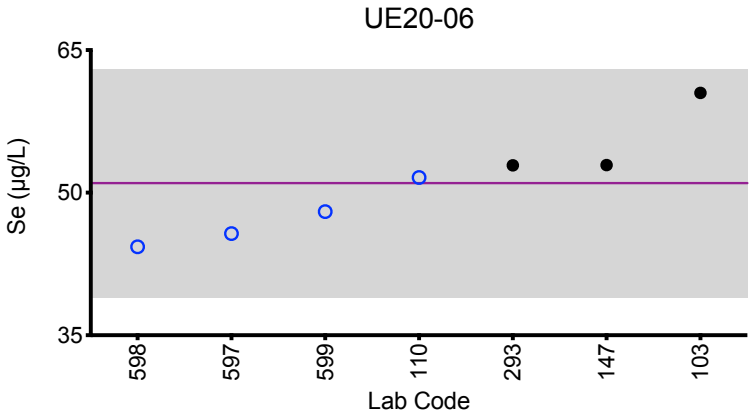
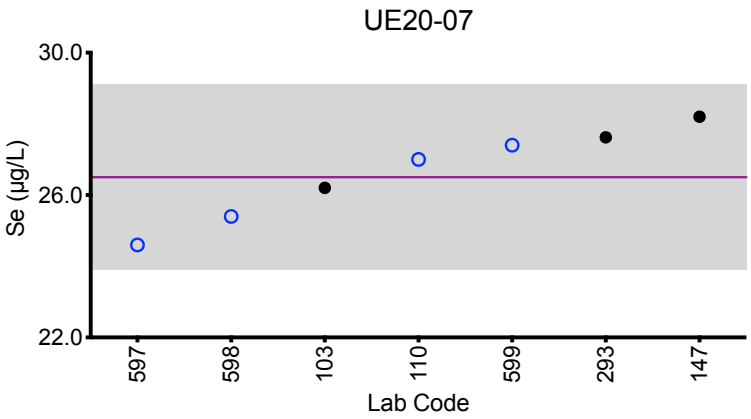
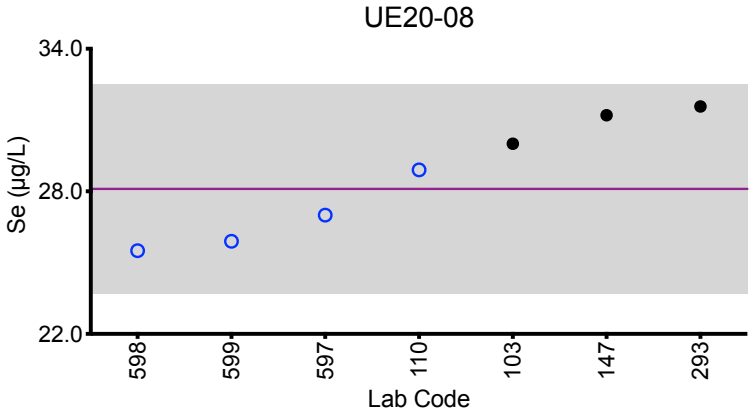
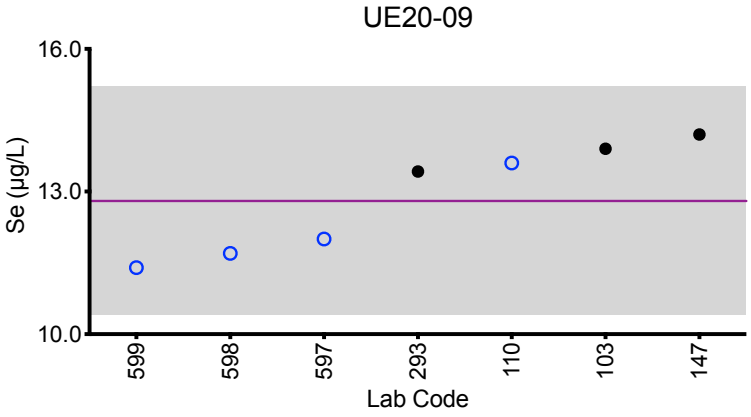
Results for Event #2, 2020: Summary Figures

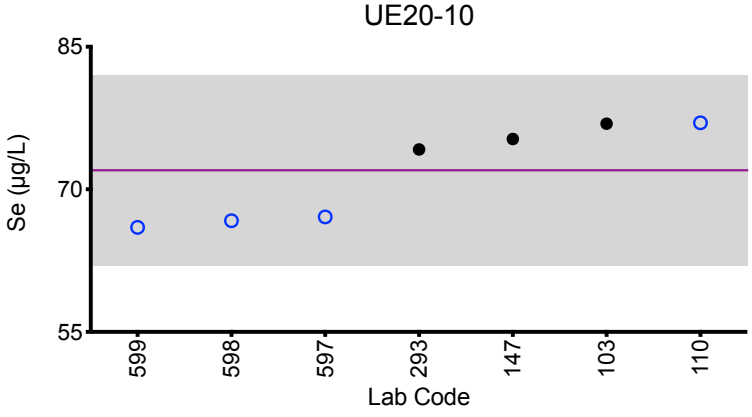
Urine Se











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Sn (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
107	ICP-MS	1.40	1.69	3.53	0.43	6.32
110	ICP-MS	1.29	2.18	4.49	0.50	6.55
147	ICP-MS	1.37	1.66	3.40	0.469	6.76
220	ICP-MS	1.33	1.81	3.78	0.77	6.34
264	ICP-MS	1.17	1.11	2.40	0.50	6.09
399	ICP-MS/MS	1.24	1.94	3.93	0.460	6.22
597	ICP-MS	1.40	1.75	3.33	0.56	6.40
598	ICP-MS	1.19	1.29	2.78	0.36	5.82
605	ICP-MS	1.00	1.53	3.28	<0.900	5.65
676	ICP-MS	1.22	1.56	2.92	0.429	5.86

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Robust Mean (x*)	1.27	1.7	3.4	0.50	6.2
Robust SD (s*)	0.12	0.2	0.6	0.12	0.4
Robust RSD (%)	9.4	14	18	24	6.0
Number of Sample Measurements (N)	10	10	10	9	10
Standard Uncertainty (*u*)	0.05	0.1	0.3	NA	0.1

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An arithmetic mean, SD, RSD and n are provided for samples UE20-09.

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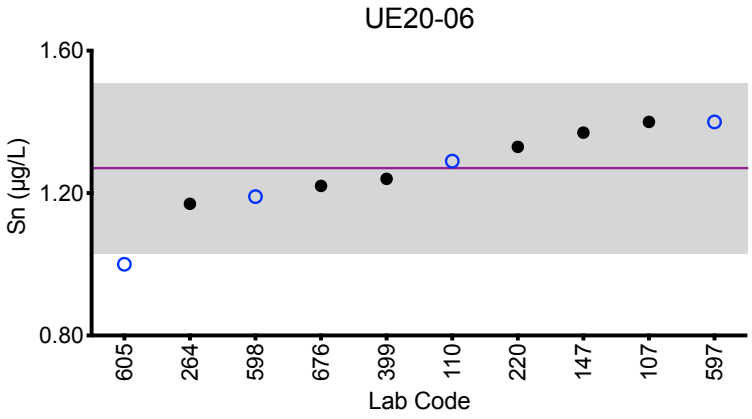
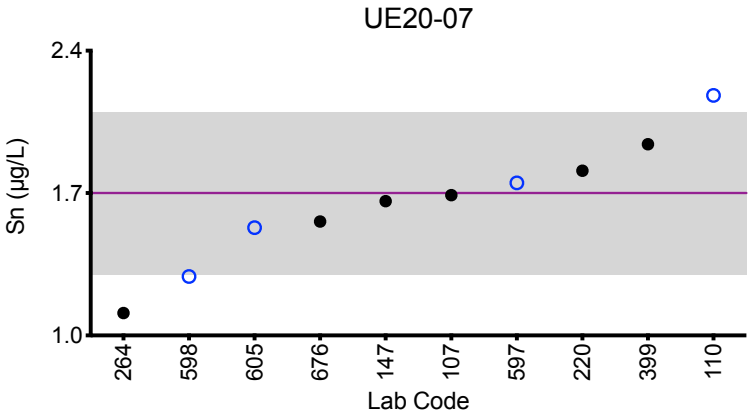
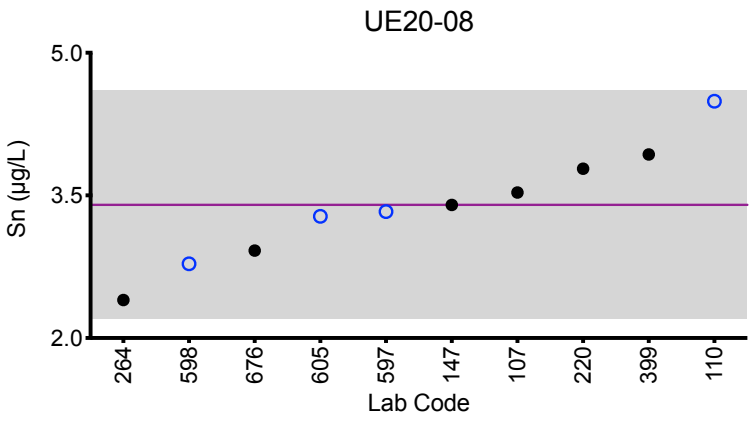
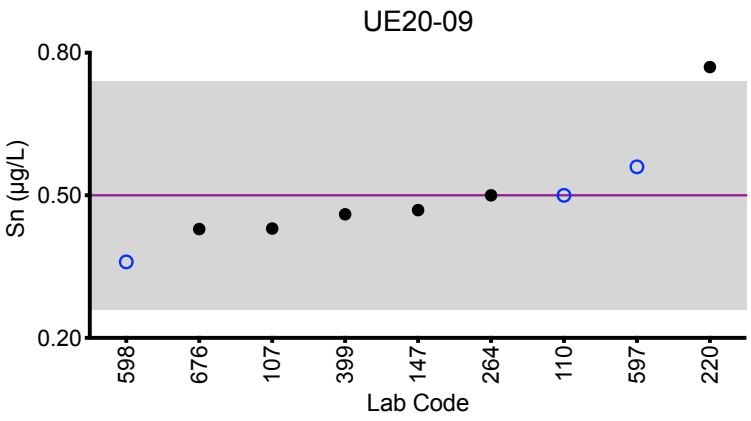
Results for Event #2, 2020: Summary Figures

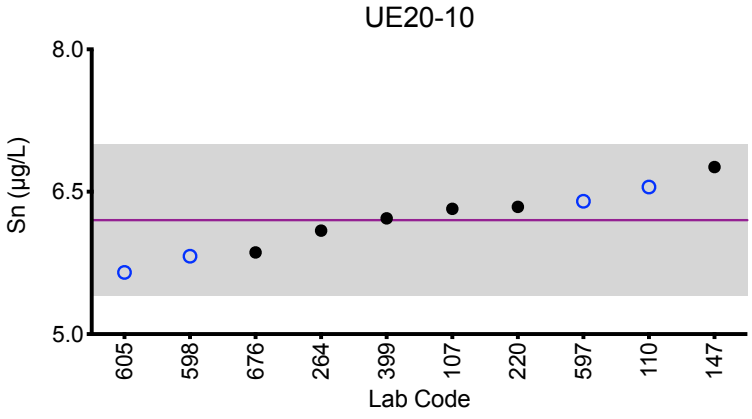
Urine Sn











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Sr (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
103	DRC/CC-ICP-MS	354	448	119	188	218
107	ICP-MS	352.7	433.8	112.6	174.8	217.0
200	ICP-MS	376	433	125	179	226
220	ICP-MS	378	477	124	196	231
264	ICP-MS	319.44	390.55	105.27	173.93	204.17
399	DRC/CC-ICP-MS	368	465	118	186	217
597	ICP-MS	333	424	115	182	209
605	ICP-MS	357	449	116	186	219
676	ICP-MS	355	444	116	187	217

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Arithmetic Mean ($\bar{x}$)	355	440	117	184	218
Arithmetic SD (s)	18	24	6	7	8
Arithmetic RSD (%)	5.1	5.5	4.9	3.8	3.7
Number of Sample Measurements (N)	9	9	9	9	9

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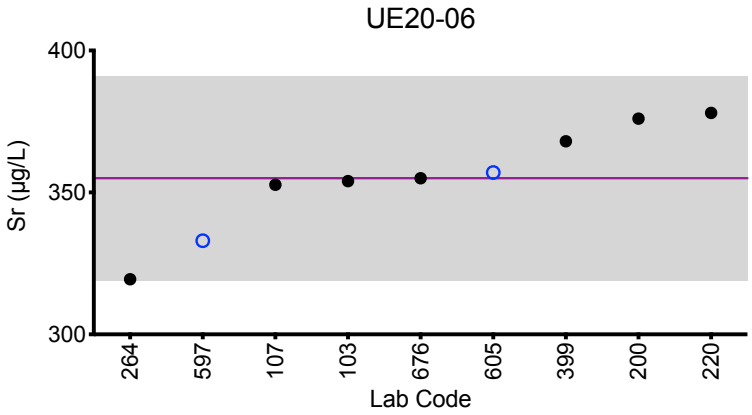
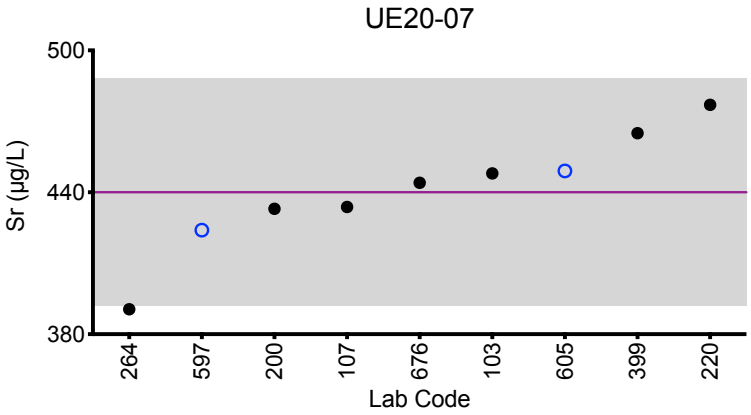
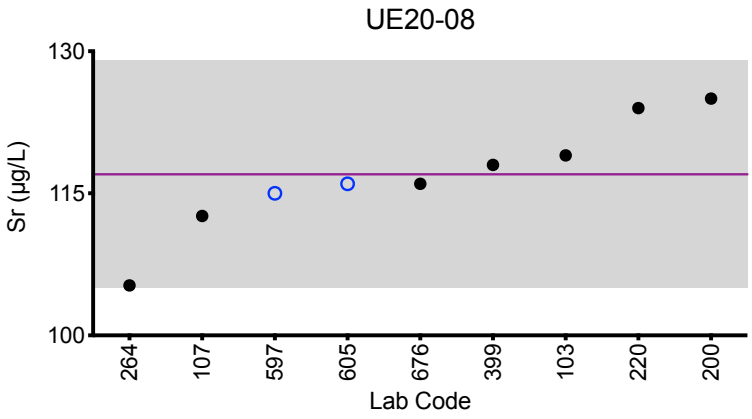
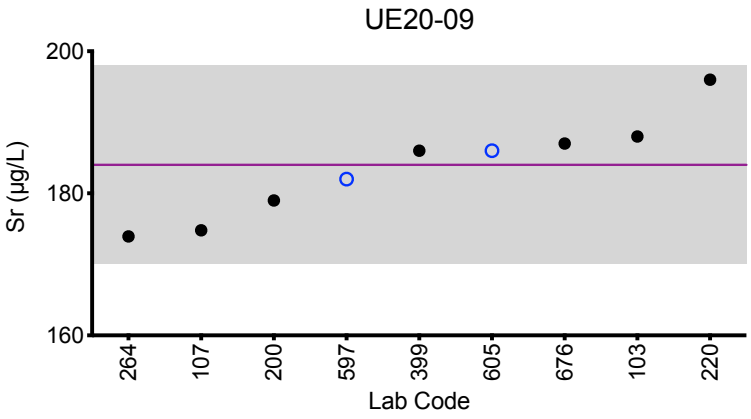
Results for Event #2, 2020: Summary Figures

