



**Department  
of Health**

**Wadsworth  
Center**

# **New York State Biomonitoring Program for Trace Elements**

## **Event #3, 2025**

### **Trace Elements in Whole Blood, Urine, and Serum**

## **December, 2025**

**Wadsworth Center**  
NEW YORK STATE DEPARTMENT OF HEALTH  
*Trace Elements Laboratory*



**Event #3, 2025:  
Trace Elements in Whole Blood, Urine, and Serum**

12/11/2025

Dear Laboratory Director,

This report summarizes performance for the third 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 #1, 2026) will be shipped February 11, 2026. Comments about this report may be directed to [trel@health.ny.gov](mailto:trel@health.ny.gov). If you have not yet enrolled for next year, please contact PT program staff at [trel@health.ny.gov](mailto:trel@health.ny.gov).

Sincerely,

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Kayla Mehigan  
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Wadsworth Center



**Department  
of Health**

**Wadsworth  
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**Event #3, 2025**

**Trace Elements in  
Whole Blood**

**Wadsworth Center**  
NEW YORK STATE DEPARTMENT OF HEALTH  
*Trace Elements Laboratory*



**Event #3, 2025:  
Trace Elements in Whole Blood**

**PT Materials**

Human whole blood was purchased from BioIVT and preserved with K<sub>2</sub>EDTA. 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 31 elements were reported by at least one participant: Ag, Al, 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 #3, 2025: Summary Statistics

Whole Blood As (µg/L)					
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	30.2	6.7	0.84	3.1	13.0
<b>Upper Limit</b>	36.2	12.7	6.84	9.1	19.0
<b>Lower Limit</b>	24.2	0.7	0.00	0.0	7.0
<b>Arithmetic SD (s)</b>	1.6	0.5	0.24	0.3	0.9
<b>Arithmetic RSD (%)</b>	5.3	7.5	29	8.3	6.9
<b>Number of Sample Measurements (N)</b>	7	7	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 #3, 2025: Performance of Participating Laboratories

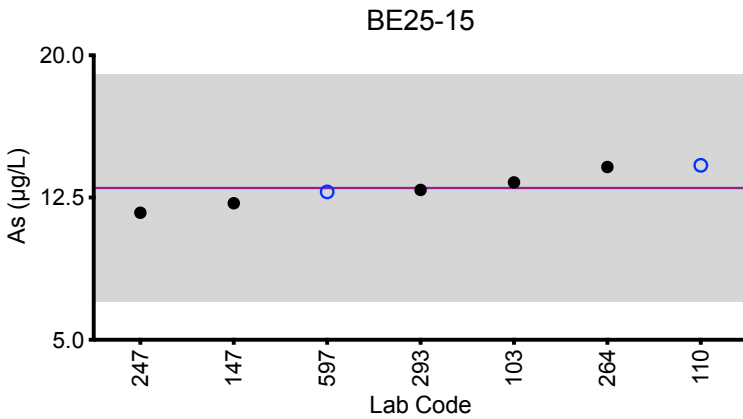
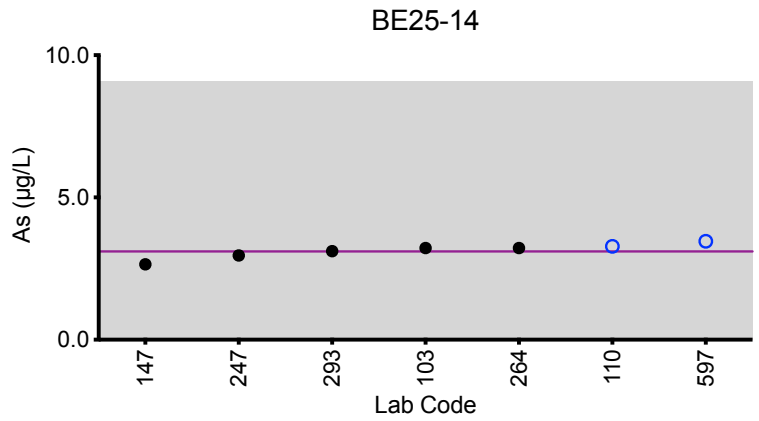
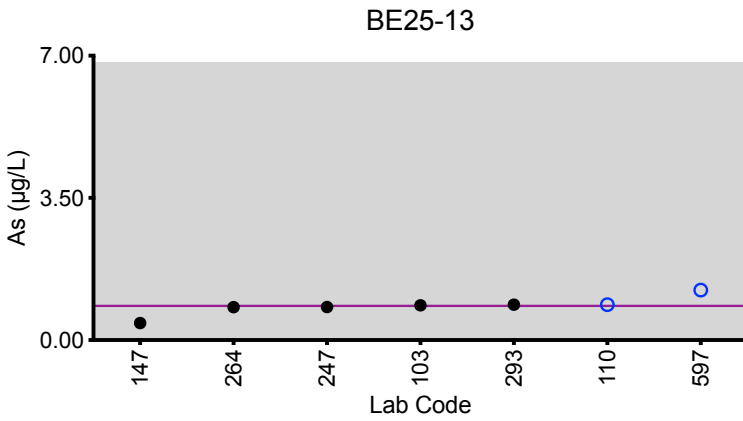
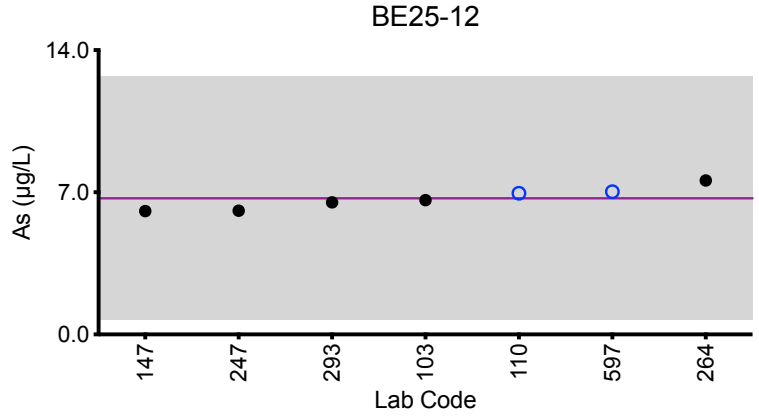
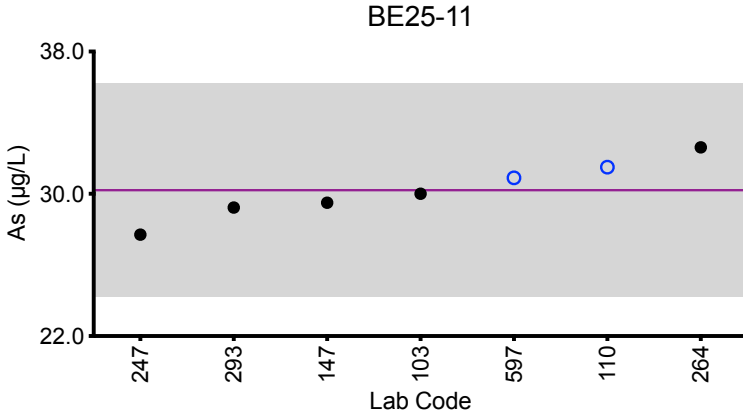
Whole Blood As (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Target		30.2	6.7	0.84	3.1	13.0
103	ICP-MS/MS	30.0	6.61	0.855	3.22	13.3
110	ICP-MS/MS	31.5	6.95	0.87	3.28	14.2
147	ICP-MS	29.5	6.07	0.419	2.65	12.2
247	ICP-MS/MS	27.7	6.09	0.813	2.96	11.7
264	ICP-MS	32.61	7.58	0.81	3.22	14.11
293	DRC/CC-ICP-MS	29.23	6.5	0.87	3.11	12.9
597	ICP-MS/MS	30.9	7.03	1.23	3.46	12.8

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 #3, 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:

±6 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±6 µg/L at concentrations less than or equal to 30 µg/L.



## Results for Event #3, 2025: Summary Statistics

Whole Blood Cd (µg/L)					
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
<b>Target (Robust Mean (x*))</b>	3.40	8.4	1.00	0.62	5.6
<b>Upper Limit</b>	4.40	9.7	2.00	1.62	6.6
<b>Lower Limit</b>	2.40	7.1	0.00	0.00	4.6
<b>Robust SD (s*)</b>	0.20	0.6	0.06	0.03	0.3
<b>Robust RSD (%)</b>	5.9	7.1	6.7	5.0	5.2
<b>Number of Sample Measurements (N)</b>	12	12	11	11	12
<b>Standard Uncertainty (u)</b>	0.07	0.2	0.02	0.01	0.1

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.



### Results for Event #3, 2025: Performance of Participating Laboratories

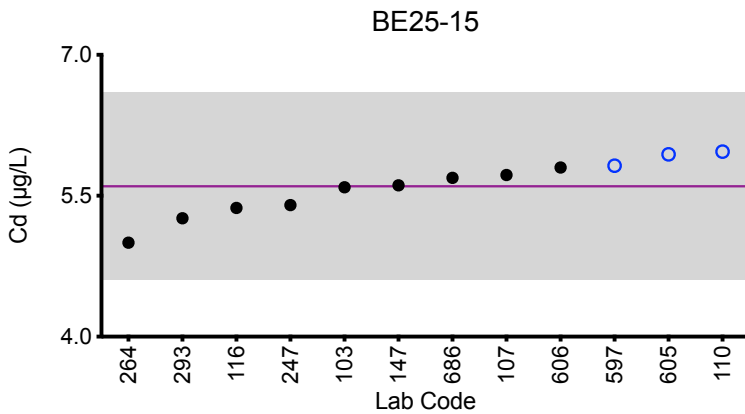
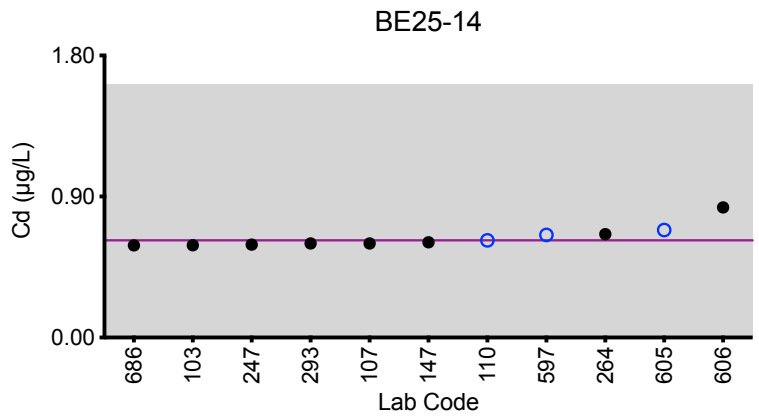
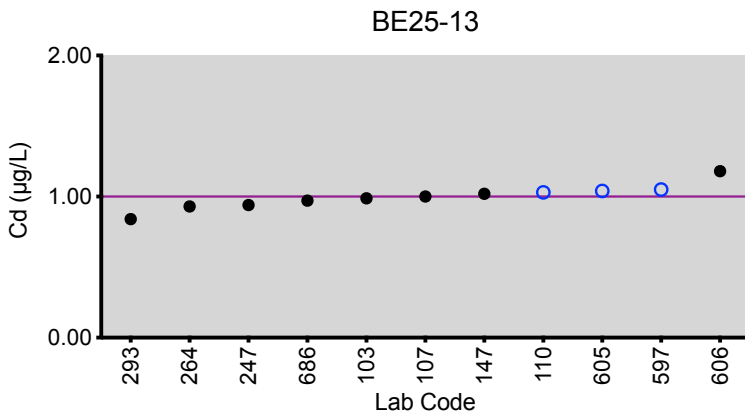
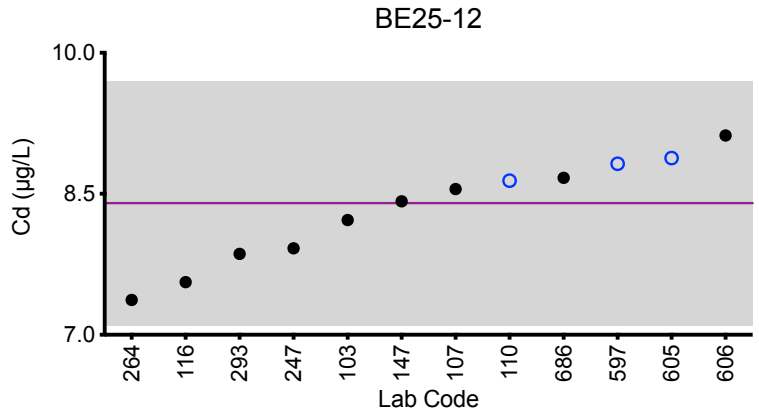
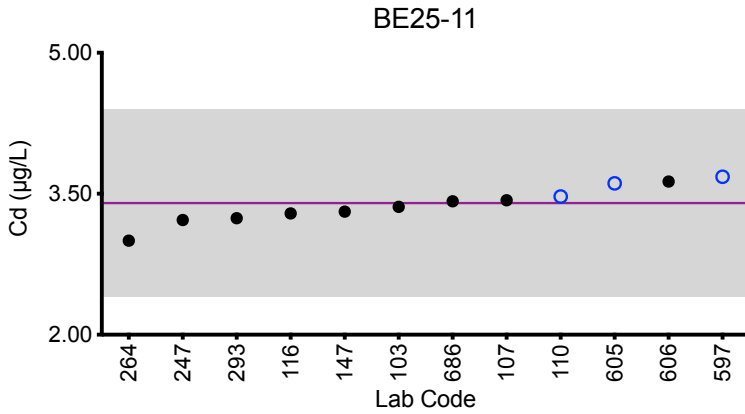
Whole Blood Cd (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
	Target	3.40	8.4	1.00	0.62	5.6
103	ICP-MS/MS	3.36	8.22	0.988	0.589	5.59
107	ICP-MS/MS	3.43	8.55	1.00	0.600	5.72
110	ICP-MS/MS	3.47	8.64	1.03	0.62	5.97
116	ICP-MS/MS	3.29	7.56	<1.50	<1.50	5.37
147	ICP-MS	3.31	8.42	1.02	0.608	5.61
247	ICP-MS/MS	3.22	7.92	0.940	0.593	5.40
264	ICP-MS	3.00	7.37	0.93	0.66	5.00
293	DRC/CC-ICP-MS	3.24	7.86	0.840	0.6	5.26
597	ICP-MS/MS	3.68	8.82	1.05	0.655	5.82
605	ICP-MS	3.61	8.88	1.04	0.686	5.94
606	ICP-MS/MS	3.63	9.12	1.18	0.830	5.80
686	ICP-MS	3.42	8.67	0.971	0.588	5.69

