



**Department
of Health**

**Wadsworth
Center**

New York State Biomonitoring Program for Trace Elements

Event #2, 2025

Trace Elements in Whole Blood, Urine, and Serum

July, 2025

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory



**Event #2, 2025:
Trace Elements in Whole Blood, Urine, and Serum**

7/22/2025

Dear Laboratory Director,

This report summarizes performance for the second biomonitoring proficiency test (PT) event of 2025 for Trace Elements in Whole Blood, Urine, and Serum. One of the key goals of this PT program is to achieve harmonization of biomonitoring data for trace elements.

Target Value Assignment and Performance Evaluation:

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

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

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

Samples for the next PT event (Event #3, 2025) will be shipped September 10, 2025. Comments about this report may be directed to trel@health.ny.gov.

Sincerely,

Patrick J. Parsons, PhD
Chief, Inorganic and Nuclear Chemistry,
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Wadsworth Center



**Department
of Health**

**Wadsworth
Center**

Event #2, 2025

**Trace Elements in
Whole Blood**

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory



**Event #2, 2025:
Trace Elements in Whole Blood**

PT Materials

Human whole blood was purchased from BioIVT and preserved with K₂EDTA. The company certifies that this material was "non-reactive" for HBsAg, HBV DNA, HIV-1,2 Ab, HIV-1 RNA, HCV Ab, HCV RNA, and STS. Units of whole blood were filtered into polypropylene containers through cheesecloth to remove particulates and supplemented with arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), mercury (Hg), manganese (Mn), lead (Pb), barium (Ba), beryllium (Be), copper (Cu), molybdenum (Mo), nickel (Ni), platinum (Pt), antimony (Sb), selenium (Se), tin (Sn), titanium (Ti), thallium (Tl), uranium (U), vanadium (V), tungsten (W), and zinc (Zn). Whole blood samples were homogenized overnight prior to aliquoting 2-mL into polypropylene vials. PT samples were stored at -80°C until the week of the PT event, when they were thawed at 4°C prior to circulation to laboratories for analysis.

Graded Elements

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

Additional Elements

An additional 32 elements were reported by at least one participant: Ag, Al, B, Ba, Be, Bi, Br, Ca, Cl, Cs, Cu, Fe, Ga, I, Li, Mg, Mo, Ni, Pt, S, Sb, Se, Sn, Sr, Te, Th, Ti, Tl, U, V, W, and Zn. These data are included here to provide a more complete characterization of the PT materials. All results reported by participant laboratories are tabulated and organized by lab code. The PT data are graphed for visual comparison purposes for all elements where at least five laboratories reported a value greater than the LOD. A statistical summary table is provided for samples where at least two comparable values were reported as above the LOD.

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



Results for Event #2, 2025: Summary Statistics

Whole Blood As (µg/L)					
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target (Arithmetic Mean (\bar{x}))	5.16	9.85	0.66	34.0	1.33
Upper Limit	11.16	15.85	6.66	40.8	7.33
Lower Limit	0.00	3.85	0.00	27.2	0.00
Arithmetic SD (s)	0.21	0.15	0.11	1.7	0.09
Arithmetic RSD (%)	4.1	1.5	17	5.0	6.8
Number of Sample Measurements (N)	7	6	7	7	7

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



Results for Event #2, 2025: Performance of Participating Laboratories

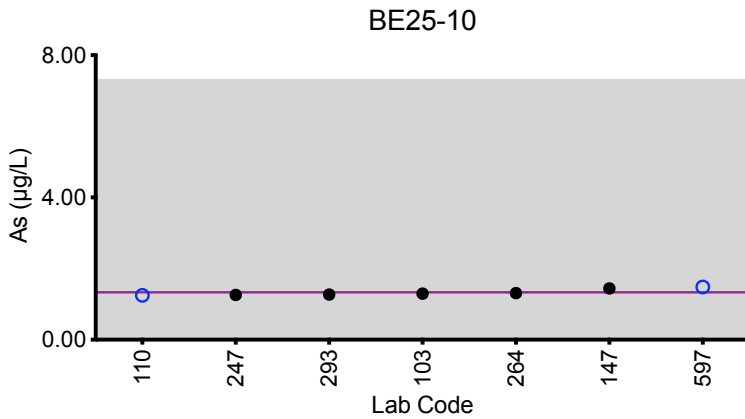
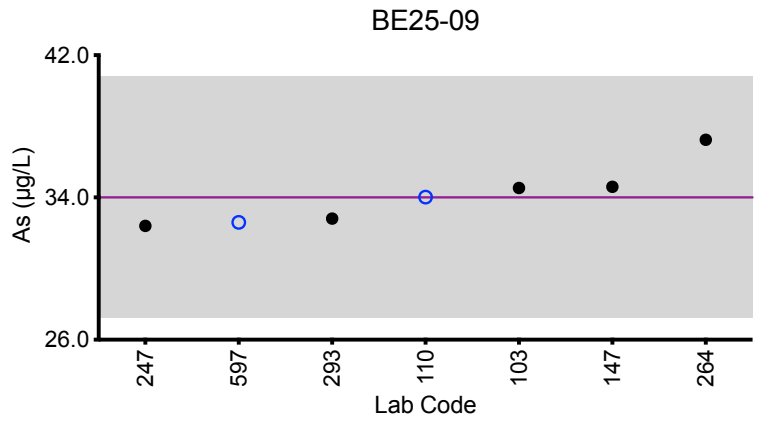
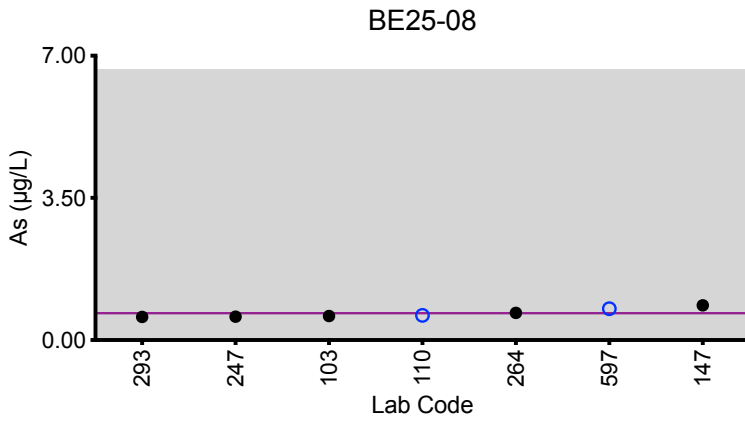
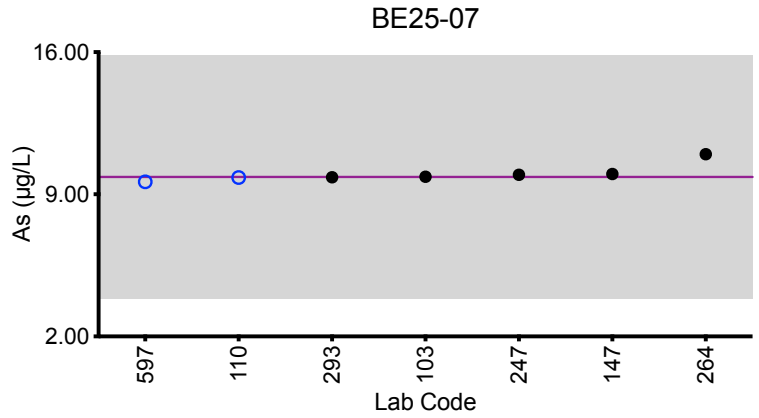
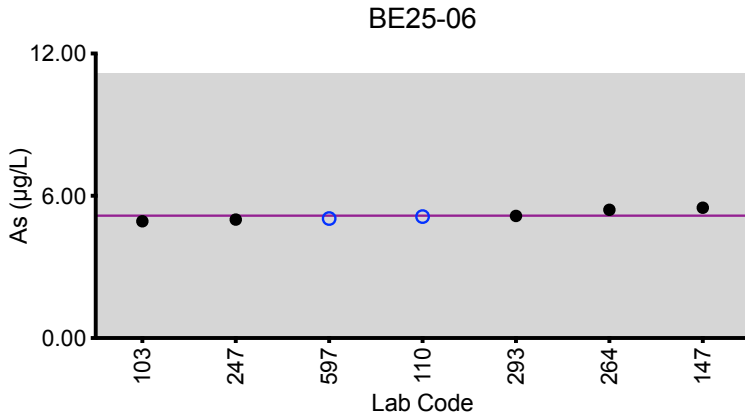
Whole Blood As (µg/L)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
	Target	5.16	9.85	0.66	34.0	1.33
103	ICP-MS/MS	4.93	9.86	0.591	34.5	1.29
110	ICP-MS/MS	5.12	9.83	0.61	34.0	1.25
147	ICP-MS	5.50	10.0	0.855	34.6	1.44
247	ICP-MS/MS	5.00	10.0	0.576	32.4	1.26
264	ICP-MS	5.41	*10.97	0.67	37.24	1.31
293	DRC/CC-ICP-MS	5.15	9.8	0.57	32.81	1.3
597	ICP-MS/MS	5.04	9.61	0.771	32.6	1.48

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



Results for Event #2, 2025: Summary Figures

Whole Blood As



Legend:

○ 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:

$\pm 6 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 6 \mu\text{g/L}$ at concentrations less than or equal to $30 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Whole Blood Cd (µg/L)				
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target (Robust Mean (x*))	9.1	1.84	0.42	1.53	0.60
Upper Limit	10.5	2.84	1.42	2.53	1.60
Lower Limit	7.7	0.84	0.00	0.53	0.00
Robust SD (s*)	0.6	0.11	0.03	0.08	0.06
Robust RSD (%)	6.6	6.0	7.5	5.2	10
Number of Sample Measurements (N)	12	12	8	11	11
Standard Uncertainty (u)	0.2	0.04	NA	0.03	0.02

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

An arithmetic mean, SD, RSD and n are provided for sample BE25-08.



Results for Event #2, 2025: Performance of Participating Laboratories

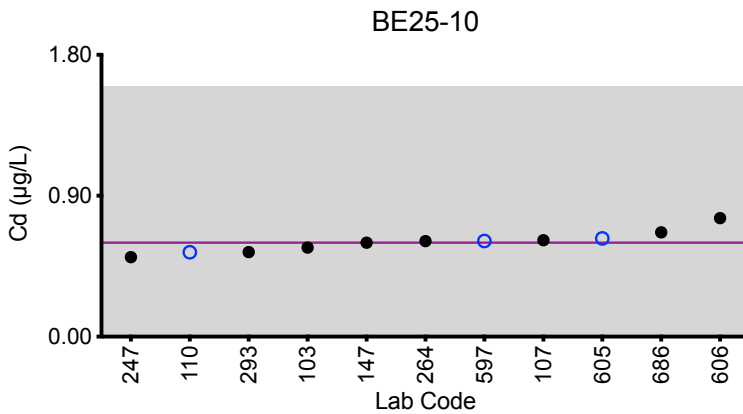
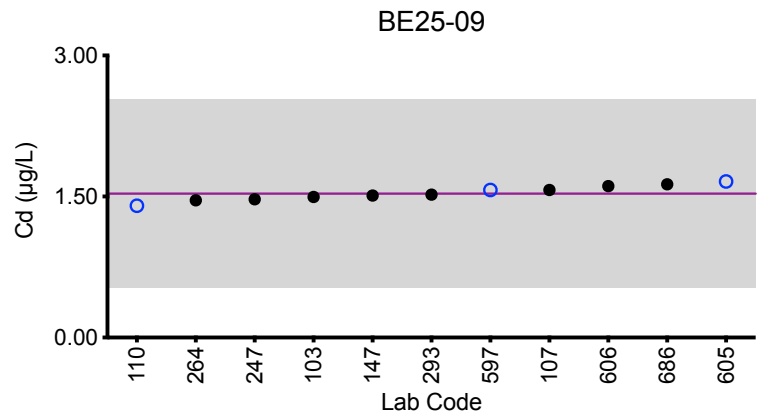
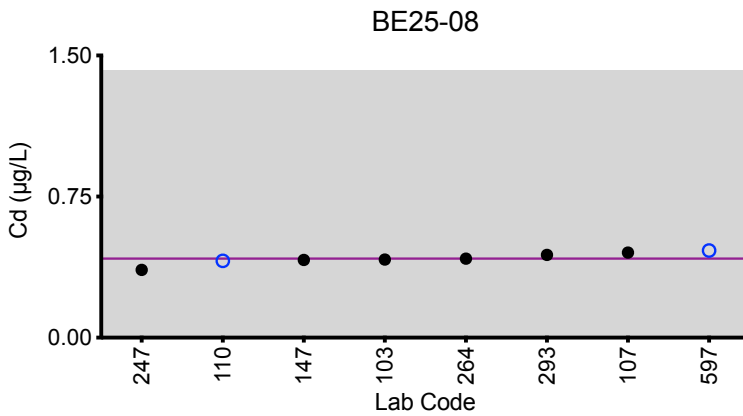
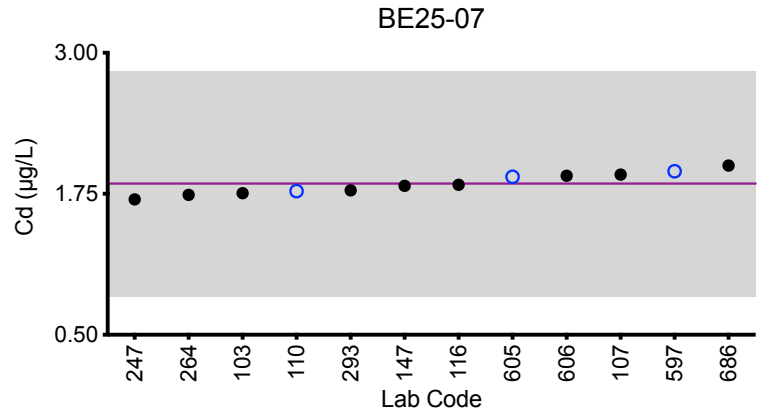
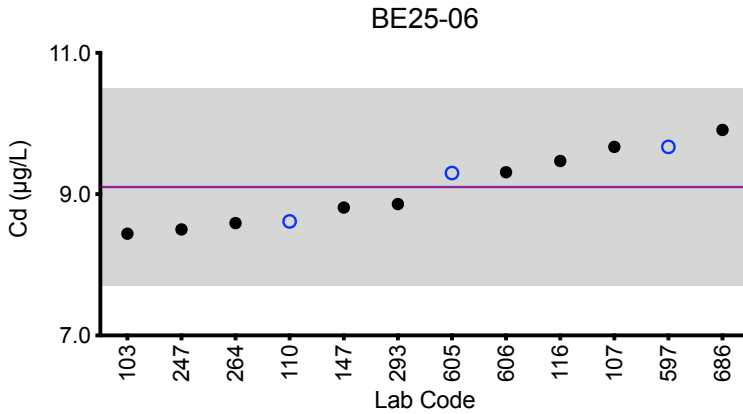
Whole Blood Cd (µg/L)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target		9.1	1.84	0.42	1.53	0.60
103	ICP-MS/MS	8.44	1.75	0.415	1.49	0.568
107	ICP-MS/MS	9.67	1.92	0.452	1.57	0.616
110	ICP-MS/MS	8.62	1.77	0.41	1.40	0.54
116	ICP-MS/MS	9.47	1.83	<1.50	<1.50	<1.50
147	ICP-MS	8.81	1.82	0.413	1.51	0.600
247	ICP-MS/MS	8.50	1.70	0.360	1.47	0.508
264	ICP-MS	8.59	1.74	0.42	1.46	0.61
293	DRC/CC-ICP-MS	8.86	1.78	0.440	1.5	0.54
597	ICP-MS/MS	9.67	1.95	0.463	1.57	0.611
605	ICP-MS	9.30	1.90	<0.500	1.66	0.627
606	ICP-MS/MS	9.31	1.91	<0.500	1.61	0.757
686	ICP-MS	9.91	2.00	<0.500	1.63	0.666

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



Results for Event #2, 2025: Summary Figures

Whole Blood Cd



Legend:

○ 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:

$\pm 1 \mu\text{g/L}$ or $\pm 15\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 1 \mu\text{g/L}$ at concentrations less than or equal to $6.7 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Whole Blood Co (µg/L)				
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target (Arithmetic Mean (\bar{x}))	4.16	0.88	7.5	0.57	2.31
Upper Limit	5.66	2.38	9.0	2.07	3.81
Lower Limit	2.66	0.00	6.0	0.00	0.81
Arithmetic SD (s)	0.24	0.07	0.4	0.05	0.08
Arithmetic RSD (%)	5.8	8.0	4.6	8.8	3.5
Number of Sample Measurements (N)	8	8	8	8	8

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



Results for Event #2, 2025: Performance of Participating Laboratories

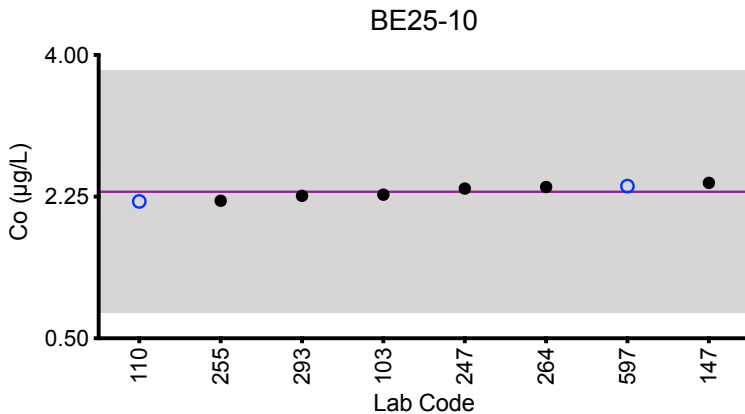
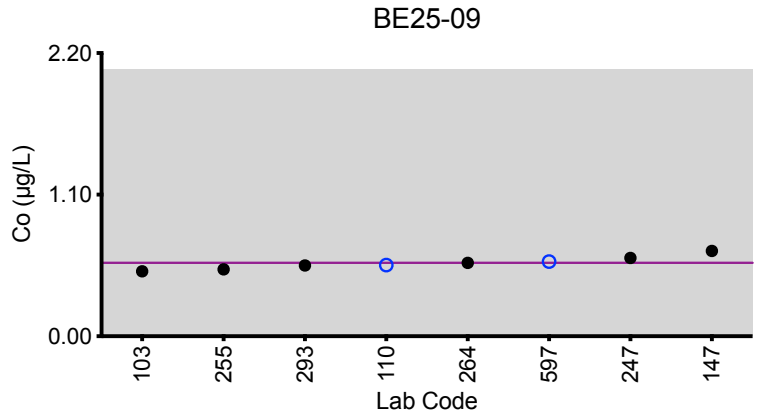
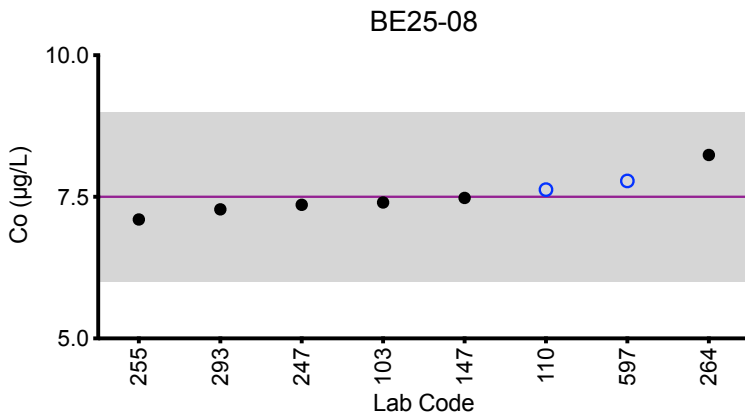
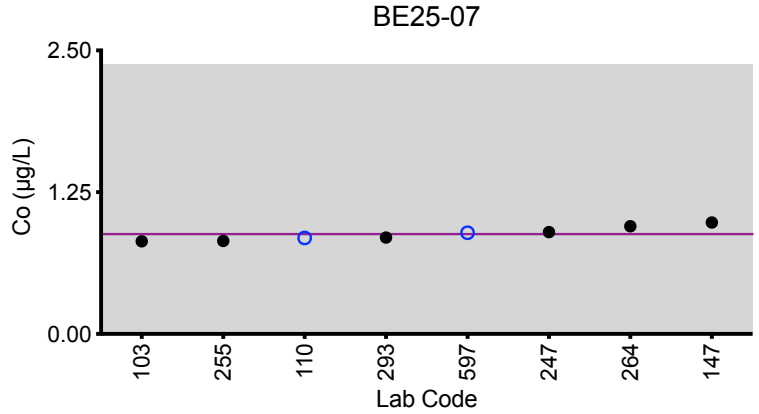
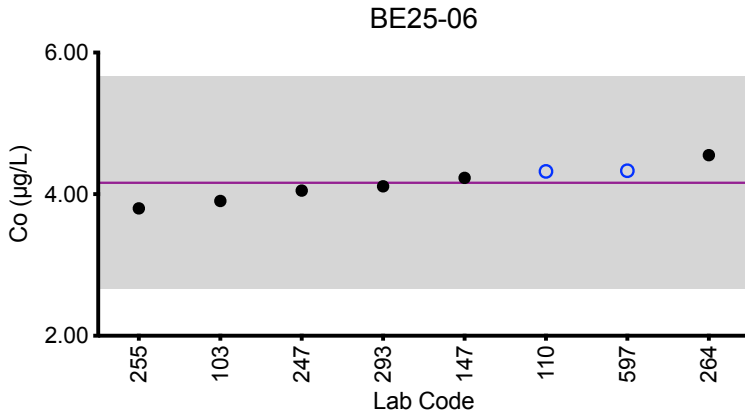
Whole Blood Co (µg/L)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target		4.16	0.88	7.5	0.57	2.31
103	ICP-MS/MS	3.90	0.817	7.40	0.505	2.27
110	ICP-MS/MS	4.3	0.8	7.6	0.6	2.2
147	ICP-MS	4.23	0.983	7.48	0.663	2.42
247	ICP-MS/MS	4.05	0.898	7.36	0.608	2.35
255	ICP-MS	3.8	0.82	7.1	0.52	2.2
264	ICP-MS	4.55	0.95	8.24	0.57	2.37
293	DRC/CC-ICP-MS	4.11	0.85	7.28	0.55	2.26
597	ICP-MS/MS	4.33	0.892	7.78	0.580	2.38

Based on the grading criteria for Co 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.



Results for Event #2, 2025: Summary Figures

Whole Blood Co



Legend:

○ 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:

$\pm 1.5 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 1.5 \mu\text{g/L}$ at concentrations less than or equal to $7.5 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

Whole Blood Cr (µg/L)					
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target (Arithmetic Mean (\bar{x}))	1.97	0.5	4.98	7.2	0.45
Upper Limit	3.97	2.5	6.98	9.2	2.45
Lower Limit	0.00	0.0	2.98	5.2	0.00
Arithmetic SD (s)	0.10	0.1	0.15	0.3	0.04
Arithmetic RSD (%)	5.1	16	3.0	5.4	8.9
Number of Sample Measurements (N)	7	4	7	8	5

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



Results for Event #2, 2025: Performance of Participating Laboratories

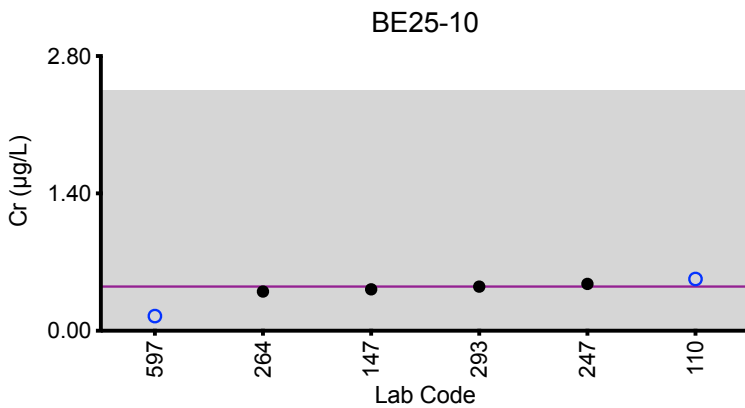
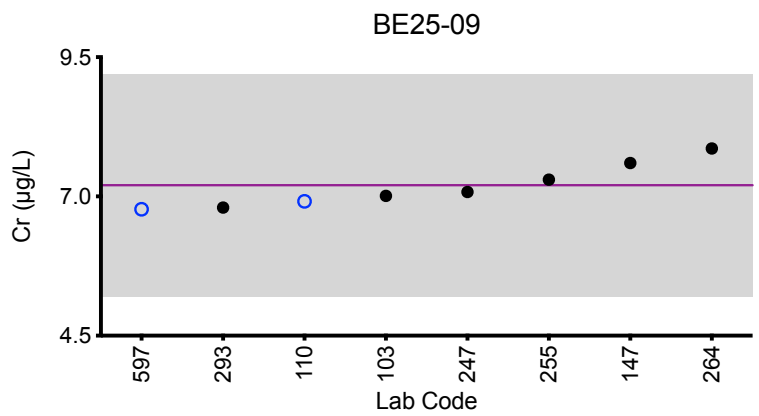
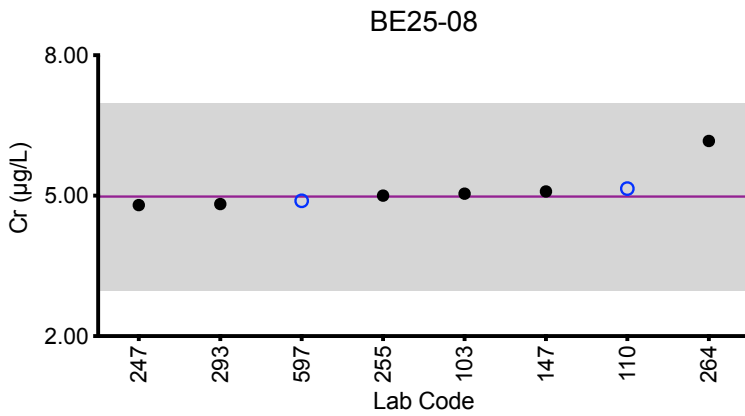
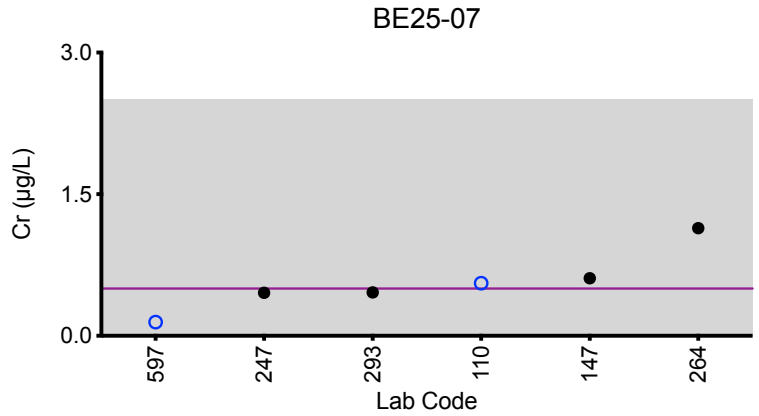
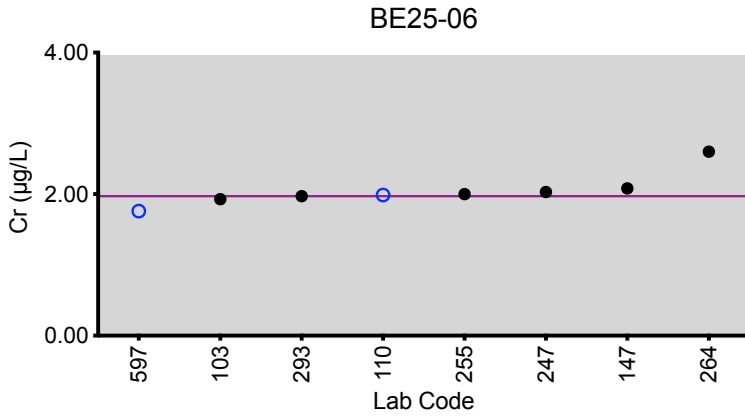
Whole Blood Cr (µg/L)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
	Target	1.97	0.5	4.98	7.2	0.45
103	ICP-MS/MS	1.93	<1.50	5.04	7.01	<1.50
110	ICP-MS/MS	2.0	0.6	5.2	6.9	0.5
147	DRC/CC-ICP-MS	2.08	0.609	5.09	7.60	0.422
247	ICP-MS/MS	2.03	0.456	4.80	7.08	0.477
255	ICP-MS	2	<1.0	5	7.3	<1.0
264	ICP-MS	*2.60	*1.14	*6.17	7.86	0.40
293	DRC/CC-ICP-MS	1.97	0.46	4.82	6.80	0.45
597	ICP-MS/MS	1.76	*0.145	4.89	6.77	*0.149

Based on the grading criteria for Cr 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.



Results for Event #2, 2025: Summary Figures

Whole Blood Cr



Legend:

○ 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:

$\pm 2 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 2 \mu\text{g/L}$ at concentrations less than or equal to $10 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Whole Blood Hg (µg/L)				
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target (Robust Mean (x*))	3.6	7.8	18.3	0.73	4.81
Upper Limit	6.6	10.8	23.8	3.73	7.81
Lower Limit	0.6	4.8	12.8	0.00	1.81
Robust SD (s*)	0.3	0.4	1.2	0.08	0.20
Robust RSD (%)	8.0	5.1	6.6	11	4.2
Number of Sample Measurements (N)	13	13	13	12	13
Standard Uncertainty (u)	0.1	0.2	0.4	0.03	0.07

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



Results for Event #2, 2025: Performance of Participating Laboratories

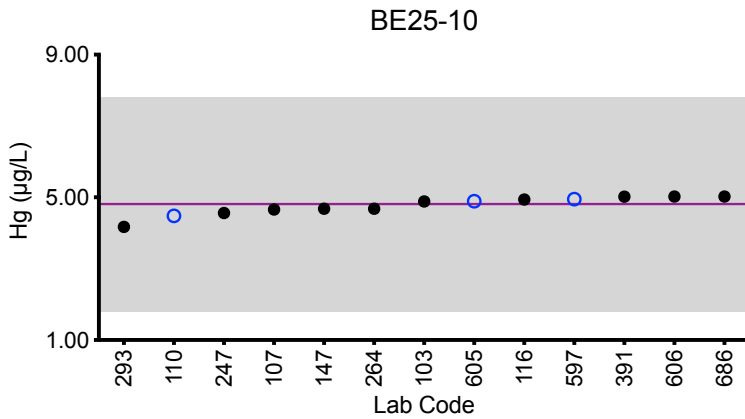
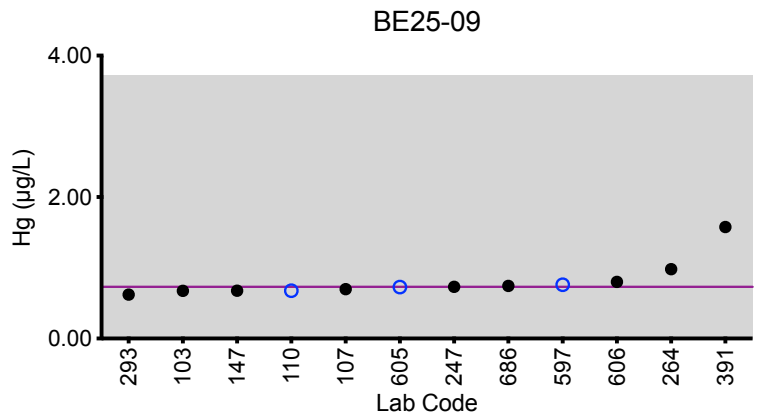
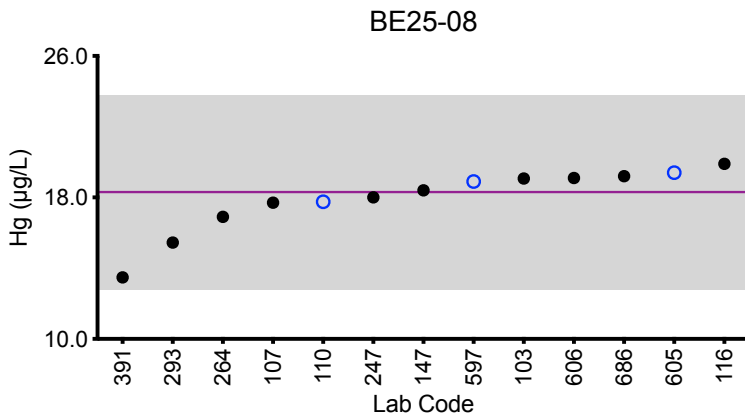
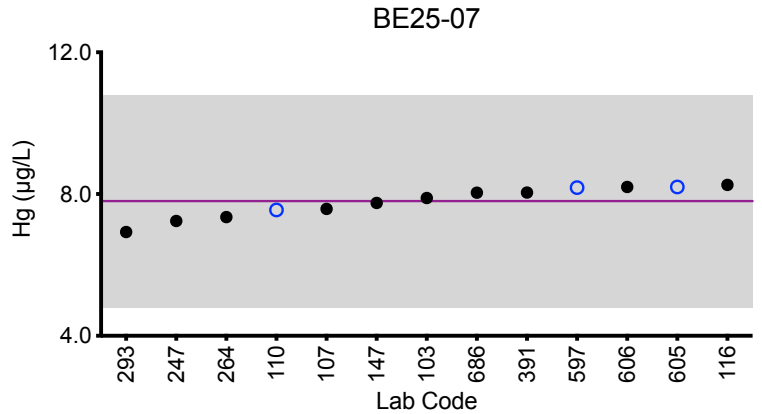
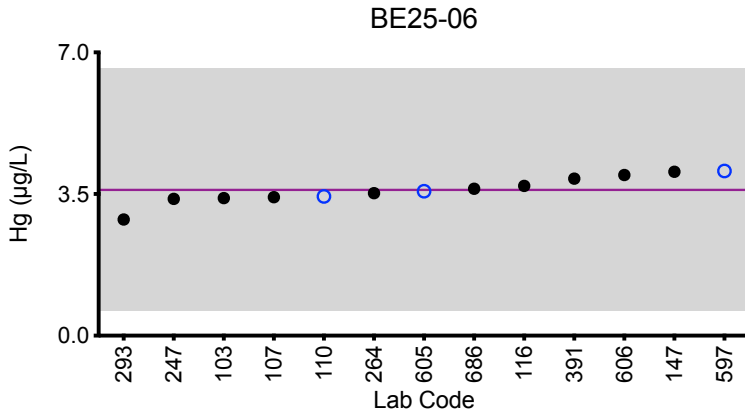
Whole Blood Hg (µg/L)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
	Target	3.6	7.8	18.3	0.73	4.81
103	ICP-MS/MS	3.40	7.89	19.1	0.674	4.89
107	ICP-MS/MS	3.42	7.58	17.7	0.697	4.66
110	ICP-MS/MS	3.44	7.55	17.8	0.68	4.48
116	ICP-MS/MS	3.70	8.26	19.9	<1.50	4.94
147	ICP-MS	4.05	7.75	18.4	0.676	4.68
247	ICP-MS/MS	3.38	7.24	18.0	0.730	4.56
264	ICP-MS	3.52	7.35	16.90	0.98	4.68
293	DRC/CC-ICP-MS	2.9	6.93	15.5	0.62	4.17
391	CV-AAS	3.88	8.04	13.48	1.58	5.02
597	ICP-MS/MS	4.07	8.18	18.9	0.760	4.95
605	ICP-MS	3.57	8.20	19.4	0.727	4.89
606	ICP-MS/MS	3.97	8.20	19.1	0.801	5.02
686	ICP-MS	3.63	8.04	19.2	0.744	5.02

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



Results for Event #2, 2025: Summary Figures

Whole Blood Hg



Legend:

○ 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:

$\pm 3 \mu\text{g/L}$ or $\pm 30\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 3 \mu\text{g/L}$ at concentrations less than or equal to $10 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

Whole Blood Mn (µg/L)					
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target (Arithmetic Mean (\bar{x}))	22.6	10.2	19.0	8.1	29.0
Upper Limit	26.4	13.2	22.2	11.1	33.9
Lower Limit	18.8	7.2	15.8	5.1	24.1
Arithmetic SD (s)	0.1	1.1	1.2	0.9	1.4
Arithmetic RSD (%)	4.4	11	6.3	11	4.8
Number of Sample Measurements (N)	8	9	9	9	9

The acceptable range is based on quality specifications: $\pm 3 \mu\text{g/L}$ or $\pm 17\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 3 \mu\text{g/L}$ at concentrations less than or equal to $17.7 \mu\text{g/L}$. These quality specifications were 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).