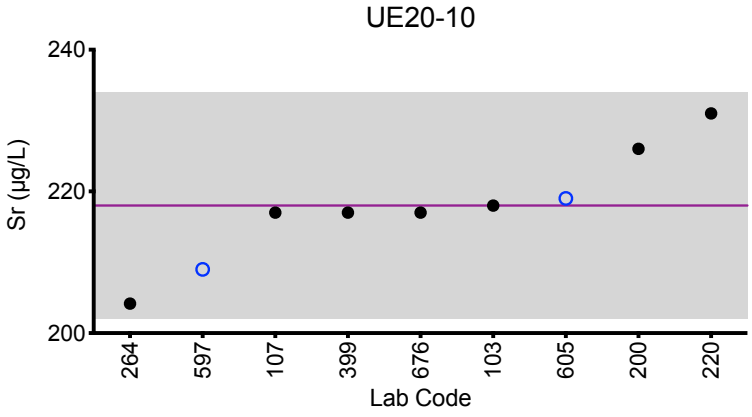
Urine Sr











Legend:
o C/HHEAR 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 intended to be quality specifications and are included for informational purposes only.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine V (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
116	ICP-MS/MS	0.686	5.25	1.09	2.35	0.379
147	DRC/CC-ICP-MS	0.691	4.74	1.02	2.19	0.409
293	DRC/CC-ICP-MS	0.7 L	5.06 L	1.04 L	2.34 L	0.49 L
597	ICP-MS		4.54	1.31	2.35	
598	DRC/CC-ICP-MS	0.72	5.47	1.21	2.5	0.53
599	DRC/CC-ICP-MS	0.822	5.04	1.12	2.27	0.506
605	ICP-MS	0.585	5.11	0.963	2.17	0.315

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Arithmetic Mean ($\bar{x}$)	0.70	5.03	1.12	2.31	0.43
Arithmetic SD (s)	0.08	0.32	0.12	0.12	0.08
Arithmetic RSD (%)	11	6.4	11	5.2	19
Number of Sample Measurements (N)	5	6	6	6	5

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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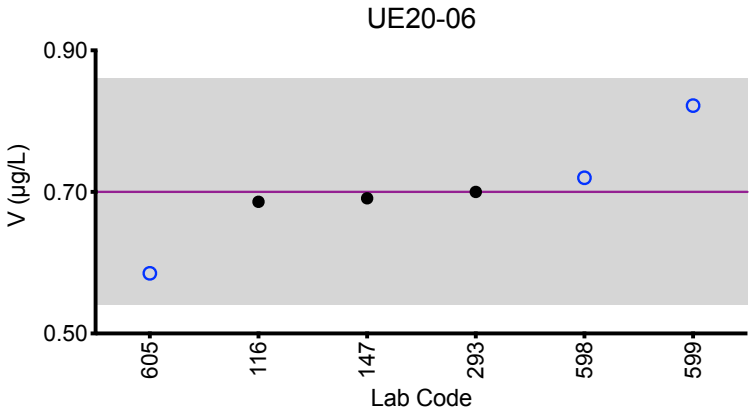
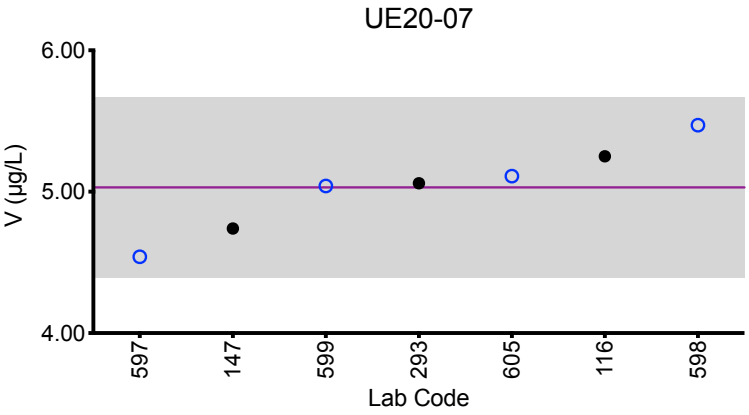
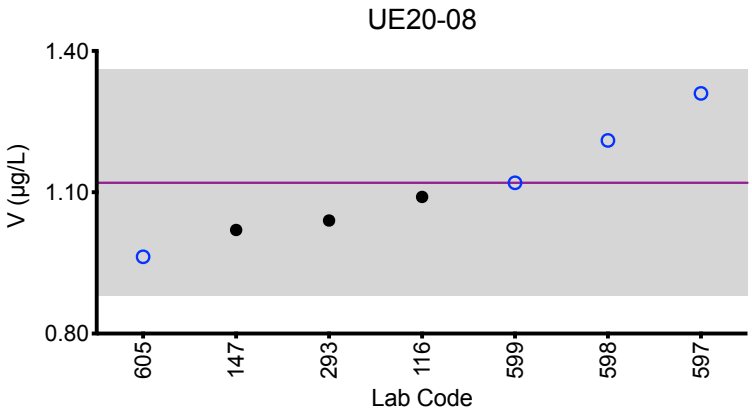
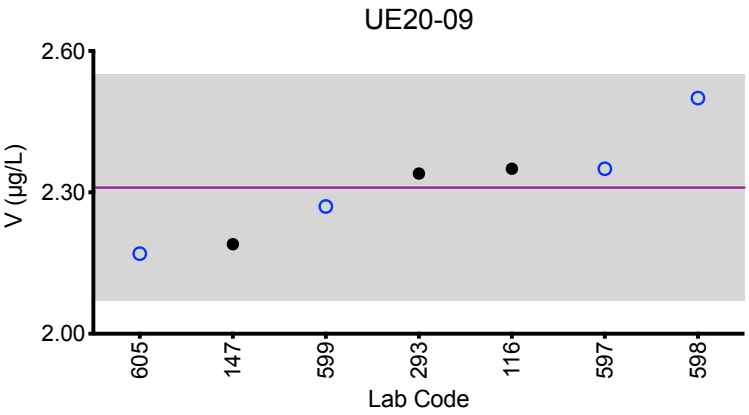
Results for Event #2, 2020: Summary Figures

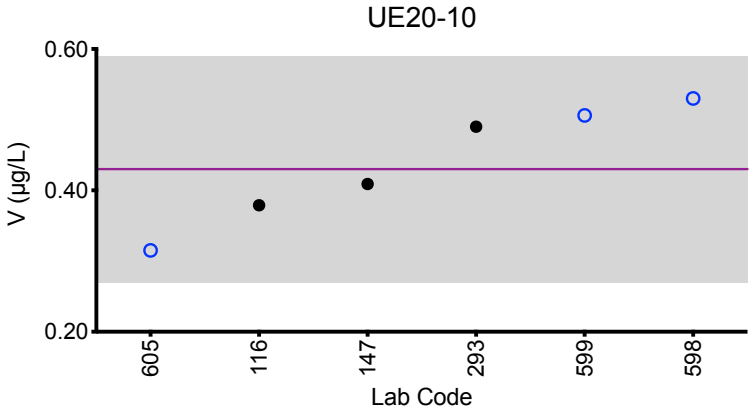
Urine V











Legend:
o C/HHEAR Labs ● Other Labs
Horizontal purple line = arithmetic mean of all laboratories.
Gray area = ±2SD of the mean.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine W (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
107	ICP-MS	0.488	0.730	0.575	1.712	0.544
110	ICP-MS	0.490	0.812	0.583	1.84	0.534
147	ICP-MS	0.463	0.670	0.509	1.57	0.535
200	ICP-MS	0.4	0.7	0.5	1.7	0.5
220	ICP-MS	0.52	0.81	0.58	1.84	0.57
264	ICP-MS	0.43	0.70	0.51	1.67	0.49
399	ICP-MS/MS	0.495	0.802	0.585	1.84	0.551
598	ICP-MS	0.60	0.88	0.69	1.90	0.63
605	ICP-MS	0.449	0.763	0.576	1.74	0.541
606	ICP-MS/MS	0.507	0.744	0.577	1.79	0.555
676	ICP-MS	0.495	0.798	0.549	1.79	0.55

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Robust Mean (x*)	0.48	0.76	0.572	1.77	0.544
Robust SD (s*)	0.04	0.07	0.016	0.09	0.017
Robust RSD (%)	8.3	9.2	2.8	5.1	3.1
Number of Sample Measurements (N)	11	11	11	11	11
Standard Uncertainty (*u*)	0.02	0.03	0.006	0.03	0.007

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L Denotes late submission, results not included in statistics

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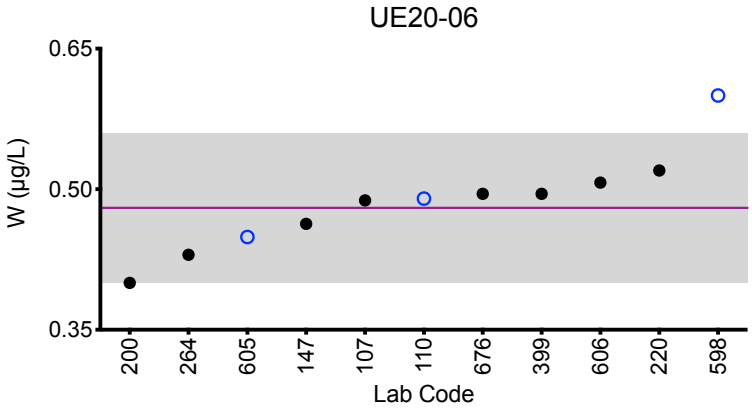
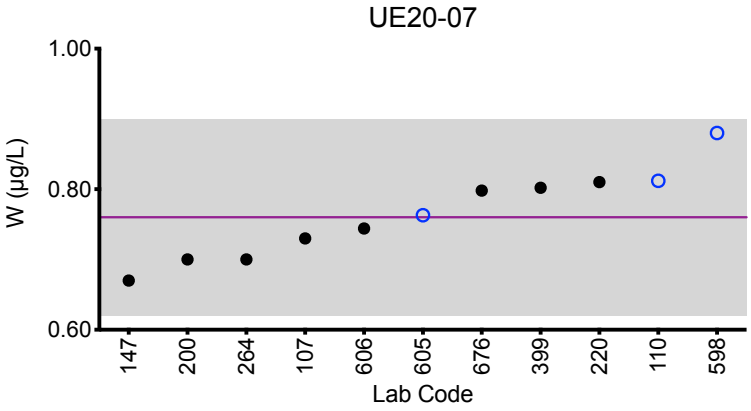
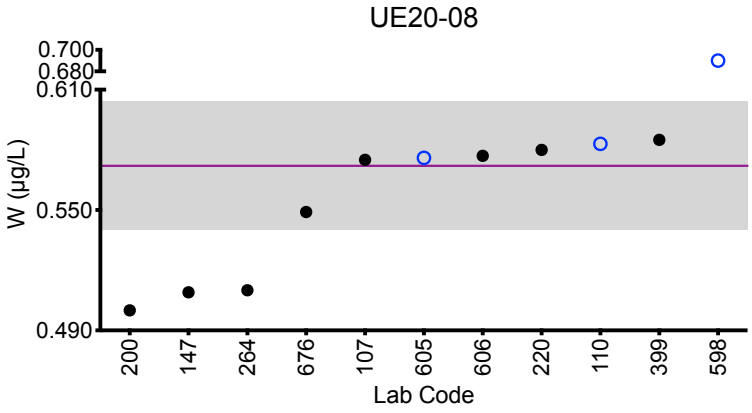
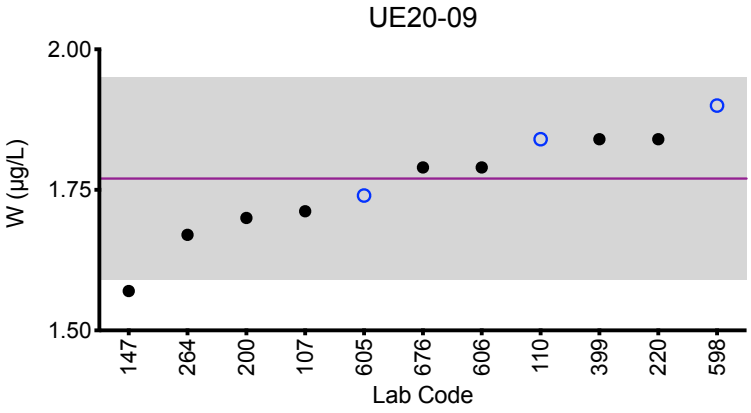
Results for Event #2, 2020: Summary Figures

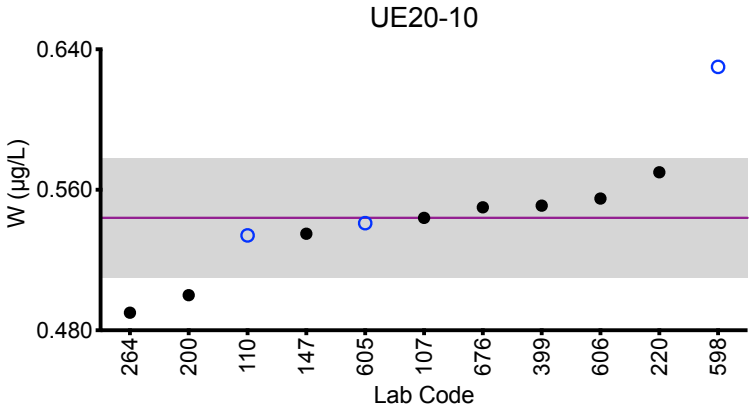
Urine W











Legend:
○ C/HHEAR Labs ● Other Labs
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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Zn (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
110	ICP-MS	485	1020	767	155	1130
147	ICP-MS	502	1108	817	152	1224
264	ICP-MS	503.22	1058.42	805.86	155.20	1185.55
293	DRC/CC-ICP-MS	516.34 L	1069.28 L	792.16 L	167.32 L	1232.03 L
597	ICP-MS	*400	924	697	*64.9	1076
598	ICP-MS	485	991	781	207	1110
599	DRC/CC-ICP-MS	482.1	1006	737.6	140.5	1196

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Arithmetic Mean ($\bar{x}$)	491	1020	768	162	1150
Arithmetic SD (s)	10	60	43	26	50
Arithmetic RSD (%)	2.0	5.9	5.6	16	4.3
Number of Sample Measurements (N)	5	6	6	5	6

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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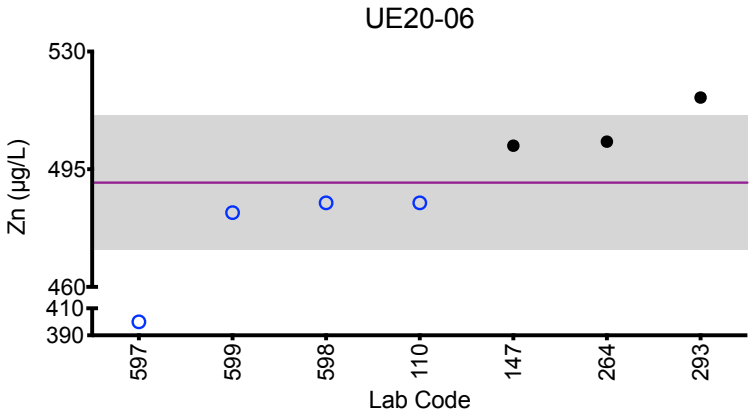
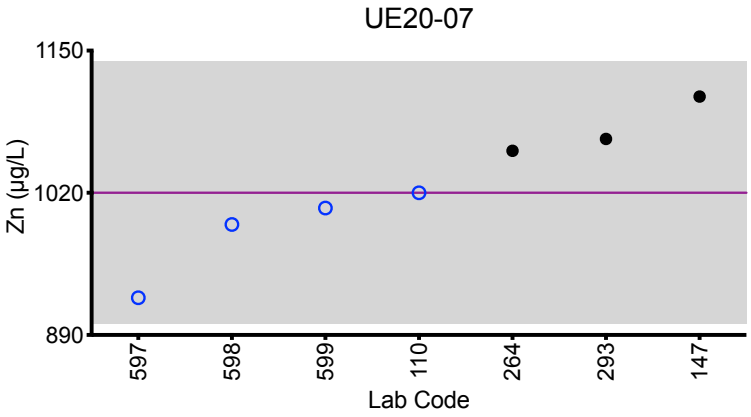
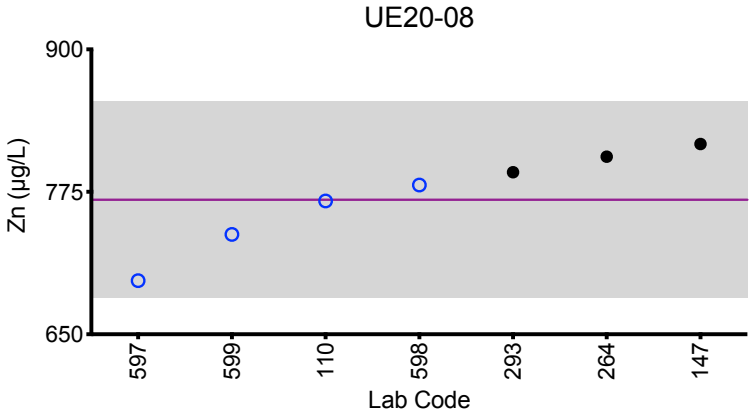
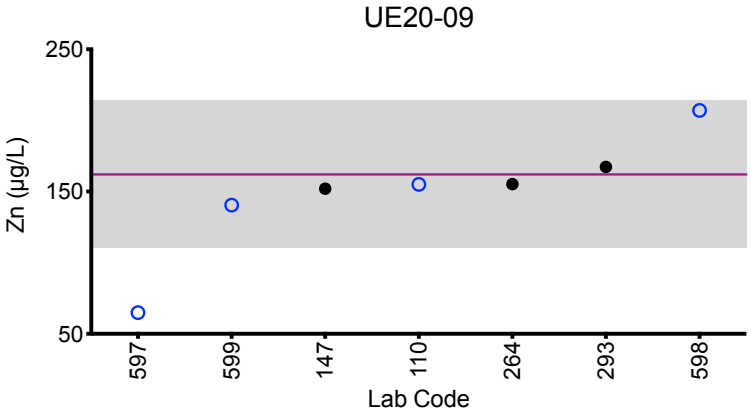
Results for Event #2, 2020: Summary Figures