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 #3, 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 #3, 2025: Summary Statistics

	Whole Blood Co (µg/L)				
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	3.12	9.4	1.67	0.93	5.8
<b>Upper Limit</b>	4.62	11.3	3.17	2.43	7.3
<b>Lower Limit</b>	1.62	7.5	0.17	0.00	4.3
<b>Arithmetic SD (s)</b>	0.16	0.4	0.11	0.05	0.5
<b>Arithmetic RSD (%)</b>	5.1	4.4	6.6	5.4	8.6
<b>Number of Sample Measurements (N)</b>	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 #3, 2025: Performance of Participating Laboratories

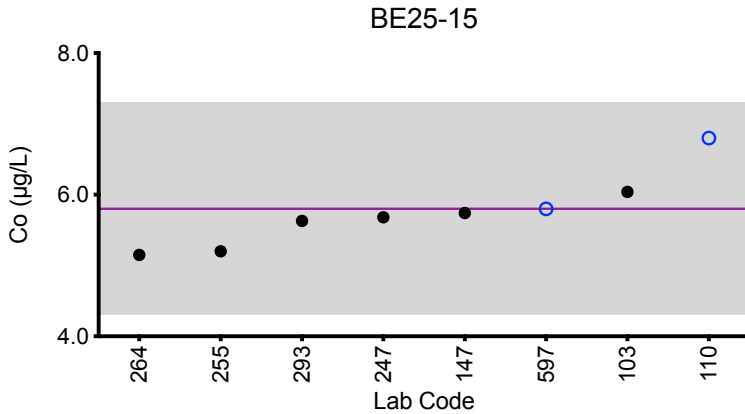
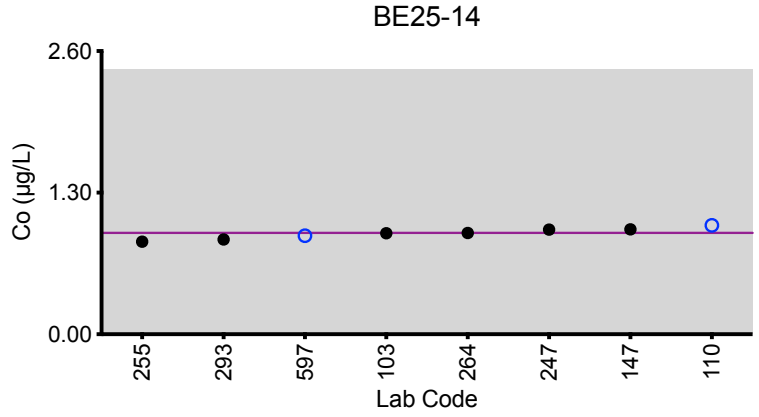
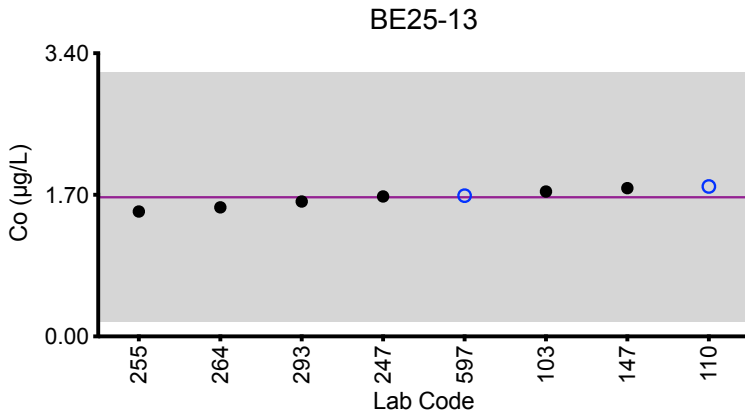
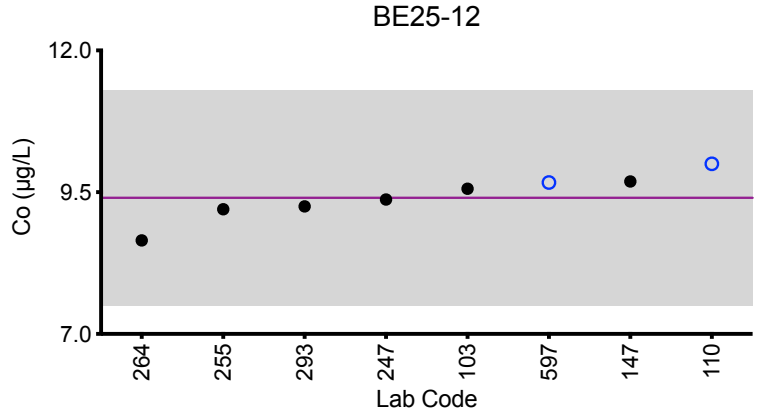
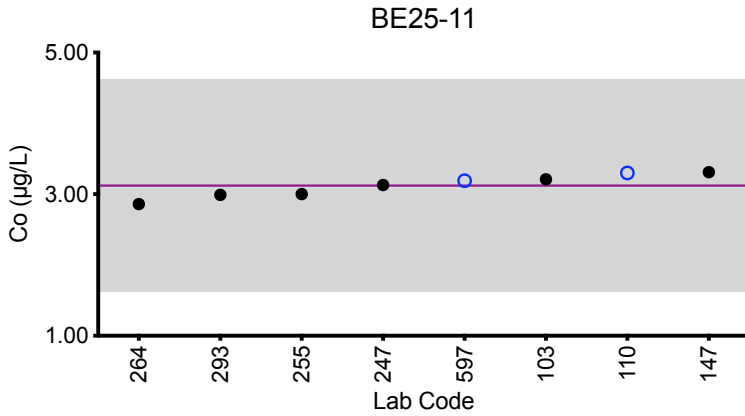
Whole Blood Co (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Target		3.12	9.4	1.67	0.93	5.8
103	ICP-MS/MS	3.21	9.56	1.74	0.927	6.04
110	ICP-MS/MS	3.3	10.0	1.8	1.0	6.8
147	ICP-MS	3.31	9.69	1.78	0.963	5.74
247	ICP-MS/MS	3.13	9.37	1.68	0.960	5.68
255	ICP-MS	3	9.2	1.5	0.85	5.2
264	ICP-MS	2.86	8.65	1.55	0.93	5.15
293	DRC/CC-ICP-MS	2.99	9.25	1.62	0.87	5.63
597	ICP-MS/MS	3.19	9.67	1.69	0.905	5.80

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 #3, 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:

±1.5 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±1.5 µg/L at concentrations less than or equal to 7.5 µg/L.



### Results for Event #3, 2025: Summary Statistics

Whole Blood Cr (µg/L)					
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	9.1	1.81	5.8	0.73	3.48
<b>Upper Limit</b>	11.1	3.81	7.8	2.73	5.48
<b>Lower Limit</b>	7.1	0.00	3.8	0.00	1.48
<b>Arithmetic SD (s)</b>	0.4	0.13	0.3	0.17	0.26
<b>Arithmetic RSD (%)</b>	4.4	7.2	4.5	23	7.5
<b>Number of Sample Measurements (N)</b>	8	8	7	6	8

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 #3, 2025: Performance of Participating Laboratories

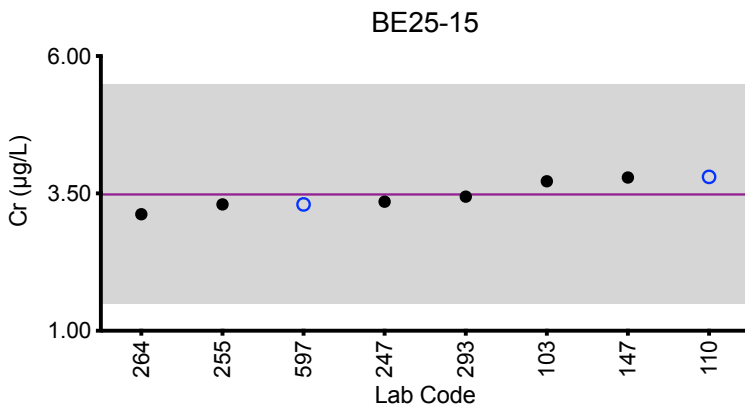
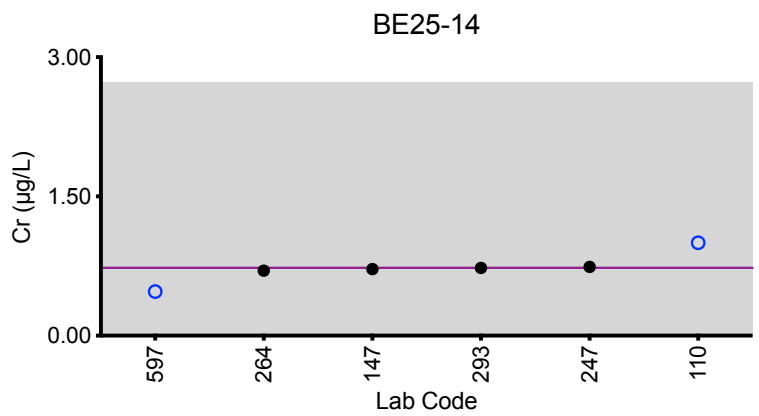
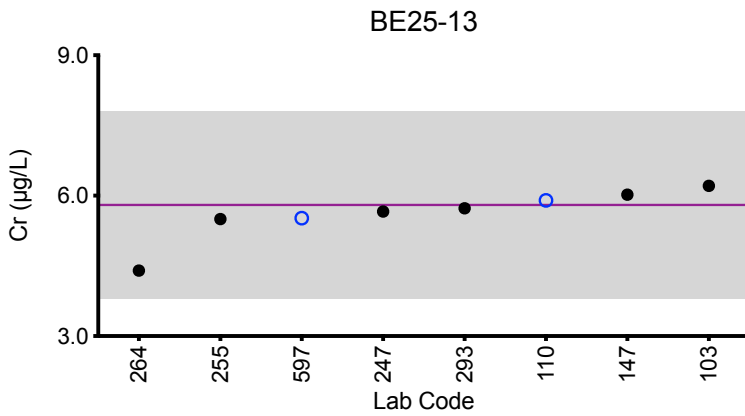
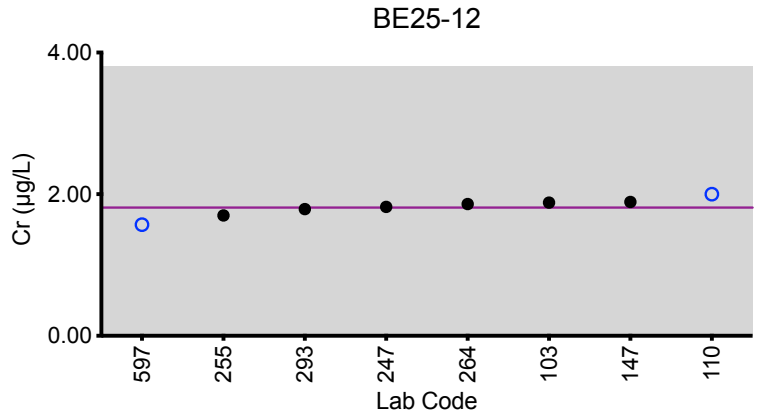
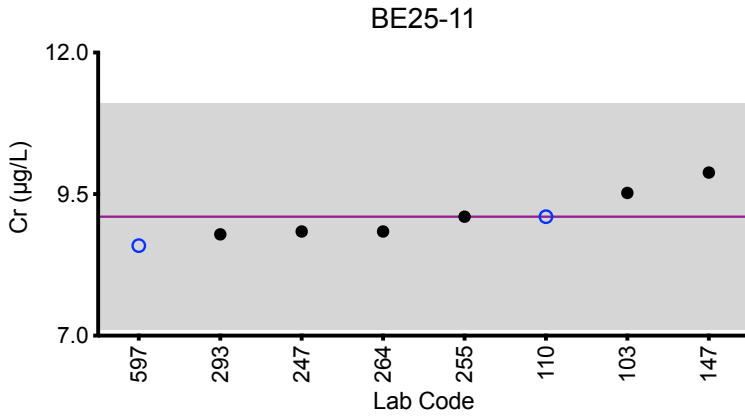
Whole Blood Cr (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Target		9.1	1.81	5.8	0.73	3.48
103	ICP-MS/MS	9.52	1.88	6.21	<1.50	3.72
110	ICP-MS/MS	9.1	2.0	5.9	1.0	3.8
147	DRC/CC-ICP-MS	9.88	1.89	6.02	0.717	3.79
247	ICP-MS/MS	8.84	1.82	5.66	0.740	3.35
255	ICP-MS	9.1	1.7	5.5	<1	3.3
264	ICP-MS	8.84	1.86	*4.40	0.70	3.12
293	DRC/CC-ICP-MS	8.79	1.79	5.73	0.73	3.44
597	ICP-MS/MS	8.59	1.57	5.52	0.475	3.30

