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New York State Biomonitoring Program for Trace Elements

Event #3, 2021

Trace Elements in Whole Blood, Urine, and Serum

November, 2021

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

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Event #3, 2021:
Trace Elements in Whole Blood, Urine, and Serum

11/12/2021

Dear Laboratory Director,

This report summarizes performance for the third biomonitoring proficiency test (PT) event of 2021 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 #1, 2022) will be shipped February 2, 2022. Comments about this report may be directed to trel@health.ny.gov. If you have not yet enrolled for next year, please contact PT program staff at 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 #3, 2021

Trace Elements in Whole Blood

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Trace Elements Laboratory

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Event #3, 2021:
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

Graded Elements

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

Additional Elements

An additional 25 elements were reported by at least one participant: Ag, Al, Ba, Be, Bi, Cs, Cu, I, Li, Mg, Mo, Ni, Pt, Sb, Se, Sn, Sr, Te, Th, Ti, Tl, U, V, W, and Zn. These data are included here to provide a more complete characterization of the PT materials. All results reported by participant laboratories are tabulated and organized by lab code. The PT data are graphed for visual comparison purposes for all elements where at least five laboratories reported a value greater than the LOD. A statistical summary table is provided for samples where at least two comparable values were reported as above the LOD.

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

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Results for Event #3, 2021:
Summary Statistics

Whole Blood As (µg/L)					
	BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Target (Arithmetic Mean ($\bar{x}$))	5.9	2.6	40.2	19.0	3.6
Upper Limit	11.9	8.6	48.2	25.0	9.6
Lower Limit	0.0	0.0	32.2	13.0	0.0
Arithmetic SD (s)	1.2	0.6	2.6	1.5	0.9
Arithmetic RSD (%)	20	23	6.5	7.9	25
Number of Sample Measurements (N)	8	8	8	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 #3, 2021:
Performance of Participating Laboratories

Whole Blood As (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
	Target	**5.9**	**2.6**	**40.2**	**19.0**	**3.6**
103	ICP-MS/MS	5.96	2.39	39.1	18.7	3.47
110	DRC/CC-ICP-MS	6.61	2.41	42.6	20.4	3.72
147	ICP-MS	5.51	2.24	39.7	19.2	3.42
264	ICP-MS	5.19	2.27	35.84	17.16	2.92
293	DRC/CC-ICP-MS	6.16	2.5	42.37	19.86	3.5
391	ICP-MS	8.26	4.1	40.66	21.43	5.6
597	ICP-MS/MS	5.60	2.37	37.7	17.6	3.64
598	DRC/CC-ICP-MS	4.28	2.63	43.5	17.5	2.85

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

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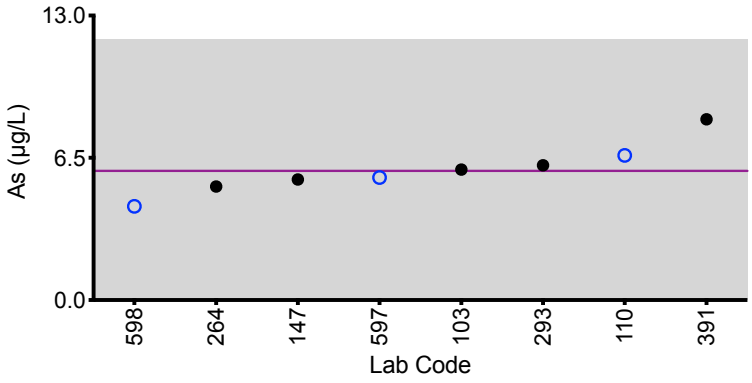
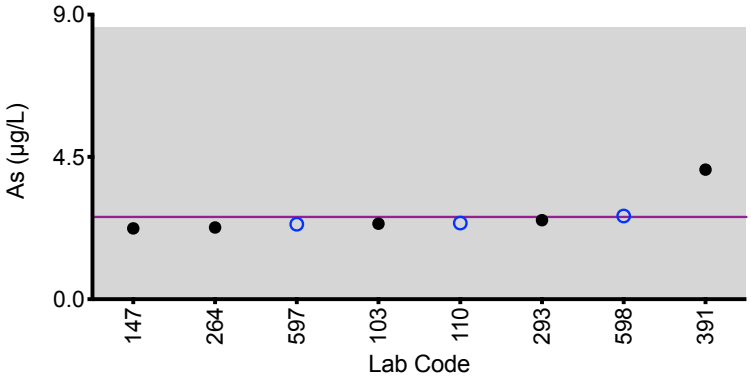
Results for Event #3, 2021: Summary Figures

Whole Blood As

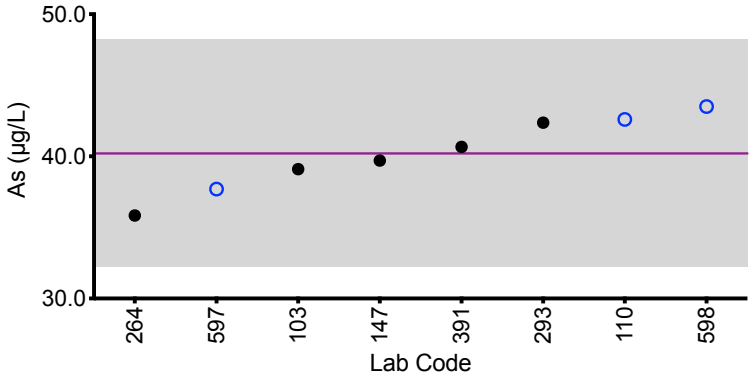
BE21-11



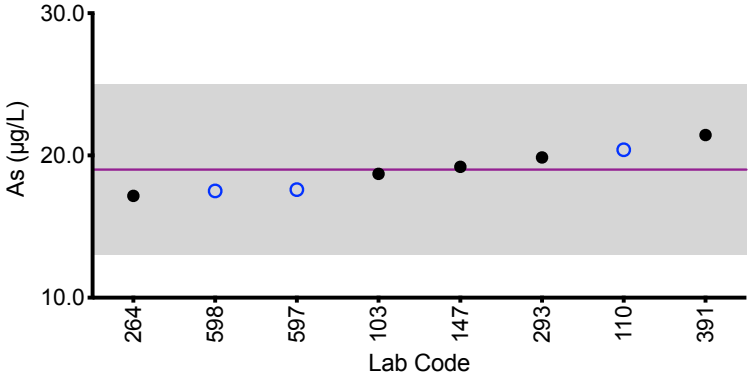
BE21-12



BE21-13



BE21-14



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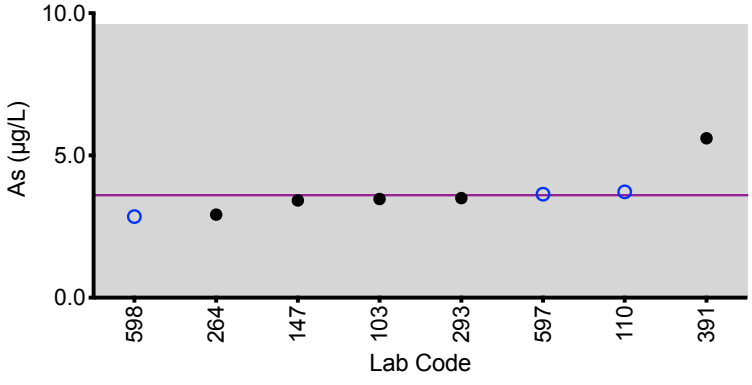

Legend:

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 #3, 2021:
Summary Statistics

Whole Blood Cd (µg/L)					
	BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Target (Robust Mean (x*))	1.20	5.25	1.81	0.63	7.2
Upper Limit	2.20	6.25	2.81	1.63	8.3
Lower Limit	0.20	4.25	0.81	0.00	6.1
Robust SD (s*)	0.08	0.19	0.08	0.05	0.4
Robust RSD (%)	6.7	3.6	4.4	7.9	5.8
Number of Sample Measurements (N)	12	13	13	11	13
Standard Uncertainty (*u*)	0.03	0.07	0.03	0.02	0.1

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 #3, 2021:
Performance of Participating Laboratories

Whole Blood Cd (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
	Target	**1.20**	**5.25**	**1.81**	**0.63**	**7.2**
103	ICP-MS/MS	1.27	5.60	1.82	0.618	7.75
107	ICP-MS/MS	1.20	5.26	1.83	0.614	7.40
110	ICP-MS	1.21	5.27	1.91	0.61	7.32
116	ICP-MS/MS	<1.50	5.30	1.77	<1.50	7.63
147	ICP-MS	1.27	5.32	1.85	0.695	7.35
264	ICP-MS	1.19	4.95	1.58	0.67	6.56
293	DRC/CC-ICP-MS	1.18	5.14	1.83	0.58	7.17
391	ICP-MS	1.07	5.26	1.707	0.6	5.31 ↓
597	ICP-MS/MS	1.09	5.02	1.79	0.575	7.00
598	DRC/CC-ICP-MS	1.21	5.61	1.78	0.585	6.72
605	ICP-MS	0.94	5.12	1.70	<0.500	7.32
606	ICP-MS/MS	1.43	5.12	1.88	0.818	7.62
686	ICP-MS	1.23	5.34	1.94	0.651	7.37

Based on the grading criteria for Cd in Whole Blood, 98% of results were satisfactory, with 0 of the 13 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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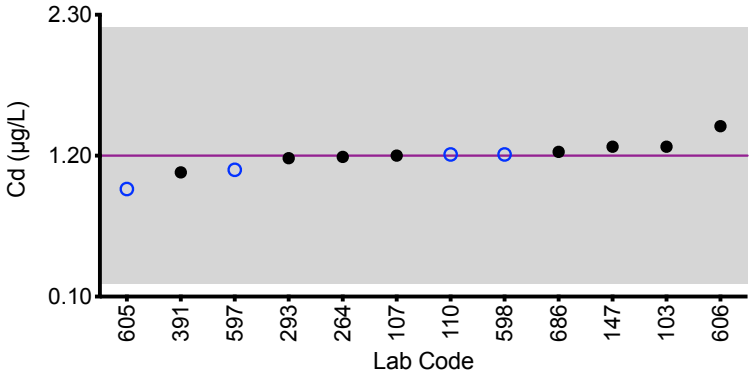
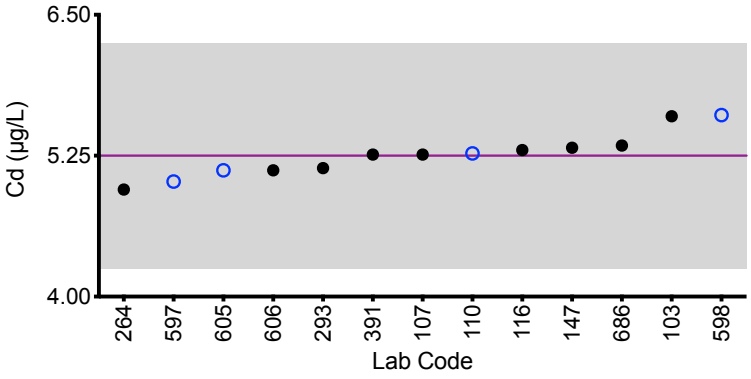
Results for Event #3, 2021: Summary Figures

Whole Blood Cd

BE21-11



BE21-12



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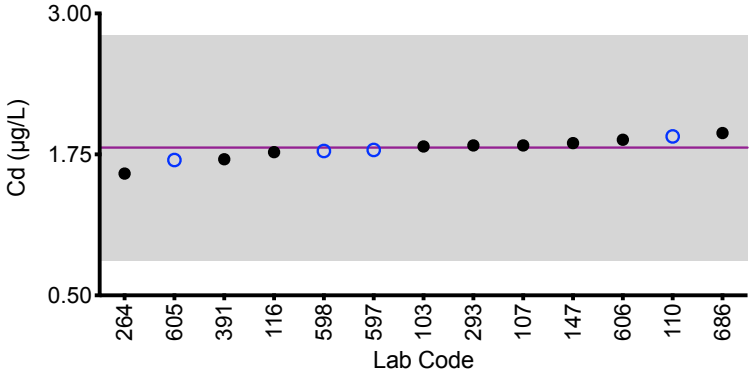

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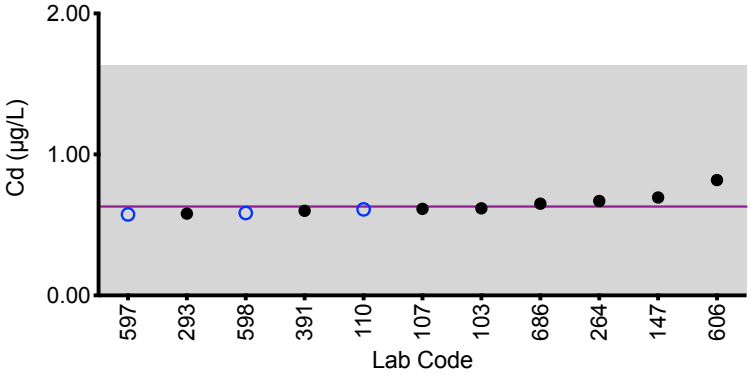
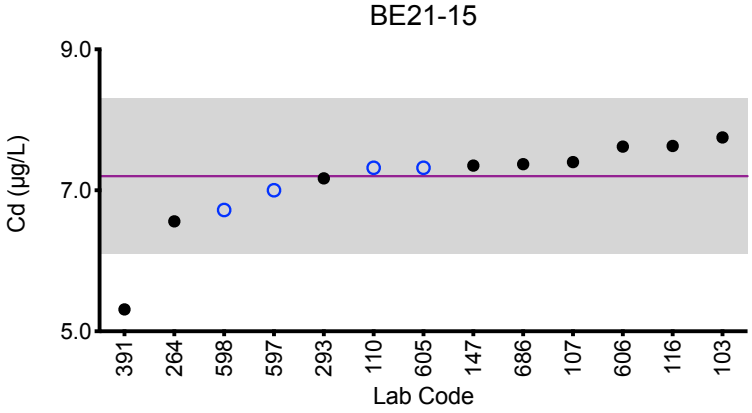


BE21-15



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 #3, 2021:
Summary Statistics

Whole Blood Co (µg/L)					
	BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Target (Arithmetic Mean ($\bar{x}$))	14.7	3.29	7.9	34.6	1.14
Upper Limit	17.6	4.79	9.5	41.5	2.64
Lower Limit	11.8	1.79	6.3	27.7	0.00
Arithmetic SD (s)	0.8	0.18	0.5	1.9	0.07
Arithmetic RSD (%)	5.4	5.5	6.3	5.5	6.1
Number of Sample Measurements (N)	9	8	9	9	8

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

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Results for Event #3, 2021:
Performance of Participating Laboratories

Whole Blood Co (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
	Target	**14.7**	**3.29**	**7.9**	**34.6**	**1.14**
103	ICP-MS/MS	15.3	3.38	8.07	35.8	1.13
110	ICP-MS	15.3	3.47	8.30	36.0	1.17
147	ICP-MS	15.7	3.55	8.43	37.6	1.27
255	ICP-MS	14	3.1	7.8	35	1
264	ICP-MS	13.66	3.14	7.16	32.19	1.15
293	DRC/CC-ICP-MS	15.65	3.43	8.24	34.92	1.14
391	ICP-MS	14.54	*2.23	8.08	34.47	*0.00
597	ICP-MS/MS	14.2	3.13	7.86	33.7	1.12
598	ICP-MS	13.8	3.15	7.22	31.7	1.11

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

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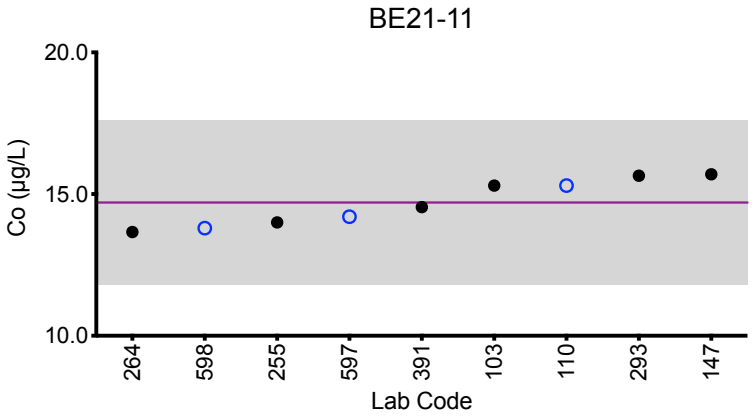
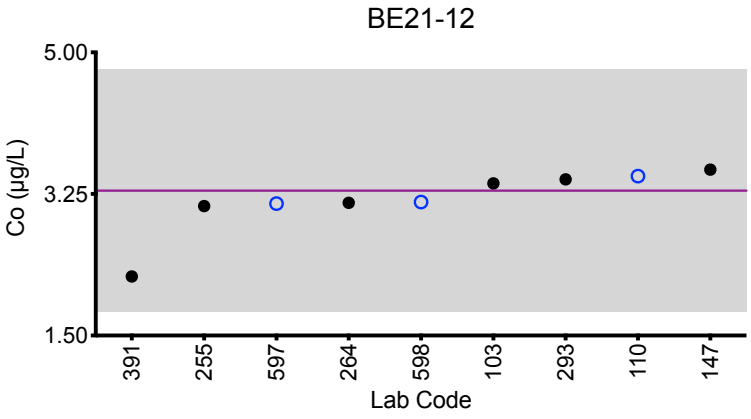
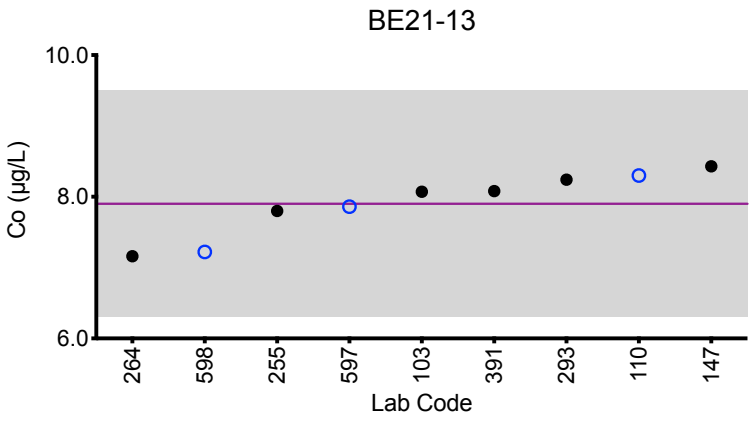
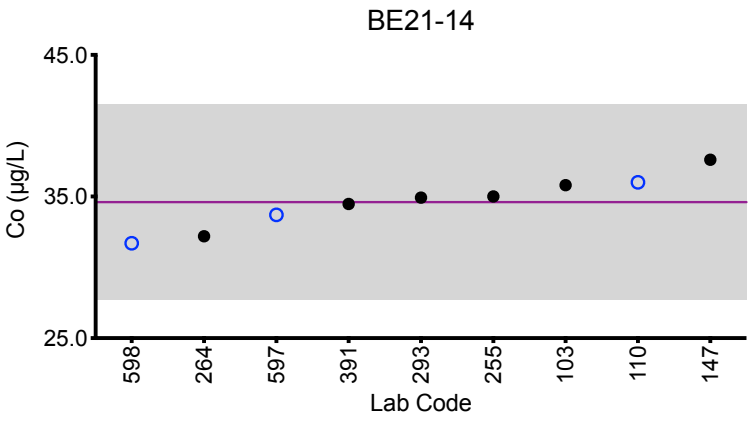
Results for Event #3, 2021: Summary Figures

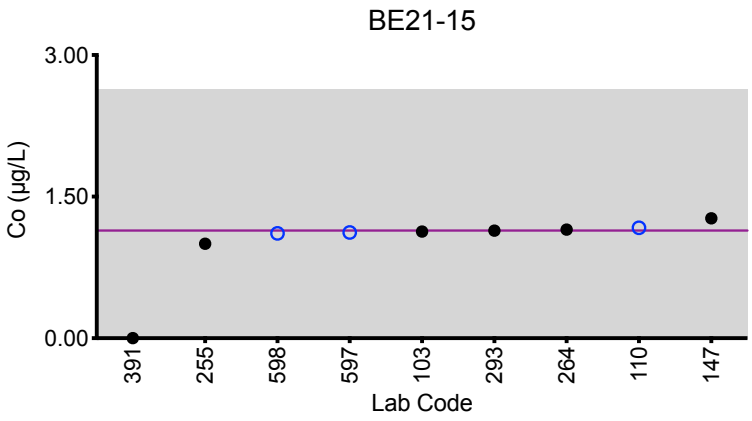
Whole Blood Co











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 #3, 2021:
Summary Statistics

Whole Blood Cr (µg/L)					
	BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Target (Arithmetic Mean ($\bar{x}$))	3.7	11.2	3.0	1.4	5.5
Upper Limit	5.7	13.4	5.0	3.4	7.5
Lower Limit	1.7	9.0	1.0	0.0	3.5
Arithmetic SD (s)	0.3	0.5	0.3	0.1	0.2
Arithmetic RSD (%)	8.6	4.5	11	8.8	4.1
Number of Sample Measurements (N)	8	8	6	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 #3, 2021:
Performance of Participating Laboratories

Whole Blood Cr (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
	Target	**3.7**	**11.2**	**3.0**	**1.4**	**5.5**
103	ICP-MS/MS	3.40	10.8	2.77	<1.50	5.80
110	DRC/CC-ICP-MS	3.83	11.6	3.45	1.33	5.37
147	DRC/CC-ICP-MS	3.75	10.9	2.96	1.55	5.82
255	ICP-MS	3.9	12	3.2	<1.0	5.6
264	ICP-MS	4.40	10.67	*5.72 ↑	1.38	5.24
293	DRC/CC-ICP-MS	3.58	11.44	2.92	1.31	5.53
597	ICP-MS/MS	3.48	10.6	2.47	1.23	5.35
598	DRC/CC-ICP-MS	3.58	11.3	*5.53 ↑	*2.70	*8.17 ↑

Based on the grading criteria for Cr in Whole Blood, 93% of results were satisfactory, with 1 of the 8 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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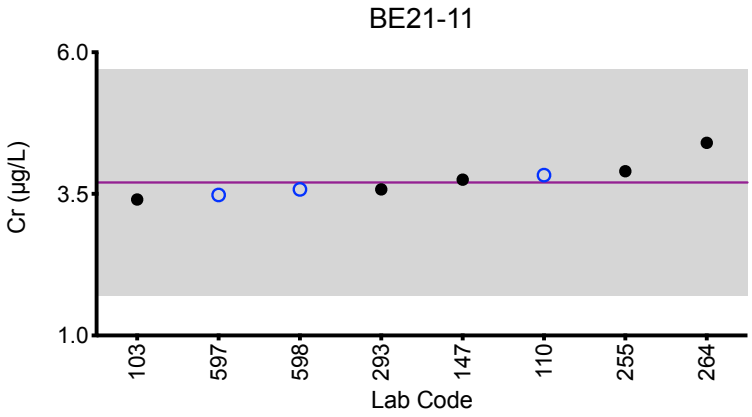
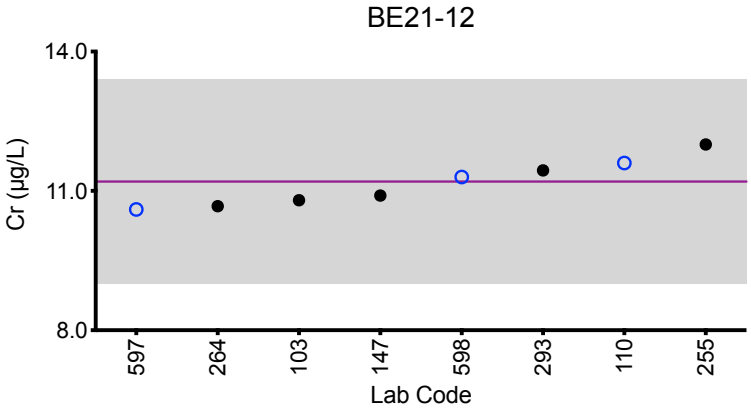
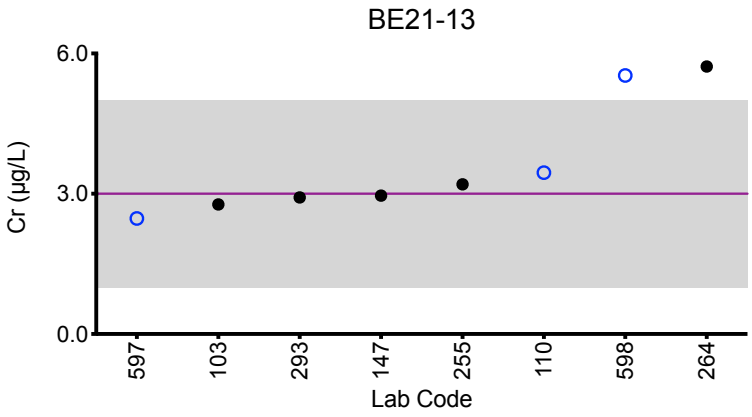
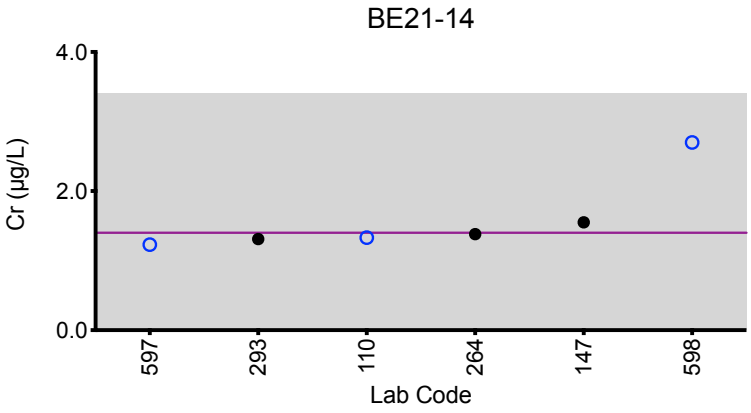
Results for Event #3, 2021: Summary Figures

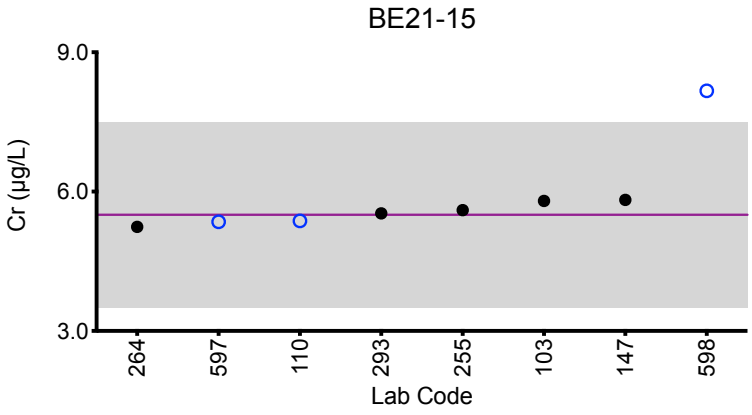
Whole Blood Cr











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 #3, 2021: Summary Statistics

Whole Blood Hg (µg/L)					
	BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Target (Robust Mean (x*))	4.7	0.78	15.3	2.42	5.6
Upper Limit	7.7	3.78	19.9	5.42	8.6
Lower Limit	1.7	0.00	10.7	0.00	2.6
Robust SD (s*)	0.6	0.06	1.7	0.18	0.5
Robust RSD (%)	13	7.7	11	7.4	8.9
Number of Sample Measurements (N)	13	12	13	13	13
Standard Uncertainty (*u*)	0.2	0.02	0.6	0.06	0.2

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 #3, 2021:
Performance of Participating Laboratories

Whole Blood Hg (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
	Target	**4.7**	**0.78**	**15.3**	**2.42**	**5.6**
103	ICP-MS/MS	4.87	0.796	15.6	2.53	5.93
107	ICP-MS/MS	4.96	0.77	16.1	2.48	5.94
110	ICP-MS	4.63	0.79	14.7	2.40	5.51
116	ICP-MS/MS	5.29	<1.50	16.4	2.41	6.28
147	ICP-MS	4.51	0.730	14.9	2.43	5.50
264	ICP-MS	4.11	1.66	9.04 ↓	2.15	4.19
293	DRC/CC-ICP-MS	3.1	0.50	10.0 ↓	1.64	3.65
391	CV-AAS	5.6	1.12	17.6	3.12	5.68
597	ICP-MS/MS	4.34	0.808	14.4	2.27	5.23
598	ICP-MS	3.33	0.529	13.2	1.87	4.51
605	ICP-MS	4.89	0.782	16.7	2.53	5.93
606	ICP-MS/MS	5.29	0.742	17.0	2.71	6.43
686	ICP-MS	4.96	0.802	16.3	2.50	5.86

Based on the grading criteria for Hg in Whole Blood, 97% of results were satisfactory, with 0 of the 13 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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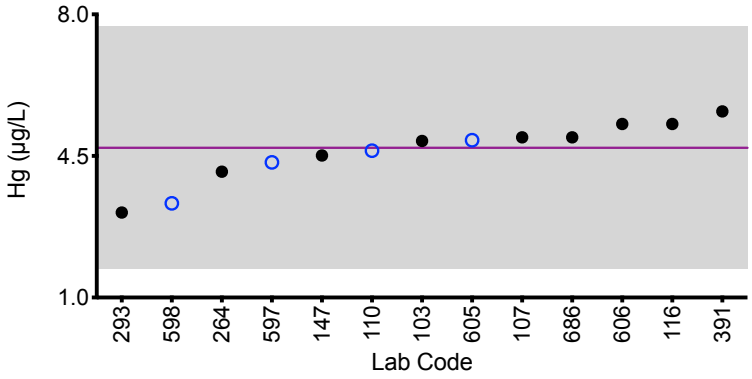
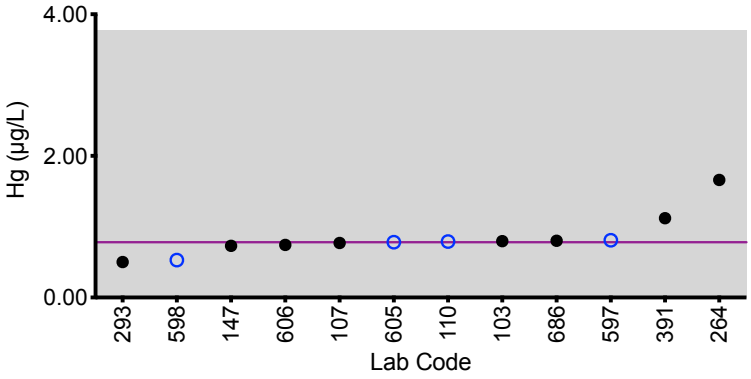
Results for Event #3, 2021: Summary Figures

Whole Blood Hg

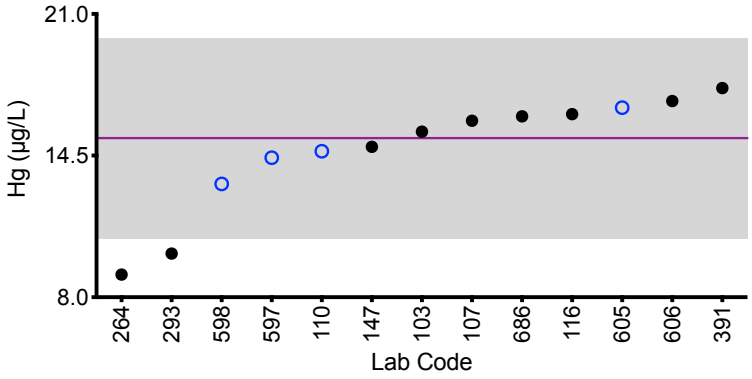
BE21-11



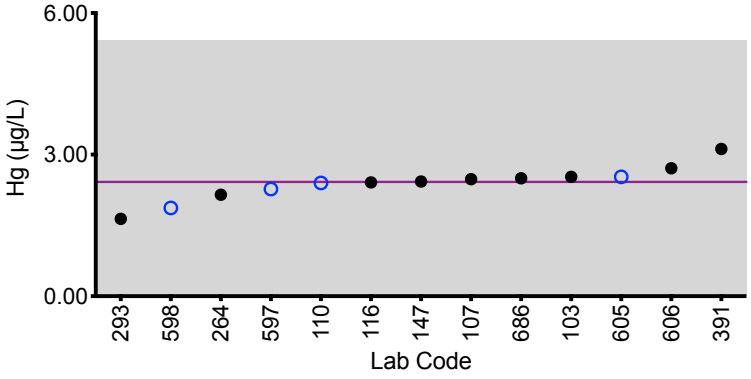
BE21-12



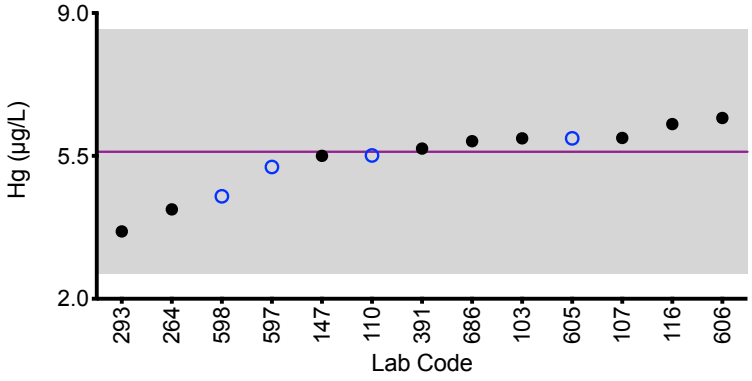
BE21-13



BE21-14



BE21-15



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 #3, 2021: Summary Statistics

Whole Blood Mn (µg/L)					
	BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Target (Robust Mean (x*))	19.9	9.6	20.4	12.0	16.6
Upper Limit	23.3	12.6	23.9	15.0	19.6
Lower Limit	16.5	6.6	16.9	9.0	13.6
Robust SD (s*)	1.8	1.5	1.5	1.7	1.3
Robust RSD (%)	8.9	16	7.4	14	7.8
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (*u*)	0.7	0.6	0.6	0.7	0.5

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 #3, 2021:
Performance of Participating Laboratories

Whole Blood Mn (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
	Target	**19.9**	**9.6**	**20.4**	**12.0**	**16.6**
103	ICP-MS/MS	21.1	10.2	21.2	12.7	17.5
107	ICP-MS/MS	19.9	9.11	20.2	11.7	16.8
110	ICP-MS	20.1	9.4	20.5	11.6	16.4
147	ICP-MS	21.4	11.0	22.0	14.0	19.1
264	ICP-MS	24.92 ↑	15.12 ↑	23.40	16.17 ↑	21.13 ↑
293	DRC/CC-ICP-MS	16.1 ↓	7.52	18.7	9.7	12.9 ↓
391	ICP-MS	18.7	9.45	18.2	10.4	15.97
597	ICP-MS/MS	18.2	8.64	19.8	11.1	15.7
598	ICP-MS	20.2	11.4	21.0	13.0	15.6
606	ICP-MS/MS	19.4	8.48	19.4	11.3	16.5

Based on the grading criteria for Mn in Whole Blood, 88% of results were satisfactory, with 2 of the 10 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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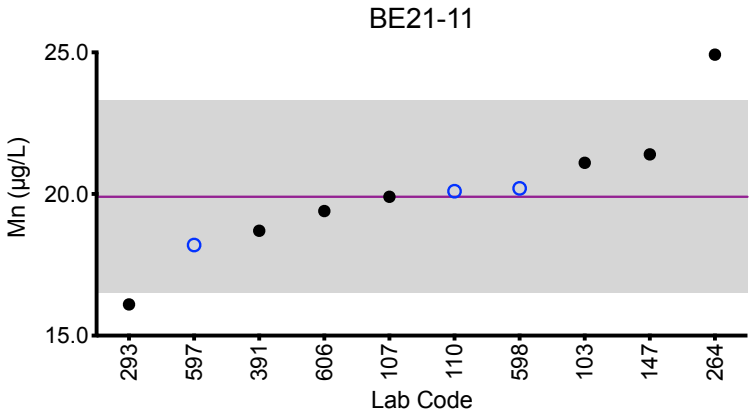
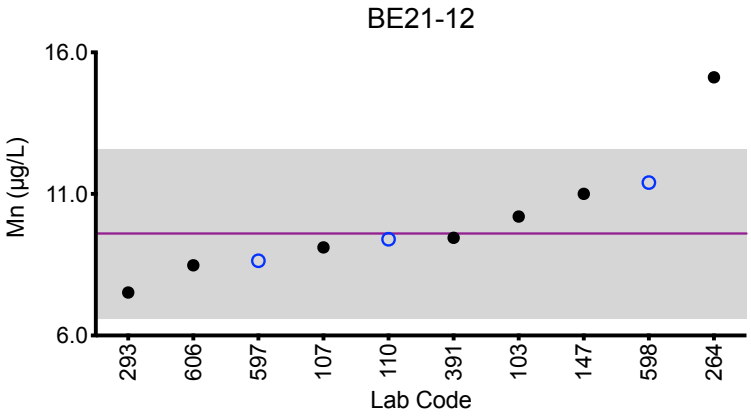
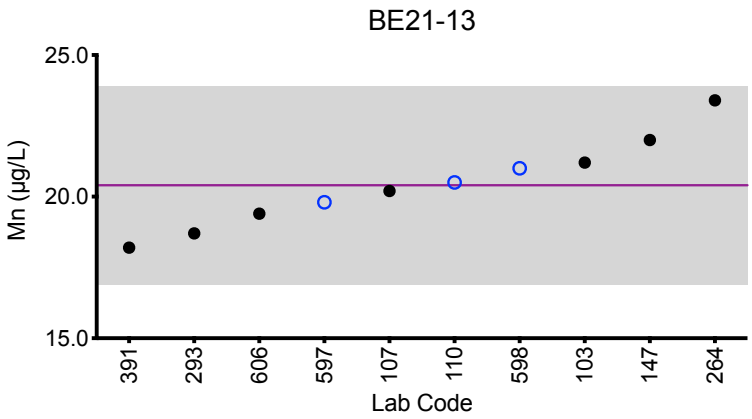
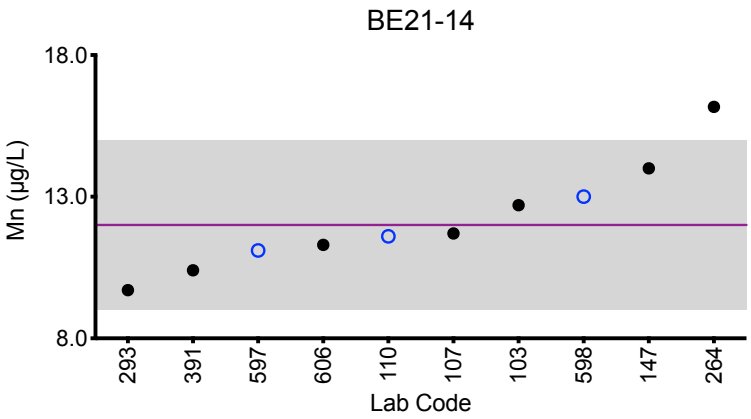
Results for Event #3, 2021: Summary Figures

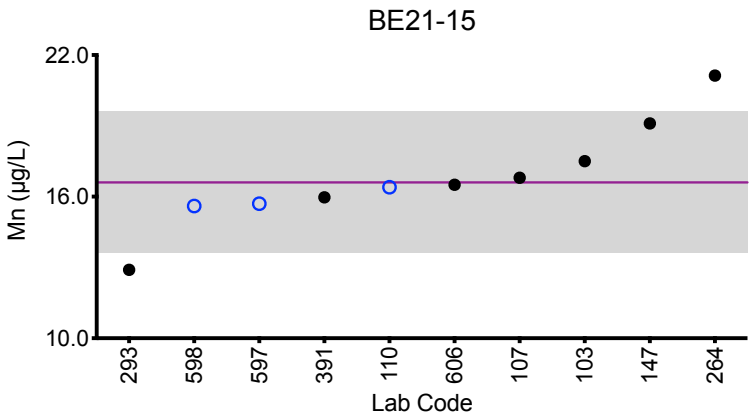
Whole Blood Mn











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:

±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 #3, 2021: Summary Statistics

Whole Blood Pb (µg/dL)					
	BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Target (Robust Mean (x*))	1.65	18.3	3.75	5.48	0.82
Upper Limit	3.65	20.3	5.75	7.48	2.82
Lower Limit	0.00	16.3	1.75	3.48	0.00
Robust SD (s*)	0.07	0.9	0.15	0.21	0.12
Robust RSD (%)	4.2	4.9	4.0	3.8	15
Number of Sample Measurements (N)	12	14	13	14	9
Standard Uncertainty (*u*)	0.02	0.3	0.05	0.07	NA

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/)

An arithmetic mean, SD, RSD and n are provided for samples BE21-15.