Results for Event #2, 2025: Performance of Participating Laboratories

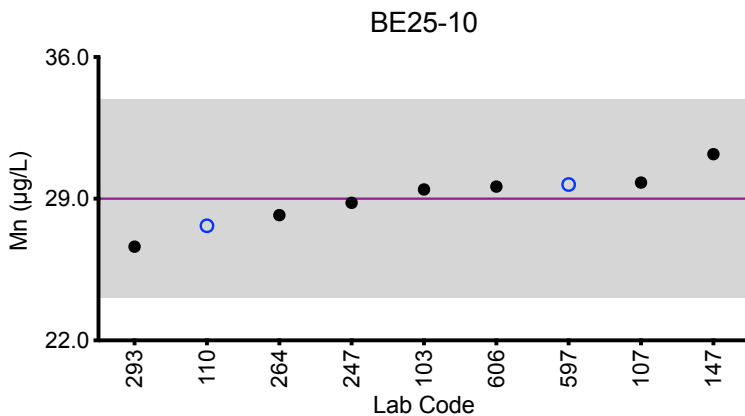
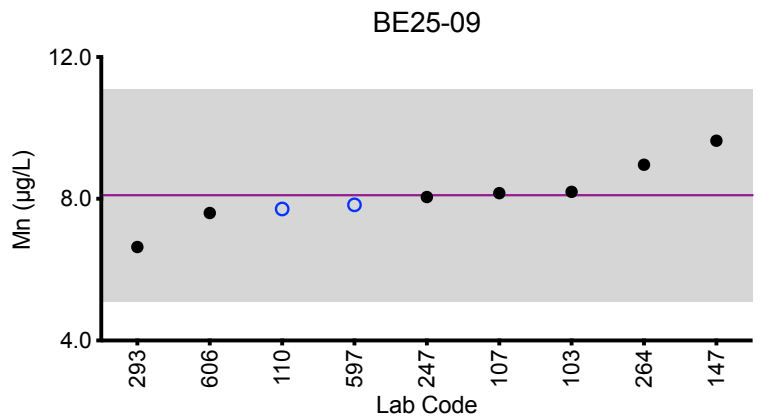
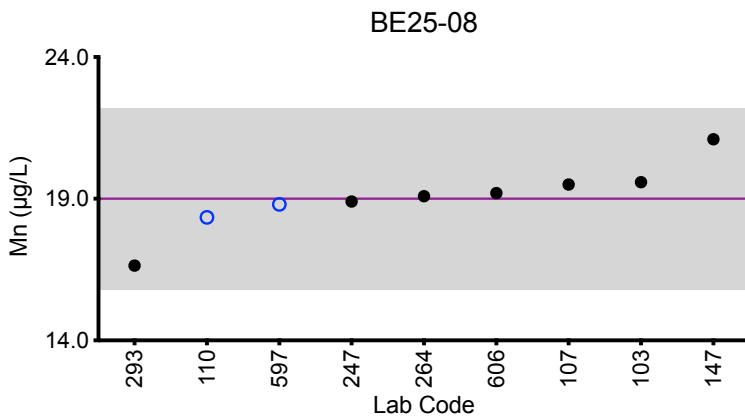
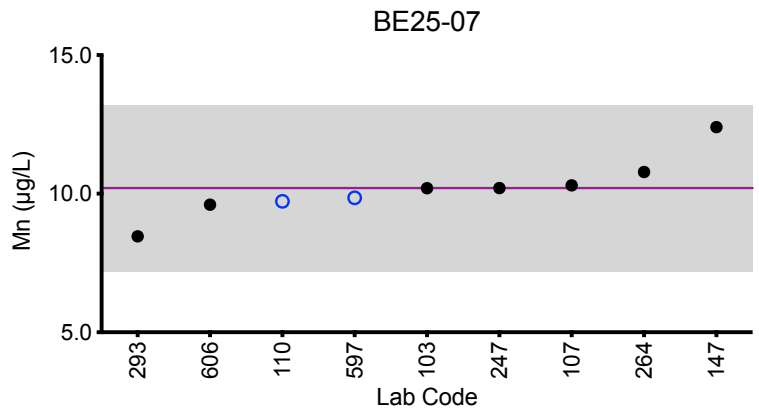
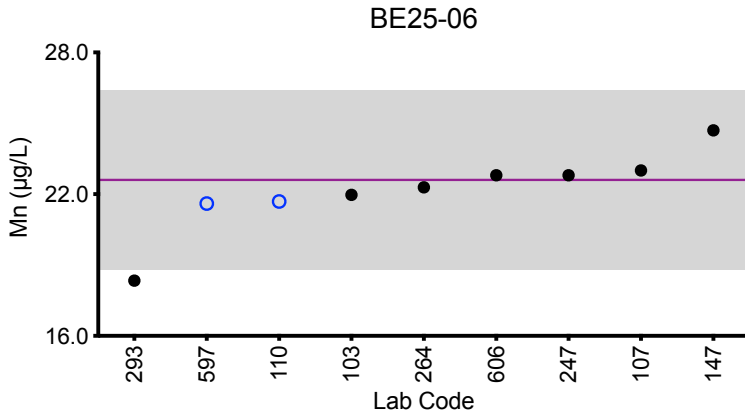
Whole Blood Mn (µg/L)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target		22.6	10.2	19.0	8.1	29.0
103	ICP-MS/MS	22.0	10.2	19.6	8.20	29.5
107	ICP-MS/MS	23.0	10.3	19.5	8.16	29.8
110	ICP-MS/MS	21.7	9.7	18.3	7.7	27.7
147	ICP-MS	24.7	12.4	21.1	9.64	31.2
247	ICP-MS/MS	22.8	10.2	18.9	8.05	28.8
264	ICP-MS	22.29	10.78	19.09	8.96	28.19
293	DRC/CC-ICP-MS	*18.3 ↓	8.46	16.6	6.6	26.63
597	ICP-MS/MS	21.6	9.85	18.8	7.83	29.7
606	ICP-MS/MS	22.8	9.60	19.2	7.60	29.6

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



Results for Event #2, 2025: Summary Figures

Whole Blood Mn



Legend:

○ 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:

±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.



Results for Event #2, 2025: Summary Statistics

	Whole Blood Pb (µg/dL)				
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Target (Robust Mean (x*))	1.48	7.8	1.17	3.31	45.1
Upper Limit	3.48	9.8	3.17	5.31	49.6
Lower Limit	0.00	5.8	0.00	1.31	40.6
Robust SD (s*)	0.07	0.3	0.07	0.18	1.9
Robust RSD (%)	4.7	4.4	6.0	5.4	4.2
Number of Sample Measurements (N)	12	14	12	13	14
Standard Uncertainty (u)	0.03	0.1	0.03	0.06	0.6

The acceptable range is based on quality specifications: $\pm 2 \mu\text{g/dL}$ or $\pm 10\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 2 \mu\text{g/dL}$ at concentrations less than or equal to $20 \mu\text{g/dL}$. 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/>)



Results for Event #2, 2025: Performance of Participating Laboratories

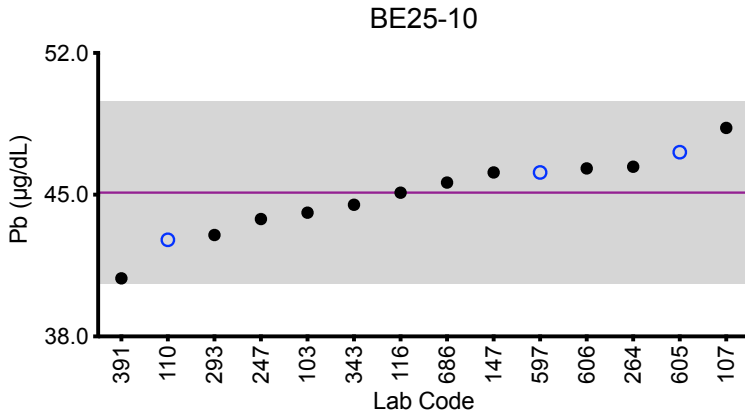
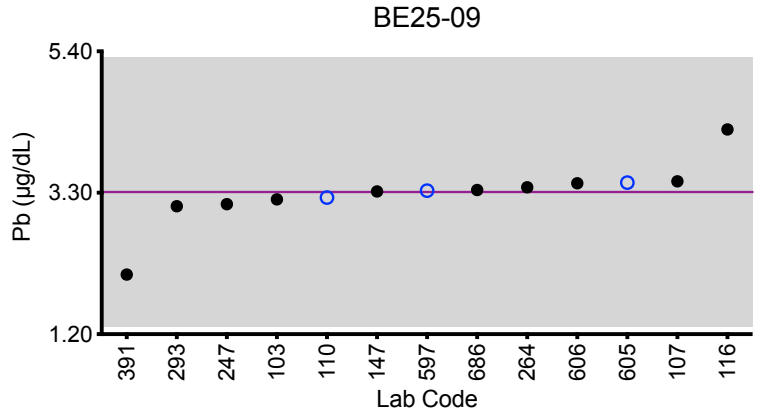
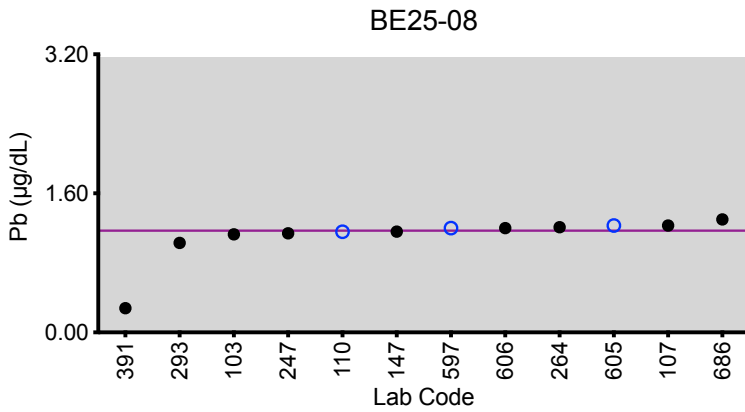
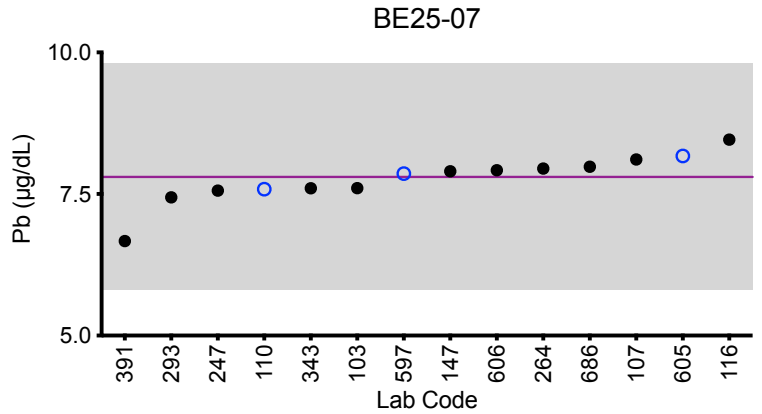
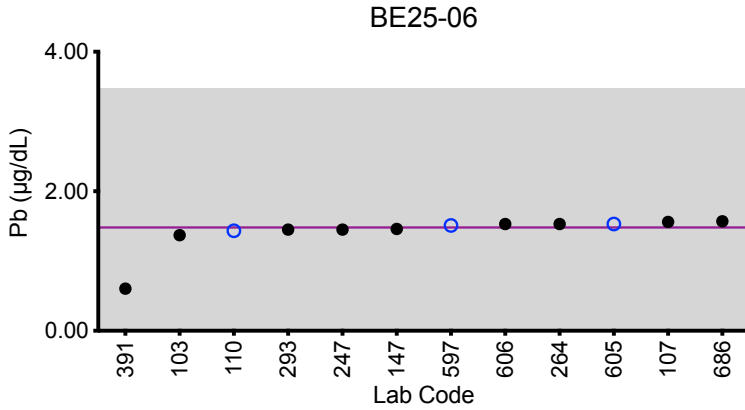
Whole Blood Pb (µg/dL)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
	Target	1.48	7.8	1.17	3.31	45.1
103	ICP-MS/MS	1.37	7.60	1.13	3.20	44.1
107	ICP-MS/MS	1.56	8.11	1.23	3.47	48.3
110	ICP-MS/MS	1.43	7.58	1.16	3.23	42.8
116	ICP-MS/MS	<3.00	8.46	<3.00	4.24	45.1
147	ICP-MS	1.46	7.90	1.16	3.32	46.1
247	ICP-MS/MS	1.45	7.56	1.14	3.13	43.8
264	ICP-MS	1.53	7.95	1.21	3.38	46.38
293	DRC/CC-ICP-MS	1.45	7.44	1.03	3.1	43.01
343	ASV-LeadCare	<3.3	7.6	<3.3	<3.3	44.5
391	ETAAS-Z	0.60	6.67	0.28	2.08	40.87
597	ICP-MS/MS	1.51	7.86	1.20	3.33	46.1
605	ICP-MS	1.53	8.17	1.23	3.45	47.1
606	ICP-MS/MS	1.53	7.92	1.20	3.44	46.3
686	ICP-MS	1.57	7.98	1.30	3.34	45.6

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



Results for Event #2, 2025: Summary Figures

Whole Blood Pb



Legend:

○ 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.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Mo (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
103	ICP-MS/MS	1.09	2.30	0.521	7.23	3.86
110	ICP-MS/MS	1.14	2.25	0.44	6.87	3.73
147	ICP-MS	1.32	2.39	0.547	7.30	3.98
264	ICP-MS	1.64	*2.91	0.68	8.43	4.36
597	ICP-MS/MS	1.16	2.42	0.506	7.45	3.84

Summary Statistics

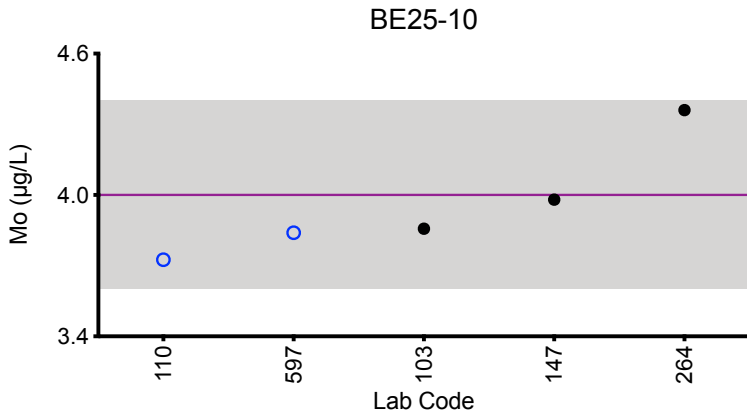
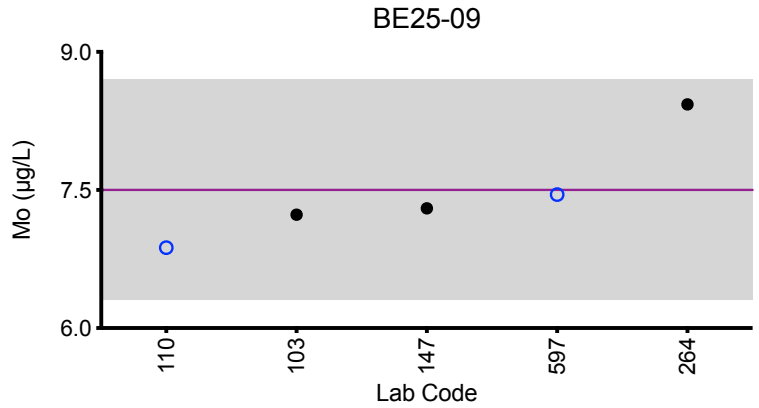
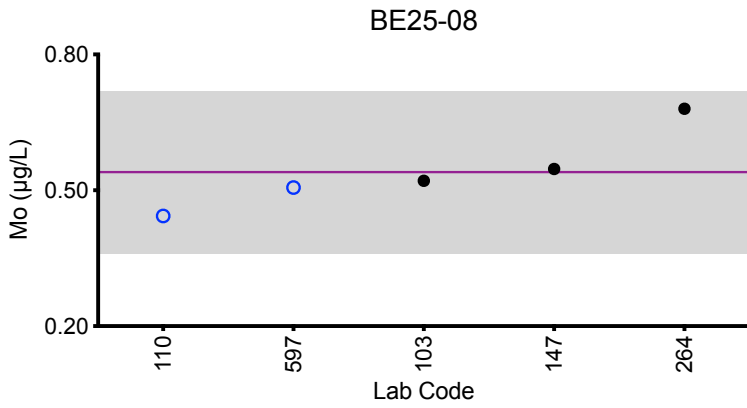
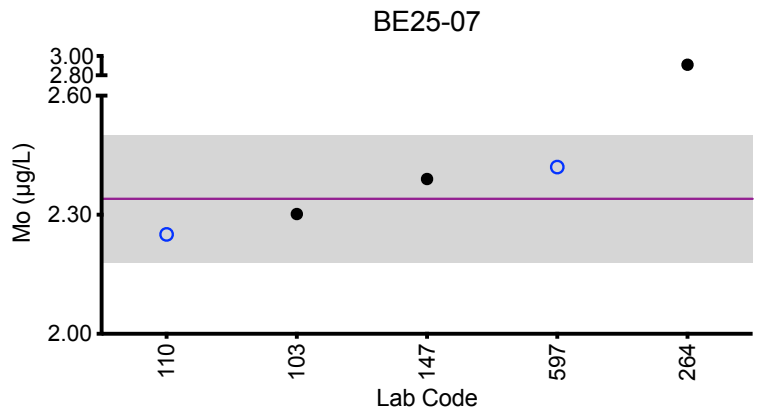
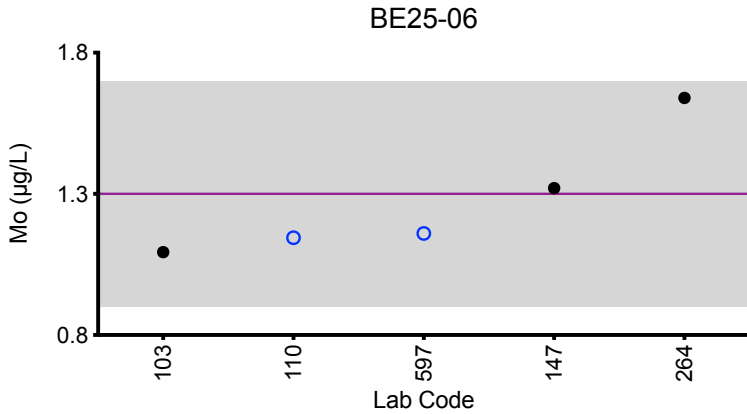
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	1.3	2.34	0.54	7.5	4.0
Arithmetic SD (s)	0.2	0.08	0.09	0.6	0.2
Arithmetic RSD (%)	17	3.4	17	8.0	6.1
Number of Sample Measurements (N)	5	4	5	5	5

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Whole Blood Mo



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Sb (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
103	ICP-MS/MS	2.58	0.656	1.65	5.18	0.827
110	ICP-MS/MS	2.68	0.65	1.52	5.32	0.76
147	ICP-MS	2.61	0.645	1.56	5.32	0.829
264	ICP-MS	2.88	0.67	1.64	5.55	0.80
293	DRC/CC-ICP-MS	2.36	0.60	1.440	4.77	0.79
597	ICP-MS/MS	2.49	0.669	1.53	5.33	0.794

Summary Statistics

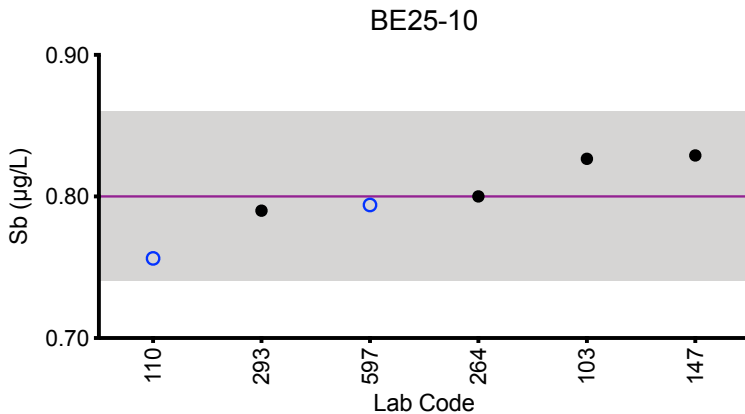
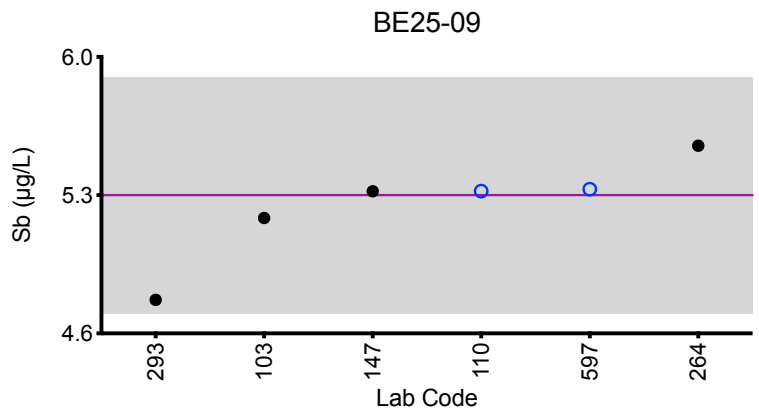
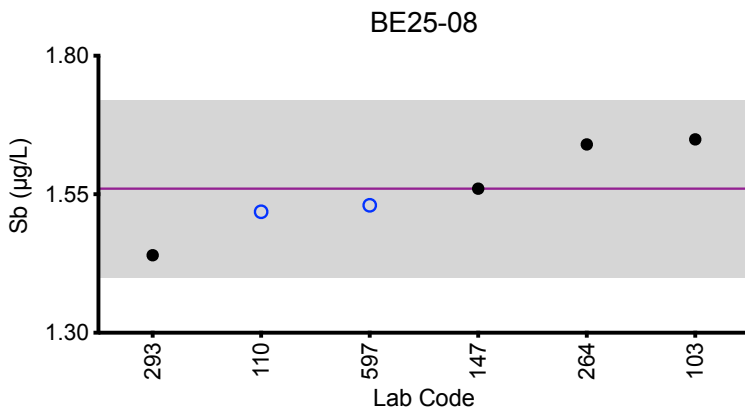
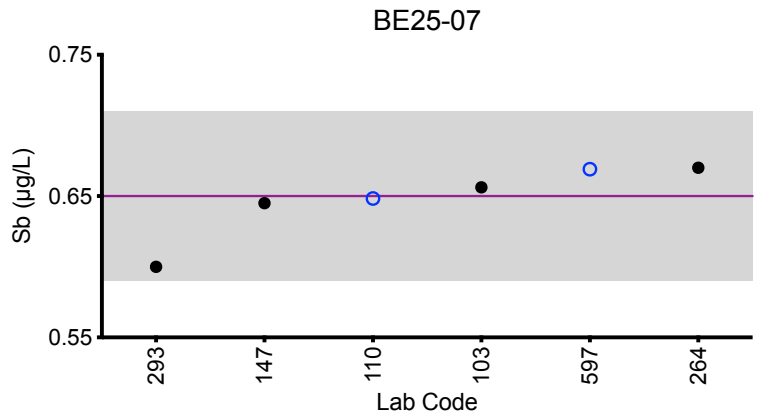
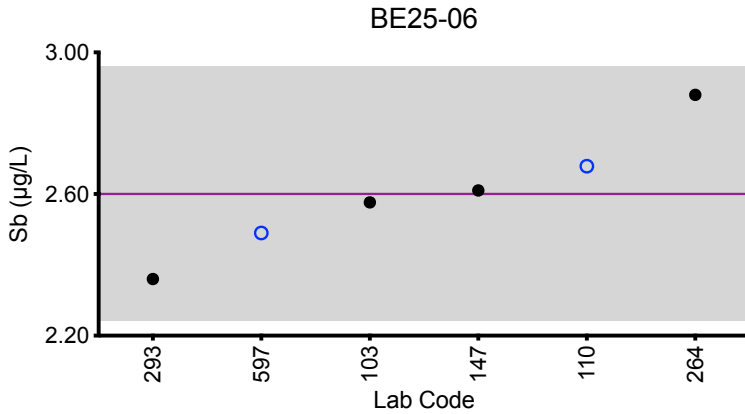
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	2.60	0.65	1.56	5.3	0.80
Arithmetic SD (s)	0.18	0.03	0.08	0.3	0.03
Arithmetic RSD (%)	6.9	4.0	5.1	5.0	3.3
Number of Sample Measurements (N)	6	6	6	6	6

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Whole Blood Sb



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Se (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
103	ICP-MS/MS	176	231	159	185	321
107	ICP-MS/MS	171	225	147	177	317
110	ICP-MS/MS	169	213	139	168	280
147	ICP-MS	176	220	146	175	312
247	ICP-MS/MS	181	239	156	188	341
264	ICP-MS	182	236	155	181	315
293	DRC/CC-ICP-MS	*152.5	223.5	141.4	172.2	309.6
597	ICP-MS/MS	173	218	148	174	307

Summary Statistics

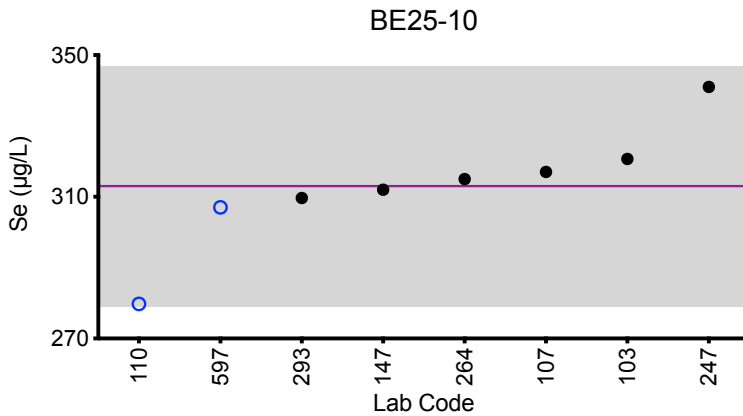
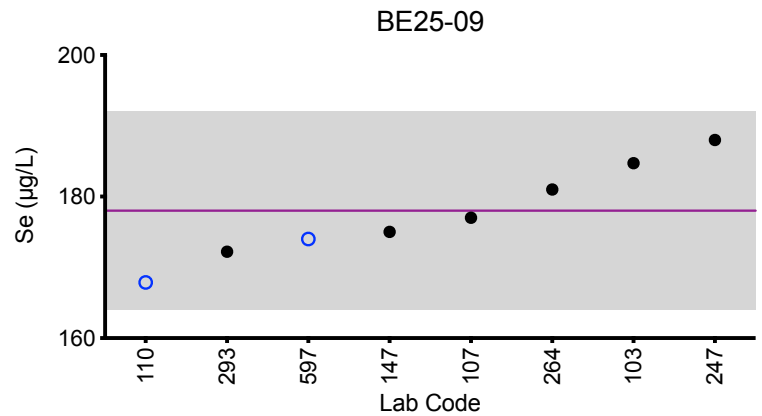
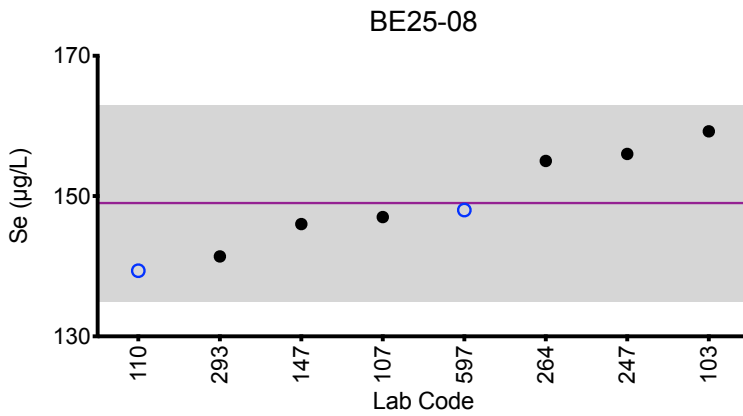
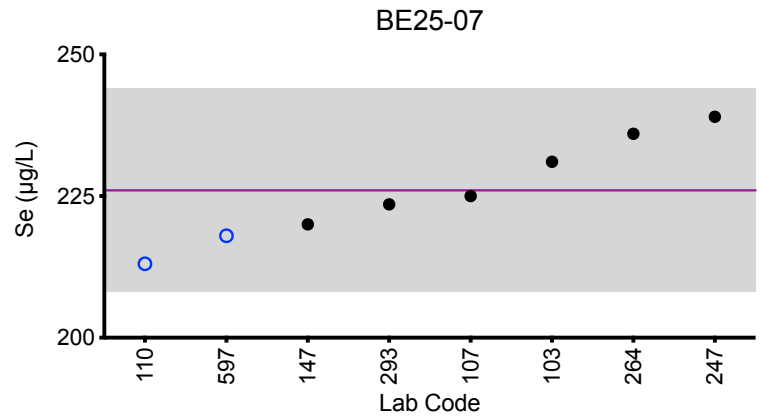
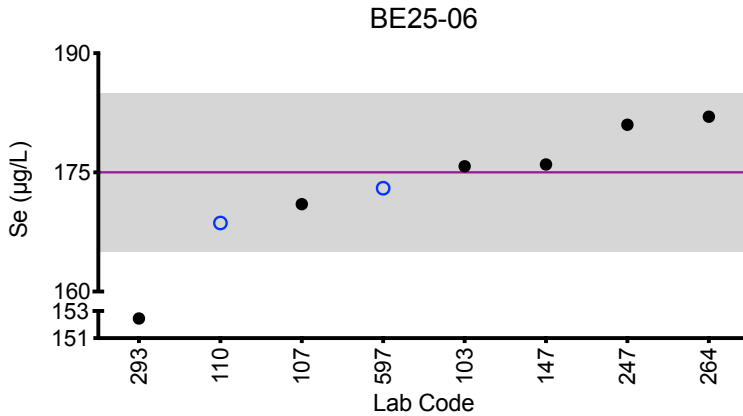
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	175	226	149	178	313
Arithmetic SD (s)	5	9	7	7	17
Arithmetic RSD (%)	2.9	4.0	4.7	3.9	5.4
Number of Sample Measurements (N)	7	8	8	8	8

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Whole Blood Se



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood TI (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
103	ICP-MS/MS	0.294	1.05	1.72	0.641	0.151
110	ICP-MS/MS	0.300	1.03	1.69	0.627	0.147
147	ICP-MS	0.317	1.10	1.75	0.657	0.161
264	ICP-MS	0.35	1.18	1.95	0.72	0.17
293	DRC/CC-ICP-MS	0.31	1.05	1.69	0.63	0.15
597	ICP-MS/MS	0.343	1.16	1.87	0.718	0.176

Summary Statistics

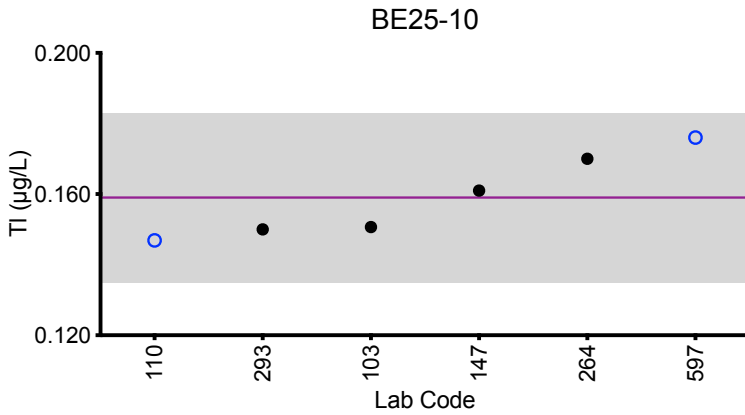
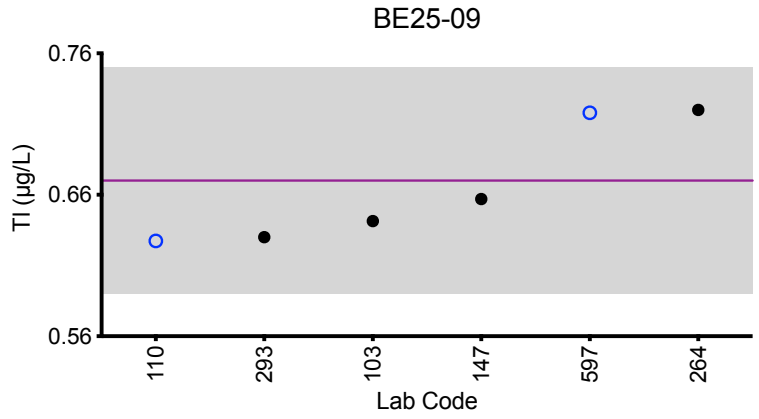
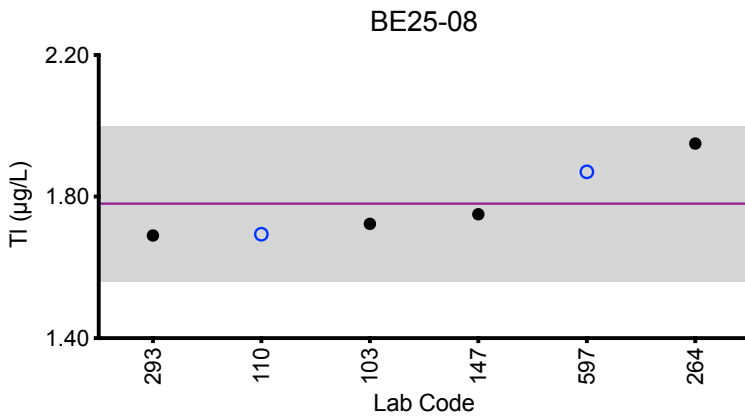
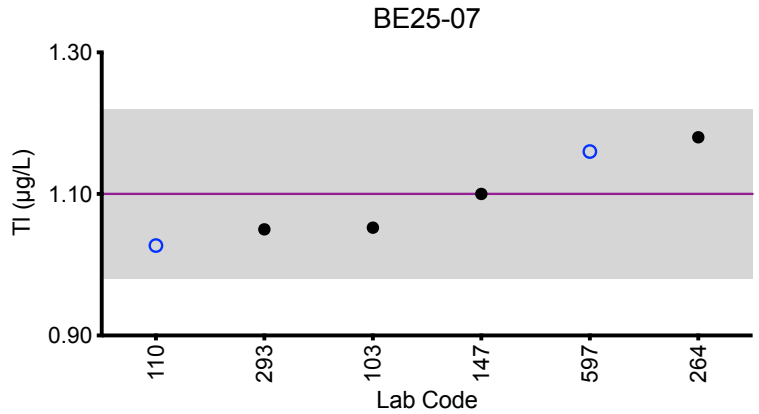
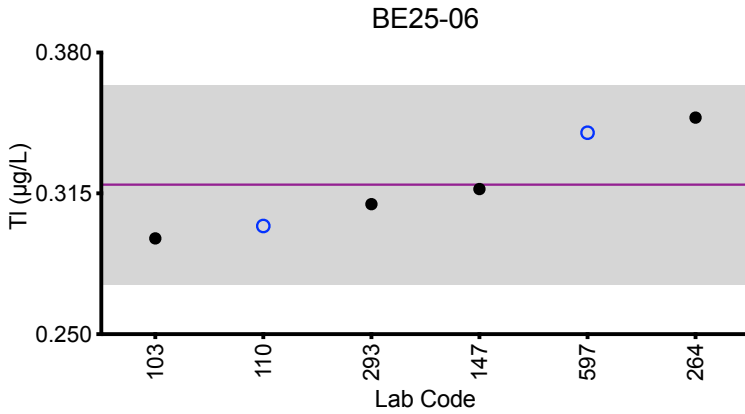
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	0.319	1.10	1.78	0.67	0.159
Arithmetic SD (s)	0.023	0.06	0.11	0.04	0.012
Arithmetic RSD (%)	7.2	5.5	6.2	6.0	7.5
Number of Sample Measurements (N)	6	6	6	6	6

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Whole Blood TI



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Ba (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	2.91	6.54	0.98	7.90	1.66
147	ICP-MS	3.10	7.10	1.20	8.30	1.95
597	ICP-MS/MS	2.99	7.06	1.27	8.68	2.00

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	3.00	6.9	1.15	8.3	1.9
Arithmetic SD (s)	0.10	0.3	0.15	0.4	0.2
Arithmetic RSD (%)	3.3	4.3	13	4.8	9.6
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Be (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	2.78	1.08	6.22	0.59	3.86
147	ICP-MS	2.64	1.04	6.06	<0.991	3.81
597	ICP-MS	2.63	1.06	5.86	0.557	3.69

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	2.68	1.06	6.1	0.57	3.79
Arithmetic SD (s)	0.08	0.02	0.2	0.02	0.09
Arithmetic RSD (%)	3.0	1.9	3.0	3.5	2.4
Number of Sample Measurements (N)	3	3	3	2	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Cs (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	2.07	1.96	1.98	1.93	1.83
147	ICP-MS	2.08	1.98	1.99	1.94	1.88
597	ICP-MS/MS	2.12	2.00	2.04	1.97	1.93

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	2.09	1.98	2.00	1.95	1.88
Arithmetic SD (s)	0.03	0.02	0.03	0.02	0.05
Arithmetic RSD (%)	1.4	1.0	1.5	1.1	2.7
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Cu (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	1030	782	2240	1110	816
147	ICP-MS	1117	861	2406	1223	960
247	ICP-MS/MS	1035	843	2279	1146	913
597	ICP-MS/MS	1070	819	2370	1180	926

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	1060	830	2320	1160	900
Arithmetic SD (s)	40	30	80	50	60
Arithmetic RSD (%)	3.8	3.6	3.4	4.3	6.7
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood I (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
147	ICP-MS	28.3	38.5	32.8	27.4	27.0
597	ICP-MS/MS	30.4	42.6	38.9	30.7	31.5

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	29.4	41	36	29.0	29
Arithmetic SD (s)	1.5	3	4	2.0	3
Arithmetic RSD (%)	5.1	7.3	11	6.9	10
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Li (µg/L)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
147	ICP-MS	1.05	1.22	0.671	1.13	1.14
597	ICP-MS	1.09	1.19	0.759	1.25	1.29

Summary Statistics						
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10	
Arithmetic Mean (\bar{x})	1.07	1.21	0.71	1.19	1.22	
Arithmetic SD (s)	0.03	0.02	0.06	0.08	0.11	
Arithmetic RSD (%)	2.8	1.7	8.5	6.7	9.0	
Number of Sample Measurements (N)	2	2	2	2	2	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Ni (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
103	ICP-MS/MS	<1.50	3.68	3.23	5.95	1.80
110	ICP-MS/MS	0.92	4.87	3.16	5.94	1.79
147	ICP-MS	0.437	3.39	2.69	6.19	1.23
597	ICP-MS/MS	0.256	3.57	3.15	6.27	1.43

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	NA	3.9	3.1	6.09	1.6
Arithmetic SD (s)	NA	0.7	0.3	0.17	0.3
Arithmetic RSD (%)	NA	18	8.2	2.8	18
Number of Sample Measurements (N)	NA	4	4	4	4

*Denotes a statistical Outlier.

Statistical data was not calculated for BE25-06 based on a lack of consensus among participating labs.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Pt (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	0.441	0.694	1.60	0.128	2.17
293	DRC/CC-ICP-MS	0	1	2	0	2

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	NA	0.8	1.8	NA	2.09
Arithmetic SD (s)	NA	0.2	0.3	NA	0.12
Arithmetic RSD (%)	NA	25	17	NA	5.7
Number of Sample Measurements (N)	NA	2	2	NA	2

*Denotes a statistical Outlier.