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 #3, 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 #3, 2025: Summary Statistics

Whole Blood Hg (µg/L)					
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
<b>Target (Robust Mean (x*))</b>	12.9	1.66	4.6	2.67	1.29
<b>Upper Limit</b>	16.8	4.66	7.6	5.67	4.29
<b>Lower Limit</b>	9.0	0.00	1.6	0.00	0.00
<b>Robust SD (s*)</b>	1.5	0.09	0.8	0.21	0.10
<b>Robust RSD (%)</b>	12	5.4	17	7.9	7.8
<b>Number of Sample Measurements (N)</b>	13	12	13	13	12
<b>Standard Uncertainty (u)</b>	0.5	0.03	0.3	0.07	0.04

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 #3, 2025: Performance of Participating Laboratories

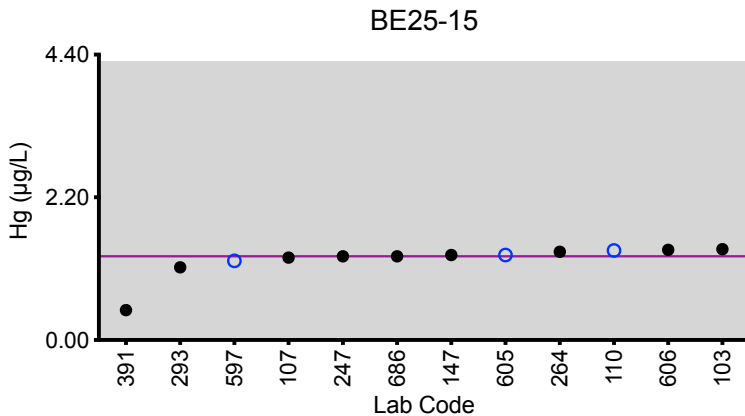
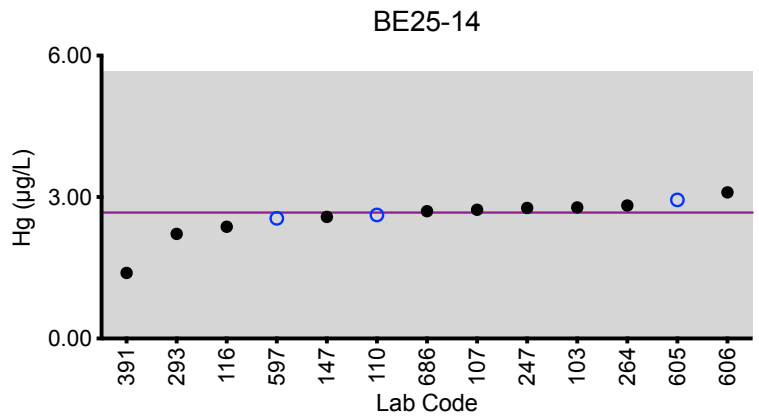
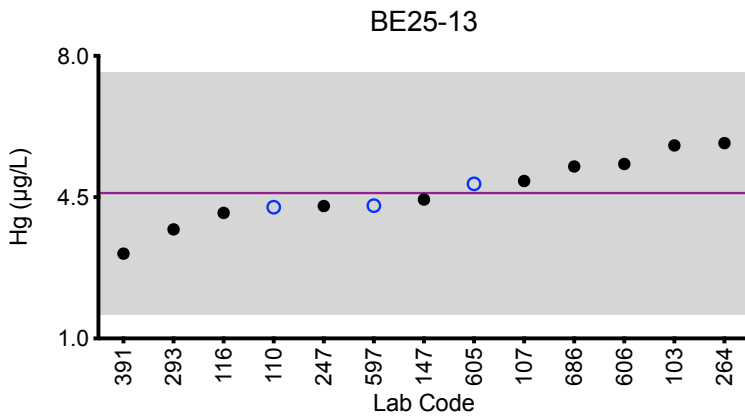
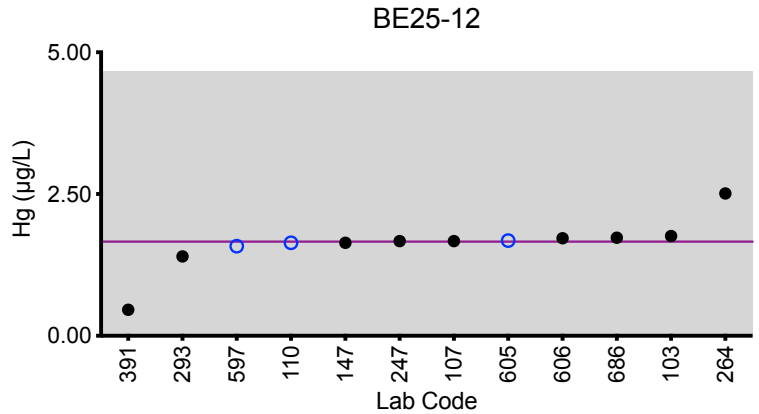
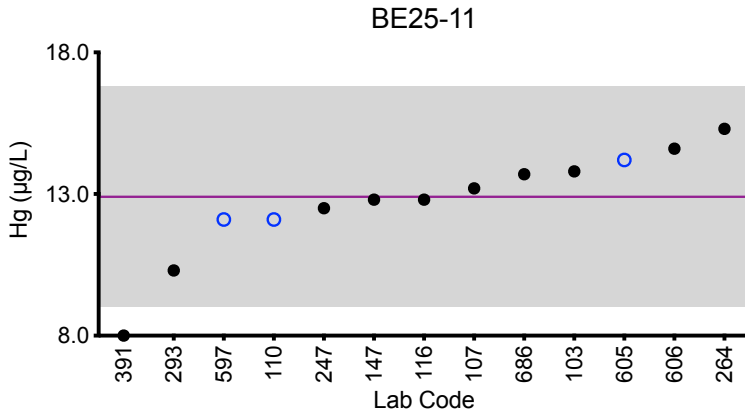
Whole Blood Hg (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
	Target	12.9	1.66	4.6	2.67	1.29
103	ICP-MS/MS	13.8	1.76	5.78	2.78	1.40
107	ICP-MS/MS	13.2	1.67	4.90	2.73	1.27
110	ICP-MS/MS	12.1	1.64	4.25	2.62	1.38
116	ICP-MS/MS	12.8	<1.50	4.11	2.37	<1.50
147	ICP-MS	12.8	1.64	4.44	2.58	1.31
247	ICP-MS/MS	12.5	1.67	4.28	2.77	1.29
264	ICP-MS	15.30	2.51	5.84	2.82	1.36
293	DRC/CC-ICP-MS	10.3	1.40	3.7	2.22	1.12
391	CV-AAS	8.0 ↓	0.46	3.1	1.39	0.46
597	ICP-MS/MS	12.1	1.58	4.29	2.55	1.22
605	ICP-MS	14.2	1.68	4.83	2.94	1.31
606	ICP-MS/MS	14.6	1.72	5.32	3.10	1.39
686	ICP-MS	13.7	1.73	5.26	2.70	1.29

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



## Results for Event #3, 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 #3, 2025: Summary Statistics

Whole Blood Mn (µg/L)					
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	33.4	20.1	8.0	17.1	28.8
<b>Upper Limit</b>	39.1	23.5	11.0	20.1	33.7
<b>Lower Limit</b>	27.7	16.7	5.0	14.1	23.9
<b>Arithmetic SD (s)</b>	1.8	1.6	1.5	1.5	1.9
<b>Arithmetic RSD (%)</b>	5.4	8.0	19	8.8	6.6
<b>Number of Sample Measurements (N)</b>	9	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 recently proposed by a network of Trace Element PT program organizers (Praamsma M, et al. An assessment of clinical laboratory performance for the determination of manganese in blood and urine. Clinical Chemistry Laboratory Medicine 2016; 54(12): 1921-1928).



### Results for Event #3, 2025: Performance of Participating Laboratories

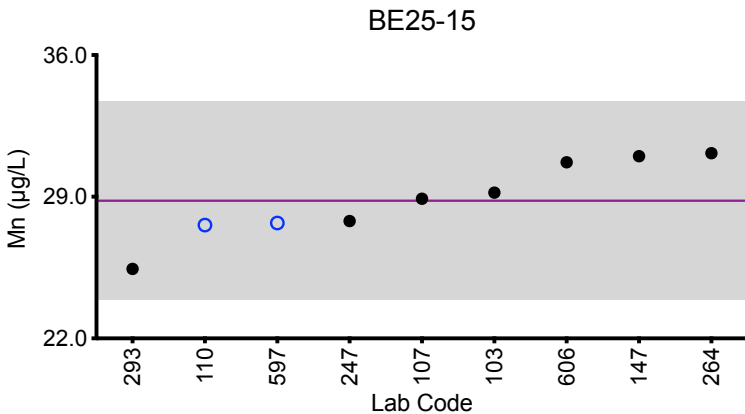
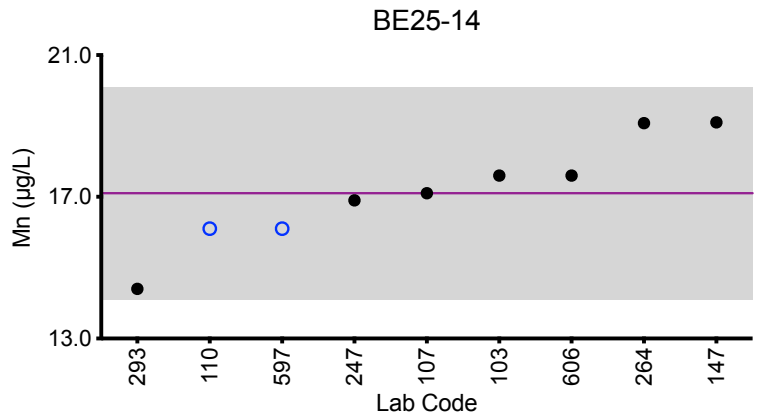
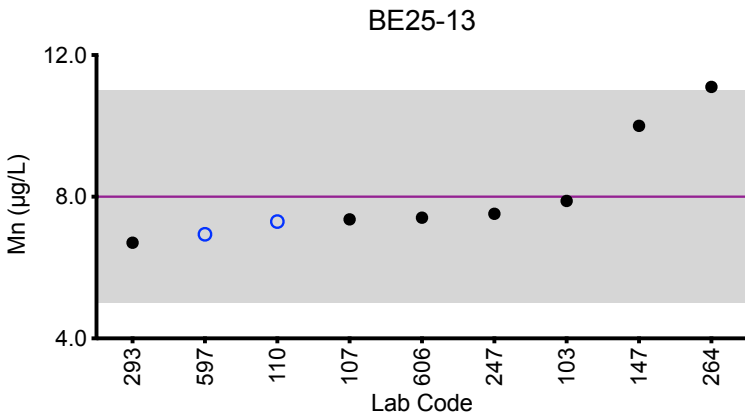
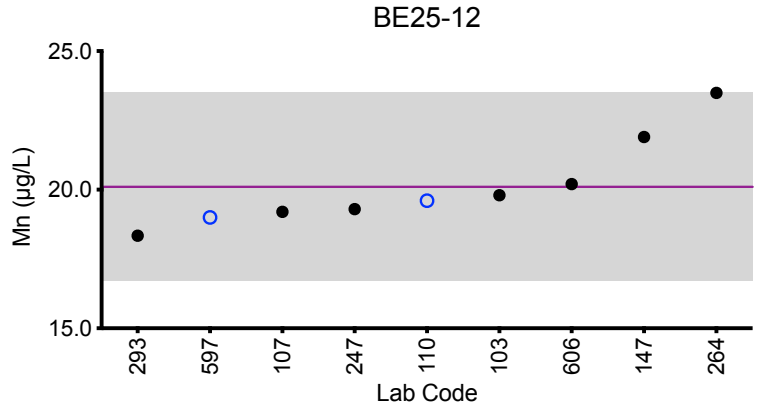
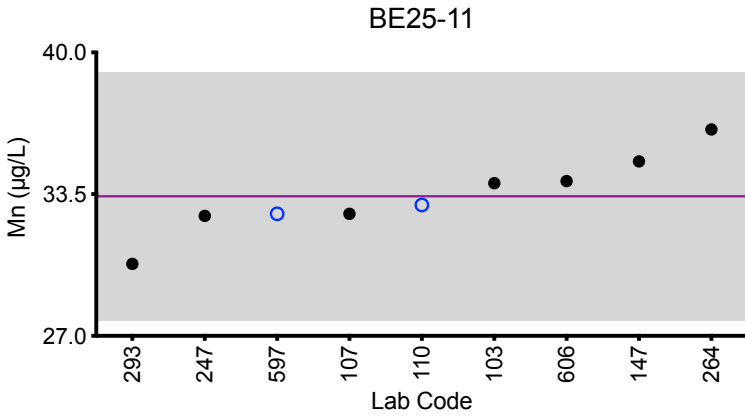
Whole Blood Mn (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Target		33.4	20.1	8.0	17.1	28.8
103	ICP-MS/MS	34.0	19.8	7.88	17.6	29.2
107	ICP-MS/MS	32.6	19.2	7.36	17.1	28.9
110	ICP-MS/MS	33.0	19.6	7.3	16.1	27.6
147	ICP-MS	35.0	21.9	10.0	19.1	31.0
247	ICP-MS/MS	32.5	19.3	7.52	16.9	27.8
264	ICP-MS	36.47	23.49	11.10 ↑	19.08	31.15
293	DRC/CC-ICP-MS	30.3	18.34	6.7	14.4	25.43
597	ICP-MS/MS	32.6	19.0	6.94	16.1	27.7
606	ICP-MS/MS	34.1	20.2	7.41	17.6	30.7

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 #3, 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:

$\pm 3 \mu\text{g/L}$  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  $17.7 \mu\text{g/L}$ .