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Results for Event #3, 2021:
Performance of Participating Laboratories

Whole Blood Pb (µg/dL)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
	Target	**1.65**	**18.3**	**3.75**	**5.48**	**0.82**
103	ICP-MS/MS	1.70	18.9	3.88	5.64	0.901
107	ICP-MS/MS	1.62	18.1	3.74	5.36	0.858
110	ICP-MS	1.69	18.8	3.89	5.62	0.89
116	ICP-MS/MS	<3.00	19.0	3.80	5.57	<3.00
147	ICP-MS	1.68	18.1	3.79	5.62	0.868
264	ICP-MS	1.58	17.29	3.45	5.01	0.86
293	DRC/CC-ICP-MS	1.65	18.40	3.72	5.4	0.83
343	ASV-LeadCare	<3.3	19.4	<3.3	5.6	<3.3
391	ETAAS-Z	0.50	15.57 ↓	2.29	3.9	0.50
597	ICP-MS/MS	1.52	16.8	3.59	5.06	0.813
598	ICP-MS	1.60	17.4	3.58	4.89	0.858
605	ICP-MS	1.70	19.6	3.98	5.63	<1.00
606	ICP-MS/MS	2.18	18.5	3.80	5.81	<1.00
686	ICP-MS	1.69	18.6	3.85	5.47	<1.00

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

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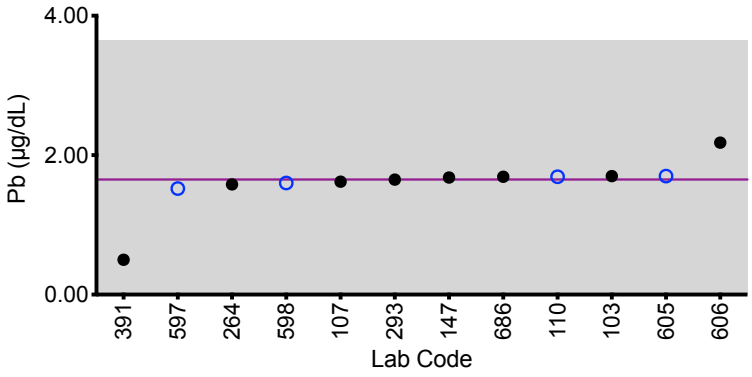
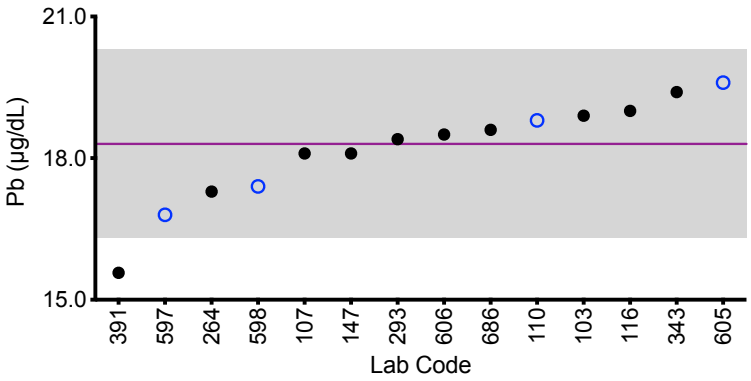
Results for Event #3, 2021: Summary Figures

Whole Blood Pb

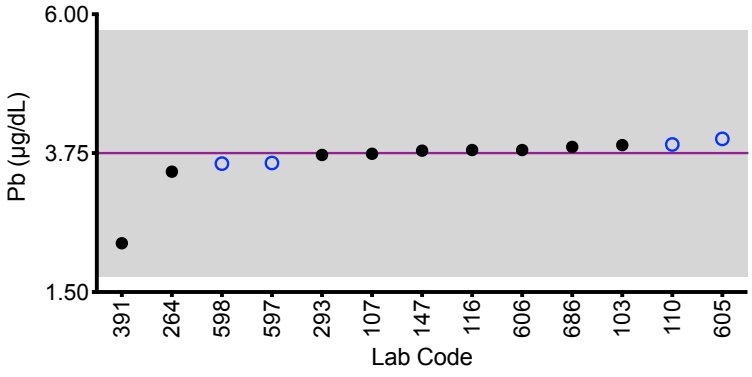
BE21-11



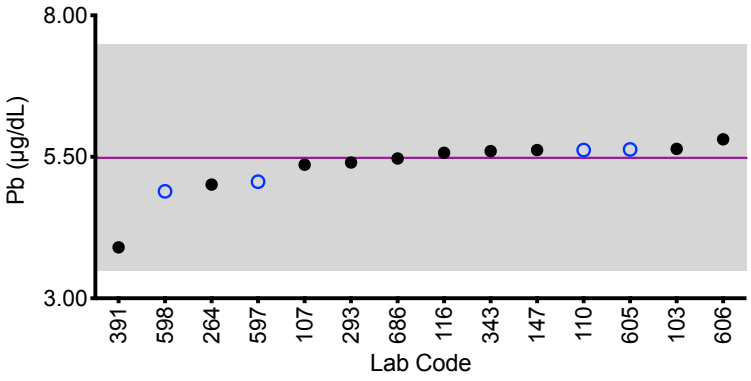
BE21-12



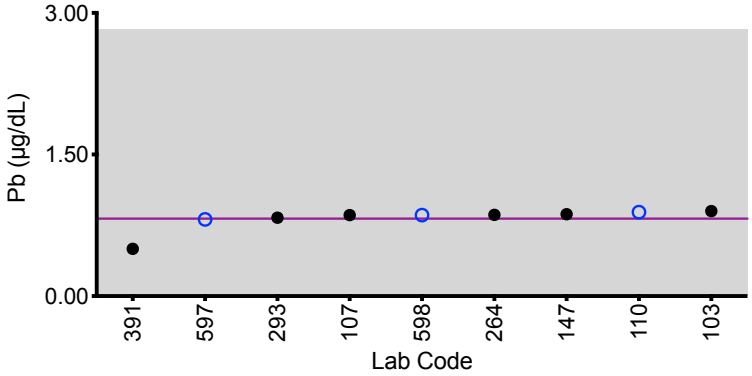
BE21-13



BE21-14



BE21-15



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 #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Mo (µg/L)

Lab Code	Method	BE21-11	BE21-12	BE21-13	BE21-14	BE21-15
103	ICP-MS/MS	2.79	9.33	6.10	5.29	7.25
147	ICP-MS	2.71	9.06	5.71	5.38	6.82
264	ICP-MS	*5.68	*12.53	6.98	*8.41	8.21
442	DRC/CC-ICP-MS	2.80	9.61	6.25	5.42	7.18
597	ICP-MS/MS	2.58	8.16	5.63	4.89	6.82
598	DRC/CC-ICP-MS	3.26	9.46	6.34	5.17	6.74

Summary Statistics

	BE21-11	BE21-12	BE21-13	BE21-14	BE21-15
Arithmetic Mean ($\bar{x}$)	2.8	9.1	6.2	5.2	7.2
Arithmetic SD (s)	0.3	0.6	0.5	0.2	0.6
Arithmetic RSD (%)	9.1	6.3	8.1	4.1	8.3
Number of Sample Measurements (N)	5	5	6	5	6

*Denotes a statistical Outlier.

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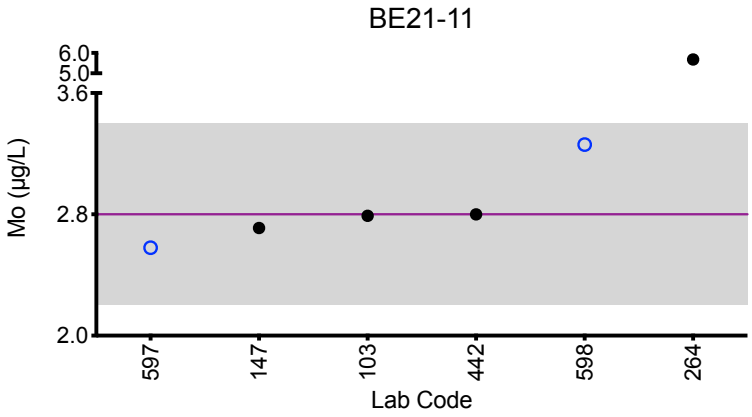
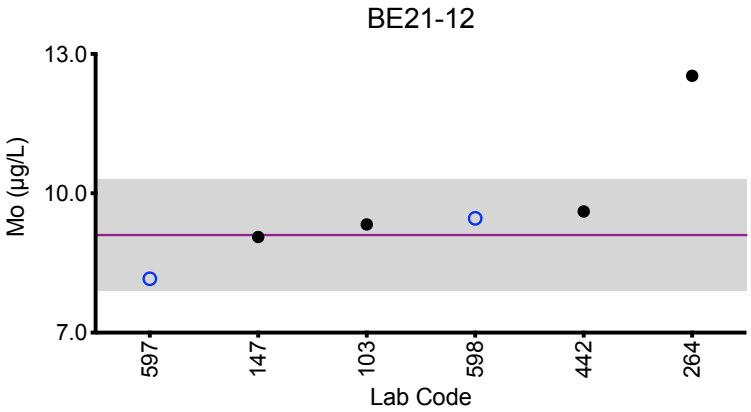
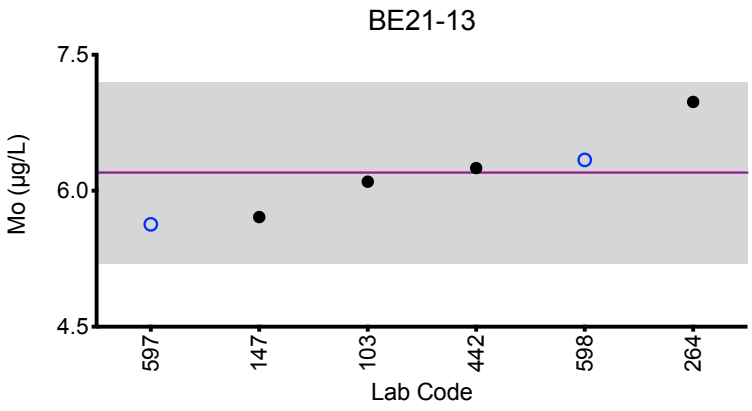
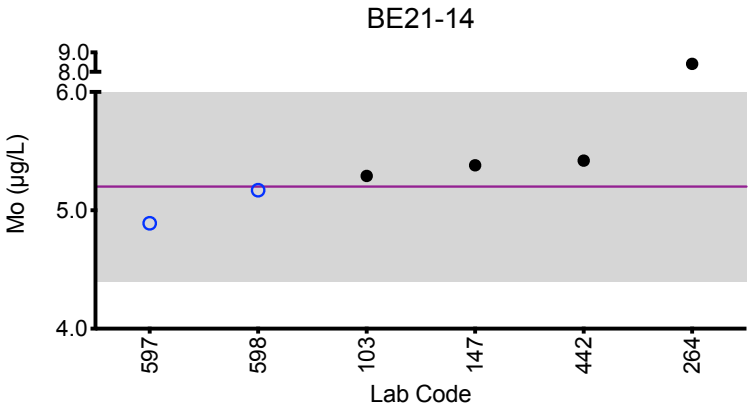
Results for Event #3, 2021: Summary Figures

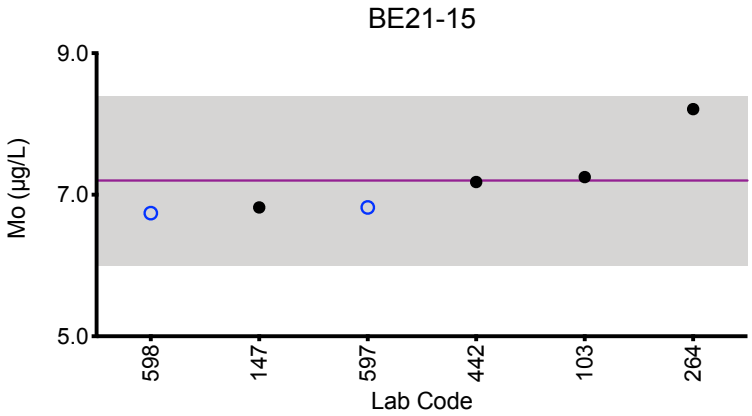
Whole Blood Mo











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 #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Sb (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
103	ICP-MS/MS	3.35	6.72	1.68	4.52	0.651
110	ICP-MS	3.65	7.91	2.06	5.06	0.77
147	ICP-MS	3.56	8.04	1.96	5.22	0.733
264	ICP-MS	2.83	6.55	1.49	4.04	0.60
293	DRC/CC-ICP-MS	3.980	7.73	*3.73	5.05	0.79
442	DRC/CC-ICP-MS	3.61	7.86	1.95	4.86	0.584
597	ICP-MS/MS	3.49	7.30	1.93	4.80	0.850
598	ICP-MS	3.12	7.26	1.82	4.53	0.685
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		3.4	7.4	1.84	4.8	0.71
Arithmetic SD (s)		0.4	0.6	0.20	0.4	0.09
Arithmetic RSD (%)		10	8.1	11	8.0	13
Number of Sample Measurements (N)		8	8	7	8	8

*Denotes a statistical Outlier.

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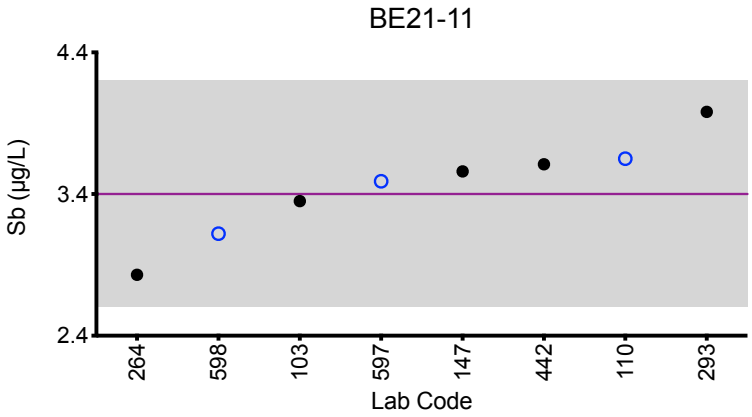
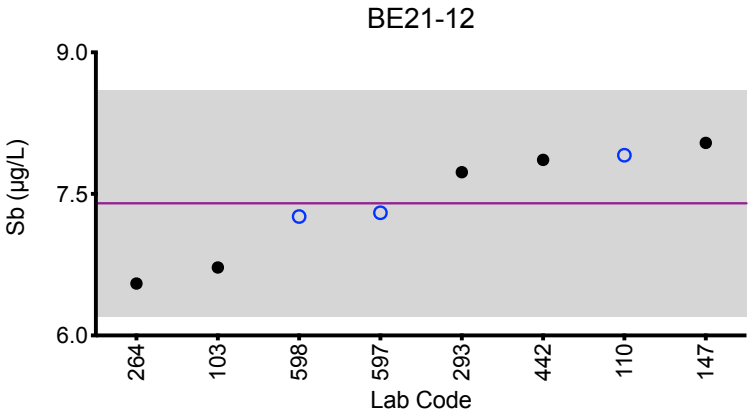
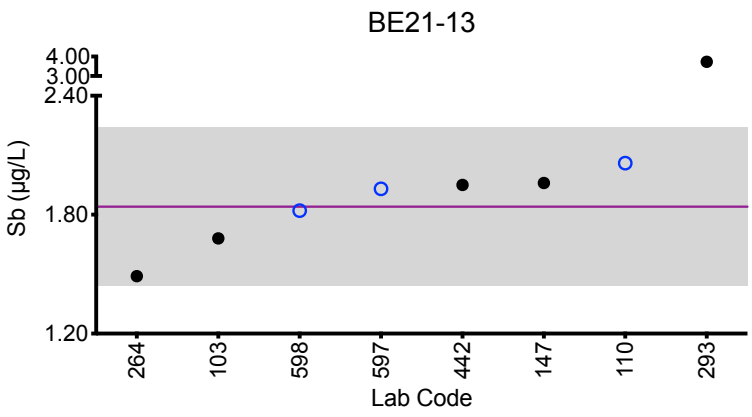
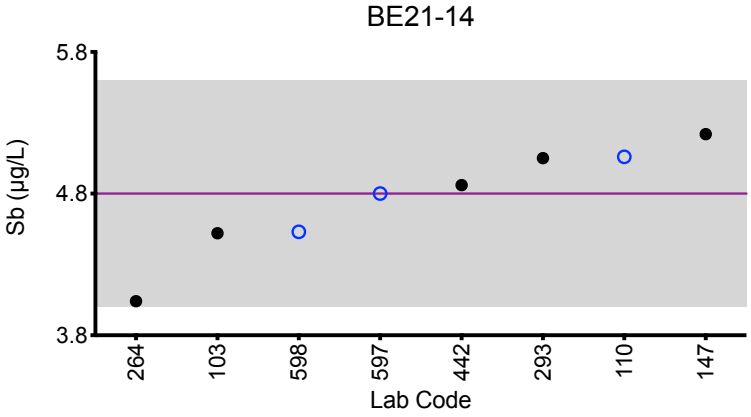
Results for Event #3, 2021: Summary Figures

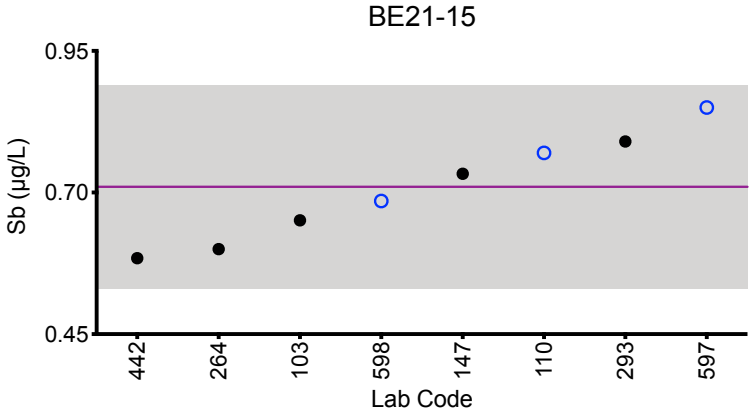
Whole Blood Sb











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 #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Se (µg/L)

Lab Code	Method	BE21-11	BE21-12	BE21-13	BE21-14	BE21-15
103	ICP-MS/MS	206	125	163	104	193
107	ICP-MS/MS	212	127	168	106	196
110	DRC/CC-ICP-MS	195	110	161	97.8	179
147	ICP-MS	197	118	157	103	180
264	ICP-MS	145.53	93.62	*110.45	69.38	134.91
293	DRC/CC-ICP-MS	169	109	150	88	146
597	ICP-MS/MS	188	113	155	95.8	174
598	DRC/CC-ICP-MS	173	100	139	86.9	152

Summary Statistics

	BE21-11	BE21-12	BE21-13	BE21-14	BE21-15
Arithmetic Mean ($\bar{x}$)	186	112	156	94	169
Arithmetic SD (s)	22	12	10	12	22
Arithmetic RSD (%)	12	11	6.4	13	13
Number of Sample Measurements (N)	8	8	7	8	8

*Denotes a statistical Outlier.

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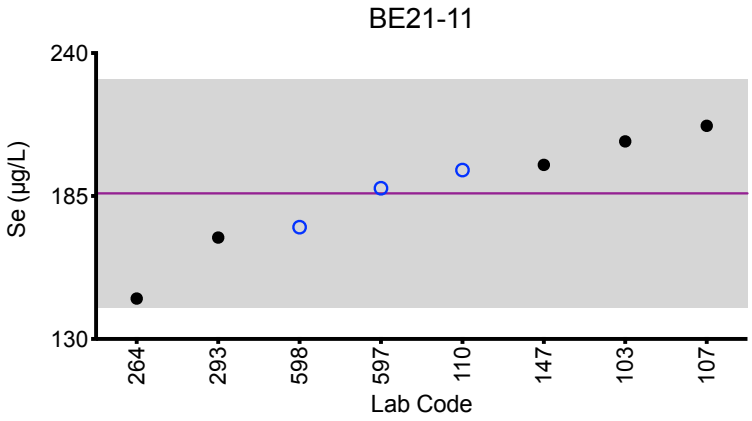
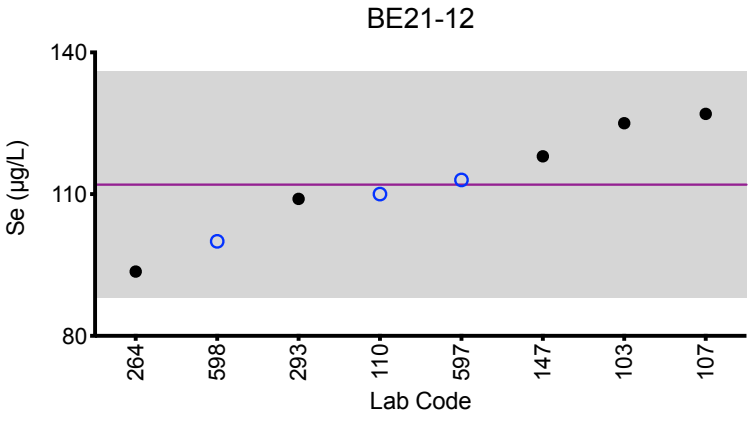
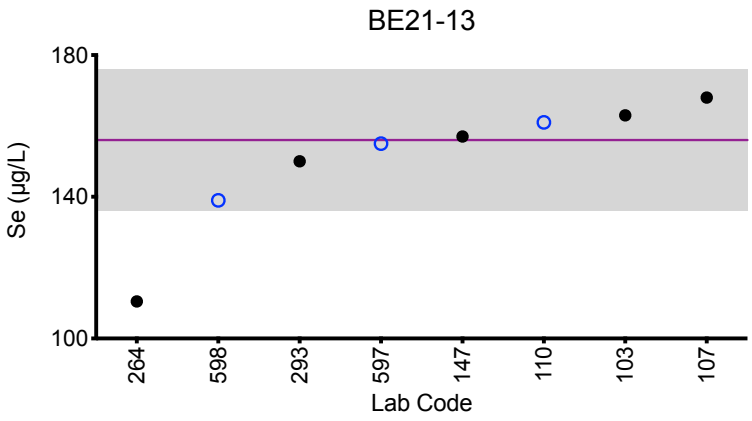
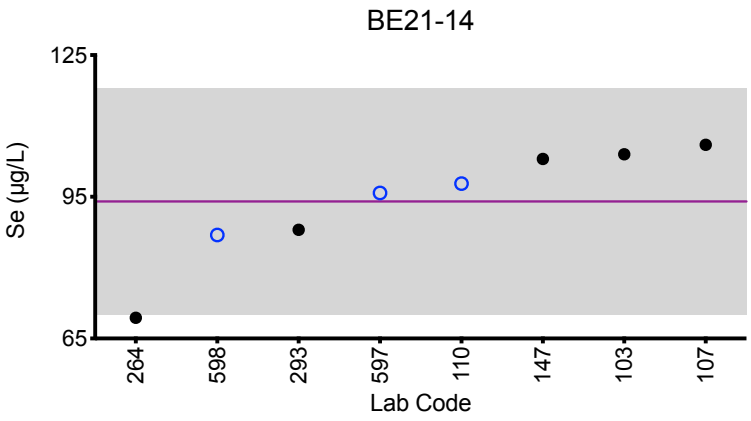
Results for Event #3, 2021: Summary Figures

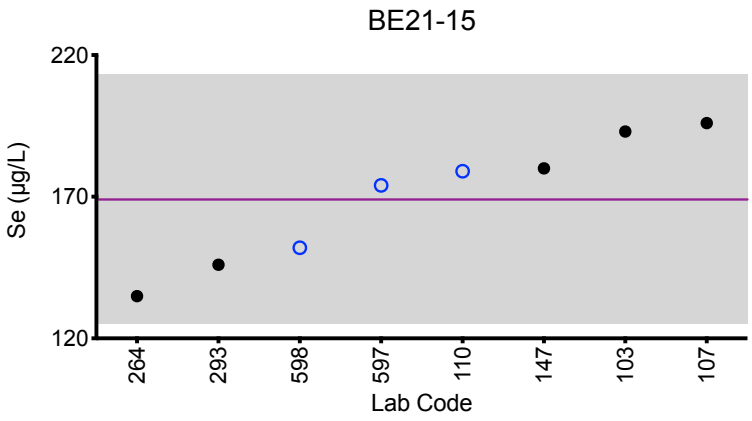
Whole Blood Se











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 #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Tl (µg/L)

Lab Code	Method	BE21-11	BE21-12	BE21-13	BE21-14	BE21-15
103	ICP-MS/MS	0.811	2.09	3.19	1.25	0.596
110	ICP-MS	0.838	2.01	3.07	1.29	0.609
147	ICP-MS	0.832	2.03	3.00	1.26	0.564
264	ICP-MS	*0.65	1.77	2.47	0.96	*0.44
293	DRC/CC-ICP-MS	0.84	2.02	3.10	1.23	0.57
597	ICP-MS/MS	0.785	1.89	2.82	1.10	0.547
598	ICP-MS	0.810	2.10	3.06	1.18	0.548

Summary Statistics

	BE21-11	BE21-12	BE21-13	BE21-14	BE21-15
Arithmetic Mean ($\bar{x}$)	0.819	1.99	2.96	1.18	0.57
Arithmetic SD (s)	0.021	0.12	0.24	0.12	0.03
Arithmetic RSD (%)	2.6	5.9	8.1	10	4.4
Number of Sample Measurements (N)	6	7	7	7	6

*Denotes a statistical Outlier.

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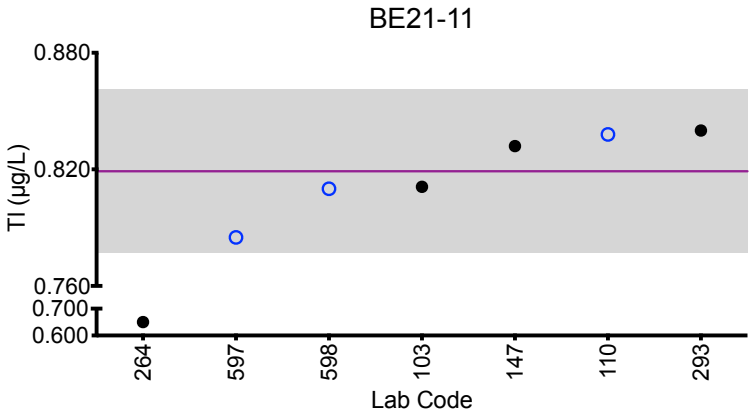
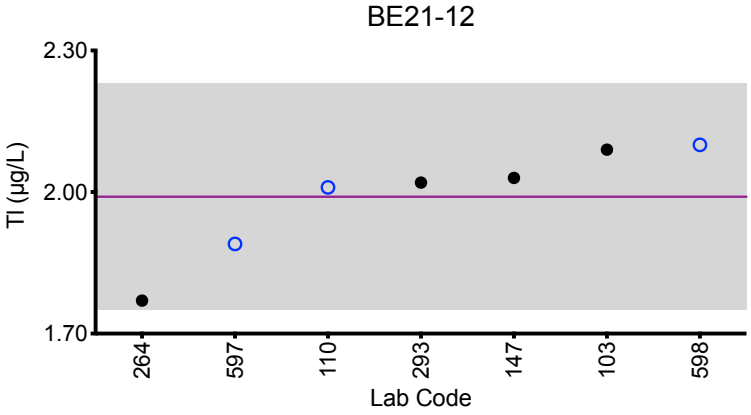
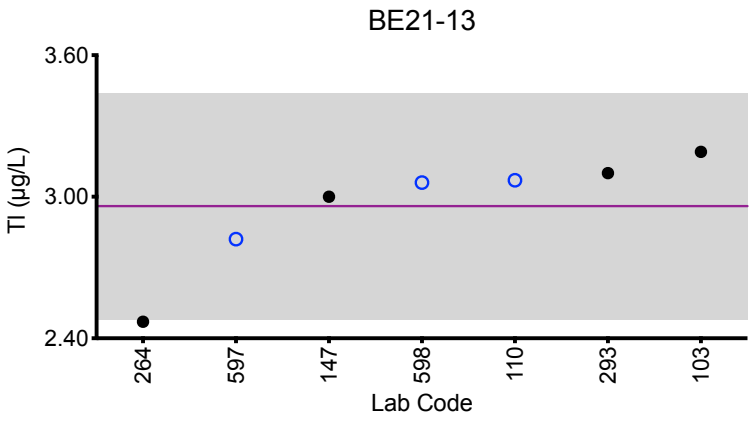
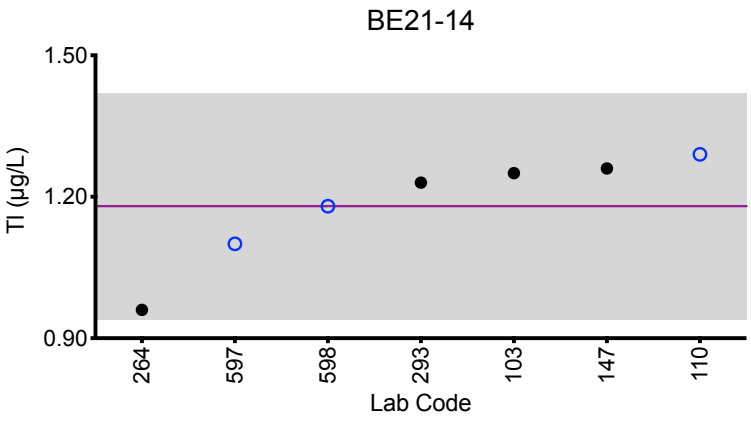
Results for Event #3, 2021: Summary Figures

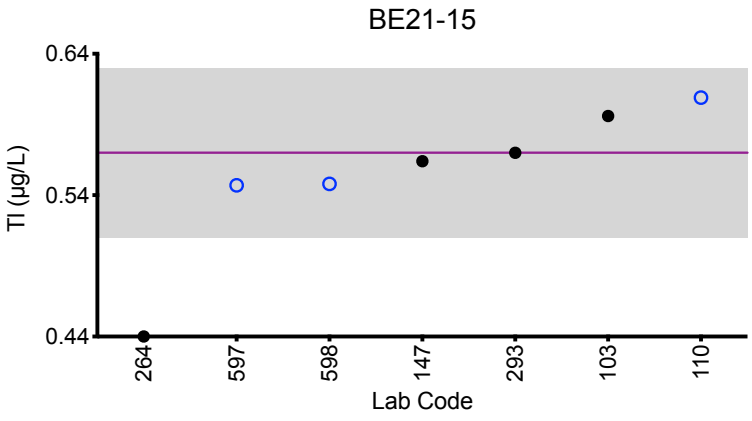
Whole Blood Tl











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 #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood U (µg/L)

Lab Code	Method	BE21-11	BE21-12	BE21-13	BE21-14	BE21-15
103	ICP-MS/MS	0.0940	0.236	0.123	0.116	0.136
110	ICP-MS	0.096	0.232	0.129	0.124	0.132
147	ICP-MS	0.0793	0.205	0.113	0.110	0.129
391	ICP-MS	0.113	0.281	0.162	0.123	0.148
597	ICP-MS/MS	0.0735	0.210	0.117	0.103	0.140
598	ICP-MS	0.130	0.240	0.140	0.120	0.130

Summary Statistics

	BE21-11	BE21-12	BE21-13	BE21-14	BE21-15
Arithmetic Mean ($\bar{x}$)	0.098	0.23	0.131	0.116	0.136
Arithmetic SD (s)	0.021	0.03	0.018	0.008	0.007
Arithmetic RSD (%)	21	12	14	6.9	5.1
Number of Sample Measurements (N)	6	6	6	6	6

*Denotes a statistical Outlier.