Statistical data was not calculated for BE25-06 and BE25-09 based on a lack of consensus among participating labs.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Sn (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	2.71	1.32	0.46	4.78	0.84
147	ICP-MS	2.64	1.38	0.462	4.81	0.909
597	ICP-MS/MS	2.81	1.45	0.546	5.02	0.937

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	2.72	1.38	0.49	4.87	0.90
Arithmetic SD (s)	0.09	0.07	0.05	0.13	0.05
Arithmetic RSD (%)	3.3	5.1	10	2.7	5.6
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Sr (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
103	ICP-MS/MS	23.5	32.4	17.5	28.1	29.3
110	ICP-MS/MS	23.8	32.7	17.2	28.7	28.2
147	ICP-MS	23.3	31.8	17.0	28.0	29.4
597	ICP-MS/MS	24.1	32.1	18.0	28.6	29.7

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	23.7	32.3	17.4	28.4	29.2
Arithmetic SD (s)	0.4	0.4	0.4	0.4	0.7
Arithmetic RSD (%)	1.7	1.2	2.3	1.4	2.4
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Ti (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
200	DRC/CC-ICP-MS	4.34	8.20	2.590	13.73	5.68
597	ICP-MS/MS	3.13	6.66	2.90	9.53	4.97

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	3.7	7.4	2.7	12	5.3
Arithmetic SD (s)	0.9	1.1	0.2	3	0.5
Arithmetic RSD (%)	24	15	7.4	25	9.4
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood U (µg/L)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
103	ICP-MS/MS	0.0821	0.291	0.0532	0.119	0.0725
110	ICP-MS/MS	0.0808	0.311	0.0497	0.129	0.0659
147	ICP-MS	0.0917	0.313	0.0523	0.133	0.0705
597	ICP-MS/MS	0.0833	0.300	0.0523	0.124	0.0667
Summary Statistics						
		BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})		0.084	0.304	0.0519	0.126	0.069
Arithmetic SD (s)		0.005	0.010	0.0015	0.006	0.003
Arithmetic RSD (%)		6.0	3.3	2.9	4.8	4.3
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood V (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	0.75	1.82	0.38	4.06	0.96
147	DRC/CC-ICP-MS	0.740	1.87	0.372	4.17	1.10
597	ICP-MS/MS	0.774	1.77	0.438	3.88	1.01

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	0.76	1.82	0.40	4.04	1.02
Arithmetic SD (s)	0.02	0.05	0.04	0.15	0.07
Arithmetic RSD (%)	2.3	2.7	10	3.7	6.9
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood W ($\mu\text{g/L}$)						
Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	0.34	0.89	0.15	1.75	0.57
200	ICP-MS	0.4	1.1	0.2	2.0	0.7
597	ICP-MS/MS	0.317	0.892	0.178	1.79	0.606

Summary Statistics						
	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10	
Arithmetic Mean (\bar{x})	0.35	0.96	0.18	1.85	0.63	
Arithmetic SD (s)	0.04	0.12	0.03	0.13	0.07	
Arithmetic RSD (%)	11	13	14	7.0	11	
Number of Sample Measurements (N)	3	3	3	3	3	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Whole Blood Zn (µg/L)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
110	ICP-MS/MS	7320	4750	7440	7780	4250
147	ICP-MS	7488	5141	7613	7885	4891
247	ICP-MS/MS	6960	4370	7003	7179	4049
597	ICP-MS/MS	8170	5220	8520	8620	4910

Summary Statistics

	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
Arithmetic Mean (\bar{x})	7500	4900	7600	7900	4500
Arithmetic SD (s)	500	400	600	600	400
Arithmetic RSD (%)	6.7	8.2	7.9	7.6	8.9
Number of Sample Measurements (N)	4	4	4	4	4

*Denotes a statistical Outlier.



Results for Event #2, 2025:
Additional Elements in Whole Blood

Whole Blood Ag (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 147, ICP-MS, <0.129, <0.129, <0.129, <0.129, <0.129

Whole Blood Al (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 147, ICP-MS, <5.13, <5.13, <5.13, <5.13, <5.13

Whole Blood B (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 597, ICP-MS/MS, 14.9, 12.5, 10.9, 6.01, 6.28

Whole Blood Bi (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Rows 1-2: 147, ICP-MS, <0.0376, <0.0376, <0.0376, <0.0376, <0.0376; 597, ICP-MS/MS, 0.0129, 0.0138, <0.00516, <0.00516, <0.00516

Whole Blood Br (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 597, ICP-MS/MS, 1217, 1337, 1388, 2179, 2146

Whole Blood Ca (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 597, ICP-MS/MS, 41300, 56600, 51600, 56100, 58300

Whole Blood Cl (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 597, ICP-MS/MS, 3809000, 4095000, 3879000, 4590000, 3887000

Whole Blood Fe (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 597, ICP-MS/MS, 459000, 298000, 386000, 324000, 309000

Whole Blood Ga (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 597, ICP-MS/MS, 0.0209, 0.0230, 0.0213, <0.0133, 0.0226

Whole Blood Mg (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 597, ICP-MS/MS, 36900, 29400, 34700, 35900, 35300

Whole Blood S (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Row 1: 597, ICP-MS/MS, 1490000, 1280000, 1460000, 1340000, 1320000

Whole Blood Te (µg/L)

Table with 7 columns: Lab Code, Method, BE25-06, BE25-07, BE25-08, BE25-09, BE25-10. Rows 1-2: 110, ICP-MS/MS, 0.022, <0.02, <0.02, <0.02, <0.02; 147, ICP-MS, <0.0740, <0.0740, <0.0740, <0.0740, <0.0740



Results for Event #2, 2025:
Additional Elements in Whole Blood

Whole Blood Th ($\mu\text{g/L}$)

Lab Code	Method	BE25-06	BE25-07	BE25-08	BE25-09	BE25-10
147	ICP-MS	<0.0255	<0.0255	<0.0255	<0.0255	<0.0255
597	ICP-MS/MS	<0.00386	<0.00386	<0.00386	<0.00386	<0.00386



**Department
of Health**

**Wadsworth
Center**

Event #2, 2025

**Trace Elements in
Urine**

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory



Event #2, 2025: 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), lithium (Li), 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

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

Additional Elements

An additional 26 elements were reported by at least one participant: Ag, Al, B, Bi, Br, Cl, Cs, Cu, Fe, I, Li, Mg, Mo, Ni, Pt, S, 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



Results for Event #2, 2025: Summary Statistics

	Urine As (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Robust Mean (x*))	29.7	2.11	12.4	6.8	1.42
Upper Limit	35.7	8.11	18.4	12.8	7.42
Lower Limit	23.7	0.00	6.4	0.8	0.00
Robust SD (s*)	1.9	0.14	0.8	0.4	0.16
Robust RSD (%)	6.4	6.6	6.5	5.9	11
Number of Sample Measurements (N)	11	10	11	11	7
Standard Uncertainty (u)	0.7	0.06	0.3	0.2	NA

The acceptable range is based on quality specifications: $\pm 6 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 6 \mu\text{g/L}$ at concentrations less than or equal to $30 \mu\text{g/L}$. 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.

An arithmetic mean, SD, RSD and n are provided for sample UE25-10.



Results for Event #2, 2025: Performance of Participating Laboratories

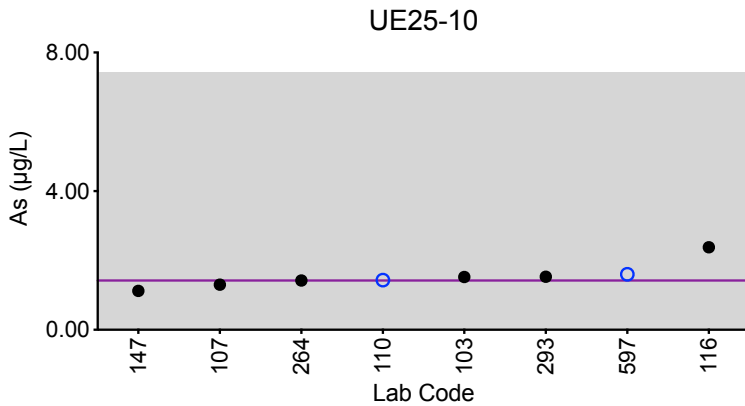
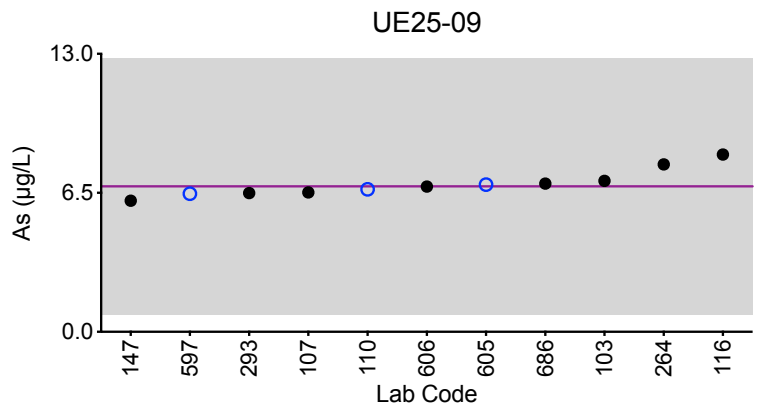
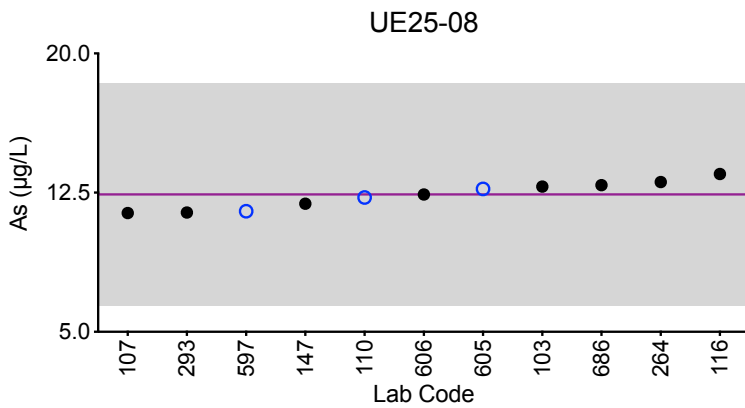
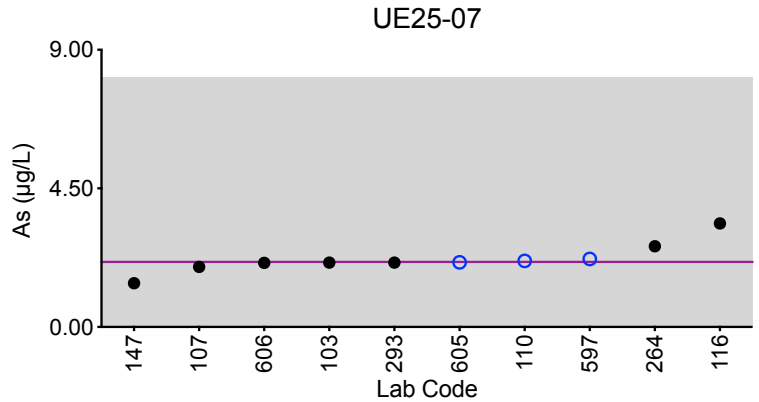
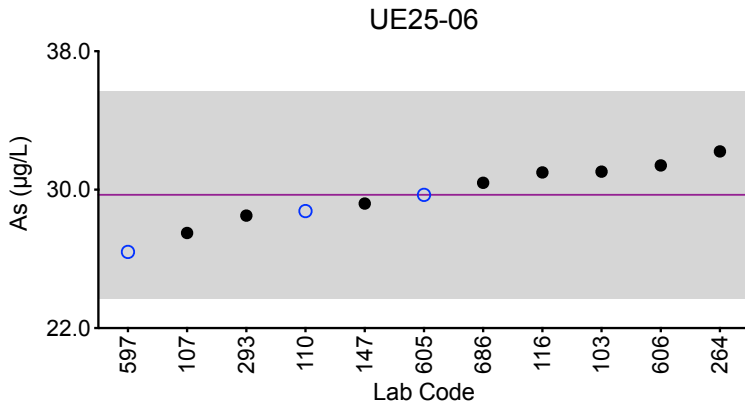
		Urine As (µg/L)				
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
	Target	29.7	2.11	12.4	6.8	1.42
103	ICP-MS/MS	31.0	2.09	12.8	7.06	1.52
107	DRC/CC-ICP-MS	27.5	1.95	11.4	6.52	1.30
110	ICP-MS/MS	28.8	2.15	12.2	6.66	1.43
116	ICP-MS/MS	31.0	3.36	13.5	8.29	*2.38
147	ICP-MS	29.2	1.42	11.9	6.13	1.12
264	ICP-MS	32.21	2.62	13.07	7.83	1.42
293	DRC/CC-ICP-MS	28.5	2.09	11.43	6.49	1.53
597	ICP-MS/MS	26.4	2.21	11.5	6.46	1.60
605	ICP-MS	29.7	2.10	12.7	6.88	<2.00
606	ICP-MS/MS	31.4	2.08	12.4	6.79	<2.00
686	DRC/CC-ICP-MS	30.4	<6.00	12.9	6.93	<6.00

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



Results for Event #2, 2025: Summary Figures

Urine As



Legend:

○ 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:

$\pm 6 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 6 \mu\text{g/L}$ at concentrations less than or equal to $30 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Urine Ba (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Arithmetic Mean (\bar{x}))	0.764	3.93	4.99	2.84	2.20
Upper Limit	1.764	4.93	5.99	3.84	3.20
Lower Limit	0.000	2.93	3.99	1.84	1.20
Arithmetic SD (s)	0.018	0.13	0.21	0.08	0.08
Arithmetic RSD (%)	2.4	3.3	4.2	2.8	3.6
Number of Sample Measurements (N)	8	9	9	9	9

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



Results for Event #2, 2025: Performance of Participating Laboratories

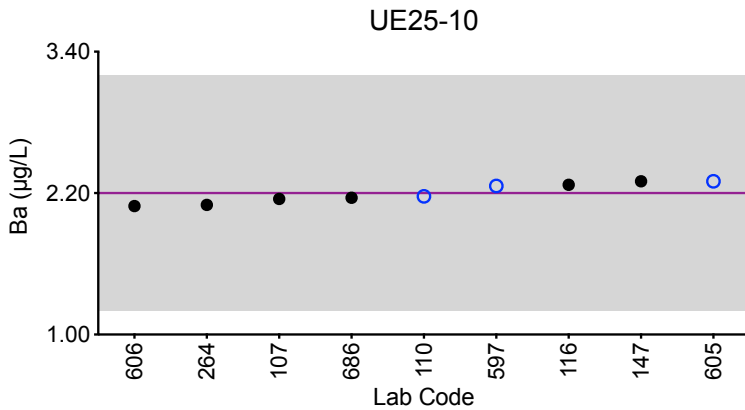
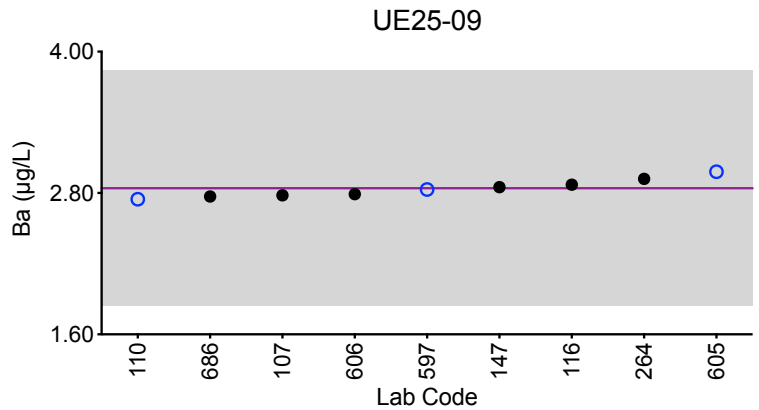
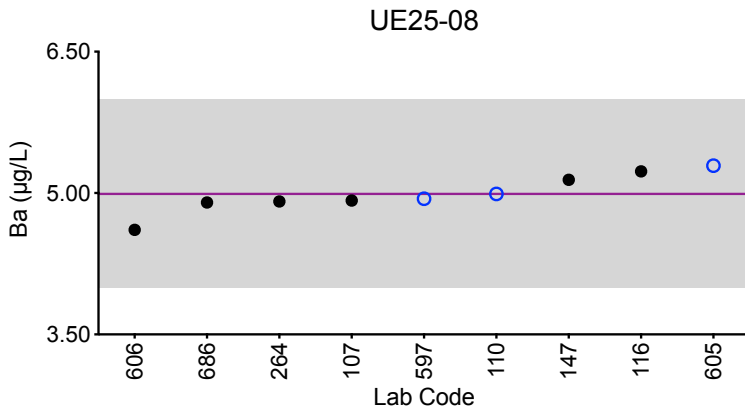
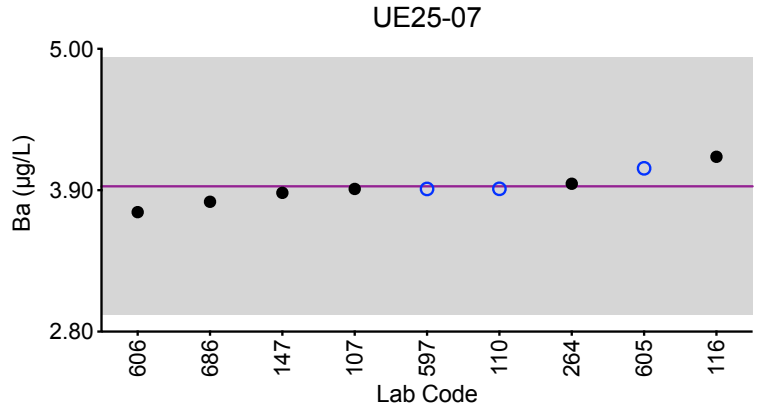
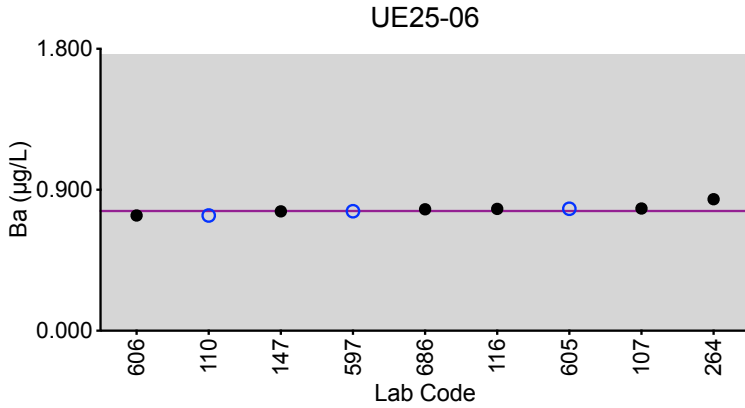
Urine Ba (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
	Target	0.764	3.93	4.99	2.84	2.20
107	ICP-MS	0.780	3.91	4.92	2.78	2.15
110	ICP-MS/MS	0.74	3.91	4.99	2.75	2.17
116	ICP-MS/MS	0.778	4.16	5.23	2.87	2.27
147	ICP-MS	0.762	3.88	5.14	2.85	2.30
264	ICP-MS	*0.84	3.95	4.91	2.92	2.10
597	ICP-MS/MS	0.763	3.91	4.94	2.83	2.26
605	ICP-MS	0.779	4.07	5.29	2.98	2.30
606	ICP-MS/MS	0.736	3.73	4.61	2.79	2.09
686	ICP-MS	0.775	3.81	4.90	2.77	2.16

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



Results for Event #2, 2025: Summary Figures

Urine Ba



Legend:

○ 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:

$\pm 1 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 1 \mu\text{g/L}$ at concentrations less than or equal to $5 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Urine Be (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Arithmetic Mean (\bar{x}))	0.83	2.18	0.52	0.99	4.00
Upper Limit	1.83	3.18	1.52	1.99	5.00
Lower Limit	0.00	1.18	0.00	0.00	3.00
Arithmetic SD (s)	0.06	0.15	0.04	0.04	0.27
Arithmetic RSD (%)	7.2	6.9	7.3	4.2	6.8
Number of Sample Measurements (N)	9	9	9	9	9

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



Results for Event #2, 2025: Performance of Participating Laboratories

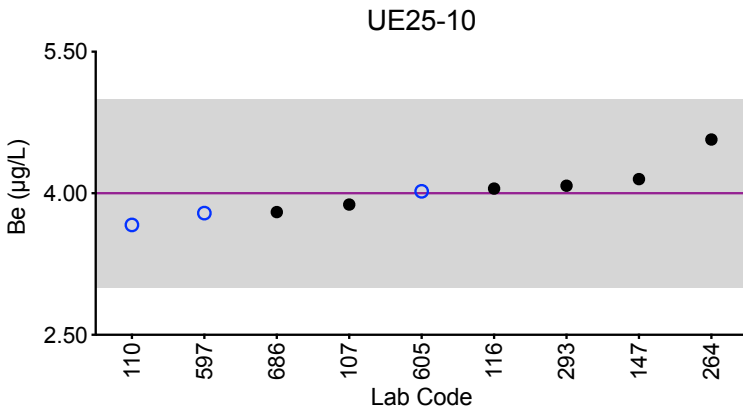
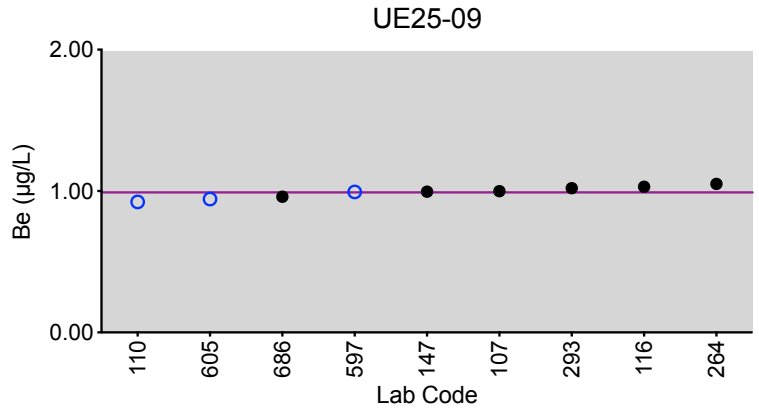
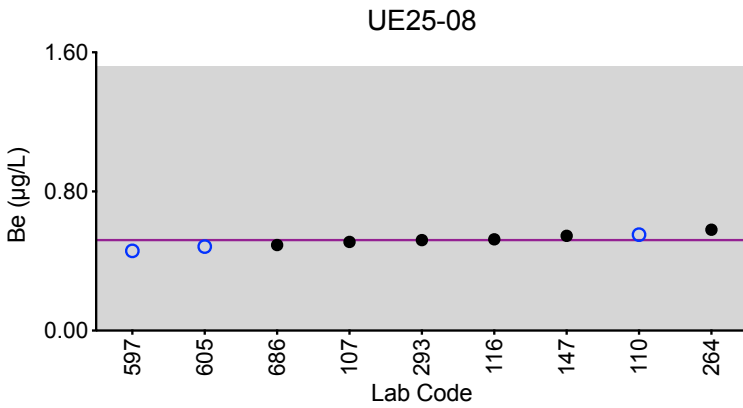
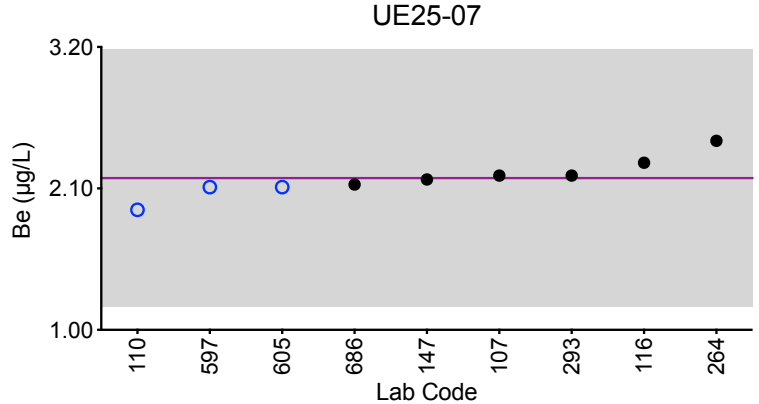
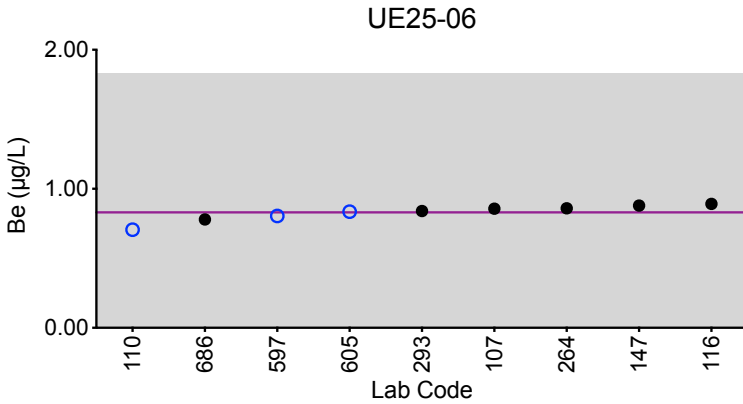
		Urine Be (µg/L)				
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target		0.83	2.18	0.52	0.99	4.00
107	ICP-MS	0.857	2.20	0.510	0.999	3.88
110	ICP-MS/MS	0.706	1.93	0.552	0.923	3.66
116	ICP-MS/MS	0.891	2.30	0.525	1.03	4.05
147	ICP-MS	0.879	2.17	0.545	0.995	4.15
264	ICP-MS	0.86	2.47	0.58	1.05	4.57
293	DRC/CC-ICP-MS	0.84	2.2	0.52	1.02	4.08
597	ICP-MS	0.805	2.11	0.458	0.994	3.79
605	ICP-MS	0.835	2.11	0.483	0.943	4.02
686	ICP-MS	0.779	2.13	0.492	0.960	3.80

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



Results for Event #2, 2025: Summary Figures

Urine Be



Legend:
 ○ 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 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 5 µg/L.



Results for Event #2, 2025: Summary Statistics

	Urine Cd ($\mu\text{g/L}$)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Robust Mean (x^*))	4.46	1.41	0.58	2.29	0.24
Upper Limit	5.46	2.41	1.58	3.29	1.24
Lower Limit	3.46	0.41	0.00	1.29	0.00
Robust SD (s^*)	0.15	0.09	0.04	0.07	0.03
Robust RSD (%)	3.4	6.4	6.7	3.1	13
Number of Sample Measurements (N)	12	12	11	12	11
Standard Uncertainty (u)	0.05	0.03	0.01	0.03	0.01

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



Results for Event #2, 2025: Performance of Participating Laboratories

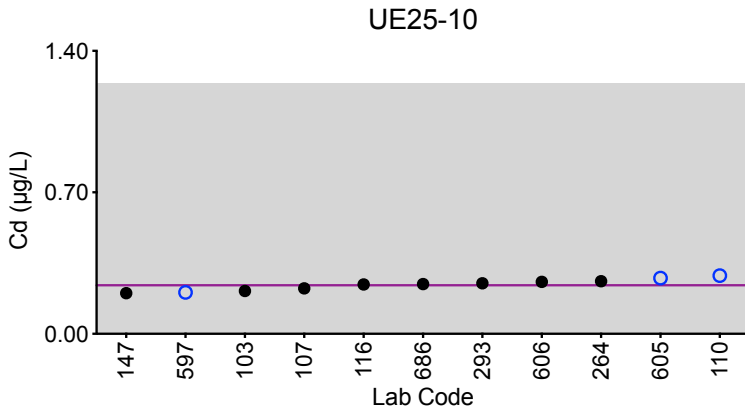
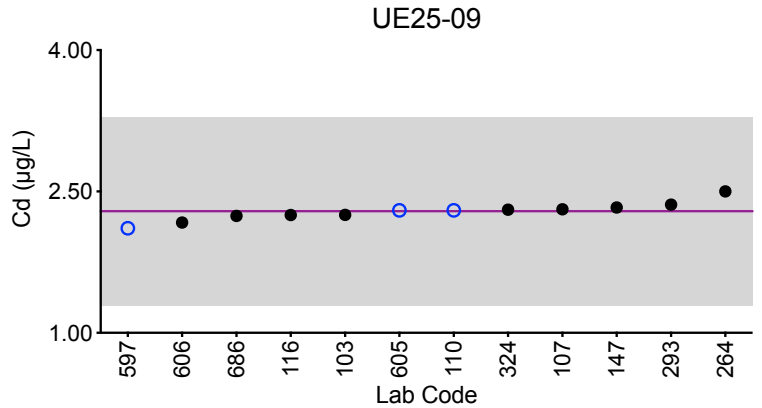
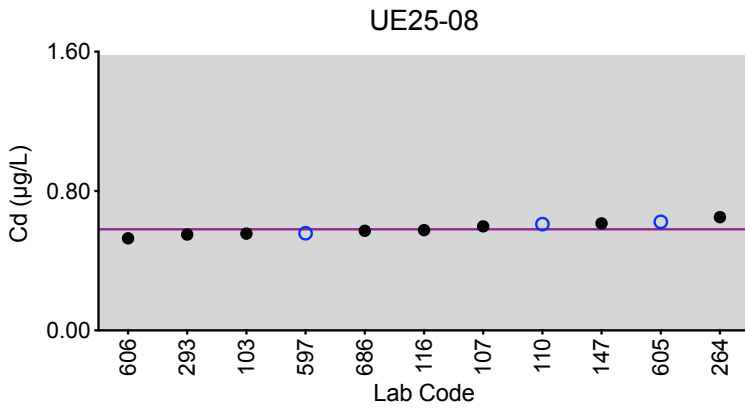
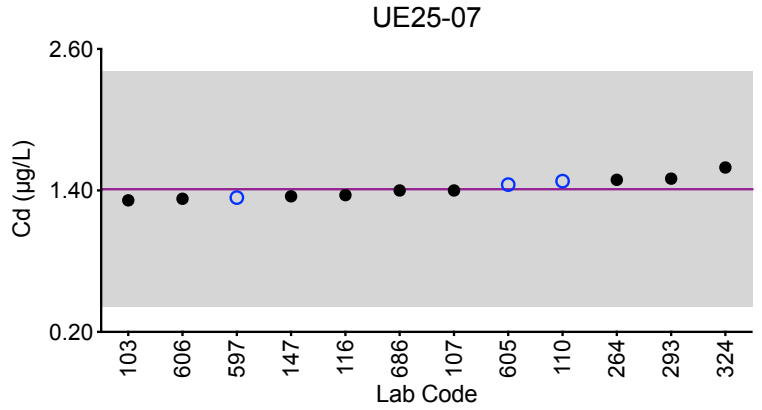
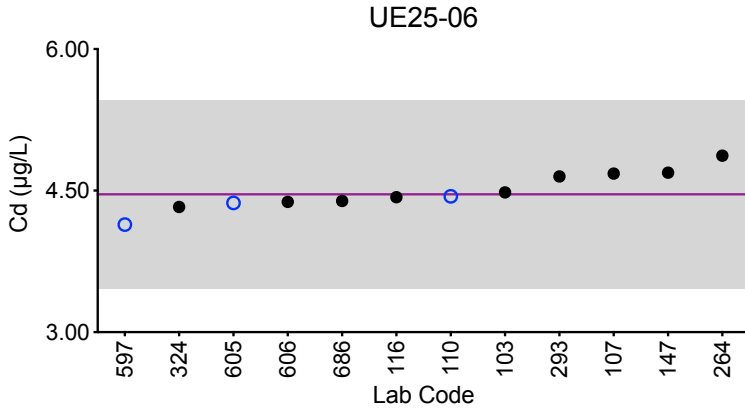
		Urine Cd (µg/L)				
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target		4.46	1.41	0.58	2.29	0.24
103	ICP-MS/MS	4.48	1.32	0.555	2.25	0.212
107	DRC/CC-ICP-MS	4.68	1.40	0.597	2.31	0.225
110	ICP-MS/MS	4.44	1.48	0.610	2.30	0.288
116	ICP-MS/MS	4.43	1.36	0.576	2.25	0.244
147	ICP-MS	4.69	1.35	0.614	2.33	0.201
264	ICP-MS	4.87	1.49	0.65	2.50	0.26
293	DRC/CC-ICP-MS	4.65	1.5	0.55	2.36	0.25
324	ICP-MS	4.327	1.595	<1	2.306	<1
597	ICP-MS/MS	4.14	1.34	0.558	2.11	0.21
605	ICP-MS	4.37	1.45	0.623	2.30	0.276
606	ICP-MS/MS	4.38	1.33	0.529	2.17	0.257
686	ICP-MS	4.39	1.40	0.572	2.24	0.246

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



Results for Event #2, 2025: Summary Figures

Urine Cd



Legend:

○ 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:

$\pm 1 \mu\text{g/L}$ or $\pm 15\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 1 \mu\text{g/L}$ at concentrations less than or equal to $6.6 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Urine Co (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Robust Mean (x*))	3.10	0.12	4.80	0.76	2.66
Upper Limit	4.60	1.62	6.30	2.26	4.16
Lower Limit	1.60	0.00	3.30	0.00	1.16
Robust SD (s*)	0.09	0.01	0.16	0.04	0.09
Robust RSD (%)	2.9	11	3.3	4.9	3.4
Number of Sample Measurements (N)	10	8	10	9	10
Standard Uncertainty (u)	0.04	NA	0.06	NA	0.04

The acceptable range is based on quality specifications: $\pm 1.5 \mu\text{g/L}$ or $\pm 15\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 1.5 \mu\text{g/L}$ at concentrations less than or equal to $10 \mu\text{g/L}$. These quality specifications were established based on discussions with the US FDA, and represent a consensus from a network of Trace Element PT program organizers

An arithmetic mean, SD, RSD and n are provided for sample UE25-07 and UE25-09.



Results for Event #2, 2025: Performance of Participating Laboratories

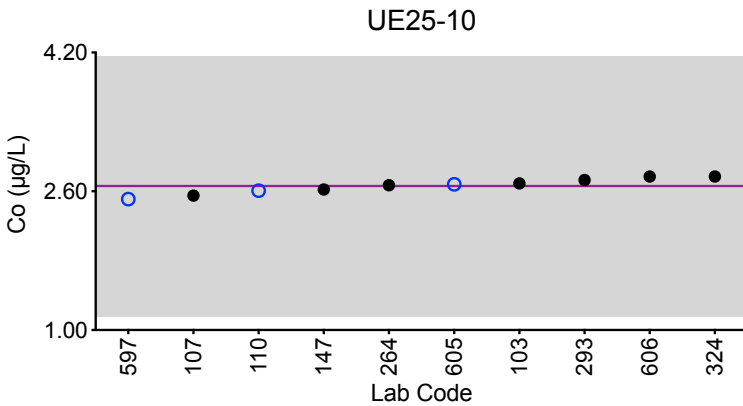
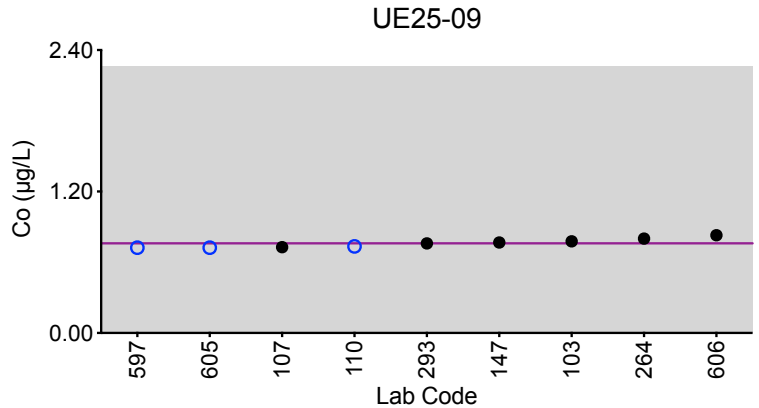
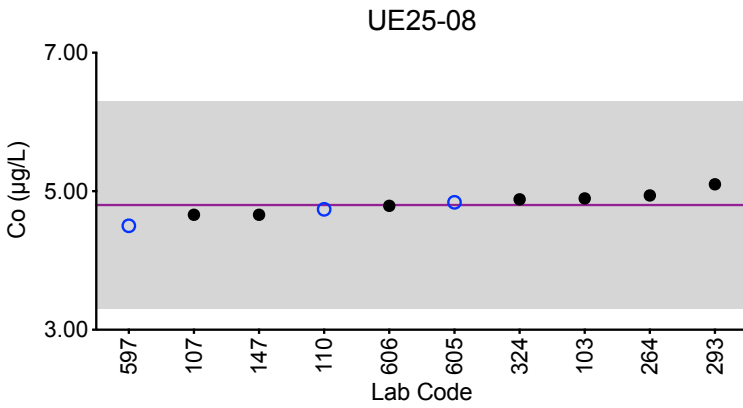
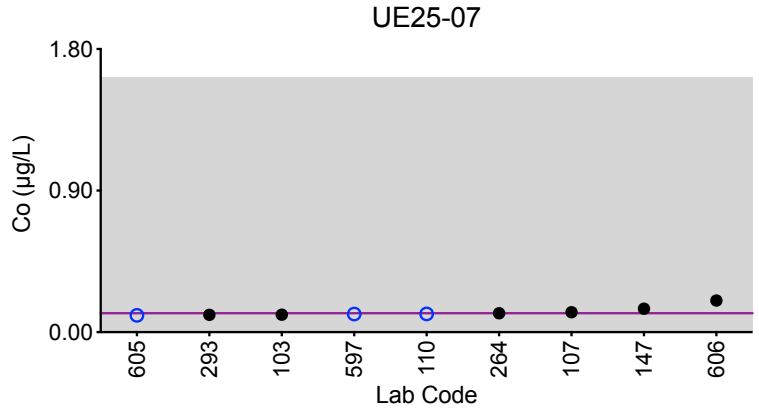
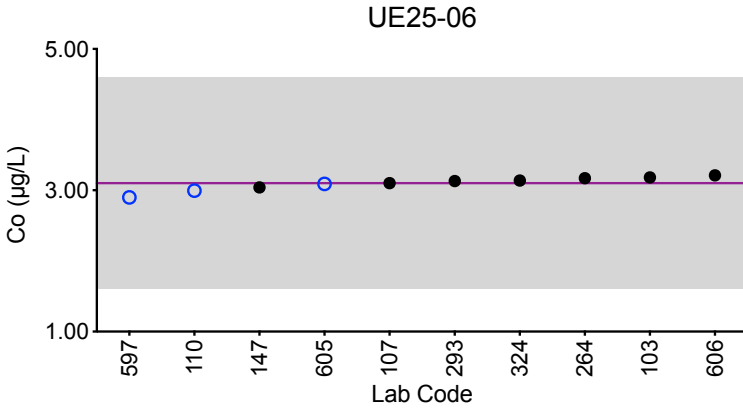
		Urine Co (µg/L)				
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target		3.10	0.12	4.80	0.76	2.66
103	ICP-MS/MS	3.18	0.111	4.90	0.778	2.69
107	DRC/CC-ICP-MS	3.10	0.127	4.66	0.728	2.55
110	ICP-MS/MS	2.99	0.116	4.74	0.734	2.61
147	ICP-MS	3.04	0.149	4.66	0.767	2.62
264	ICP-MS	3.17	0.12	4.94	0.80	2.67
293	DRC/CC-ICP-MS	3.13	0.11	5.1	0.76	2.73
324	ICP-MS	3.138	<1	4.883	<1	2.771
597	ICP-MS/MS	2.90	0.115	4.50	0.723	2.51
605	ICP-MS	3.09	0.107	4.84	0.724	2.68
606	ICP-MS/MS	3.21	*0.201	4.79	0.829	2.77

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



Results for Event #2, 2025: Summary Figures

Urine Co



Legend:

○ 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.