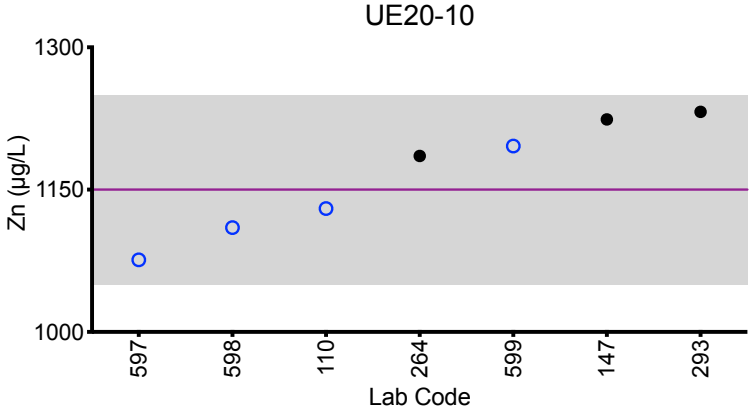
Urine Zn











Legend:
o C/HHEAR Labs ● Other Labs
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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Al (µg/L)

Lab Code	Method	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
147	ICP-MS	11.5	23.7	11.3	11.9	27.8
264	ICP-MS	12.28	23.67	9.48	14.67	19.42
293	DRC/CC-ICP-MS	13.17 L	22.58 L	9.14 L	16.13 L	21.51 L

Summary Statistics

	UE20-06	UE20-07	UE20-08	UE20-09	UE20-10
Arithmetic Mean ($\bar{x}$)	11.9	23.685	10.4	13.3	24
Arithmetic SD (s)	0.5	0.017	1.1	1.6	5
Arithmetic RSD (%)	4.2	0.070	11	12	21
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Urine Te (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
110	ICP-MS	0.563	0.765	0.755	0.978	2.39
147	ICP-MS	0.550	0.838	0.578	0.959	2.54
Summary Statistics						
		UE20-06	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
Arithmetic Mean ($\bar{x}$)		0.556	0.80	0.67	0.968	2.46
Arithmetic SD (s)		0.008	0.04	0.10	0.011	0.09
Arithmetic RSD (%)		1.4	5.0	15	1.1	3.7
Number of Sample Measurements (N)		2	2	2	2	2

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Results for Event #2, 2020: Additional Elements in Urine

Urine Ag (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
147	ICP-MS	<0.183	<0.183	<0.183	<0.183	<0.183
Urine B (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
200	ICP-MS	123	38	45	34	106
Urine Bi (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
147	ICP-MS	<0.0815	<0.0815	<0.0815	<0.0815	<0.0815
Urine I (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
147	ICP-MS	77.7	104	109	104	82.4
Urine Li (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
147	ICP-MS	19.8	5.79	12.7	5.86	19.6
Urine Mg (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
597	ICP-MS	48200	17800	21900	18000	49200
Urine Th (µg/L)						
Lab Code	**Method**	**UE20-06**	**UE20-07**	**UE20-08**	**UE20-09**	**UE20-10**
147	ICP-MS	<0.0673	<0.0673	<0.0673	<0.0673	<0.0673

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Event #2, 2020

Trace Elements in Serum

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

NEW YORK STATE | Department of Health | Wadsworth Center

Event #2, 2020:
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 samples were homogenized overnight prior to aliquoting 2-mL into polypropylene vials. PT samples were stored at -80°C until the week of the PT event, when they were thawed at 4°C prior to circulation to laboratories for analysis.

Graded Elements

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 25 were reported by at least one participant: As, B, Ba, Be, Bi, Cd, Cs, Fe, Hg, I, Li, Mg, Mn, Mo, Ni, Pb, Pt, Sb, Sn, Sr, 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 #2, 2020: Summary Statistics

	Serum Al (µg/L)				
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Target (Arithmetic Mean ($\bar{x}$))	69	50	128	94	NA
Upper Limit	83	60	154	113	NA
Lower Limit	55	40	102	75	NA
Arithmetic SD (s)	10	6	17	12	NA
Arithmetic RSD (%)	14	12	13	13	NA
Number of Sample Measurements (N)	5	5	5	5	NA

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.

Statistical data was not calculated for SE20-10 based on a lack of consensus among participating labs. Consequently, a target value cannot be assigned with confidence.

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Results for Event #2, 2020:
Performance of Participating Laboratories

		Serum Al (µg/L)				
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
	Target	**69**	**50**	**128**	**94**	**NA**
147	ETAAS-Z	60.80	44.0	110	78.6	143
264	ICP-MS	63.92	45.53	117.76	89.64	168.39
293	DRC/CC-ICP-MS	69.89 L	53.76 L	139.78 L	102.15 L	198.92 L
391	ETAAS-Z	85.23 ↑	58.67	154.00	111.80	227.60
485	HR-ICP-MS	66.4	54.1	135	97.7	191
597	ICP-MS	69.3	46.9	125	90.2	194
598	ICP-MS	*96.0 ↑	*87.2 ↑	*157 ↑	*135 ↑	220

Based on the grading criteria for Al in Serum, 86% of results were satisfactory, with 1 of the 7 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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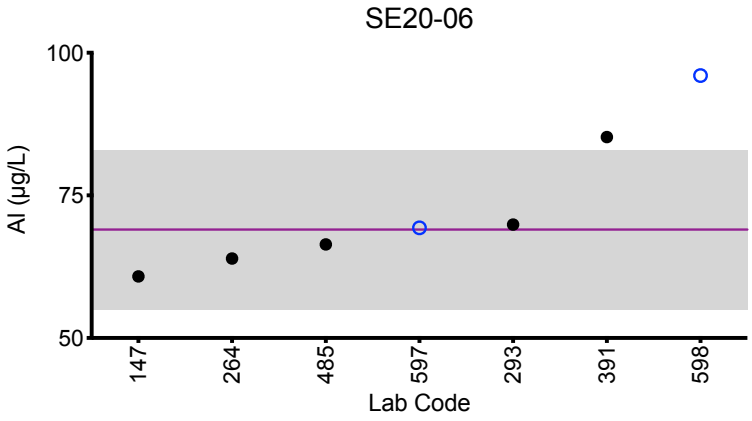
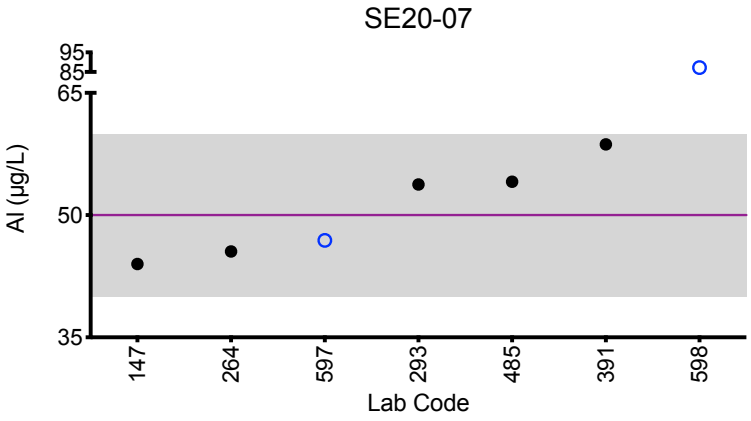
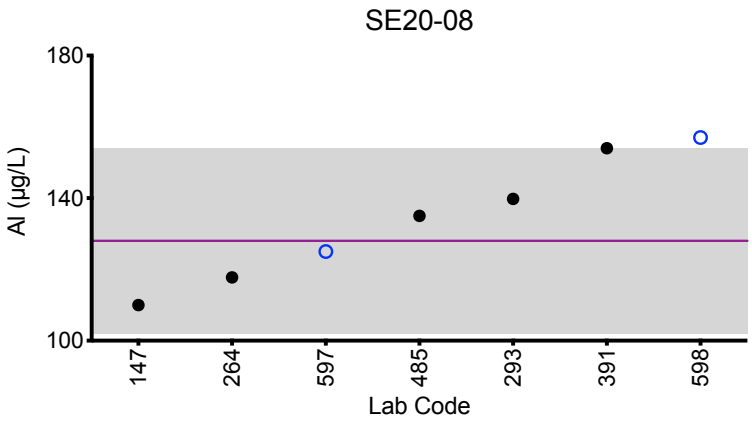
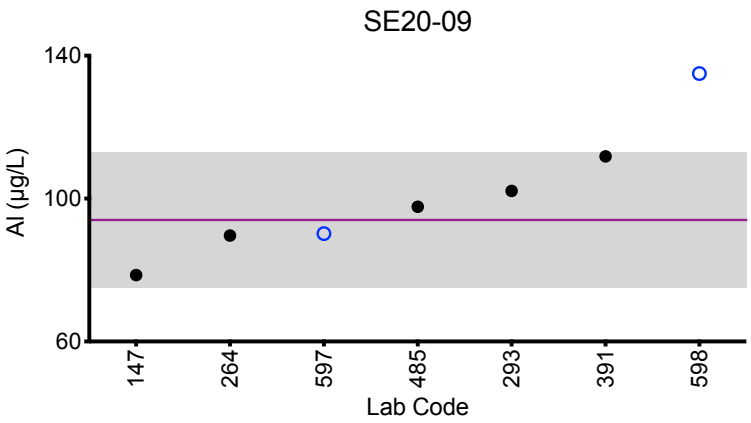
Results for Event #2, 2020: Summary Figures

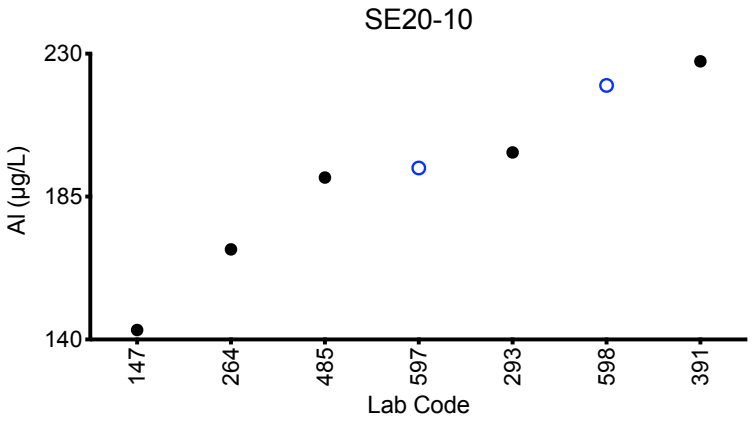
Serum Al











Legend:

o C/HHEAR 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 #2, 2020: Summary Statistics

	Serum Co (µg/L)				
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Target (Arithmetic Mean ($\bar{x}$))	7.41	13.0	5.04	1.81	7.99
Upper Limit	8.91	15.0	6.54	3.31	9.49
Lower Limit	5.91	11.1	3.54	0.31	6.49
Arithmetic SD (s)	0.20	0.6	0.18	0.12	0.28
Arithmetic RSD (%)	2.7	4.3	3.6	6.6	3.5
Number of Sample Measurements (N)	7	7	7	7	7

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 #2, 2020:
Performance of Participating Laboratories

		Serum Co (µg/L)				
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
	Target	**7.41**	**13.0**	**5.04**	**1.81**	**7.99**
103	DRC/CC-ICP-MS	7.23	13.0	5.03	1.76	8.14
110	ICP-MS	7.57	13.4	5.30	1.88	8.14
147	DRC/CC-ICP-MS	7.40	11.9	4.77	1.69	7.64
264	ICP-MS	7.24	12.43	4.86	1.69	7.55
293	DRC/CC-ICP-MS	7.56 L	13.6 L	5.16 L	1.89 L	8.32 L
485	HR-ICP-MS	7.24	13.1	5.20	1.88	8.10
597	ICP-MS	7.38	13.3	5.11	1.73	7.99
598	ICP-MS	7.79	13.5	5.01	2.04	8.35

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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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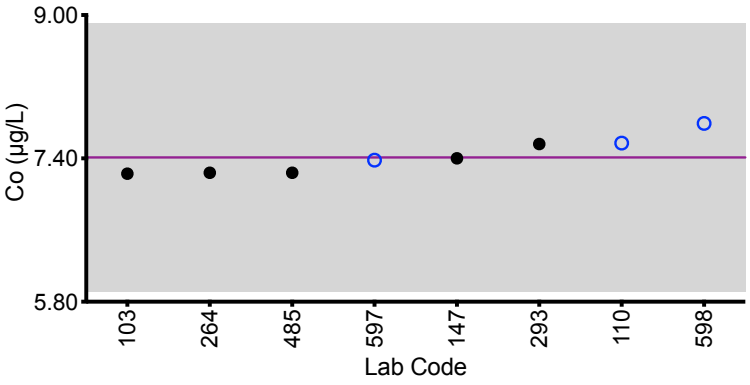
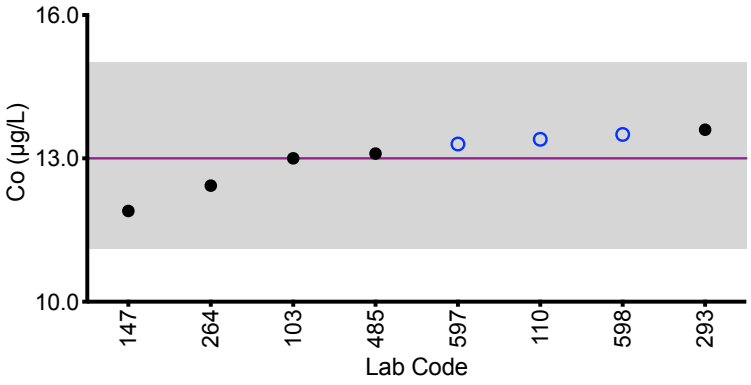
Results for Event #2, 2020: Summary Figures

Serum Co

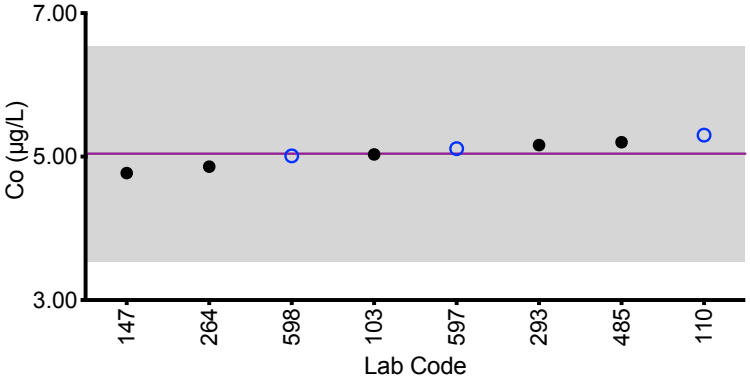
SE20-06



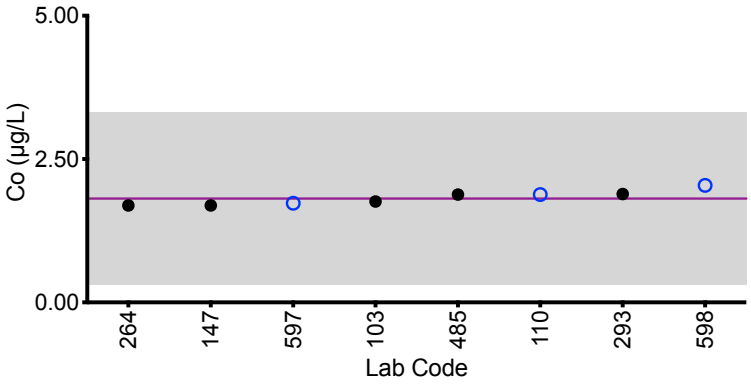
SE20-07



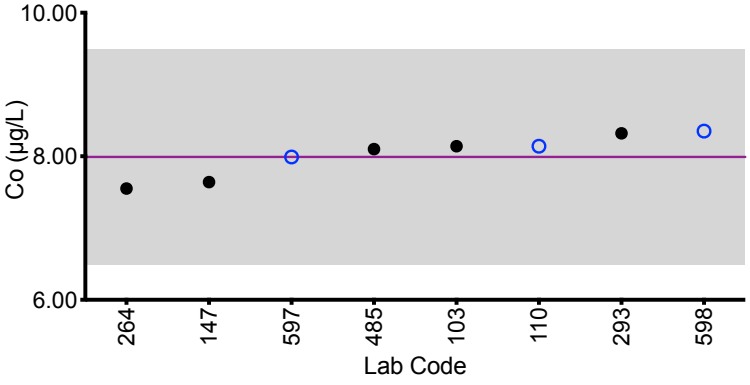
SE20-08



SE20-09



SE20-10



Legend:

o C/HHEAR 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 #2, 2020:
Summary Statistics