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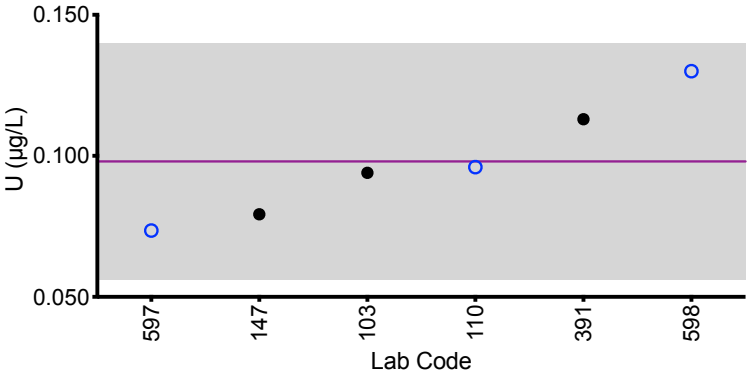
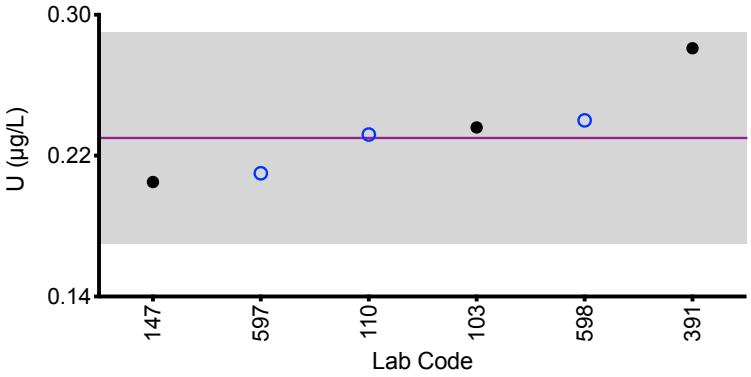
Results for Event #3, 2021: Summary Figures

Whole Blood U

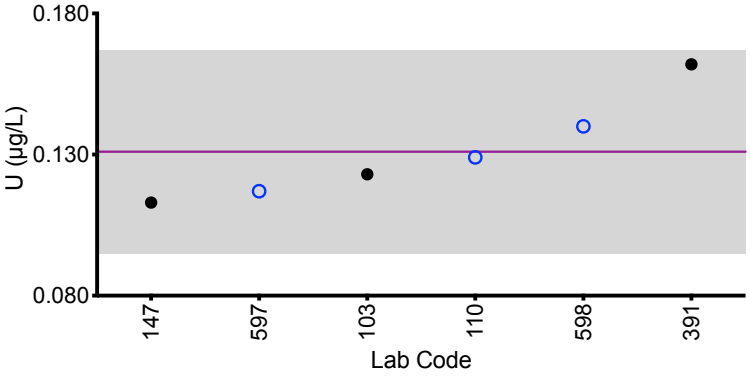
BE21-11



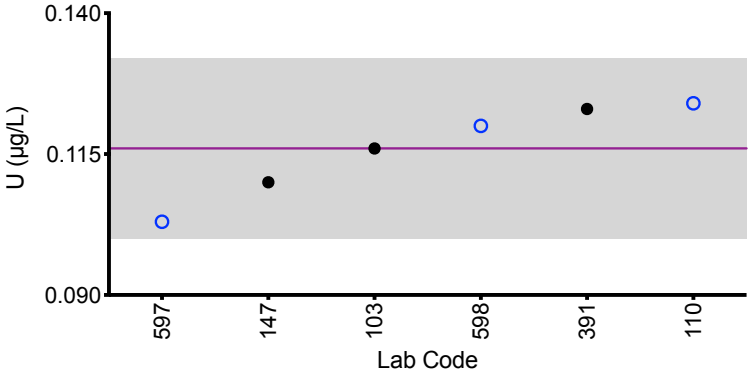
BE21-12



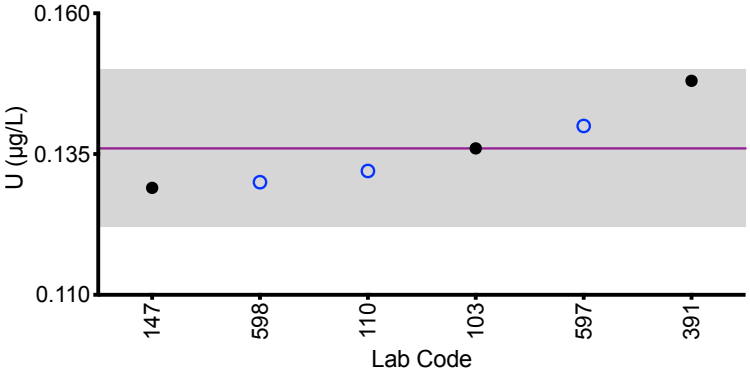
BE21-13



BE21-14



BE21-15



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 #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Ba (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	ICP-MS	4.2	8.1	12.3	14.2	12.4
147	ICP-MS	7.27	6.69	12.5	15.2	6.88
597	ICP-MS/MS	3.99	5.89	12.5	29.0	7.31
598	ICP-MS	5.73	9.54	13.1	14.4	7.16
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		5.3	7.6	12.6	18	8
Arithmetic SD (s)		1.5	1.6	0.3	7	3
Arithmetic RSD (%)		28	21	2.4	39	31
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Be (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	ICP-MS	1.40	0.948	3.50	4.19	5.54
147	ICP-MS	1.21	<1.17	2.72	3.99	5.23
597	ICP-MS/MS	1.16	0.866	2.65	4.08	5.54
598	ICP-MS	1.21	0.662	2.25	3.47	4.63
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		1.25	0.83	2.8	3.9	5.2
Arithmetic SD (s)		0.11	0.15	0.5	0.3	0.4
Arithmetic RSD (%)		8.8	18	18	7.7	7.7
Number of Sample Measurements (N)		4	3	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Cs (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	ICP-MS	1.42	2.69	1.27	2.66	1.42
597	ICP-MS/MS	1.34	2.63	1.26	2.56	1.42
598	ICP-MS	1.53	2.56	1.30	2.64	1.29
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		1.43	2.63	1.28	2.62	1.38
Arithmetic SD (s)		0.10	0.07	0.02	0.05	0.08
Arithmetic RSD (%)		6.7	2.7	1.6	1.9	5.8
Number of Sample Measurements (N)		3	3	3	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Cu (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	ICP-MS	1594	716	2733	916	1177
147	ICP-MS	1550	661	2598	902	1112
597	ICP-MS/MS	1480	636	2560	844	1090
598	ICP-MS	1370	604	2280	760	952
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		1500	650	2540	860	1080
Arithmetic SD (s)		100	50	190	70	90
Arithmetic RSD (%)		6.7	7.7	7.5	8.1	8.3
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Ni (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	DRC/CC-ICP-MS	4.27	6.11	3.74	18.8	7.79
147	ICP-MS	2.97	5.34	3.55	17.0	7.34
597	ICP-MS/MS	2.61	5.36	3.16	16.1	7.49
598	ICP-MS	*8.92	9.41	*6.84	22.2	11.9
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		3.3	7	3.5	18.5	8.6
Arithmetic SD (s)		0.9	2	0.3	2.7	2.2
Arithmetic RSD (%)		26	29	8.5	15	26
Number of Sample Measurements (N)		3	4	3	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Pt (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	ICP-MS	2.96	6.92	0.24	4.90	1.12
293	DRC/CC-ICP-MS	2.470	5.710	0.34	4.20	0.94
598	ICP-MS	2.75	6.07	0.282	4.29	0.905
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		2.7	6.2	0.29	4.5	0.99
Arithmetic SD (s)		0.2	0.6	0.05	0.4	0.12
Arithmetic RSD (%)		9.2	9.7	17	8.9	12
Number of Sample Measurements (N)		3	3	3	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Sn (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	ICP-MS	4.50	2.86	1.29	0.59	7.56
147	ICP-MS	4.25	2.74	1.25	0.463	7.34
597	ICP-MS/MS	4.03	2.60	1.24	0.474	6.88
598	ICP-MS	4.96	2.51	1.40	0.603	6.60
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		4.4	2.68	1.29	0.53	7.1
Arithmetic SD (s)		0.4	0.15	0.07	0.07	0.4
Arithmetic RSD (%)		9.1	5.6	5.4	13	5.6
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Sr (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
103	ICP-MS/MS	26.6	20.8	48.4	23.7	28.0
597	ICP-MS/MS	24.7	18.6	44.5	21.2	26.6
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		25.7	19.7	46	22.5	27.3
Arithmetic SD (s)		1.3	1.6	3	1.8	1.0
Arithmetic RSD (%)		5.1	8.1	6.5	7.9	3.7
Number of Sample Measurements (N)		2	2	2	2	2

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Ti (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
200	DRC/CC-ICP-MS	*6.7	10.2	*8.1	6.4	9.8
442	ICP-MS/MS	2.92	9.06	1.72	5.23	7.43
597	ICP-MS/MS	3.31	8.39	2.20	5.93	7.28
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		3.1	9.2	2.0	5.9	8.2
Arithmetic SD (s)		0.3	0.9	0.3	0.6	1.4
Arithmetic RSD (%)		9.7	9.8	15	10	17
Number of Sample Measurements (N)		2	3	2	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood V (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	DRC/CC-ICP-MS	1.92	0.288	1.22	5.31	0.516
147	DRC/CC-ICP-MS	1.68	0.156	0.898	4.72	0.417
597	ICP-MS/MS	1.74	0.221	0.966	4.38	0.485
598	DRC/CC-ICP-MS	1.580	<0.2	0.950	4.10	0.553
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		1.73	0.22	1.01	4.6	0.49
Arithmetic SD (s)		0.14	0.07	0.14	0.5	0.06
Arithmetic RSD (%)		8.1	32	14	11	12
Number of Sample Measurements (N)		4	3	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood W (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	ICP-MS	0.305	0.852	0.674	5.02	1.79
200	ICP-MS	0.30	0.80	0.700	5.40	1.60
597	ICP-MS/MS	0.266	0.812	0.594	4.68	1.51
598	ICP-MS	0.537	1.12	0.75	4.94	1.66
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		0.35	0.90	0.68	5.0	1.64
Arithmetic SD (s)		0.12	0.15	0.07	0.3	0.12
Arithmetic RSD (%)		34	17	10	5.9	7.3
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Whole Blood Zn (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
110	ICP-MS	5373	4881	29195	14655	24365
147	ICP-MS	5170	4654	27386	14510	23203
597	ICP-MS/MS	5060	4530	27900	13900	22900
598	ICP-MS	4540	4060	24200	11700	19600
Summary Statistics						
		BE21-11	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
Arithmetic Mean ($\bar{x}$)		5000	4500	27200	13700	22500
Arithmetic SD (s)		400	300	2100	1400	2000
Arithmetic RSD (%)		7.0	6.7	7.7	10	8.9
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021: Additional Elements in Whole Blood

Whole Blood Ag (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
147	ICP-MS	<0.302	<0.302	<0.302	<0.302	<0.302

Whole Blood Al (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
147	ICP-MS	<5.13	<5.13	<5.13	<5.13	<5.13
597	ICP-MS/MS	<6.91	9.27	<6.91	7.49	8.14

Whole Blood Bi (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
147	ICP-MS	<0.0334	<0.0334	<0.0334	<0.0334	<0.0334
597	ICP-MS/MS	<0.0469	<0.0469	<0.0469	<0.0469	<0.0469

Whole Blood I (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
147	ICP-MS	23.3	27.8	30.6	28.5	23.3

Whole Blood Li (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
147	ICP-MS	0.515	0.549	0.985	0.622	0.510

Whole Blood Mg (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
597	ICP-MS/MS	27400	33200	33500	34200	28100

Whole Blood Te (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
147	ICP-MS	<0.117	<0.117	<0.117	<0.117	<0.117

Whole Blood Th (µg/L)						
Lab Code	**Method**	**BE21-11**	**BE21-12**	**BE21-13**	**BE21-14**	**BE21-15**
147	ICP-MS	<0.0278	<0.0278	<0.0278	<0.0278	<0.0278
597	ICP-MS/MS	0.128	0.0912	0.0328	0.0720	0.0502

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Event #3, 2021

Trace Elements in Urine

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Trace Elements Laboratory

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Event #3, 2021:
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), titanium (Ti), vanadium (V), tungsten (W), and zinc (Zn). 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

Ten elements in urine are formally graded: As, Ba, Be, Cd, Co, Cr, 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.

Urine Hg

The statistical data for urine Hg show the %RSD varies from ~17-22% for Hg concentrations well above most lab-reported LOQs. Typically we expect to see %RSD for these urine Hg pools to be in the range 8-11%. The inflated %RSD for this event suggests the PT samples for urine Hg may be unreliable. Consequently, we have suspended grading for urine Hg pending further investigation.

Additional Elements

An additional 22 elements were reported by at least one participant: Ag, Al, Bi, Cs, Cu, Fe, I, Li, Mg, Mo, Ni, Pt, Sb, Se, Sn, Sr, Te, Th, Ti, 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 #3, 2021: Summary Statistics

	Urine As (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	58.8	7.4	24.7	39.0	15.9
Upper Limit	70.6	13.4	30.7	46.8	21.9
Lower Limit	47.0	1.4	18.7	31.2	9.9
Robust SD (s*)	3.0	0.3	1.5	1.9	0.7
Robust RSD (%)	5.1	4.7	6.1	4.9	4.4
Number of Sample Measurements (N)	16	16	16	16	16
Standard Uncertainty (*u*)	0.9	0.1	0.5	0.6	0.2

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 #3, 2021:
Performance of Participating Laboratories

Urine As (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**58.8**	**7.4**	**24.7**	**39.0**	**15.9**
103	ICP-MS/MS	59.3	7.28	24.9	38.1	15.5
107	DRC/CC-ICP-MS	57.9	7.08	23.6	38.3	15.7
110	DRC/CC-ICP-MS	60.5	7.94	25.3	39.4	16.4
116	ICP-MS/MS	53.9	6.68	23.3	34.8	14.8
147	ICP-MS	60.9	7.34	25.4	40.4	16.4
264	ICP-MS	60.51	7.76	26.22	42.97	17.28
293	DRC/CC-ICP-MS	56.84	7.6	24.3	39.58	15.96
324	ICP-MS	63.34	7.87	26.31	40.54	15.62
399	DRC/CC-ICP-MS	59.3	7.28	23.0	39.0	15.2
442	DRC/CC-ICP-MS	62.8	7.39	28	40.2	15.9
597	ICP-MS/MS	57.3	7.62	25.0	37.2	15.6
598	DRC/CC-ICP-MS	48.9	5.94	22.7	35.4	14.4
605	ICP-MS	59.4	7.49	25.3	39.7	16.4
606	ICP-MS/MS	61.2	7.68	25.5	41.5	16.6
676	DRC/CC-ICP-MS	56.7	7.2	23.1	36.3	16.1
686	DRC/CC-ICP-MS	55.6	7.39	24.0	39.0	15.9

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

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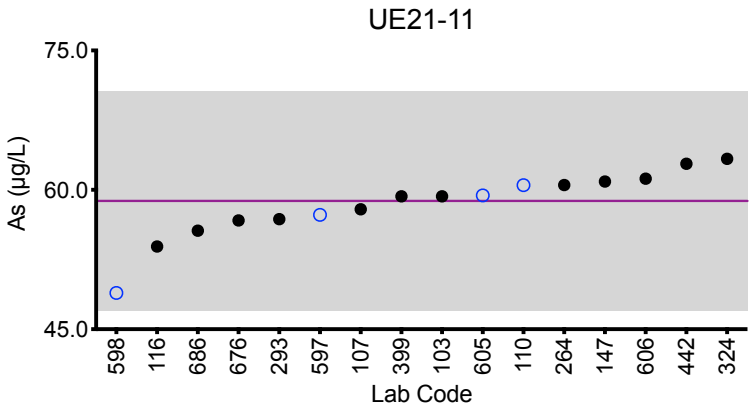
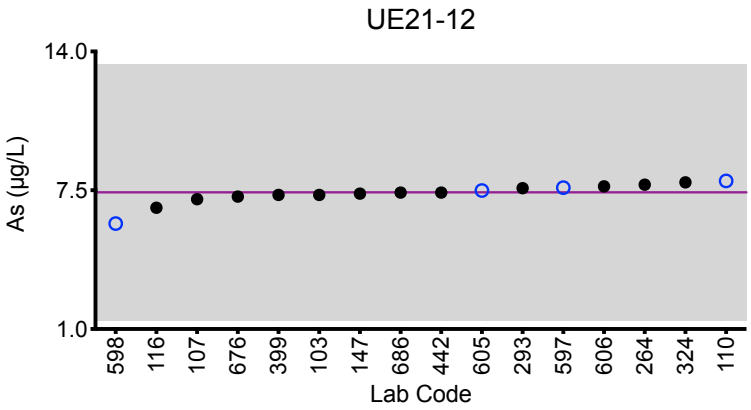
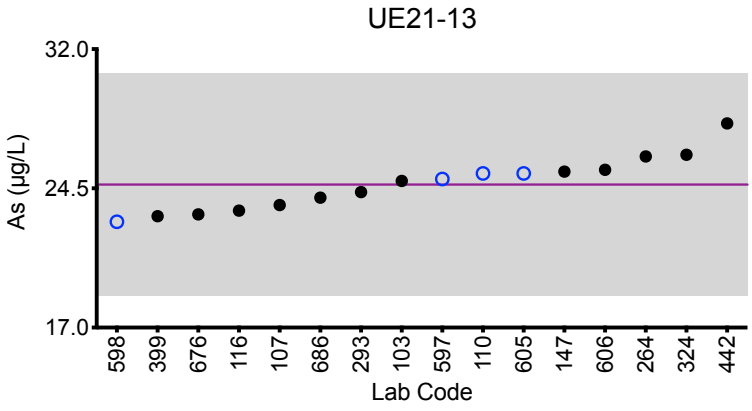
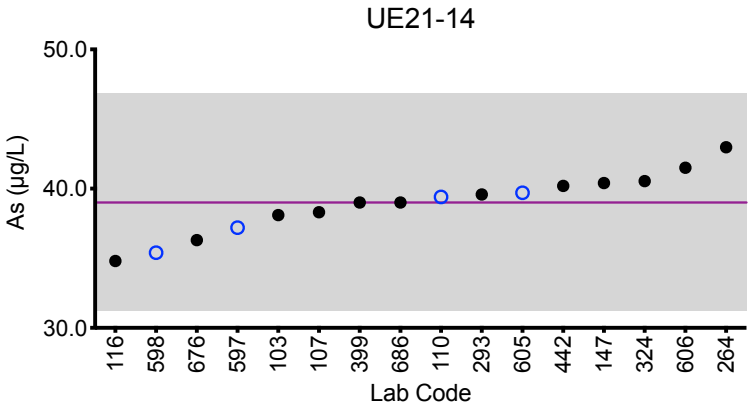
Results for Event #3, 2021: Summary Figures

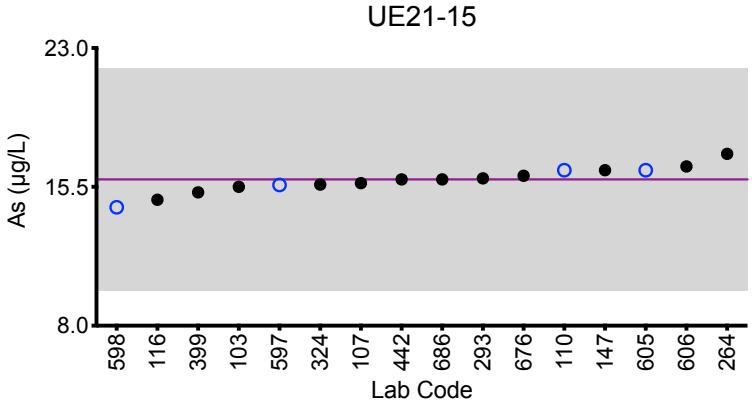
Urine As











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 #3, 2021: Summary Statistics

	Urine Ba (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	4.65	2.70	0.61	7.0	1.15
Upper Limit	5.65	3.70	1.61	8.4	2.15
Lower Limit	3.65	1.70	0.00	5.6	0.15
Robust SD (s*)	0.24	0.17	0.11	0.4	0.08
Robust RSD (%)	5.2	6.3	18	5.9	6.9
Number of Sample Measurements (N)	14	14	12	14	14
Standard Uncertainty (*u*)	0.08	0.06	0.04	0.1	0.03

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 #3, 2021:
Performance of Participating Laboratories

		Urine Ba (µg/L)				
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**4.65**	**2.70**	**0.61**	**7.0**	**1.15**
107	ICP-MS	4.43	2.21	0.565	6.54	1.13
110	ICP-MS	5.30	3.27	0.73	8.17	1.36
116	ICP-MS/MS	4.49	2.70	0.531	6.66	1.26
147	ICP-MS	4.79	2.88	<0.687	6.66	1.14
220	ICP-MS	4.49	2.56	0.37	7.02	0.94
264	ICP-MS	4.60	2.70	0.62	7.06	1.16
399	ICP-MS/MS	4.84	2.76	0.631	7.18	1.18
597	ICP-MS/MS	4.62	2.76	0.804	7.40	1.21
598	ICP-MS	4.22	2.38	0.55	6.53	1.09
605	ICP-MS	4.94	2.58	<0.600	7.12	1.11
606	ICP-MS/MS	4.54	2.76	0.545	7.74	1.20
607	ICP-MS	4.87	2.92	0.694	6.94	1.20
676	ICP-MS	4.75	2.72	0.526	6.81	1.02
686	ICP-MS	4.49	2.62	0.796	6.74	1.14

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.

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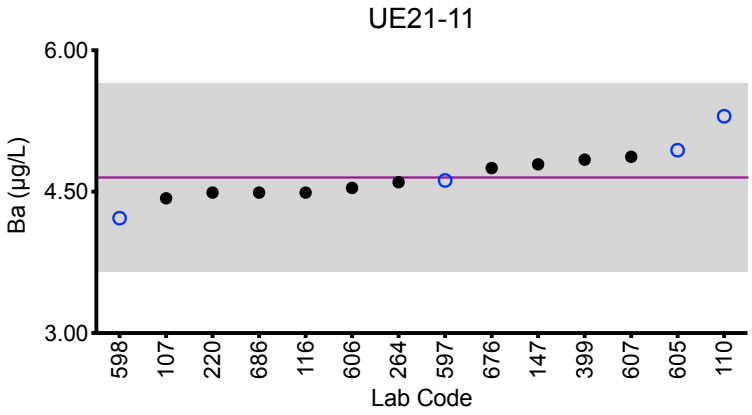
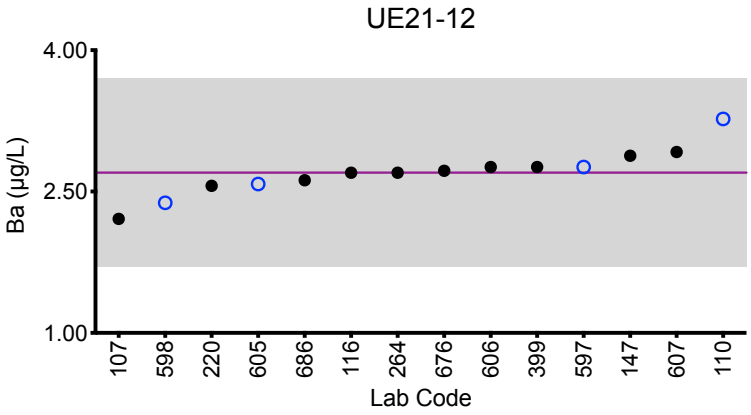
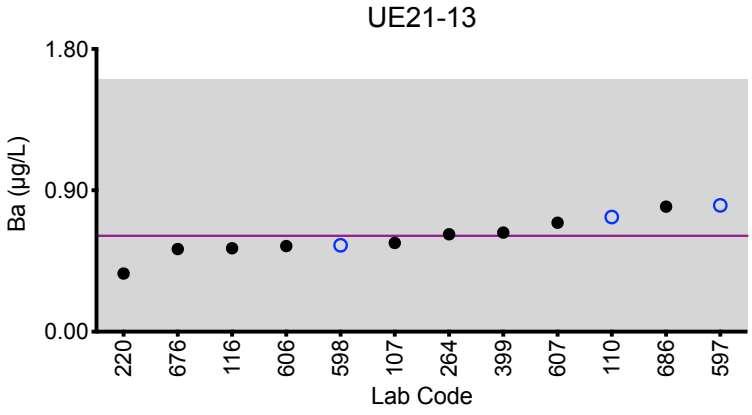
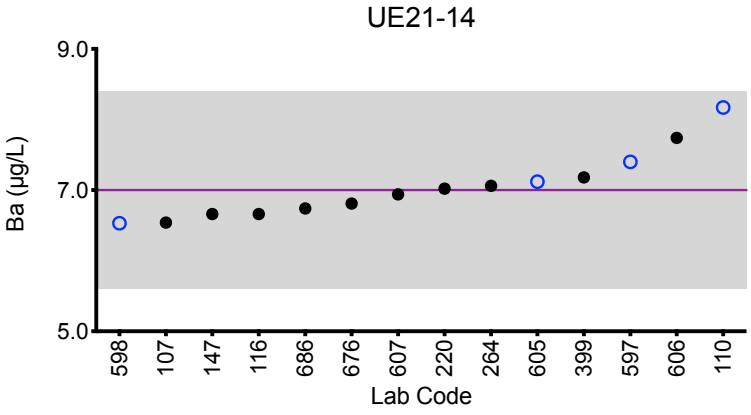
Results for Event #3, 2021: Summary Figures

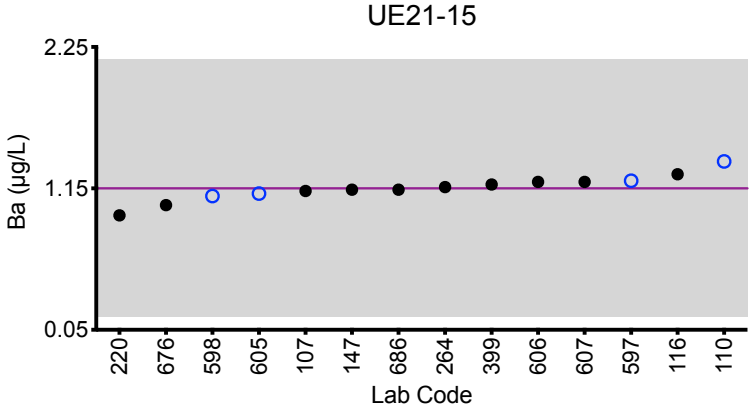
Urine Ba











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 #3, 2021: Summary Statistics

	Urine Be (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	0.55	1.65	4.49	2.49	3.39
Upper Limit	1.55	2.65	5.49	3.49	4.39
Lower Limit	0.00	0.65	3.49	1.49	2.39
Robust SD (s*)	0.04	0.10	0.21	0.12	0.22
Robust RSD (%)	6.7	6.1	4.7	4.8	6.5
Number of Sample Measurements (N)	14	14	14	14	14
Standard Uncertainty (*u*)	0.01	0.03	0.07	0.04	0.07

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 #3, 2021:
Performance of Participating Laboratories

Urine Be (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**0.55**	**1.65**	**4.49**	**2.49**	**3.39**
107	ICP-MS	0.494	1.52	3.81	2.20	3.13
110	ICP-MS	0.591	1.87	5.03	2.74	3.74
116	ICP-MS/MS	0.561	1.54	4.13	2.26	3.04
147	ICP-MS	0.564	1.64	4.40	2.50	3.44
220	ICP-MS	0.55	1.71	4.55	2.54	3.47
264	ICP-MS	0.55	1.72	4.76	2.71	3.62
293	DRC/CC-ICP-MS	0.56	1.77	4.69	2.61	3.54
399	ICP-MS/MS	0.531	1.64	4.38	2.51	3.39
597	ICP-MS/MS	0.530	1.63	4.53	2.47	3.29
598	ICP-MS	0.496	1.61	4.39	2.40	3.23
605	ICP-MS	0.583	1.73	4.62	2.53	3.52
607	ICP-MS	0.572	1.70	4.49	2.47	3.33
676	ICP-MS	0.598	1.61	4.55	2.51	3.55
686	ICP-MS	0.483	1.52	4.11	2.33	3.11

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

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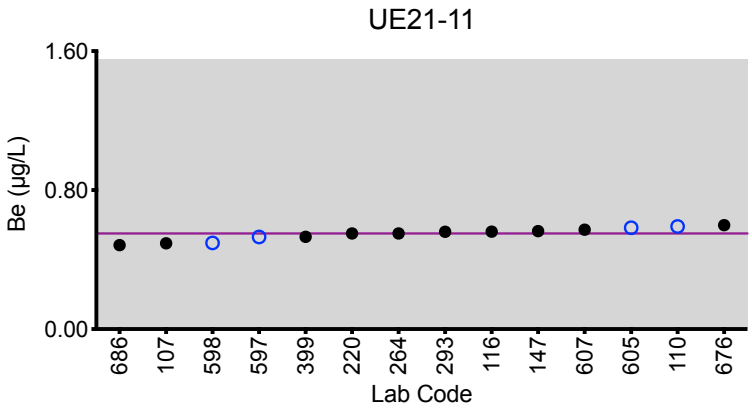
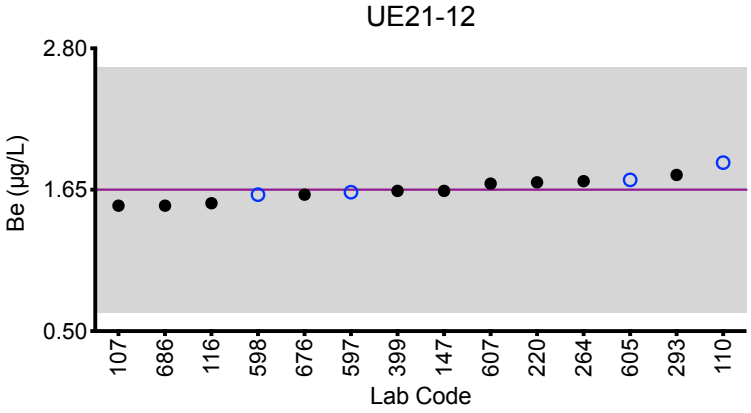
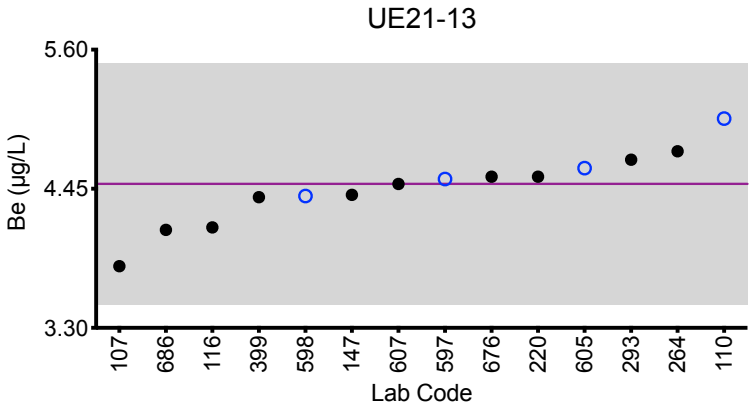
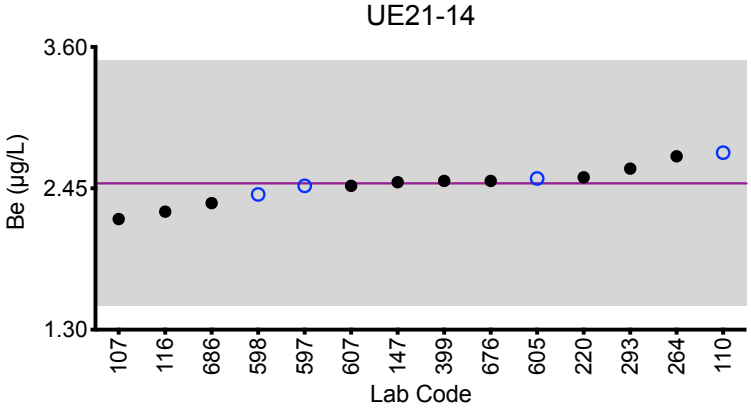
Results for Event #3, 2021: Summary Figures

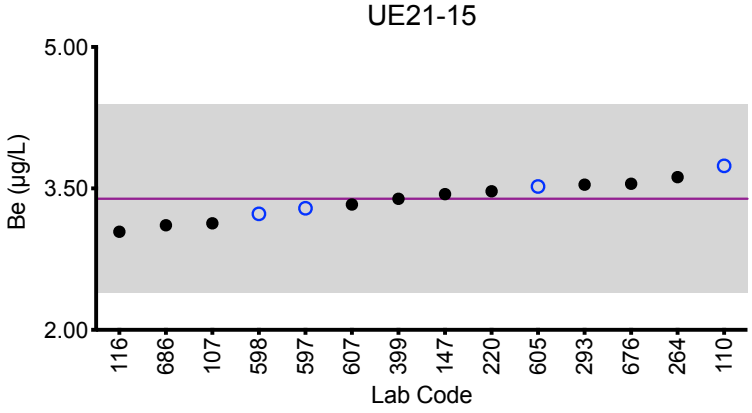
Urine Be











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:

±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 #3, 2021: Summary Statistics

	Urine Cd (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	4.73	0.73	3.35	0.46	1.81
Upper Limit	5.73	1.73	4.35	1.46	2.81
Lower Limit	3.73	0.00	2.35	0.00	0.81
Robust SD (s*)	0.21	0.06	0.17	0.04	0.12
Robust RSD (%)	4.4	8.2	5.1	8.1	6.6
Number of Sample Measurements (N)	19	18	19	18	19
Standard Uncertainty (*u*)	0.06	0.02	0.05	0.01	0.03

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 #3, 2021:
Performance of Participating Laboratories

		Urine Cd (µg/L)				
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**4.73**	**0.73**	**3.35**	**0.46**	**1.81**
103	ICP-MS/MS	4.93	0.758	3.51	0.481	1.88
107	DRC/CC-ICP-MS	4.84	0.652	3.04	0.417	1.66
110	ICP-MS	4.78	0.697	3.46	0.430	1.69
116	ICP-MS/MS	4.20	0.810	3.18	0.410	1.86
147	ICP-MS	4.70	0.692	3.28	0.436	1.76
220	ICP-MS	4.62	0.74	3.37	0.49	1.84
264	ICP-MS	4.83	0.73	3.60	0.50	1.92
293	DRC/CC-ICP-MS	4.64	0.72	3.35	0.47	1.81
324	ICP-MS	4.87	<1	3.56	<1	1.89
391	ICP-MS	4.363	0.848	3.211	0.447	1.845
399	DRC/CC-ICP-MS	4.80	0.762	3.47	0.485	1.88
442	DRC/CC-ICP-MS	5.18	0.624	3.43	0.470	2.00
597	ICP-MS/MS	4.84	0.755	3.31	0.449	1.84
598	DRC/CC-ICP-MS	3.74	0.586	2.93	0.395	1.50
605	ICP-MS	4.75	0.728	3.38	0.449	1.82
606	ICP-MS/MS	4.56	0.684	3.28	0.448	1.75
607	ICP-MS	4.34	0.824	3.17	0.446	1.65
676	DRC/CC-ICP-MS	4.84	0.728	3.36	0.505	1.68
686	ICP-MS	5.02	0.786	3.58	0.509	1.97

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

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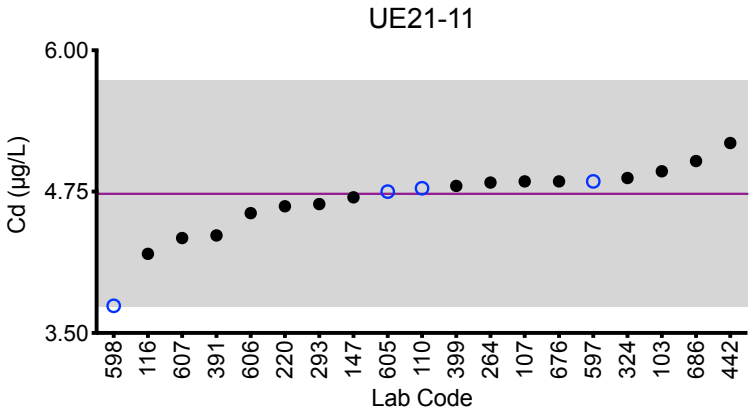
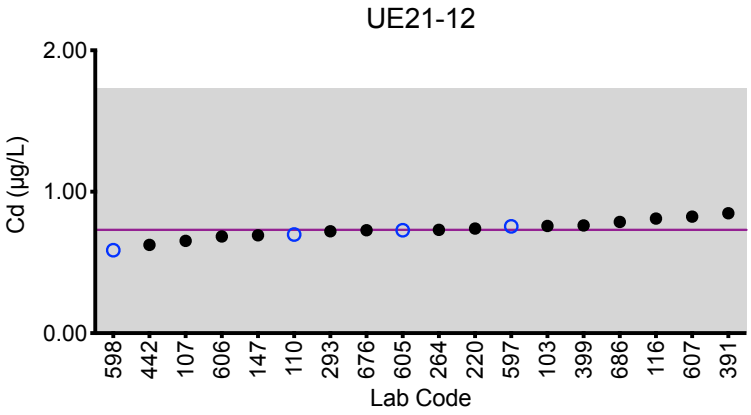
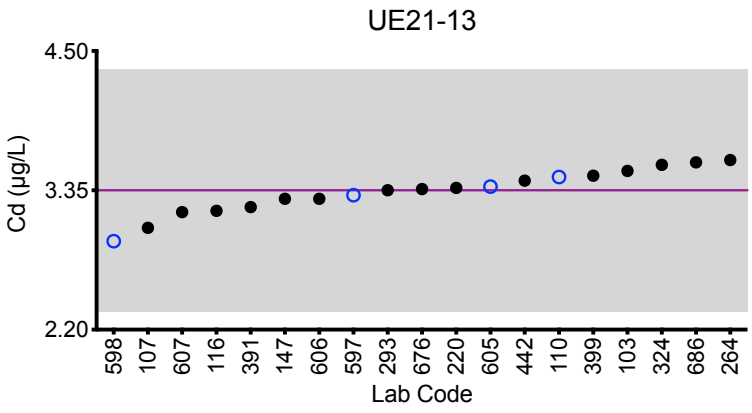
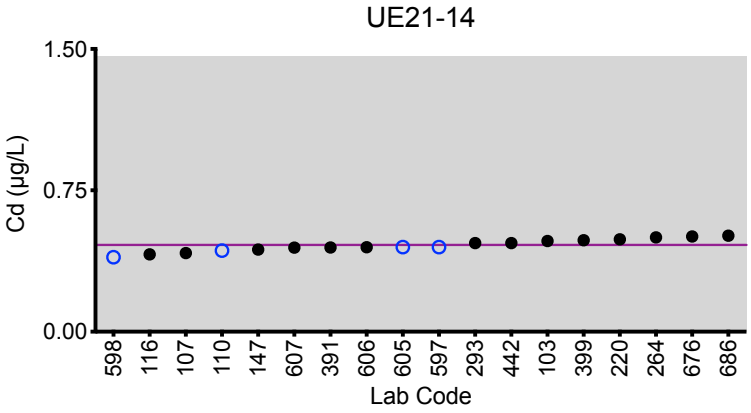
Results for Event #3, 2021: Summary Figures

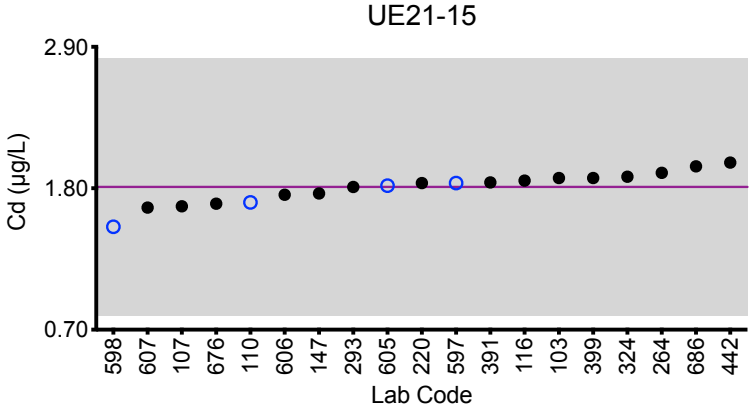
Urine Cd











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 #3, 2021: Summary Statistics

	Urine Co (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	5.14	4.89	2.02	6.39	1.01
Upper Limit	6.64	6.39	3.52	7.89	2.51
Lower Limit	3.64	3.39	0.52	4.89	0.00
Robust SD (s*)	0.22	0.18	0.10	0.30	0.07
Robust RSD (%)	4.3	3.7	5.1	4.7	6.9
Number of Sample Measurements (N)	15	15	15	15	15
Standard Uncertainty (*u*)	0.07	0.06	0.03	0.1	0.02

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 #3, 2021:
Performance of Participating Laboratories

Urine Co (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**5.14**	**4.89**	**2.02**	**6.39**	**1.01**
103	ICP-MS/MS	5.12	4.78	1.99	6.18	0.945
107	ICP-MS	4.73	4.57	1.75	5.87	0.896
110	ICP-MS	5.42	5.11	2.07	6.70	1.03
147	ICP-MS	4.93	4.58	1.90	6.13	0.949
220	ICP-MS	5.32	5.17	2.08	6.72	1.07
264	ICP-MS	4.97	4.87	1.99	6.44	0.98
293	DRC/CC-ICP-MS	5.18	4.92	2.01	6.46	0.97
324	ICP-MS	5.23	4.98	2.10	6.68	1.12
391	ICP-MS	7.763 ↑	7.497 ↑	4.388 ↑	6.628	3.607 ↑
399	DRC/CC-ICP-MS	5.01	4.82	1.94	6.23	0.933
597	ICP-MS/MS	5.03	4.88	1.95	6.09	0.960
598	ICP-MS	4.58	4.45	1.94	6.09	1.01
605	ICP-MS	5.28	5.03	2.07	6.68	1.03
606	ICP-MS/MS	5.24	4.92	2.16	6.31	1.05
676	ICP-MS	5.2	4.87	2.01	6.51	1.03

Based on the grading criteria for Co in Urine, 95% of results were satisfactory, with 1 of the 15 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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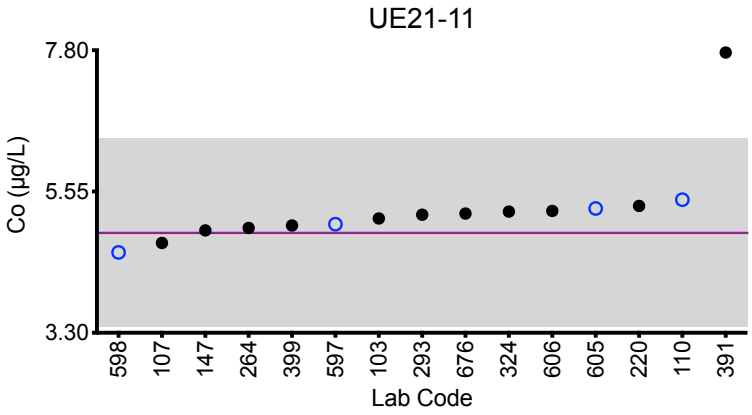
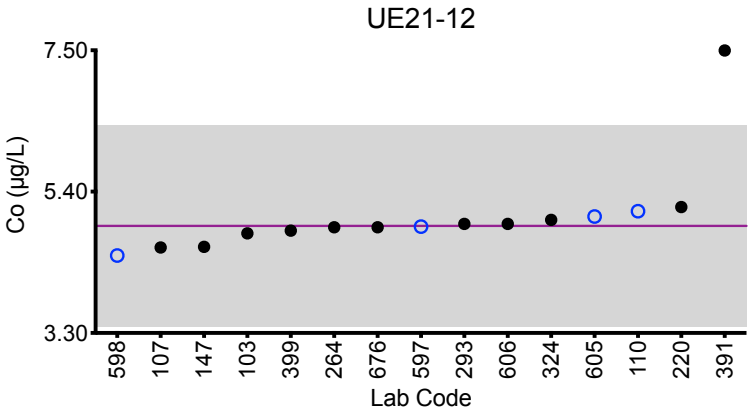
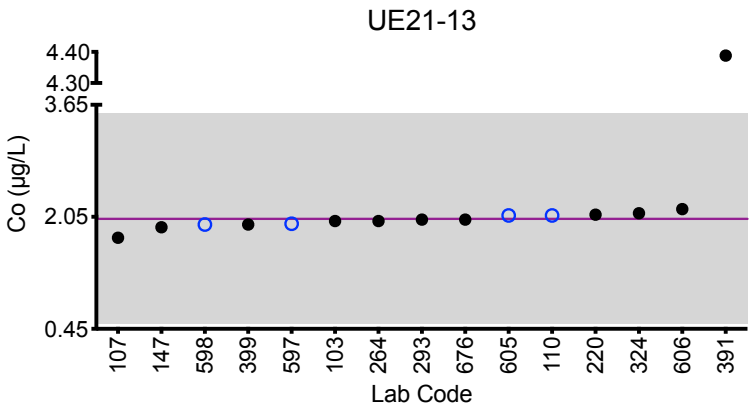
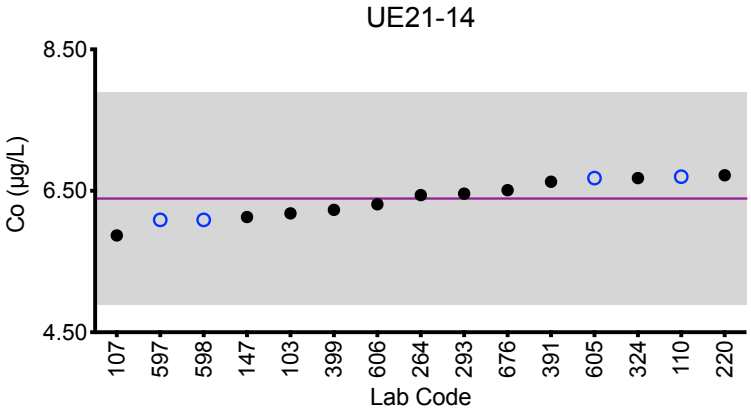
Results for Event #3, 2021: Summary Figures