## Results for Event #3, 2025: Summary Statistics

Whole Blood Pb (µg/dL)					
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
<b>Target (Robust Mean (x*))</b>	1.04	2.89	10.7	0.87	6.0
<b>Upper Limit</b>	3.04	4.89	12.7	2.87	8.0
<b>Lower Limit</b>	0.00	0.89	8.7	0.00	4.0
<b>Robust SD (s*)</b>	0.07	0.13	0.7	0.04	0.3
<b>Robust RSD (%)</b>	6.7	4.5	6.5	4.3	5.6
<b>Number of Sample Measurements (N)</b>	11	12	14	9	14
<b>Standard Uncertainty (u)</b>	0.03	0.05	0.2	NA	0.1

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/>)

An arithmetic mean, SD, RSD and n are provided for sample BE25-14.



### Results for Event #3, 2025: Performance of Participating Laboratories

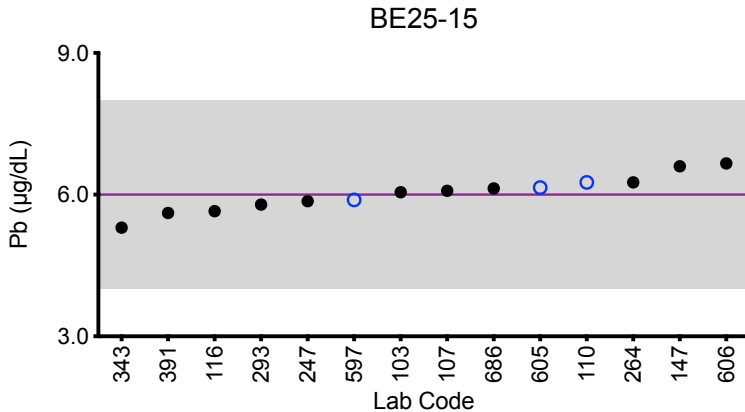
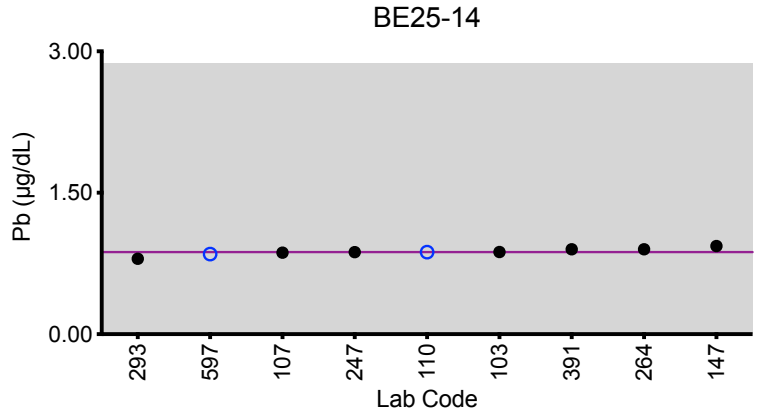
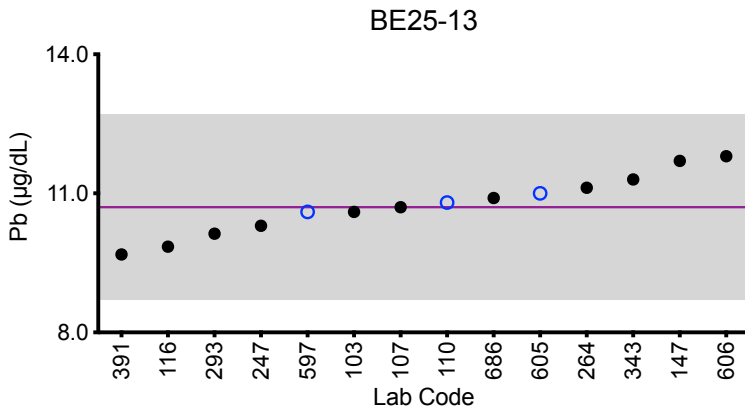
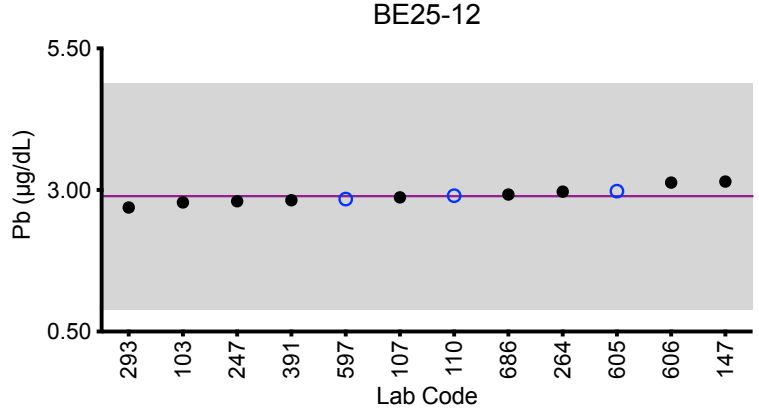
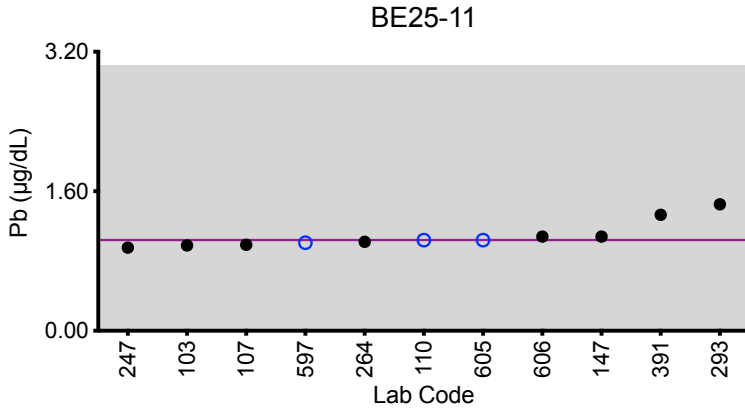
Whole Blood Pb (µg/dL)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Target		1.04	2.89	10.7	0.87	6.0
103	ICP-MS/MS	0.979	2.78	10.6	0.871	6.05
107	ICP-MS/MS	0.986	2.87	10.7	0.865	6.08
110	ICP-MS/MS	1.04	2.90	10.8	0.87	6.26
116	ICP-MS/MS	<3.00	<3.00	9.85	<3.00	5.65
147	ICP-MS	1.08	3.15	11.7	0.935	6.60
247	ICP-MS/MS	0.953	2.80	10.3	0.870	5.86
264	ICP-MS	1.02	2.97	11.12	0.90	6.26
293	DRC/CC-ICP-MS	1.45	2.69	10.13	0.8	5.79
343	ASV-LeadCare	<3.3	<3.3	11.3	<3.3	5.3
391	ETAAS-Z	1.33	2.82	9.68	0.9	5.61
597	ICP-MS/MS	1.01	2.84	10.6	0.850	5.89
605	ICP-MS	1.04	2.98	11.0	<1.00	6.15
606	ICP-MS/MS	1.08	3.13	11.8	<1.00	6.66
686	ICP-MS	<1.00	2.92	10.9	<1.00	6.13

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 #3, 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 #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood Mo (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
103	ICP-MS/MS	0.501	0.822	1.72	2.92	5.48
110	ICP-MS/MS	0.61	0.91	1.81	3.02	5.70
147	ICP-MS	0.630	0.904	1.80	2.95	5.12
264	ICP-MS	*2.24	*1.81	*2.48	*3.65	5.79
597	ICP-MS/MS	0.602	0.924	1.68	2.89	5.07

### Summary Statistics

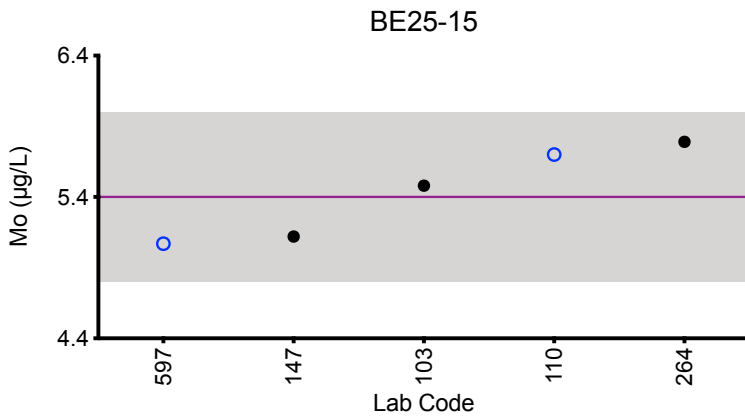
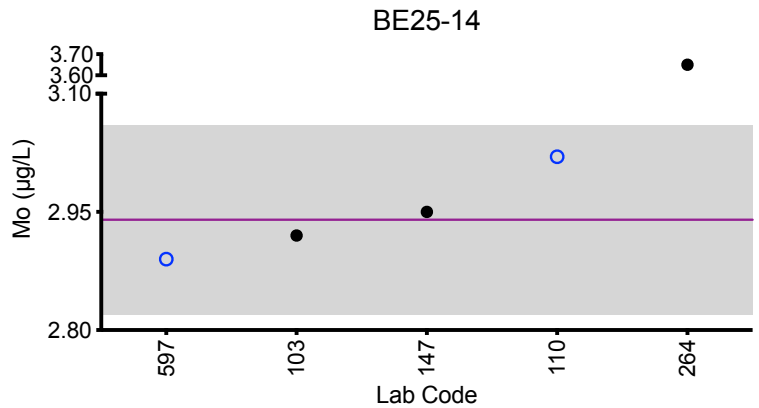
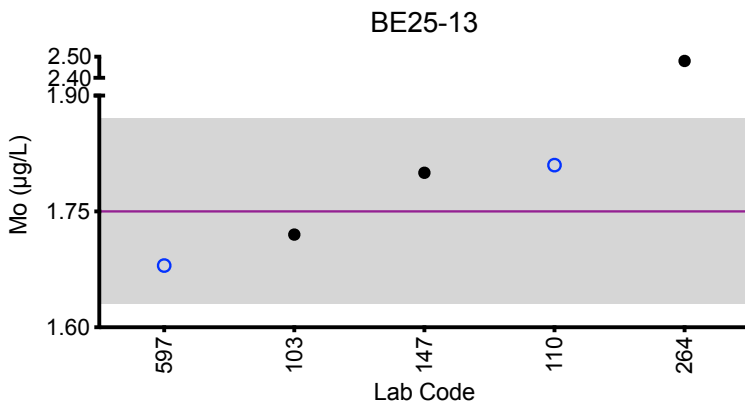
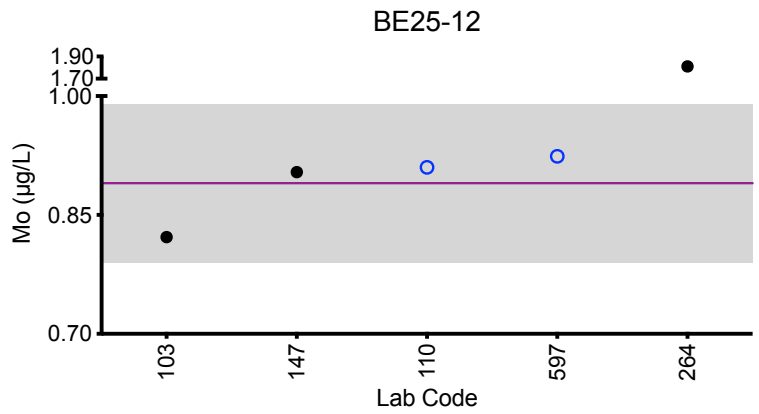
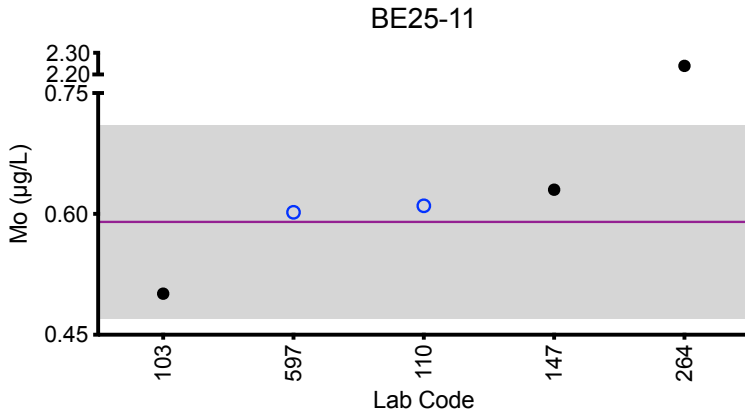
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	0.59	0.89	1.75	2.94	5.4
Arithmetic SD (s)	0.06	0.05	0.06	0.06	0.3
Arithmetic RSD (%)	10	5.6	3.4	2.0	6.1
Number of Sample Measurements (N)	4	4	4	4	5

\*Denotes a statistical Outlier.



# Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood Sb (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
103	ICP-MS/MS	2.22	1.05	0.677	3.45	0.340
110	ICP-MS/MS	2.23	1.06	0.68	3.45	0.37
147	ICP-MS	2.23	1.07	0.677	3.34	0.338
264	ICP-MS	2.51	1.19	0.80	3.94	0.40
293	DRC/CC-ICP-MS	2.01	0.94	0.630	3.17	0.34
597	ICP-MS/MS	2.34	1.13	0.718	3.75	*0.583

### Summary Statistics

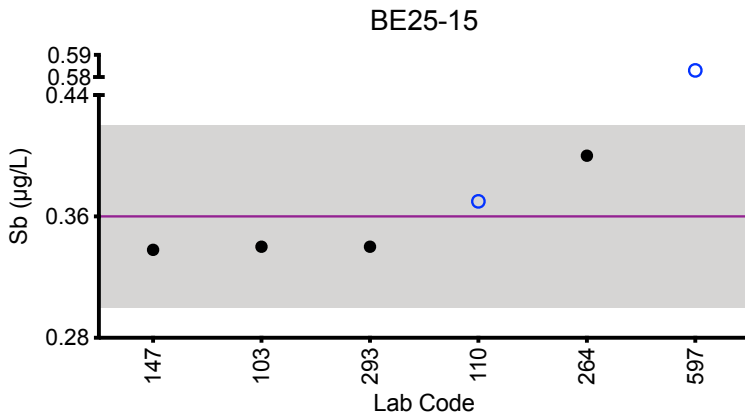
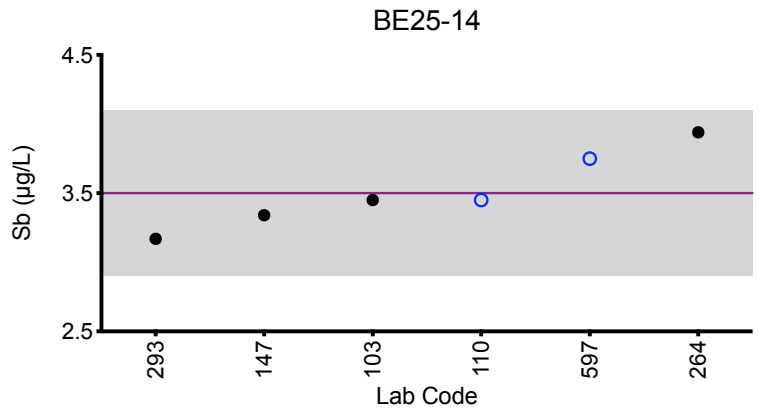
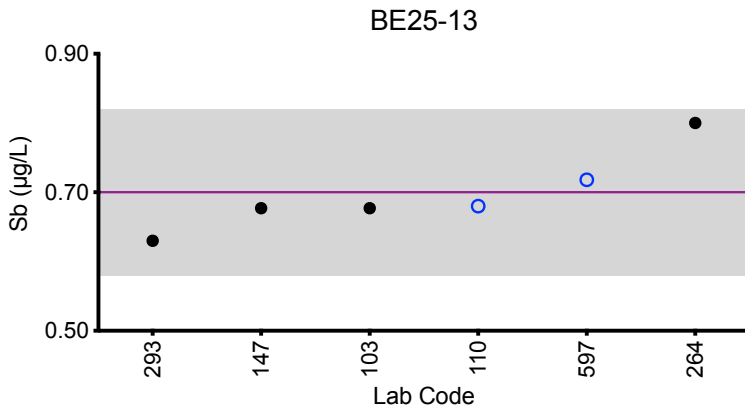
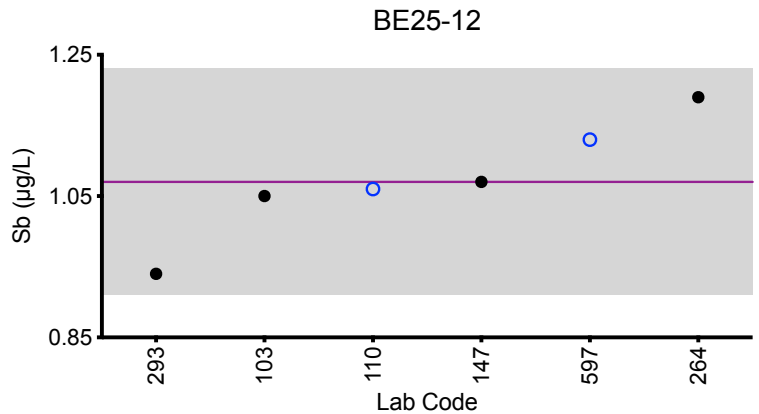
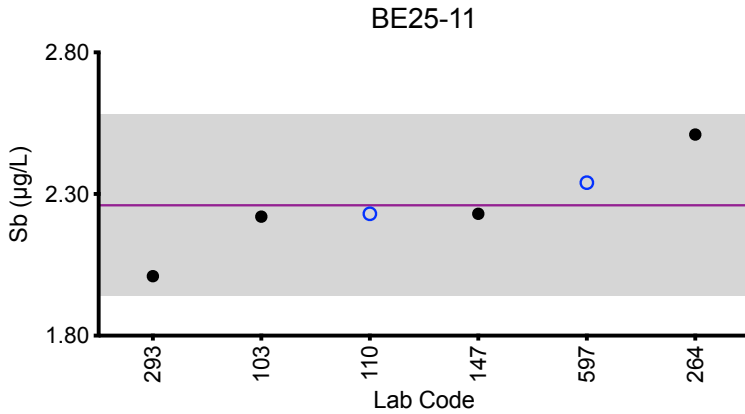
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
<b>Arithmetic Mean (<math>\bar{x}</math>)</b>	2.26	1.07	0.70	3.5	0.36
<b>Arithmetic SD (s)</b>	0.16	0.08	0.06	0.3	0.03
<b>Arithmetic RSD (%)</b>	7.1	7.5	8.6	8.0	7.5
<b>Number of Sample Measurements (N)</b>	6	6	6	6	5

\*Denotes a statistical Outlier.



# Results for Event #3, 2025: Summary Figures

## Whole Blood Sb



### 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 #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood Se (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
103	ICP-MS/MS	175	343	217	137	277
107	ICP-MS/MS	182	362	224	142	280
110	ICP-MS/MS	168	322	206	134	250
147	ICP-MS	184	347	216	138	266
247	ICP-MS/MS	214	404	252	148	277
264	ICP-MS	190.27	398.93	247.20	143.60	285.65
293	DRC/CC-ICP-MS	171.33	323.5	212.6	132.0	263.1
597	ICP-MS/MS	198	367	228	142	273

### Summary Statistics

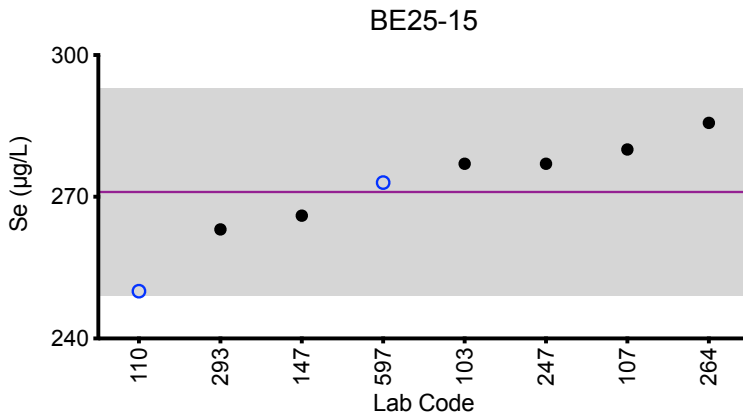
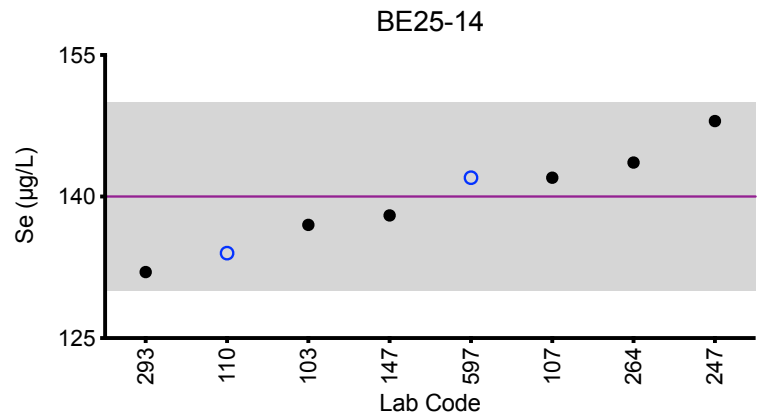
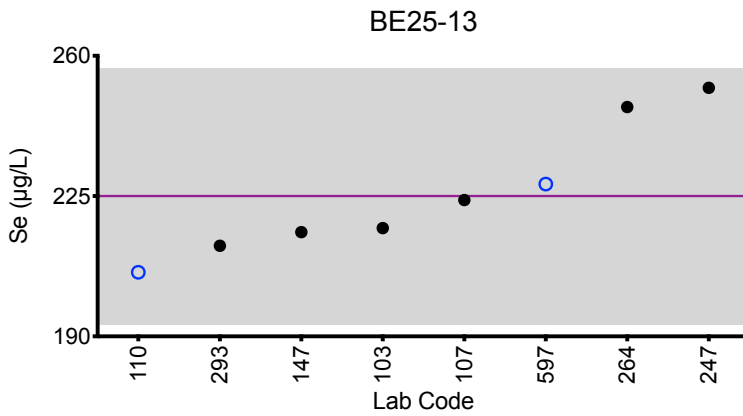
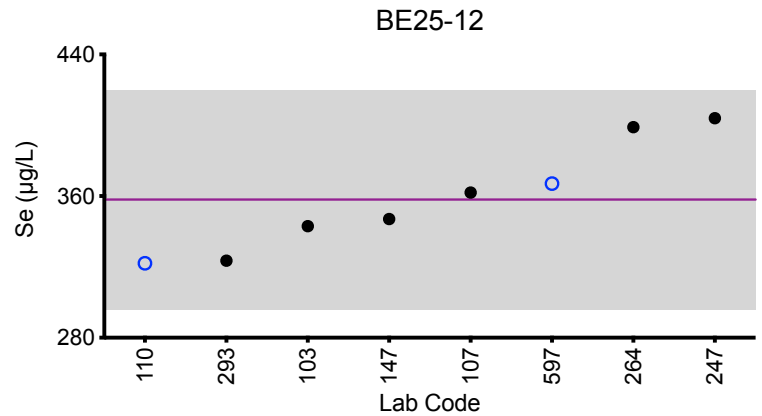
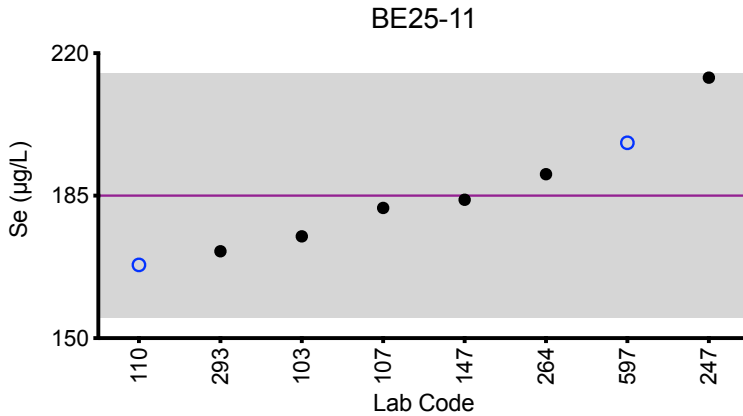
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	185	358	225	140	271
Arithmetic SD (s)	15	31	16	5	11
Arithmetic RSD (%)	8.1	8.7	7.1	3.6	4.1
Number of Sample Measurements (N)	8	8	8	8	8

\*Denotes a statistical Outlier.



## Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood TI (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
103	ICP-MS/MS	0.169	0.466	1.79	0.293	0.796
110	ICP-MS/MS	0.165	0.493	1.81	0.294	0.826
147	ICP-MS	*0.190	0.534	1.93	0.310	0.860
264	ICP-MS	0.16	0.50	1.85	0.29	0.80
293	DRC/CC-ICP-MS	0.17	0.45	1.72	0.27	0.75
597	ICP-MS/MS	0.165	0.452	1.69	0.278	0.722