Serum Cr (µg/L)					
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Target (Arithmetic Mean ($\bar{x}$))	4.48	3.01	9.7	1.21	6.55
Upper Limit	6.48	5.01	11.7	3.21	8.55
Lower Limit	2.48	1.01	7.7	0.00	4.55
Arithmetic SD (s)	0.20	0.25	0.6	0.14	0.35
Arithmetic RSD (%)	4.5	8.3	6.2	12	5.3
Number of Sample Measurements (N)	7	7	7	7	7

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 #2, 2020:
Performance of Participating Laboratories

		Serum Cr (µg/L)				
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
	Target	**4.48**	**3.01**	**9.7**	**1.21**	**6.55**
103	DRC/CC-ICP-MS	4.32	2.77	9.34	1.04	6.16
110	DRC/CC-ICP-MS	4.52	3.20	10.5	1.39	6.93
147	DRC/CC-ICP-MS	4.39	2.82	9.24	1.09	6.17
264	ICP-MS	4.88	2.95	9.79	1.40	6.95
293	DRC/CC-ICP-MS	4.4 L	3.06 L	9.71 L	1.22 L	6.57 L
485	HR-ICP-MS	4.28	3.02	9.96	1.15	6.59
597	ICP-MS	4.61	3.5	10.4	1.23	6.85
598	DRC/CC-ICP-MS	4.35	2.81	8.79	1.15	6.23

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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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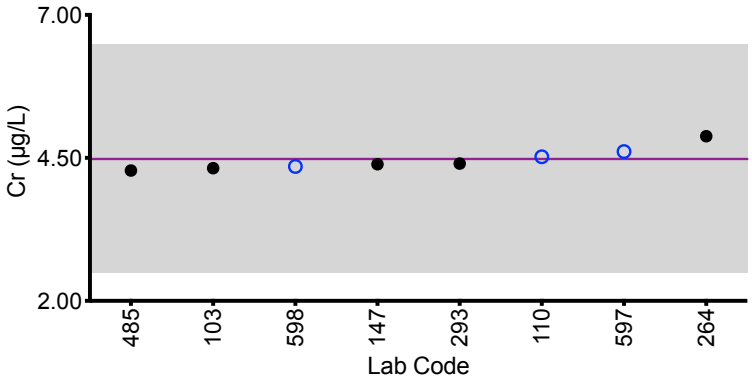
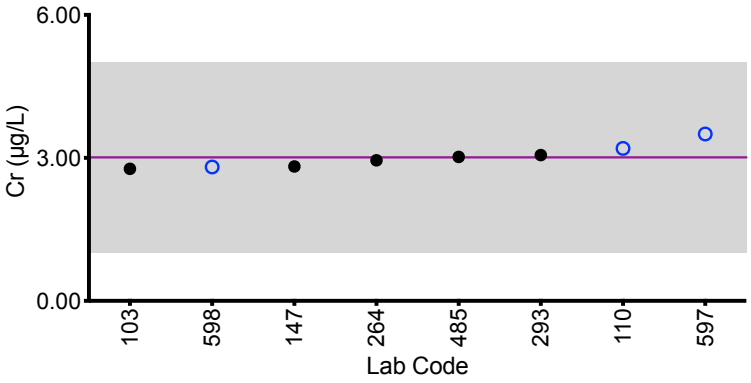
Results for Event #2, 2020: Summary Figures

Serum Cr

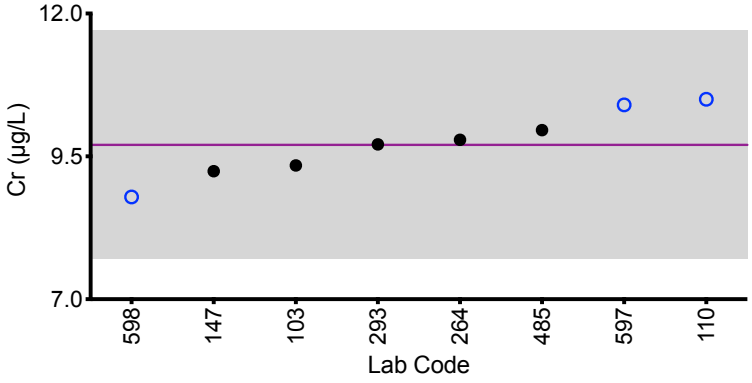
SE20-06



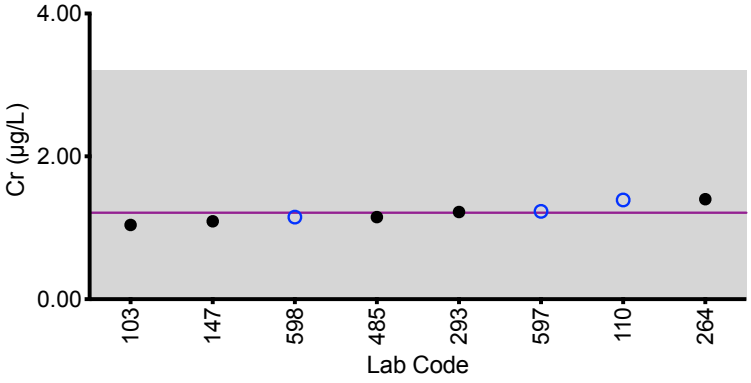
SE20-07



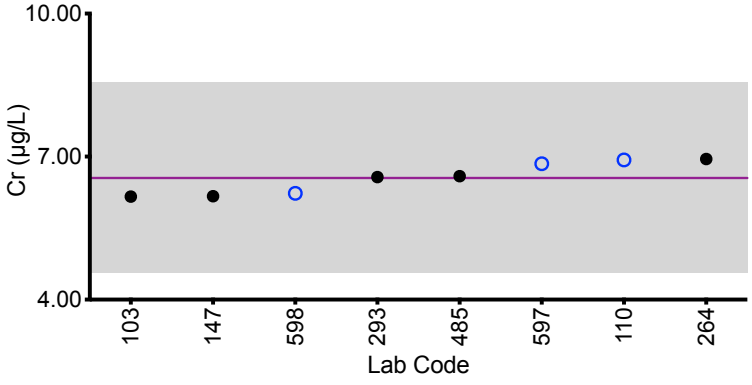
SE20-08



SE20-09



SE20-10



Legend:

o C/HHEAR 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 #2, 2020:
Summary Statistics

	Serum Cu (µg/L)				
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Target (Arithmetic Mean ($\bar{x}$))	958	1140	1260	961	1175
Upper Limit	1102	1310	1450	1105	1351
Lower Limit	814	970	1070	817	999
Arithmetic SD (s)	49	90	90	47	55
Arithmetic RSD (%)	5.1	7.9	7.1	4.9	4.7
Number of Sample Measurements (N)	7	7	7	7	7

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 #2, 2020:
Performance of Participating Laboratories

		Serum Cu (µg/L)				
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
	Target	**958**	**1140**	**1260**	**961**	**1175**
107	DRC/CC-ICP-MS	935	1140	1287	928	1185
110	ICP-MS	980	1180	1320	1020	1200
147	DRC/CC-ICP-MS	997	1165	1270	973	1172
264	ICP-MS	952	1133	1248	952	1158
293	DRC/CC-ICP-MS	1029.88 L	1220.6 L	1385.89 L	1061.67 L	1290.53 L
483	DRC/CC-ICP-MS	915	972	1150	903	1130
597	ICP-MS	1040	1300	1390	1029	1280
598	ICP-MS	890	1090	1120	924	1100

Based on the grading criteria for Cu 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.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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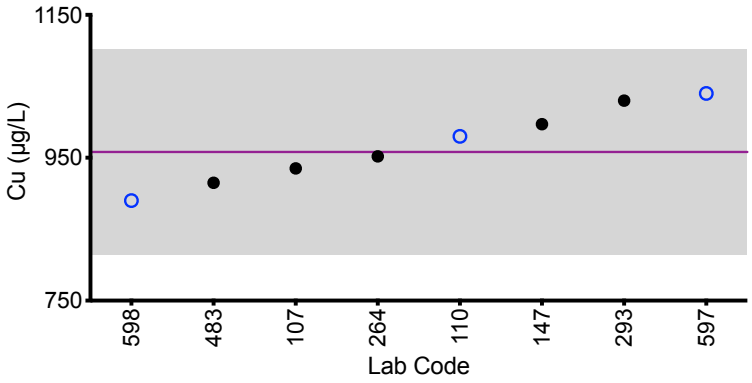
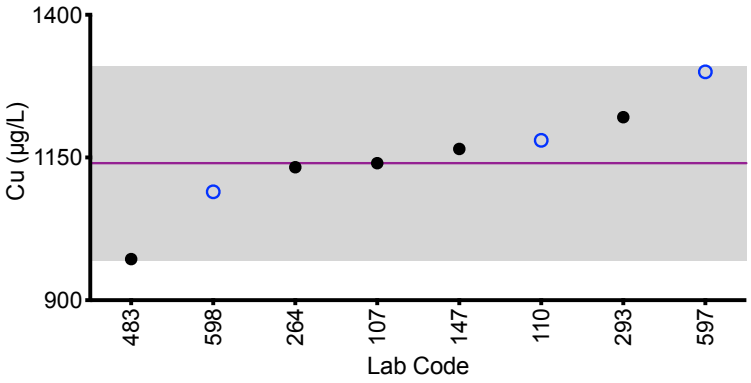
Results for Event #2, 2020: Summary Figures

Serum Cu

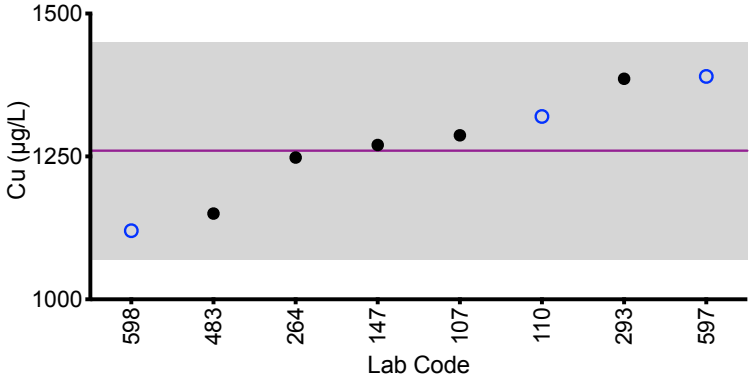
SE20-06



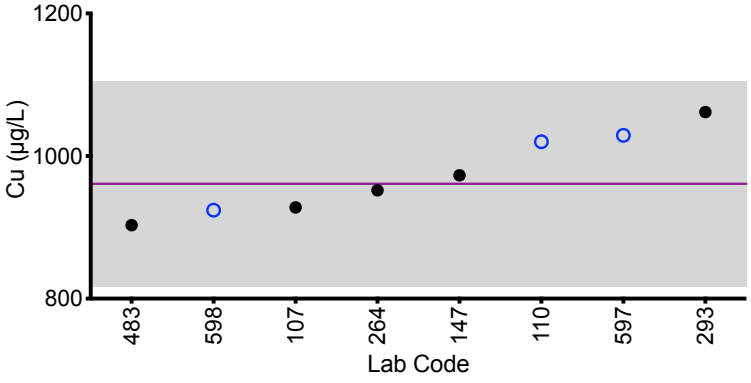
SE20-07



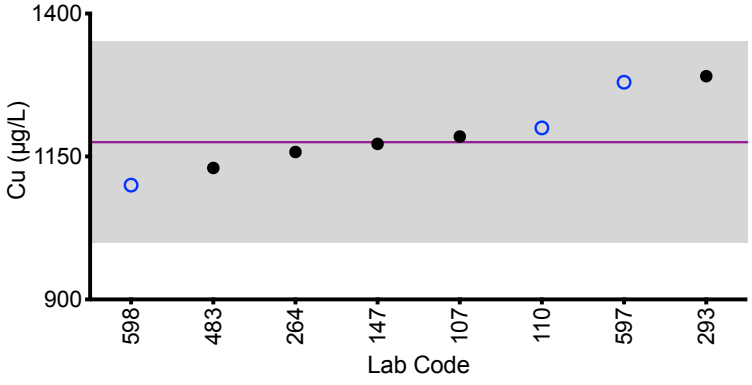
SE20-08



SE20-09



SE20-10



Legend:

o C/HHEAR 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:

±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 #2, 2020: Summary Statistics

	Serum Se (µg/L)				
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Target (Arithmetic Mean ($\bar{x}$))	104	123	132	129	135
Upper Limit	125	148	158	155	162
Lower Limit	83	98	106	103	108
Arithmetic SD (s)	5	10	7	7	6
Arithmetic RSD (%)	4.6	8.1	5.3	5.4	4.4
Number of Sample Measurements (N)	8	8	8	8	8

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 #2, 2020:
Performance of Participating Laboratories

		Serum Se (µg/L)				
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
	Target	**104**	**123**	**132**	**129**	**135**
103	DRC/CC-ICP-MS	106	128	142	136	140
107	DRC/CC-ICP-MS	98.9	120.0	133.3	121.5	130.8
110	DRC/CC-ICP-MS	105	136	142	143	143
147	DRC/CC-ICP-MS	104	118	127	124	131
264	ICP-MS	103.7	119.5	128.1	127.3	132.3
293	DRC/CC-ICP-MS	107.34 L	127.07 L	139.7 L	138.12 L	140.49 L
483	DRC/CC-ICP-MS	99.6	104	121	121	129
597	ICP-MS	101	125	135	128	131
598	DRC/CC-ICP-MS	114	133	131	128	145