Results for Event #2, 2025: Summary Statistics

	Urine Cr (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Arithmetic Mean (\bar{x}))	3.48	1.70	0.69	7.0	2.65
Upper Limit	6.48	4.70	3.69	10.0	5.65
Lower Limit	0.48	0.00	0.00	4.0	0.00
Arithmetic SD (s)	0.18	0.10	0.11	0.7	0.25
Arithmetic RSD (%)	5.2	5.9	16	10	9.4
Number of Sample Measurements (N)	9	8	8	9	9

The acceptable range is based on quality specifications: $\pm 3 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 3 \mu\text{g/L}$ at concentrations less than or equal to $15 \mu\text{g/L}$. These quality specifications were established based on discussions with the US FDA, and represent a consensus from a network of Trace Element PT program organizers



Results for Event #2, 2025: Performance of Participating Laboratories

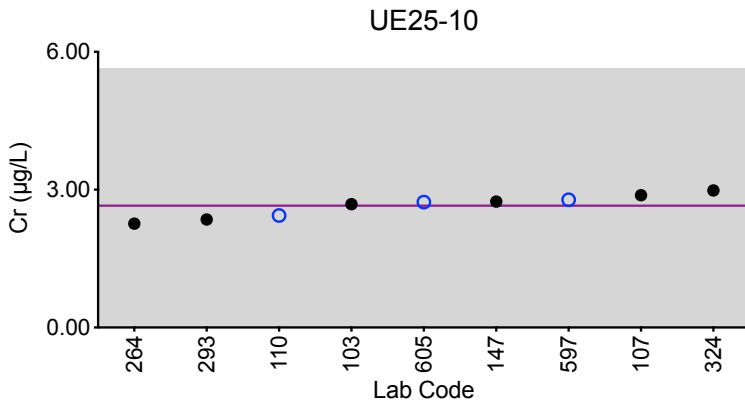
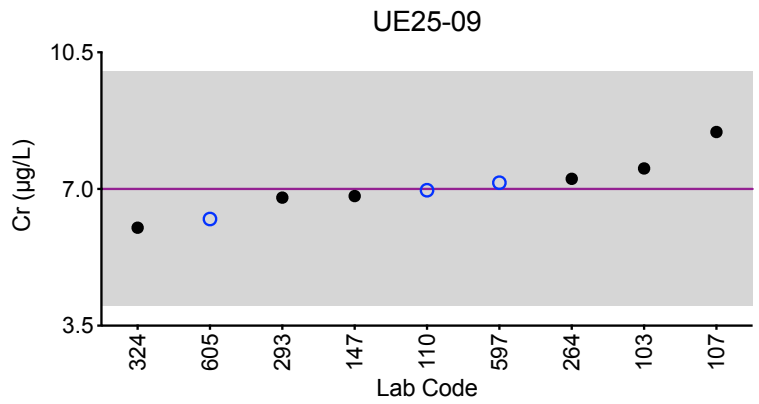
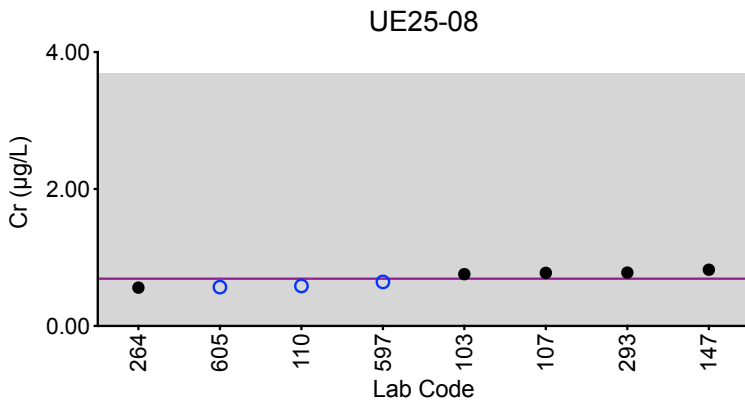
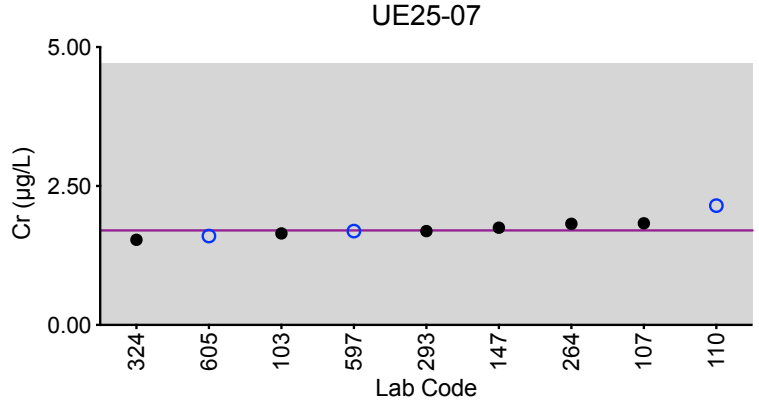
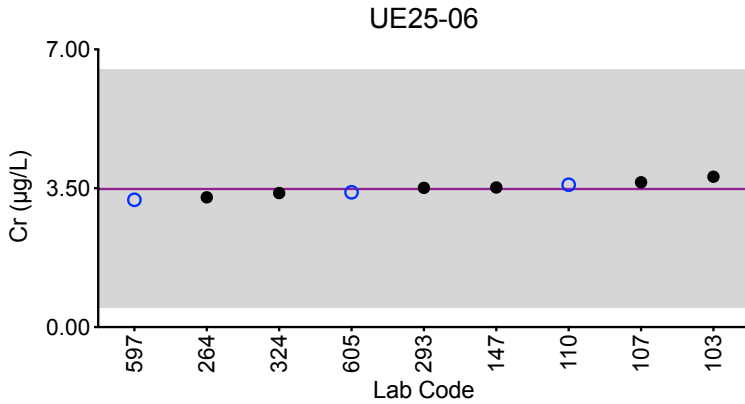
Lab Code	Method	Urine Cr (µg/L)				
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
	Target	3.48	1.70	0.69	7.0	2.65
103	ICP-MS/MS	3.79	1.65	0.756	7.53	2.68
107	DRC/CC-ICP-MS	3.65	1.83	0.776	8.46	2.88
110	ICP-MS/MS	3.59	*2.15	0.584	6.97	2.44
147	DRC/CC-ICP-MS	3.52	1.75	0.821	6.82	2.74
264	ICP-MS	3.27	1.82	0.56	7.26	2.26
293	DRC/CC-ICP-MS	3.51	1.69	0.78	6.78	2.35
324	ICP-MS	3.378	1.533	<1	6.009	2.984
597	ICP-MS/MS	3.21	1.69	0.643	7.16	2.78
605	ICP-MS	3.40	1.60	0.568	6.23	2.73

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



Results for Event #2, 2025: Summary Figures

Urine Cr



Legend:

○ 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:

$\pm 3 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 3 \mu\text{g/L}$ at concentrations less than or equal to $15 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Urine Hg (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Robust Mean (x*))	26.1	9.5	17.5	3.4	0.8
Upper Limit	33.9	12.5	22.8	6.4	3.8
Lower Limit	18.3	6.5	12.3	0.4	0.0
Robust SD (s*)	1.9	0.4	1.5	0.3	0.2
Robust RSD (%)	7.3	3.9	8.6	9.0	24
Number of Sample Measurements (N)	10	10	10	10	8
Standard Uncertainty (u)	0.8	0.1	0.6	0.1	NA

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

An arithmetic mean, SD, RSD and n are provided for sample UE25-10.



Results for Event #2, 2025: Performance of Participating Laboratories

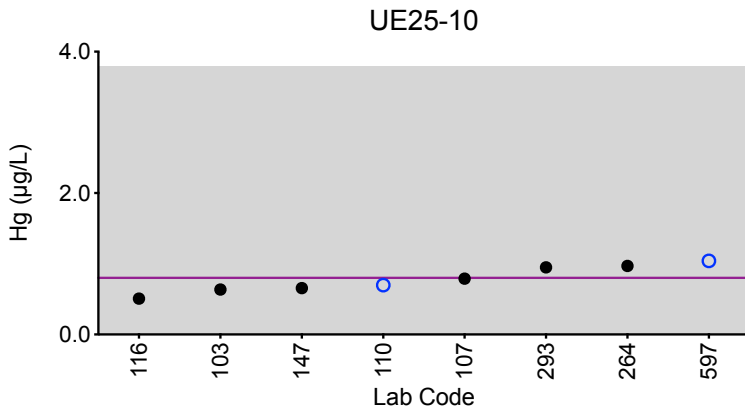
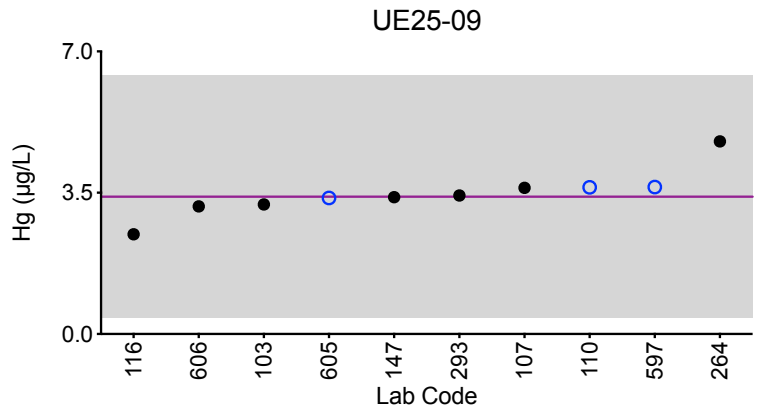
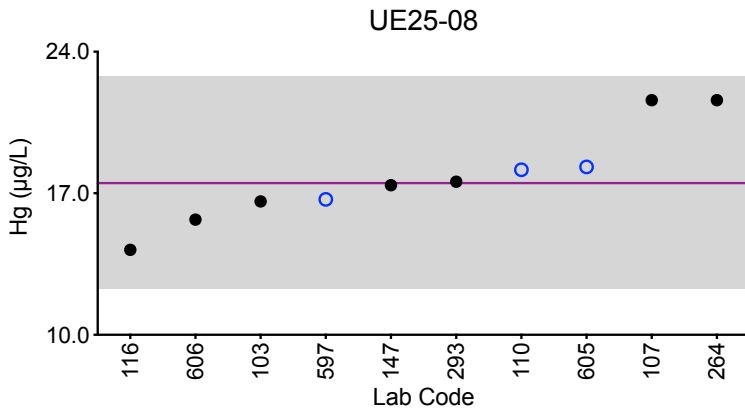
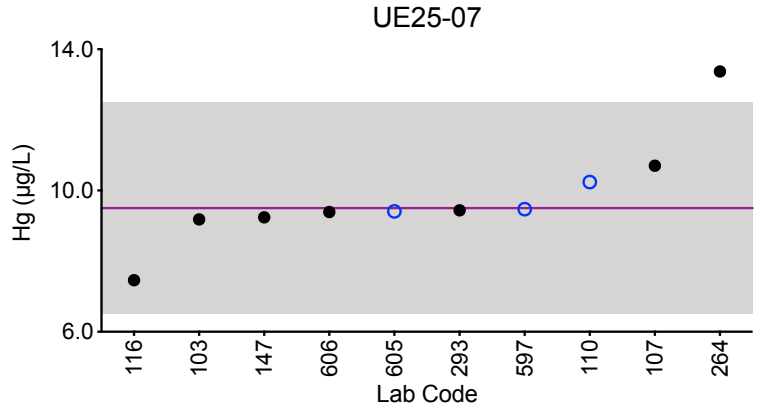
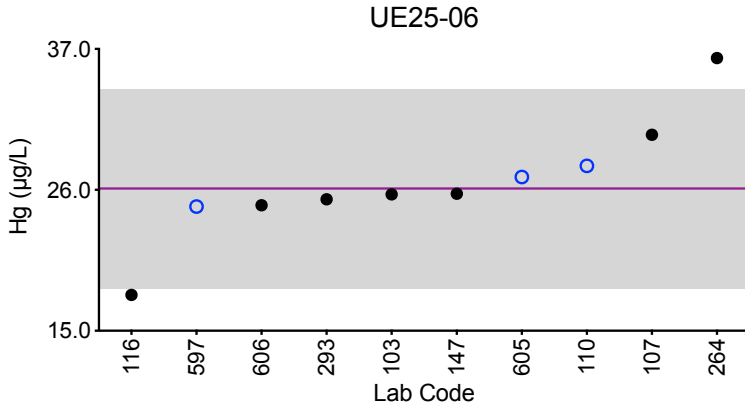
Lab Code	Method	Urine Hg (µg/L)				
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
	Target	26.1	9.5	17.5	3.4	0.8
103	ICP-MS/MS	25.6	9.18	16.6	3.21	0.636
107	DRC/CC-ICP-MS	30.3	10.7	21.6	3.62	0.790
110	ICP-MS	27.9	10.2	18.2	3.63	0.70
116	ICP-MS/MS	17.8 ↓	7.46	14.2	2.47	0.508
147	ICP-MS	25.7	9.24	17.4	3.39	0.655
264	ICP-MS	36.29 ↑	13.37 ↑	21.60	4.77	0.97
293	DRC/CC-ICP-MS	25.26	9.44	17.57	3.43	0.95
597	ICP-MS/MS	24.7	9.47	16.7	3.64	1.04
605	ICP-MS	27.0	9.41	18.3	3.37	<1.00
606	ICP-MS/MS	24.8	9.39	15.7	3.16	<1.00

Based on the grading criteria for Hg in Urine, 94% of results were satisfactory, with 1 of the 10 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.



Results for Event #2, 2025: Summary Figures

Urine Hg



Legend:

○ 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:

$\pm 3 \mu\text{g/L}$ or $\pm 30\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 3 \mu\text{g/L}$ at concentrations less than or equal to $10 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Urine Mn (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Robust Mean (x*))	6.47	0.60	1.40	3.67	9.29
Upper Limit	8.09	1.15	1.95	4.59	11.61
Lower Limit	4.85	0.05	0.85	2.75	6.97
Robust SD (s*)	0.16	0.06	0.01	0.13	0.28
Robust RSD (%)	2.5	11	0.64	3.5	3.0
Number of Sample Measurements (N)	10	9	10	10	10
Standard Uncertainty (u)	0.06	NA	0.01	0.05	0.09

The acceptable range is based on quality specifications: $\pm 0.55 \mu\text{g/L}$ or $\pm 25\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 0.55 \mu\text{g/L}$ at concentrations less than or equal to $2.2 \mu\text{g/L}$. 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).

An arithmetic mean, SD, RSD and n are provided for sample UE25-07.



Results for Event #2, 2025: Performance of Participating Laboratories

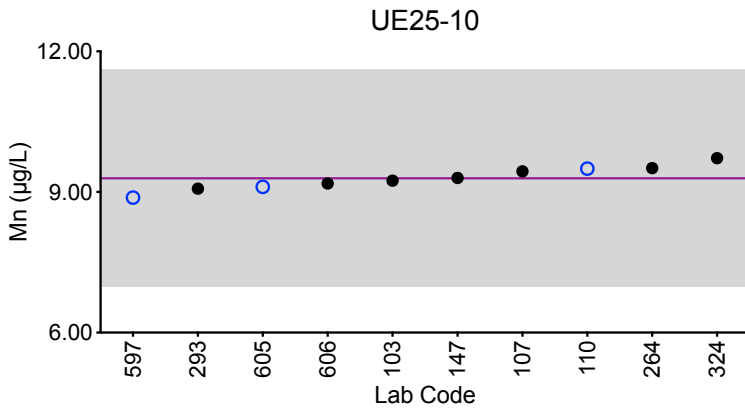
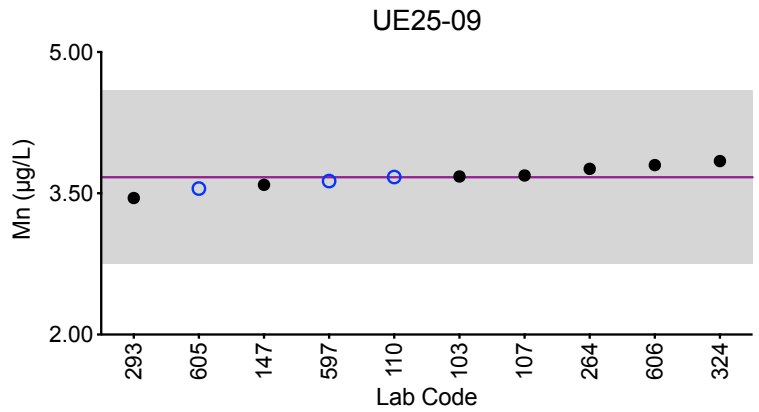
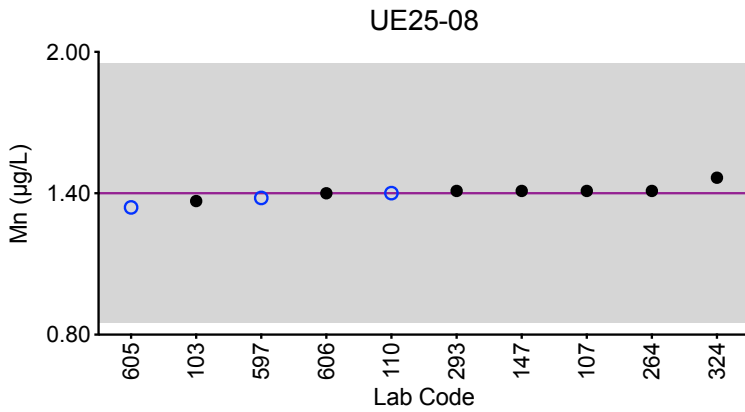
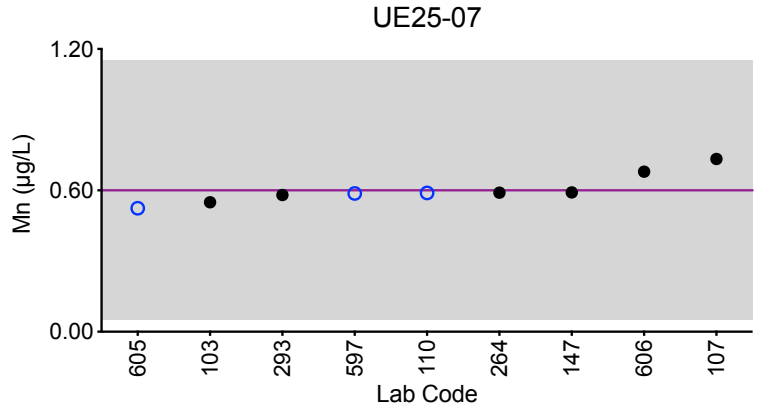
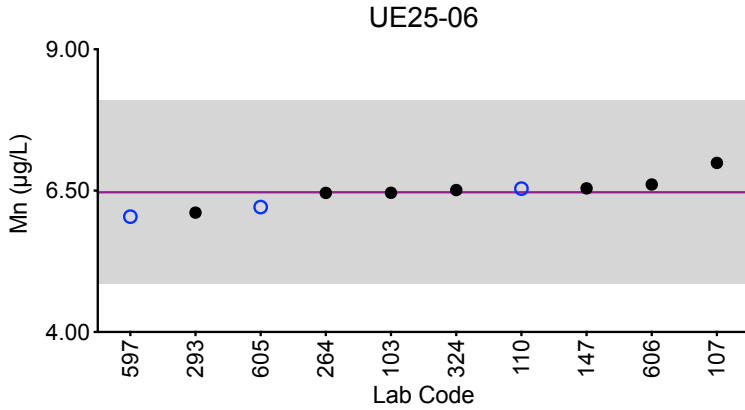
		Urine Mn (µg/L)				
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target		6.47	0.60	1.40	3.67	9.29
103	ICP-MS/MS	6.46	0.549	1.37	3.68	9.24
107	DRC/CC-ICP-MS	6.99	0.733	1.41	3.69	9.44
110	ICP-MS/MS	6.54	0.589	1.40	3.67	9.50
147	DRC/CC-ICP-MS	6.54	0.591	1.41	3.59	9.30
264	ICP-MS	6.46	0.59	1.41	3.76	9.51
293	DRC/CC-ICP-MS	6.11	0.58	1.41	3.45	9.07
324	ICP-MS	6.510	<1	1.466	3.843	9.721
597	ICP-MS/MS	6.04	0.587	1.38	3.63	8.88
605	ICP-MS	6.21	0.524	1.34	3.55	9.11
606	ICP-MS/MS	6.61	0.679	1.40	3.80	9.18

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



Results for Event #2, 2025: Summary Figures

Urine Mn



Legend:

○ 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.



Results for Event #2, 2025: Summary Statistics

	Urine Pb (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Robust Mean (x*))	0.592	6.62	4.12	1.66	9.6
Upper Limit	1.592	7.94	5.12	2.66	11.5
Lower Limit	0.000	5.30	3.12	0.66	7.7
Robust SD (s*)	0.024	0.12	0.10	0.07	0.3
Robust RSD (%)	4.1	1.8	2.4	4.2	3.1
Number of Sample Measurements (N)	11	12	12	12	12
Standard Uncertainty (u)	0.009	0.04	0.04	0.02	0.1

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



Results for Event #2, 2025: Performance of Participating Laboratories

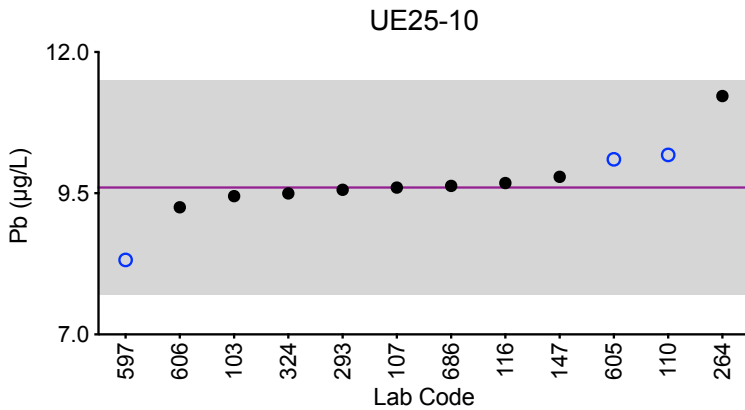
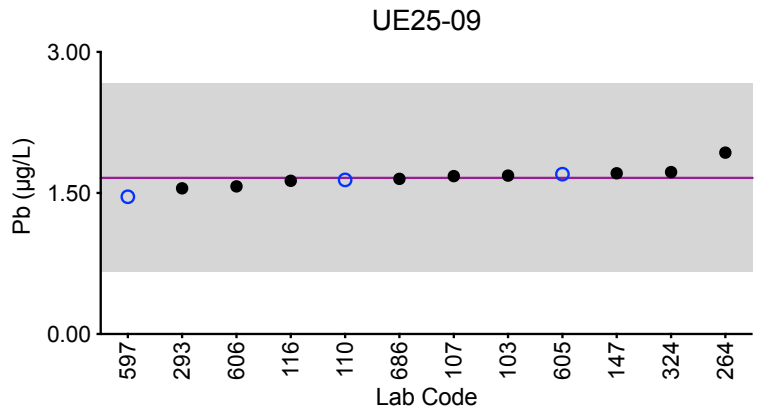
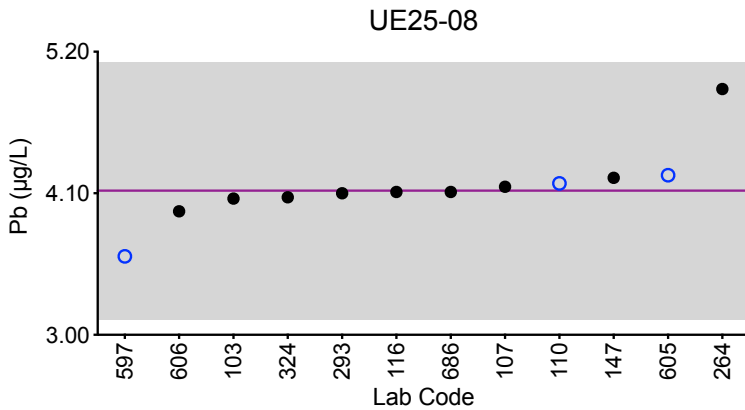
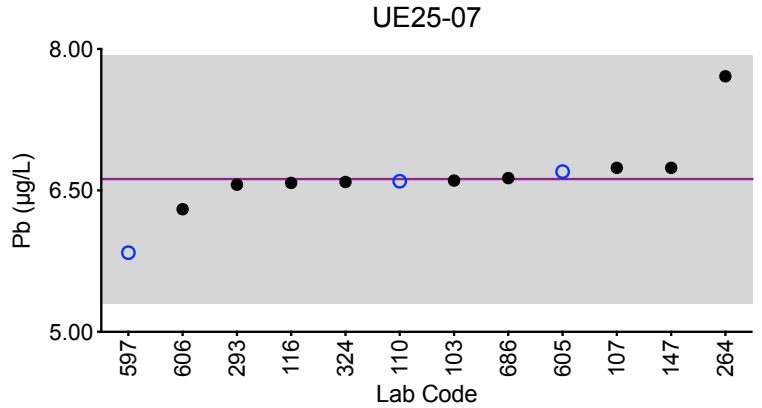
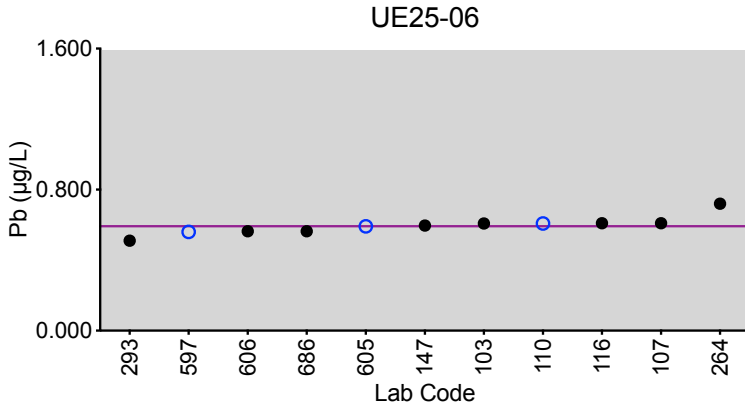
		Urine Pb (µg/L)				
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target		0.592	6.62	4.12	1.66	9.6
103	ICP-MS/MS	0.607	6.60	4.06	1.68	9.45
107	ICP-MS	0.609	6.74	4.15	1.68	9.60
110	ICP-MS/MS	0.608	6.60	4.18	1.64	10.2
116	ICP-MS/MS	0.609	6.58	4.11	1.63	9.68
147	ICP-MS	0.596	6.74	4.22	1.71	9.79
264	ICP-MS	0.72	7.71	4.91	1.93	11.22
293	DRC/CC-ICP-MS	0.51	6.56	4.1	1.55	9.56
324	ICP-MS	<1	6.589	4.069	1.722	9.498
597	ICP-MS/MS	0.560	5.84	3.61	1.46	8.32
605	ICP-MS	0.592	6.70	4.24	1.70	10.1
606	ICP-MS/MS	0.564	6.30	3.96	1.57	9.25
686	ICP-MS	0.564	6.63	4.11	1.65	9.63

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



Results for Event #2, 2025: Summary Figures

Urine Pb



Legend:

○ 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.



Results for Event #2, 2025: Summary Statistics

	Urine TI (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Robust Mean (x*))	1.64	0.46	0.249	2.94	0.83
Upper Limit	1.97	0.66	0.449	3.53	1.03
Lower Limit	1.31	0.26	0.049	2.35	0.63
Robust SD (s*)	0.06	0.03	0.016	0.10	0.04
Robust RSD (%)	3.7	5.4	6.4	3.4	4.8
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (u)	0.02	0.01	0.006	0.04	0.02

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



Results for Event #2, 2025: Performance of Participating Laboratories

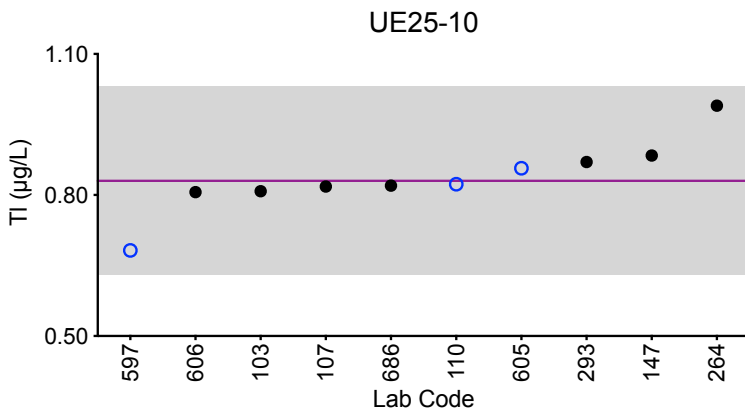
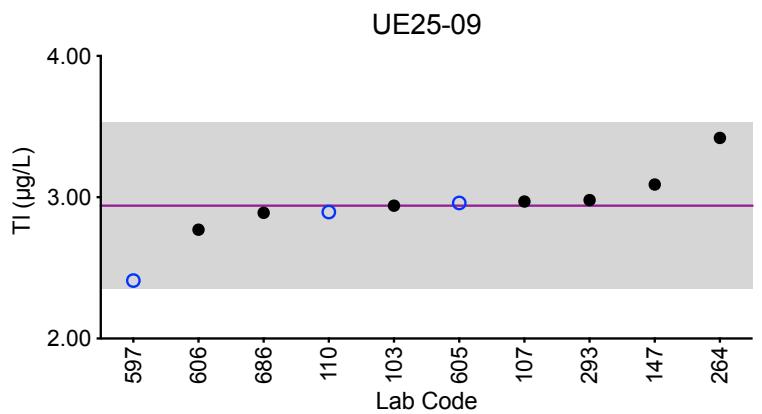
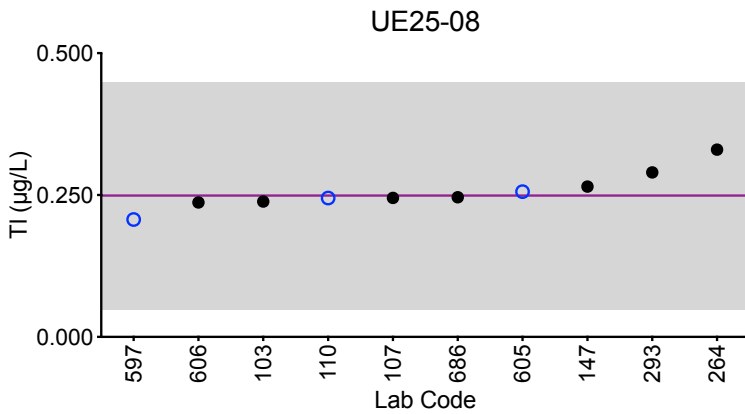
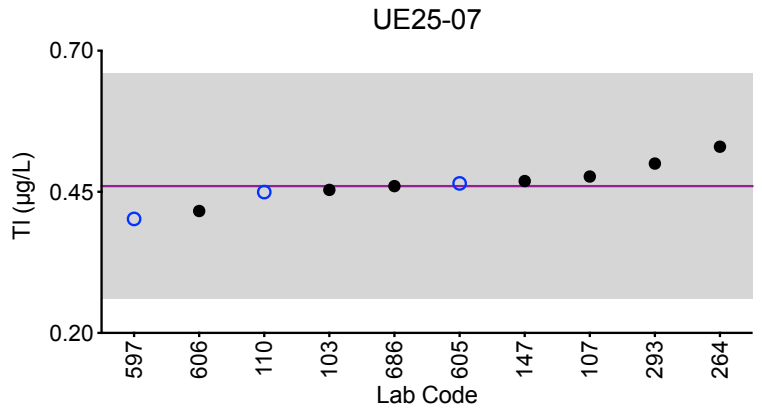
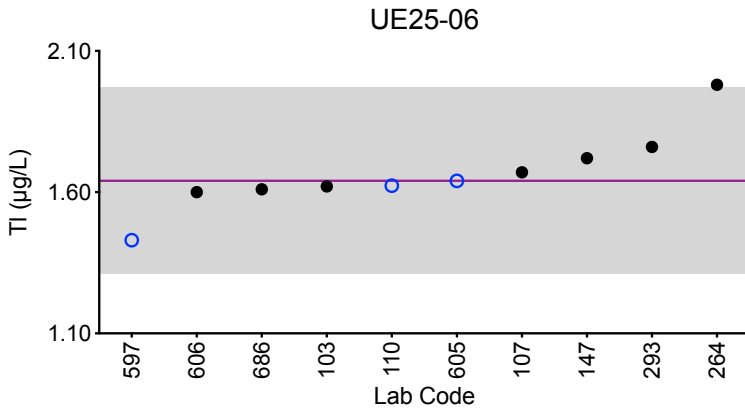
Lab Code	Method	Urine TI (µg/L)				
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
	Target	1.64	0.46	0.249	2.94	0.83
103	ICP-MS/MS	1.62	0.453	0.239	2.94	0.808
107	ICP-MS	1.67	0.477	0.245	2.97	0.818
110	ICP-MS/MS	1.62	0.449	0.245	2.90	0.823
147	ICP-MS	1.72	0.469	0.265	3.09	0.884
264	ICP-MS	1.98 ↑	0.53	0.33	3.42	0.99
293	DRC/CC-ICP-MS	1.76	0.5	0.29	2.98	0.87
597	ICP-MS/MS	1.43	0.402	0.207	2.41	0.682
605	ICP-MS	1.64	0.465	0.256	2.96	0.857
606	ICP-MS/MS	1.60	0.416	0.237	2.77	0.806
686	ICP-MS	1.61	0.460	0.246	2.89	0.820

Based on the grading criteria for TI in Urine, 98% of results were satisfactory, with 0 of the 10 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.



Results for Event #2, 2025: Summary Figures

Urine TI



Legend:

○ 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:

$\pm 0.2 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 0.2 \mu\text{g/L}$ at concentrations less than or equal to $1 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Urine U (µg/L)				
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Target (Robust Mean (x*))	0.119	0.51	0.010	0.264	0.057
Upper Limit	0.149	0.61	0.040	0.317	0.087
Lower Limit	0.089	0.41	0.000	0.211	0.027
Robust SD (s*)	0.005	0.03	0.001	0.013	0.003
Robust RSD (%)	4.2	6.1	11	4.9	5.8
Number of Sample Measurements (N)	11	11	8	11	11
Standard Uncertainty (u)	0.002	0.01	NA	0.005	0.001

The acceptable range is based on quality specifications: $\pm 0.03 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 0.03 \mu\text{g/L}$ at concentrations less than or equal to $0.15 \mu\text{g/L}$. 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.

An arithmetic mean, SD, RSD and n are provided for sample UE25-08.