### Summary Statistics

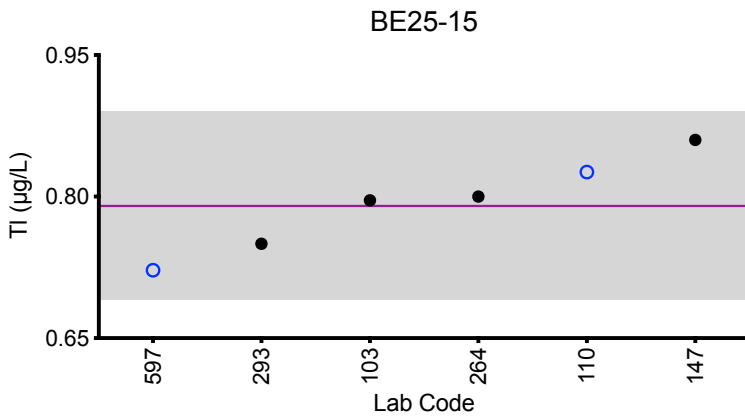
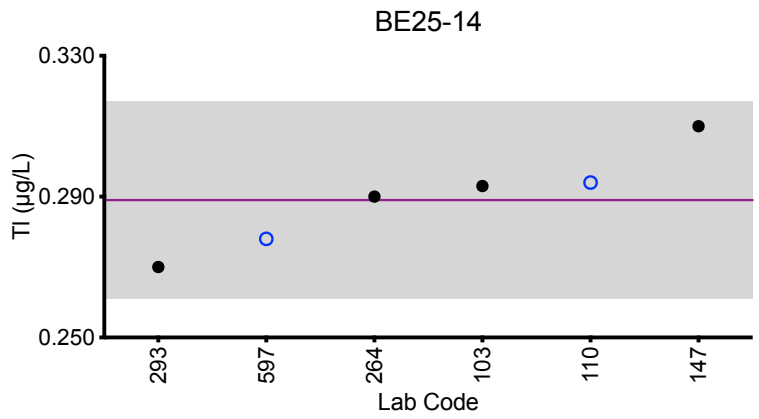
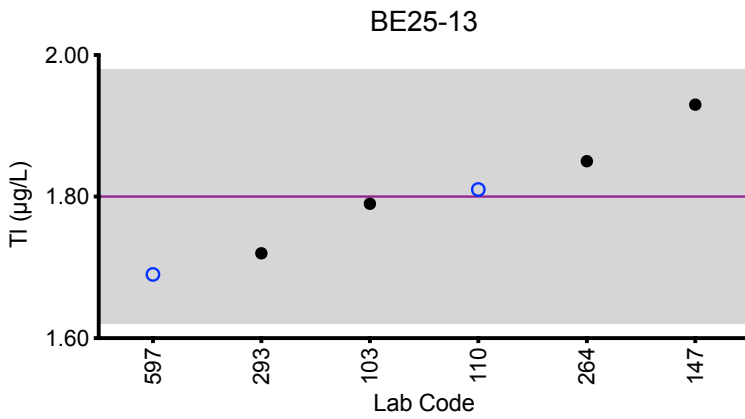
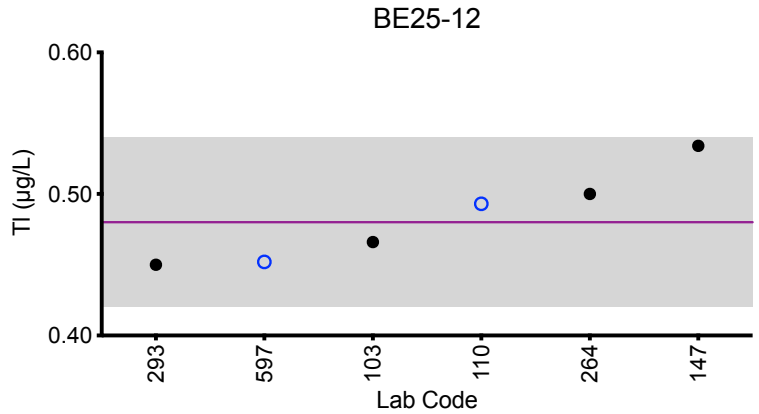
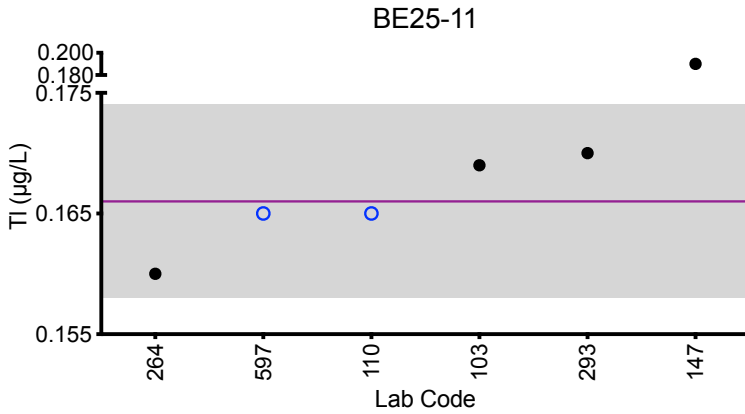
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	0.166	0.48	1.80	0.289	0.79
Arithmetic SD (s)	0.004	0.03	0.09	0.014	0.05
Arithmetic RSD (%)	2.4	6.8	5.0	4.8	6.3
Number of Sample Measurements (N)	5	6	6	6	6

\*Denotes a statistical Outlier.



# Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood AI (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
147	ICP-MS	5.49	6.89	<5.13	<5.13	5.60
597	ICP-MS/MS	3.18	3.69	3.74	3.38	3.32

### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	NA	NA	NA	NA	NA
Arithmetic SD (s)	NA	NA	NA	NA	NA
Arithmetic RSD (%)	NA	NA	NA	NA	NA
Number of Sample Measurements (N)	NA	NA	NA	NA	NA

\*Denotes a statistical Outlier.

Statistical data was not calculated for BE25-11 through BE25-15 based on a lack of consensus among participating labs.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Whole Blood Ba (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	3.26	4.47	1.89	8.00	6.04
147	ICP-MS	2.90	4.16	1.65	6.94	4.74
597	ICP-MS/MS	3.22	4.37	1.78	7.74	5.11
Summary Statistics						
		BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )		3.1	4.33	1.77	7.6	5.3
Arithmetic SD (s)		0.2	0.16	0.12	0.6	0.7
Arithmetic RSD (%)		6.4	3.7	6.8	7.9	13
Number of Sample Measurements (N)		3	3	3	3	3

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Whole Blood Be (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	2.00	0.80	5.39	3.62	1.18
147	ICP-MS	2.08	<0.991	5.27	3.41	1.02
597	ICP-MS/MS	2.06	0.678	5.17	3.35	1.08
Summary Statistics						
		BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )		2.05	0.74	5.28	3.46	1.09
Arithmetic SD (s)		0.04	0.09	0.11	0.14	0.08
Arithmetic RSD (%)		2.0	12	2.1	4.0	7.3
Number of Sample Measurements (N)		3	2	3	3	3

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Whole Blood Cs (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	1.58	1.55	1.44	1.78	1.68
147	ICP-MS	1.71	1.67	1.50	1.83	1.81
597	ICP-MS/MS	1.56	1.57	1.44	1.77	1.72
Summary Statistics						
		BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )		1.62	1.60	1.46	1.79	1.74
Arithmetic SD (s)		0.08	0.06	0.03	0.03	0.07
Arithmetic RSD (%)		4.9	3.8	2.1	1.7	4.0
Number of Sample Measurements (N)		3	3	3	3	3

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood Cu (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	1360	1230	994	833	1080
147	ICP-MS	1401	1236	979	807	1078
247	ICP-MS/MS	1486	1369	1081	969	1242
597	ICP-MS/MS	1420	1290	1010	851	1140

### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	1420	1280	1020	870	1140
Arithmetic SD (s)	50	60	50	70	80
Arithmetic RSD (%)	3.5	4.7	4.9	8.0	7.0
Number of Sample Measurements (N)	4	4	4	4	4

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Whole Blood I ( $\mu\text{g/L}$ )						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
147	ICP-MS	37.4	36.6	28.4	41.7	41.5
597	ICP-MS/MS	37.7	36.6	27.9	42.9	42.6

Summary Statistics						
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15	
Arithmetic Mean ( $\bar{x}$ )	37.5	36.6	28.2	42.3	42.1	
Arithmetic SD (s)	0.2	0.0	0.4	0.8	0.8	
Arithmetic RSD (%)	0.53	0.0	1.4	1.9	1.9	
Number of Sample Measurements (N)	2	2	2	2	2	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood Li (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
147	ICP-MS	0.855	0.810	0.807	1.49	1.49
597	ICP-MS/MS	0.835	0.920	0.883	1.73	1.70

### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	0.85	0.86	0.84	1.6	1.6
Arithmetic SD (s)	0.01	0.08	0.05	0.2	0.2
Arithmetic RSD (%)	1.7	9.3	6.0	11	9.4
Number of Sample Measurements (N)	2	2	2	2	2

\*Denotes a statistical Outlier.



### Results for Event #3, 2025: Laboratory Data and Summary Statistics

#### Whole Blood Ni (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
103	ICP-MS/MS	5.21	1.57	2.85	<1.50	4.11
110	ICP-MS/MS	6.26	2.13	3.74	*1.21	5.21
147	ICP-MS	5.27	1.22	2.48	0.549	3.68
597	ICP-MS/MS	5.60	1.58	2.57	0.566	4.04

#### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	5.6	1.6	2.9	0.56	4.3
Arithmetic SD (s)	0.5	0.4	0.6	0.01	0.7
Arithmetic RSD (%)	8.9	25	21	2.2	16
Number of Sample Measurements (N)	4	4	4	2	4

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Whole Blood Pt ( $\mu\text{g/L}$ )						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	0.069	0.211	0.523	0.119	1.49
293	DRC/CC-ICP-MS	0.10	0.21	0.40	0.11	1.25

Summary Statistics						
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15	
Arithmetic Mean ( $\bar{x}$ )	0.08	0.211	0.46	0.115	1.4	
Arithmetic SD (s)	0.02	0.001	0.09	0.006	0.2	
Arithmetic RSD (%)	25	0.33	20	5.2	12	
Number of Sample Measurements (N)	2	2	2	2	2	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood Sn (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	0.52	2.60	0.27	1.76	0.87
147	ICP-MS	0.505	2.46	<0.439	1.63	0.742
597	ICP-MS/MS	0.497	2.59	0.218	1.77	0.732

### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	0.507	2.55	0.24	1.72	0.78
Arithmetic SD (s)	0.012	0.08	0.04	0.08	0.08
Arithmetic RSD (%)	2.4	3.1	17	4.7	10
Number of Sample Measurements (N)	3	3	2	3	3

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood Sr (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
103	ICP-MS/MS	27.0	26.7	34.4	36.6	37.0
110	ICP-MS/MS	27.1	27.4	34.1	37.5	38.6
147	ICP-MS	26.9	26.6	33.6	36.2	35.9
597	ICP-MS/MS	27.7	27.2	34.4	38.4	38.2

### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	27.2	27.0	34.1	37.2	37.4
Arithmetic SD (s)	0.4	0.4	0.4	0.1	1.2
Arithmetic RSD (%)	1.5	1.5	1.2	2.7	3.2
Number of Sample Measurements (N)	4	4	4	4	4

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Whole Blood Ti (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
200	DRC/CC-ICP-MS	9.0	2.9	6.3	4.9	4.3
597	ICP-MS/MS	8.12	3.28	6.17	5.63	4.13

Summary Statistics						
	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15	
Arithmetic Mean ( $\bar{x}$ )	8.6	3.1	6.24	5.3	4.21	
Arithmetic SD (s)	0.6	0.3	0.09	0.5	0.12	
Arithmetic RSD (%)	7.0	9.7	1.4	9.4	2.9	
Number of Sample Measurements (N)	2	2	2	2	2	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Whole Blood U (µg/L)						
Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
103	ICP-MS/MS	0.190	0.0314	0.119	0.0617	0.0931
110	ICP-MS/MS	0.201	0.0337	0.125	0.0647	0.101
147	ICP-MS	0.204	0.0329	0.118	0.0607	0.0910
597	ICP-MS/MS	0.211	0.0351	0.124	0.0640	0.0953
Summary Statistics						
		BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )		0.202	0.0333	0.122	0.0628	0.095
Arithmetic SD (s)		0.009	0.0015	0.004	0.0019	0.004
Arithmetic RSD (%)		4.5	4.5	3.3	3.0	4.2
Number of Sample Measurements (N)		4	4	4	4	4

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood V (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	0.31	3.26	0.87	*0.06	1.44
147	DRC/CC-ICP-MS	0.252	3.14	0.791	0.0236	1.26
597	ICP-MS/MS	0.314	3.21	0.838	0.0166	1.29

### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	0.29	3.20	0.83	0.020	1.33
Arithmetic SD (s)	0.03	0.06	0.04	0.005	0.10
Arithmetic RSD (%)	10	1.9	4.8	25	7.5
Number of Sample Measurements (N)	3	3	3	2	3

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood W (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	0.36	0.08	0.13	0.78	0.49
597	ICP-MS/MS	0.353	0.0915	0.121	0.672	0.415

### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	0.356	0.086	0.126	0.73	0.45
Arithmetic SD (s)	0.005	0.008	0.006	0.08	0.05
Arithmetic RSD (%)	1.4	9.3	4.8	11	11
Number of Sample Measurements (N)	2	2	2	2	2

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Whole Blood Zn (µg/L)

Lab Code	Method	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
110	ICP-MS/MS	5570	10100	8530	5260	4520
147	ICP-MS	5305	9442	7929	4730	3875
247	ICP-MS/MS	4500	8840	7345	4255	3495
597	ICP-MS/MS	5650	10700	8580	5280	4350

### Summary Statistics

	BE25-11	BE25-12	BE25-13	BE25-14	BE25-15
Arithmetic Mean ( $\bar{x}$ )	5300	9800	8100	4900	4100
Arithmetic SD (s)	500	800	600	500	500
Arithmetic RSD (%)	9.4	8.2	7.4	10	12
Number of Sample Measurements (N)	4	4	4	4	4

\*Denotes a statistical Outlier.