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

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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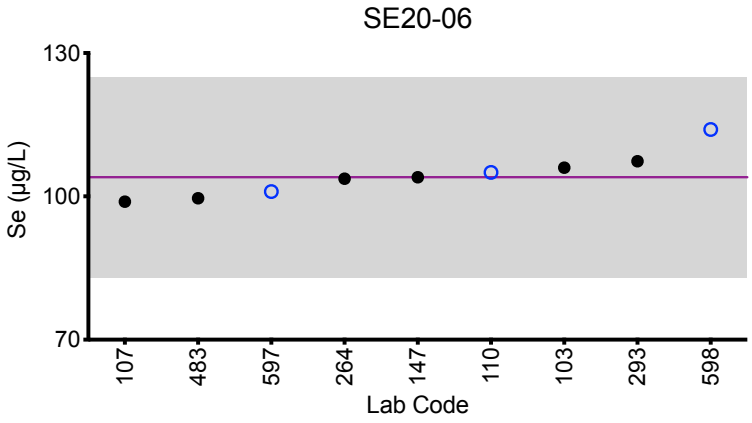
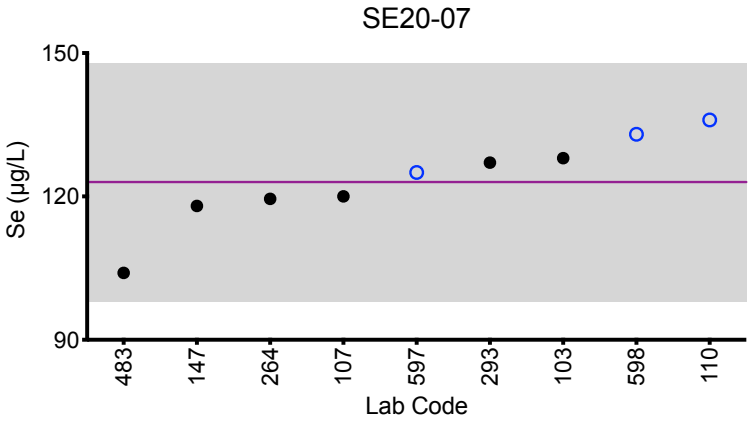
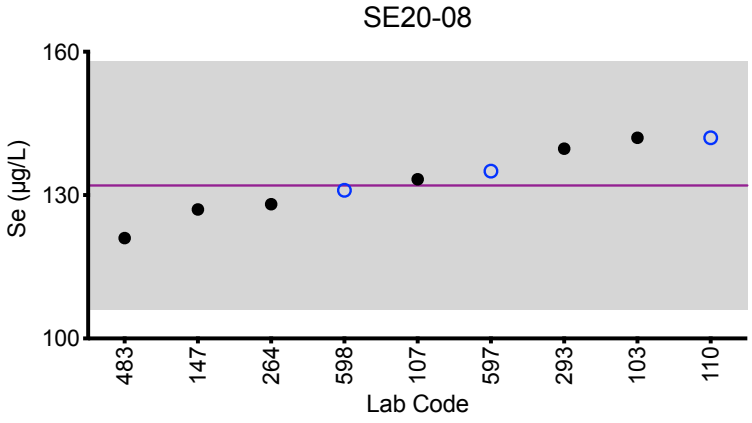
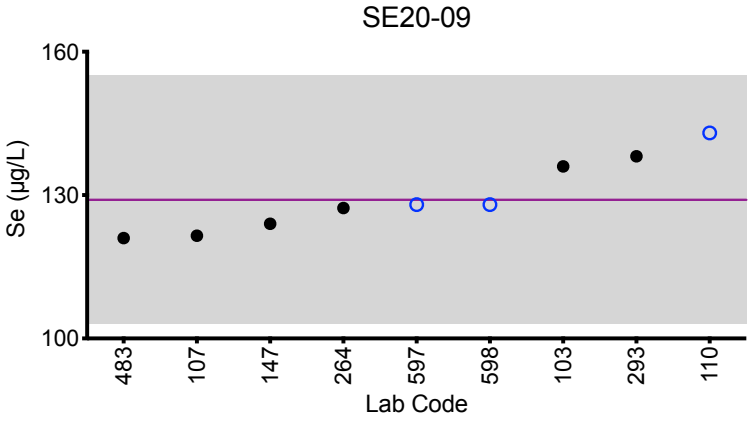
Results for Event #2, 2020: Summary Figures

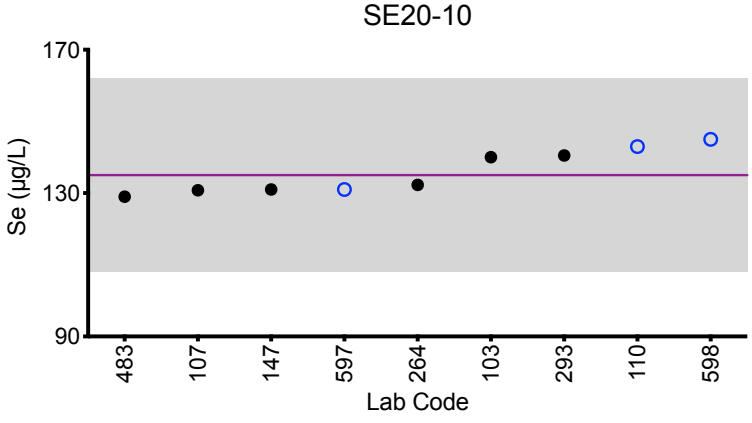
Serum Se











Legend:

o C/HHEAR 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 #2, 2020:
Summary Statistics

Serum Zn (µg/L)					
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Target (Arithmetic Mean ($\bar{x}$))	1090	2210	1550	770	2680
Upper Limit	1250	2540	1780	890	3080
Lower Limit	930	1880	1320	650	2280
Arithmetic SD (s)	100	230	160	80	210
Arithmetic RSD (%)	9.2	10	10	10	7.8
Number of Sample Measurements (N)	7	7	7	7	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 #2, 2020:
Performance of Participating Laboratories

		Serum Zn (µg/L)				
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
	Target	**1090**	**2210**	**1550**	**770**	**2680**
107	DRC/CC-ICP-MS	1079	2278	1591	731	2770
110	ICP-MS	1150	2340	1720	831	2800
147	DRC/CC-ICP-MS	1044	2222	1566	764	2675
264	ICP-MS	1089	2247	1553	778	2675
293	DRC/CC-ICP-MS	1150.33 L	2366.01 L	1673.2 L	830.07 L	2901.96 L
483	DRC/CC-ICP-MS	992	1800 ↓	1340	687	2440
597	ICP-MS	1280 ↑	2550 ↑	1740	924 ↑	3010
598	ICP-MS	982	2010	1320	693	2380

Based on the grading criteria for Zn in Serum, 90% of results were satisfactory, with 1 of the 8 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

* Denotes a statistical Outlier
L Denotes late submission, results not included in statistics

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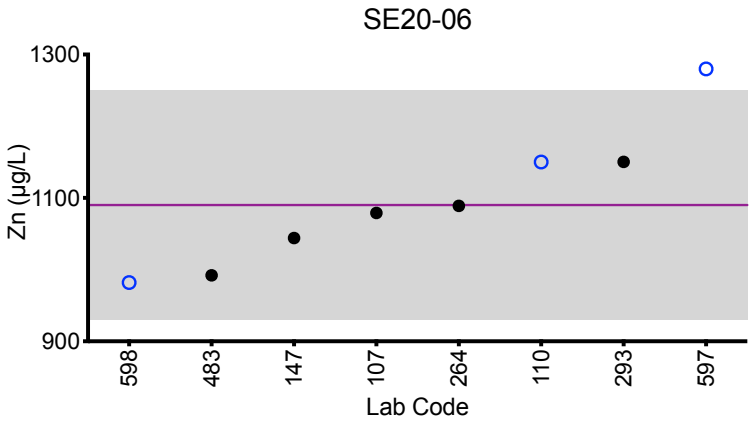
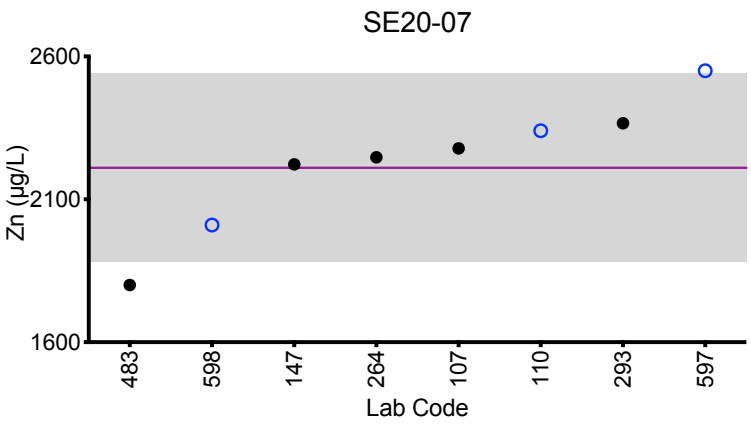
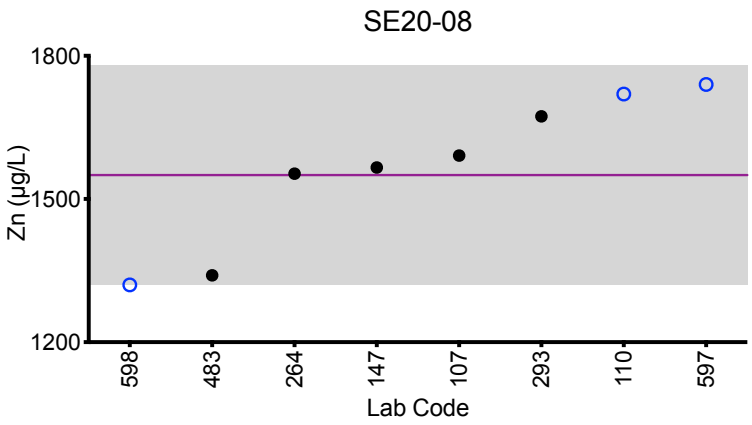
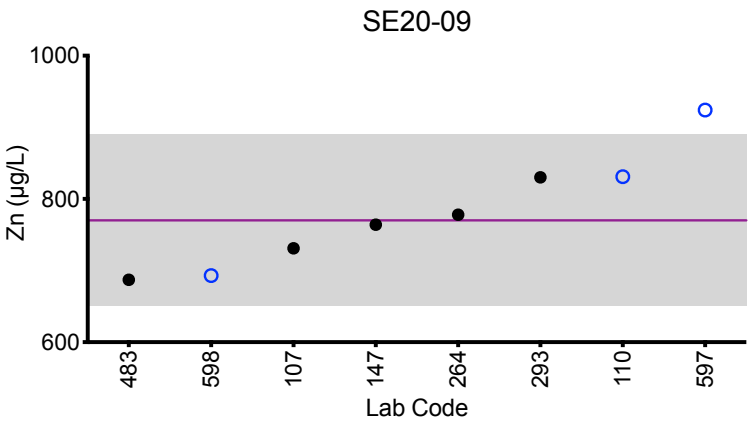
Results for Event #2, 2020: Summary Figures

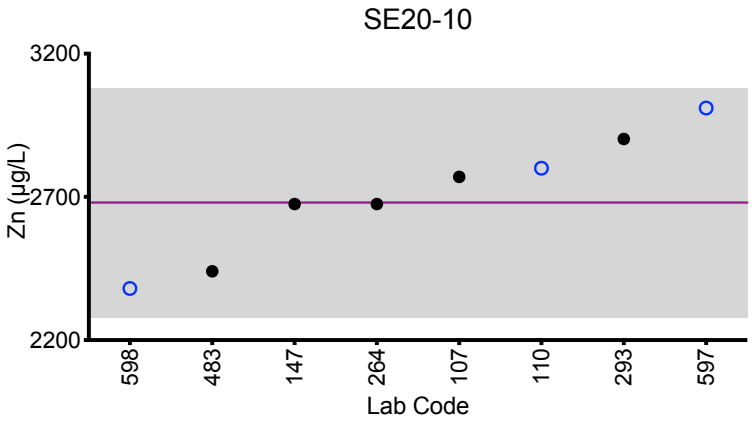
Serum Zn











Legend:

o C/HHEAR 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:

±15 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±15 µg/L at concentrations less than or equal to 100 µg/L.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum As (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
103	DRC/CC-ICP-MS	0.380	25.1	7.40	2.26	17.5
110	DRC/CC-ICP-MS	*1.06	22.5	7.65	2.31	16.1
147	DRC/CC-ICP-MS	0.426	23.8	6.83	2.22	16.6
597	ICP-MS	0.49	23.75	6.85	2.18	15.61
598	DRC/CC-ICP-MS	0.64	26.8	6.94	2.40	18.0

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	0.48	24.4	7.1	2.27	16.8
Arithmetic SD (s)	0.11	1.5	0.4	0.08	0.9
Arithmetic RSD (%)	23	6.1	4.9	4.9	5.4
Number of Sample Measurements (N)	4	5	5	5	5

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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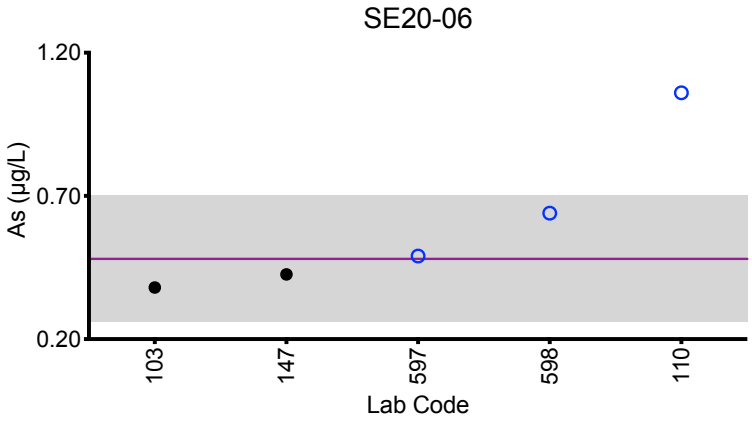
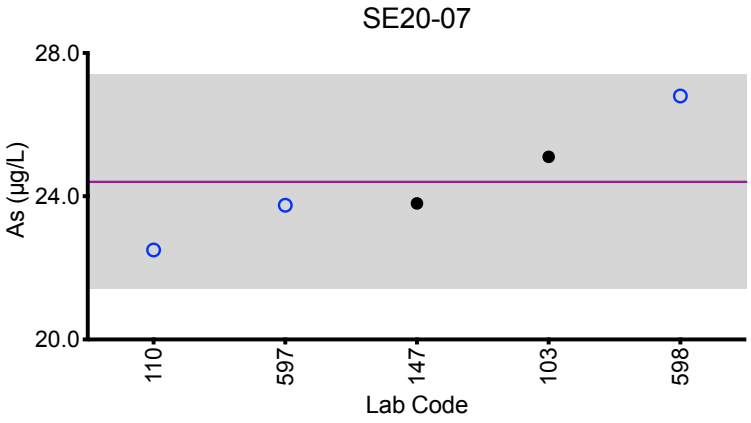
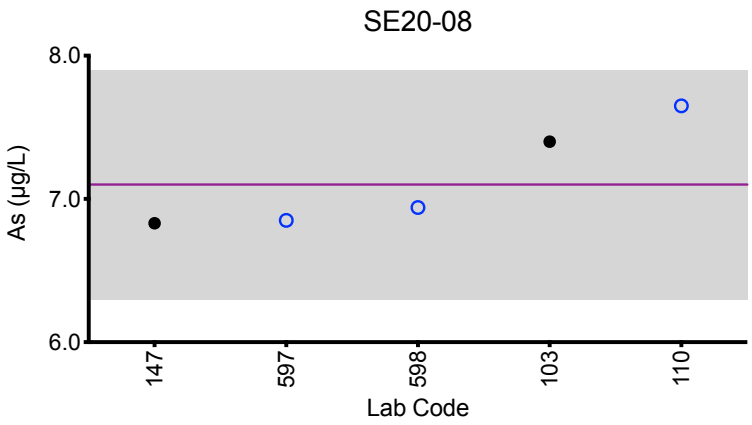
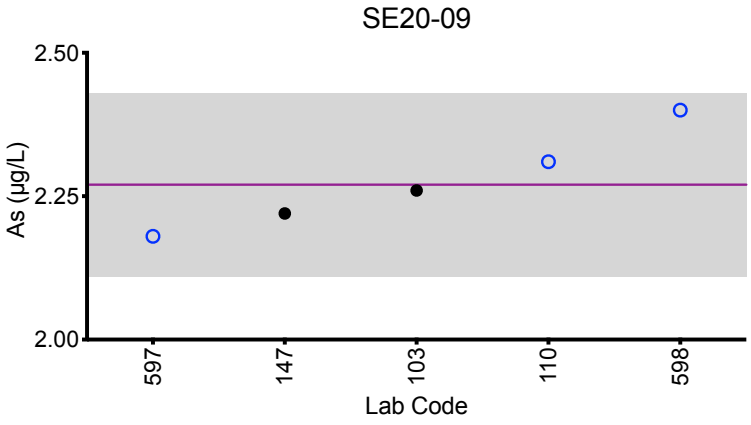
Results for Event #2, 2020: Summary Figures

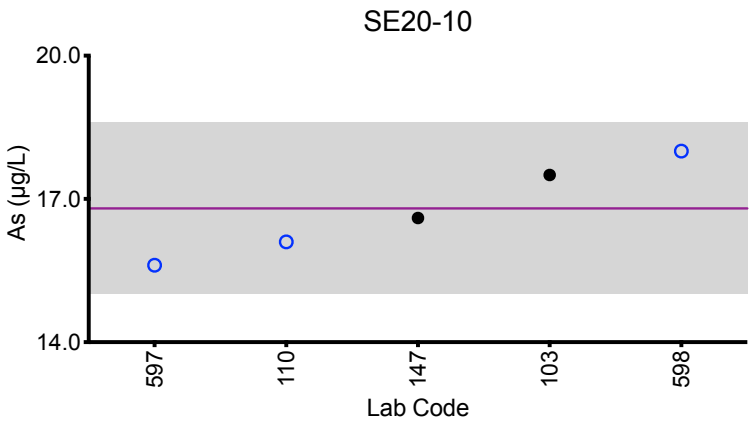
Serum As











Legend:
o C/HHEAR 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 intended to be quality specifications and are included for informational purposes only.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Cd (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
103	DRC/CC-ICP-MS	7.51	0.671	3.61	0.260	4.65
110	ICP-MS	7.69	0.586	3.72	0.263	4.79
147	ICP-MS	7.530	0.671	3.57	0.264	4.410
597	ICP-MS	7.57	0.68	3.48		4.46
598	DRC/CC-ICP-MS	7.32	0.71	3.30	0.24	4.39