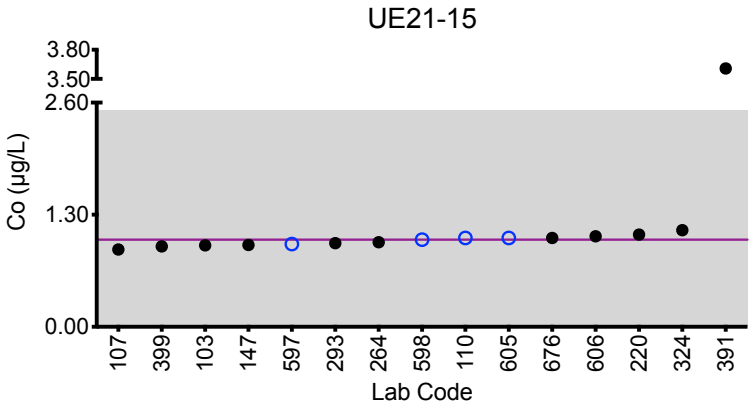
Urine Co











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 #3, 2021:
Summary Statistics

	Urine Cr (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	1.14	2.32	0.86	4.0	7.2
Upper Limit	4.14	5.32	3.86	7.0	10.2
Lower Limit	0.00	0.00	0.00	1.0	4.2
Robust SD (s*)	0.14	0.25	0.18	0.5	0.6
Robust RSD (%)	12	11	21	13	8.3
Number of Sample Measurements (N)	12	12	12	12	12
Standard Uncertainty (*u*)	0.05	0.09	0.07	0.2	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

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Results for Event #3, 2021:
Performance of Participating Laboratories

		Urine Cr (µg/L)				
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**1.14**	**2.32**	**0.86**	**4.0**	**7.2**
103	ICP-MS/MS	0.901	2.28	0.723	3.70	6.94
107	DRC/CC-ICP-MS	1.01	2.21	0.74	4.00	7.24
110	DRC/CC-ICP-MS	1.18	2.66	1.08	4.56	7.76
116	ICP-MS/MS	1.19	2.13	0.628	3.24	6.47
147	DRC/CC-ICP-MS	1.02	2.05	0.697	3.50	6.55
264	ICP-MS	1.13	2.34	0.94	4.16	7.34
293	DRC/CC-ICP-MS	1.1	2.38	0.8	3.95	7.2
324	ICP-MS	1.33	2.77	1.07	4.35	7.81
391	ICP-MS	3.967	7.206 ↑	4.731 ↑	11.436 ↑	11.206 ↑
597	ICP-MS/MS	1.40	2.20	0.965	3.77	7.23
598	DRC/CC-ICP-MS	1.11	1.95	0.752	3.53	6.30
605	ICP-MS	1.09	2.41	0.828	4.17	7.46

Based on the grading criteria for Cr in Urine, 93% of results were satisfactory, with 1 of the 12 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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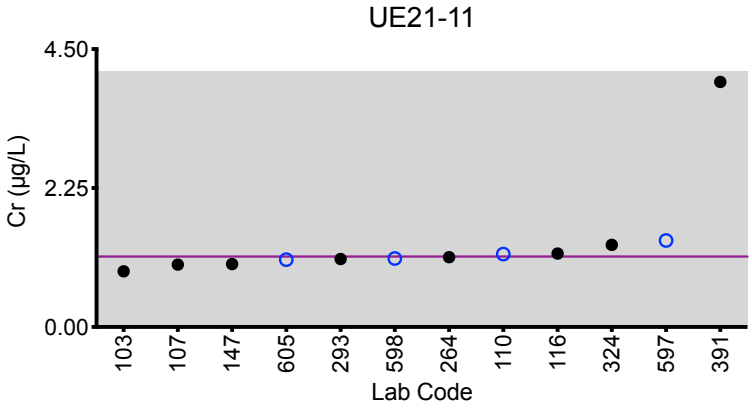
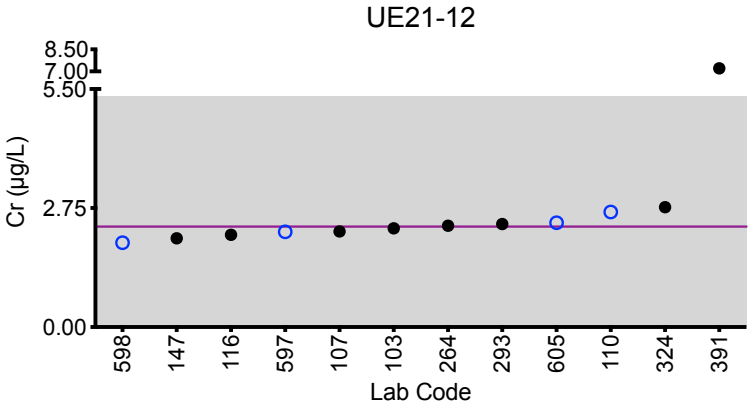
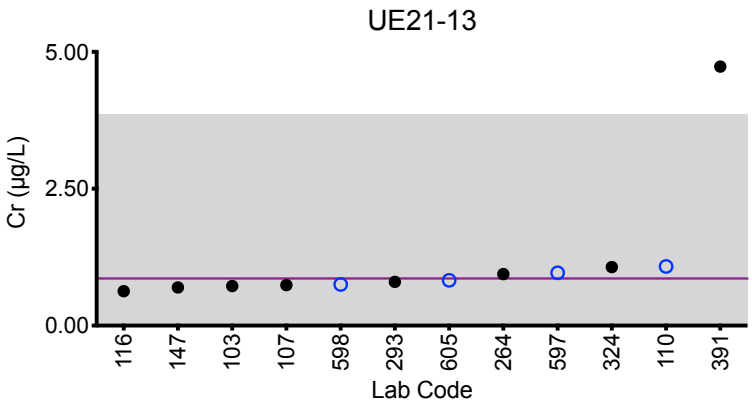
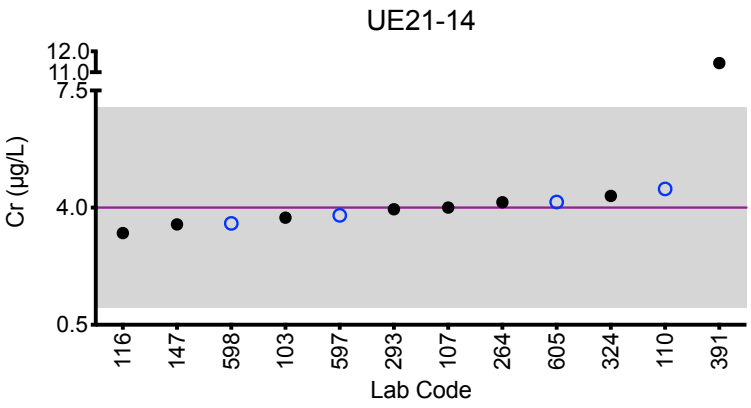
Results for Event #3, 2021: Summary Figures

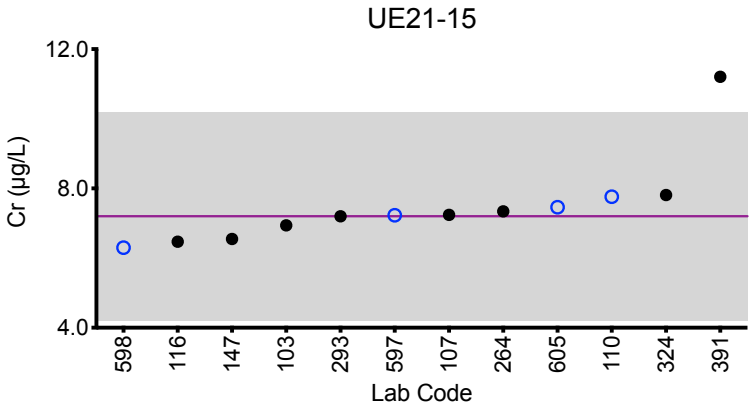
Urine Cr











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 #3, 2021:
Summary Statistics

	Urine Hg (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	25.6	2.31	9.0	0.47	4.6
Upper Limit	33.3	5.31	12.0	3.47	7.6
Lower Limit	17.9	0.00	6.0	0.00	1.6
Robust SD (s*)	1.8	0.19	0.6	0.17	0.7
Robust RSD (%)	6.8	8.2	6.7	36	15
Number of Sample Measurements (N)	15	15	15	11	15
Standard Uncertainty (*u*)	0.6	0.06	0.2	0.06	0.2

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 #3, 2021:
Performance of Participating Laboratories

		Urine Hg (µg/L)				
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**25.6**	**2.31**	**9.0**	**0.47**	**4.6**
103	ICP-MS/MS	26.8	2.44	9.55	0.488	5.18
107	DRC/CC-ICP-MS	26.9	2.37	9.49	0.41	4.65
110	ICP-MS	25.9	2.30	9.19	0.304	4.87
116	ICP-MS/MS	19.6	1.77	7.16	<0.500	3.27
147	ICP-MS	25.9	2.29	9.33	0.520	4.81
264	ICP-MS	24.31	2.14	7.10	0.68	2.96
293	DRC/CC-ICP-MS	25.28	2.4	8.89	0.52	4.66
391	ICP-MS	21.105	2.552	6.305	0.583	3.235
442	DRC/CC-ICP-MS	26.1	2.23	9.38	0.305	5.21
597	ICP-MS/MS	22.1	2.31	8.39	0.723	4.41
598	ICP-MS	20.8	2.10	7.51	0.416	4.06
605	ICP-MS	25.9	2.21	8.89	<1.00	4.69
606	ICP-MS/MS	28.2	2.49	9.32	<1.00	5.23
676	ICP-MS	26.3	2.14	9.1	0.001	4.61
686	ICP-MS	28.8	2.77	10.8	<1.00	5.44

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

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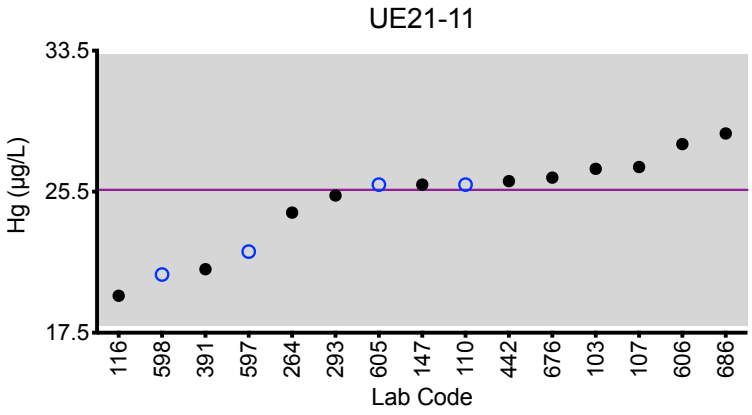
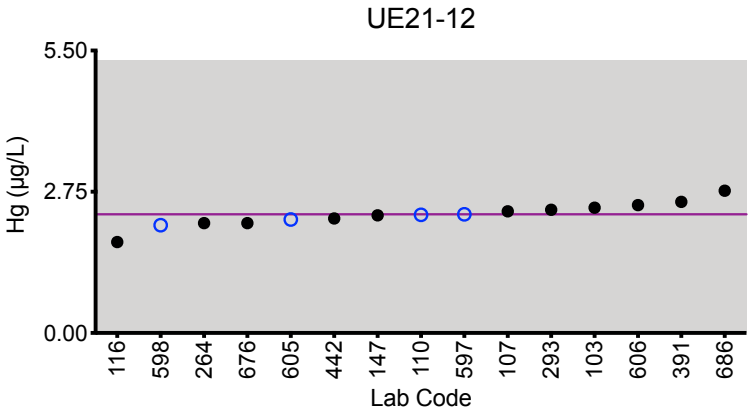
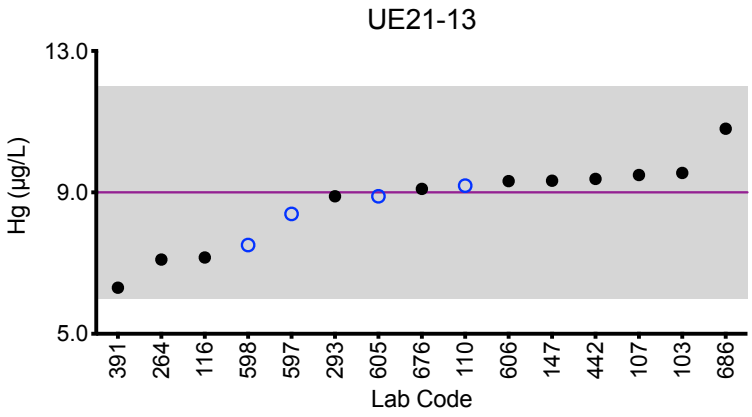
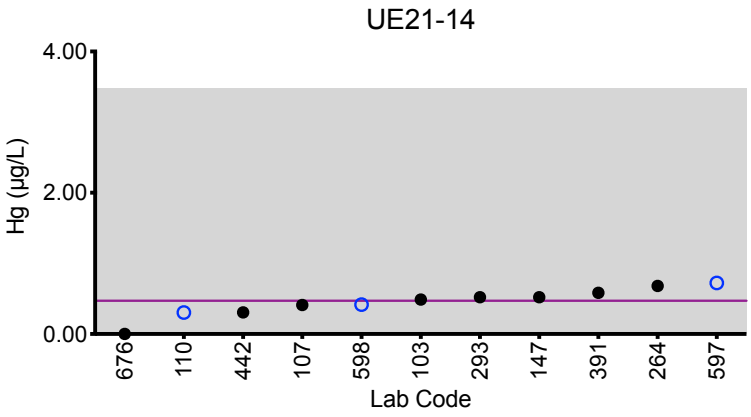
Results for Event #3, 2021: Summary Figures

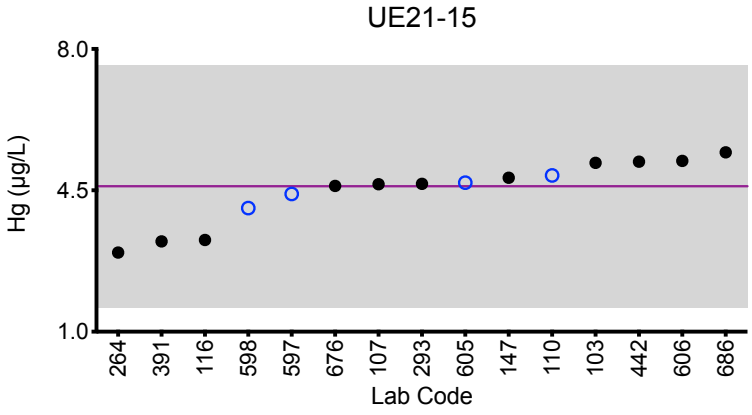
Urine Hg











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 #3, 2021: Summary Statistics

	Urine Mn (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	3.24	8.1	0.76	2.59	1.67
Upper Limit	4.05	10.1	1.31	3.24	2.22
Lower Limit	2.43	6.1	0.21	1.94	1.12
Robust SD (s*)	0.17	0.6	0.09	0.24	0.15
Robust RSD (%)	5.2	7.4	12	9.3	9.0
Number of Sample Measurements (N)	16	16	15	16	16
Standard Uncertainty (*u*)	0.05	0.2	0.03	0.08	0.05

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 #3, 2021:
Performance of Participating Laboratories

		Urine Mn (µg/L)				
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**3.24**	**8.1**	**0.76**	**2.59**	**1.67**
103	ICP-MS/MS	3.34	8.12	0.761	2.53	1.62
107	DRC/CC-ICP-MS	3.16	7.67	0.706	2.38	1.56
110	DRC/CC-ICP-MS	3.54	8.96	0.821	2.83	1.78
116	ICP-MS/MS	2.76	6.94	0.405	1.88 ↓	1.04 ↓
147	DRC/CC-ICP-MS	3.22	7.58	0.725	2.45	1.57
220	DRC/CC-ICP-MS	3.23	8.09	0.73	2.59	1.78
264	ICP-MS	3.23	8.14	0.78	2.75	1.78
293	DRC/CC-ICP-MS	3.35	8.37	0.76	2.65	1.71
324	ICP-MS	3.44	8.83	<1	3.10	1.83
391	ICP-MS	3.004	9.016	0.638	2.427	1.562
399	DRC/CC-ICP-MS	3.23	8.19	0.925	2.58	1.64
597	ICP-MS/MS	3.29	7.92	0.870	2.65	1.65
598	ICP-MS	3.00	7.67	0.79	2.55	1.67
605	ICP-MS	3.34	8.41	0.777	2.78	1.77
606	ICP-MS/MS	3.38	8.42	0.852	2.86	1.91
676	DRC/CC-ICP-MS	3.2	7.37	0.621	2.11	1.35

Based on the grading criteria for Mn in Urine, 98% of results were satisfactory, with 1 of the 16 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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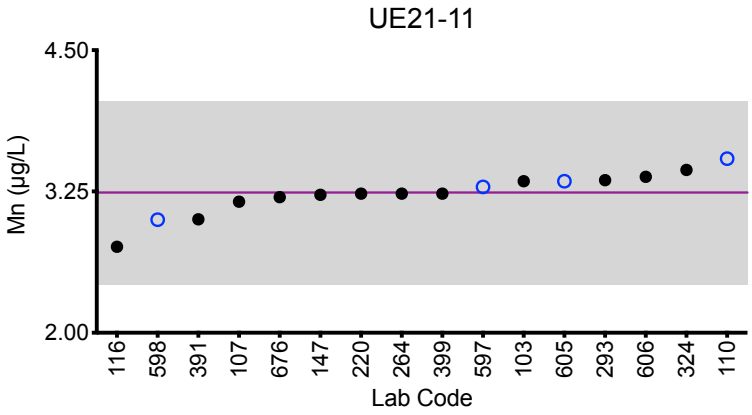
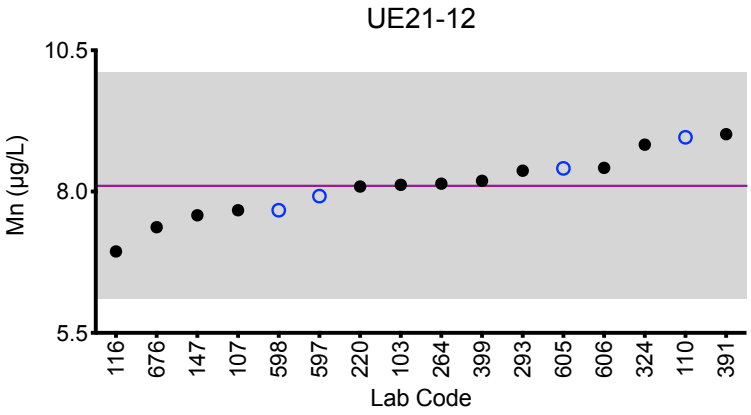
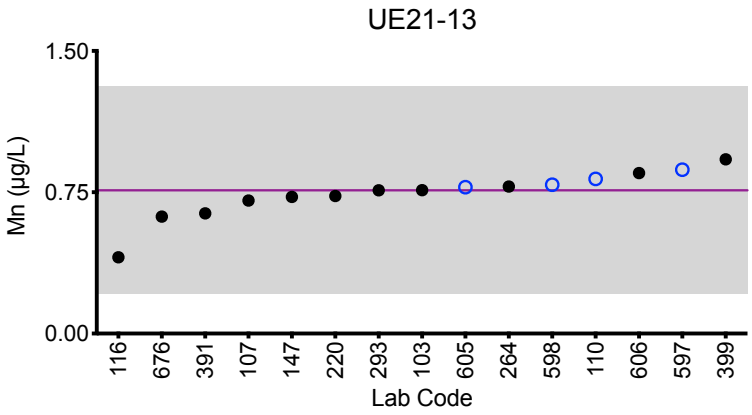
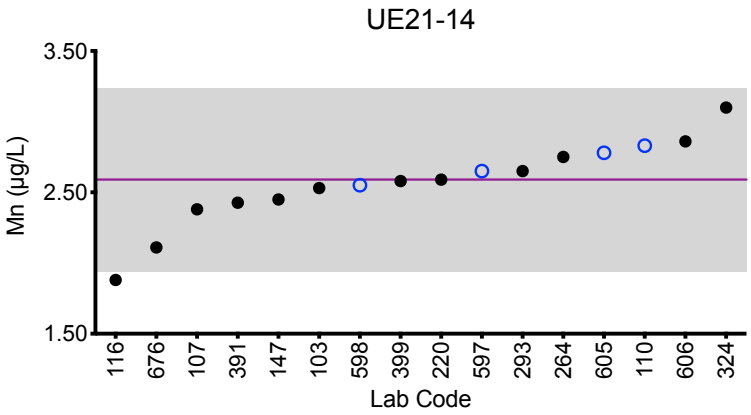
Results for Event #3, 2021: Summary Figures

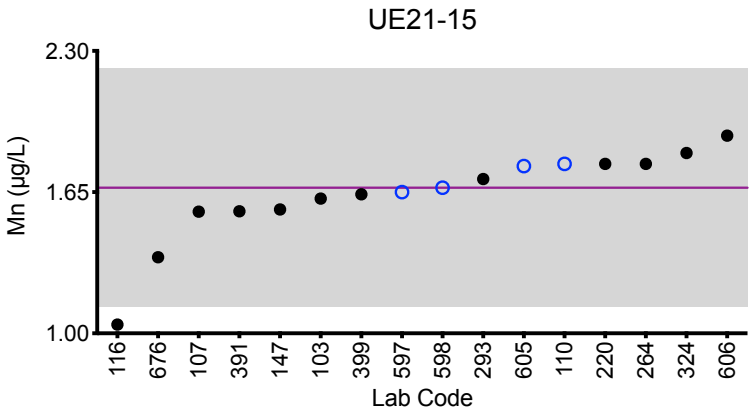
Urine Mn











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 #3, 2021: Summary Statistics

	Urine Pb (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	0.61	2.20	0.33	10.4	3.54
Upper Limit	1.61	3.20	1.33	12.4	4.54
Lower Limit	0.00	1.20	0.00	8.3	2.54
Robust SD (s*)	0.04	0.11	0.04	0.5	0.16
Robust RSD (%)	7.1	5.1	12	4.9	4.5
Number of Sample Measurements (N)	18	19	16	19	19
Standard Uncertainty (*u*)	0.01	0.03	0.01	0.1	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 #3, 2021:
Performance of Participating Laboratories

		Urine Pb (µg/L)				
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**0.61**	**2.20**	**0.33**	**10.4**	**3.54**
103	ICP-MS/MS	0.660	2.28	0.357	10.8	3.69
107	ICP-MS	0.616	1.82	0.307	9.96	3.55
110	ICP-MS	0.63	2.30	0.35	10.5	3.69
116	ICP-MS/MS	0.541	1.98	<0.300	9.66	3.25
147	ICP-MS	0.642	2.18	0.342	10.5	3.56
220	ICP-MS	0.56	2.10	0.29	10.1	3.39
264	ICP-MS	0.66	2.29	0.34	10.96	3.73
293	DRC/CC-ICP-MS	0.61	2.2	0.31	10.31	3.43
324	ICP-MS	<1	2.28	<1	10.45	3.57
391	ICP-MS	0.618	2.439	0.392	9.569	3.368
399	ICP-MS/MS	0.644	2.25	0.351	10.9	3.66
442	DRC/CC-ICP-MS	0.579	2.26	0.304	10.9	3.62
597	ICP-MS/MS	0.579	2.17	0.363	10.0	3.42
598	ICP-MS	0.534	1.81	0.281	8.58	2.92
605	ICP-MS	0.624	2.19	<0.300	9.86	3.63
606	ICP-MS/MS	0.594	2.17	0.316	10.5	3.51
607	ICP-MS	0.612	2.26	0.304	10.8	3.58
676	ICP-MS	0.529	2.15	0.205	10.4	3.49
686	ICP-MS	0.639	2.28	0.396	10.8	3.75

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

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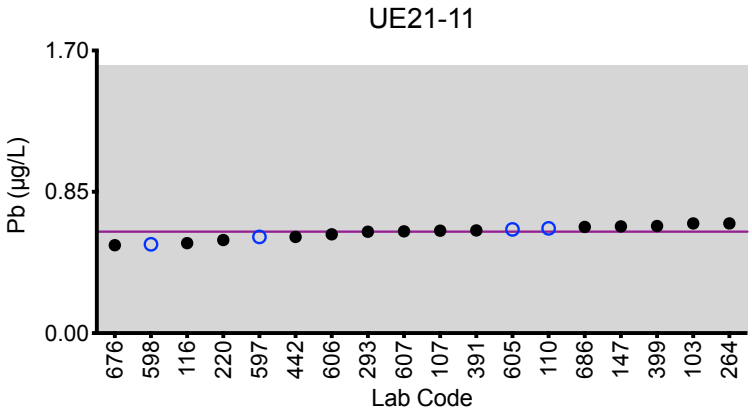
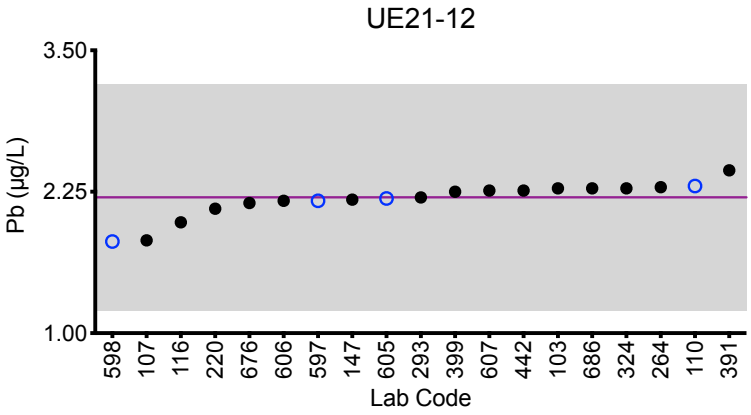
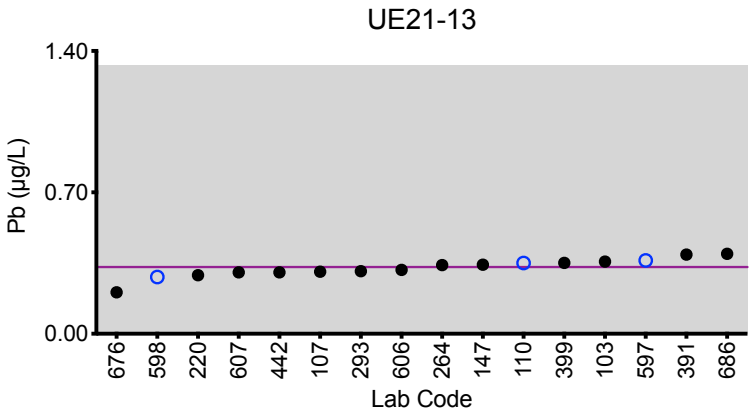
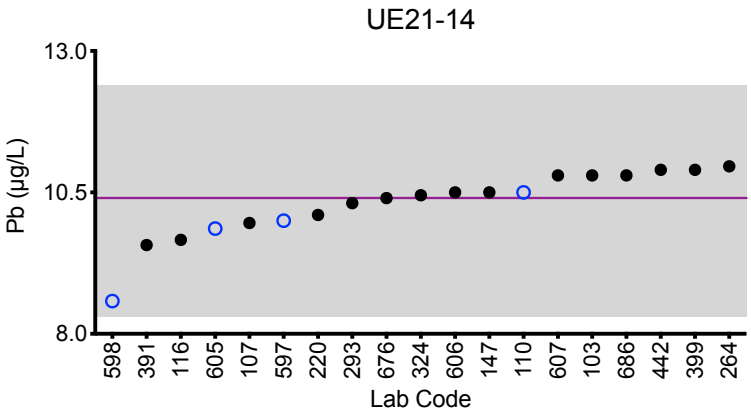
Results for Event #3, 2021: Summary Figures

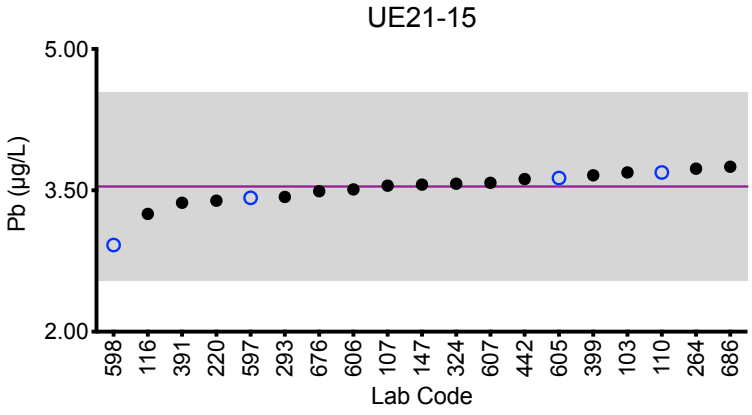
Urine Pb











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:

±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 #3, 2021: Summary Statistics

	Urine Tl (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	4.77	0.813	2.94	0.462	0.200
Upper Limit	5.72	1.013	3.53	0.662	0.400
Lower Limit	3.82	0.613	2.35	0.262	0.000
Robust SD (s*)	0.20	0.025	0.15	0.026	0.015
Robust RSD (%)	4.2	3.1	5.1	5.6	7.5
Number of Sample Measurements (N)	17	17	17	17	17
Standard Uncertainty (*u*)	0.06	0.008	0.05	0.008	0.005

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 #3, 2021:
Performance of Participating Laboratories

Urine Tl (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**4.77**	**0.813**	**2.94**	**0.462**	**0.200**
103	ICP-MS/MS	5.07	0.851	3.21	0.493	0.216
107	ICP-MS	4.87	0.799	2.74	0.447	0.196
110	ICP-MS	4.80	0.836	3.03	0.534	0.288
116	ICP-MS/MS	4.65	0.766	2.89	0.443	0.191
147	ICP-MS	4.89	0.801	2.90	0.462	0.196
220	ICP-MS	4.64	0.77	2.90	0.45	0.19
264	ICP-MS	4.97	0.83	3.12	0.49	0.21
293	DRC/CC-ICP-MS	5.04	0.83	3.11	0.48	0.21
391	ICP-MS	4.425	0.826	2.779	0.458	0.218
399	ICP-MS/MS	4.82	0.803	2.94	0.467	0.200
597	ICP-MS/MS	4.70	0.832	2.96	0.443	0.173
598	ICP-MS	4.23	0.673	2.56	0.422	0.179
605	ICP-MS	4.39	0.737	2.65	0.408	0.186
606	ICP-MS/MS	4.67	0.804	2.94	0.459	0.191
607	ICP-MS	4.84	0.820	2.91	0.473	0.210
676	ICP-MS	4.77	0.818	3.01	0.482	0.205
686	ICP-MS	4.89	0.834	3.06	0.466	0.204

Based on the grading criteria for Tl 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.

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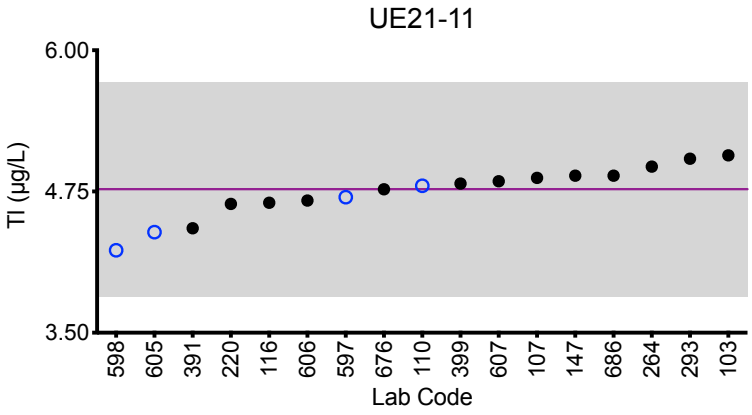
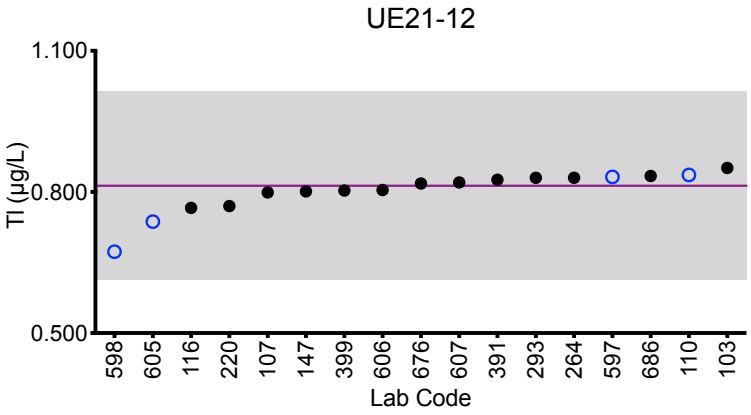
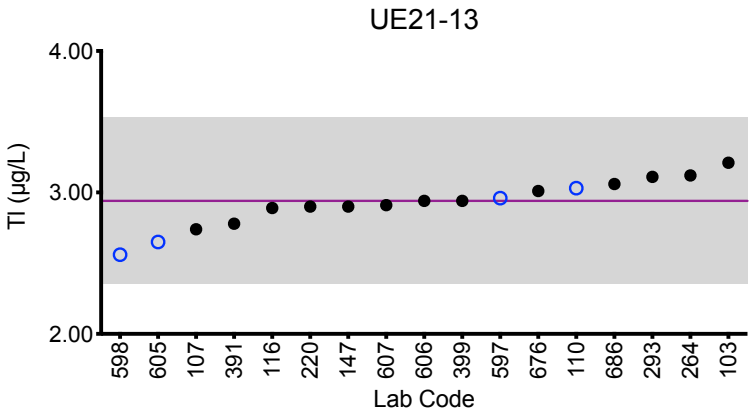
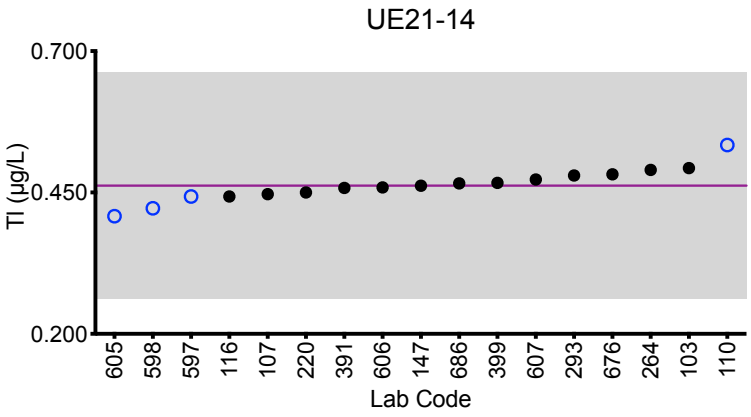
Results for Event #3, 2021: Summary Figures

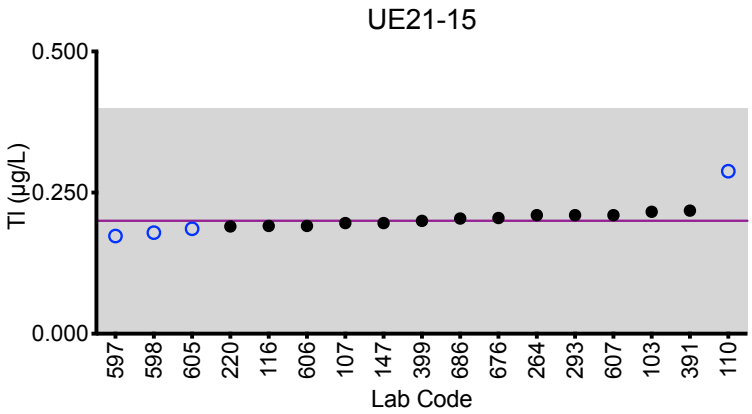
Urine Tl











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 #3, 2021: Summary Statistics

	Urine U (µg/L)				
	UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Target (Robust Mean (x*))	0.169	0.0128	0.112	0.048	0.0290
Upper Limit	0.203	0.0428	0.142	0.078	0.0590
Lower Limit	0.135	0.0000	0.082	0.018	0.0000
Robust SD (s*)	0.005	0.0017	0.008	0.004	0.0029
Robust RSD (%)	3.2	13	7.1	7.6	10
Number of Sample Measurements (N)	17	14	17	17	17
Standard Uncertainty (*u*)	0.002	0.0006	0.002	0.001	0.0009

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 #3, 2021:
Performance of Participating Laboratories

Urine U (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
	Target	**0.169**	**0.0128**	**0.112**	**0.048**	**0.0290**
103	ICP-MS/MS	0.177	<0.0200	0.121	0.0515	0.0329
107	ICP-MS	0.171	0.0105	0.107	0.0481	0.0295
110	ICP-MS	0.175	0.0133	0.119	0.0511	0.0301
116	ICP-MS/MS	0.159	<0.0150	0.102	0.0459	0.0269
147	ICP-MS	0.169	0.0131	0.110	0.0498	0.0269
220	ICP-MS	0.153	0.014	0.111	0.048	0.029
264	ICP-MS	0.17	0.01	0.12	0.05	0.03
324	ICP-MS	0.1460	0.0111	0.0948	0.0429	0.0238
391	ICP-MS	0.172	0.017	0.103	0.049	0.029
399	ICP-MS/MS	0.169	0.011	0.114	0.044	0.030
597	ICP-MS/MS	0.170	0.0120	0.113	0.0464	0.0250
598	ICP-MS	0.168	0.013	0.103	0.047	0.028
605	ICP-MS	0.168	0.013	0.107	0.046	0.027
606	ICP-MS/MS	0.168	0.014	0.114	0.053	0.032
607	ICP-MS	0.180	0.0172	0.119	0.0547	0.0353
676	ICP-MS	0.152	0.012	0.113	0.044	0.027
686	ICP-MS	0.179	<0.015	0.121	0.121 ↑	0.0315