Results for Event #2, 2025: Performance of Participating Laboratories

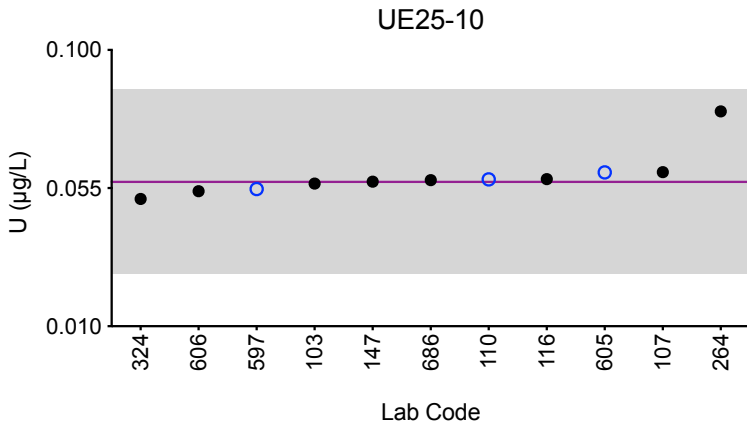
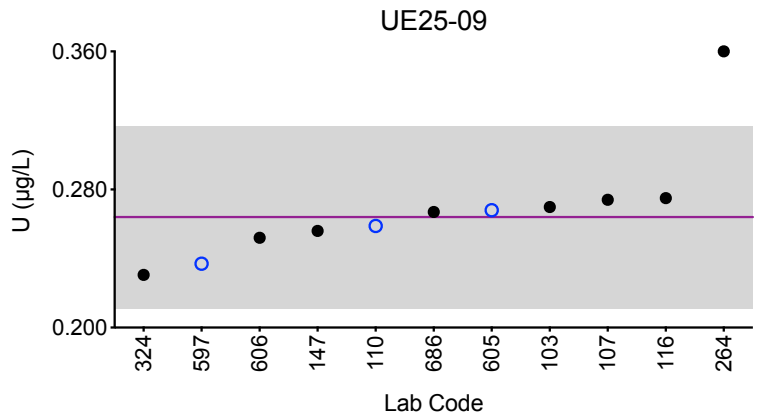
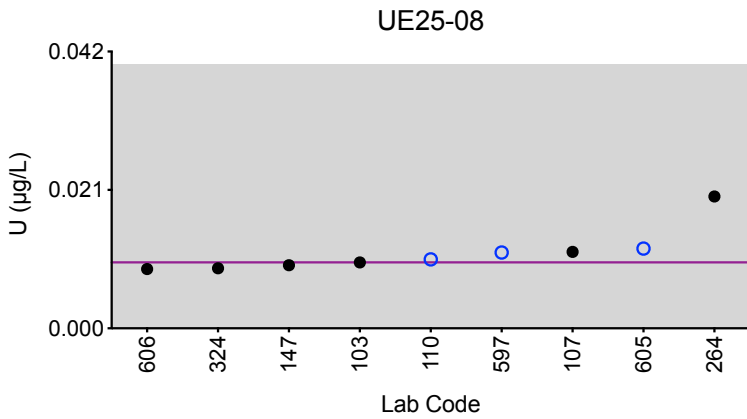
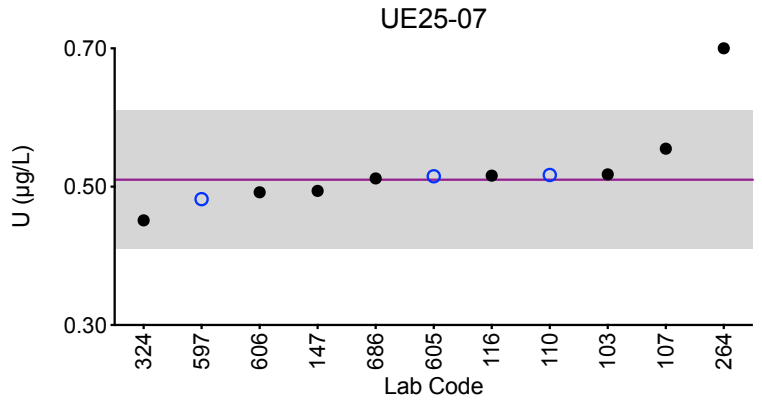
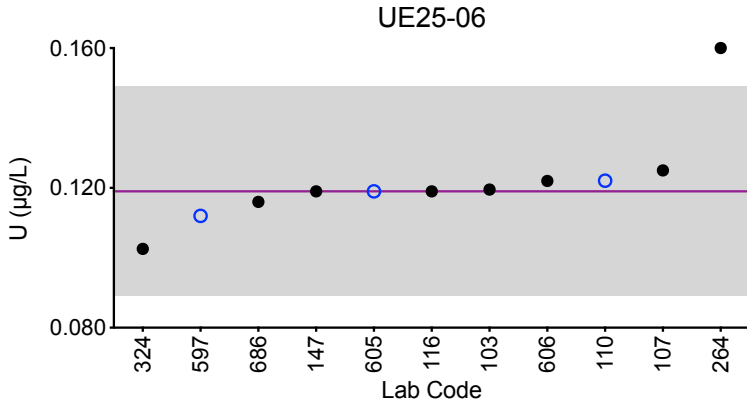
Lab Code	Method	Urine U (µg/L)				
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
	Target	0.119	0.51	0.010	0.264	0.057
103	ICP-MS/MS	0.120	0.518	0.0100	0.270	0.0565
107	ICP-MS	0.125	0.555	0.0116	0.274	0.0602
110	ICP-MS/MS	0.122	0.517	0.0105	0.259	0.0578
116	ICP-MS/MS	0.119	0.516	<0.0150	0.275	0.0579
147	ICP-MS	0.119	0.494	0.00958	0.256	0.0571
264	ICP-MS	0.16 ↑	0.70 ↑	*0.02	0.36 ↑	0.08
324	ICP-MS	0.103	0.451	0.009	0.230	0.051
597	ICP-MS/MS	0.112	0.482	0.0115	0.237	0.0547
605	ICP-MS	0.119	0.515	0.0121	0.268	0.0601
606	ICP-MS/MS	0.122	0.492	0.009	0.252	0.054
686	ICP-MS	0.116	0.512	<0.0150	0.267	0.0576

Based on the grading criteria for U in Urine, 95% of results were satisfactory, with 1 of the 11 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.



Results for Event #2, 2025: Summary Figures

Urine U



Legend:

○ 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:

$\pm 0.03 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 0.03 \mu\text{g/L}$ at concentrations less than or equal to $0.15 \mu\text{g/L}$.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

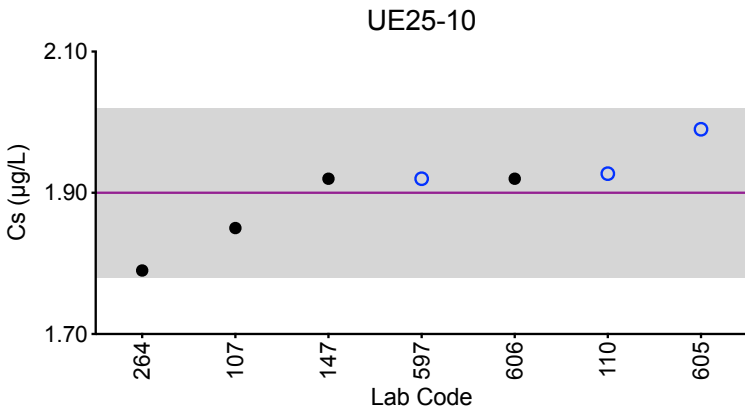
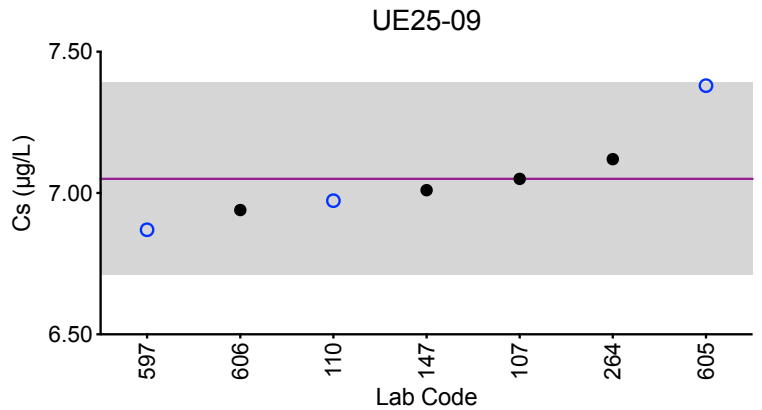
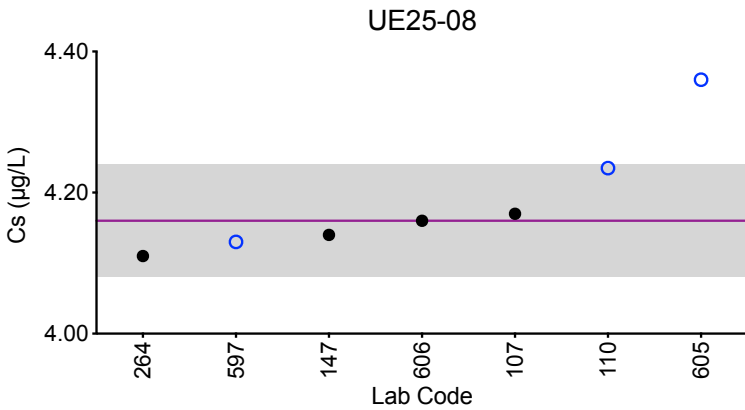
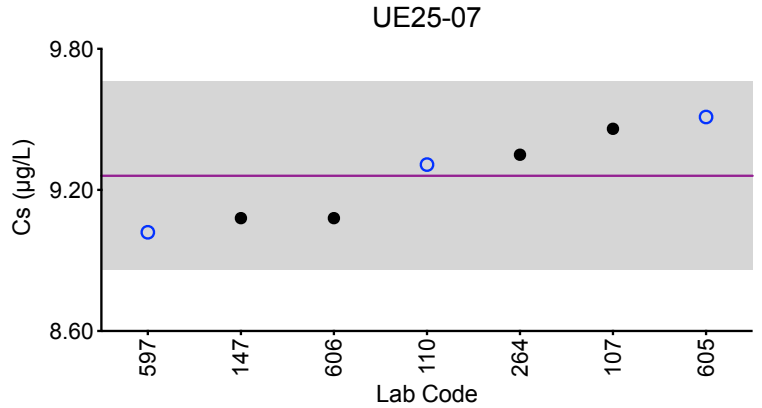
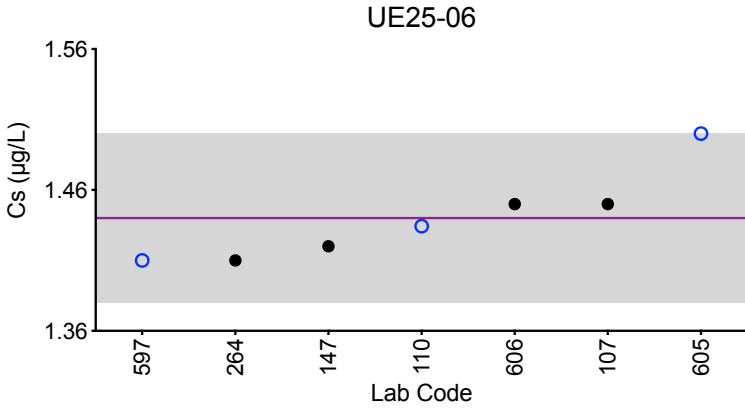
Urine Cs (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
107	ICP-MS	1.45	9.46	4.17	7.05	1.85
110	ICP-MS/MS	1.43	9.31	4.23	6.97	1.93
147	ICP-MS	1.42	9.08	4.14	7.01	1.92
264	ICP-MS	1.41	9.35	4.11	7.12	1.79
597	ICP-MS/MS	1.41	9.02	4.13	6.87	1.92
605	ICP-MS	1.50	9.51	*4.36	7.38	1.99
606	ICP-MS/MS	1.45	9.08	4.16	6.94	1.92
Summary Statistics						
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})		1.44	9.26	4.16	7.05	1.90
Arithmetic SD (s)		0.03	0.20	0.04	0.17	0.06
Arithmetic RSD (%)		2.2	2.2	0.96	2.4	3.2
Number of Sample Measurements (N)		7	7	6	7	7

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Cs



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

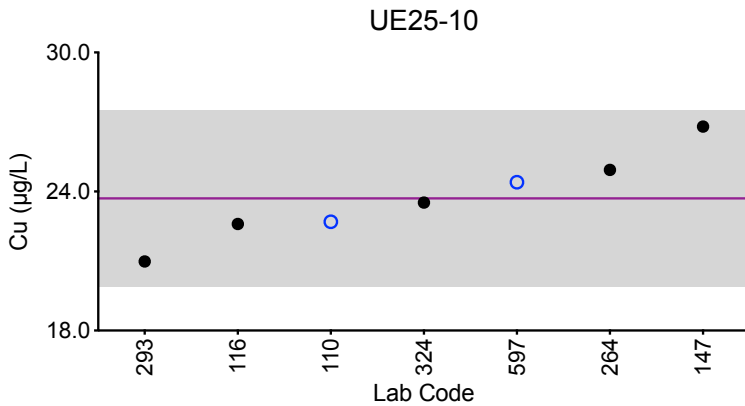
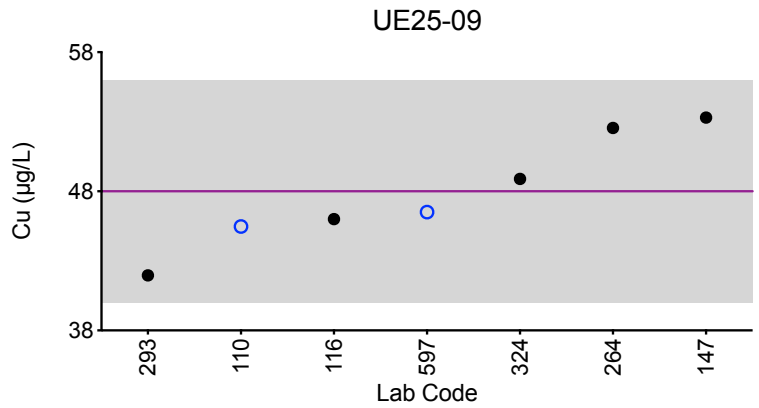
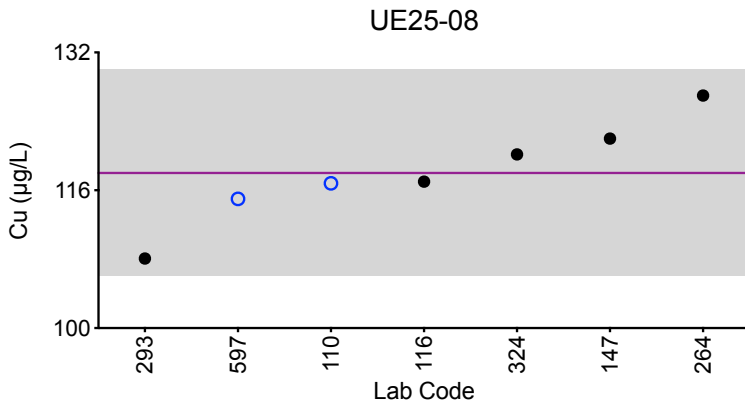
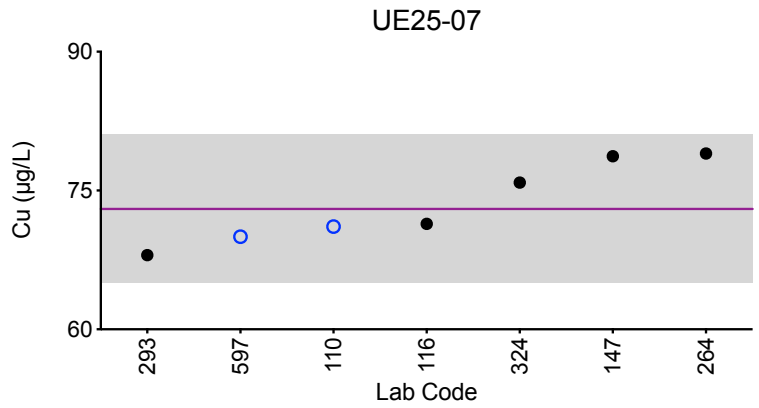
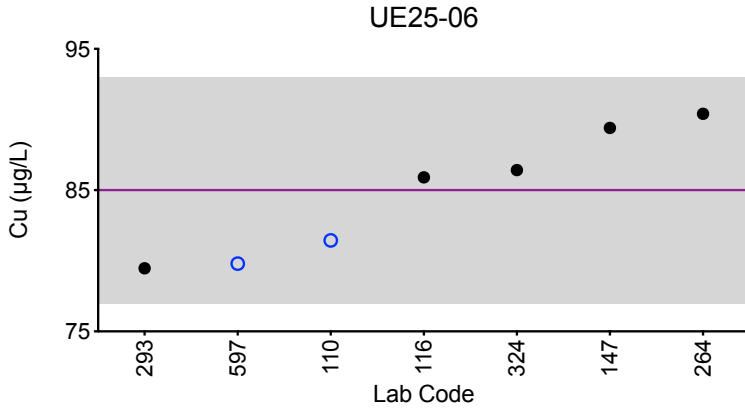
Urine Cu (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
110	ICP-MS/MS	81.4	71.1	117	45.5	22.7
116	ICP-MS/MS	85.9	71.4	117	46.0	22.6
147	ICP-MS	89.4	78.7	122	53.3	26.8
264	ICP-MS	90.40	79.00	127	52.55	24.93
293	DRC/CC-ICP-MS	79.47	68.02	108.07	41.96	20.98
324	ICP-MS	86.418	75.855	120.168	48.892	23.519
597	ICP-MS/MS	79.8	70.0	115	46.5	24.4
Summary Statistics						
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})		85	73	118	48	23.7
Arithmetic SD (s)		4	4	6	4	1.9
Arithmetic RSD (%)		4.7	5.5	5.1	8.3	8.0
Number of Sample Measurements (N)		7	7	7	7	7

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Cu



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Urine Mo (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
103	ICP-MS/MS	10.3	118	24.3	65.8	78.1
107	ICP-MS	9.69	116	22.5	62.7	72.8
110	ICP-MS/MS	10.2	118	23.2	62.9	76.0
147	ICP-MS	9.85	112	22.7	61.0	73.9
264	ICP-MS	10.55	128	25.13	69.17	81.85
293	DRC/CC-ICP-MS	11.55	117.66	24.53	66.53	81.13
324	ICP-MS	9.862	115.914	22.917	62.971	77.103
597	ICP-MS/MS	8.87	104	21.2	56.5	67.9
605	ICP-MS	9.93	118	23.7	64.5	78.7
606	ICP-MS/MS	10.1	117	23.2	64.3	77.6

Summary Statistics

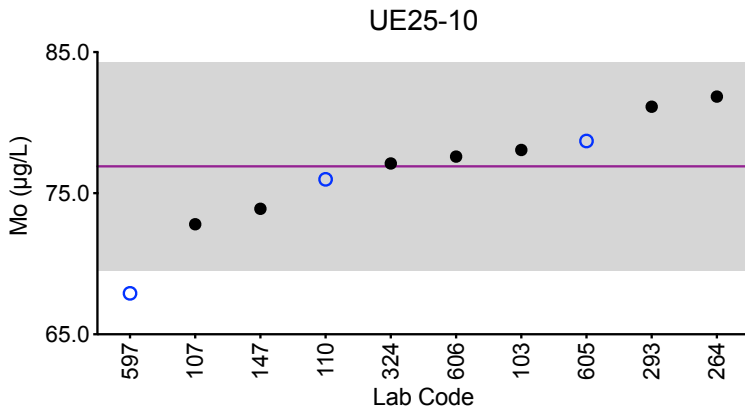
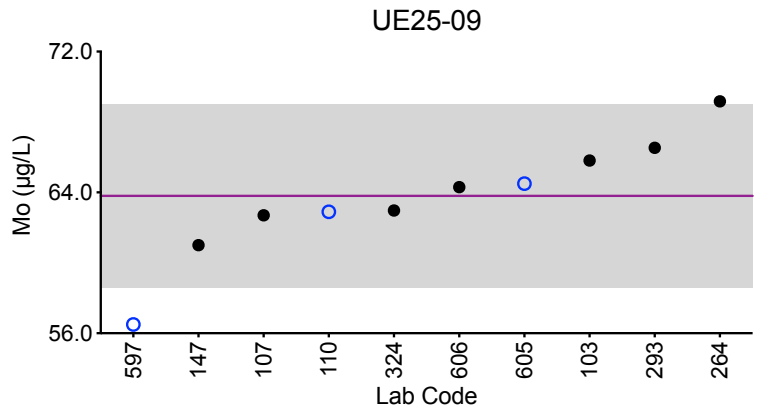
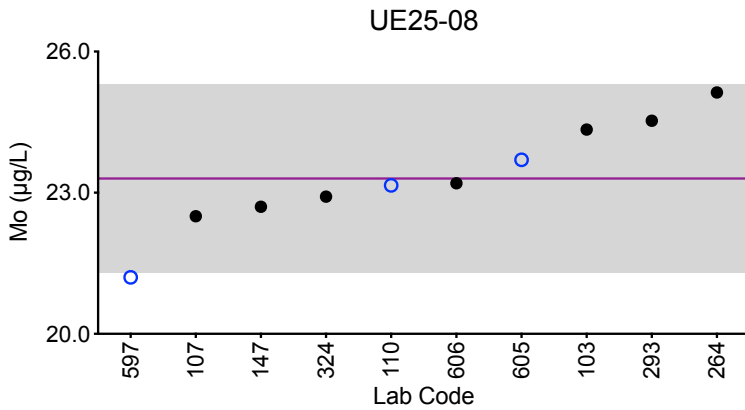
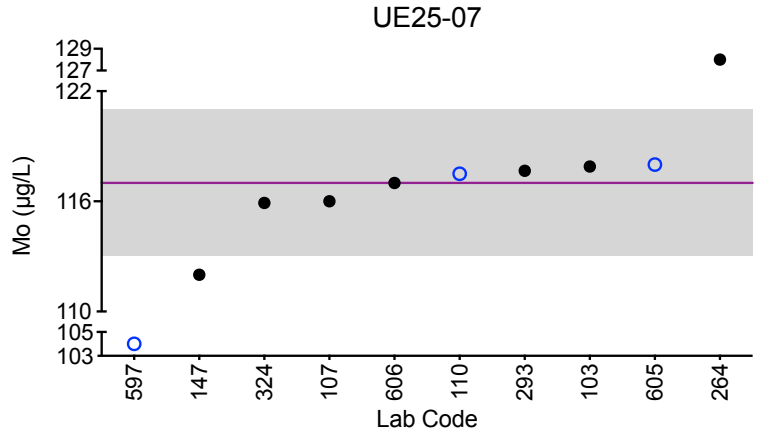
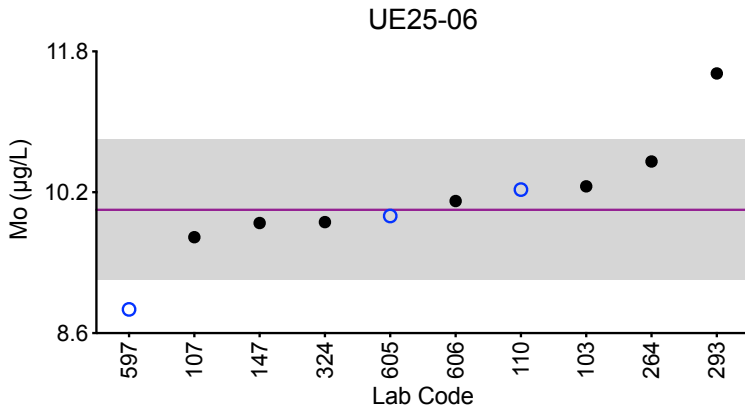
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Robust Mean (x*)	10.0	117	23.3	63.8	76.9
Robust SD (s*)	0.4	2	1.0	2.6	3.7
Robust RSD (%)	4.0	1.4	4.3	4.1	4.8
Number of Sample Measurements (N)	10	10	10	10	10
Standard Uncertainty (u)	0.2	1	0.4	0.1	0.1

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Mo



Legend:

- HHEAR Labs ● Other Labs
- Horizontal purple line = robust mean of all laboratories.
- Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Urine Ni (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
103	ICP-MS/MS	3.69	1.22	4.75	2.95	5.95
107	DRC/CC-ICP-MS	3.66	1.17	5.90	3.50	6.80
110	ICP-MS/MS	3.91	1.60	5.18	3.10	6.18
147	ICP-MS	3.72	1.08	4.87	2.66	6.03
264	ICP-MS	4.20	1.53	5.55	3.52	6.41
293	DRC/CC-ICP-MS	4	1.13	4.95	2.62	6.48
324	ICP-MS	3.824	1.501	4.902	3.085	5.973
597	ICP-MS/MS	3.75	1.16	4.70	3.05	5.92
605	ICP-MS	3.61	0.957	4.81	2.40	6.07

Summary Statistics

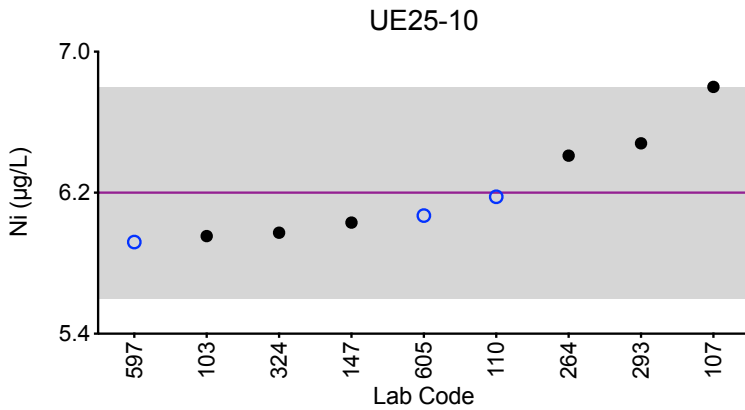
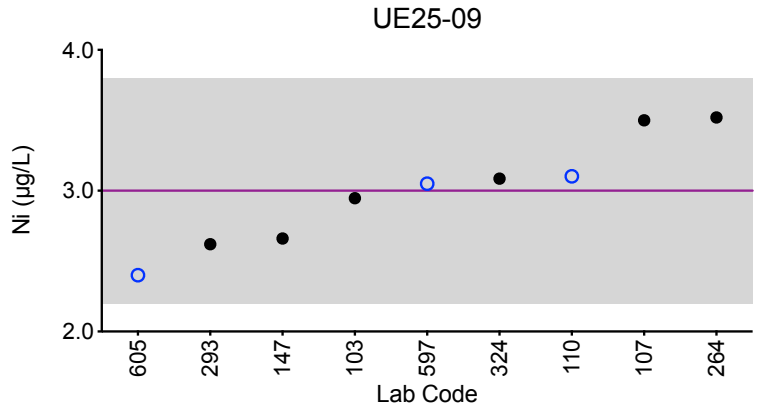
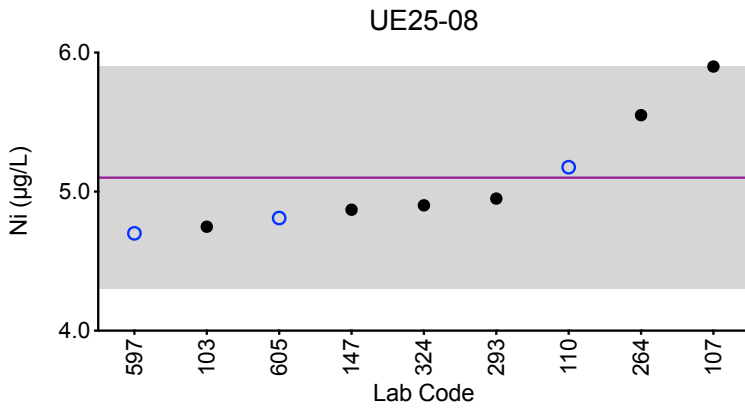
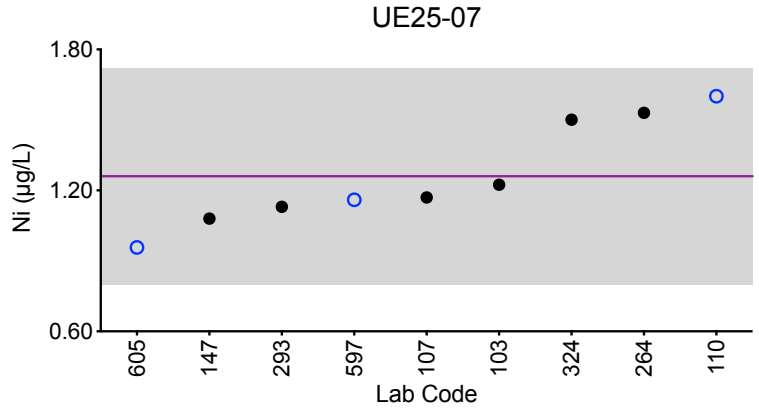
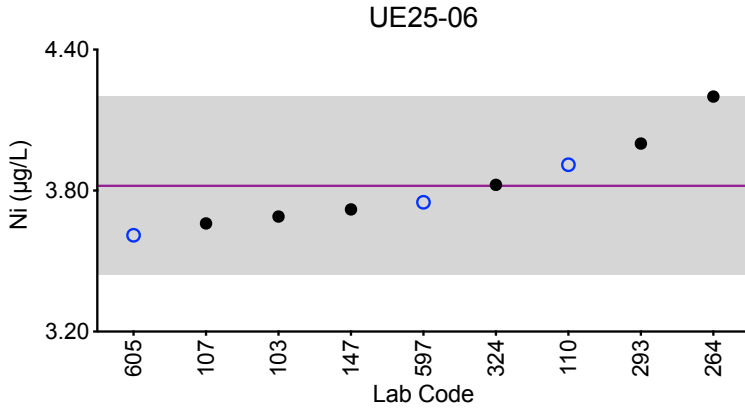
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})	3.82	1.26	5.1	3.0	6.2
Arithmetic SD (s)	0.19	0.23	0.4	0.4	0.3
Arithmetic RSD (%)	5.0	18	8.1	13	4.8
Number of Sample Measurements (N)	9	9	9	9	9

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Ni



Legend:

○ 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.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

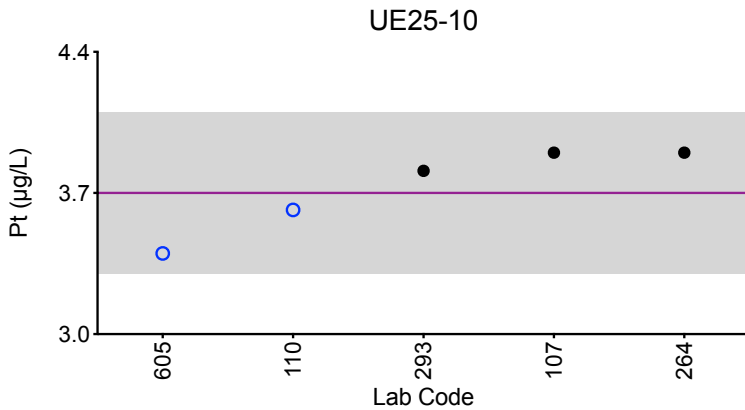
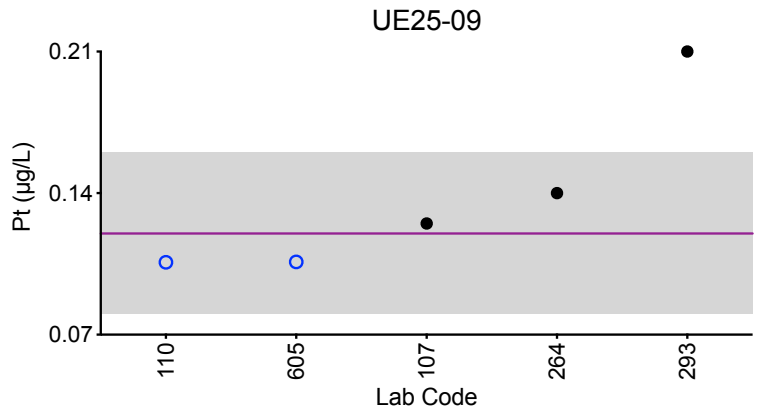
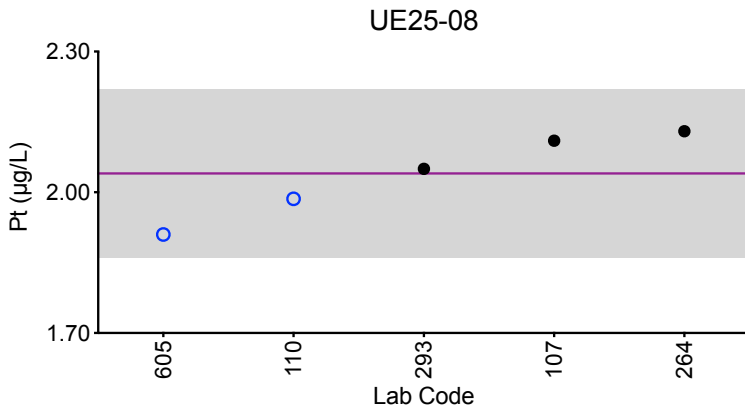
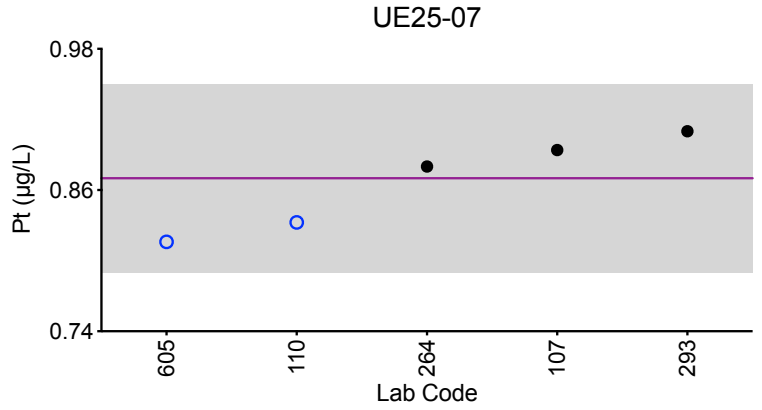
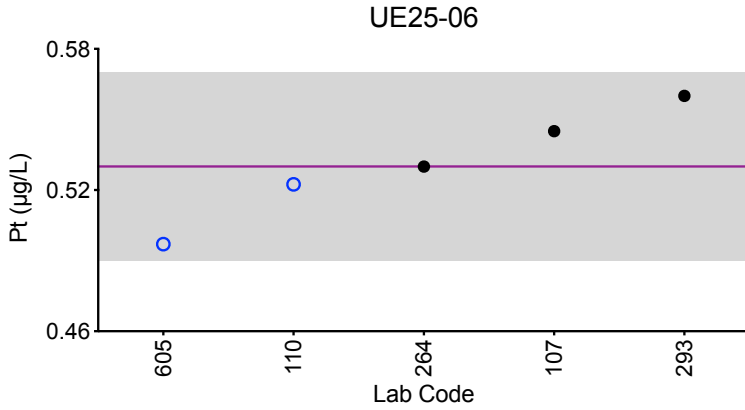
Urine Pt (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
107	ICP-MS	0.545	0.894	2.11	0.125	3.90
110	ICP-MS/MS	0.522	0.832	1.99	0.106	3.62
264	ICP-MS	0.53	0.88	2.13	0.14	3.90
293	DRC/CC-ICP-MS	0.56	0.91	2.05	*0.21	3.81
605	ICP-MS	0.497	0.816	1.91	0.106	3.40
Summary Statistics						
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})		0.53	0.87	2.04	0.12	3.7
Arithmetic SD (s)		0.02	0.04	0.09	0.02	0.2
Arithmetic RSD (%)		4.5	4.6	4.4	14	5.9
Number of Sample Measurements (N)		5	5	5	4	5

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Pt



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Urine Sb (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
103	ICP-MS/MS	2.05	0.301	0.681	1.10	0.446
107	ICP-MS	2.06	0.305	0.704	1.07	0.433
110	ICP-MS/MS	2.03	0.329	0.675	1.07	0.439
147	ICP-MS	2.05	0.308	0.712	1.09	0.468
264	ICP-MS	2.00	0.32	0.65	1.01	0.42
293	DRC/CC-ICP-MS	2.02	0.3	0.74	1.1	0.48
324	ICP-MS	2.107	<1	<1	1.086	<1
597	ICP-MS/MS	1.86	0.320	0.658	0.990	0.434
605	ICP-MS	2.11	<0.800	<0.800	1.05	<0.800
606	ICP-MS/MS	2.05	0.298	0.641	1.04	0.423

Summary Statistics

	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})	2.03	0.310	0.68	1.06	0.443
Arithmetic SD (s)	0.07	0.011	0.03	0.04	0.021
Arithmetic RSD (%)	3.4	3.5	5.0	3.6	4.7
Number of Sample Measurements (N)	10	8	8	10	8

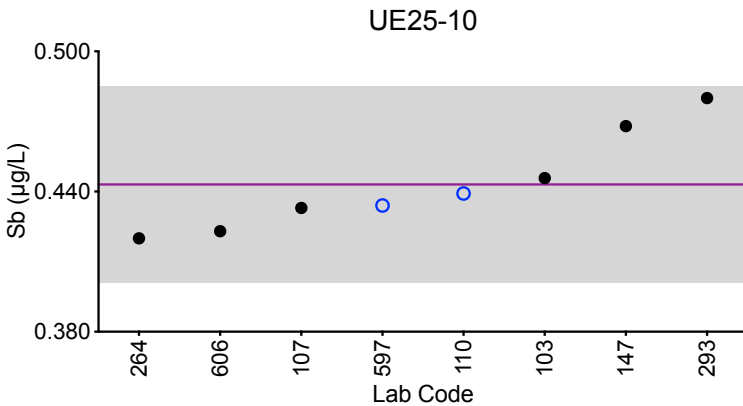
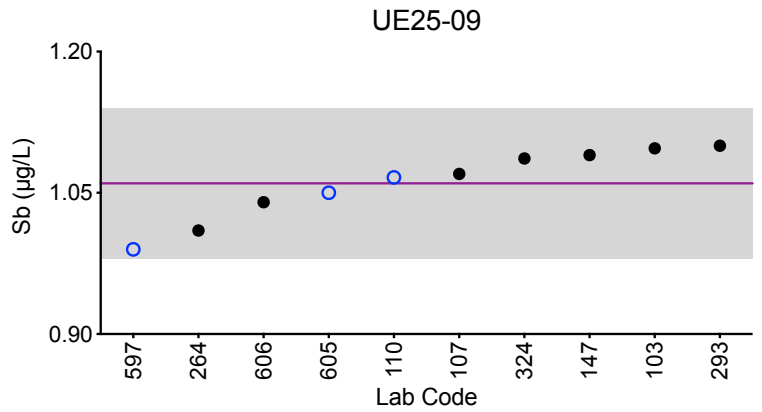
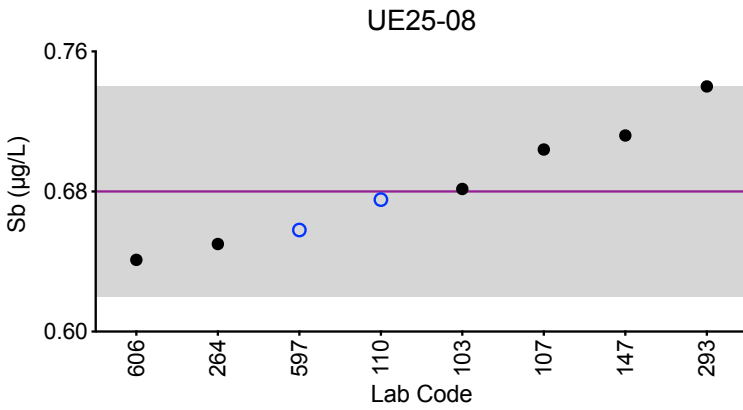
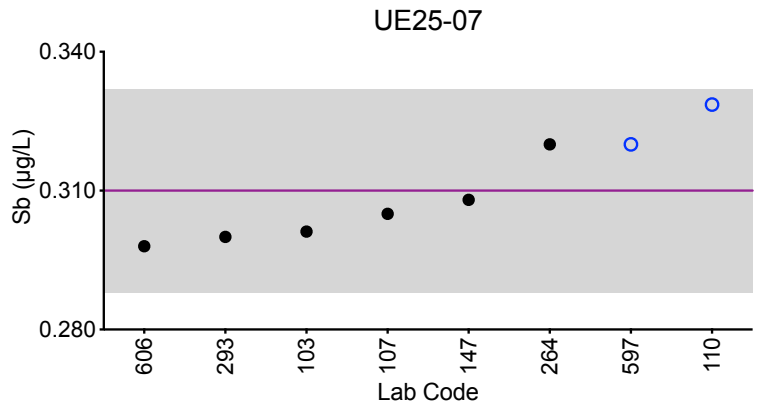
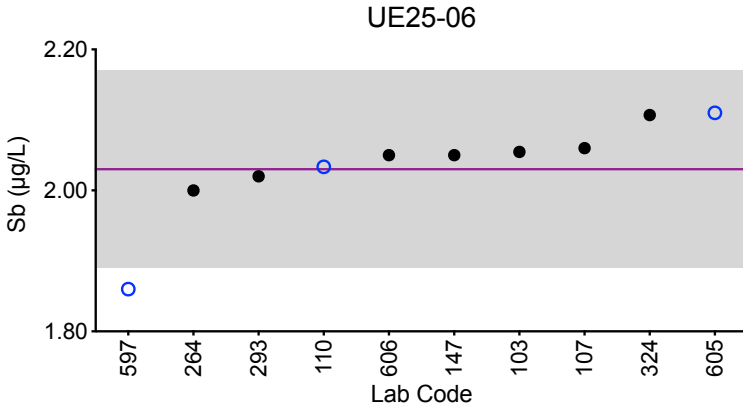
*Denotes a statistical Outlier.