Results for Event #3, 2025:
Additional Elements in Whole Blood

Whole Blood Ag (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Row 1: 147, ICP-MS, <0.129, 0.148, <0.129, 0.274, 0.265

Whole Blood Bi (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Rows 1-2: 147, ICP-MS, <0.0376, <0.0376, <0.0376, <0.0376, <0.0376; 597, ICP-MS/MS, <0.00589, <0.00589, <0.00589, <0.00589, <0.00589

Whole Blood Br (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Row 1: 597, ICP-MS/MS, 2230, 2260, 2170, 3520, 3460

Whole Blood Ca (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Row 1: 597, ICP-MS/MS, 50500, 50500, 56000, 56600, 56200

Whole Blood Cl (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Row 1: 597, ICP-MS/MS, 4130000, 4130000, 4440000, 4650000, 4950000

Whole Blood Fe (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Row 1: 597, ICP-MS/MS, 343000, 340000, 306000, 285000, 281000

Whole Blood Ga (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Row 1: 597, ICP-MS/MS, <0.0360, <0.0360, <0.0360, <0.0360, <0.0360

Whole Blood Mg (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Row 1: 597, ICP-MS/MS, 38000, 38700, 30300, 33300, 32700

Whole Blood S (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Row 1: 597, ICP-MS/MS, 1430000, 1420000, 1420000, 1320000, 1310000

Whole Blood Te (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Rows 1-2: 110, ICP-MS/MS, 0.035, 0.034, 0.042, 0.027, 0.019; 147, ICP-MS, <0.0740, <0.0740, <0.0740, <0.0740, <0.0740

Whole Blood Th (µg/L)

Table with 7 columns: Lab Code, Method, BE25-11, BE25-12, BE25-13, BE25-14, BE25-15. Rows 1-2: 147, ICP-MS, <0.0255, <0.0255, <0.0255, <0.0255, <0.0255; 597, ICP-MS/MS, 0.0114, 0.00417, 0.00362, <0.00158, <0.00158



**Department  
of Health**

**Wadsworth  
Center**

**Event #3, 2025**

**Trace Elements in  
Urine**

**Wadsworth Center**  
NEW YORK STATE DEPARTMENT OF HEALTH  
*Trace Elements Laboratory*



## Event #3, 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). Urine samples were homogenized overnight prior to aliquoting 10-mL into polypropylene vials. PT samples were stored at -80°C until the week of the PT event, when they were thawed at 4°C prior to circulation to laboratories for analysis.

### Graded Elements

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

### Additional Elements

An additional 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 #3, 2025: Summary Statistics

	Urine As (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	3.0	24.1	36.8	13.5	8.7
<b>Upper Limit</b>	9.0	30.1	44.2	19.5	14.7
<b>Lower Limit</b>	0.0	18.1	29.4	7.5	2.7
<b>Robust SD (s*)</b>	0.3	1.6	2.4	0.9	0.8
<b>Robust RSD (%)</b>	9.1	6.6	6.5	6.7	9.2
<b>Number of Sample Measurements (N)</b>	9	11	11	11	11
<b>Standard Uncertainty (u)</b>	NA	0.6	0.9	0.3	0.3

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 UE25-11.



### Results for Event #3, 2025: Performance of Participating Laboratories

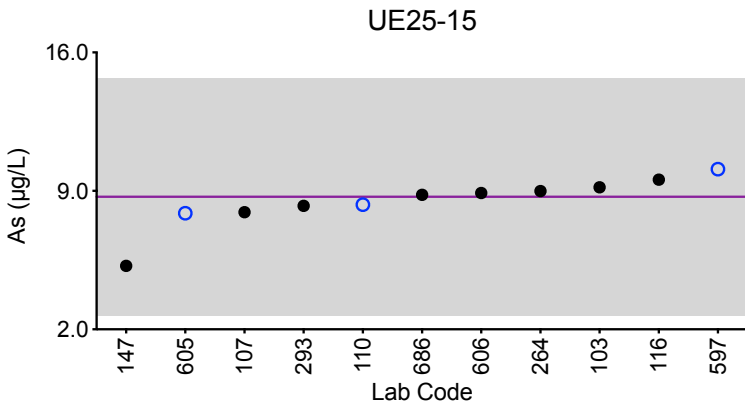
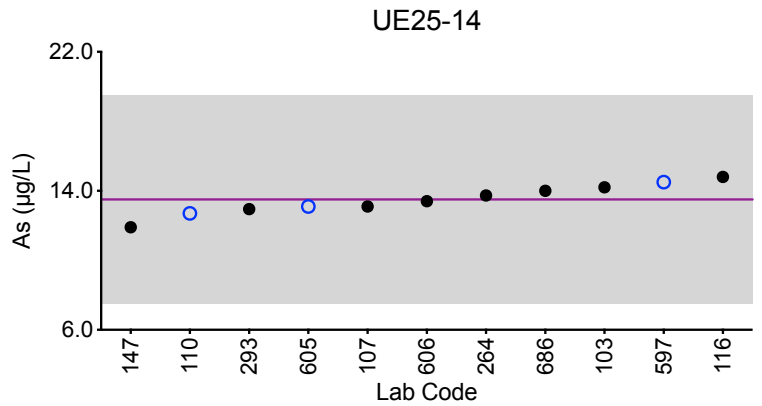
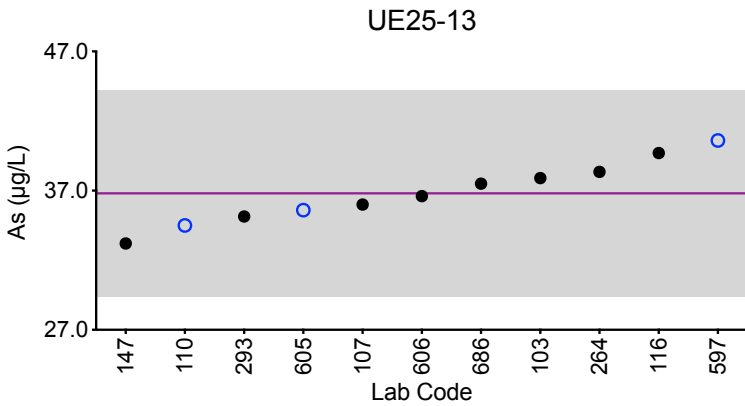
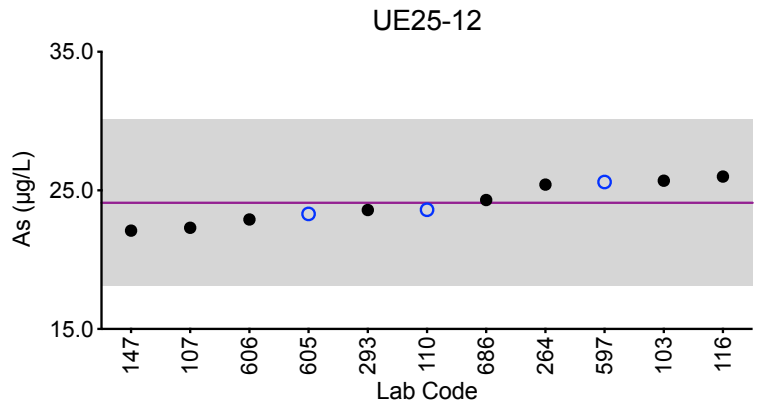
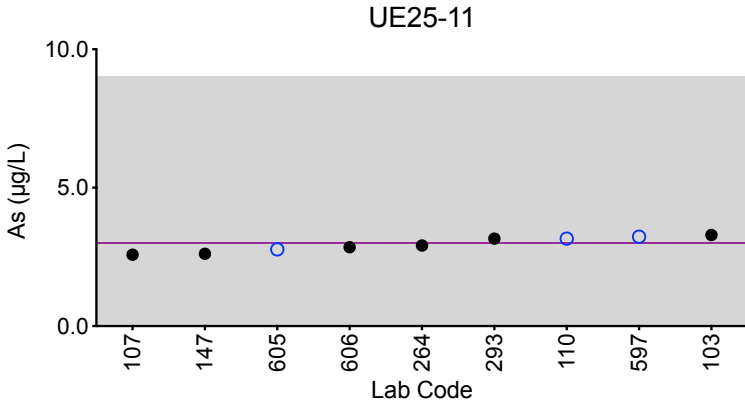
Urine As (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	Target	3.0	24.1	36.8	13.5	8.7
103	ICP-MS/MS	3.29	25.7	37.9	14.2	9.18
107	DRC/CC-ICP-MS	2.58	22.3	36.0	13.1	7.92
110	ICP-MS/MS	3.16	23.6	34.5	12.7	8.30
116	ICP-MS/MS	<6.00	26.0	39.7	14.8	9.57
147	ICP-MS	2.61	22.1	33.2	11.9	5.21
264	ICP-MS	2.91	25.42	38.35	13.73	8.99
293	DRC/CC-ICP-MS	3.16	23.58	35.14	12.95	8.24
597	ICP-MS/MS	3.23	25.6	40.6	14.5	10.1
605	ICP-MS	2.77	23.3	35.6	13.1	7.87
606	ICP-MS/MS	2.85	22.9	36.6	13.4	8.89
686	ICP-MS/MS	<6.00	24.3	37.5	14.0	8.80

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 #3, 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:

±6 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±6 µg/L at concentrations less than or equal to 30 µg/L.



## Results for Event #3, 2025: Summary Statistics

	Urine Ba (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	3.64	1.23	2.20	4.67	0.78
<b>Upper Limit</b>	4.64	2.23	3.20	5.67	1.78
<b>Lower Limit</b>	2.64	0.23	1.20	3.67	0.00
<b>Arithmetic SD (s)</b>	0.17	0.05	0.11	0.14	0.06
<b>Arithmetic RSD (%)</b>	4.7	4.0	5.0	3.0	7.7
<b>Number of Sample Measurements (N)</b>	9	9	8	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 #3, 2025: Performance of Participating Laboratories

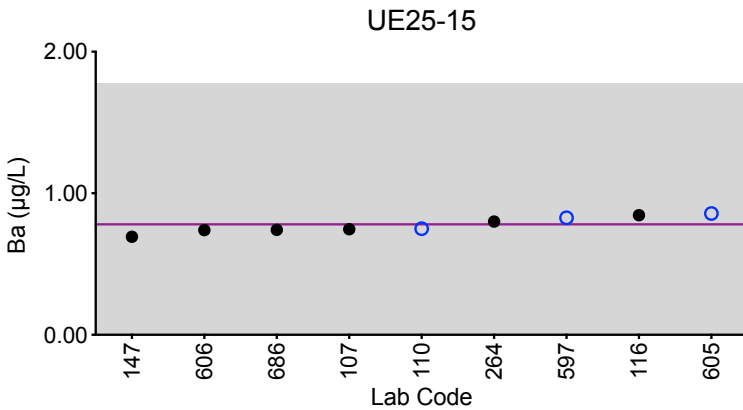
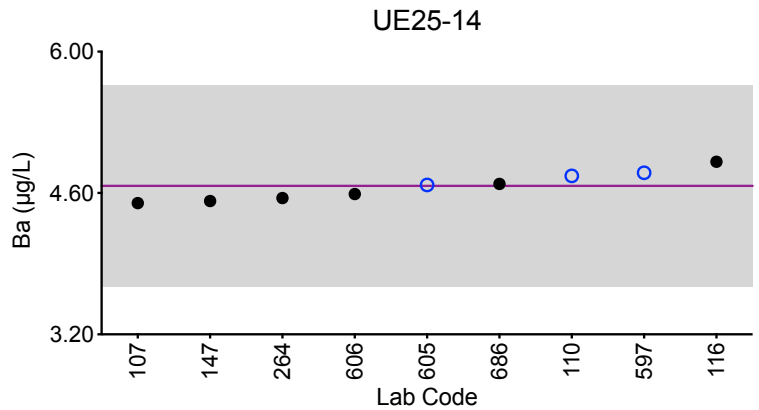
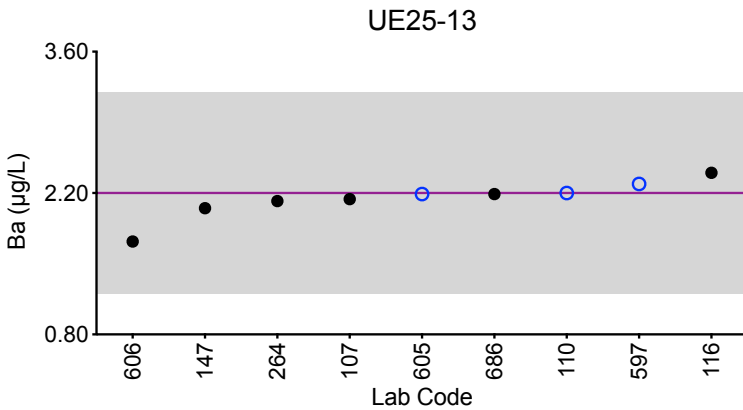
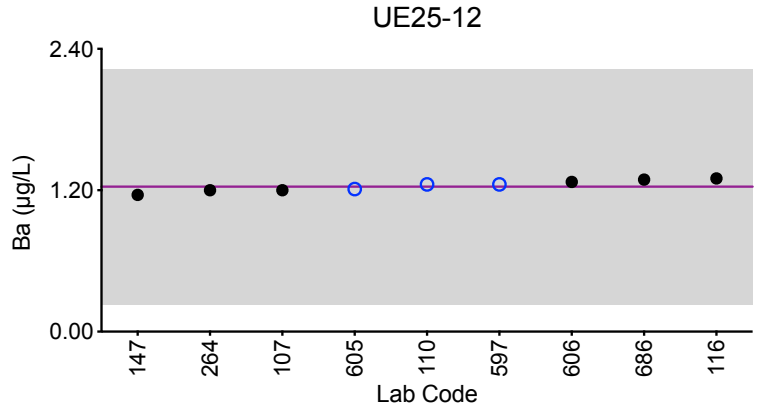
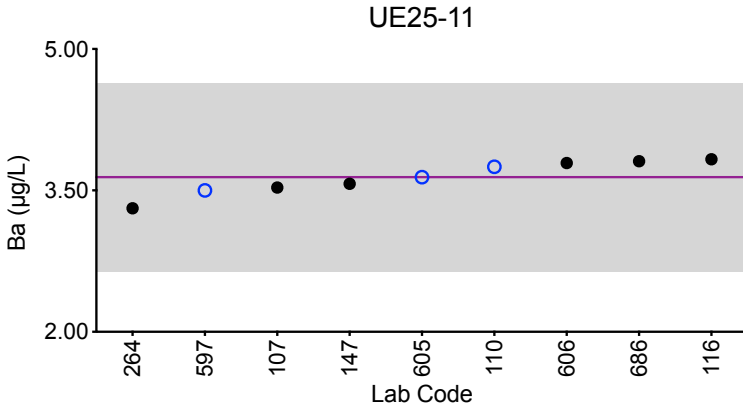
		Urine Ba (µg/L)				
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	<b>Target</b>	<b>3.64</b>	<b>1.23</b>	<b>2.20</b>	<b>4.67</b>	<b>0.78</b>
107	ICP-MS	3.53	1.20	2.14	4.50	0.746
110	ICP-MS/MS	3.75	1.25	2.20	4.77	0.75
116	ICP-MS/MS	3.83	1.30	2.40	4.91	0.845
147	ICP-MS	3.57	1.16	2.05	4.52	0.693
264	ICP-MS	3.31	1.20	2.12	4.55	0.80
597	ICP-MS/MS	3.50	1.25	2.29	4.80	0.827
605	ICP-MS	3.64	1.21	2.19	4.68	0.857
606	ICP-MS/MS	3.79	1.27	*1.72	4.59	0.740
686	ICP-MS/MS	3.81	1.29	2.19	4.69	0.741