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	7.52	0.66	3.54	0.257	4.54
Arithmetic SD (s)	0.13	0.04	0.15	0.010	0.16
Arithmetic RSD (%)	1.7	6.6	4.2	3.9	3.5
Number of Sample Measurements (N)	5	5	5	4	5

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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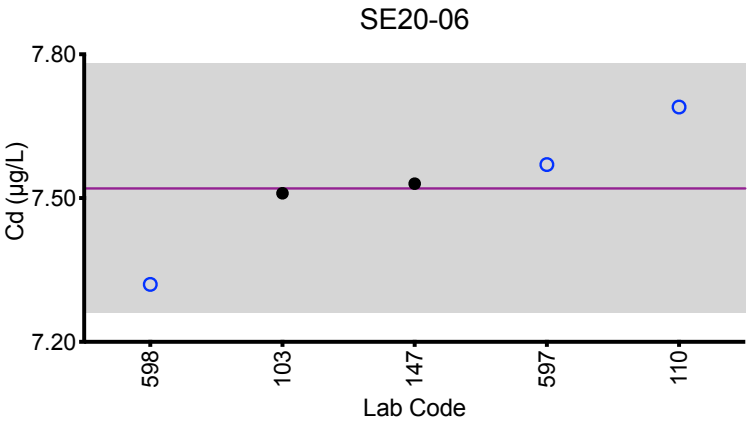
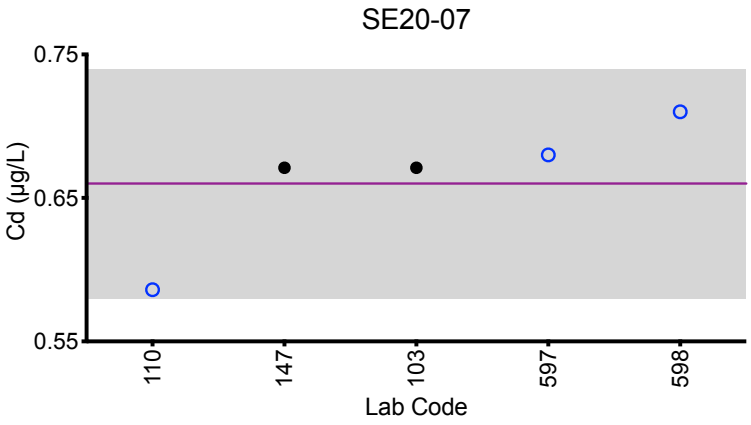
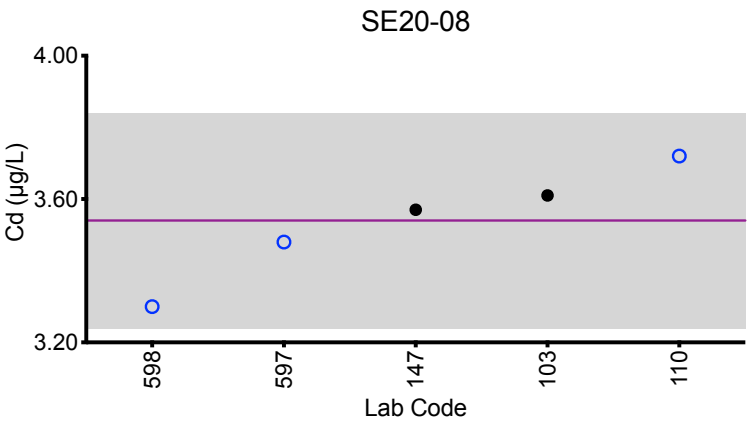
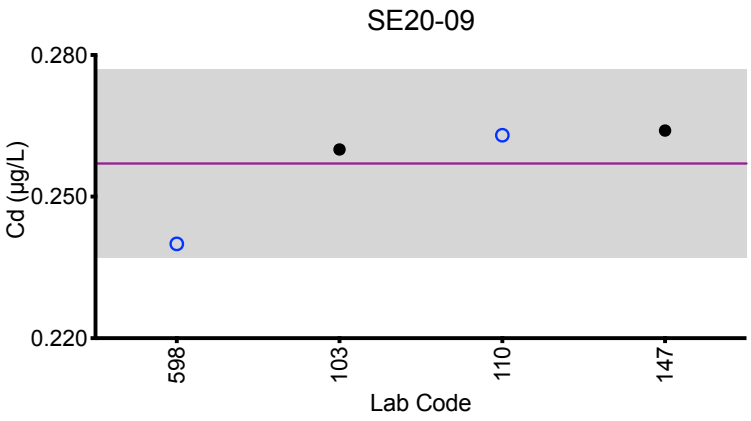
Results for Event #2, 2020: Summary Figures

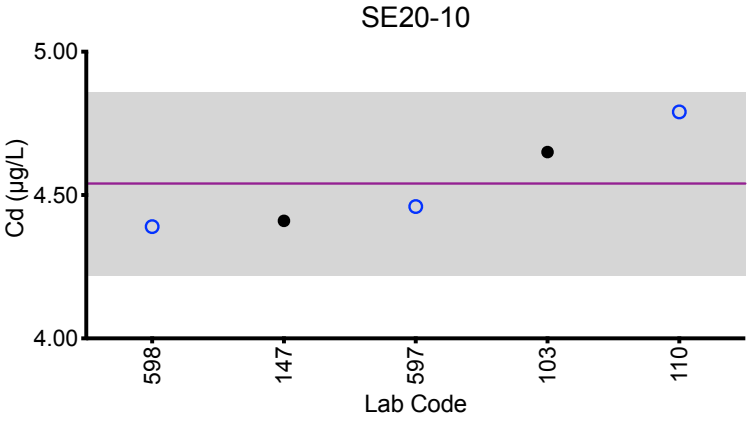
Serum Cd











Legend:
o C/HHEAR Labs ● Other Labs
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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Mn (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
103	DRC/CC-ICP-MS	17.2	2.88	11.4	7.51	4.81
110	ICP-MS	17.8	2.88	11.5	7.91	4.75
147	DRC/CC-ICP-MS	15.9	2.65	10.2	7.02	4.44
264	ICP-MS	17.37	2.97	11.18	7.83	4.85
293	DRC/CC-ICP-MS	16.28 L	2.66 L	10.53 L	7.25 L	4.61 L
597	ICP-MS	16.3	3.03	10.6	6.99	4.64
598	ICP-MS	17.5	2.73	10.1	7.42	4.55

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	17.0	2.86	10.8	7.4	4.67
Arithmetic SD (s)	0.7	0.14	0.6	0.4	0.15
Arithmetic RSD (%)	4.1	4.9	5.6	5.0	3.2
Number of Sample Measurements (N)	6	6	6	6	6

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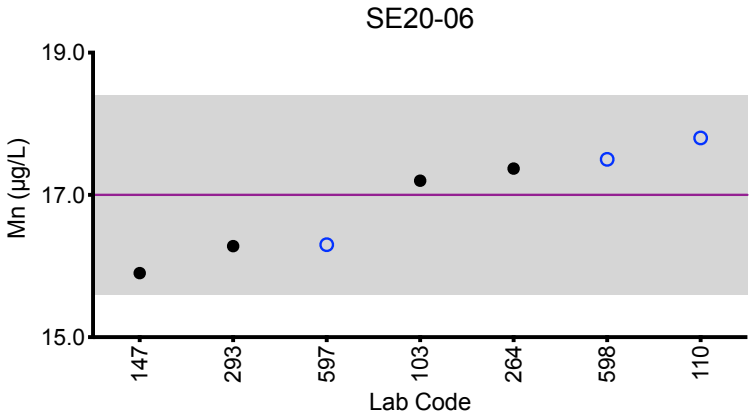
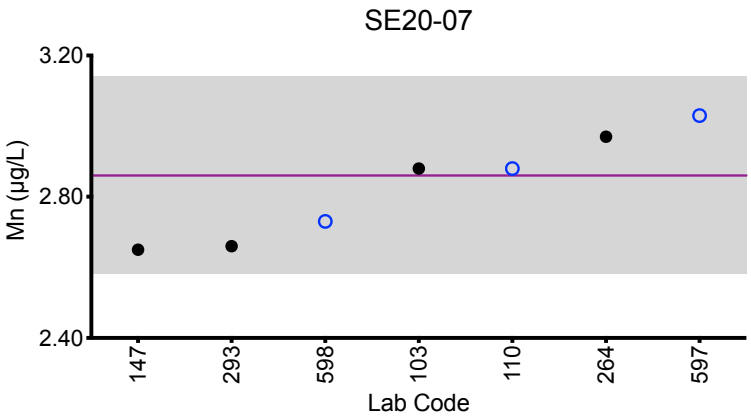
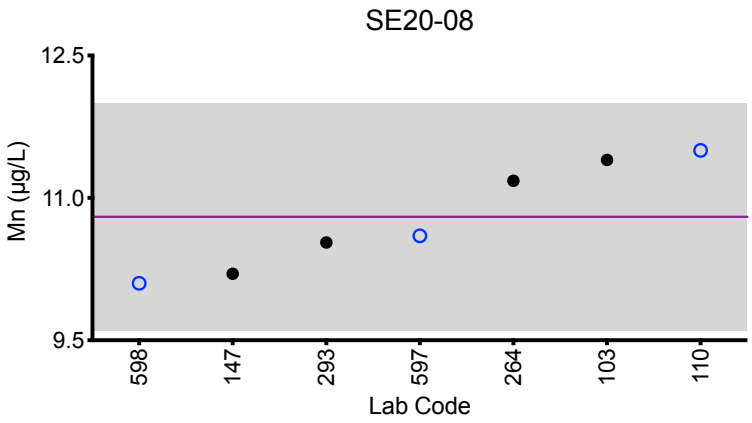
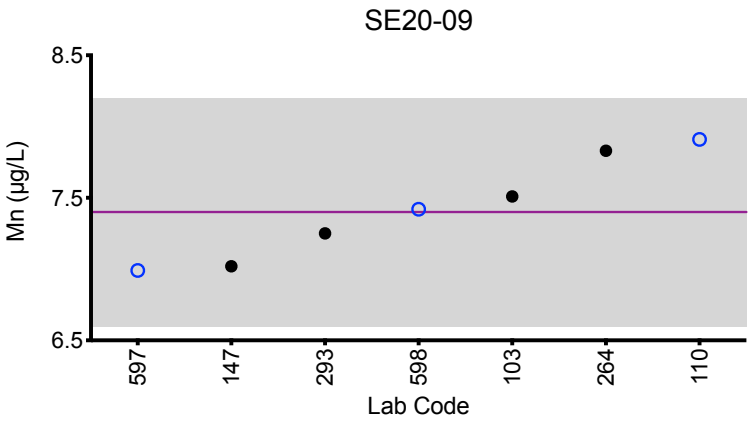
Results for Event #2, 2020: Summary Figures

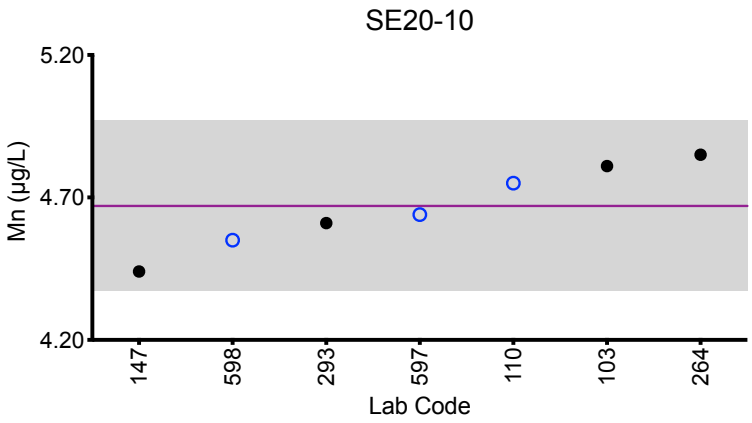
Serum Mn











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Mo (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
103	DRC/CC-ICP-MS	6.24	1.90	3.88	2.02	7.80
110	ICP-MS	6.58	2.00	3.92	2.36	8.17
147	DRC/CC-ICP-MS	6.09	1.78	3.62	1.97	7.12
293	DRC/CC-ICP-MS	6.74 L	2.09 L	3.79 L	2.09 L	7.4 L
485	HR-ICP-MS	5.67	1.89	3.93	2.31	7.76
597	ICP-MS	6.12	1.86	3.65	1.99	7.33
598	DRC/CC-ICP-MS	6.78	2.02	3.97	2.20	8.03

Summary Statistics					
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)	6.3	1.91	3.83	2.14	7.7
Arithmetic SD (s)	0.4	0.15	0.15	0.16	0.4
Arithmetic RSD (%)	5.9	4.7	3.9	7.5	5.1
Number of Sample Measurements (N)	6	6	6	6	6

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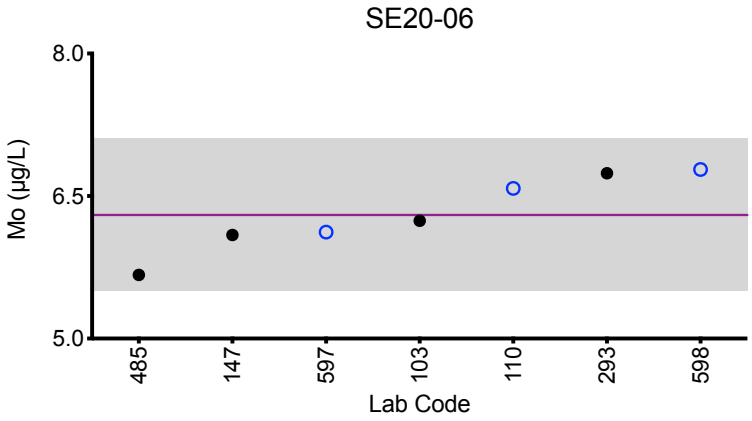
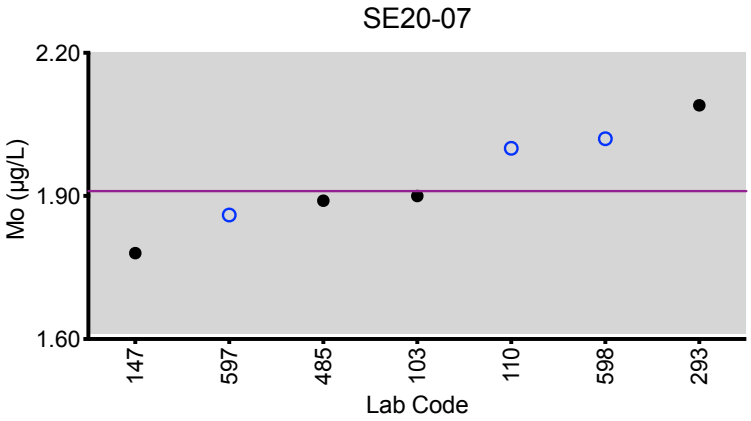
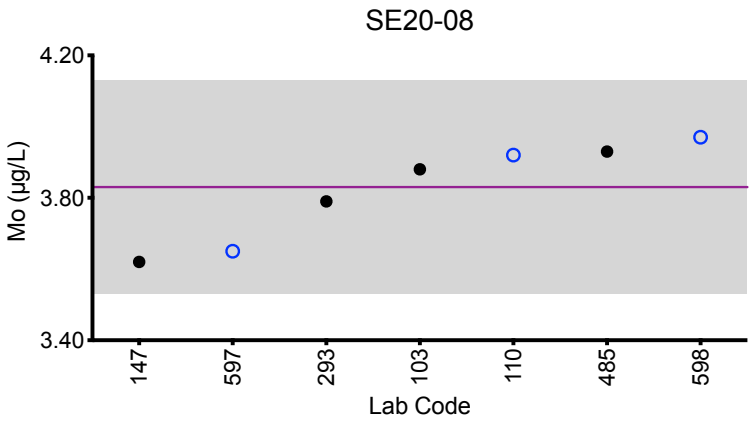
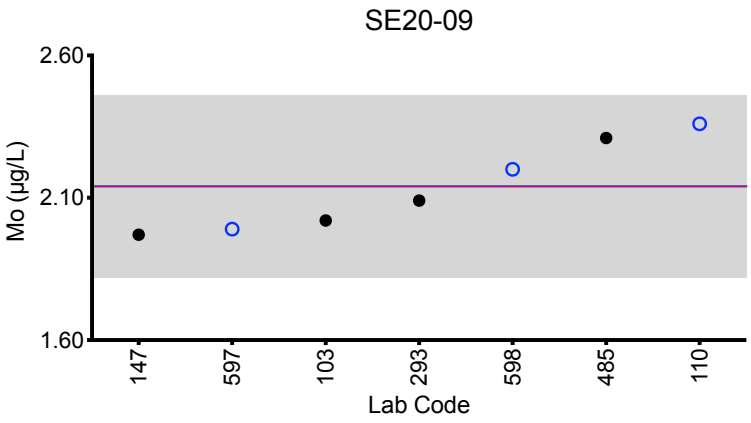
Results for Event #2, 2020: Summary Figures