A robust mean, SD, RSD and n are provided for sample UE25-06 and UE25-09.



Results for Event #2, 2025: Summary Figures

Urine Sb



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Urine Se (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
103	ICP-MS/MS	123	20.3	87.5	191	32.3
110	ICP-MS/MS	109	19.4	76.9	173	30.6
147	ICP-MS	121	22.2	86.3	182	33.0
293	DRC/CC-ICP-MS	113.74	19.75	75.04	165.88	31.6
597	ICP-MS/MS	108	18.8	77.9	172	30.3

Summary Statistics

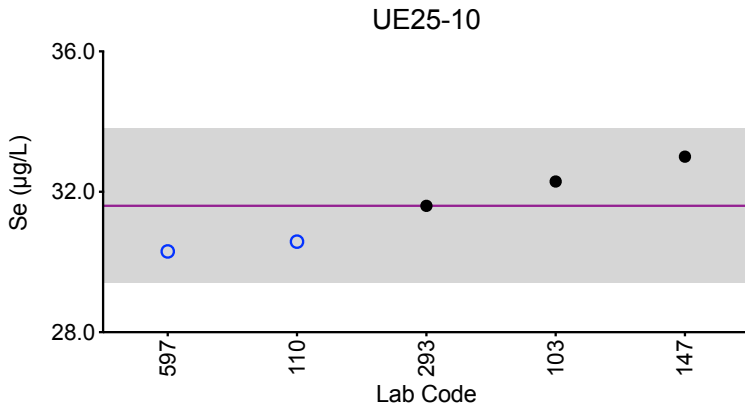
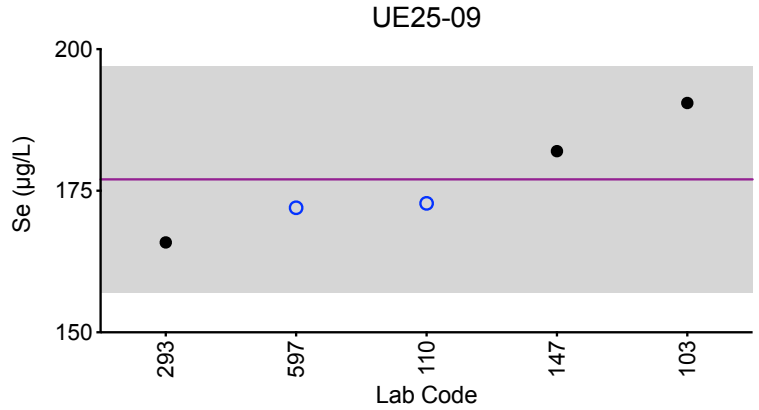
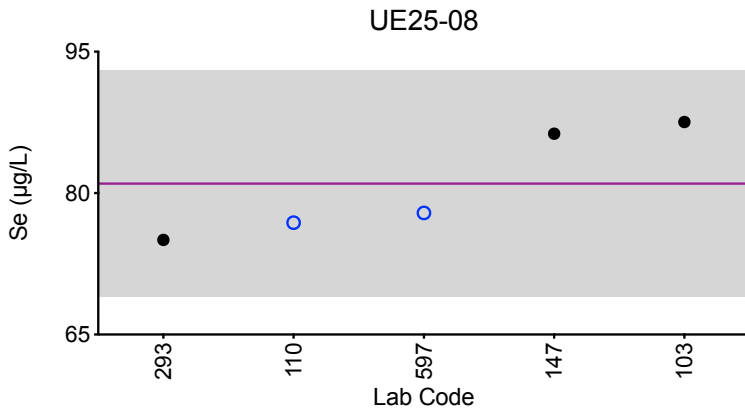
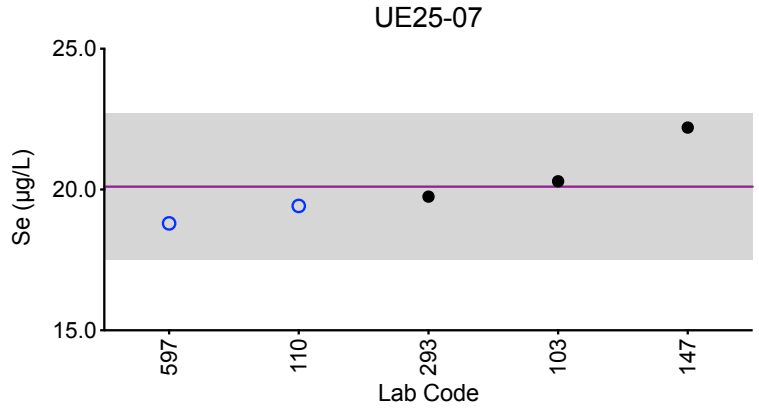
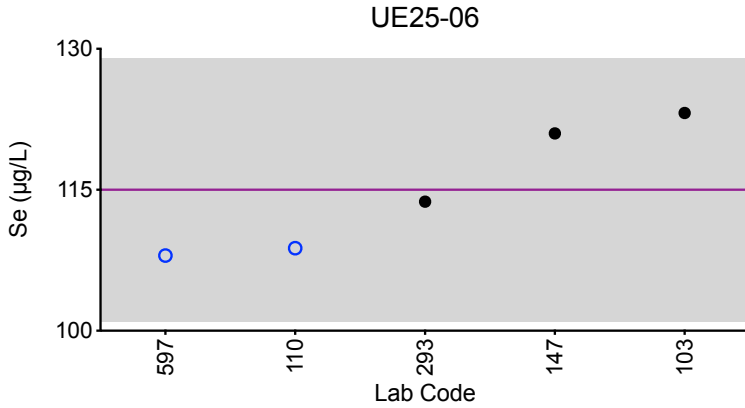
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})	115	20.1	81	177	31.6
Arithmetic SD (s)	7	1.3	6	10	1.1
Arithmetic RSD (%)	6.1	6.5	7.4	5.6	3.5
Number of Sample Measurements (N)	5	5	5	5	5

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Se



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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Results for Event #2, 2025: Laboratory Data and Summary Statistics

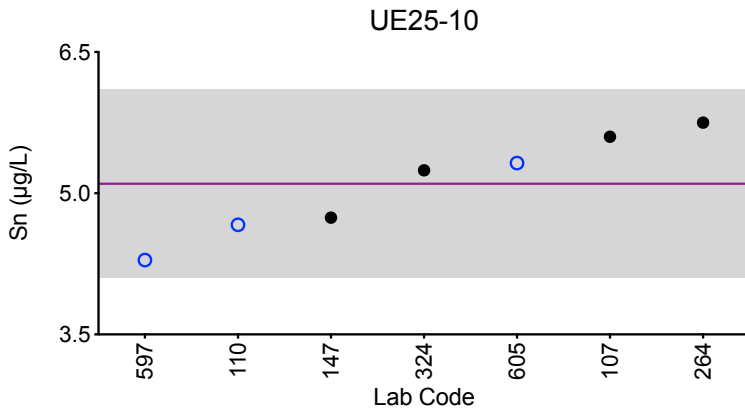
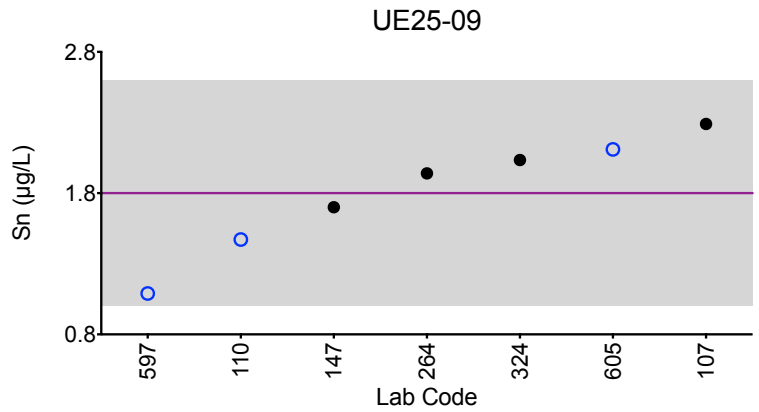
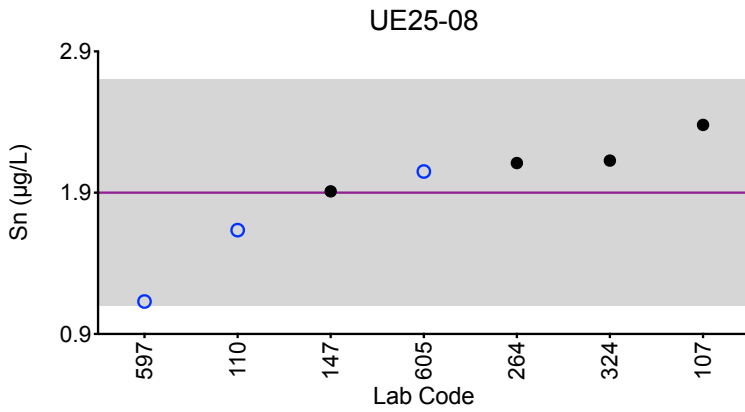
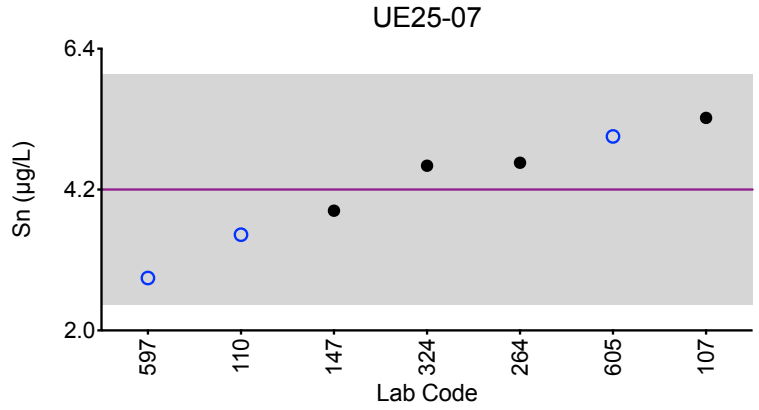
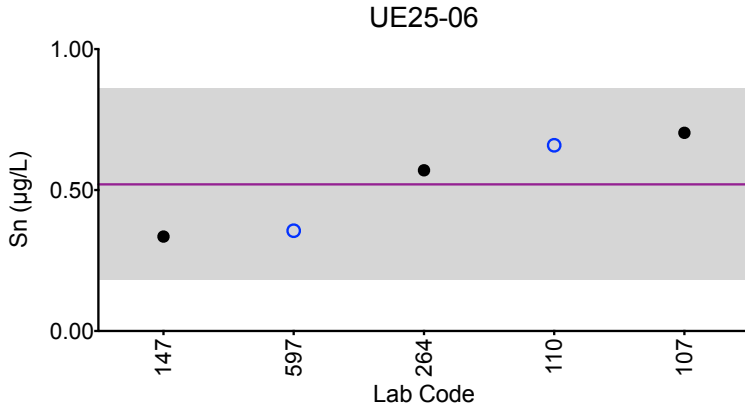
Urine Sn (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
107	ICP-MS	0.703	5.32	2.38	2.29	5.60
110	ICP-MS/MS	0.659	3.50	1.64	1.47	4.67
147	ICP-MS	0.335	3.87	1.91	1.70	4.74
264	ICP-MS	0.57	4.62	2.11	1.94	5.75
324	ICP-MS	<1	4.573	2.127	2.035	5.243
597	ICP-MS/MS	0.356	2.82	1.13	1.09	4.29
605	ICP-MS	<0.900	5.03	2.05	2.11	5.32
Summary Statistics						
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})		0.52	4.2	1.9	1.8	5.1
Arithmetic SD (s)		0.17	0.9	0.4	0.4	0.5
Arithmetic RSD (%)		33	21	21	22	9.8
Number of Sample Measurements (N)		5	7	7	7	7

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Sn



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

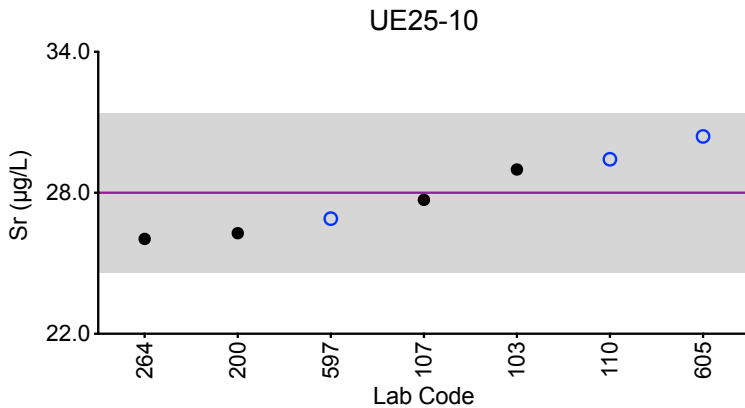
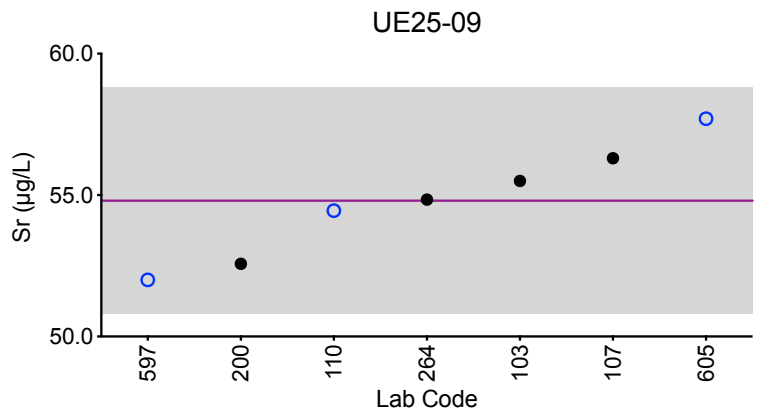
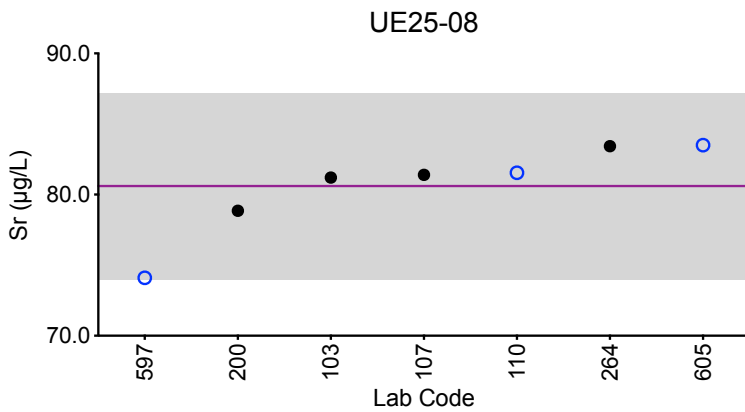
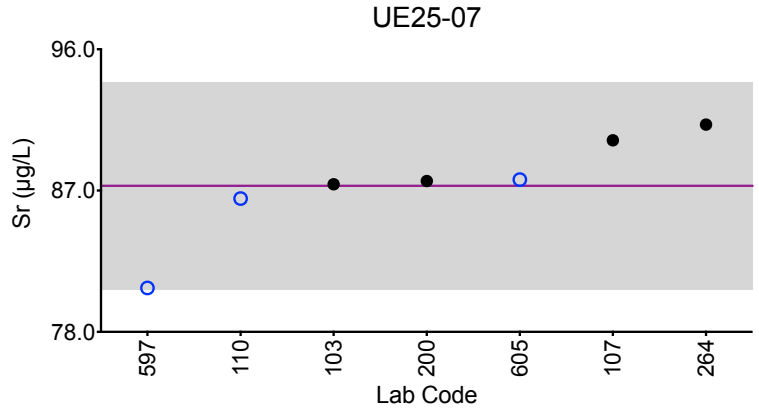
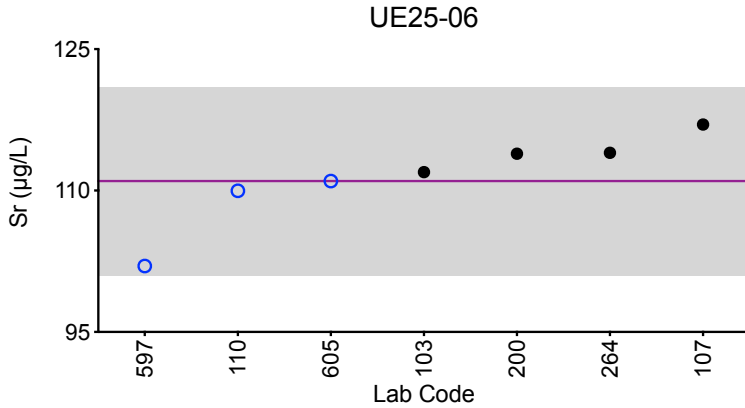
Urine Sr (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
103	ICP-MS/MS	112	87.4	81.2	55.5	29.0
107	ICP-MS	117	90.2	81.4	56.3	27.7
110	ICP-MS/MS	110	86.5	81.5	54.4	29.4
200	ICP-MS	113.9	87.61	78.85	52.57	26.28
264	ICP-MS	114	91.2	83.43	54.84	26.04
597	ICP-MS/MS	102	80.8	74.1	52.0	26.9
605	ICP-MS	111	87.7	83.5	57.7	30.4
Summary Statistics						
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})		111	87.3	80.6	54.8	28.0
Arithmetic SD (s)		5	3.3	3.3	2.0	1.7
Arithmetic RSD (%)		4.5	3.8	4.1	3.6	6.1
Number of Sample Measurements (N)		7	7	7	7	7

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Sr



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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Results for Event #2, 2025: Laboratory Data and Summary Statistics

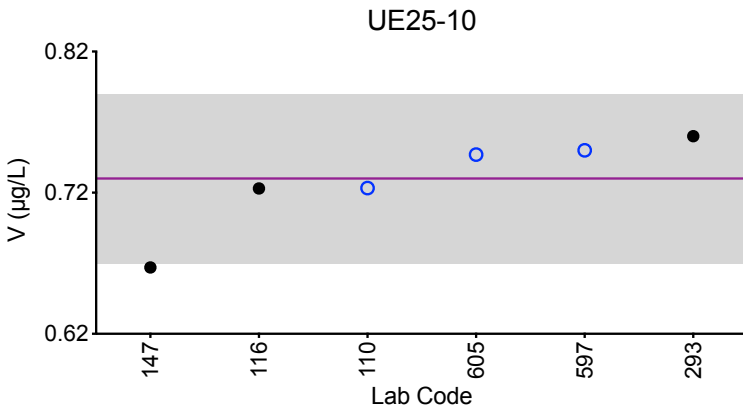
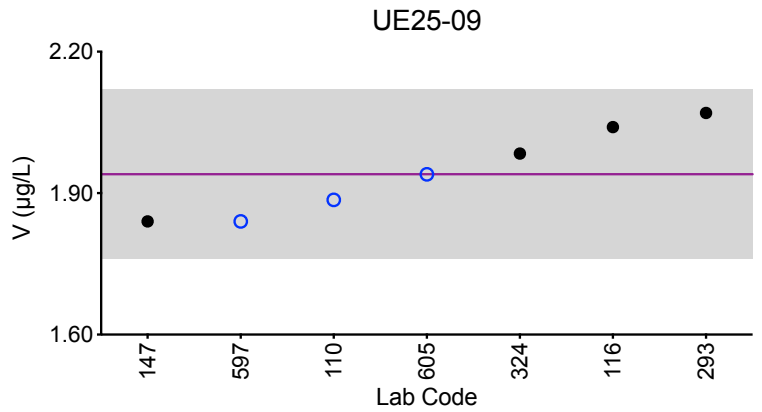
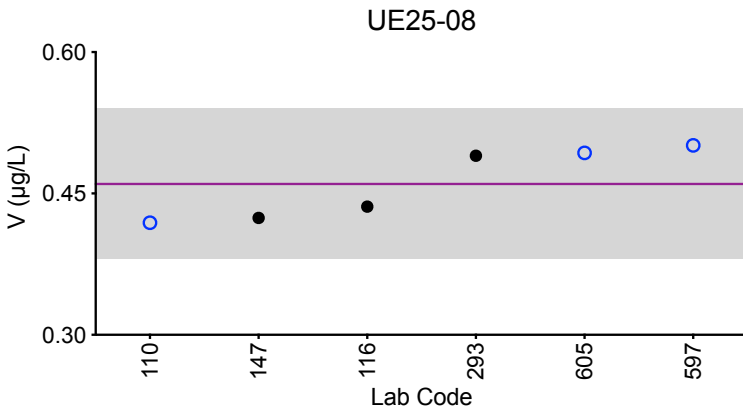
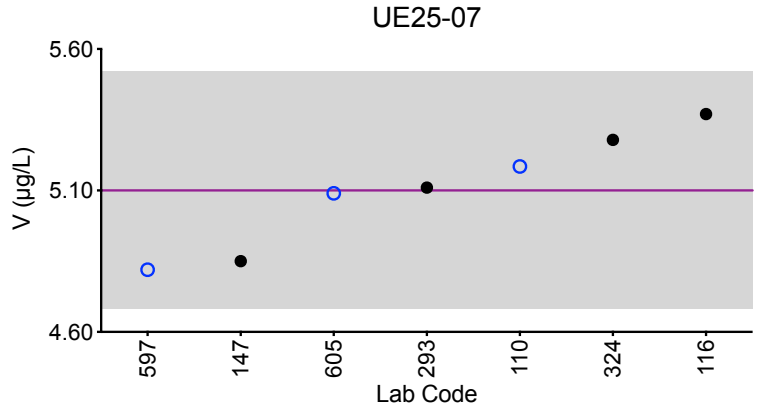
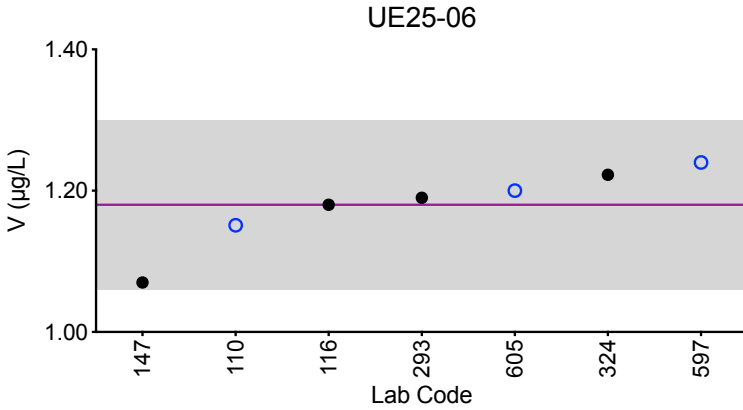
Urine V (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
110	ICP-MS/MS	1.15	5.19	0.419	1.89	0.723
116	ICP-MS/MS	1.18	5.37	0.436	2.04	0.723
147	DRC/CC-ICP-MS	1.07	4.85	0.424	1.84	0.667
293	DRC/CC-ICP-MS	1.19	5.11	0.49	2.07	0.76
324	ICP-MS	1.222	5.279	<1	1.984	<1
597	ICP-MS/MS	1.24	4.82	0.501	1.84	0.750
605	ICP-MS	1.20	5.09	0.493	1.94	0.747
Summary Statistics						
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10	
Arithmetic Mean (\bar{x})	1.18	5.10	0.46	1.94	0.73	
Arithmetic SD (s)	0.06	0.21	0.04	0.09	0.03	
Arithmetic RSD (%)	5.1	4.1	8.7	4.6	4.7	
Number of Sample Measurements (N)	7	7	6	7	6	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine V



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = ±2SD of the mean.

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Results for Event #2, 2025: Laboratory Data and Summary Statistics

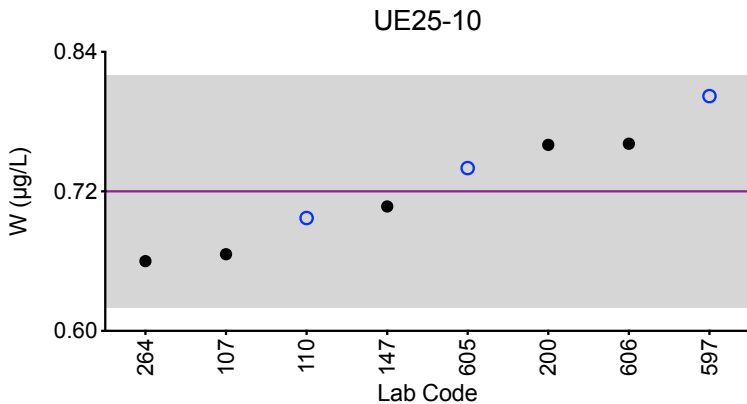
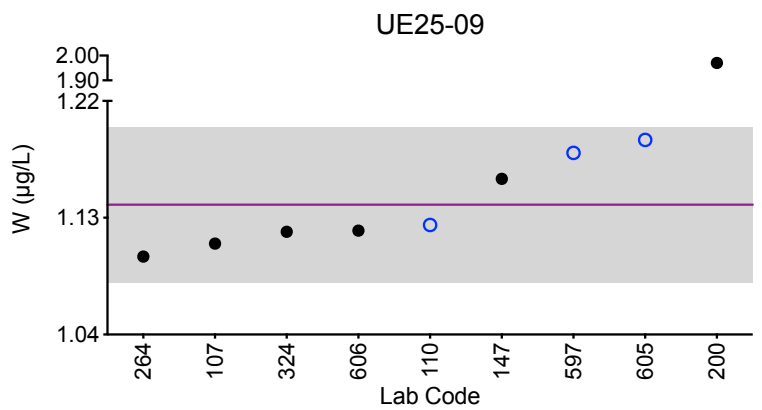
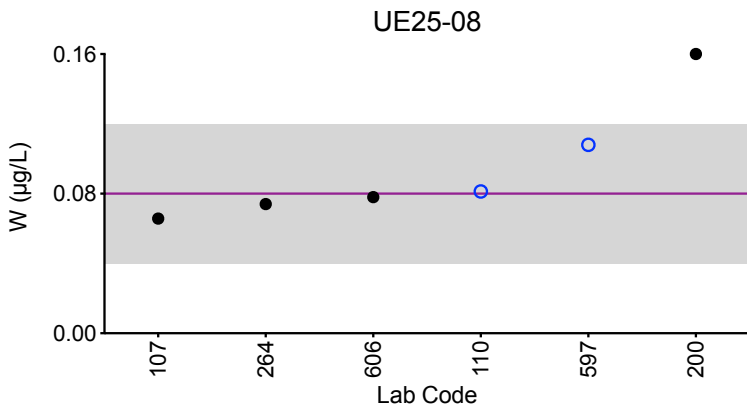
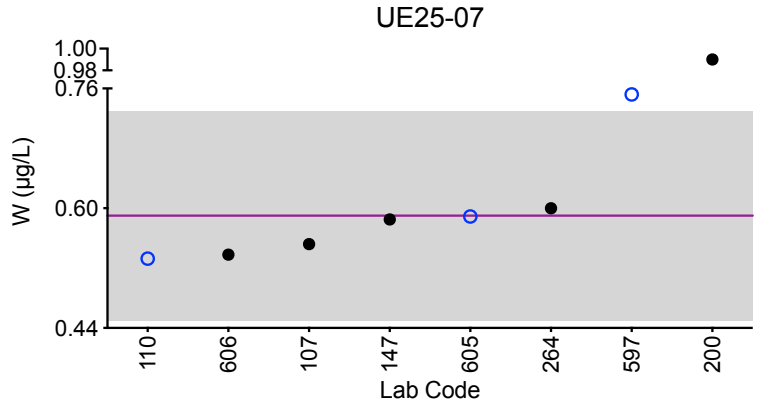
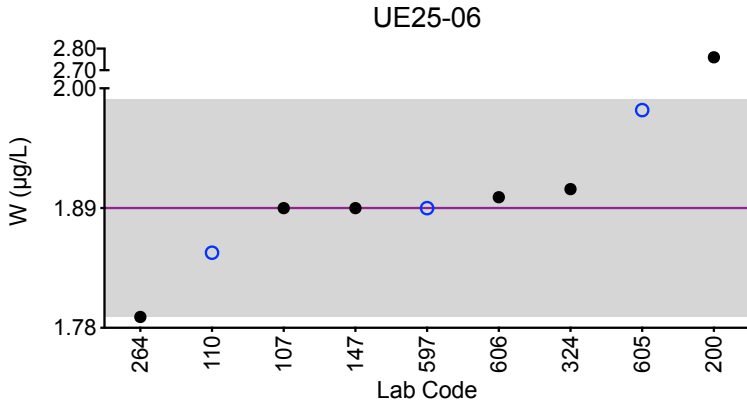
Urine W (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
107	ICP-MS	1.89	0.552	0.0657	1.11	0.666
110	ICP-MS/MS	1.85	0.533	0.081	1.12	0.697
147	ICP-MS	1.89	0.585	<0.178	1.16	0.707
200	ICP-MS	*2.76	*0.99	*0.16	*1.97	0.76
264	ICP-MS	1.79	0.60	0.074	1.10	0.66
324	ICP-MS	1.907	<1	<1	1.119	<1
597	ICP-MS/MS	1.89	0.752	0.108	1.18	0.802
605	ICP-MS	1.98	0.589	<0.180	1.19	0.740
606	ICP-MS/MS	1.90	0.538	0.078	1.12	0.761
Summary Statistics						
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10	
Arithmetic Mean (\bar{x})	1.89	0.59	0.08	1.14	0.72	
Arithmetic SD (s)	0.05	0.07	0.02	0.03	0.05	
Arithmetic RSD (%)	2.6	12	20	3.0	6.9	
Number of Sample Measurements (N)	8	7	5	8	8	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine W



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = ±2SD of the mean.

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Results for Event #2, 2025: Laboratory Data and Summary Statistics

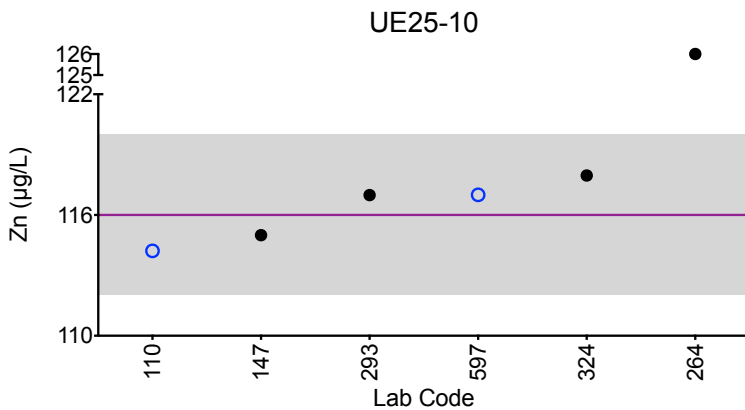
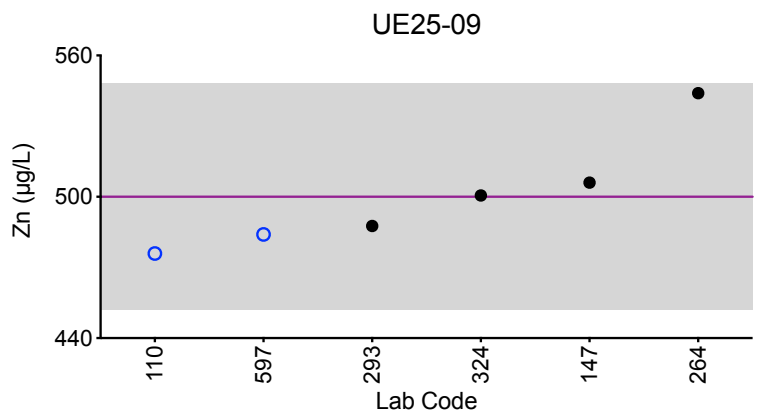
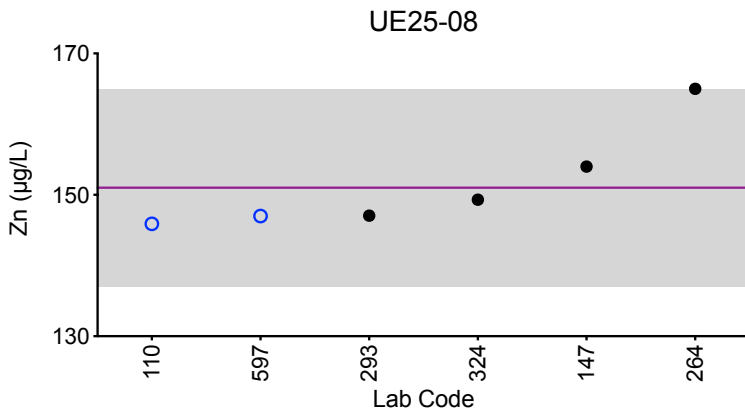
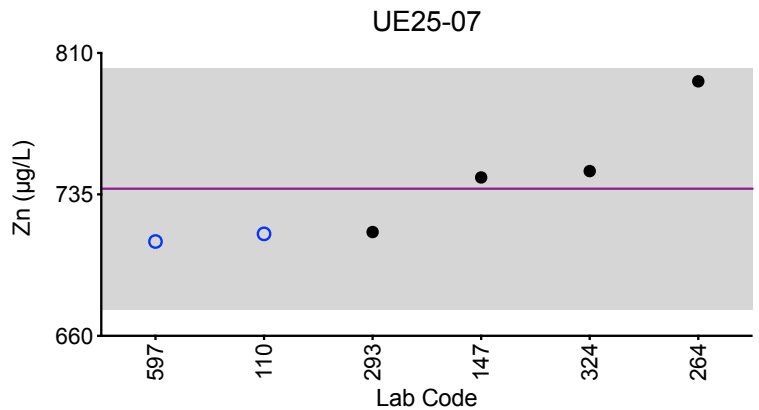
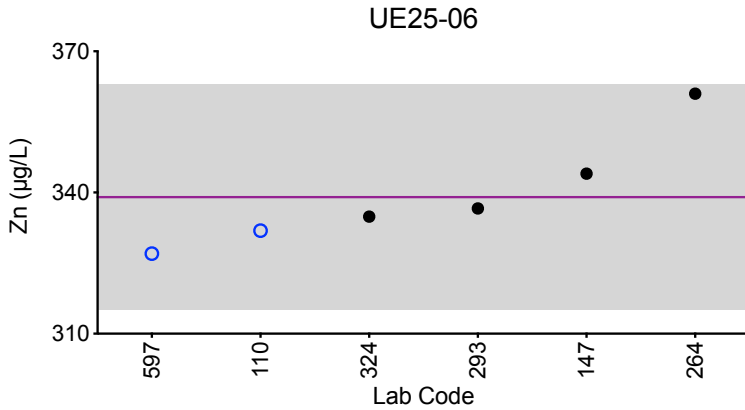
Urine Zn (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
110	ICP-MS/MS	332	714	146	476	114
147	ICP-MS	344	744	154	506	115
264	ICP-MS	361	795	165	544	*126
293	DRC/CC-ICP-MS	336.6	715.03	147.06	487.58	116.99
324	ICP-MS	334.881	747.395	149.319	500.561	117.962
597	ICP-MS/MS	327	710	147	484	117
Summary Statistics						
		UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})		339	738	151	500	116
Arithmetic SD (s)		12	32	7	24	2
Arithmetic RSD (%)		3.5	4.3	4.6	4.8	1.4
Number of Sample Measurements (N)		6	6	6	6	5

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Urine Zn



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = ±2SD of the mean.