Based on the grading criteria for U in Urine, 99% of results were satisfactory, with 0 of the 17 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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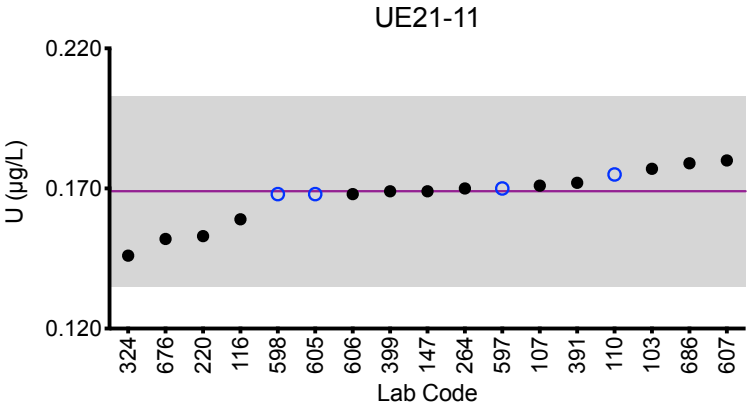
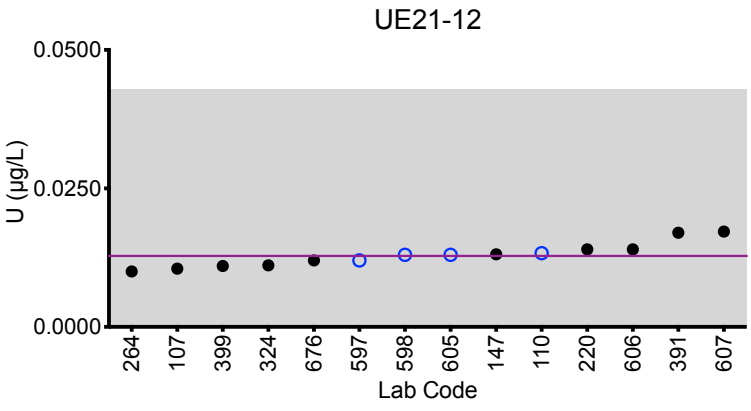
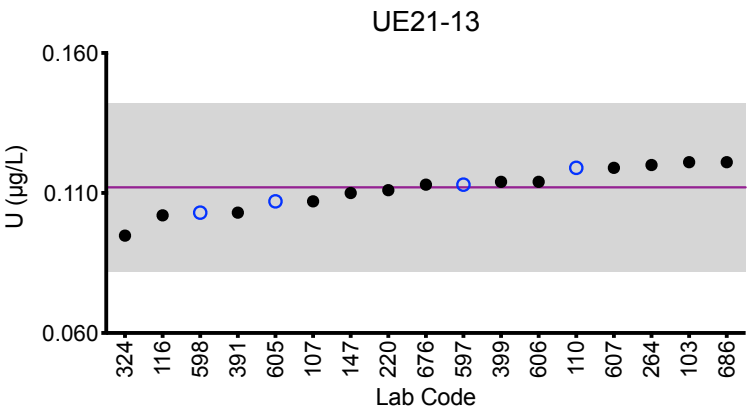
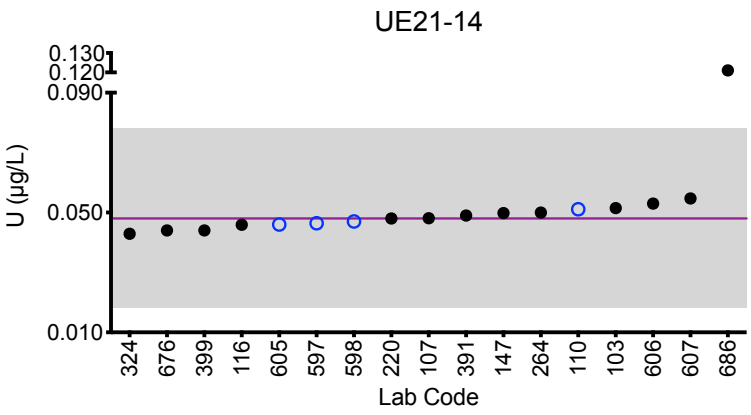
Results for Event #3, 2021: Summary Figures

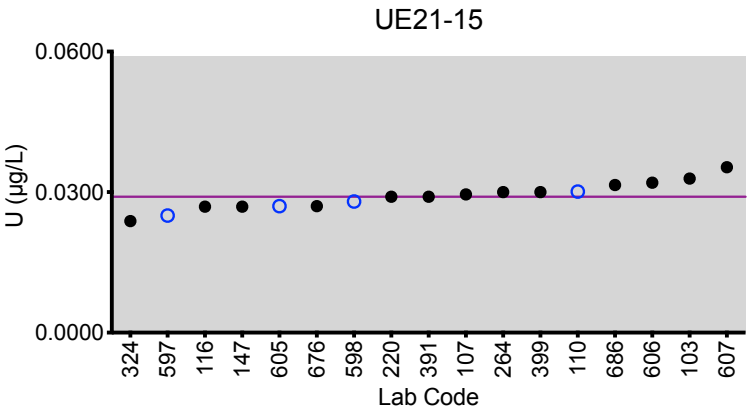
Urine U











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:

±0.03 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 #3, 2021:
Laboratory Data and Summary Statistics

Urine Al (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
147	ICP-MS	19.5	16.6	17.7	17.8	14.8
264	ICP-MS	17.50	11.21	14.52	17.18	7.83
293	DRC/CC-ICP-MS	20.16	12.37	16.13	18.01	9.95
324	ICP-MS	16.69	13.13	14.98	20.58	12.01
597	ICP-MS/MS	18.5	14.5	19.4	18.9	9.3

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Arithmetic Mean ($\bar{x}$)	18.5	13.6	16.5	18.5	11
Arithmetic SD (s)	1.4	2.1	2.0	1.3	3
Arithmetic RSD (%)	7.6	15	12	7.1	25
Number of Sample Measurements (N)	5	5	5	5	5

*Denotes a statistical Outlier.

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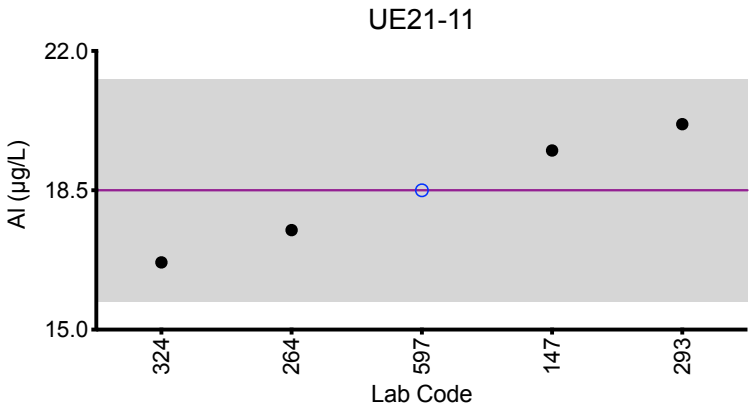
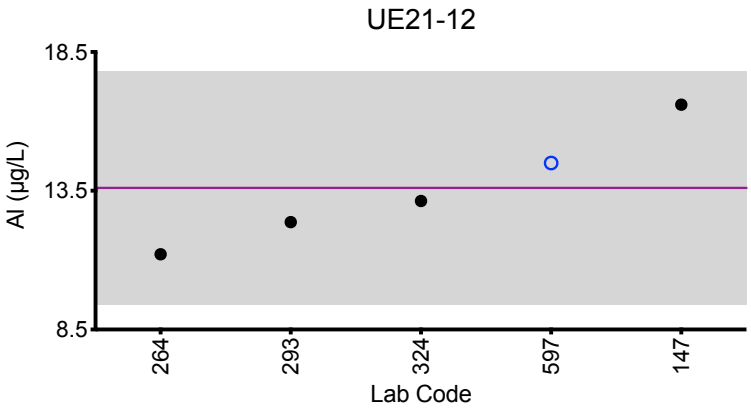
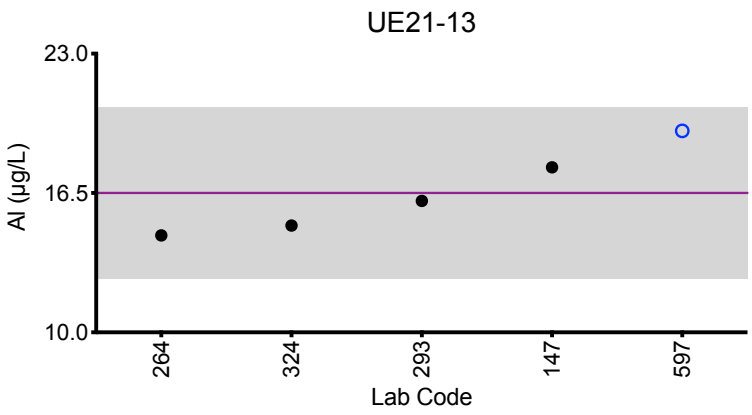
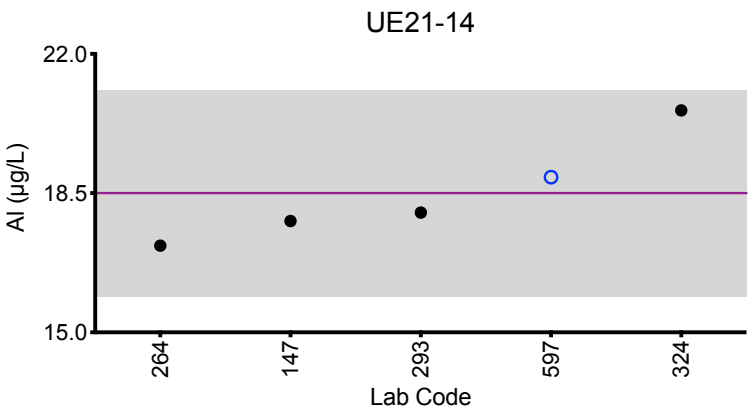
Results for Event #3, 2021: Summary Figures

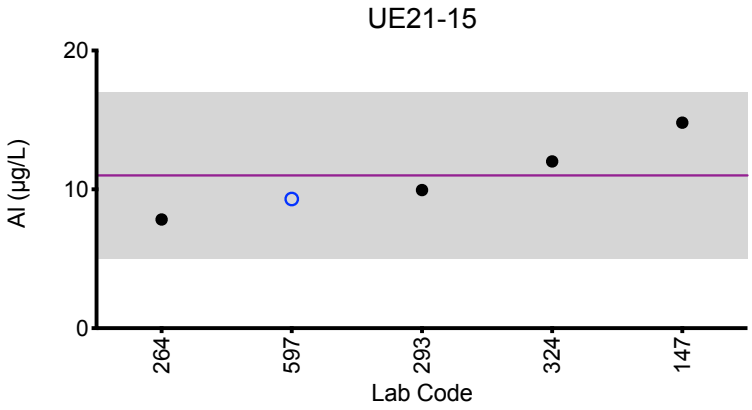
Urine Al











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 #3, 2021:
Laboratory Data and Summary Statistics

Urine Cs (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
107	ICP-MS	10.6	0.91	4.39	8.17	2.13
110	ICP-MS	13.2	1.31	5.83	10.4	2.58
220	ICP-MS	11.4	1.08	4.97	9.11	2.26
264	ICP-MS	11.27	1.07	4.98	8.84	2.21
399	ICP-MS/MS	11.5	1.09	4.95	8.91	2.22
597	ICP-MS/MS	11.4	1.03	4.88	8.73	2.15
598	ICP-MS	10.6	0.993	4.75	8.29	2.11
605	ICP-MS	11.2	1.02	4.74	8.06	2.07
606	ICP-MS/MS	11.5	1.13	5.03	8.93	2.27
676	ICP-MS	11.8	1.04	5.04	9.12	2.26

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Robust Mean (x*)	11.4	1.06	4.93	8.8	2.20
Robust SD (s*)	0.3	0.06	0.14	0.4	0.10
Robust RSD (%)	2.6	5.7	2.8	4.5	4.5
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (*u*)	0.1	0.02	0.06	0.2	0.04

*Denotes a statistical Outlier.

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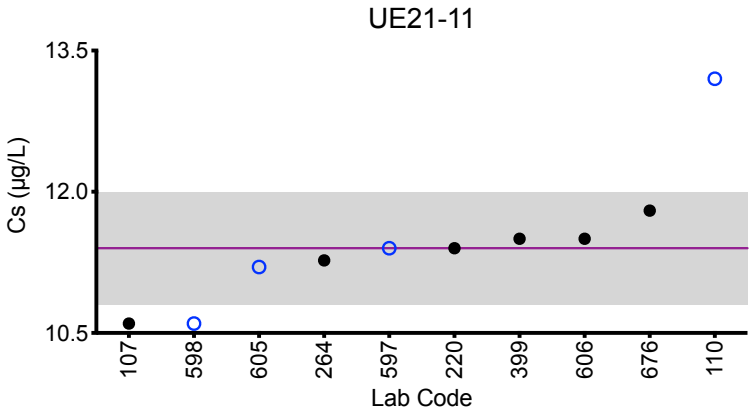
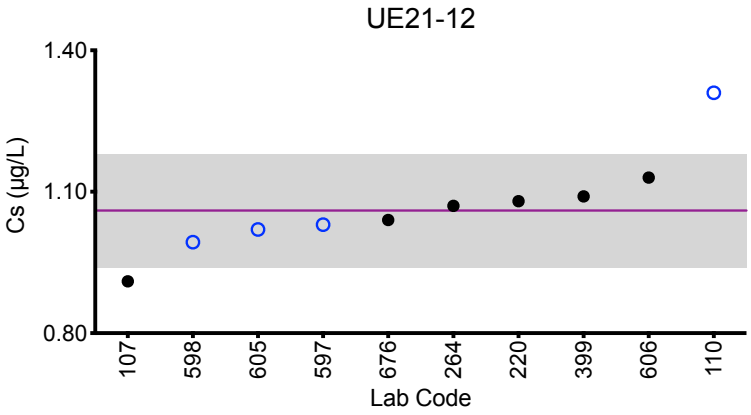
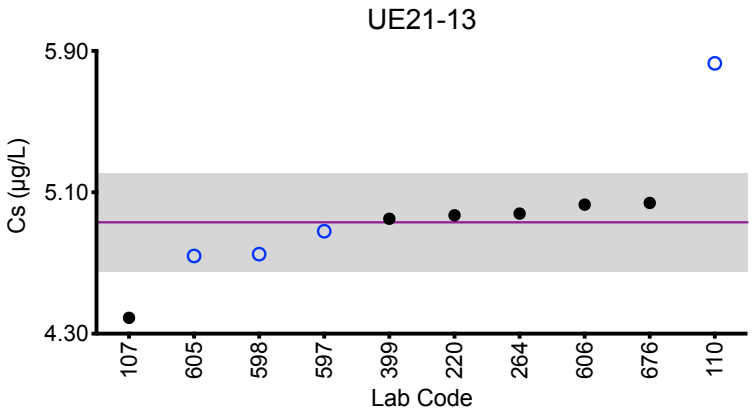
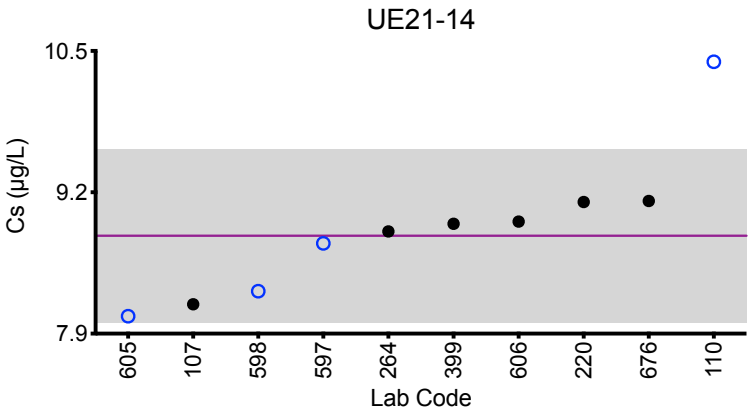
Results for Event #3, 2021: Summary Figures

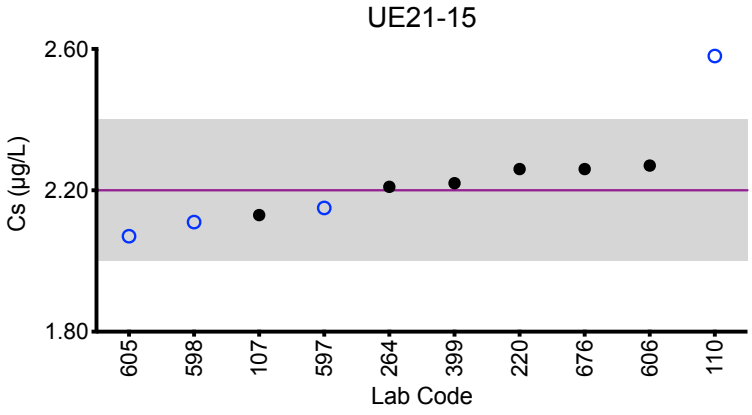
Urine Cs











Legend:
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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Cu (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
110	ICP-MS	7.7	34.7	109	7.3	7.0
116	ICP-MS/MS	5.79	28.7	93.3	<5.00	<5.00
147	ICP-MS	*10.2	35.4	107	*12.5	*11.8
264	ICP-MS	7.05	32.27	102.27	6.66	5.55
293	DRC/CC-ICP-MS	6.99	31.79	101.72	5.72	5.72
324	ICP-MS	7.40	34.73	108.32	7.14	6.60
391	ICP-MS	7.71	32.4865	98.265	7.95	7.048
597	ICP-MS/MS	7.74	33.3	106	7.35	7.10
598	ICP-MS	6.55	29.1	92.4	6.91	6.65

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Arithmetic Mean ($\bar{x}$)	7.1	32.5	102	7.0	6.5
Arithmetic SD (s)	0.7	2.4	6	0.7	0.6
Arithmetic RSD (%)	9.6	7.4	5.9	9.9	9.8
Number of Sample Measurements (N)	8	9	9	7	7

*Denotes a statistical Outlier.

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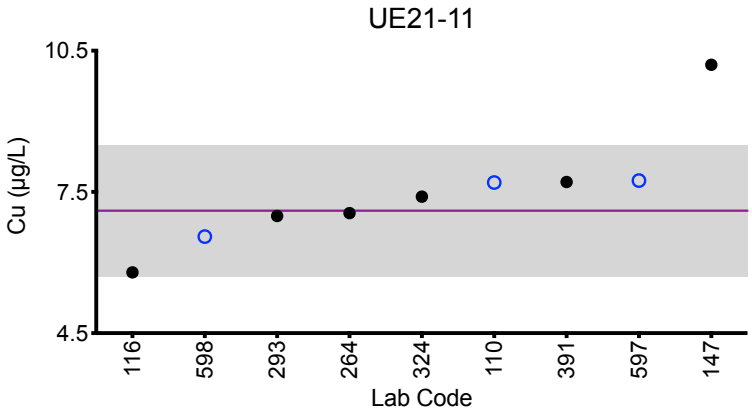
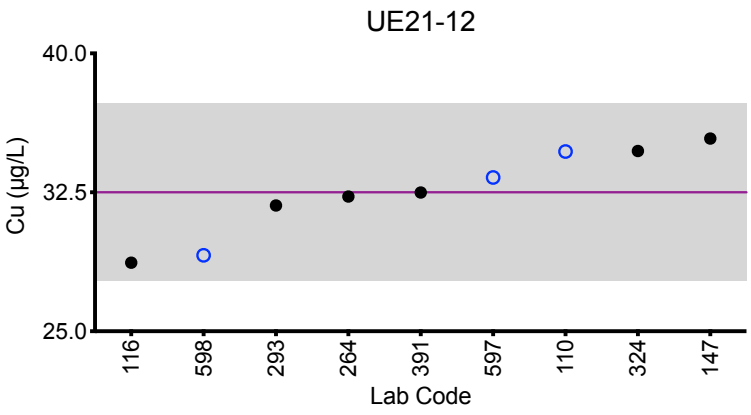
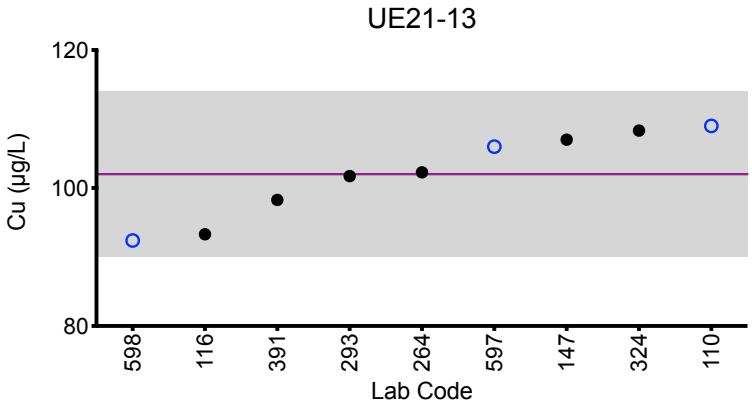
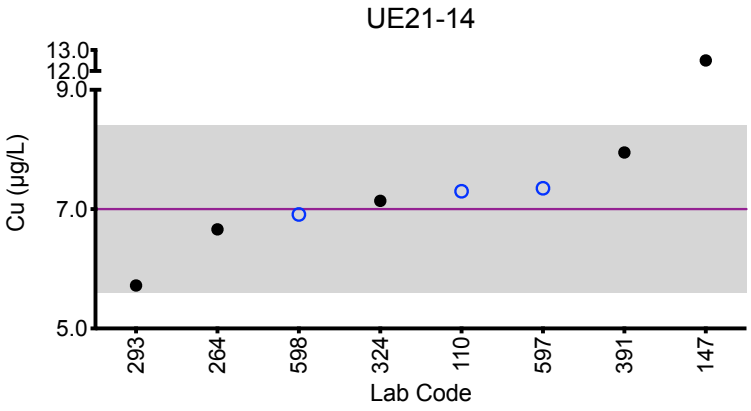
Results for Event #3, 2021: Summary Figures

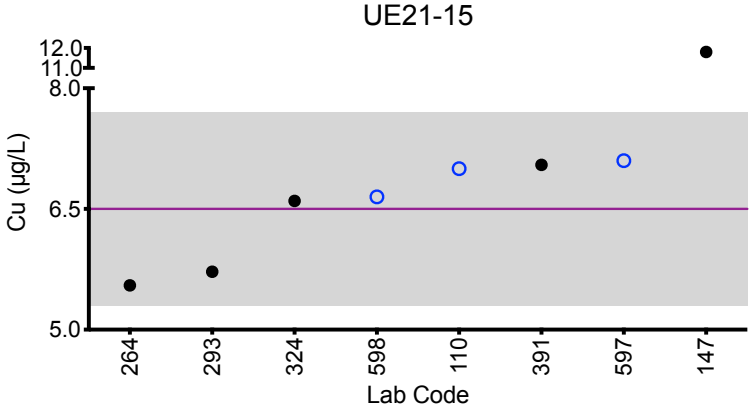
Urine Cu











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Mo (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
103	ICP-MS/MS	61.2	15.6	118	33.9	72.3
107	ICP-MS	56.7	12.5	103	31.8	69.8
110	ICP-MS	61.8	16.7	121	36.3	76.4
147	ICP-MS	56.3	14.3	107	32.5	68.2
220	ICP-MS	60.9	18.6	123	35.8	74.8
264	ICP-MS	50.15	11.71	99.34	29.59	62.31
293	DRC/CC-ICP-MS	64.67	16.39	122.83	37.51	79.51
324	ICP-MS	61.00	15.44	115.35	32.15	69.58
399	ICP-MS/MS	61.2	15.8	117	35.0	73.9
597	ICP-MS/MS	58.3	15.8	114	32.5	69.9
598	DRC/CC-ICP-MS	46.9	13.2	104	29.8	63.6
605	ICP-MS	57.8	14.7	112	33.4	71.6
606	ICP-MS/MS	60.4	15.8	118	34.6	74.5
676	ICP-MS	59.7	15.5	116	34.7	73.1

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Robust Mean (x*)	59.4	15.3	114	33.6	72
Robust SD (s*)	2.8	1.3	7	2.3	4
Robust RSD (%)	4.7	8.5	6.1	6.8	5.4
Number of Sample Measurements (N)	14	14	14	14	14
Standard Uncertainty (*u*)	0.9	0.4	2	0.8	1

*Denotes a statistical Outlier.

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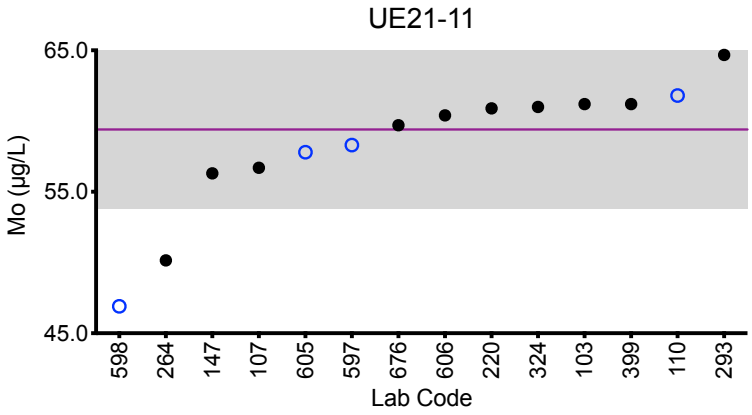
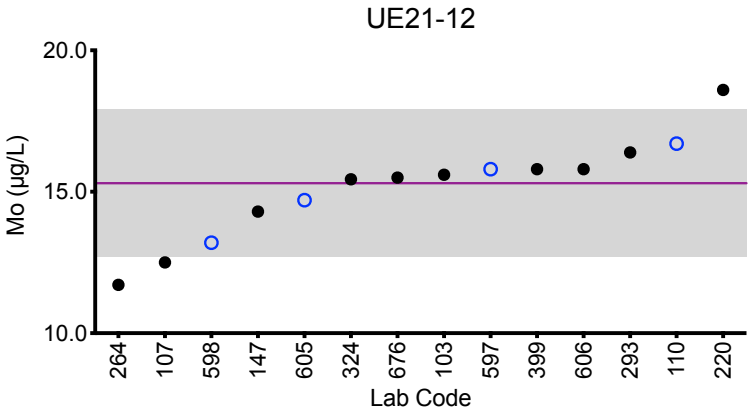
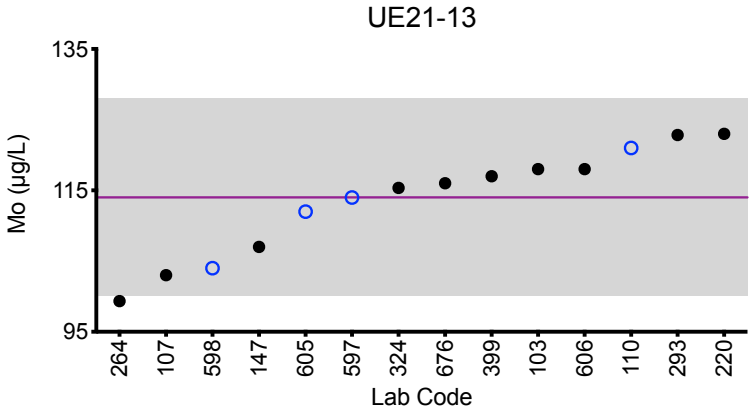
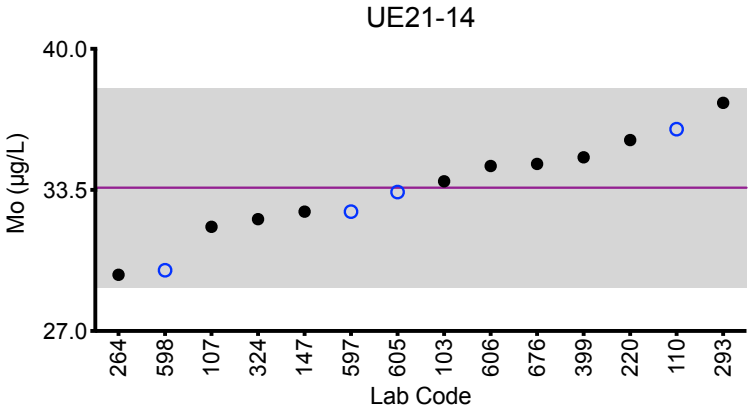
Results for Event #3, 2021: Summary Figures

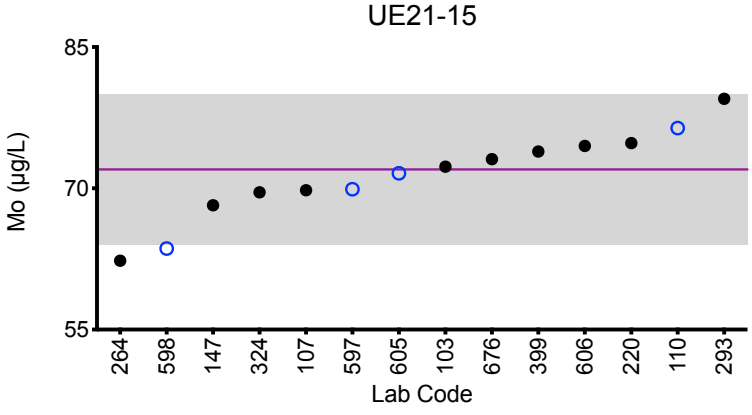
Urine Mo











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Ni (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
107	DRC/CC-ICP-MS	2.28	3.51	6.91	5.00	1.17
110	ICP-MS	3.06	5.20	9.04	7.12	2.28
147	ICP-MS	2.07	3.66	6.87	4.44	1.14
264	ICP-MS	2.21	4.08	7.50	5.39	1.53
293	DRC/CC-ICP-MS	5.7	4	7.93	5.37	1.3
324	ICP-MS	2.34	4.52	7.60	6.17	1.98
391	ICP-MS	0.763	3.455	5.618	3.914	0.059
442	DRC/CC-ICP-MS	4.16	4.13	7.32	5.21	1.32
597	ICP-MS/MS	2.07	4.07	7.11	5.09	1.38
598	ICP-MS	3.11	3.84	6.95	5.60	1.71
605	ICP-MS	2.21	4.04	7.47	5.31	1.36

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Robust Mean (x*)	2.4	4.0	7.3	5.3	1.4
Robust SD (s*)	0.4	0.4	0.6	0.5	0.3
Robust RSD (%)	16	8.8	8.2	9.4	22
Number of Sample Measurements (N)	11	11	11	11	11
Standard Uncertainty (*u*)	0.1	0.1	0.2	0.2	0.1

*Denotes a statistical Outlier.

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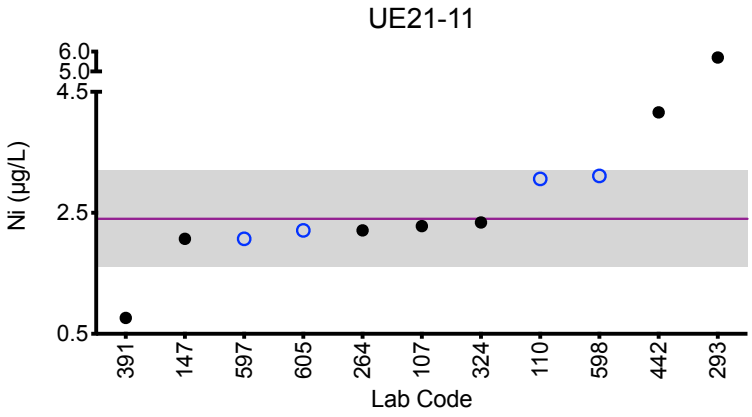
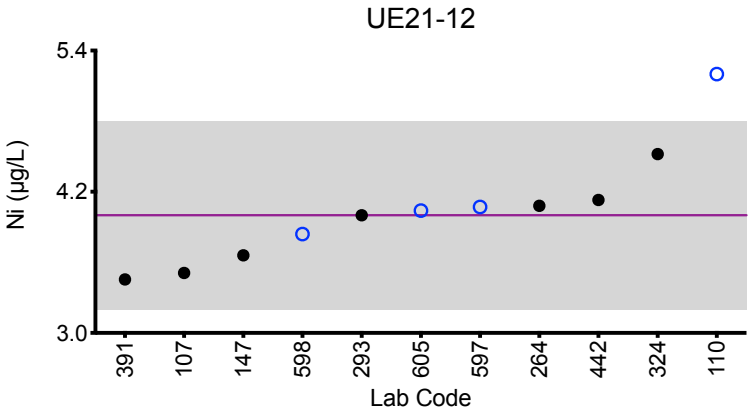
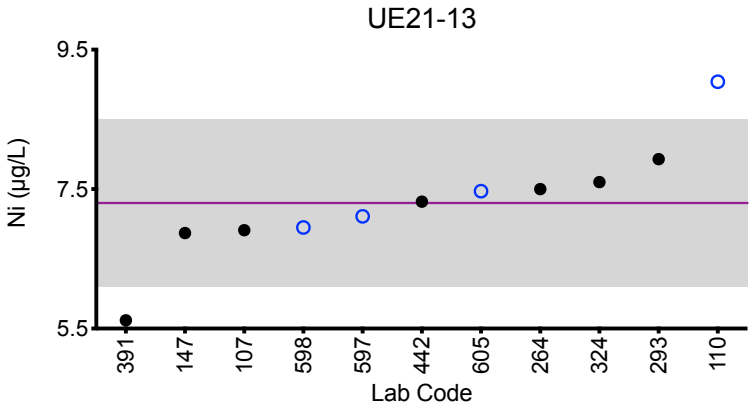
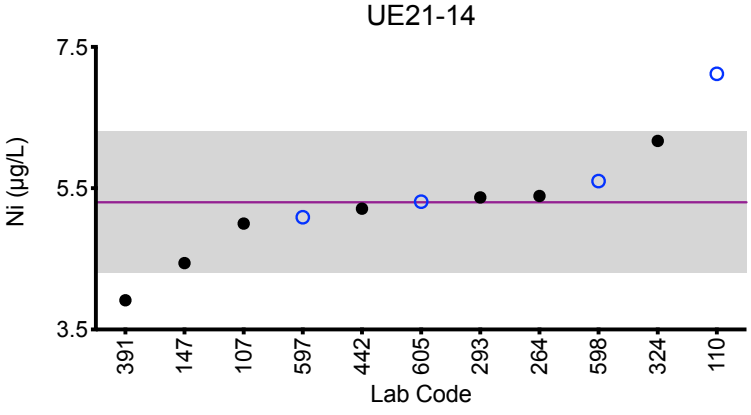
Results for Event #3, 2021: Summary Figures

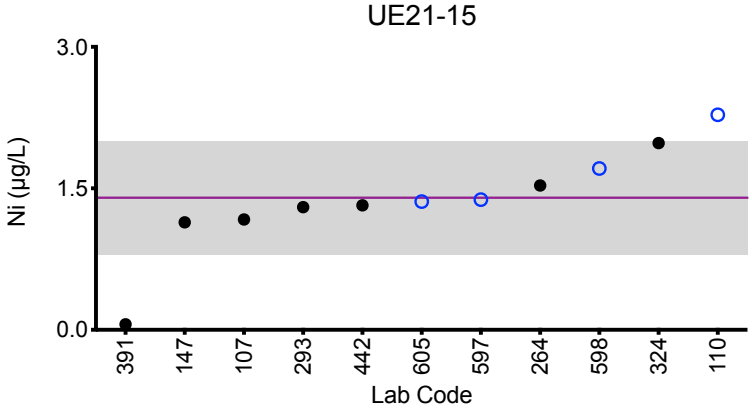
Urine Ni











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Pt (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
107	ICP-MS	0.587	4.82	0.169	1.43	0.209
110	ICP-MS	0.551	5.11	0.154	1.42	0.204
220	ICP-MS	0.52	4.54	0.18	1.35	0.21
264	ICP-MS	0.52	4.30	0.16	1.33	0.20
293	DRC/CC-ICP-MS	*0.98	5.08	*0.53	1.54	*0.49
399	ICP-MS/MS	0.525	4.66	0.130	1.37	0.177
598	ICP-MS	0.680	3.95	0.255	1.24	0.247
605	ICP-MS	0.514	4.73	0.136	1.33	0.184
676	ICP-MS	0.521	4.65	0.127	1.35	0.173

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Arithmetic Mean ($\bar{x}$)	0.55	4.6	0.16	1.37	0.201
Arithmetic SD (s)	0.06	0.4	0.04	0.08	0.024
Arithmetic RSD (%)	11	7.7	25	5.8	12
Number of Sample Measurements (N)	8	9	8	9	8

*Denotes a statistical Outlier.