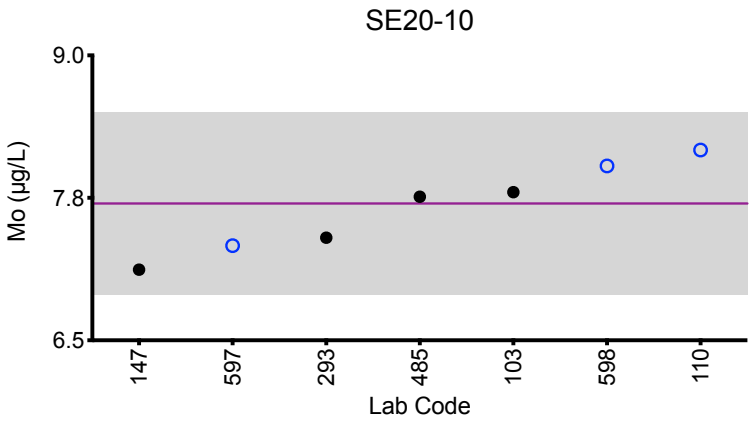
Serum Mo











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Ni (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
110	DRC/CC-ICP-MS	9.67	2.37	18.5	3.64	15.0
147	DRC/CC-ICP-MS	9.88	2.04	16.2	3.40	13.5
293	DRC/CC-ICP-MS	9.52 L	2.27 L	16.36 L	3.81 L	13.63 L
485	HR-ICP-MS	9.14	2.02	17.7	3.50	14.4
597	ICP-MS	10.2	2.72	18.0	3.58	14.5
598	ICP-MS	9.14	1.20	14.1	*2.53	12.0

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	9.6	2.1	16.9	3.53	13.9
Arithmetic SD (s)	0.4	0.5	1.7	0.10	1.1
Arithmetic RSD (%)	4.6	24	10	2.8	7.9
Number of Sample Measurements (N)	5	5	5	4	5

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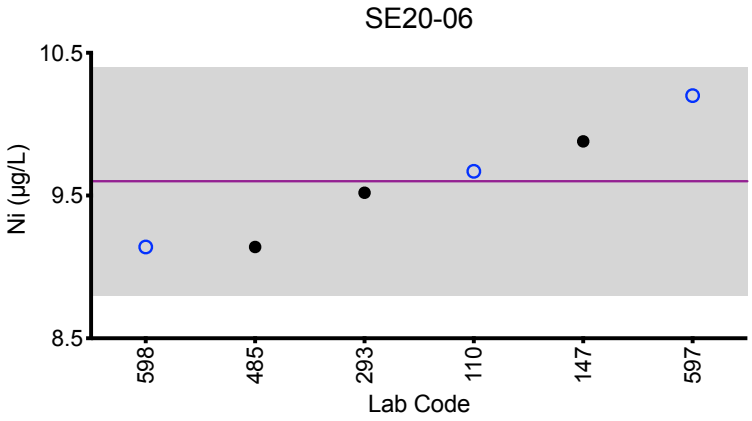
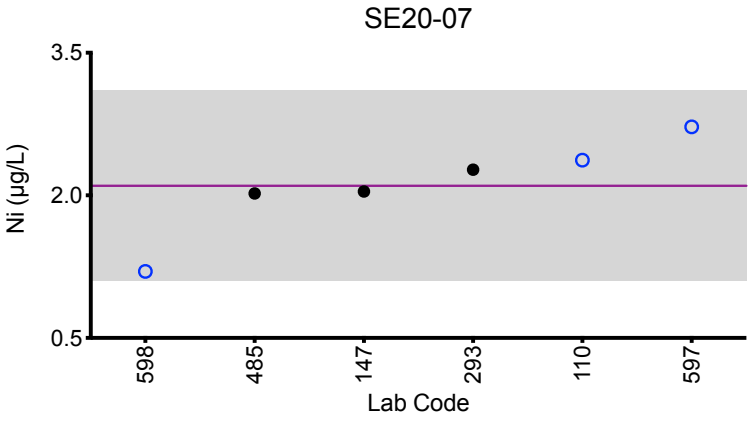
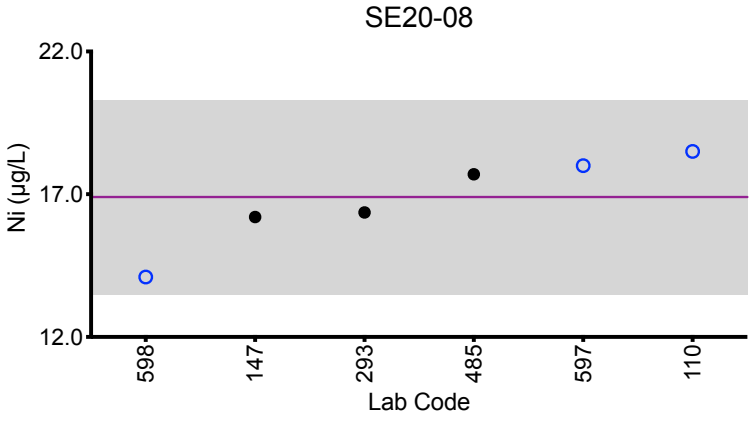
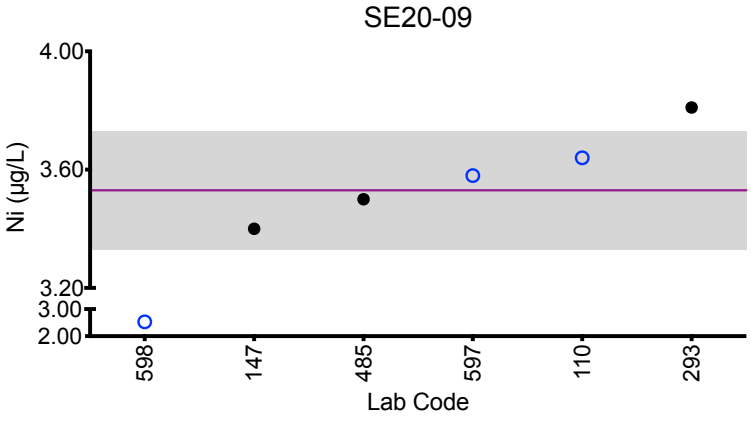
Results for Event #2, 2020: Summary Figures

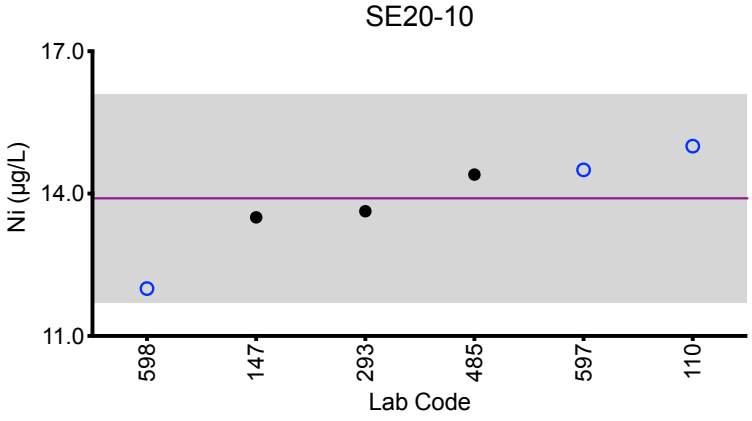
Serum Ni











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Sb (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
103	DRC/CC-ICP-MS	7.24	1.70	0.720	5.08	3.49
110	ICP-MS	7.29	1.69	0.734	5.16	3.45
147	ICP-MS	7.34	1.64	0.683	4.78	3.35
597	ICP-MS	6.93	1.64	0.71	4.63	3.18
598	ICP-MS	7.19	1.66	0.68	4.82	3.40
Summary Statistics						
		SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)		7.20	1.666	0.705	4.89	3.37
Arithmetic SD (s)		0.15	0.026	0.022	0.21	0.11
Arithmetic RSD (%)		2.1	1.6	3.1	4.3	3.3
Number of Sample Measurements (N)		5	5	5	5	5

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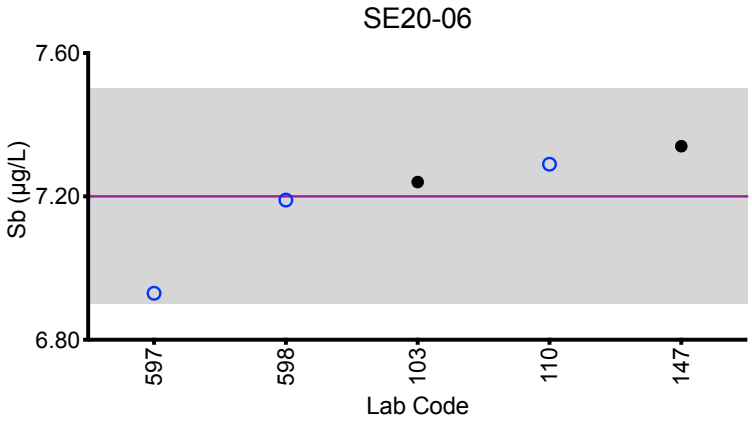
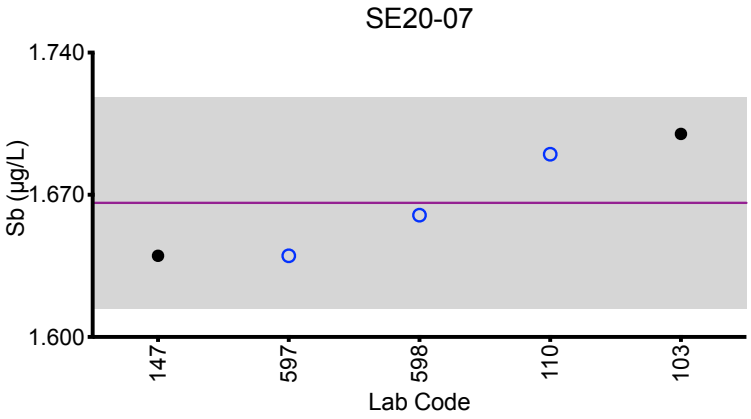
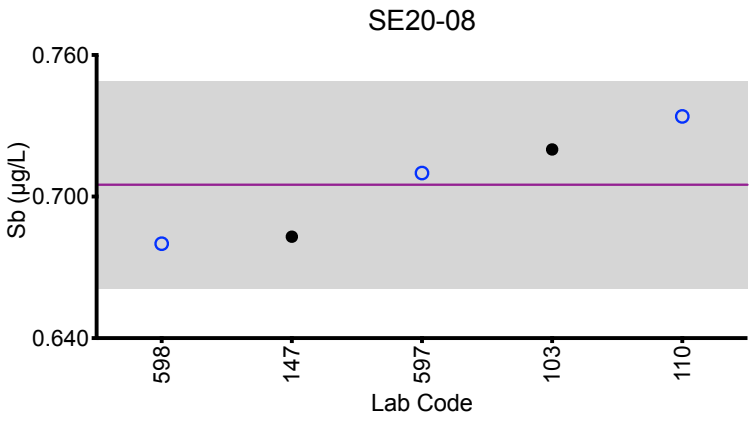
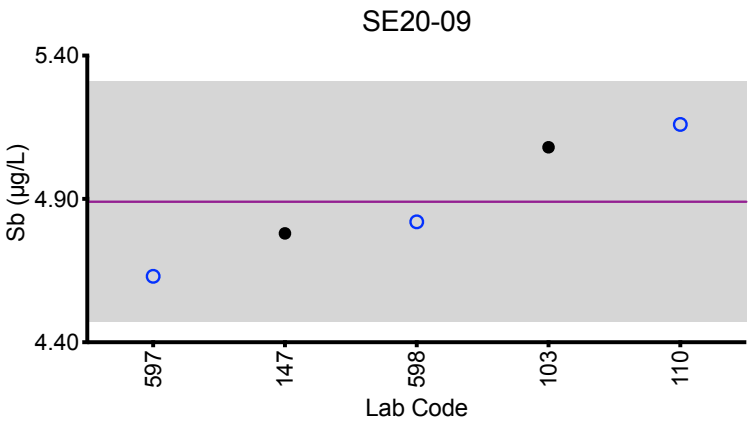
Results for Event #2, 2020: Summary Figures

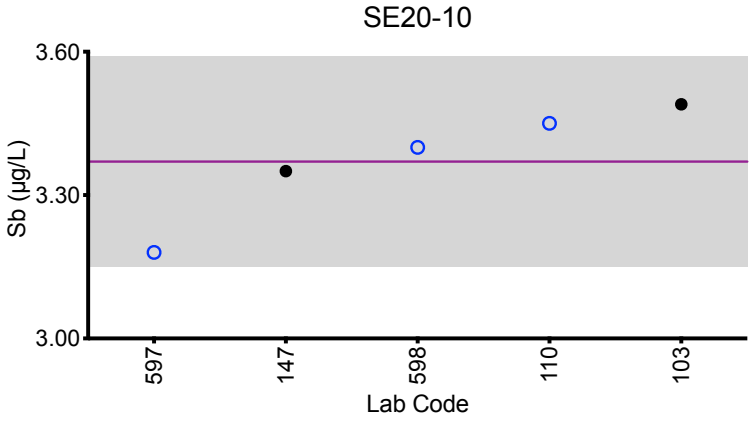
Serum Sb











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Tl (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
103	DRC/CC-ICP-MS	0.501	2.91	1.00	4.61	2.34
110	ICP-MS	0.478	2.93	0.977	4.58	2.30
147	ICP-MS	0.485	2.84	0.975	4.39	2.27
597	ICP-MS	0.50	2.94	0.98	4.30	2.26
598	ICP-MS	*0.59	2.66	0.84	3.99	2.11

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	0.491	2.86	0.95	4.37	2.26
Arithmetic SD (s)	0.011	0.11	0.06	0.24	0.08
Arithmetic RSD (%)	2.2	3.8	6.3	5.5	3.5
Number of Sample Measurements (N)	4	5	5	5	5

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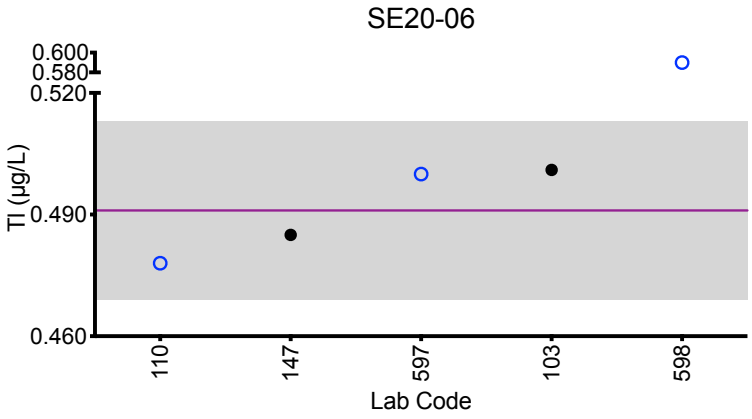
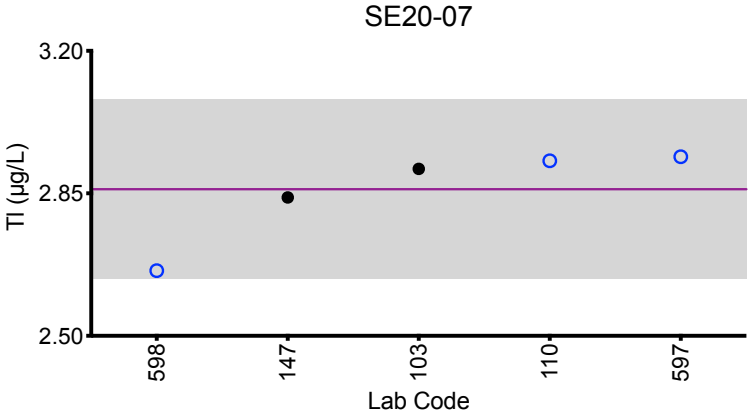
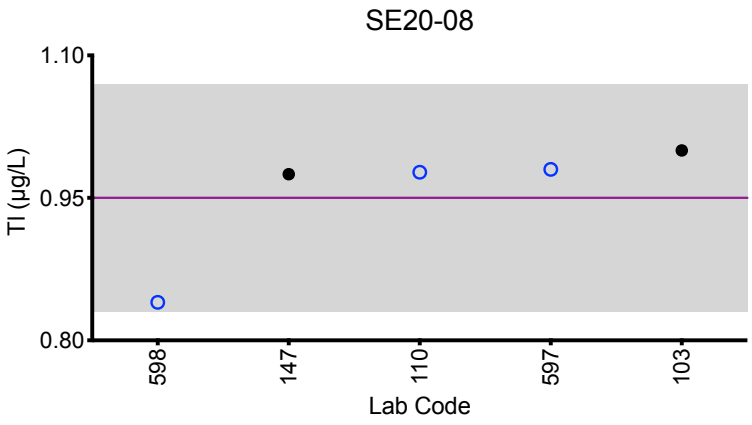
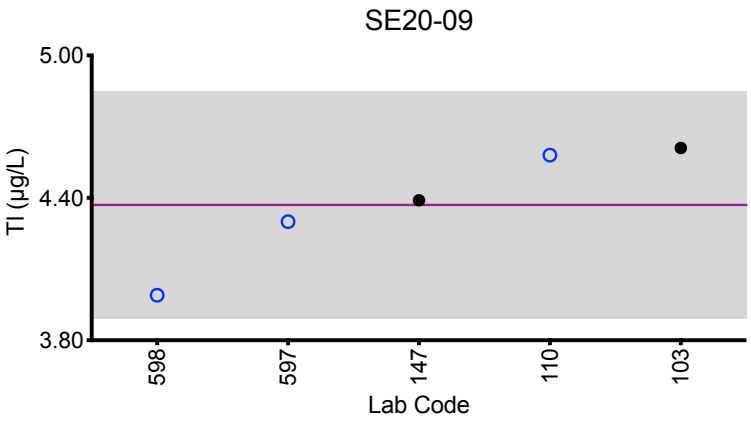
Results for Event #2, 2020: Summary Figures