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Results for Event #2, 2025: Laboratory Data and Summary Statistics

Urine AI (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
147	ICP-MS	23.8	17.4	<13.5	22.5	<13.5
264	ICP-MS	22.51	20.76	9.47	29.15	12.14
293	DRC/CC-ICP-MS	22.13	18.62	8.9	25.63	14.84
324	ICP-MS	18.540	16.576	7.218	22.031	10.329
597	ICP-MS/MS	<26.0	<26.0	<26.0	<26.0	<26.0

Summary Statistics

	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})	21.7	18.3	8.5	25	12.4
Arithmetic SD (s)	2.3	1.8	1.2	3	2.3
Arithmetic RSD (%)	11	9.8	14	12	19
Number of Sample Measurements (N)	4	4	3	4	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Urine I (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
110	ICP-MS	94.9	128	88.2	128	66.0
147	ICP-MS	112	148	104	148	75.5
597	ICP-MS/MS	103	137	94.5	136	71.1

Summary Statistics						
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10	
Arithmetic Mean (\bar{x})	103	138	96	137	71	
Arithmetic SD (s)	9	10	8	10	5	
Arithmetic RSD (%)	8.7	7.2	8.3	7.3	7.0	
Number of Sample Measurements (N)	3	3	3	3	3	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Urine Li (µg/L)						
Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
110	ICP-MS/MS	9.93	32.9	67.0	46.8	8.01
147	ICP-MS	11.0	38.4	75.9	52.9	8.78
597	ICP-MS	10.9	38.2	73.9	51.8	8.70

Summary Statistics						
	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10	
Arithmetic Mean (\bar{x})	10.6	37	72	51	8.5	
Arithmetic SD (s)	0.6	3	5	3	0.4	
Arithmetic RSD (%)	5.7	8.1	6.9	5.9	4.7	
Number of Sample Measurements (N)	3	3	3	3	3	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Urine Te (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
110	ICP-MS/MS	0.559	0.543	1.48	0.575	0.775
147	ICP-MS	0.521	0.538	1.58	0.614	0.885

Summary Statistics

	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
Arithmetic Mean (\bar{x})	0.54	0.540	1.53	0.59	0.83
Arithmetic SD (s)	0.03	0.004	0.07	0.03	0.08
Arithmetic RSD (%)	5.6	0.74	4.6	5.1	9.6
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.



Results for Event #2, 2025: Additional Elements in Urine

Urine Ag (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
147	ICP-MS	<0.108	<0.108	<0.108	<0.108	<0.108

Urine B (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
597	ICP-MS/MS	350	524	321	507	280

Urine Bi (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
147	ICP-MS	<0.0773	<0.0773	<0.0773	<0.0773	<0.0773
597	ICP-MS/MS	<0.00727	<0.00727	<0.00727	<0.00727	<0.00727

Urine Br (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
597	ICP-MS/MS	751	997	550	790	446

Urine Cl (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
597	ICP-MS/MS	1760000	2330000	1330000	1800000	1110000

Urine Fe (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
324	ICP-MS	9.088	8.145	5.181	10.948	6.676

Urine Mg (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
597	ICP-MS/MS	20600	32200	19700	31800	15400

Urine S (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
597	ICP-MS/MS	436000	653000	429000	687000	277000

Urine Th (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
147	ICP-MS	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951
597	ICP-MS/MS	<0.0156	<0.0156	<0.0156	<0.0156	<0.0156

Urine Ti (µg/L)

Lab Code	Method	UE25-06	UE25-07	UE25-08	UE25-09	UE25-10
597	ICP-MS/MS	6.06	3.32	1.61	4.55	3.50



**Department
of Health**

**Wadsworth
Center**

Event #2, 2025

**Trace Elements in
Serum**

Wadsworth Center
NEW YORK STATE DEPARTMENT OF HEALTH
Trace Elements Laboratory



Event #2, 2025: Trace Elements in Serum

PT Materials

Test materials were prepared from human serum obtained from BioIVT. The company certifies that these materials were tested by FDA approved methods and found to be negative for HIV 1₂ 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 32 were reported by at least one participant: As, B, Ba, Be, Bi, Br, Ca, Cd, Cl, Cs, Fe, Ga, Hg, I, Li, Mg, Mn, Mo, Ni, Pb, Pt, S, Sb, Sn, Sr, Te, Th, Ti, Tl, U, V, and W. These data are included here to provide a more complete characterization of the PT materials. All results reported by participant laboratories are tabulated and organized by lab code. The PT data are graphed for visual comparison purposes for all elements where at least five laboratories reported a value greater than the LOD. A statistical summary table is provided for samples where at least two comparable values were reported as above the LOD.

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



Results for Event #2, 2025: Summary Statistics

	Serum AI (µg/L)				
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Target (Arithmetic Mean (\bar{x}))	20.1	37	58	45	71.7
Upper Limit	25.1	44	70	54	86.0
Lower Limit	15.1	30	46	36	57.4
Arithmetic SD (s)	0.6	4	6	5	3.1
Arithmetic RSD (%)	3.0	11	10	11	4.3
Number of Sample Measurements (N)	5	6	6	6	6

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



Results for Event #2, 2025: Performance of Participating Laboratories

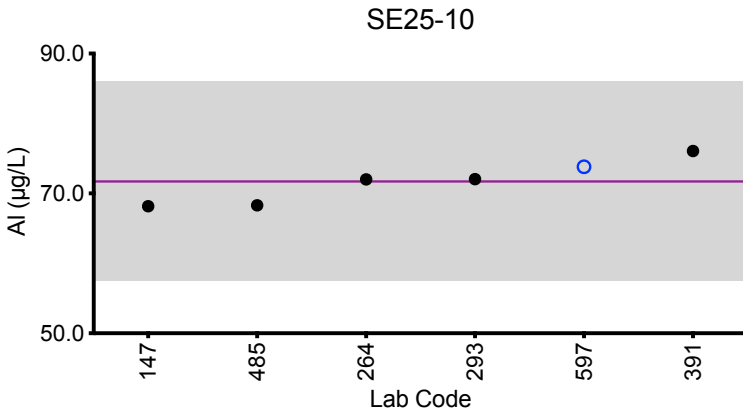
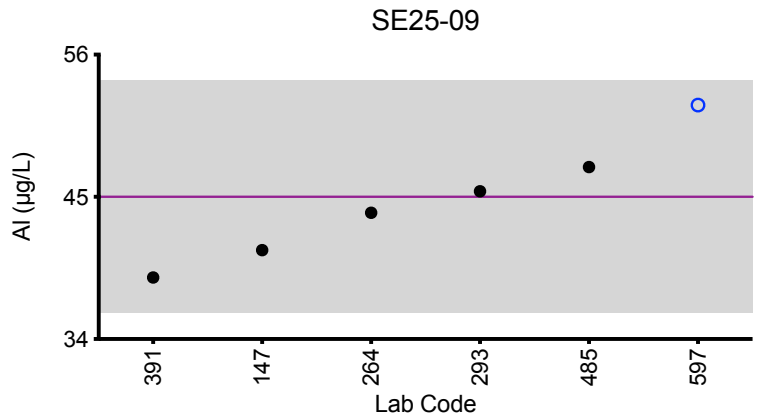
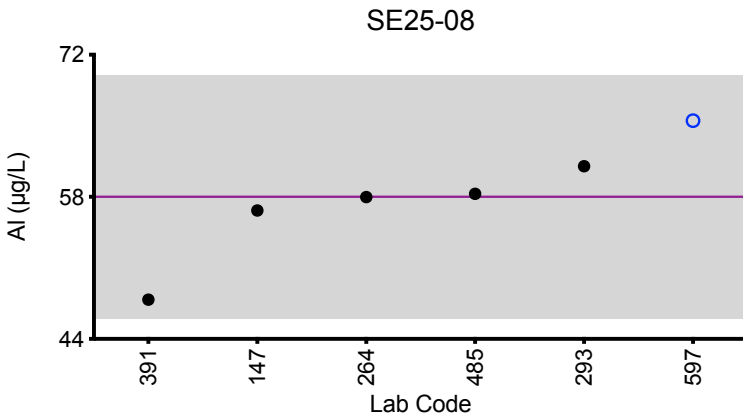
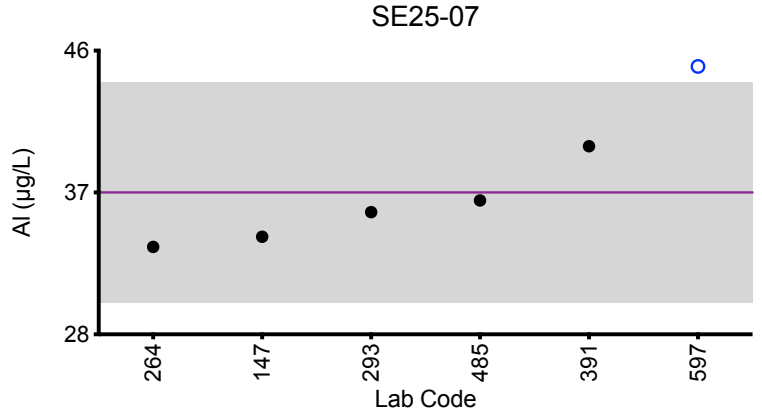
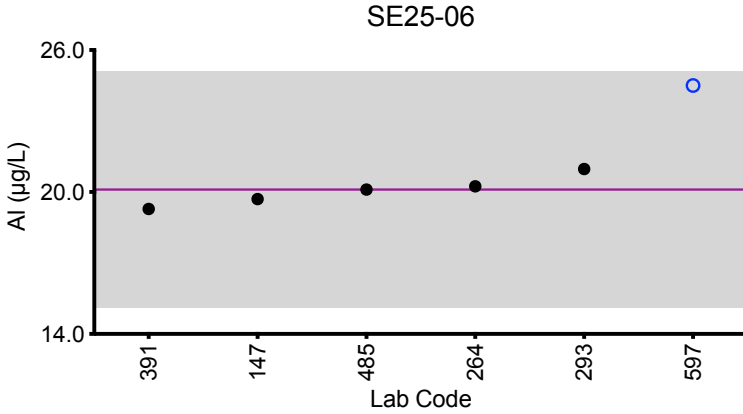
		Serum AI (µg/L)				
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
	Target	20.1	37	58	45	71.7
147	ETAAS-Z	19.7	34.2	56.7	40.9	68.2
264	ICP-MS	20.24	33.55	57.97	43.77	72.00
293	DRC/CC-ICP-MS	20.97	35.75	61.02	45.43	72.04
391	ETAAS-Z	19.28	39.93	47.87	38.76	76.07
485	HR-ICP-MS	20.1	36.5	58.3	47.3	68.3
597	ICP-MS/MS	*24.5	45.0 ↑	65.5	52.1	73.8

Based on the grading criteria for AI in Serum, 97% of results were satisfactory, with 0 of the 6 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.



Results for Event #2, 2025: Summary Figures

Serum AI



Legend:

○ 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.



Results for Event #2, 2025: Summary Statistics

	Serum Co (µg/L)				
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Target (Arithmetic Mean (\bar{x}))	1.07	7.4	2.07	8.4	0.89
Upper Limit	2.57	8.9	3.57	9.9	2.39
Lower Limit	0.00	5.9	0.57	6.9	0.00
Arithmetic SD (s)	0.03	0.4	0.07	0.3	0.04
Arithmetic RSD (%)	2.5	4.8	3.4	4.1	4.4
Number of Sample Measurements (N)	7	7	7	7	7

The acceptable range is based on quality specifications: $\pm 1.5 \mu\text{g/L}$ or $\pm 15\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 1.5 \mu\text{g/L}$ at concentrations less than or equal to $10 \mu\text{g/L}$. These quality specifications were established based on discussions with the US FDA, and represent a consensus from a network of Trace Element PT program organizers



Results for Event #2, 2025: Performance of Participating Laboratories

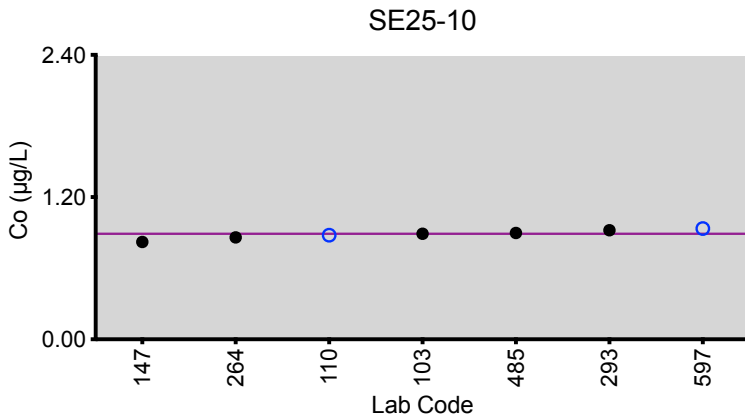
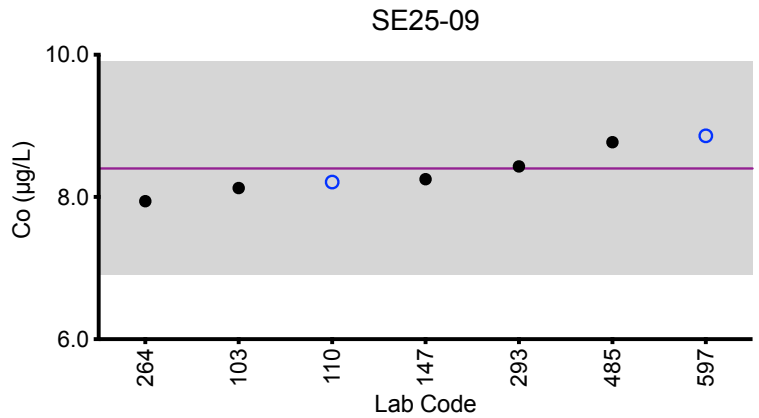
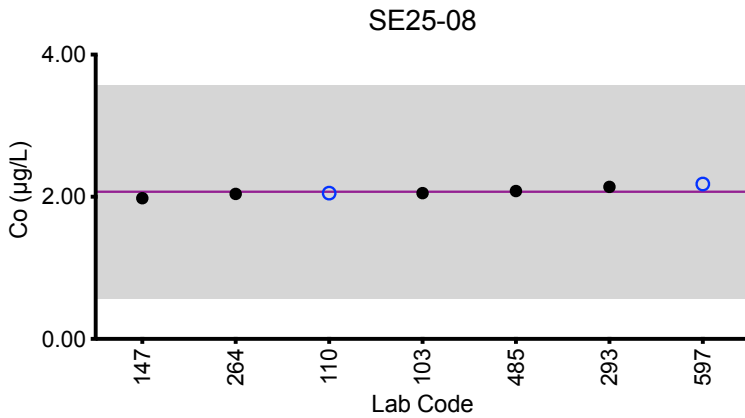
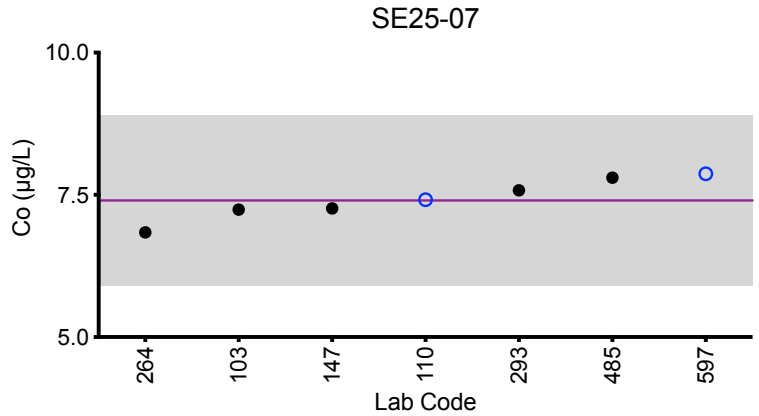
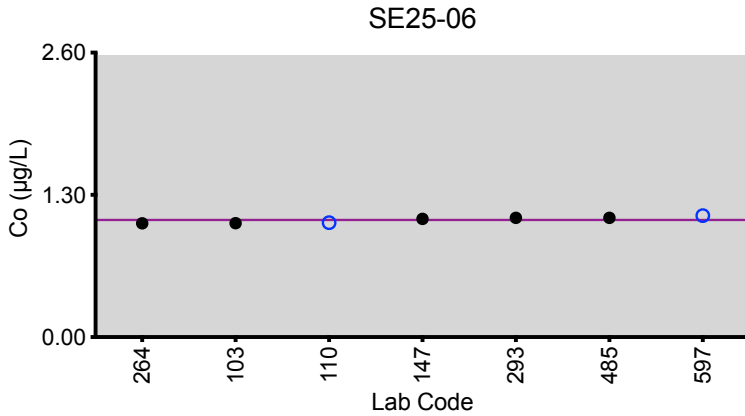
Lab Code	Method	Serum Co (µg/L)				
		SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
	Target	1.07	7.4	2.07	8.4	0.89
103	ICP-MS/MS	1.04	7.24	2.05	8.13	0.891
110	ICP-MS/MS	1.05	7.41	2.05	8.21	0.88
147	DRC/CC-ICP-MS	1.08	7.26	1.98	8.25	0.821
264	ICP-MS	1.04	6.84	2.04	7.94	0.86
293	DRC/CC-ICP-MS	1.1	7.58	2.14	8.43	0.92
485	HR-ICP-MS	1.09	7.80	2.08	8.77	0.897
597	ICP-MS/MS	1.1	7.87	2.18	8.86	0.94

Based on the grading criteria for Co 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.



Results for Event #2, 2025: Summary Figures

Serum Co



Legend:

○ 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.



Results for Event #2, 2025: Summary Statistics

	Serum Cr (µg/L)				
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Target (Arithmetic Mean (\bar{x}))	2.53	0.77	0.17	1.30	4.37
Upper Limit	4.53	2.77	2.17	3.30	6.37
Lower Limit	0.53	0.00	0.00	0.00	2.37
Arithmetic SD (s)	0.16	0.15	0.03	0.07	0.22
Arithmetic RSD (%)	6.3	19	18	5.4	5.0
Number of Sample Measurements (N)	7	7	4	7	7

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



Results for Event #2, 2025: Performance of Participating Laboratories

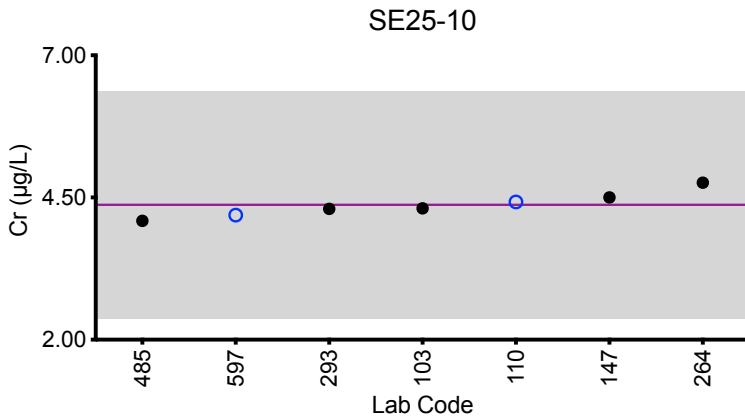
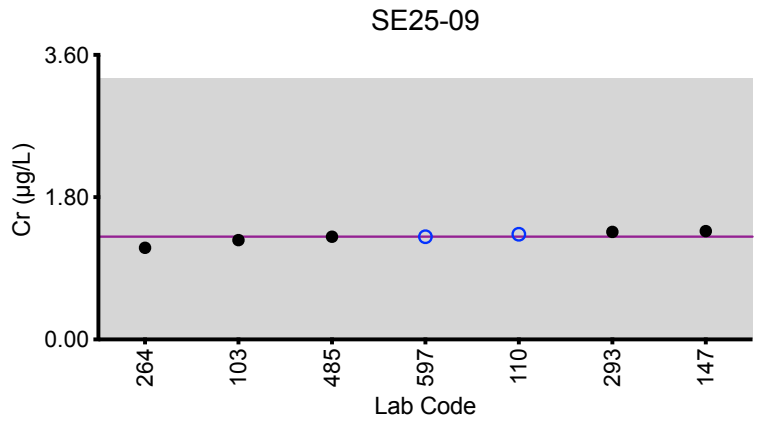
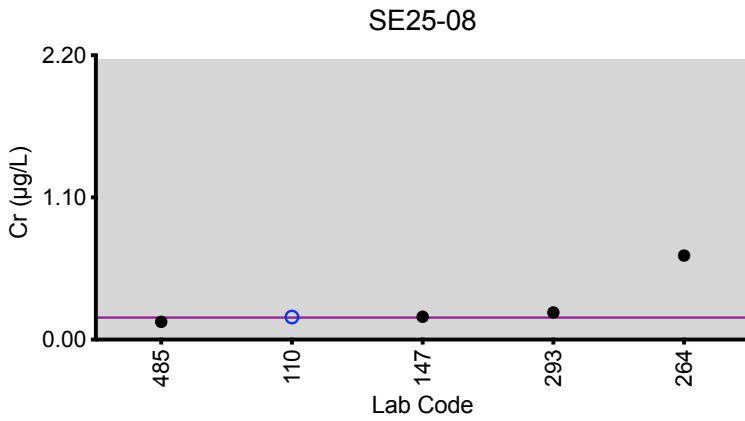
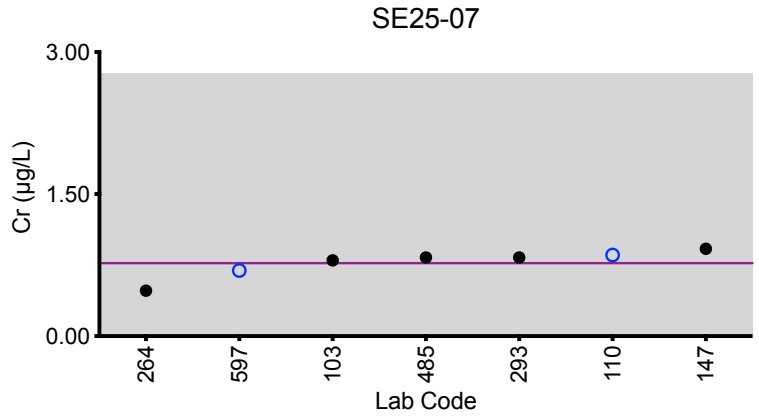
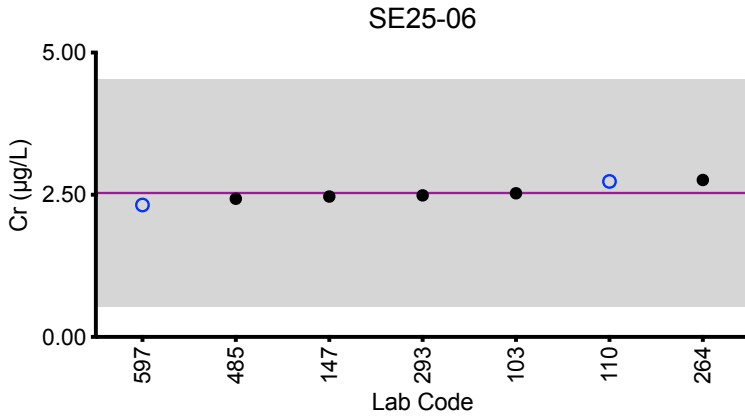
		Serum Cr (µg/L)				
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
	Target	2.53	0.77	0.17	1.30	4.37
103	ICP-MS/MS	2.53	0.800	<0.600	1.26	4.31
110	ICP-MS/MS	2.74	0.86	0.17	1.33	4.42
147	DRC/CC-ICP-MS	2.47	0.923	0.177	1.37	4.50
264	ICP-MS	2.76	0.48	*0.65	1.16	4.76
293	DRC/CC-ICP-MS	2.49	0.83	0.21	1.36	4.30
485	HR-ICP-MS	2.43	0.83	0.138	1.30	4.09
597	ICP-MS/MS	2.32	0.69	<0.153	1.30	4.19

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.



Results for Event #2, 2025: Summary Figures

Serum Cr



Legend:
 ○ 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:
 $\pm 2 \mu\text{g/L}$ or $\pm 20\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 2 \mu\text{g/L}$ at concentrations less than or equal to $10 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Serum Cu (µg/L)				
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Target (Arithmetic Mean (\bar{x}))	1240	1670	1770	1850	1510
Upper Limit	1430	1920	2040	2130	1740
Lower Limit	1050	1420	1500	1570	1280
Arithmetic SD (s)	40	40	110	100	60
Arithmetic RSD (%)	3.2	2.4	6.2	5.4	4.0
Number of Sample Measurements (N)	6	6	7	7	7

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



Results for Event #2, 2025: Performance of Participating Laboratories

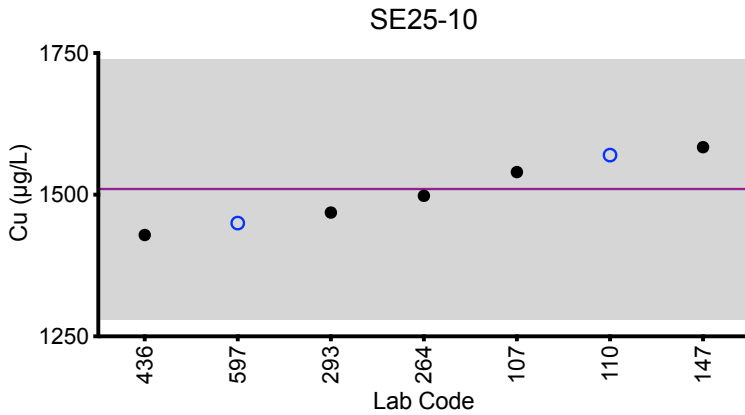
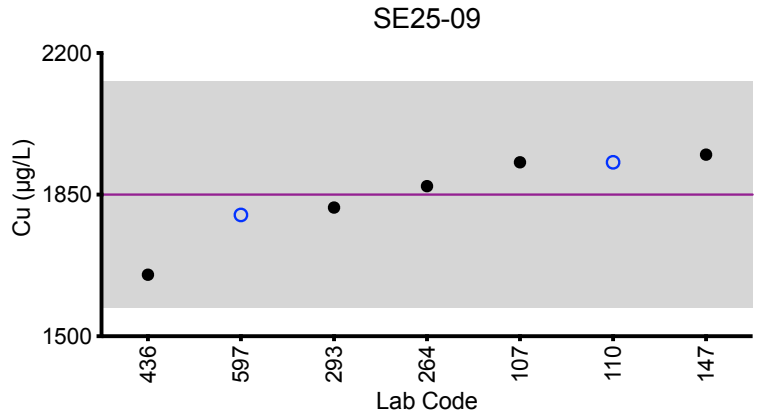
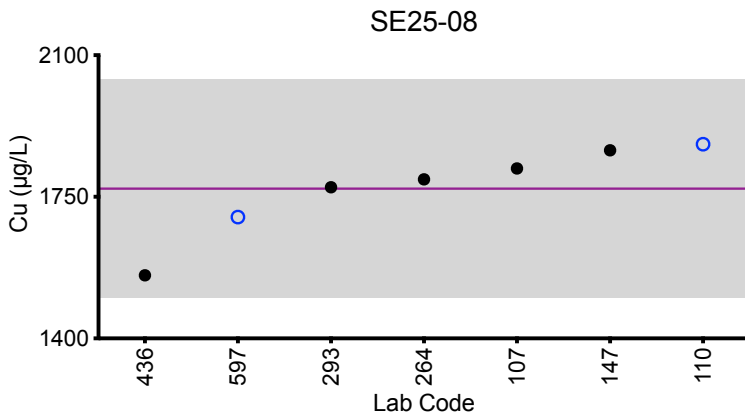
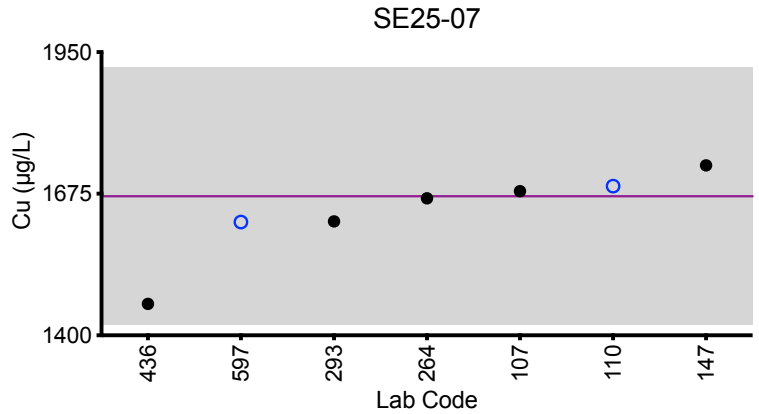
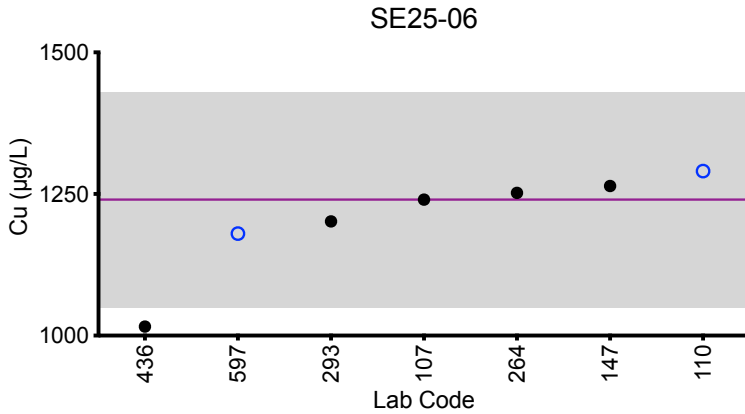
		Serum Cu (µg/L)				
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
	Target	1240	1670	1770	1850	1510
107	DRC/CC-ICP-MS	1240	1680	1820	1930	1540
110	ICP-MS/MS	1290	1690	1880	1930	1570
147	DRC/CC-ICP-MS	1264	1730	1865	1949	1584
264	ICP-MS	1252	1666	1793	1871	1498
293	DRC/CC-ICP-MS	1202	1621	1774	1818	1469
436	FAAS	*1016 ↓	*1461	1556	1652	1429
597	ICP-MS/MS	1180	1620	1700	1800	1450

Based on the grading criteria for Cu 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.



Results for Event #2, 2025: Summary Figures

Serum Cu



Legend:

○ 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:

$\pm 95 \mu\text{g/L}$ or $\pm 15\%$ around the target value, whichever is greater; thus, it is fixed at $\pm 95 \mu\text{g/L}$ at concentrations less than or equal to $635 \mu\text{g/L}$.



Results for Event #2, 2025: Summary Statistics

	Serum Se (µg/L)				
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Target (Arithmetic Mean (\bar{x}))	100	133	217	122	228
Upper Limit	120	160	260	146	274
Lower Limit	80	106	174	98	182
Arithmetic SD (s)	7	7	15	7	15
Arithmetic RSD (%)	7.0	5.3	6.9	5.7	6.6
Number of Sample Measurements (N)	8	8	8	8	8

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



Results for Event #2, 2025: Performance of Participating Laboratories

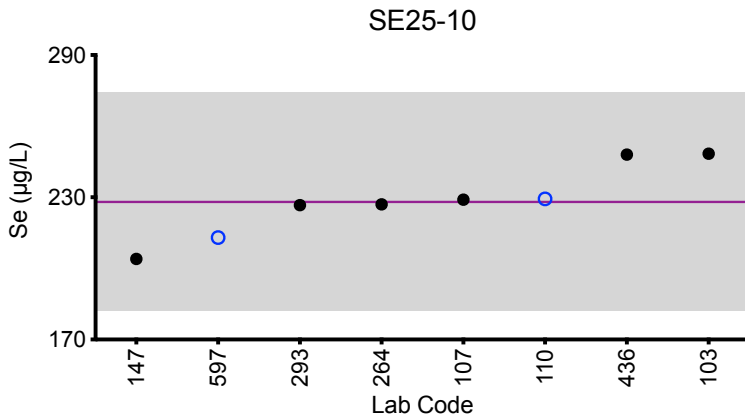
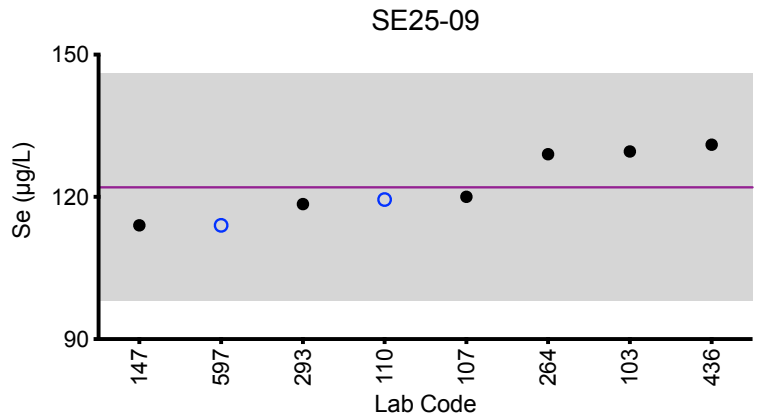
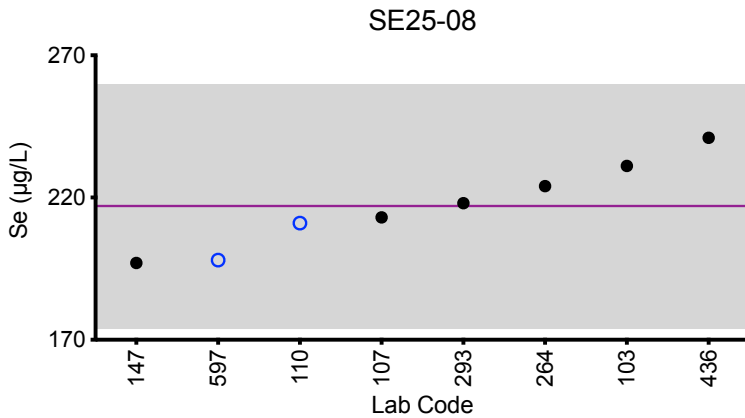
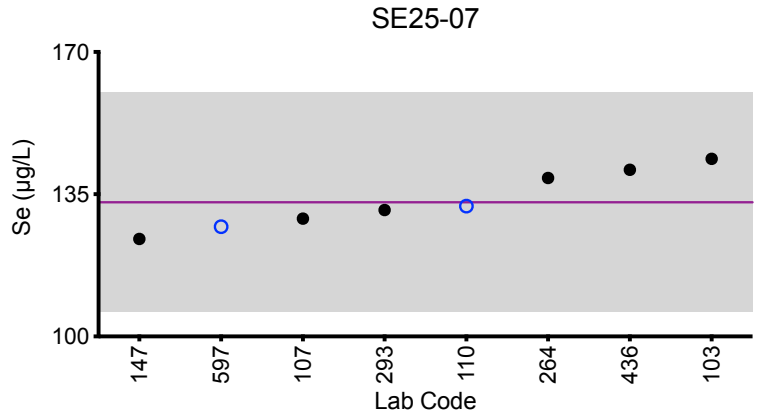
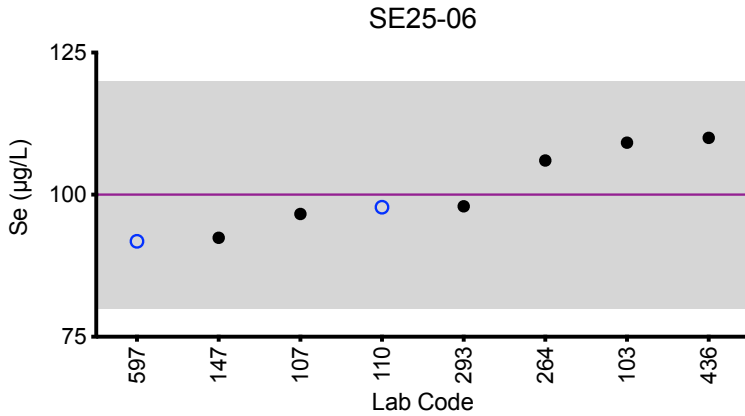
		Serum Se (µg/L)				
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
	Target	100	133	217	122	228
103	ICP-MS/MS	109	144	231	130	248
107	DRC/CC-ICP-MS	96.6	129	213	120	229
110	ICP-MS/MS	97.8	132	211	119	229
147	DRC/CC-ICP-MS	92.4	124	197	114	204
264	ICP-MS	106	139	224	129	227
293	DRC/CC-ICP-MS	98	131	218	118	227
436	ETAAS-Other	110	141	241	131	248
597	ICP-MS/MS	92	127	198	114	213

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.



Results for Event #2, 2025: Summary Figures

Serum Se



Legend:

○ 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.