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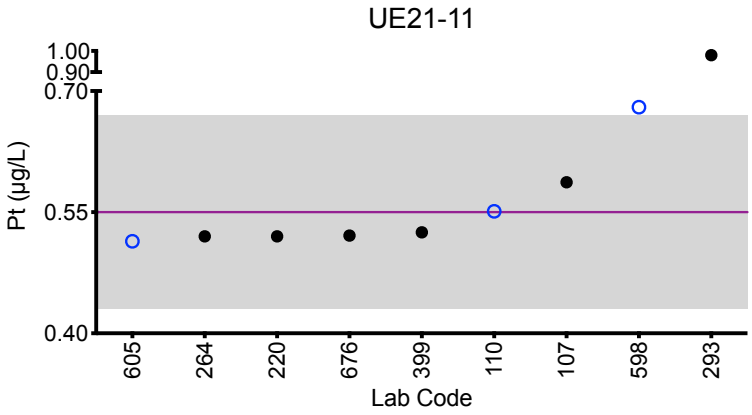
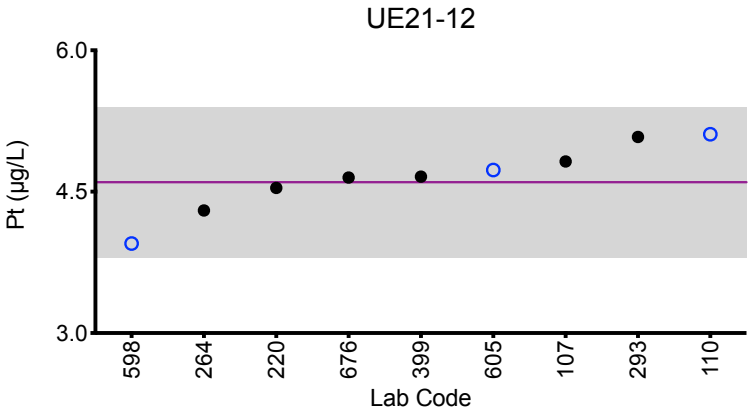
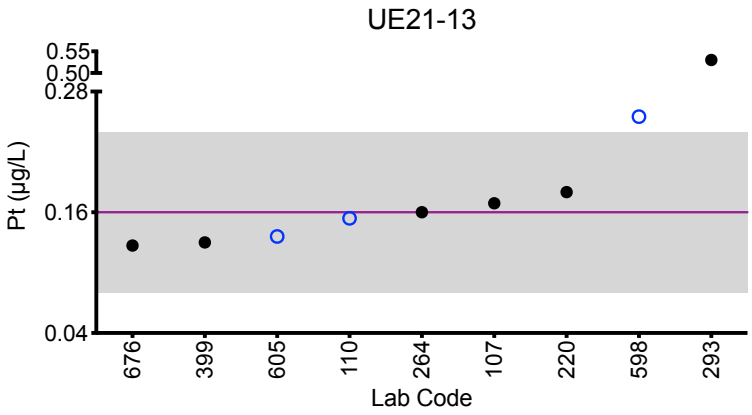
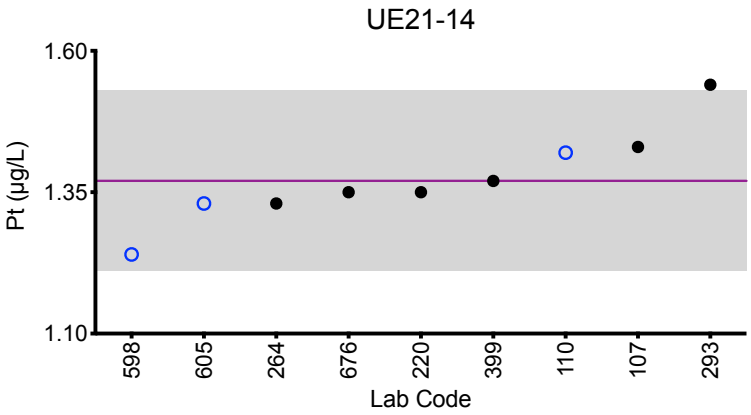
Results for Event #3, 2021: Summary Figures

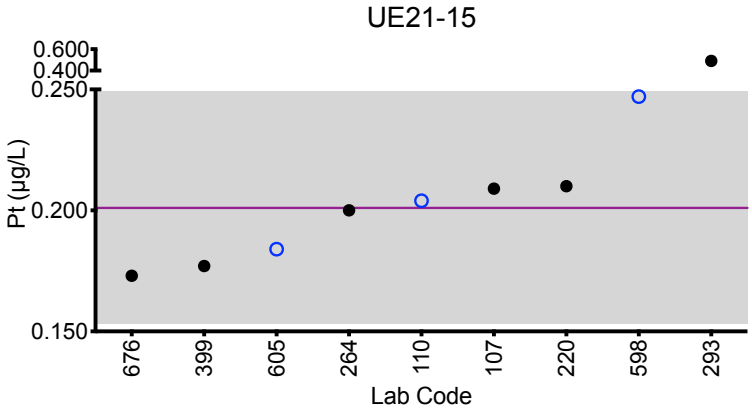
Urine Pt











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Sb (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
103	ICP-MS/MS	1.65	0.583	0.877	2.27	0.208
107	ICP-MS	1.68	0.506	0.850	2.24	0.230
110	ICP-MS	1.79	0.712	1.01	2.55	0.268
147	ICP-MS	1.74	0.608	0.920	2.44	0.242
220	ICP-MS	1.70	0.63	0.92	2.29	0.23
264	ICP-MS	1.51	0.57	0.78	2.22	0.23
293	DRC/CC-ICP-MS	5.21	0.76	1.58	2.43	0.21
399	ICP-MS/MS	1.74	0.606	0.844	2.36	0.229
597	ICP-MS/MS	1.79	0.811	1.07	2.69	0.573
598	ICP-MS	1.50	0.541	0.819	2.11	0.214
605	ICP-MS	1.66	<0.800	0.857	2.14	<0.800
606	ICP-MS/MS	1.65	0.601	0.867	2.35	0.231
676	ICP-MS	1.73	0.604	0.942	2.36	0.252

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Robust Mean (x*)	1.70	0.61	0.89	2.34	0.233
Robust SD (s*)	0.08	0.05	0.07	0.15	0.020
Robust RSD (%)	4.7	8.2	7.9	6.4	8.6
Number of Sample Measurements (N)	13	12	13	13	12
Standard Uncertainty (*u*)	0.03	0.02	0.02	0.05	0.007

*Denotes a statistical Outlier.

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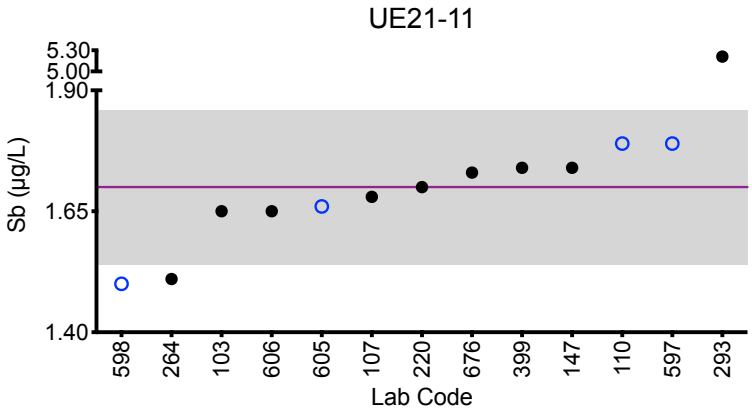
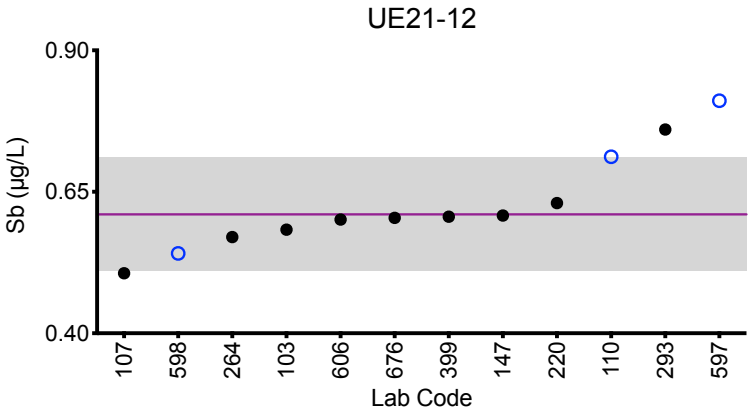
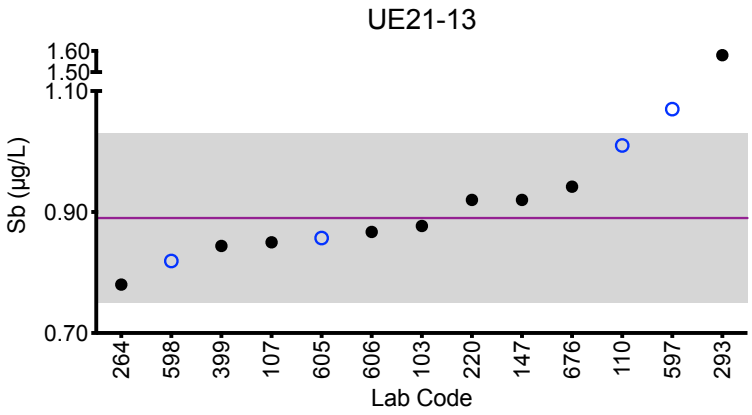
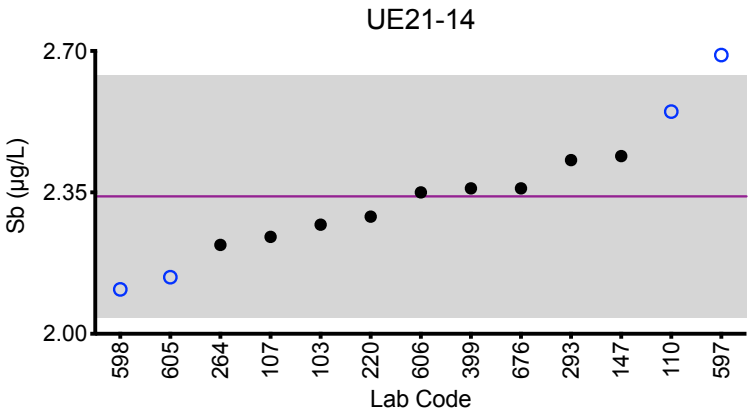
Results for Event #3, 2021: Summary Figures

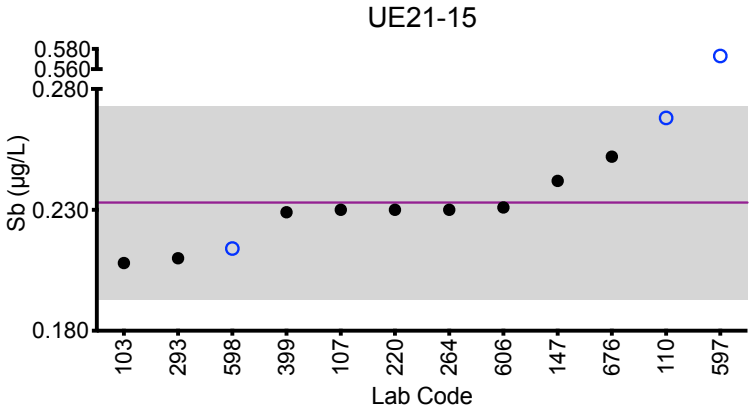
Urine Sb











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Se (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
103	ICP-MS/MS	88.6	27.1	80.5	249	61.2
110	DRC/CC-ICP-MS	91.6	29.0	87.7	301	78.7
147	ICP-MS	86.9	28.0	78.5	258	61.2
293	DRC/CC-ICP-MS	80.51	26.05	74.19	238.36	56.04
597	ICP-MS/MS	83.4	27.9	79.2	250	60.1
598	DRC/CC-ICP-MS	75.4	23.2	66.6	211	50.7
Summary Statistics						
		UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Arithmetic Mean ($\bar{x}$)		84	26.9	78	251	61
Arithmetic SD (s)		6	2.1	7	29	9
Arithmetic RSD (%)		7.1	7.8	9.0	12	15
Number of Sample Measurements (N)		6	6	6	6	6

*Denotes a statistical Outlier.

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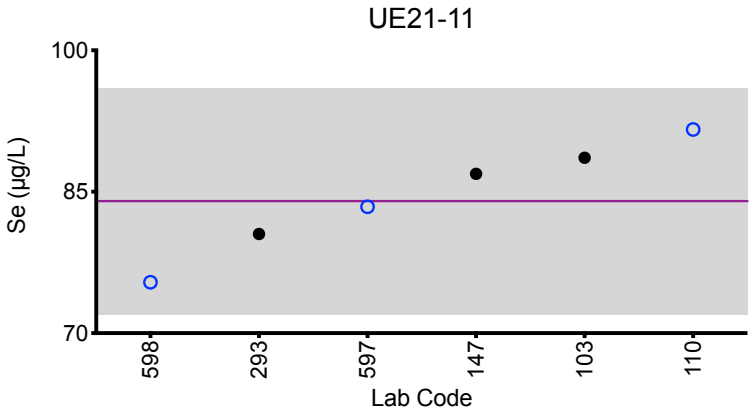
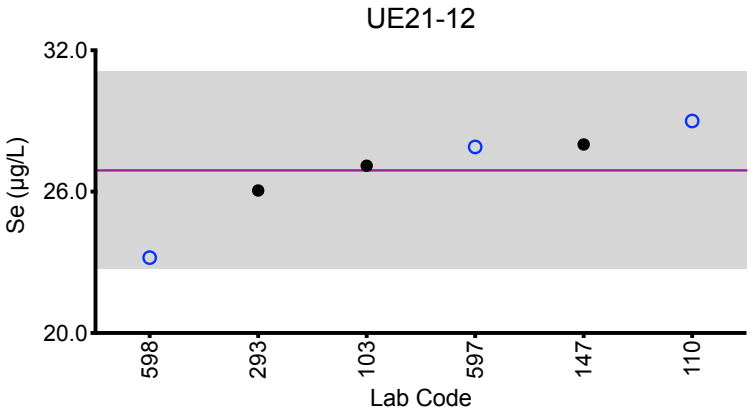
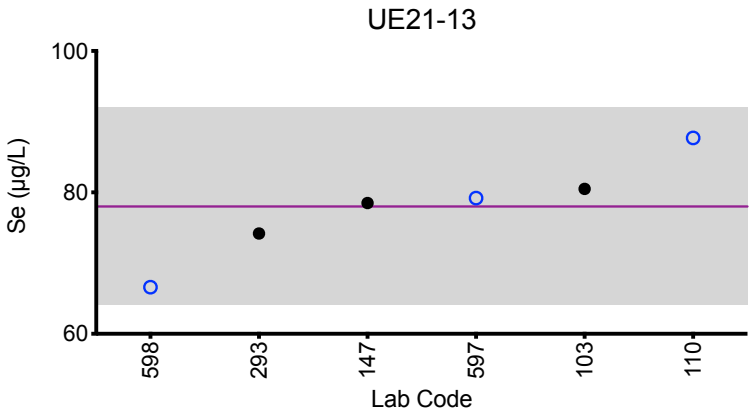
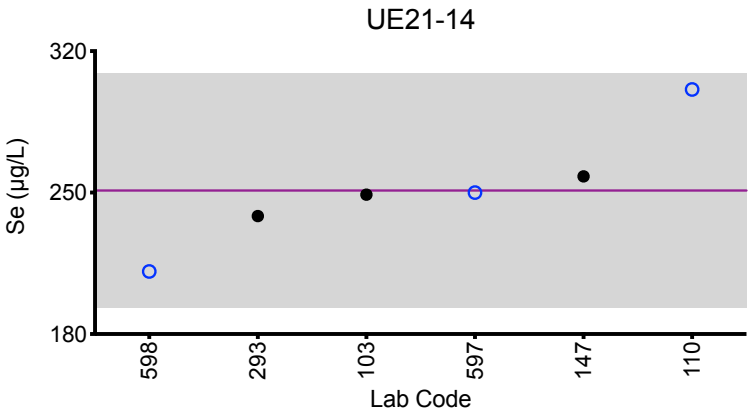
Results for Event #3, 2021: Summary Figures

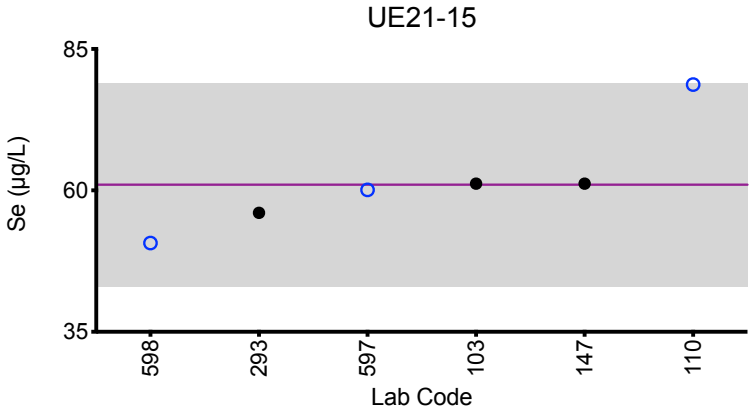
Urine Se











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Sn (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
107	ICP-MS	1.89	3.99	2.63	0.50	1.08
110	ICP-MS	2.16	5.81	3.18	0.53	1.20
147	ICP-MS	1.81	4.31	2.61	0.495	0.926
220	ICP-MS	1.63	4.10	2.58	0.63	0.94
264	ICP-MS	1.37	330	1.92	0.42	0.64
399	ICP-MS/MS	1.80	4.77	2.89	0.362	0.937
597	ICP-MS/MS	1.86	4.31	2.47	0.445	0.867
598	ICP-MS	1.39	3.55	2.03	0.420	0.707
605	ICP-MS	1.26	3.89	2.14	<0.900	<0.900
676	ICP-MS	1.91	4.68	2.75	0.44	1.04

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Robust Mean (x*)	1.7	4.4	2.5	0.5	0.9
Robust SD (s*)	0.2	0.6	0.4	0.1	0.2
Robust RSD (%)	14	14	16	17	19
Number of Sample Measurements (N)	10	10	10	9	9
Standard Uncertainty (*u*)	0.1	0.2	0.2	NA	NA

*Denotes a statistical Outlier.

An arithmetic mean, SD, RSD and n are provided for samples UE21-14 and UE21-15.

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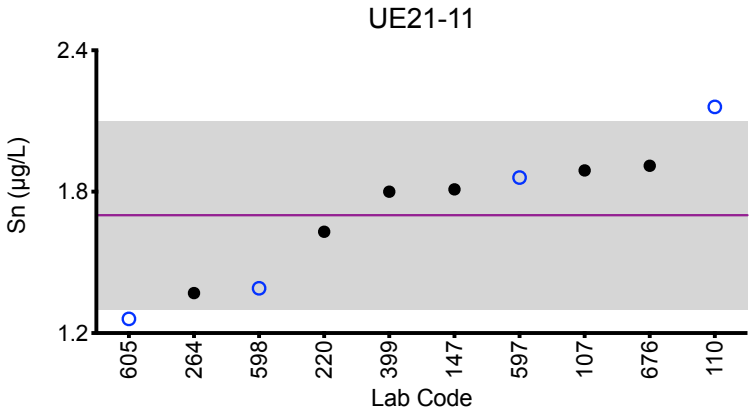
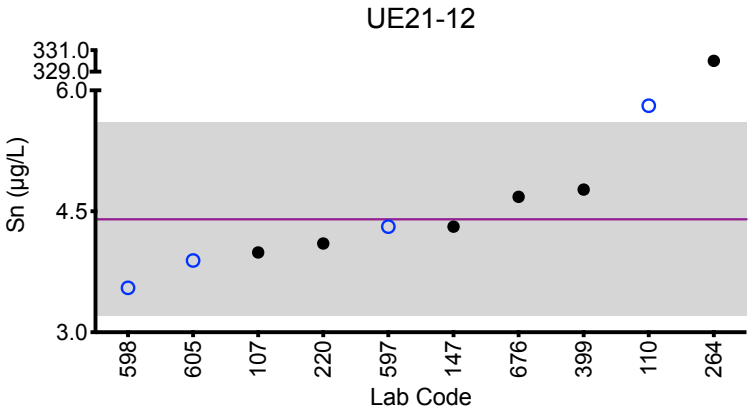
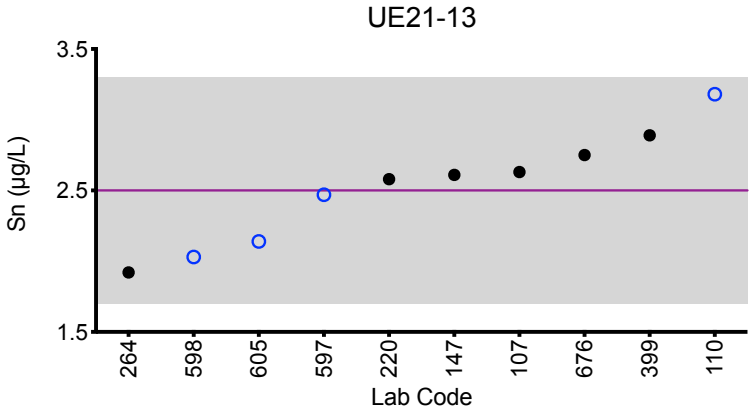
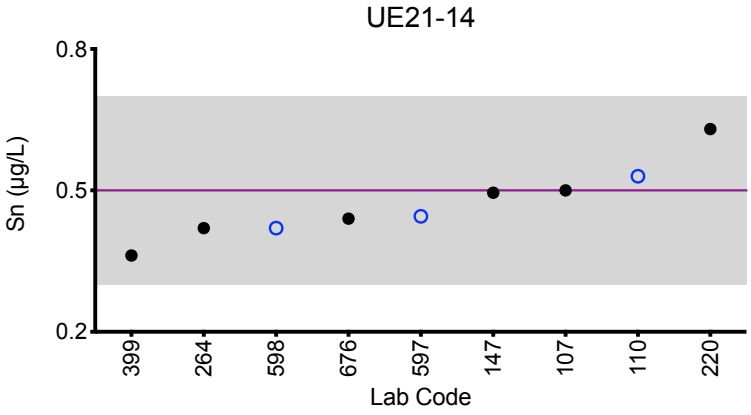
Results for Event #3, 2021: Summary Figures

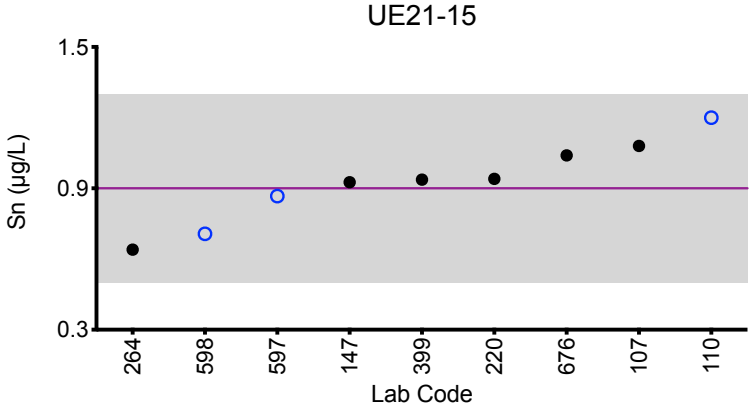
Urine Sn











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Sr (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
103	ICP-MS/MS	50.6	51.0	49.0	88.3	57.7
107	ICP-MS	45.8	40.6	42.1	79.8	54.5
220	ICP-MS	52.6	54.4	51.1	93.8	61.9
264	ICP-MS	48.87	49.53	47.40	87.99	56.97
399	DRC/CC-ICP-MS	50.9	52.2	49.0	91.2	60.1
597	ICP-MS/MS	50.7	52.3	48.5	87.5	58.3
605	ICP-MS	49.1	50.1	47.5	87.2	57.1
676	ICP-MS	43.9	44.9	41.5	83.2	51.7
Summary Statistics						
		UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Arithmetic Mean ($\bar{x}$)		49	49	47	87	57
Arithmetic SD (s)		3	5	3	4	3
Arithmetic RSD (%)		5.9	10	7.2	5.0	5.5
Number of Sample Measurements (N)		8	8	8	8	8

*Denotes a statistical Outlier.

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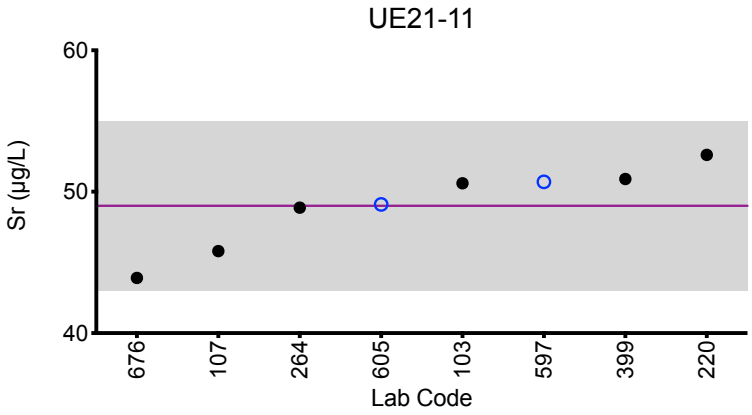
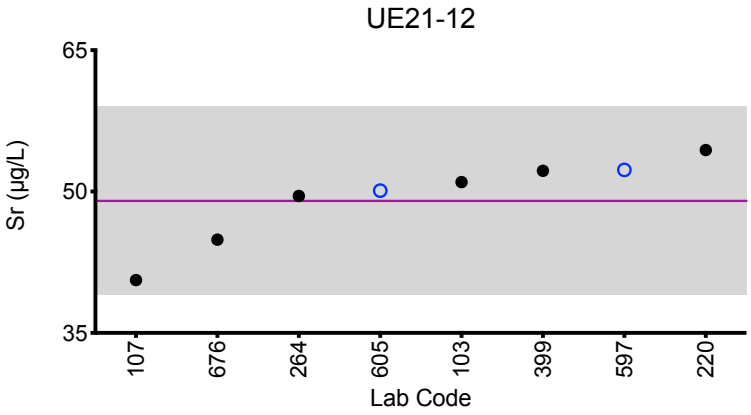
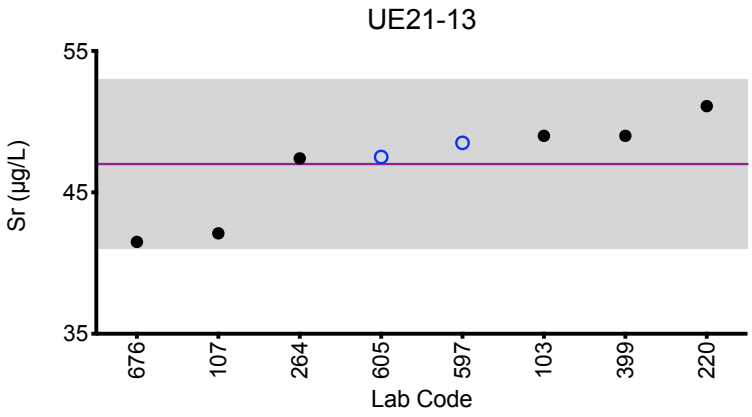
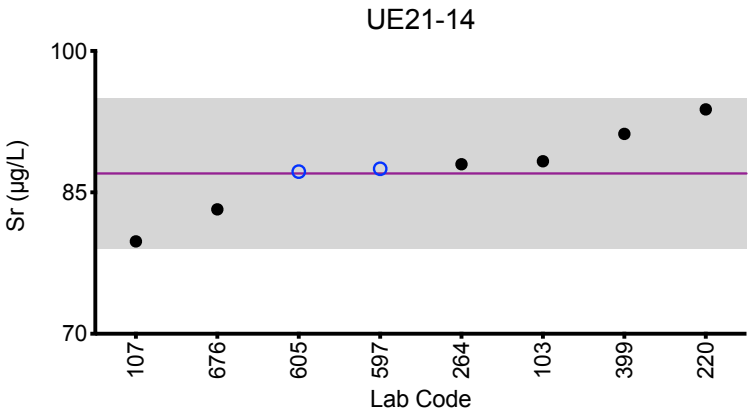
Results for Event #3, 2021: Summary Figures

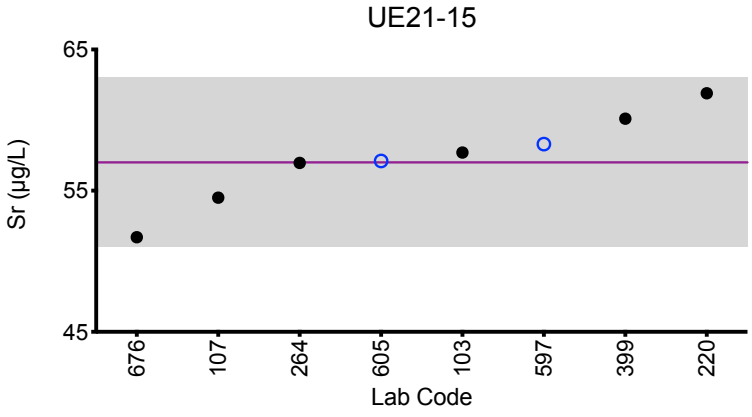
Urine Sr











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine V (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
116	ICP-MS/MS	2.50	4.24	0.424	1.48	0.715
147	DRC/CC-ICP-MS	2.90	4.49	0.479	1.65	0.750
293	DRC/CC-ICP-MS	2.98	5.07	0.6	1.9	0.93
597	ICP-MS/MS	3.05	4.87	0.531	1.76	0.794
598	DRC/CC-ICP-MS	2.35	4.08	0.448	1.68	0.749
605	ICP-MS	2.92	4.91	0.348	1.79	0.710

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Arithmetic Mean ($\bar{x}$)	2.8	4.6	0.47	1.71	0.77
Arithmetic SD (s)	0.3	0.4	0.09	0.14	0.08
Arithmetic RSD (%)	10	8.7	19	8.2	10
Number of Sample Measurements (N)	6	6	6	6	6

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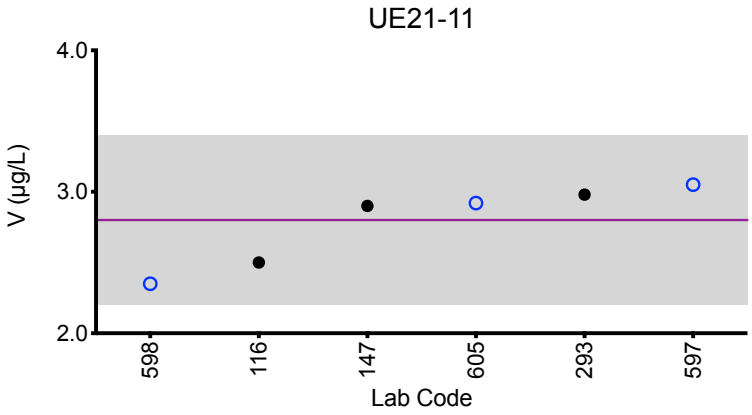
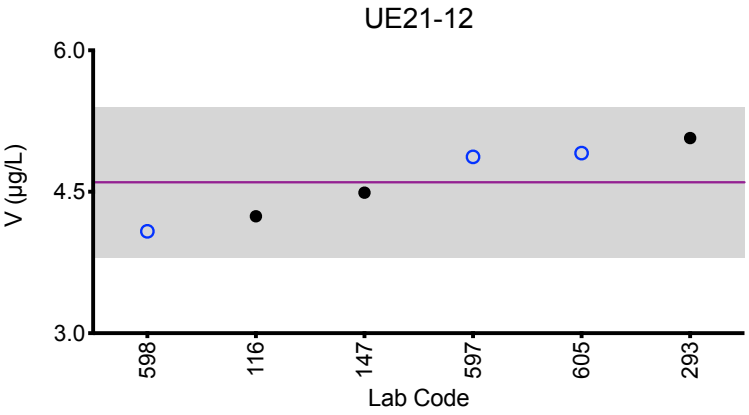
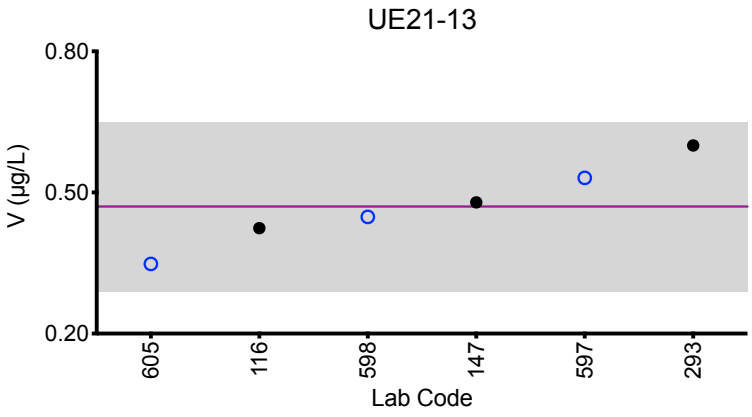
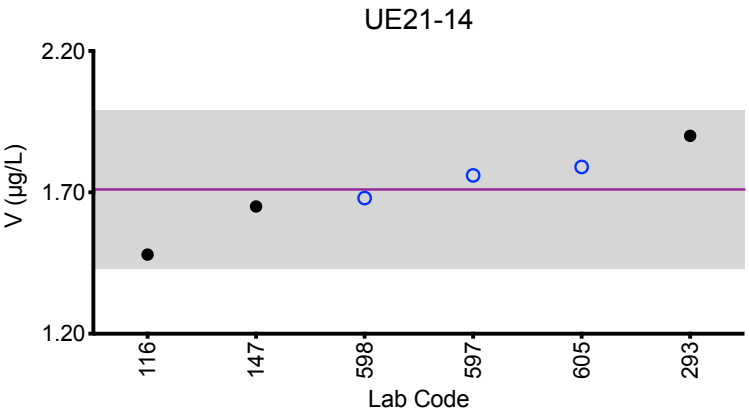
Results for Event #3, 2021: Summary Figures

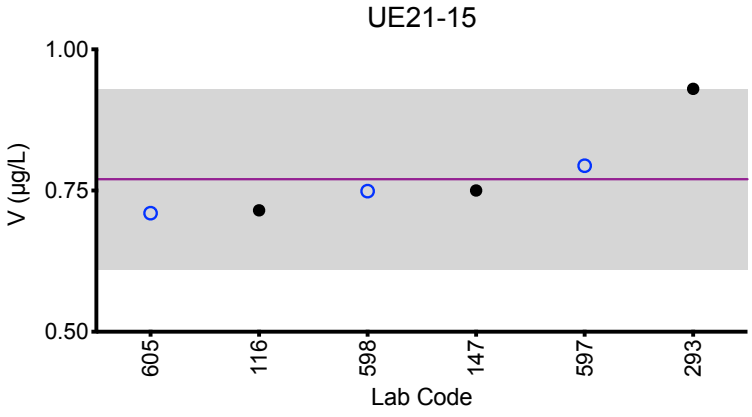
Urine V











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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine W (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
107	ICP-MS	7.57	0.143	3.76	0.538	0.403
110	ICP-MS	7.81	0.145	3.99	0.577	0.413
147	ICP-MS	7.52	<0.184	3.71	0.585	0.403
200	ICP-MS	6.3	0.2	3.4	0.7	0.4
220	ICP-MS	7.69	0.16	3.82	0.58	0.41
264	ICP-MS	7.42	0.13	3.71	0.55	0.35
324	ICP-MS	7.98	<1	3.93	<1	<1
399	ICP-MS/MS	7.83	0.152	3.87	0.578	0.386
597	ICP-MS/MS	7.69	0.183	3.95	0.554	0.380
598	ICP-MS	7.69	<0.2	3.82	0.586	0.431
605	ICP-MS	7.86	<0.180	3.77	0.561	0.408
606	ICP-MS/MS	7.55	0.129	3.90	0.548	0.397
676	ICP-MS	7.77	0.144	3.76	0.576	0.453

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Robust Mean (x*)	7.67	0.15	3.82	0.570	0.403
Robust SD (s*)	0.20	0.02	0.12	0.019	0.015
Robust RSD (%)	2.6	15	3.1	3.3	3.7
Number of Sample Measurements (N)	13	9	13	12	12
Standard Uncertainty (*u*)	0.07	NA	0.04	0.007	0.005

*Denotes a statistical Outlier.

An arithmetic mean, SD, RSD and n are provided for samples UE21-12.

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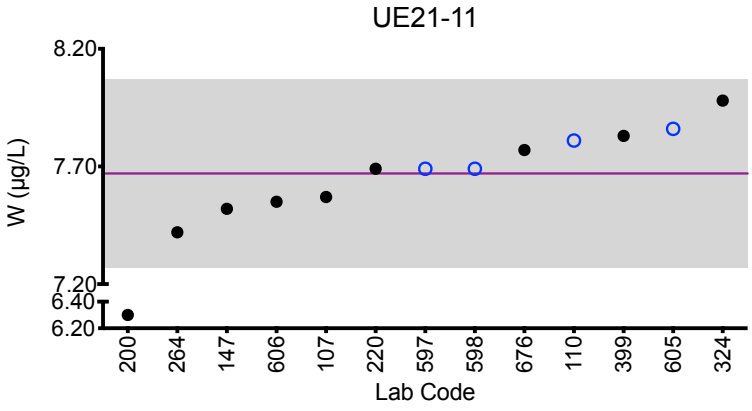
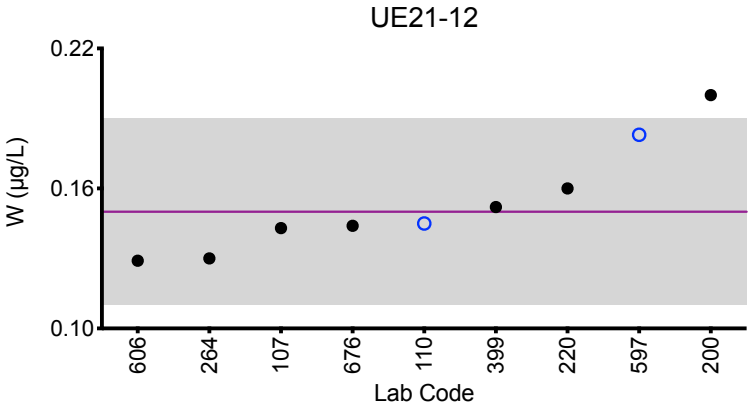
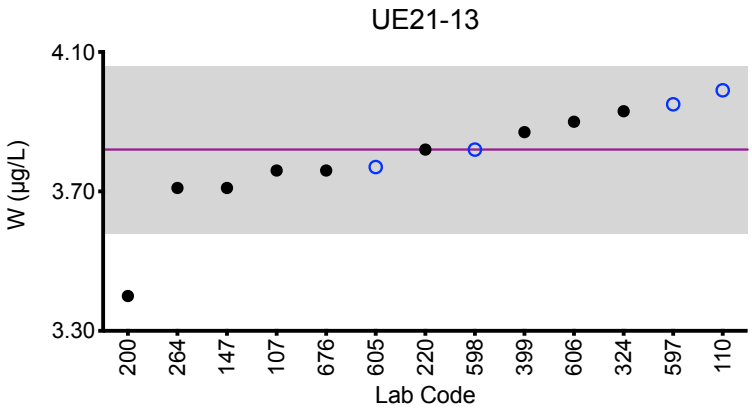
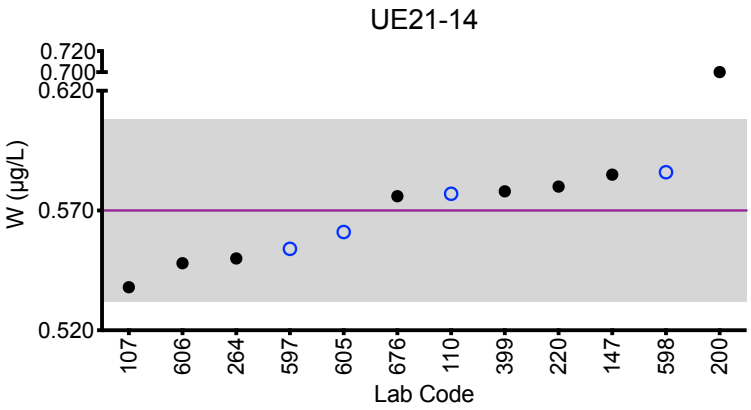
Results for Event #3, 2021: Summary Figures

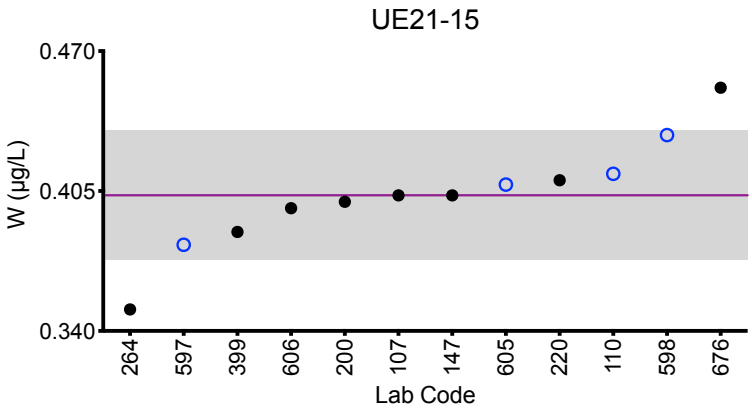
Urine W











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 #3, 2021:
Laboratory Data and Summary Statistics

Urine Zn (µg/L)

Lab Code	Method	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
110	ICP-MS	135	141	4950	4710	9470
147	ICP-MS	154	156	5595	5301	11111
264	ICP-MS	143.25	150.02	5165	5041	10071
293	DRC/CC-ICP-MS	148.37	153.59	5006.54	4850.98	9476.47
324	ICP-MS	144.38	152.68	4932.24	4879.34	9694.66
391	ICP-MS	165.82	171.161	5685.342	5851.239	11848.5
597	ICP-MS/MS	135	146	4990	4870	9380
598	ICP-MS	124	129	4300	4160	8260

Summary Statistics

	UE21-11	UE21-12	UE21-13	UE21-14	UE21-15
Arithmetic Mean ($\bar{x}$)	144	150	5100	5000	9900
Arithmetic SD (s)	13	12	400	500	1100
Arithmetic RSD (%)	8.9	8.1	7.8	10	11
Number of Sample Measurements (N)	8	8	8	8	8

*Denotes a statistical Outlier.