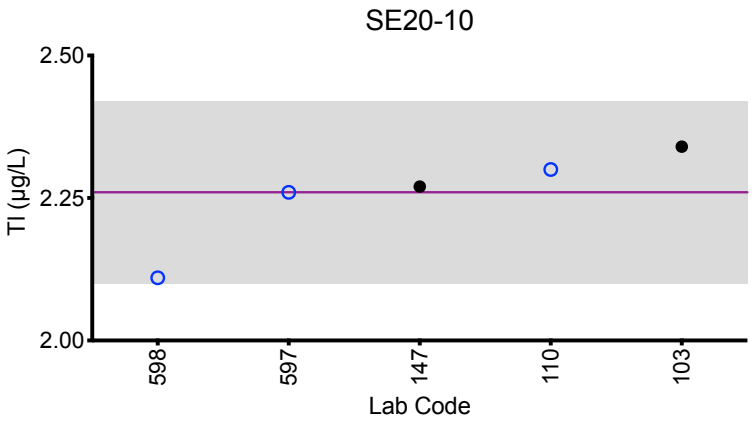
Serum Tl











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum V (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
110	DRC/CC-ICP-MS	0.5	1.3	3.6	8.0	3.6
147	DRC/CC-ICP-MS	0.0336	0.668	2.58	7.97	2.67
293	DRC/CC-ICP-MS	0.2 L	0.92 L	2.99 L	8.96 L	3.2 L
485	HR-ICP-MS	0.035	0.698	2.87	8.74	2.86
597	ICP-MS	0.10	0.70	2.45	7.39	2.54
598	DRC/CC-ICP-MS	0.27	0.98	2.97	9.10	3.10
Summary Statistics						
		SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)		NA	0.87	2.9	8.2	3.0
Arithmetic SD (s)		NA	0.26	0.4	0.6	0.4
Arithmetic RSD (%)		NA	30	15	7.3	13
Number of Sample Measurements (N)		NA	5	5	5	5

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Statistical data was not calculated for SE20-06 based on a lack of consensus among participating labs.

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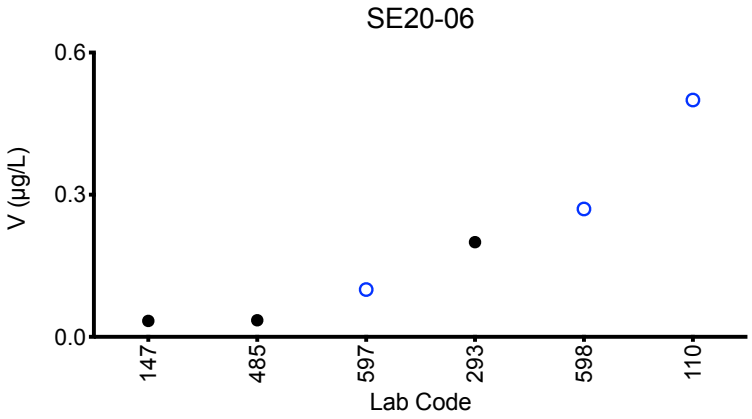
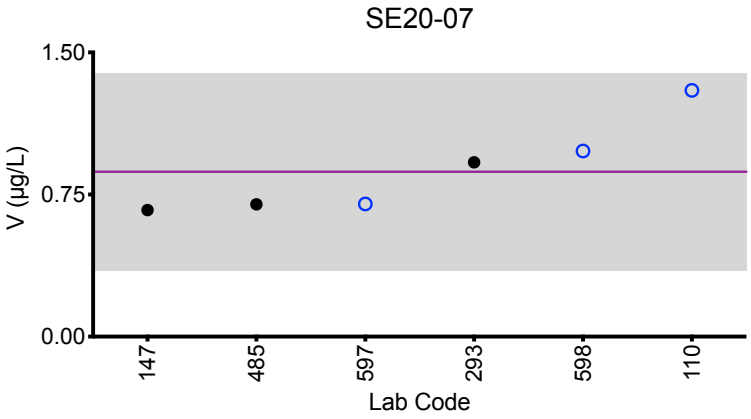
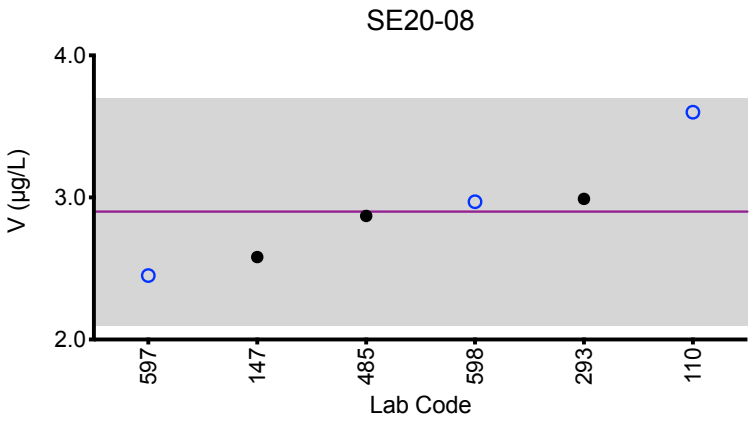
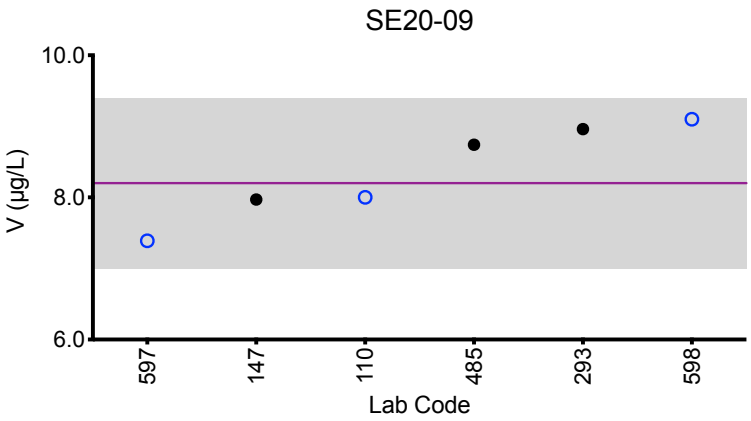
Results for Event #2, 2020: Summary Figures

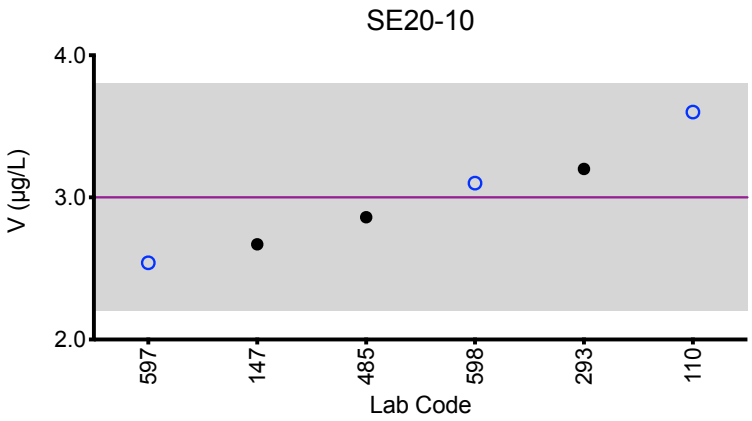
Serum V











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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Ba (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
110	ICP-MS	0.26	0.36	1.00	0.38	1.10
147	ICP-MS	0.208	0.391	1.04	0.385	1.02
597	ICP-MS			1.09		1.22
598	ICP-MS	0.40	0.44	0.98	0.50	1.34

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	NA	0.40	1.03	0.42	1.17
Arithmetic SD (s)	NA	0.04	0.04	0.06	0.13
Arithmetic RSD (%)	NA	9.1	3.9	14	11
Number of Sample Measurements (N)	NA	3	4	3	4

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L Denotes late submission, results not included in statistics

Statistical data was not calculated for SE20-06 based on a lack of consensus among participating labs.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Be (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
110	ICP-MS	2.54	0.776	0.455	7.07	4.48
147	ICP-MS	2.32	0.892	0.581	5.67	4.91
293	ICP-MS	2.4 L	0.73 L	0.49 L	6.22 L	0.46 L
598	ICP-MS	2.81	0.87	0.61	6.64	4.69
Summary Statistics						
		SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)		2.56	0.85	0.55	6.5	4.69
Arithmetic SD (s)		0.22	0.06	0.07	0.6	0.19
Arithmetic RSD (%)		8.6	7.1	13	9.2	4.1
Number of Sample Measurements (N)		3	3	3	3	3

*Denotes a statistical Outlier.
L Denotes late submission, results not included in statistics

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Cs (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
110	ICP-MS	0.335	0.455	0.656	0.447	0.653
597	ICP-MS	0.41	0.54	0.70	0.50	0.68
598	ICP-MS	0.50	0.47	0.53	0.63	0.65
Summary Statistics						
		SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)		0.42	0.49	0.63	0.53	0.661
Arithmetic SD (s)		0.07	0.04	0.08	0.08	0.015
Arithmetic RSD (%)		17	8.2	13	15	2.3
Number of Sample Measurements (N)		3	3	3	3	3

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Hg (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
103	DRC/CC-ICP-MS	5.47	1.66	0.991	7.19	6.90
110	ICP-MS	5.48	1.88	0.94	7.32	6.96
597	ICP-MS	5.31	1.71	0.83	6.77	6.29
598	ICP-MS	5.54	1.78	0.71	6.58	6.24
Summary Statistics						
		SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)		5.45	1.76	0.87	7.0	6.6
Arithmetic SD (s)		0.09	0.09	0.12	0.3	0.4
Arithmetic RSD (%)		1.7	5.1	14	4.6	5.5
Number of Sample Measurements (N)		4	4	4	4	4

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Mg (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
264	ICP-MS	18525	17706	17859	17267	17767
597	ICP-MS	18500	19400	18900	18200	18700

Summary Statistics					
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)	18513	18600	18400	17700	18200
Arithmetic SD (s)	14	1000	600	500	500
Arithmetic RSD (%)	0.080	5.4	3.3	2.8	2.7
Number of Sample Measurements (N)	2	2	2	2	2

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Pb (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
103	DRC/CC-ICP-MS	4.59	4.77	1.29	3.32	8.04
110	ICP-MS	4.49	4.72	1.28	3.27	7.93
597	ICP-MS	4.38	4.68	1.29	3.14	7.75
598	ICP-MS	4.00	3.99	1.05	2.81	6.83
Summary Statistics						
		SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)		4.37	4.5	1.23	3.13	7.6
Arithmetic SD (s)		0.24	0.3	0.11	0.21	0.5
Arithmetic RSD (%)		5.5	7.5	8.9	6.7	6.6
Number of Sample Measurements (N)		4	4	4	4	4

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Pt (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
110	ICP-MS	1.68	0.80	0.11	0.43	1.37
264	ICP-MS	1.79	0.80	0.07	0.42	1.37
293	DRC/CC-ICP-MS	1.8 L	0.9 L	0.1 L	0.5 L	1.5 L
598	ICP-MS	1.60	0.84	0.10	0.44	1.25

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	1.69	0.813	0.093	0.430	1.33
Arithmetic SD (s)	0.09	0.021	0.019	0.009	0.06
Arithmetic RSD (%)	5.3	2.6	20	2.1	4.5
Number of Sample Measurements (N)	3	3	3	3	3

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Sn (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
110	ICP-MS	12.1	7.09	1.50	4.98	2.85
597	ICP-MS	11.51	6.90	1.28	4.47	2.76
598	ICP-MS	11.8	6.95	1.44	4.86	3.00
Summary Statistics						
		SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)		11.8	6.98	1.41	4.8	2.87
Arithmetic SD (s)		0.3	0.09	0.10	0.2	0.11
Arithmetic RSD (%)		2.2	1.3	7.1	5.0	3.8
Number of Sample Measurements (N)		3	3	3	3	3

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Sr (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
103	DRC/CC-ICP-MS	56.0	96.1	69.7	120	132
200	ICP-MS	56.9	98.1	66.6	119.1	121.8
597	ICP-MS	55.3	96.4	68.2	116	124
Summary Statistics						
		SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)		56.1	96.9	68.2	118.4	126
Arithmetic SD (s)		0.7	1.0	1.4	1.9	5
Arithmetic RSD (%)		1.2	1.0	2.1	1.6	4.0
Number of Sample Measurements (N)		3	3	3	3	3

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum Ti (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
200	DRC/CC-ICP-MS	5.7	4.6	6.7	2.6	8.2
485	HR-ICP-MS	1.19	4.97	9.95	3.59	7.14

Summary Statistics					
	SE20-06	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
Arithmetic Mean ($\bar{x}$)	NA	4.8	8.3	3.1	7.7
Arithmetic SD (s)	NA	0.2	1.9	0.6	0.6
Arithmetic RSD (%)	NA	4.4	23	19	7.8
Number of Sample Measurements (N)	NA	2	2	2	2

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L Denotes late submission, results not included in statistics

Statistical data was not calculated for SE20-06 based on a lack of consensus among participating labs.

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum U (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
103	DRC/CC-ICP-MS	0.0642	0.0425	0.165	0.0891	0.152
110	ICP-MS	0.069	0.047	0.173	0.098	0.158
598	ICP-MS	*0.12	0.05	0.15	0.09	0.15

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	0.067	0.047	0.163	0.092	0.153
Arithmetic SD (s)	0.003	0.003	0.010	0.004	0.004
Arithmetic RSD (%)	4.2	7.3	6.1	4.3	2.6
Number of Sample Measurements (N)	2	3	3	3	3

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Results for Event #2, 2020:
Laboratory Data and Summary Statistics

Serum W (µg/L)

Lab Code	Method	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
110	ICP-MS	1.69	0.88	0.28	1.38	0.50
200	ICP-MS	1.7	0.9	0.3	1.5	0.6
598	ICP-MS	1.91	0.99	0.32	1.48	0.53

Summary Statistics

	SE20-06	SE20-07	SE20-08	SE20-09	SE20-10
Arithmetic Mean ($\bar{x}$)	1.77	0.92	0.300	1.45	0.54
Arithmetic SD (s)	0.11	0.05	0.018	0.06	0.05
Arithmetic RSD (%)	6.2	5.4	6.0	4.1	9.3
Number of Sample Measurements (N)	3	3	3	3	3

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Results for Event #2, 2020: Additional Elements in Serum

Serum B (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
200	ICP-MS	58.0	89	67	79	59

Serum Bi (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
147	ICP-MS	<0.040	<0.040	<0.040	<0.040	<0.040

Serum Fe (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
264	ICP-MS	574	612	879	602	869

Serum I (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
147	ICP-MS	50.90	50.5	53.0	49.6	52.9

Serum Li (µg/L)						
Lab Code	**Method**	**SE20-06**	**SE20-07**	**SE20-08**	**SE20-09**	**SE20-10**
147	ICP-MS	0.557	0.628	0.670	0.637	0.690

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.