Results for Event #2, 2025: Summary Statistics

	Serum Zn (µg/L)				
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Target (Arithmetic Mean (\bar{x}))	550	928	2870	1002	1730
Upper Limit	630	1067	3300	1152	1990
Lower Limit	470	789	2440	852	1470
Arithmetic SD (s)	40	32	190	33	140
Arithmetic RSD (%)	7.3	3.4	6.6	3.3	8.1
Number of Sample Measurements (N)	6	5	6	5	6

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



Results for Event #2, 2025: Performance of Participating Laboratories

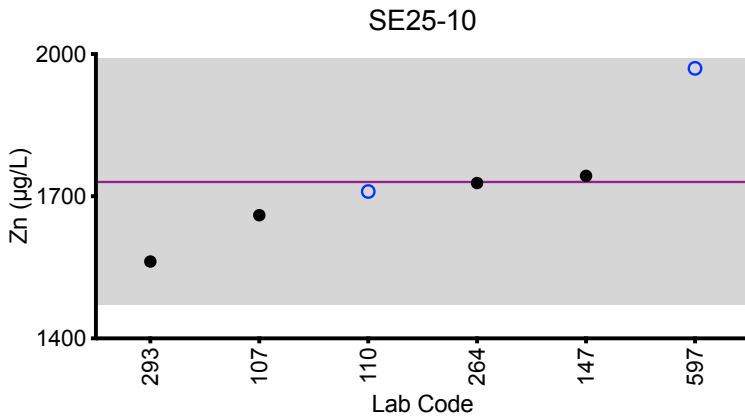
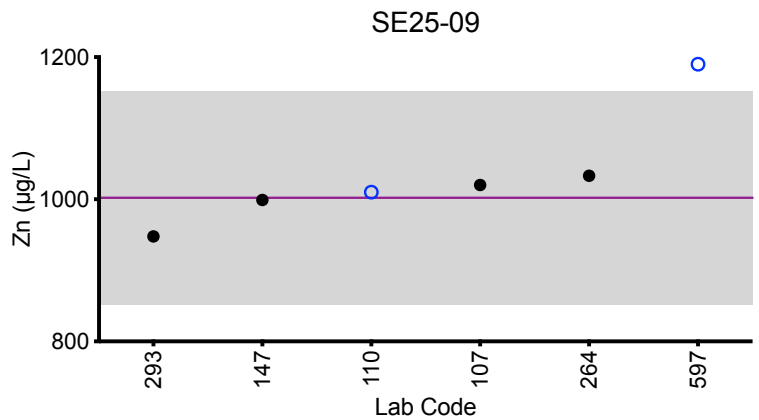
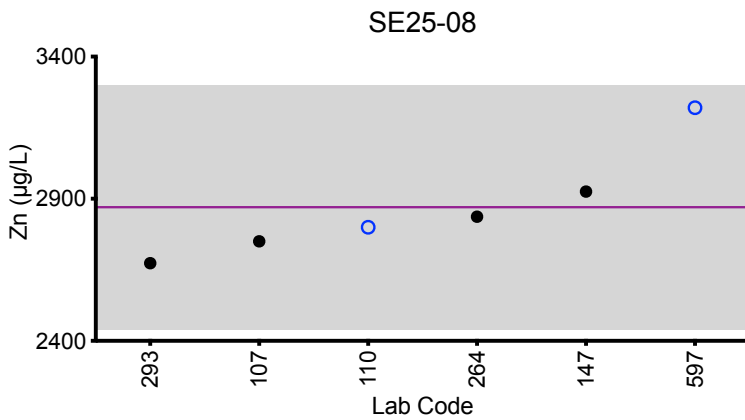
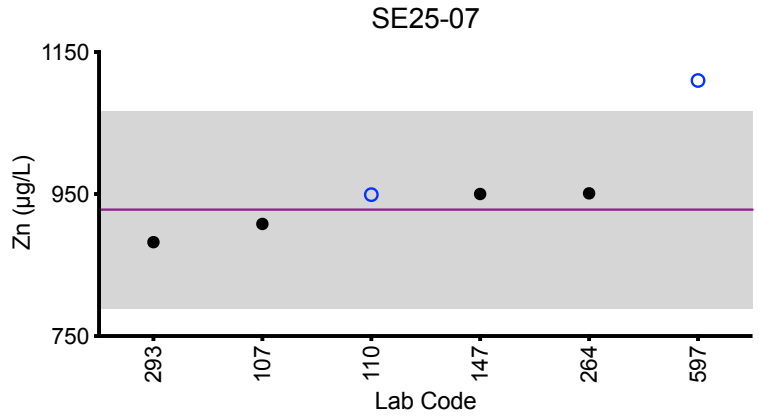
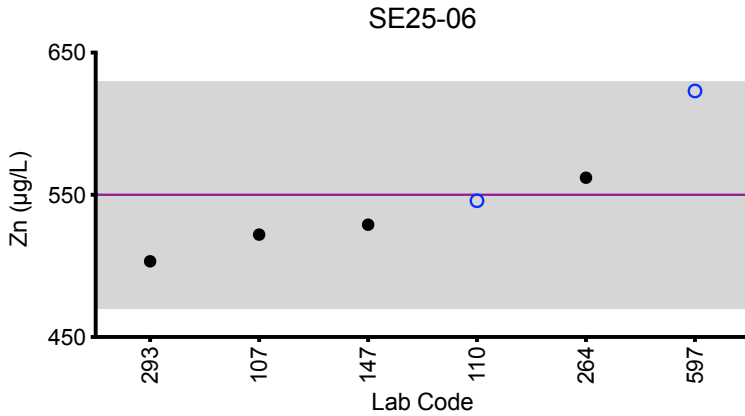
		Serum Zn (µg/L)				
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
	Target	550	928	2870	1002	1730
107	DRC/CC-ICP-MS	522	908	2750	1020	1660
110	ICP-MS/MS	546	949	2800	1010	1710
147	DRC/CC-ICP-MS	529	950	2925	999	1743
264	ICP-MS	562	951	2837	1033	1728
293	DRC/CC-ICP-MS	503	882	2673	948	1562
597	ICP-MS/MS	623	*1110 ↑	3220	*1190 ↑	1970

Based on the grading criteria for Zn in Serum, 93% of results were satisfactory, with 1 of the 6 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.



Results for Event #2, 2025: Summary Figures

Serum Zn



Legend:

○ 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.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Mn (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	3.95	1.86	6.50	11.5	7.17
110	ICP-MS/MS	3.83	1.79	6.23	11.0	6.92
147	DRC/CC-ICP-MS	3.81	1.80	6.48	12.0	7.24
264	ICP-MS	4.06	1.78	6.31	11.65	7.35
293	DRC/CC-ICP-MS	3.670	1.76	6.35	10.96	6.650
597	ICP-MS/MS	4.10	*2.06	6.94	12.2	7.53

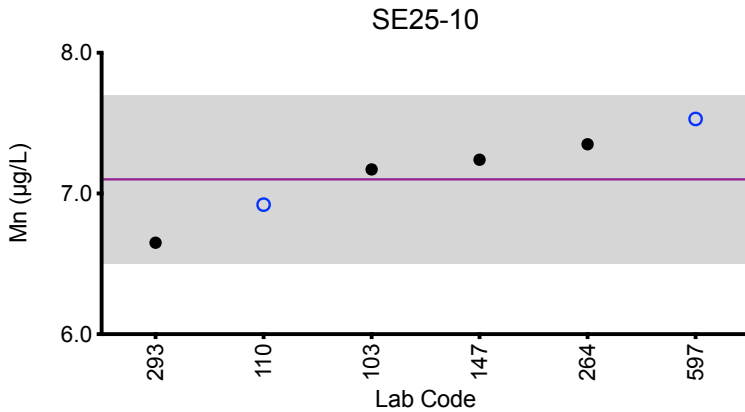
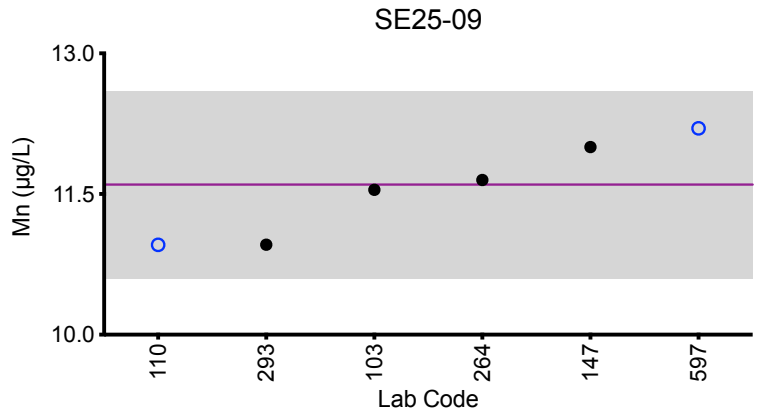
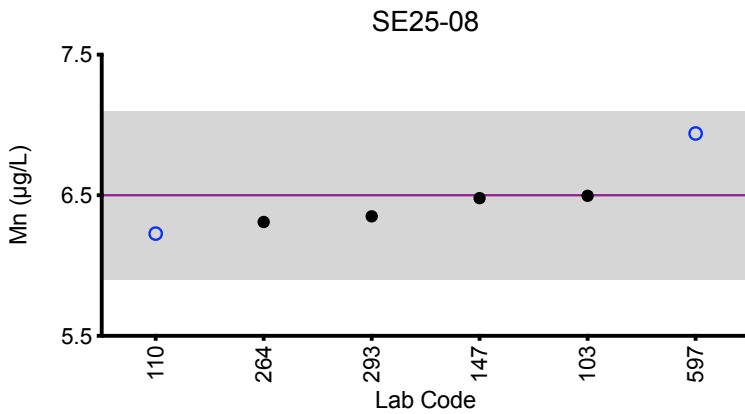
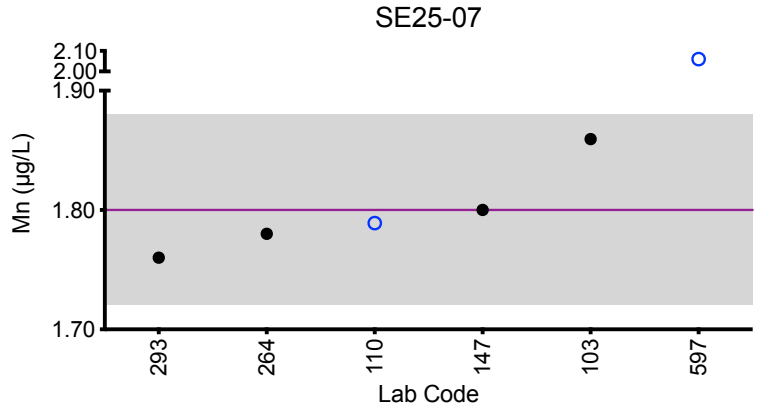
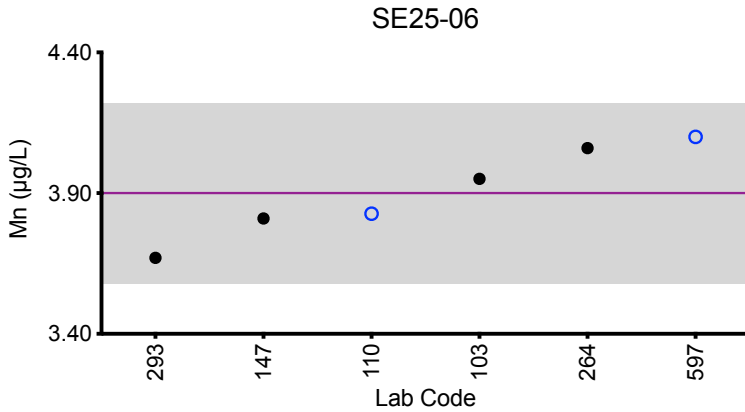
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	3.90	1.80	6.5	11.6	7.1	
Arithmetic SD (s)	0.16	0.04	0.3	0.5	0.3	
Arithmetic RSD (%)	4.1	2.2	3.9	4.3	4.3	
Number of Sample Measurements (N)	6	5	6	6	6	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Serum Mn



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Mo (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	3.11	5.80	1.43	4.76	2.48
110	ICP-MS/MS	3.08	5.71	1.52	4.76	2.48
147	DRC/CC-ICP-MS	2.90	5.41	1.37	4.47	2.23
293	DRC/CC-ICP-MS	2.980	5.810	1.400	4.610	2.420
485	HR-ICP-MS	3.18	5.36	1.60	4.74	2.60
597	ICP-MS/MS	*2.34	4.58	1.15	*3.72	1.91

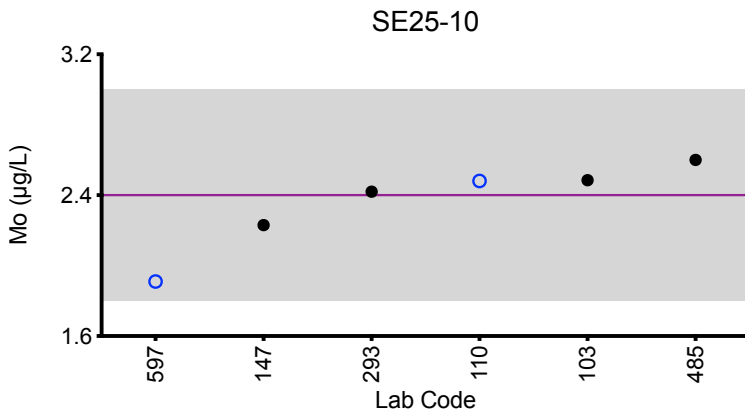
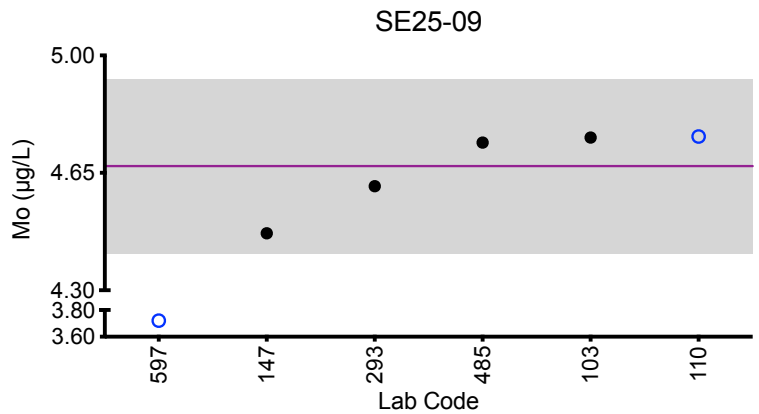
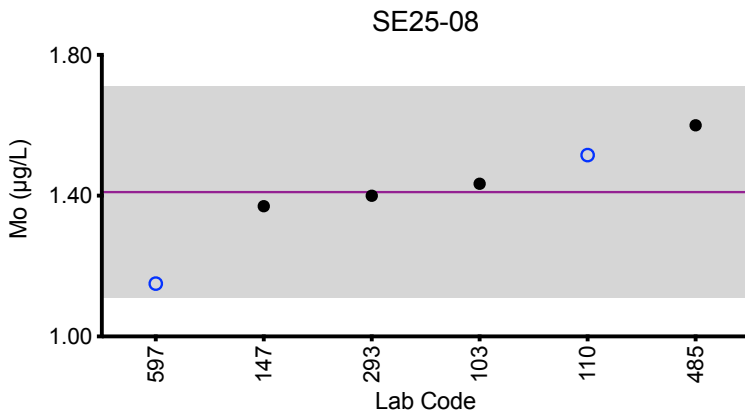
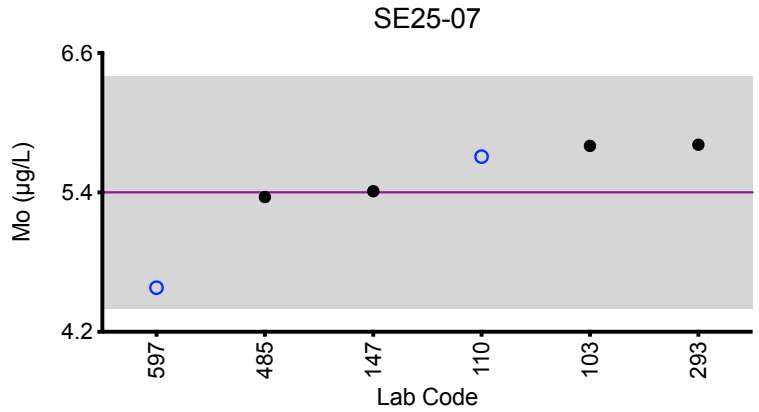
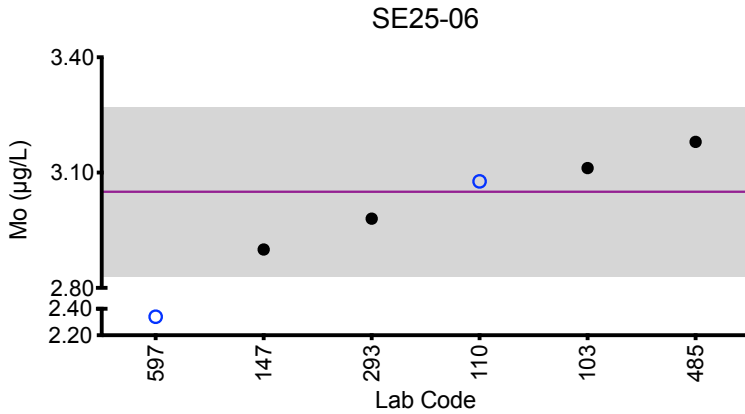
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	3.05	5.4	1.41	4.67	2.4	
Arithmetic SD (s)	0.11	0.5	0.15	0.13	0.3	
Arithmetic RSD (%)	3.6	9.3	11	2.8	11	
Number of Sample Measurements (N)	5	6	6	5	6	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Serum Mo



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Ni (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	8.66	5.40	3.11	4.10	6.63
110	ICP-MS/MS	9.36	5.71	3.41	4.81	7.07
147	DRC/CC-ICP-MS	8.22	5.43	2.89	3.90	6.13
293	DRC/CC-ICP-MS	8.67	5.55	3.03	3.94	6.60
485	HR-ICP-MS	8.50	5.26	2.55	3.99	6.42
597	ICP-MS/MS	9.23	5.95	3.42	4.48	7.18

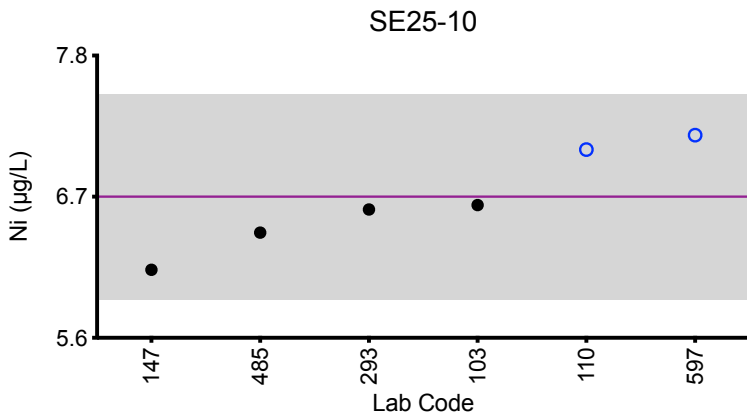
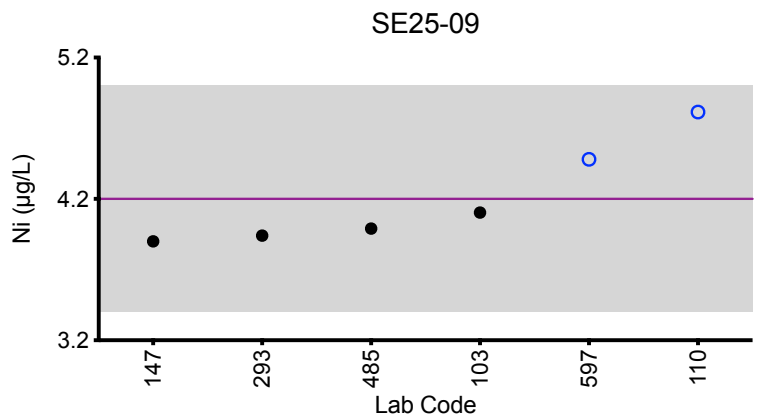
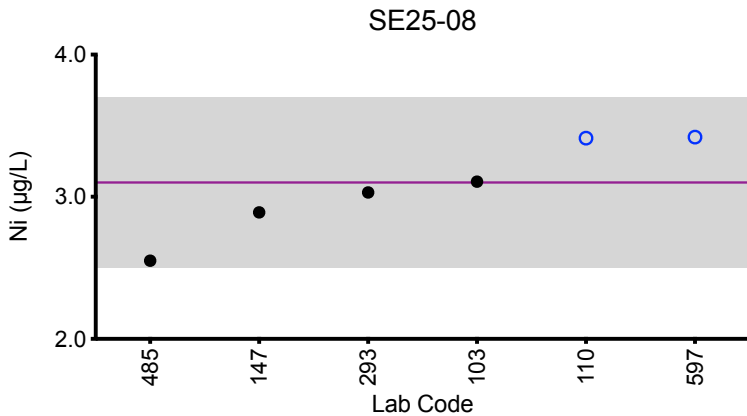
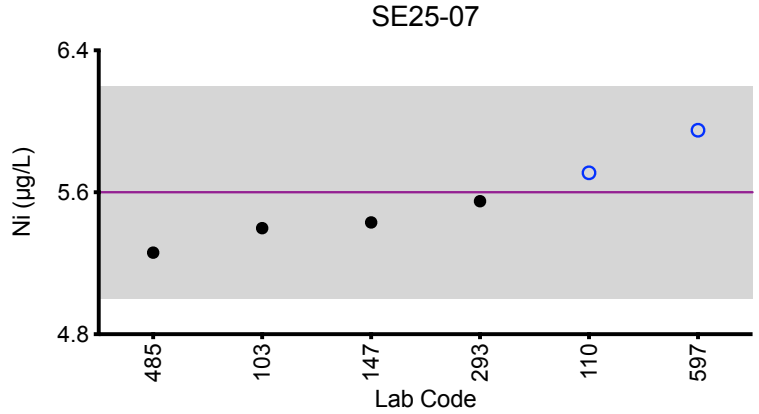
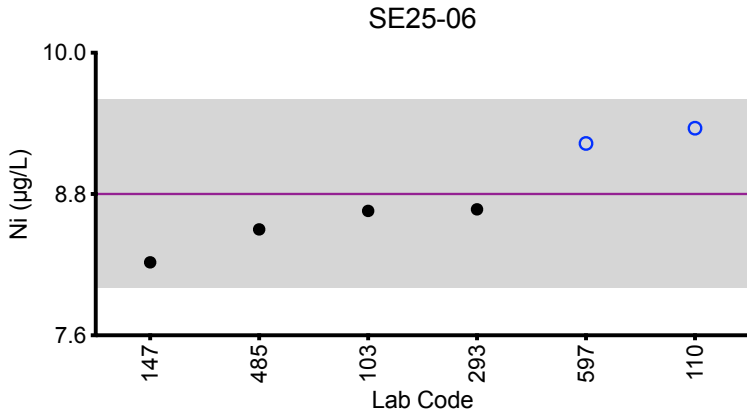
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	8.8	5.6	3.1	4.2	6.7	
Arithmetic SD (s)	0.4	0.3	0.3	0.4	0.4	
Arithmetic RSD (%)	4.5	4.5	11	8.6	6.0	
Number of Sample Measurements (N)	6	6	6	6	6	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Serum Ni



Legend:

○ 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.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

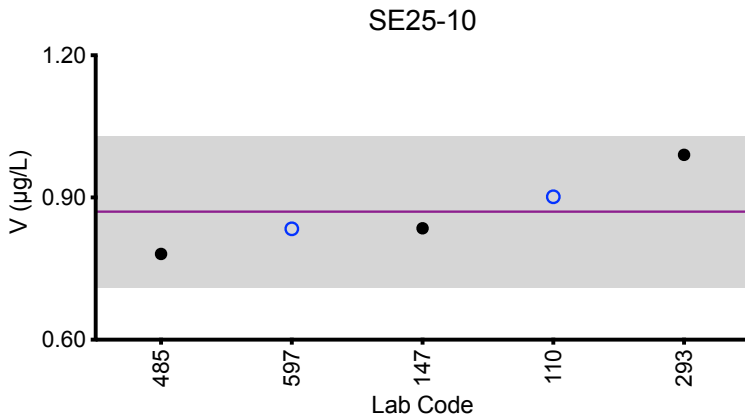
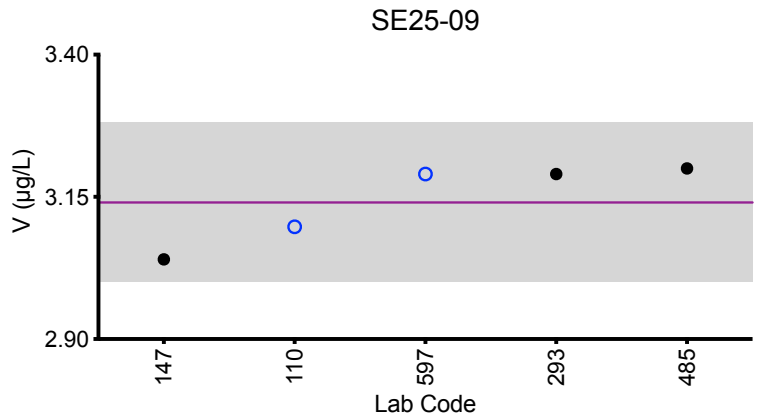
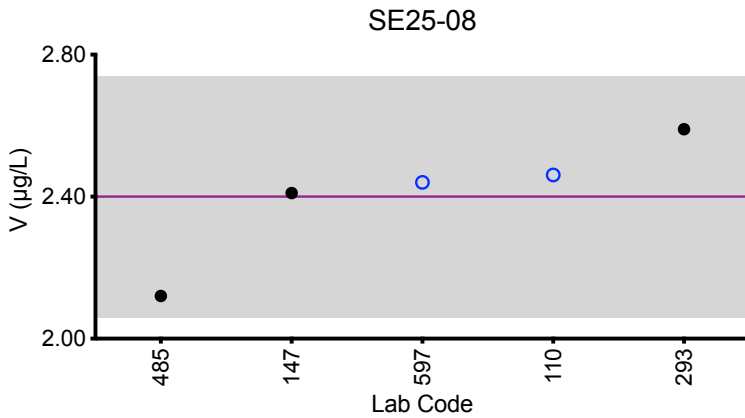
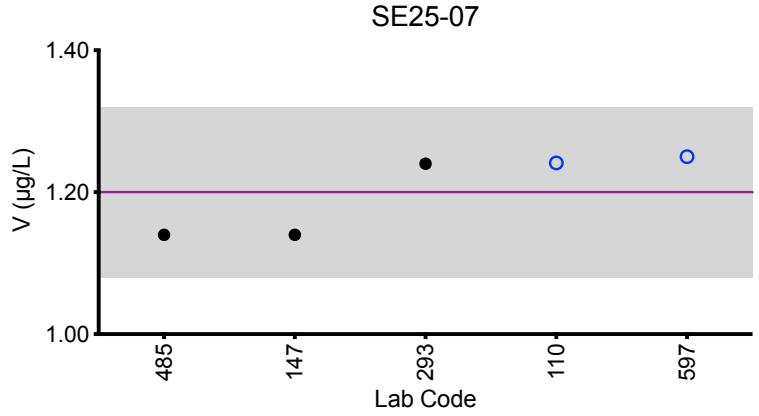
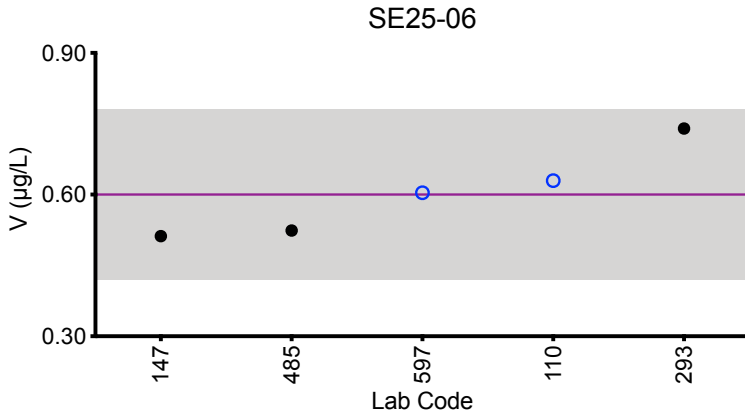
Serum V (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
110	ICP-MS/MS	0.63	1.24	2.46	3.10	0.90
147	DRC/CC-ICP-MS	0.512	1.14	2.41	3.04	0.835
293	DRC/CC-ICP-MS	0.74	1.24	2.59	3.19	1.0
485	HR-ICP-MS	0.524	1.14	2.12	3.20	0.781
597	ICP-MS/MS	0.604	1.25	2.44	3.19	0.834
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	0.60	1.20	2.40	3.14	0.87	
Arithmetic SD (s)	0.09	0.06	0.17	0.07	0.08	
Arithmetic RSD (%)	15	5.0	7.1	2.2	9.2	
Number of Sample Measurements (N)	5	5	5	5	5	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Summary Figures

Serum V



Legend:

○ HHEAR Labs ● Other Labs

Horizontal purple line = arithmetic mean of all laboratories.

Gray area = $\pm 2SD$ of the mean.

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



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum As (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	2.53	18.4	3.51	8.30	14.7
110	ICP-MS/MS	2.34	17.4	3.35	8.07	14.2
147	DRC/CC-ICP-MS	2.29	16.7	3.19	7.47	13.0
597	ICP-MS/MS	2.90	19.2	3.80	8.82	14.9
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	2.5	17.9	3.5	8.2	14.2	
Arithmetic SD (s)	0.3	1.1	0.3	0.6	0.9	
Arithmetic RSD (%)	11	6.1	7.5	7.3	6.3	
Number of Sample Measurements (N)	4	4	4	4	4	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Ba (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
110	ICP-MS/MS	1.89	1.08	2.31	0.74	0.84
147	ICP-MS	1.720	0.946	2.41	0.645	0.740
597	ICP-MS/MS	2.15	1.30	2.62	0.977	0.963
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	1.9	1.1	2.45	0.8	0.85	
Arithmetic SD (s)	0.2	0.2	0.16	0.2	0.11	
Arithmetic RSD (%)	11	16	6.5	22	13	
Number of Sample Measurements (N)	3	3	3	3	3	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Be (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
110	ICP-MS/MS	0.70	2.60	3.33	1.62	0.89
147	ICP-MS	0.912	2.21	2.86	1.44	0.917
293	DRC/CC-ICP-MS	0.68	2.31	3.12	1.35	0.85
597	ICP-MS	0.833	2.30	3.21	1.15	0.933
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	0.78	2.36	3.1	1.4	0.90	
Arithmetic SD (s)	0.11	0.17	0.2	0.2	0.04	
Arithmetic RSD (%)	14	7.2	6.4	14	4.4	
Number of Sample Measurements (N)	4	4	4	4	4	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Cd (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	1.34	3.30	0.288	0.883	2.09
110	ICP-MS/MS	1.45	3.38	0.34	0.91	2.09
147	ICP-MS	1.34	3.30	0.246	0.858	1.96
597	ICP-MS/MS	1.57	3.94	0.353	1.07	2.51
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	1.43	3.5	0.31	0.93	2.2	
Arithmetic SD (s)	0.11	0.3	0.05	0.10	0.2	
Arithmetic RSD (%)	7.7	8.6	16	11	11	
Number of Sample Measurements (N)	4	4	4	4	4	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Cs ($\mu\text{g/L}$)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
110	ICP-MS/MS	0.32	0.57	0.22	0.27	0.34
597	ICP-MS/MS	0.356	0.631	0.254	0.304	0.376

Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	0.34	0.60	0.24	0.29	0.36	
Arithmetic SD (s)	0.03	0.04	0.02	0.02	0.03	
Arithmetic RSD (%)	8.8	6.7	8.3	6.9	8.3	
Number of Sample Measurements (N)	2	2	2	2	2	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Hg (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	7.36	2.31	0.609	5.54	1.15
110	ICP-MS/MS	7.72	2.42	0.66	5.58	1.18
597	ICP-MS/MS	8.66	2.85	0.799	6.56	1.41

Summary Statistics

	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Arithmetic Mean (\bar{x})	7.9	2.5	0.69	5.9	1.25
Arithmetic SD (s)	0.7	0.3	0.10	0.6	0.14
Arithmetic RSD (%)	8.9	12	14	10	11
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum I (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
147	ICP-MS	55.2	65.5	56.6	53.2	59.3
597	ICP-MS/MS	64.1	73.7	63.1	60.9	68.5

Summary Statistics

	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Arithmetic Mean (\bar{x})	60	70	60	57	64
Arithmetic SD (s)	6	6	5	5	7
Arithmetic RSD (%)	10	8.6	8.3	8.8	11
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Li (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
147	ICP-MS	1.00	2.61	0.465	0.385	0.664
597	ICP-MS	1.06	2.64	0.571	0.422	0.751

Summary Statistics

	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Arithmetic Mean (\bar{x})	1.03	2.63	0.52	0.40	0.71
Arithmetic SD (s)	0.04	0.02	0.07	0.03	0.06
Arithmetic RSD (%)	3.9	0.80	13	7.5	8.5
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Mg (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
264	ICP-MS	18979	19046	17963	19430	18316
597	ICP-MS/MS	19600	20200	18800	20200	19200

Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	19300	19600	18400	19800	18800	
Arithmetic SD (s)	400	800	600	500	600	
Arithmetic RSD (%)	2.1	4.1	3.3	2.5	3.2	
Number of Sample Measurements (N)	2	2	2	2	2	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Pb ($\mu\text{g/L}$)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	7.40	3.89	2.20	0.949	5.24
110	ICP-MS/MS	7.36	3.84	2.20	0.95	5.14
597	ICP-MS/MS	8.20	4.28	2.41	1.06	5.72
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	7.7	4.0	2.27	0.99	5.4	
Arithmetic SD (s)	0.5	0.2	0.12	0.06	0.3	
Arithmetic RSD (%)	6.5	6.0	5.3	6.1	5.6	
Number of Sample Measurements (N)	3	3	3	3	3	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Pt ($\mu\text{g/L}$)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
110	ICP-MS/MS	0.685	1.35	0.848	0.314	1.01
264	ICP-MS	0.73	1.47	0.89	0.29	1.05
293	DRC/CC-ICP-MS	0.72	1.45	0.87	0.36	1.05

Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	0.71	1.42	0.87	0.32	1.04	
Arithmetic SD (s)	0.02	0.06	0.02	0.04	0.02	
Arithmetic RSD (%)	3.4	4.2	2.4	13	2.2	
Number of Sample Measurements (N)	3	3	3	3	3	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Sb (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	1.63	1.11	2.16	1.38	1.24
110	ICP-MS/MS	1.71	1.13	2.26	1.45	1.38
147	ICP-MS	1.51	1.03	2.11	1.32	1.15
597	ICP-MS/MS	1.71	1.20	2.31	1.43	1.36
Summary Statistics						
		SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Arithmetic Mean (\bar{x})		1.64	1.12	2.21	1.40	1.28
Arithmetic SD (s)		0.09	0.07	0.09	0.06	0.11
Arithmetic RSD (%)		5.5	6.3	4.1	4.3	8.6
Number of Sample Measurements (N)		4	4	4	4	4

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Sn (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
110	ICP-MS/MS	2.38	1.07	1.45	5.28	3.67
597	ICP-MS/MS	2.50	1.17	1.75	5.77	3.98

Summary Statistics

	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Arithmetic Mean (\bar{x})	2.44	1.12	1.6	5.5	3.8
Arithmetic SD (s)	0.08	0.07	0.2	0.3	0.2
Arithmetic RSD (%)	3.3	6.3	13	5.5	5.3
Number of Sample Measurements (N)	2	2	2	2	2

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Sr (µg/L)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	54.3	71.3	90.8	31.1	84.5
597	ICP-MS/MS	54.8	72.9	92.8	32.3	86.4

Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	54.6	72.1	91.8	31.7	85.5	
Arithmetic SD (s)	0.4	1.1	1.4	0.8	1.3	
Arithmetic RSD (%)	0.73	1.5	1.5	2.5	1.5	
Number of Sample Measurements (N)	2	2	2	2	2	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum Ti (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
200	DRC/CC-ICP-MS	11.100	4.96	5.05	6.36	1.570
485	HR-ICP-MS	9.89	3.57	3.03	5.37	0.800
597	ICP-MS/MS	13.7	7.88	6.61	9.04	3.78

Summary Statistics

	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Arithmetic Mean (\bar{x})	11.6	NA	NA	6.9	NA
Arithmetic SD (s)	1.9	NA	NA	1.9	NA
Arithmetic RSD (%)	16	NA	NA	28	NA
Number of Sample Measurements (N)	3	NA	NA	3	NA

*Denotes a statistical Outlier.

Statistical data was not calculated for SE25-07, SE25-08 and SE25-10 based on a lack of consensus among participating labs.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum TI ($\mu\text{g/L}$)						
Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	0.747	1.94	0.420	2.44	3.04
110	ICP-MS/MS	0.759	1.94	0.413	2.47	3.06
147	ICP-MS	0.758	2.02	0.414	2.57	3.20
597	ICP-MS/MS	0.877	2.23	0.474	2.83	3.50
Summary Statistics						
	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10	
Arithmetic Mean (\bar{x})	0.79	2.03	0.43	2.58	3.2	
Arithmetic SD (s)	0.06	0.14	0.03	0.18	0.2	
Arithmetic RSD (%)	7.6	6.9	6.7	7.0	6.6	
Number of Sample Measurements (N)	4	4	4	4	4	

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum U (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
103	ICP-MS/MS	0.0931	0.0818	0.0507	0.0855	0.112
110	ICP-MS/MS	0.092	0.082	0.052	0.083	0.112
597	ICP-MS/MS	0.101	0.0824	0.0626	0.100	0.132

Summary Statistics

	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Arithmetic Mean (\bar{x})	0.095	0.0821	0.055	0.089	0.119
Arithmetic SD (s)	0.005	0.0003	0.007	0.009	0.012
Arithmetic RSD (%)	5.3	0.37	13	10	10
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Laboratory Data and Summary Statistics

Serum W (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
110	ICP-MS/MS	0.25	1.80	0.44	1.30	0.79
200	ICP-MS	0.280	1.930	0.460	1.290	0.840
597	ICP-MS/MS	0.312	1.97	0.520	1.40	0.920

Summary Statistics

	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
Arithmetic Mean (\bar{x})	0.28	1.90	0.47	1.33	0.85
Arithmetic SD (s)	0.03	0.09	0.04	0.06	0.07
Arithmetic RSD (%)	11	4.7	8.5	4.5	8.2
Number of Sample Measurements (N)	3	3	3	3	3

*Denotes a statistical Outlier.



Results for Event #2, 2025: Additional Elements in Serum

Serum B (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
597	ICP-MS/MS	47.1	17.3	7.86	0.834	7.00

Serum Bi (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
147	ICP-MS	<0.0397	<0.0397	<0.0397	<0.0397	<0.0397
597	ICP-MS/MS	0.0290	<0.0145	<0.0145	0.0215	<0.0145

Serum Br (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
597	ICP-MS/MS	1940	2180	1980	2240	1750

Serum Ca (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
597	ICP-MS/MS	91700	101000	94500	91400	93300

Serum Cl (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
597	ICP-MS/MS	5340000	4790000	4830000	5390000	5300000

Serum Fe (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
264	ICP-MS	4306.00	16446.00	8035.00	2800.00	5662.00
597	ICP-MS/MS	441	1700	792	288	537

Serum Ga (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
597	ICP-MS/MS	<0.0204	0.0305	0.0216	<0.0204	<0.0204

Serum S (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
597	ICP-MS/MS	1210000	1460000	1180000	1310000	1270000

Serum Te (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
110	ICP-MS/MS	<0.02	0.025	<0.02	<0.02	<0.02

Serum Th (µg/L)

Lab Code	Method	SE25-06	SE25-07	SE25-08	SE25-09	SE25-10
597	ICP-MS/MS	0.0315	0.0152	0.0105	<0.004	<0.004



References

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