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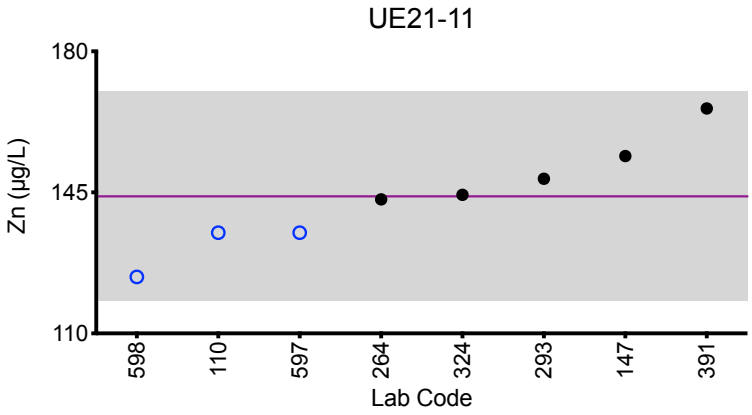
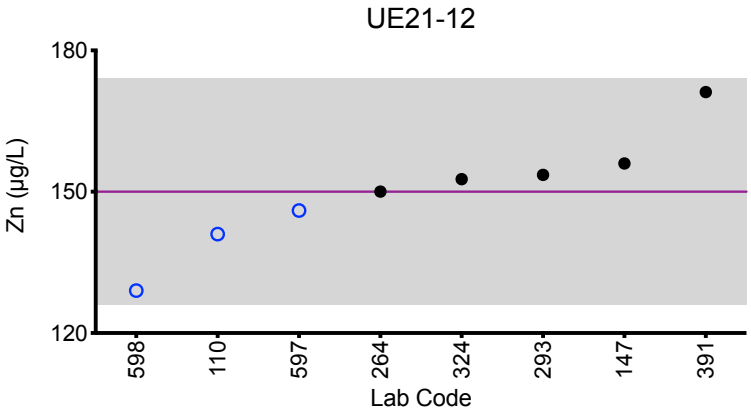
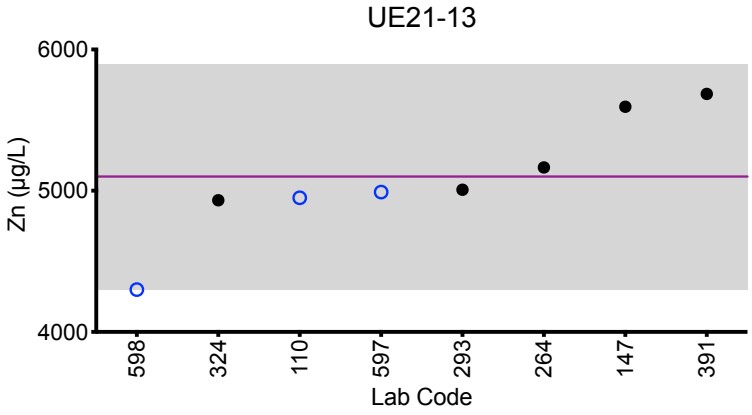
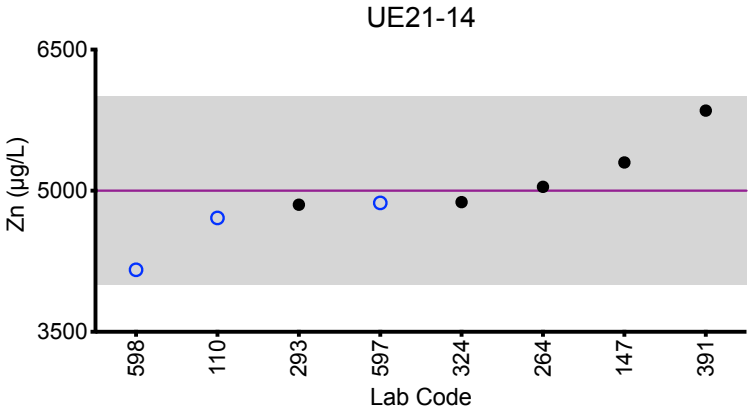
Results for Event #3, 2021: Summary Figures

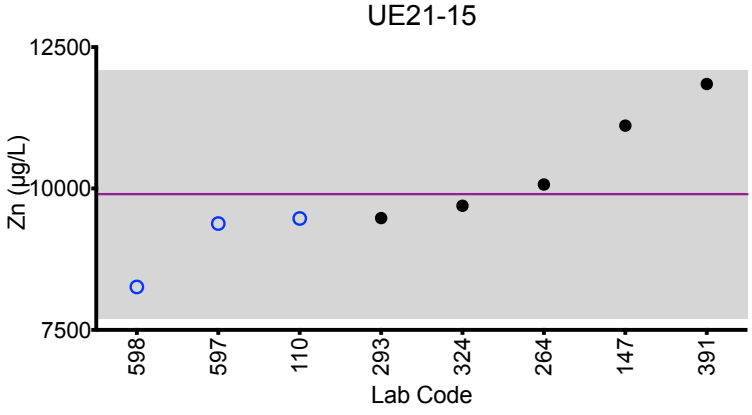
Urine Zn











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 #3, 2021:
Laboratory Data and Summary Statistics

Urine Te (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
110	ICP-MS	0.528	2.83	1.55	0.835	0.273
147	ICP-MS	0.485	2.42	1.29	0.762	0.263
Summary Statistics						
		UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Arithmetic Mean ($\bar{x}$)		0.51	2.6	1.4	0.80	0.268
Arithmetic SD (s)		0.03	0.3	0.2	0.05	0.007
Arithmetic RSD (%)		5.9	12	13	6.3	2.6
Number of Sample Measurements (N)		2	2	2	2	2

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Urine Ti (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
442	ICP-MS/MS	1.43	11.0	7.35	3.56	8.31
597	ICP-MS/MS	1.90	11.9	8.30	4.64	8.57
Summary Statistics						
		UE21-11	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
Arithmetic Mean ($\bar{x}$)		1.7	11.5	7.8	4.1	8.4
Arithmetic SD (s)		0.3	0.6	0.7	0.8	0.2
Arithmetic RSD (%)		18	5.2	8.6	20	2.1
Number of Sample Measurements (N)		2	2	2	2	2

*Denotes a statistical Outlier.

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Results for Event #3, 2021: Additional Elements in Urine

Urine Ag (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
147	ICP-MS	<0.183	<0.183	<0.183	<0.183	<0.183

Urine Bi (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
147	ICP-MS	<0.0815	<0.0815	<0.0815	<0.0815	<0.0815
264	ICP-MS	<0.010	<0.010	<0.010	<0.010	<0.010
597	ICP-MS/MS	<0.0355	<0.0355	<0.0355	<0.0355	<0.0355

Urine Fe (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
324	ICP-MS	4.16	8.27	6.69	10.98	8.21

Urine I (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
147	ICP-MS	72.2	91.6	106	165	127

Urine Li (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
147	ICP-MS	7.36	9.02	10.3	17.7	12.5

Urine Mg (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
597	ICP-MS/MS	23900	28800	32400	56500	38300

Urine Th (µg/L)						
Lab Code	**Method**	**UE21-11**	**UE21-12**	**UE21-13**	**UE21-14**	**UE21-15**
147	ICP-MS	<0.0673	<0.0673	<0.0673	<0.0673	<0.0673
597	ICP-MS/MS	0.164	0.183	0.173	0.301	0.146

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Event #3, 2021

Trace Elements in Serum

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory

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Event #3, 2021:
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). 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, Ba, Be, Bi, Cd, Cs, Fe, Hg, I, Li, Mg, Mn, Mo, Ni, Pb, Pt, Sb, Sn, Sr, Th, Ti, Tl, U, V, and W. These data are included here to provide a more complete characterization of the PT materials. All results reported by participant laboratories are tabulated and organized by lab code. The PT data are graphed for visual comparison purposes for all elements where at least five laboratories reported a value greater than the LOD. A statistical summary table is provided for samples where at least two comparable values were reported as above the LOD.

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

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Results for Event #3, 2021:
Summary Statistics

	Serum Al (µg/L)				
	SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Target (Arithmetic Mean ($\bar{x}$))	20.8	44.8	19	11	32
Upper Limit	25.8	53.8	24	16	38
Lower Limit	15.8	35.8	14	6	26
Arithmetic SD (s)	2.2	1.0	5	3	3
Arithmetic RSD (%)	11	2.2	26	24	8.2
Number of Sample Measurements (N)	6	5	6	6	5

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

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Results for Event #3, 2021:
Performance of Participating Laboratories

		Serum Al (µg/L)				
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
	Target	**20.8**	**44.8**	**19**	**11**	**32**
147	ETAAS-Z	20.2	*35.4 ↓	16.0	8.55	27.3
264	ICP-MS	20.55	45.71	17.50	7.87	33.11
293	DRC/CC-ICP-MS	18.82	45.7	16.13	10.75	32.26
391	ETAAS-Z	23.87	45.06	21.44	14.9	*50.7 ↑
485	HR-ICP-MS	18.4	44.0	15.4	12.5	32.7
597	ICP-MS/MS	23.1	43.5	27.6 ↑	11.1	33.7

Based on the grading criteria for Al in Serum, 90% of results were satisfactory, with 0 of the 6 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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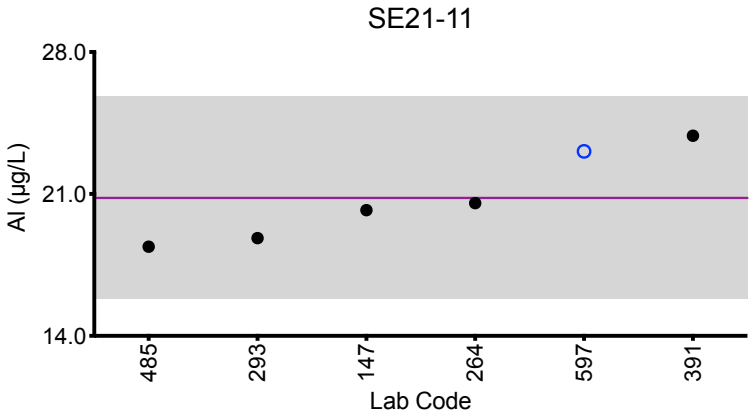
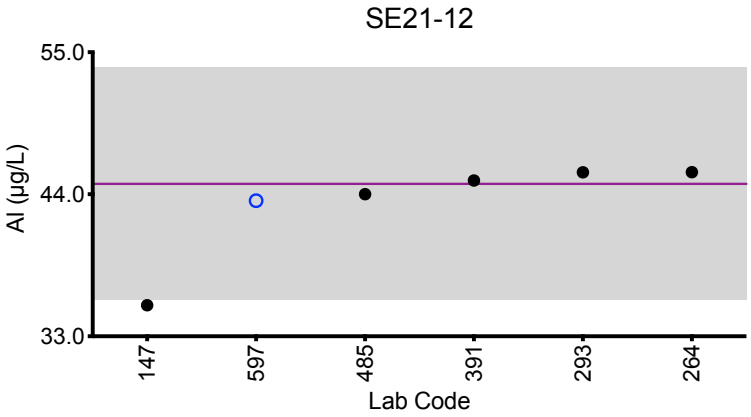
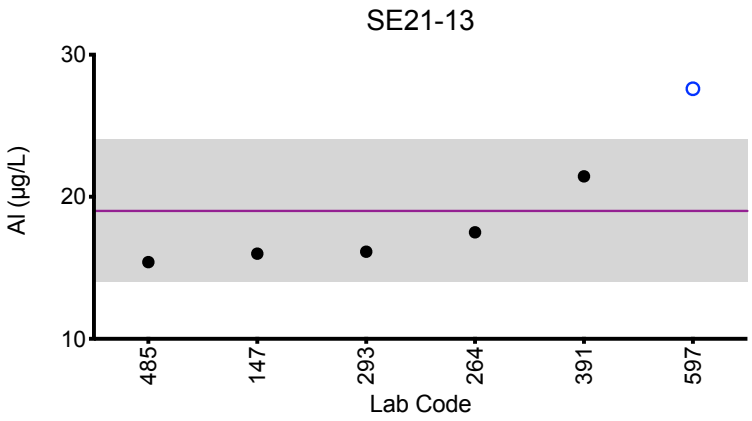
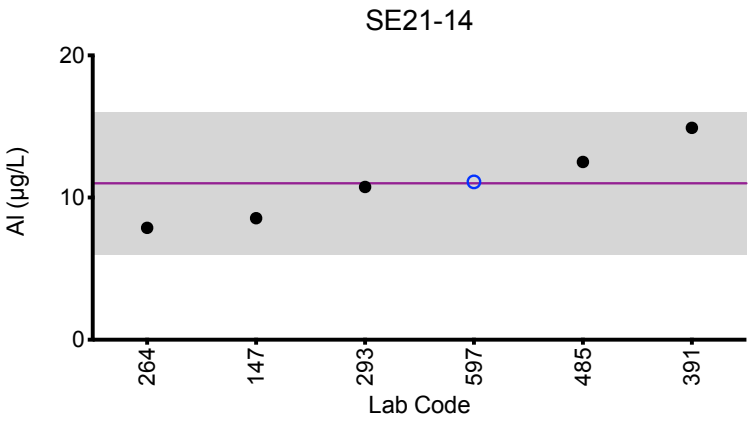
Results for Event #3, 2021: Summary Figures

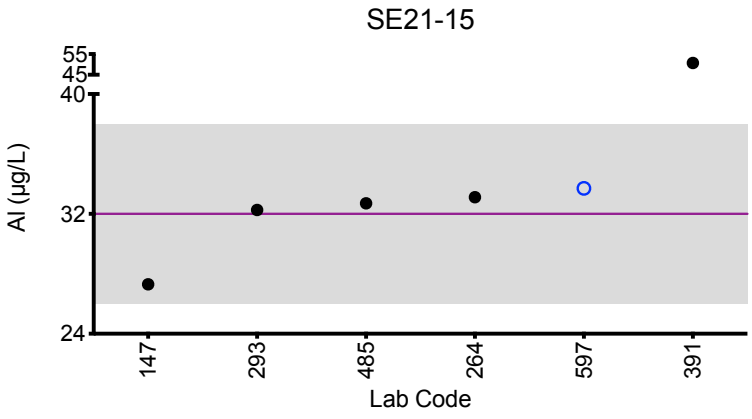
Serum AI











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 #3, 2021:
Summary Statistics

	Serum Co (µg/L)				
	SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Target (Arithmetic Mean ($\bar{x}$))	0.76	1.15	5.0	7.08	14.6
Upper Limit	2.26	2.65	6.5	8.58	16.8
Lower Limit	0.00	0.00	3.5	5.58	12.4
Arithmetic SD (s)	0.06	0.06	0.3	0.24	0.2
Arithmetic RSD (%)	7.9	5.2	5.4	3.4	1.6
Number of Sample Measurements (N)	7	7	6	7	6

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 #3, 2021:
Performance of Participating Laboratories

Serum Co (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
	Target	**0.76**	**1.15**	**5.0**	**7.08**	**14.6**
103	ICP-MS/MS	0.711	1.16	5.20	7.16	14.5
110	ICP-MS	0.83	1.11	4.76	6.93	14.2
147	DRC/CC-ICP-MS	0.660	1.07	4.57	6.60	*13.4
264	ICP-MS	0.75	1.22	*539.00↑	7.25	14.71
293	DRC/CC-ICP-MS	0.75	1.17	5.22	7.22	14.85
485	HR-ICP-MS	0.770	1.11	5.01	7.14	14.7
597	ICP-MS/MS	0.839	1.24	5.15	7.24	14.4

Based on the grading criteria for Co in Serum, 97% of results were satisfactory, with 0 of the 7 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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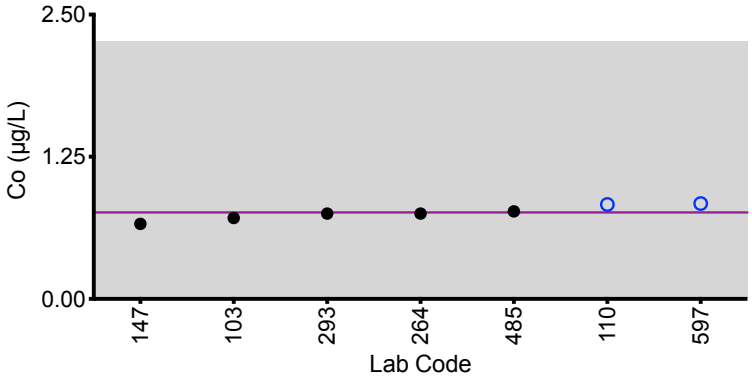
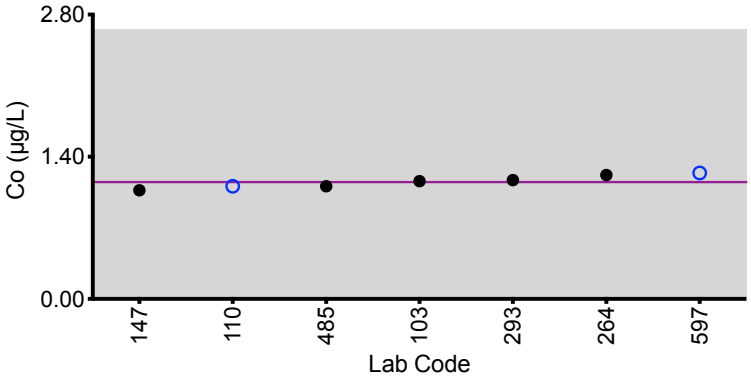
Results for Event #3, 2021: Summary Figures

Serum Co

SE21-11



SE21-12



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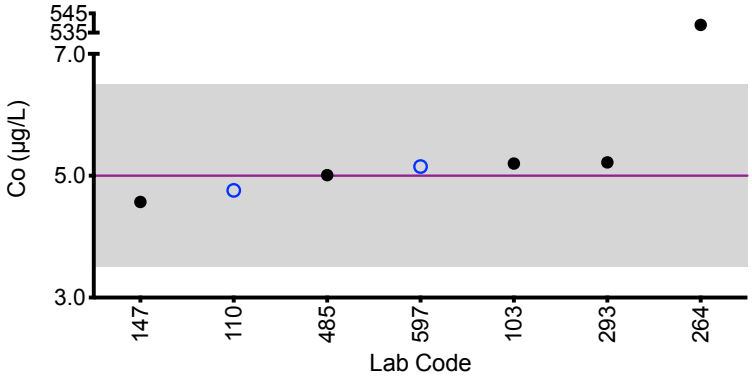

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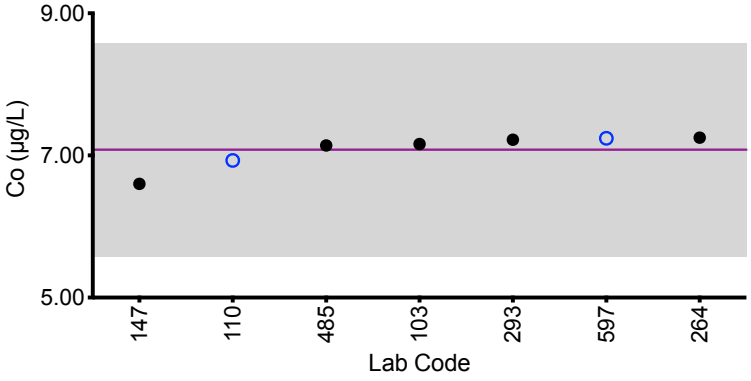
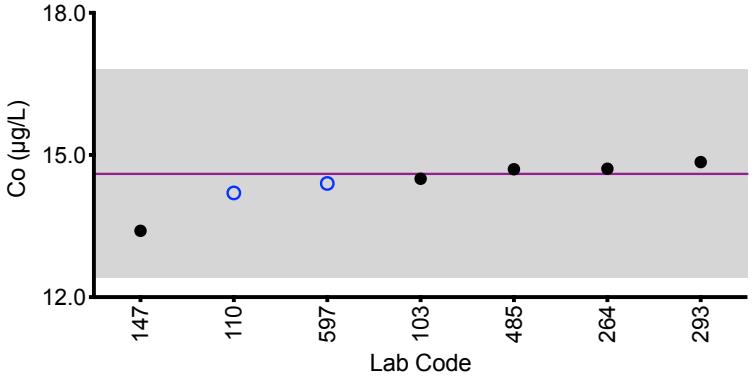


SE21-15



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 #3, 2021:
Summary Statistics

	Serum Cr (µg/L)				
	SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Target (Arithmetic Mean ($\bar{x}$))	7.2	0.6	1.58	5.0	1.05
Upper Limit	9.2	2.6	3.58	7.0	3.05
Lower Limit	5.2	0.0	0.00	3.0	0.00
Arithmetic SD (s)	0.6	0.2	0.14	0.5	0.18
Arithmetic RSD (%)	8.3	26	8.9	10	17
Number of Sample Measurements (N)	7	7	6	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 #3, 2021:
Performance of Participating Laboratories

		Serum Cr (µg/L)				
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
	Target	**7.2**	**0.6**	**1.58**	**5.0**	**1.05**
103	ICP-MS/MS	6.74	0.482	1.60	4.75	0.969
110	DRC/CC-ICP-MS	8.44	0.59	1.74	5.67	0.98
147	DRC/CC-ICP-MS	6.60	0.516	1.41	4.57	0.837
264	ICP-MS	7.45	0.82	*2.26	5.66	1.38
293	DRC/CC-ICP-MS	7.31	0.71	1.72	4.95	1.12
485	HR-ICP-MS	6.90	0.590	1.59	4.70	0.939
597	ICP-MS/MS	7.08	0.372	1.42	4.63	1.15

Based on the grading criteria for Cr in Serum, 100% of results were satisfactory, with 0 of the 7 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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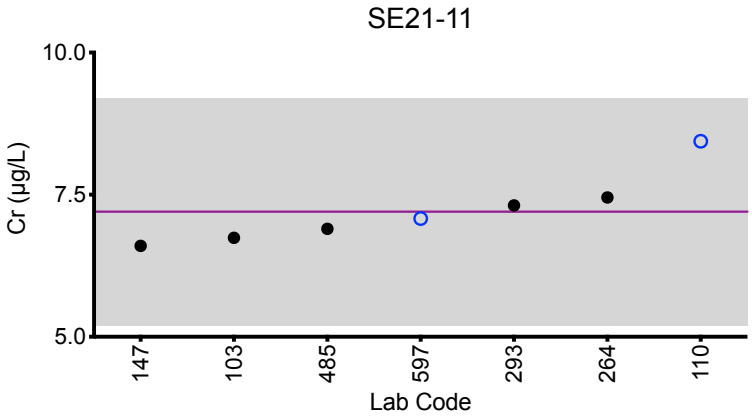
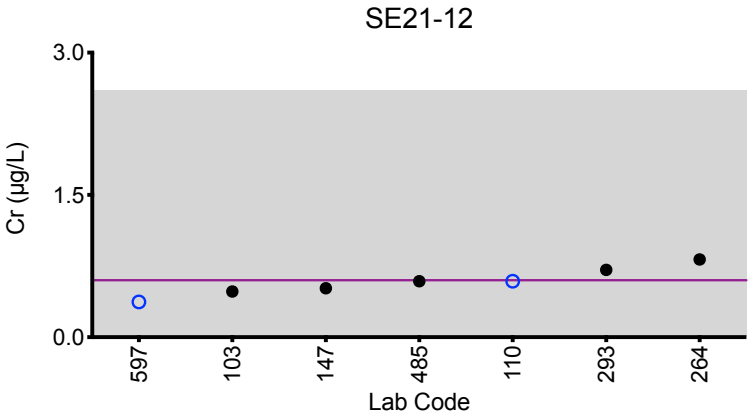
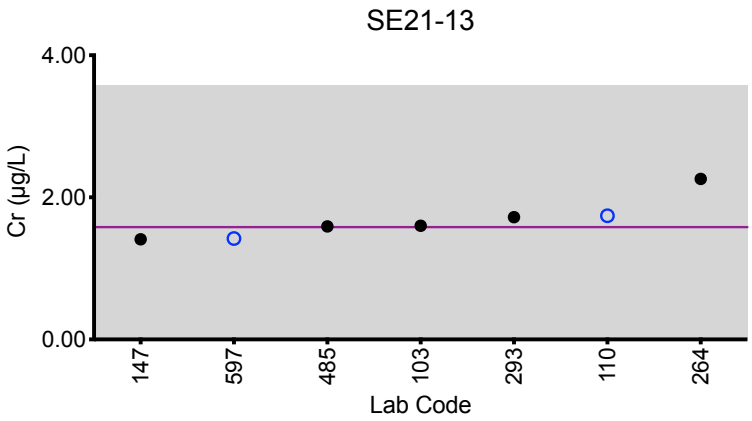
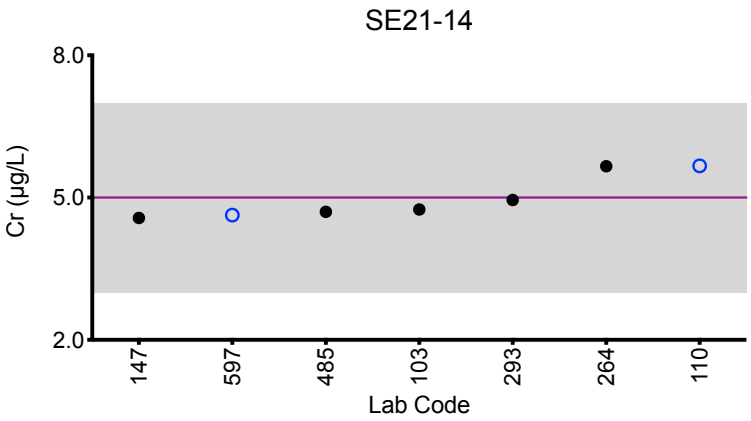
Results for Event #3, 2021: Summary Figures

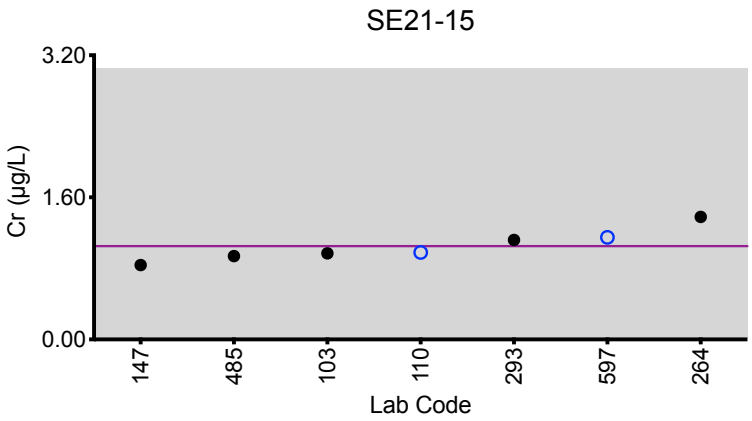
Serum Cr











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 #3, 2021:
Summary Statistics

	Serum Cu (µg/L)				
	SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Target (Arithmetic Mean ($\bar{x}$))	2190	1237	1152	983	1794
Upper Limit	2520	1423	1325	1130	2063
Lower Limit	1860	1051	979	836	1525
Arithmetic SD (s)	60	29	35	33	28
Arithmetic RSD (%)	2.7	2.3	3.1	3.4	1.6
Number of Sample Measurements (N)	8	8	8	8	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 #3, 2021:
Performance of Participating Laboratories

		Serum Cu (µg/L)				
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
	Target	**2190**	**1237**	**1152**	**983**	**1794**
107	DRC/CC-ICP-MS	2220	1240	1110	975	1810
110	ICP-MS	2244	1240	1182	1051	*1958
147	DRC/CC-ICP-MS	2147	1213	1112	959	1773
264	ICP-MS	2180	1286	1212	963	1828
293	DRC/CC-ICP-MS	2142	1214	1157	954	1780
436	FAAS	2287.6	1270	1143.8	1016.73	1779.28
483	ICP-MS	2180	1230	1170	970	1830
597	ICP-MS/MS	2120	1200	1130	978	1760

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.

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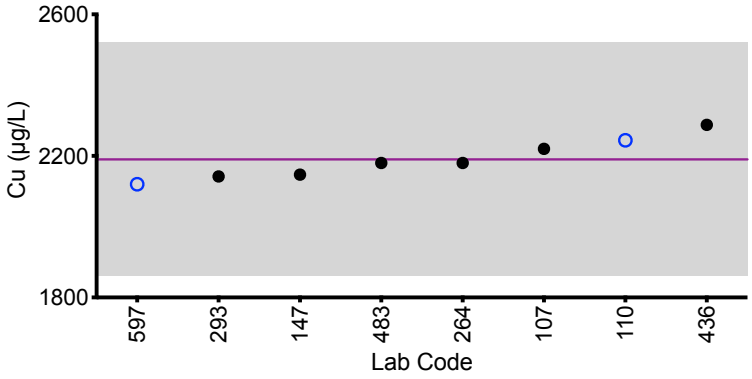
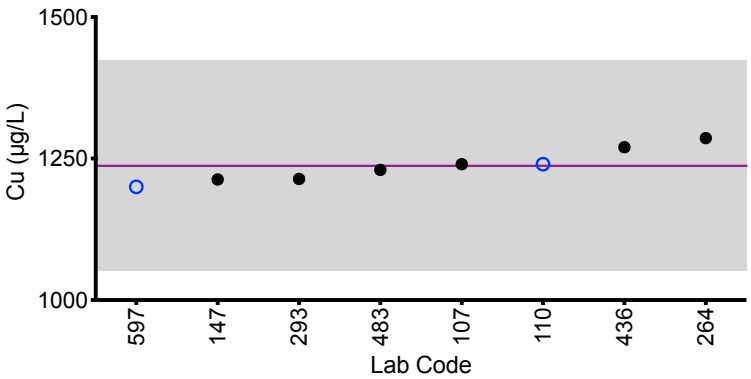
Results for Event #3, 2021: Summary Figures

Serum Cu

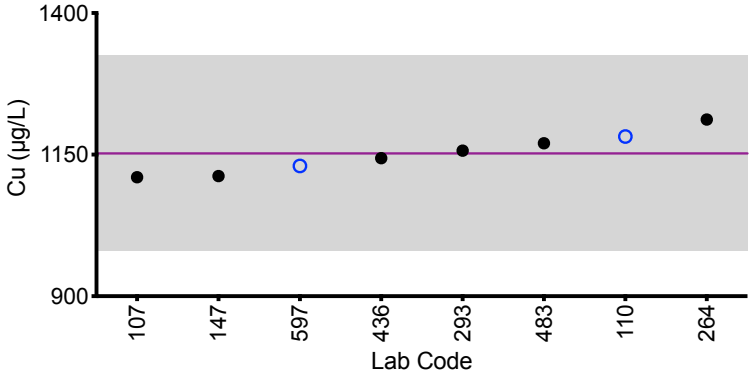
SE21-11



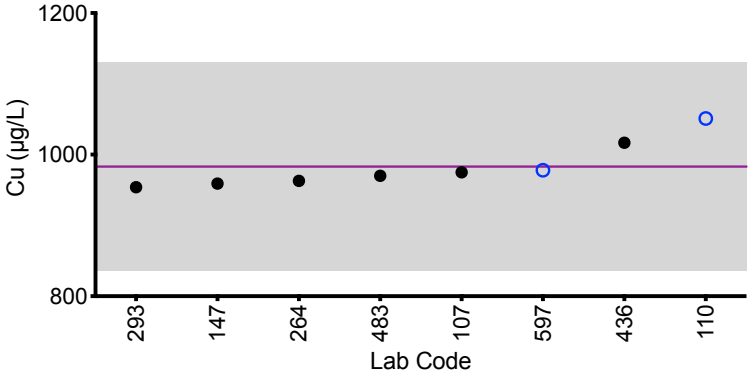
SE21-12



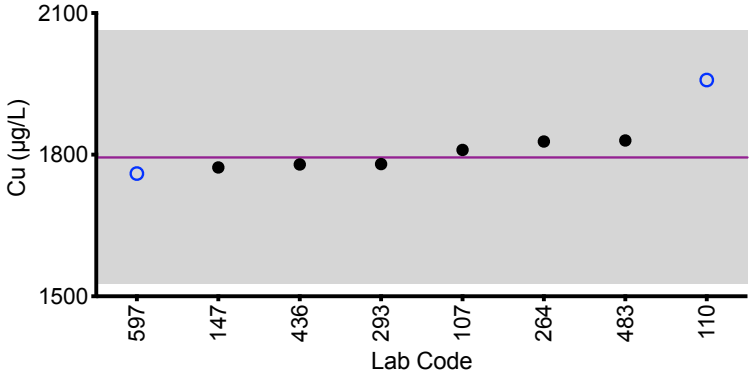
SE21-13



SE21-14



SE21-15



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 #3, 2021:
Summary Statistics

	Serum Se (µg/L)				
	SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Target (Arithmetic Mean ($\bar{x}$))	194	256	137	184	122
Upper Limit	233	307	164	221	146
Lower Limit	155	205	110	147	98
Arithmetic SD (s)	8	15	8	11	6
Arithmetic RSD (%)	4.1	5.9	5.8	6.0	4.9
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 #3, 2021:
Performance of Participating Laboratories

		Serum Se (µg/L)				
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
	Target	**194**	**256**	**137**	**184**	**122**
103	ICP-MS/MS	201	277	148	198	129
107	DRC/CC-ICP-MS	188	246	127	170	114
110	DRC/CC-ICP-MS	194	235	133	184	126
147	DRC/CC-ICP-MS	184	246	127	173	115
264	ICP-MS	187.2	253.3	138.2	172.1	117.7
293	DRC/CC-ICP-MS	208	279	148	197	129
483	ICP-MS	197	260	140	189	125
597	ICP-MS/MS	191	252	138	185	123

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

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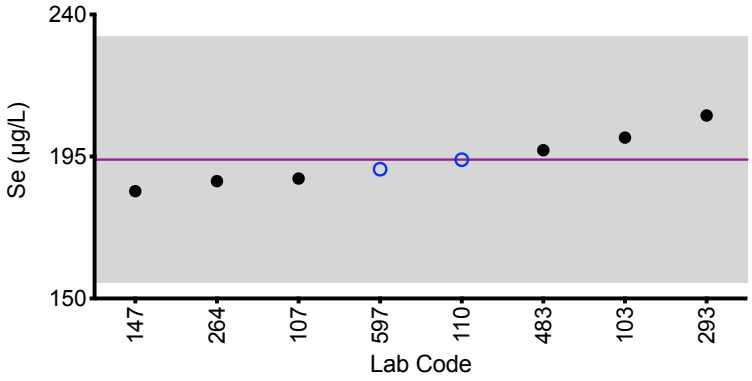
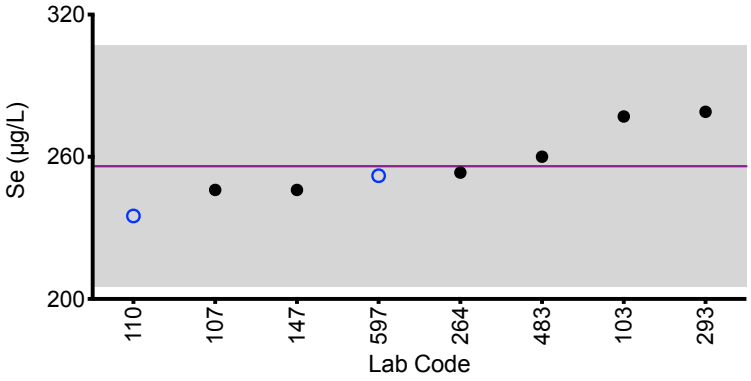
Results for Event #3, 2021: Summary Figures

Serum Se

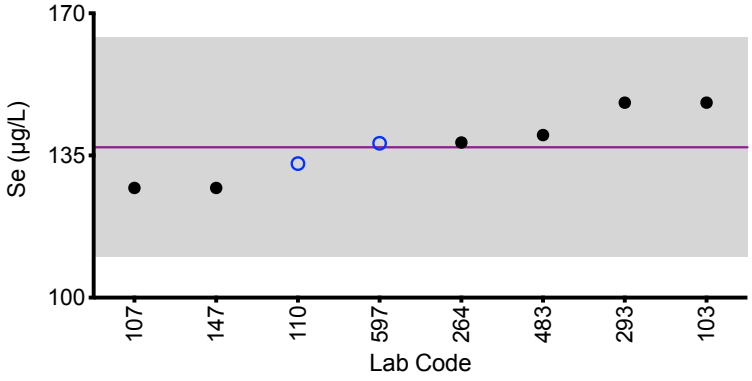
SE21-11



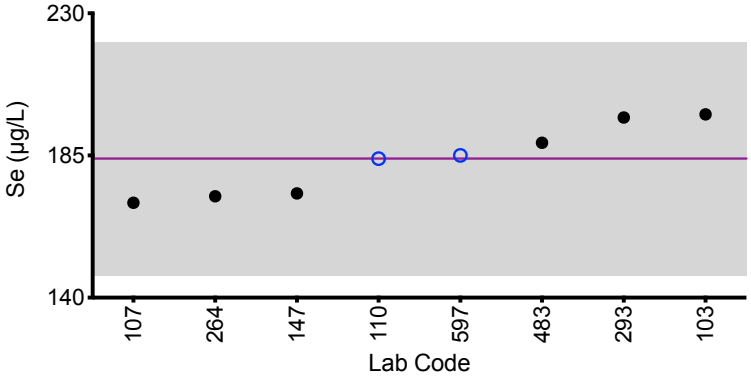
SE21-12



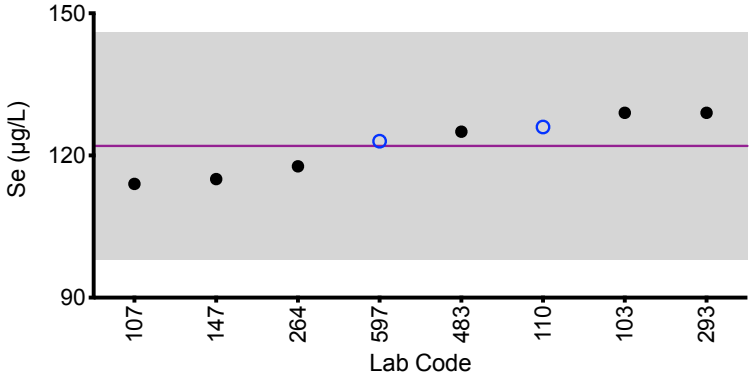
SE21-13



SE21-14



SE21-15



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 #3, 2021:
Summary Statistics

	Serum Zn (µg/L)				
	SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Target (Arithmetic Mean ($\bar{x}$))	641	4980	2850	754	674
Upper Limit	737	5730	3280	867	775
Lower Limit	545	4230	2420	641	573
Arithmetic SD (s)	28	140	90	34	28
Arithmetic RSD (%)	4.4	2.8	3.2	4.5	4.2
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 #3, 2021:
Performance of Participating Laboratories

Serum Zn (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
	Target	**641**	**4980**	**2850**	**754**	**674**
107	DRC/CC-ICP-MS	664	4710	2740	707	618
110	ICP-MS	666	5068	2924	784	706
147	DRC/CC-ICP-MS	601	4928	2739	752	667
264	ICP-MS	631	5023	2909	738	671
293	DRC/CC-ICP-MS	627	4980	2856	758	686
483	ICP-MS	624	4980	2830	731	676
597	ICP-MS/MS	676	5150	2950	808	696

Based on the grading criteria for Zn in Serum, 100% of results were satisfactory, with 0 of the 7 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.

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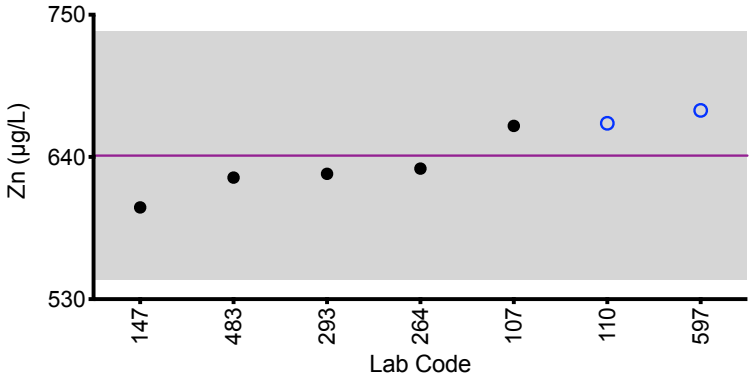
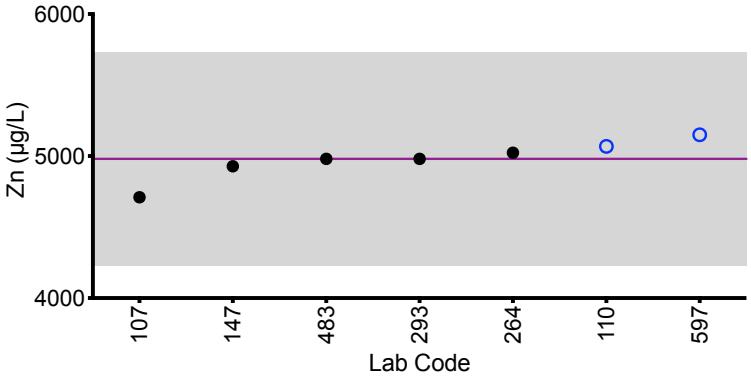
Results for Event #3, 2021: Summary Figures

Serum Zn

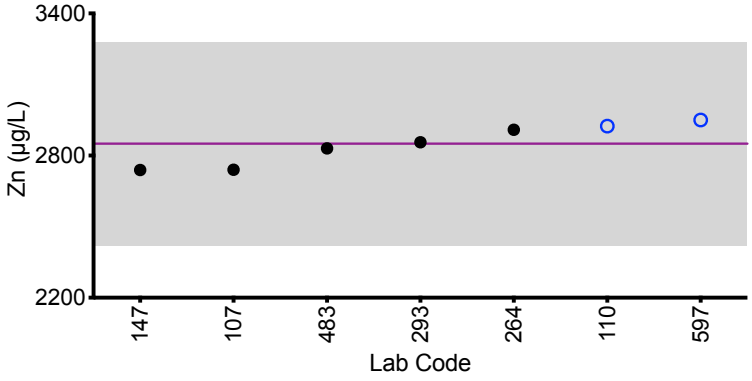
SE21-11



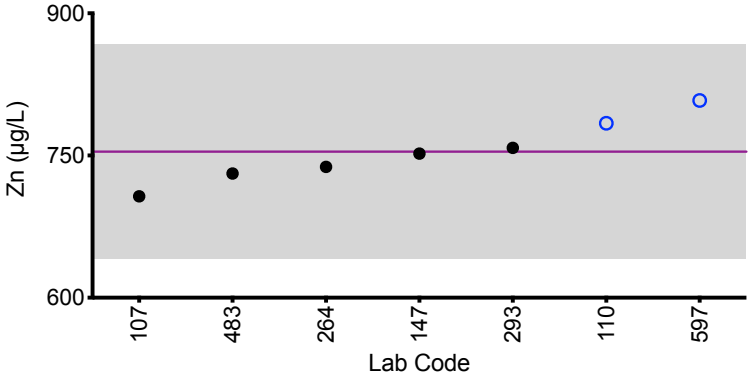
SE21-12



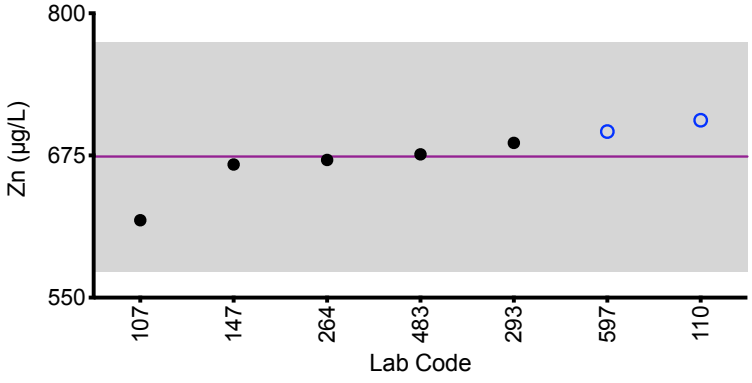
SE21-13



SE21-14



SE21-15



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 #3, 2021:
Laboratory Data and Summary Statistics

Serum Mn (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
103	ICP-MS/MS	1.69	10.7	3.00	24.4	5.76
110	ICP-MS	2.04	9.82	2.14	24.6	6.12
147	DRC/CC-ICP-MS	1.68	9.62	1.77	21.8	5.03
264	ICP-MS	*3.42	*14.27	3.80	*31.97	*8.13
293	DRC/CC-ICP-MS	1.83	10.61	1.95	24.52	5.5
597	ICP-MS/MS	2.33	10.3	2.16	24.2	5.33
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		1.9	10.2	2.5	23.9	5.5
Arithmetic SD (s)		0.3	0.5	0.8	1.2	0.4
Arithmetic RSD (%)		14	4.9	32	5.0	7.3
Number of Sample Measurements (N)		5	5	6	5	5

*Denotes a statistical Outlier.

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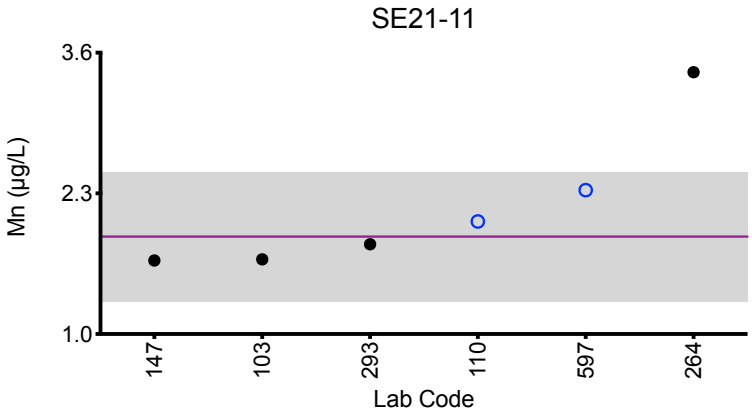
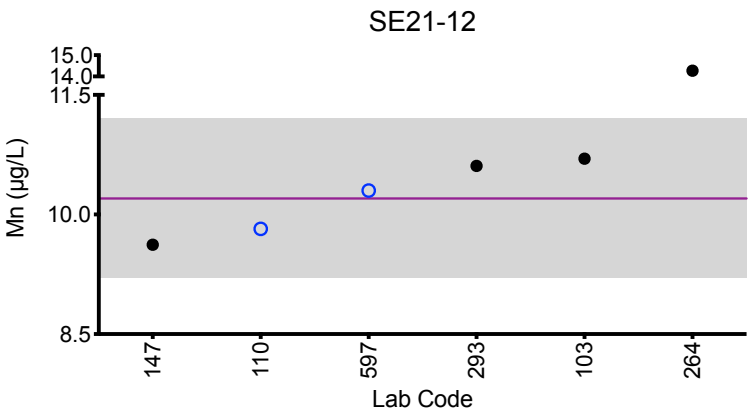
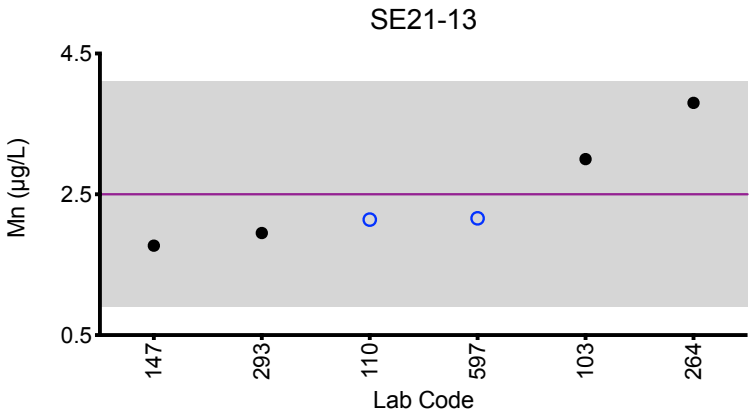
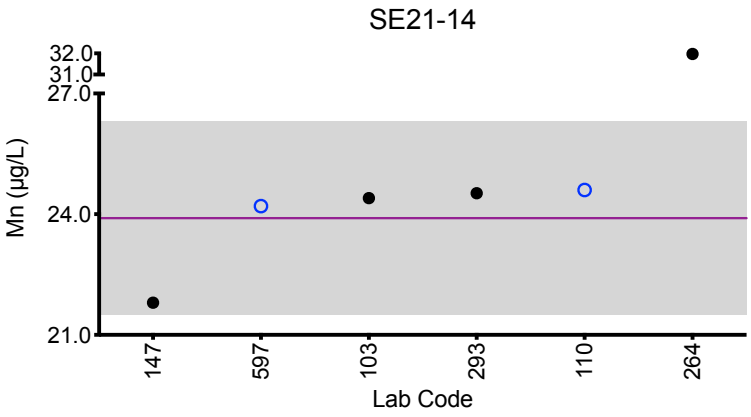
Results for Event #3, 2021: Summary Figures

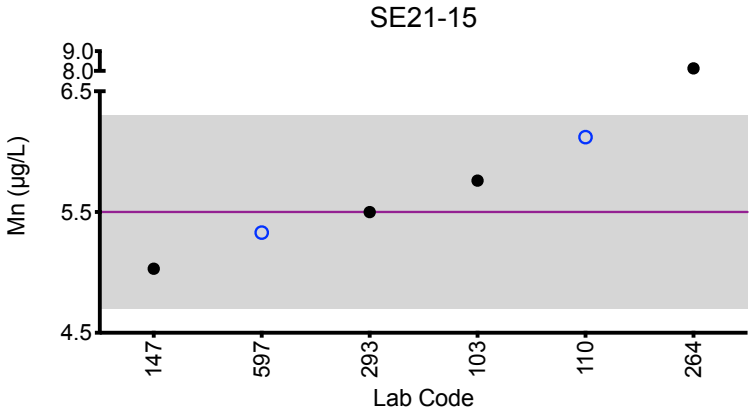
Serum Mn











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 #3, 2021:
Laboratory Data and Summary Statistics

Serum Mo (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
103	ICP-MS/MS	2.50	8.07	1.13	4.92	3.36
110	ICP-MS	2.80	8.40	1.24	5.00	3.40
147	DRC/CC-ICP-MS	2.46	7.56	1.06	4.41	3.03
293	DRC/CC-ICP-MS	2.78	8.80	1.39	5.21	3.67
485	HR-ICP-MS	2.66	8.14	1.12	4.62	3.22
597	ICP-MS/MS	2.48	7.57	1.15	4.71	3.21
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		2.61	8.1	1.18	4.8	3.31
Arithmetic SD (s)		0.15	0.5	0.12	0.3	0.22
Arithmetic RSD (%)		5.7	6.2	10	6.0	6.6
Number of Sample Measurements (N)		6	6	6	6	6

*Denotes a statistical Outlier.

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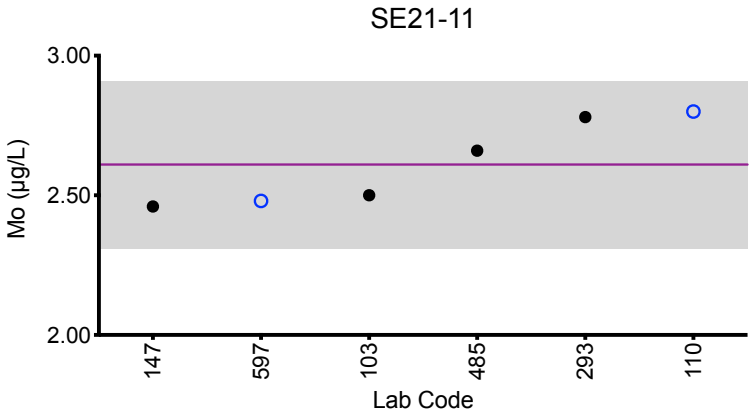
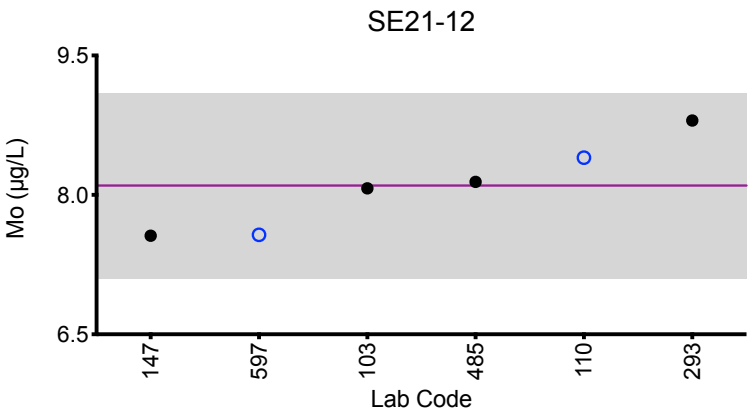
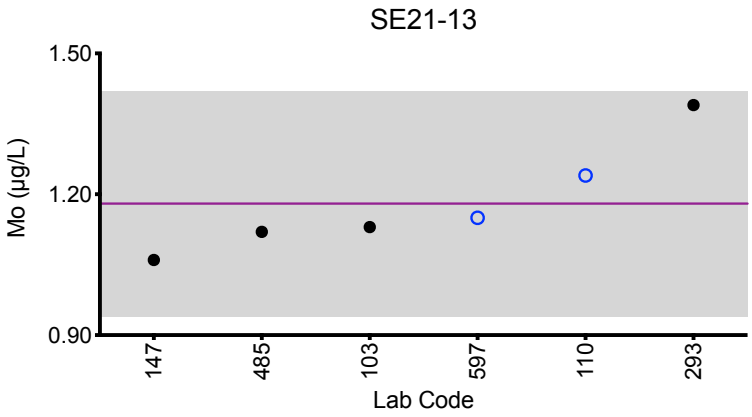
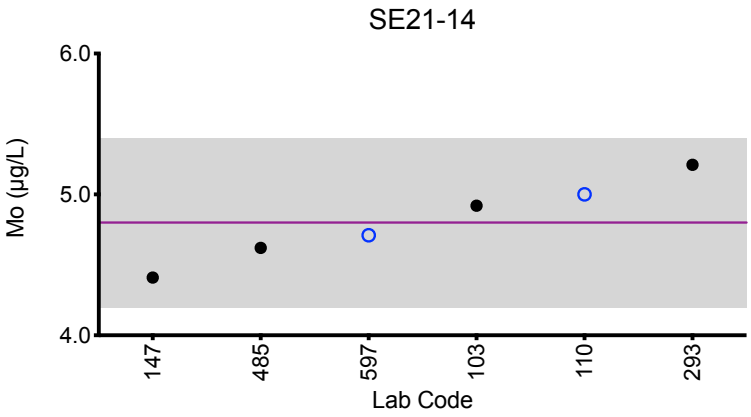
Results for Event #3, 2021: Summary Figures

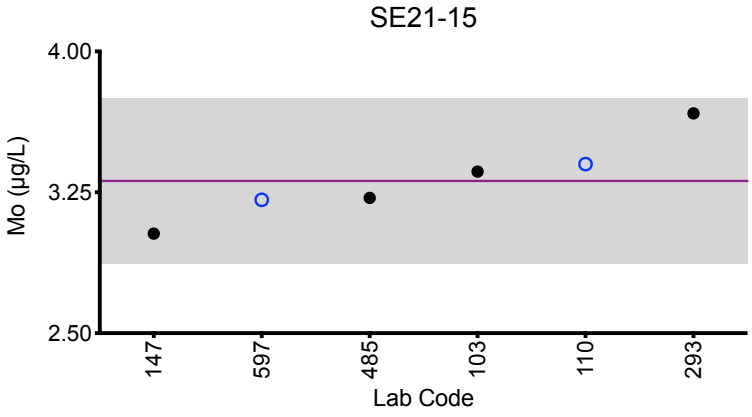
Serum Mo











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 #3, 2021:
Laboratory Data and Summary Statistics

Serum Ni (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
110	DRC/CC-ICP-MS	4.74	2.55	6.54	5.38	1.04
147	DRC/CC-ICP-MS	4.39	2.35	6.17	4.28	0.799
293	DRC/CC-ICP-MS	6.41	3.33	7.49	5.15	1.19
442	DRC/CC-ICP-MS	4.91	2.53	6.88	4.81	0.939
485	HR-ICP-MS	4.95	2.47	7.01	4.76	0.880
597	ICP-MS/MS	6.34	3.07	7.46	6.05	*2.81
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		5.3	2.7	6.9	5.1	0.97
Arithmetic SD (s)		0.9	0.4	0.5	0.6	0.15
Arithmetic RSD (%)		17	15	7.2	12	15
Number of Sample Measurements (N)		6	6	6	6	5

*Denotes a statistical Outlier.

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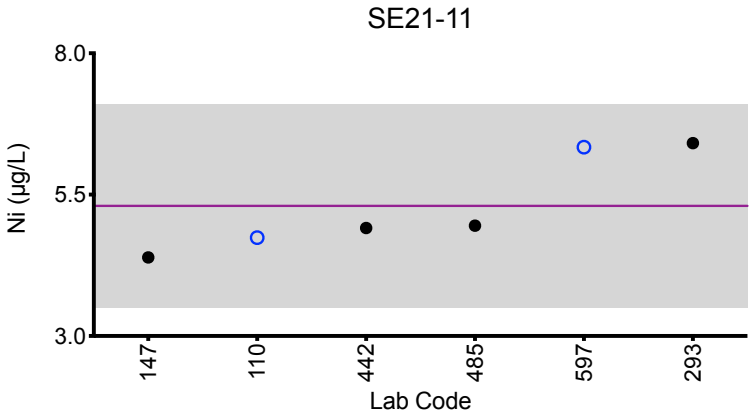
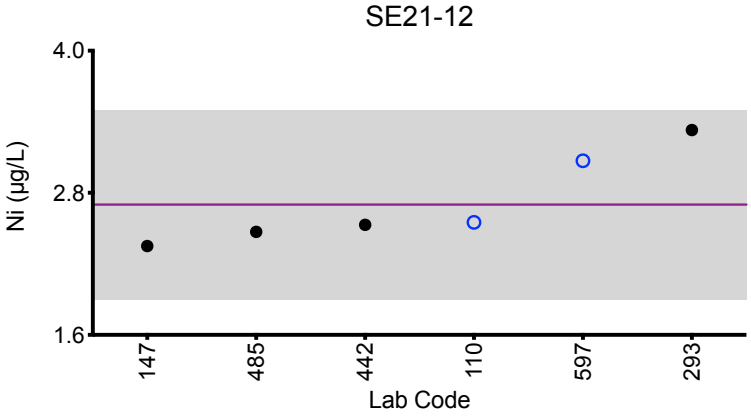
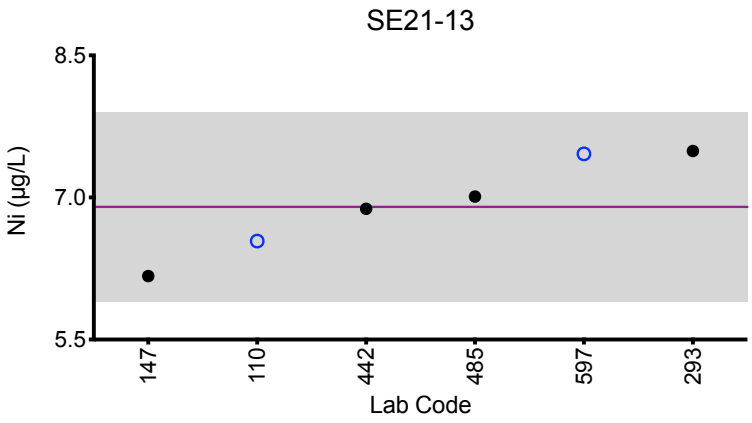
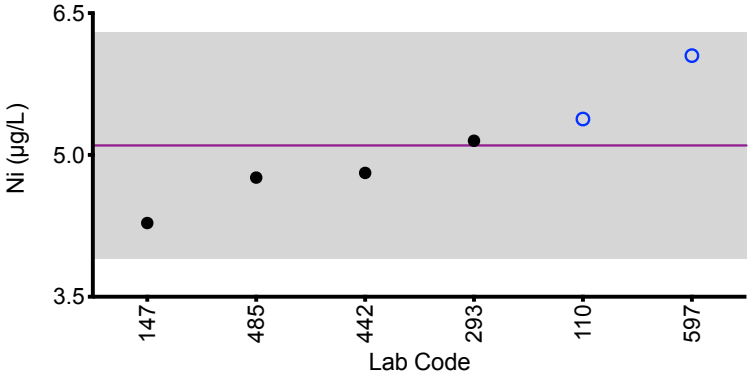
Results for Event #3, 2021: Summary Figures

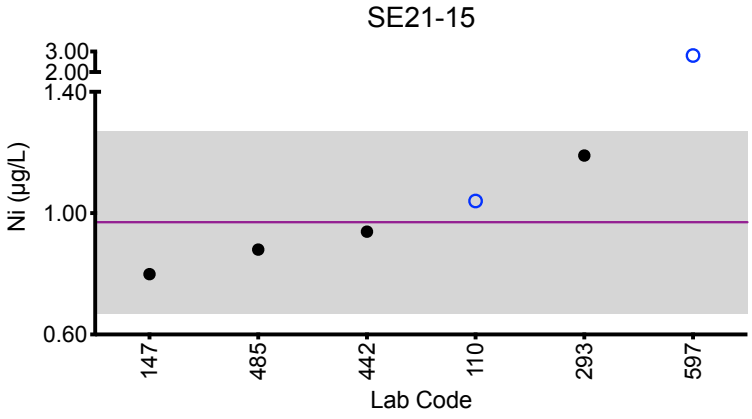
Serum Ni











Legend:
○ 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 #3, 2021:
Laboratory Data and Summary Statistics

Serum V (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
110	DRC/CC-ICP-MS	9.1	1.1	2.3	0.7	6.7
147	DRC/CC-ICP-MS	8.32	0.964	2.15	0.745	5.31
293	DRC/CC-ICP-MS	9.5	1.3	2.7	1.0	6.2
485	HR-ICP-MS	9.13	1.01	2.36	0.772	5.65
597	ICP-MS/MS	8.95	1.06	2.35	0.874	5.57
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		9.0	1.09	2.37	0.82	5.9
Arithmetic SD (s)		0.4	0.13	0.20	0.12	0.6
Arithmetic RSD (%)		4.4	12	8.4	15	10
Number of Sample Measurements (N)		5	5	5	5	5

*Denotes a statistical Outlier.

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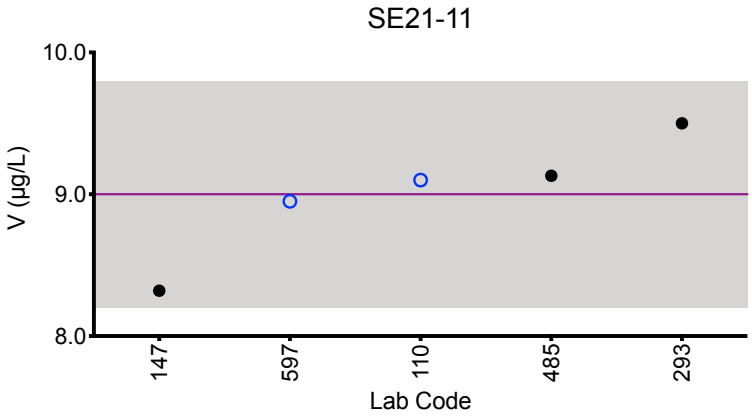
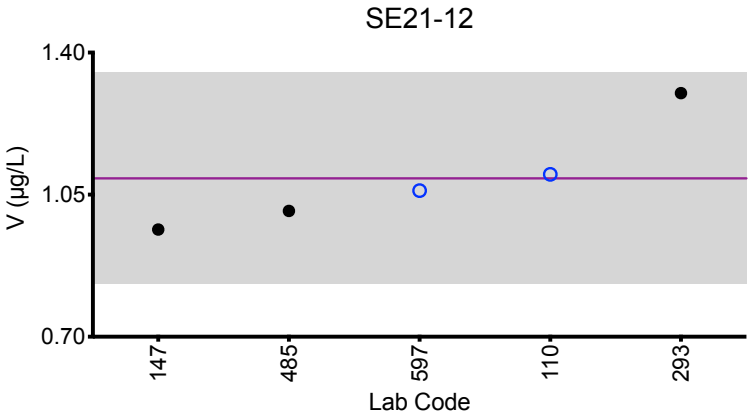
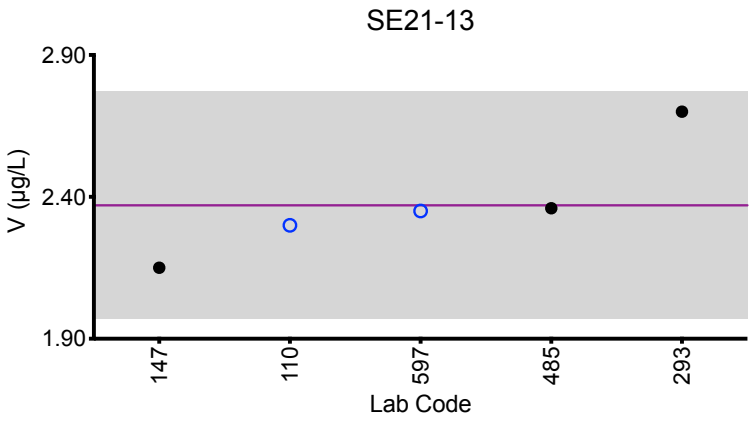
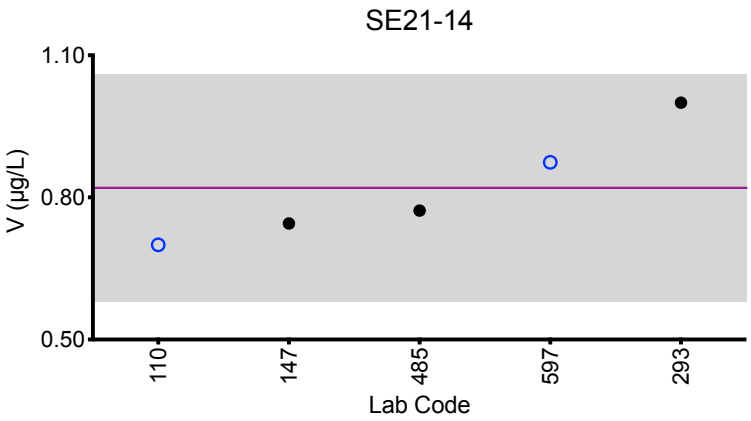
Results for Event #3, 2021: Summary Figures

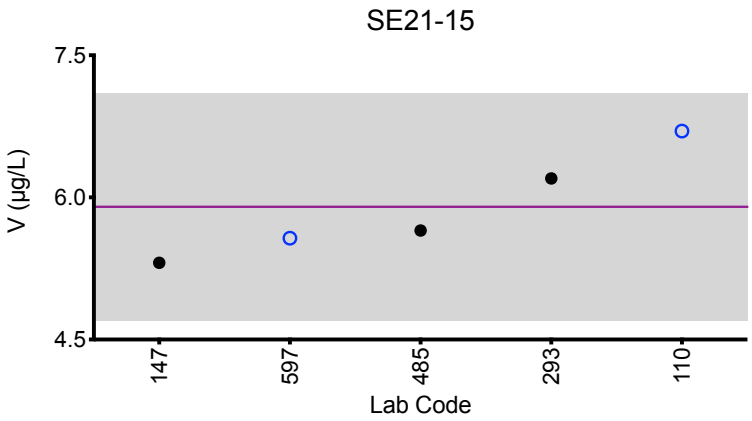
Serum V











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 #3, 2021:
Laboratory Data and Summary Statistics

Serum As (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
103	ICP-MS/MS	1.24	20.8	5.26	7.11	2.29
110	DRC/CC-ICP-MS	1.28	18.5	4.76	7.11	2.37
147	DRC/CC-ICP-MS	1.37	19.9	4.88	6.86	2.28
597	ICP-MS/MS	1.49	18.5	4.97	6.78	2.36

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	1.35	19.4	5.0	6.96	2.33
Arithmetic SD (s)	0.11	1.1	0.2	0.17	0.05
Arithmetic RSD (%)	8.1	5.7	4.2	2.4	2.1
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Ba (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
110	ICP-MS	2.31	3.14	*4.01	2.14	4.94
147	ICP-MS	2.49	3.86	11.8	2.25	4.75
597	ICP-MS/MS	2.61	4.21	15.4	2.23	6.92

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	2.47	3.7	14	2.21	5.5
Arithmetic SD (s)	0.15	0.5	3	0.06	1.2
Arithmetic RSD (%)	6.1	14	21	2.7	22
Number of Sample Measurements (N)	3	3	2	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Be (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
110	ICP-MS	2.53	3.93	0.227	1.05	0.625
147	ICP-MS	2.04	4.37	0.315	1.10	0.874
293	ICP-MS	2.270	4.57	0.25	1.12	0.820
597	ICP-MS/MS	2.10	4.43	0.278	1.06	0.695
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		2.2	4.3	0.27	1.08	0.75
Arithmetic SD (s)		0.2	0.3	0.04	0.03	0.11
Arithmetic RSD (%)		9.9	6.5	15	2.8	15
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Cd (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
103	ICP-MS/MS	3.05	0.309	6.23	1.35	0.582
110	ICP-MS	2.98	0.292	5.80	1.28	0.503
147	ICP-MS	2.80	0.285	5.50	1.23	0.498
597	ICP-MS/MS	2.88	0.281	5.68	1.32	0.535
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		2.93	0.292	5.8	1.29	0.53
Arithmetic SD (s)		0.11	0.012	0.3	0.05	0.04
Arithmetic RSD (%)		3.8	4.1	5.2	3.9	7.5
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Cs (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
110	ICP-MS	0.493	0.407	0.481	0.711	0.424
597	ICP-MS/MS	0.503	0.371	0.488	0.719	0.408

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	0.498	0.39	0.484	0.715	0.416
Arithmetic SD (s)	0.007	0.03	0.005	0.006	0.011
Arithmetic RSD (%)	1.4	7.7	1.0	0.84	2.6
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Hg (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
103	ICP-MS/MS	7.26	1.11	2.12	0.819	4.69
110	ICP-MS	7.62	1.16	2.32	0.82	4.66
597	ICP-MS/MS	6.96	1.14	2.12	0.898	4.49
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		7.3	1.14	2.19	0.85	4.61
Arithmetic SD (s)		0.3	0.03	0.12	0.05	0.11
Arithmetic RSD (%)		4.1	2.2	5.5	5.9	2.4
Number of Sample Measurements (N)		3	3	3	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum I (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
147	ICP-MS	110	77.8	106	68.4	77.5
442	ICP-MS	118	81.5	117	70.8	85.5
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		114	80	112	70	82
Arithmetic SD (s)		6	3	8	2	6
Arithmetic RSD (%)		5.3	3.8	7.1	2.4	7.3
Number of Sample Measurements (N)		2	2	2	2	2

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Mg (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
264	ICP-MS	19036	20653	19988	18589	20511
597	ICP-MS/MS	18900	19500	18900	18600	20300

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	18970	20100	19400	18595	20410
Arithmetic SD (s)	100	800	800	8	150
Arithmetic RSD (%)	0.53	4.1	4.1	0.042	0.73
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Pb (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
103	ICP-MS/MS	0.851	5.23	5.23	11.4	1.58
110	ICP-MS	0.92	5.00	3.19	11.0	1.54
597	ICP-MS/MS	0.964	4.75	2.57	10.6	1.46
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		0.91	5.0	3.7	11.0	1.53
Arithmetic SD (s)		0.06	0.2	1.4	0.4	0.06
Arithmetic RSD (%)		6.6	4.8	38	3.6	3.9
Number of Sample Measurements (N)		3	3	3	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Pt (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
110	ICP-MS	1.04	0.17	0.70	1.62	0.32
264	ICP-MS	0.78	<0.10	0.40	1.44	<0.10
293	DRC/CC-ICP-MS	1.03	0.27	0.84	1.80	0.43

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	0.95	0.22	0.7	1.6	0.38
Arithmetic SD (s)	0.15	0.07	0.2	0.2	0.08
Arithmetic RSD (%)	16	32	34	11	21
Number of Sample Measurements (N)	3	2	3	3	2

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Sb (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
103	ICP-MS/MS	1.53	4.06	3.71	5.90	1.31
110	ICP-MS	1.66	4.67	3.98	6.75	1.42
147	ICP-MS	1.57	4.15	3.51	5.89	1.36
597	ICP-MS/MS	1.72	4.05	3.59	5.90	1.14
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		1.62	4.2	3.7	6.1	1.31
Arithmetic SD (s)		0.09	0.3	0.2	0.4	0.12
Arithmetic RSD (%)		5.6	7.1	5.7	6.6	9.2
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Sn (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
110	ICP-MS	4.23	7.12	1.16	9.87	2.76
597	ICP-MS/MS	3.83	6.42	1.11	9.54	2.55
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		4.0	6.8	1.14	9.7	2.7
Arithmetic SD (s)		0.3	0.5	0.04	0.2	0.1
Arithmetic RSD (%)		7.5	7.4	3.5	2.1	5.7
Number of Sample Measurements (N)		2	2	2	2	2

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Sr (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
103	ICP-MS/MS	31.2	81.6	56.4	102	61.6
200	ICP-MS	33.3	86.7	58.7	103.4	62.2
597	ICP-MS/MS	33.3	79.8	53.8	99.6	59.4

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	32.6	83	56	102	61.1
Arithmetic SD (s)	1.2	4	2	2	1.5
Arithmetic RSD (%)	3.7	4.8	4.4	1.9	2.5
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Ti (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
200	DRC/CC-ICP-MS	8.3	*15.9	*7.5	6.4	4.5
442	ICP-MS/MS	7.87	6.91	2.31	4.31	3.00
485	HR-ICP-MS	7.73	6.29	2.26	4.11	2.80
597	ICP-MS/MS	8.89	7.54	3.33	5.11	3.66

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	8.2	6.9	2.6	5.0	3.5
Arithmetic SD (s)	0.5	0.6	0.6	1.0	0.8
Arithmetic RSD (%)	6.1	9.0	23	20	23
Number of Sample Measurements (N)	4	3	3	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum Tl (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
103	ICP-MS/MS	4.34	0.288	3.10	1.38	0.885
110	ICP-MS	4.26	0.283	3.02	1.31	0.843
147	ICP-MS	3.99	0.274	2.70	1.25	0.793
597	ICP-MS/MS	4.15	0.275	2.84	1.30	0.790
Summary Statistics						
		SE21-11	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
Arithmetic Mean ($\bar{x}$)		4.19	0.280	2.92	1.31	0.83
Arithmetic SD (s)		0.15	0.007	0.18	0.05	0.05
Arithmetic RSD (%)		3.6	2.5	6.2	3.8	5.5
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum U (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
103	ICP-MS/MS	0.0787	0.110	0.156	0.174	0.0898
110	ICP-MS	0.086	0.111	0.147	0.173	0.086
597	ICP-MS/MS	0.0696	0.0883	0.116	0.165	0.0748

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	0.078	0.103	0.14	0.171	0.084
Arithmetic SD (s)	0.008	0.013	0.02	0.005	0.008
Arithmetic RSD (%)	10	13	15	2.9	9.5
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021:
Laboratory Data and Summary Statistics

Serum W (µg/L)

Lab Code	Method	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
110	ICP-MS	0.78	4.55	1.34	0.46	3.03
200	ICP-MS	0.8	4.2	1.5	0.4	2.9
597	ICP-MS/MS	0.793	4.17	1.22	0.458	2.74

Summary Statistics

	SE21-11	SE21-12	SE21-13	SE21-14	SE21-15
Arithmetic Mean ($\bar{x}$)	0.791	4.3	1.35	0.44	2.89
Arithmetic SD (s)	0.010	0.2	0.14	0.03	0.15
Arithmetic RSD (%)	1.3	4.9	10	6.8	5.2
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.

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Results for Event #3, 2021: Additional Elements in Serum

Serum Bi (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
147	ICP-MS	<0.0397	<0.0397	<0.0397	<0.0397	<0.0397
597	ICP-MS/MS	0.0363	0.0361	0.0355	0.0406	0.0385

Serum Fe (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
264	ICP-MS	813.0	919.3	835.3	1036.5	903.8

Serum Li (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
147	ICP-MS	0.749	0.562	0.847	1.10	0.672

Serum Th (µg/L)						
Lab Code	**Method**	**SE21-11**	**SE21-12**	**SE21-13**	**SE21-14**	**SE21-15**
597	ICP-MS/MS	<0.0095	<0.0095	0.0111	<0.0095	<0.0095

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.