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 #3, 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 #3, 2025: Summary Statistics

	Urine Be (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	0.47	2.56	1.27	0.352	0.78
<b>Upper Limit</b>	1.47	3.56	2.27	1.352	1.78
<b>Lower Limit</b>	0.00	1.56	0.27	0.000	0.00
<b>Arithmetic SD (s)</b>	0.04	0.14	0.08	0.016	0.04
<b>Arithmetic RSD (%)</b>	9.0	5.4	6.3	4.5	4.7
<b>Number of Sample Measurements (N)</b>	9	9	9	8	8

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



### Results for Event #3, 2025: Performance of Participating Laboratories

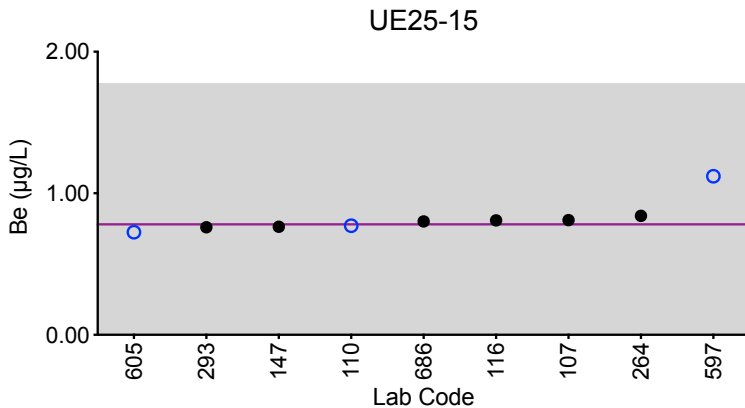
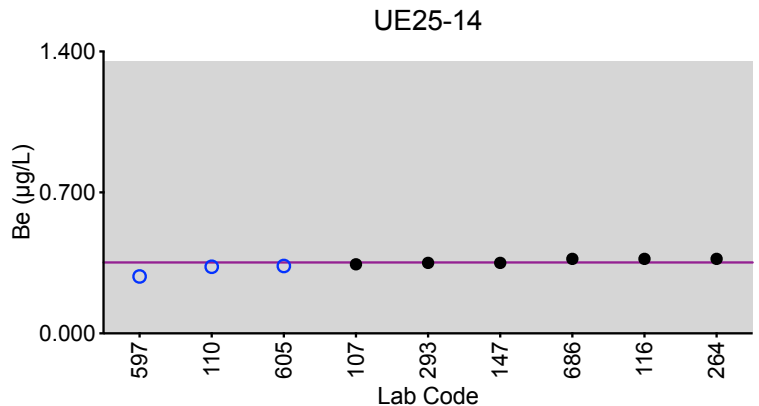
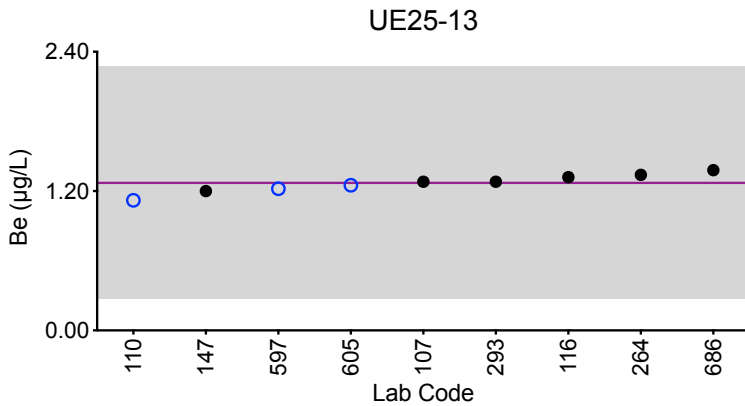
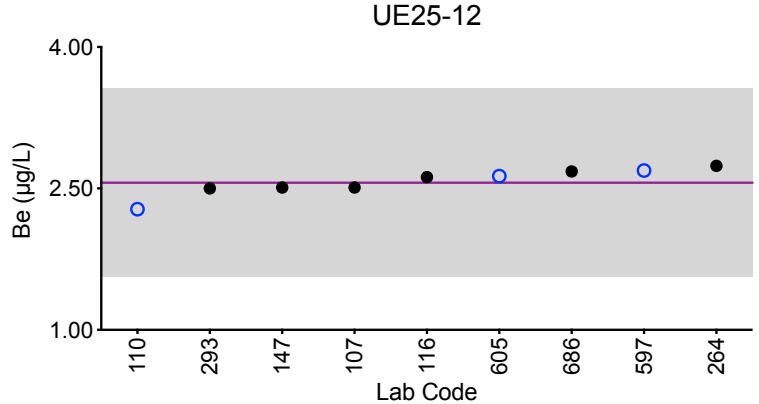
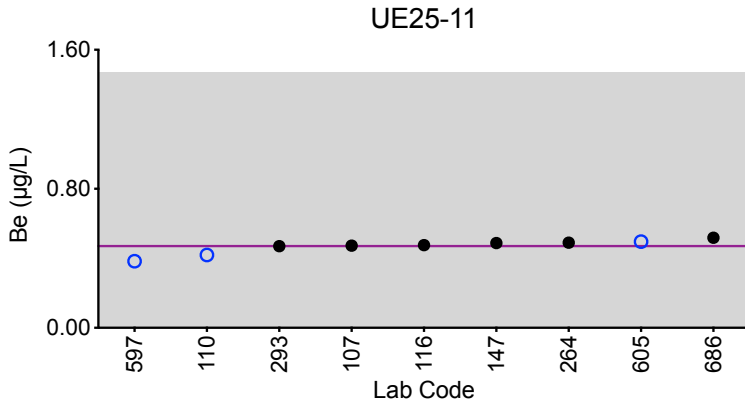
		Urine Be (µg/L)				
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	<b>Target</b>	<b>0.47</b>	<b>2.56</b>	<b>1.27</b>	<b>0.352</b>	<b>0.78</b>
107	ICP-MS	0.473	2.51	1.28	0.343	0.810
110	ICP-MS/MS	0.419	2.28	1.12	0.331	0.771
116	ICP-MS/MS	0.476	2.62	1.32	0.370	0.808
147	ICP-MS	0.488	2.51	1.20	0.350	0.763
264	ICP-MS	0.49	2.74	1.34	0.37	0.84
293	DRC/CC-ICP-MS	0.47	2.5	1.28	0.35	0.76
597	ICP-MS/MS	0.383	2.69	1.22	*0.283	*1.12
605	ICP-MS	0.496	2.63	1.25	0.335	0.725
686	ICP-MS/MS	0.518	2.68	1.38	0.370	0.801

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 #3, 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:

$\pm 1 \mu\text{g/L}$  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 #3, 2025: Summary Statistics

	Urine Cd (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	3.22	0.70	1.57	2.17	1.27
<b>Upper Limit</b>	4.22	1.70	2.57	3.17	2.27
<b>Lower Limit</b>	2.22	0.00	0.57	1.17	0.27
<b>Robust SD (s*)</b>	0.10	0.06	0.06	0.04	0.05
<b>Robust RSD (%)</b>	3.1	8.6	3.8	1.8	3.9
<b>Number of Sample Measurements (N)</b>	12	11	12	12	12
<b>Standard Uncertainty (u)</b>	0.03	0.02	0.02	0.02	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  $6.6 \mu\text{g/L}$ . 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 #3, 2025: Performance of Participating Laboratories

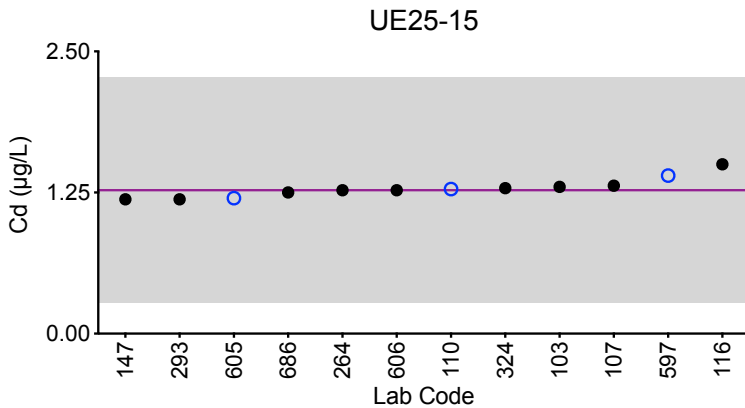
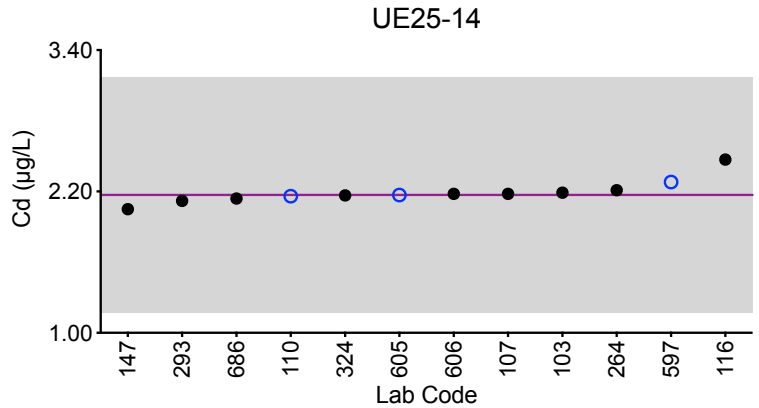
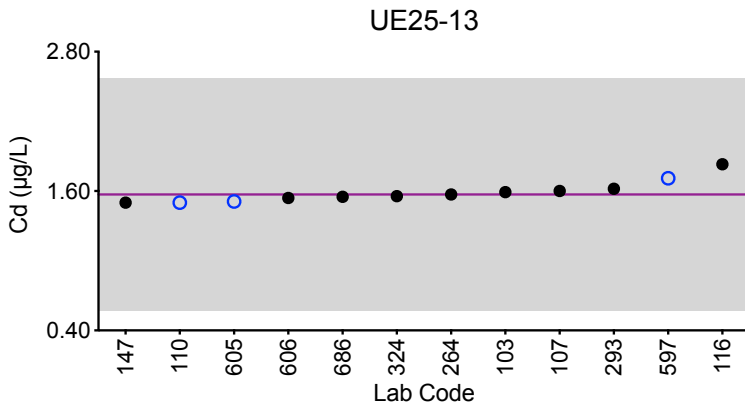
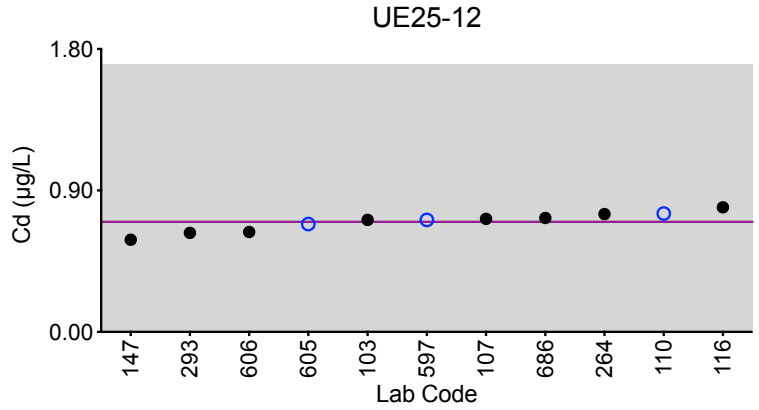
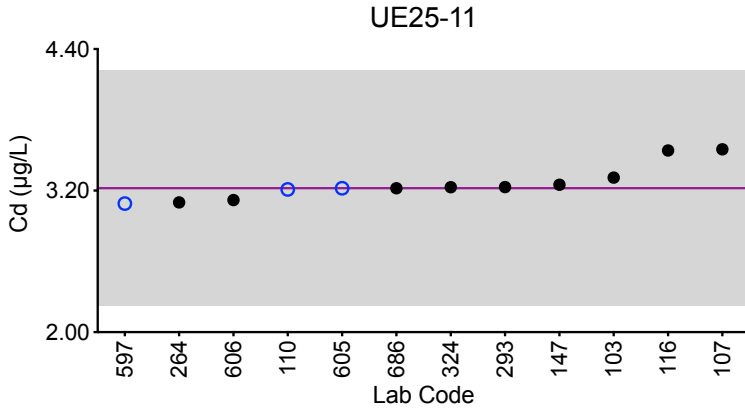
		Urine Cd (µg/L)				
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Target		3.22	0.70	1.57	2.17	1.27
103	ICP-MS/MS	3.31	0.713	1.59	2.19	1.30
107	DRC/CC-ICP-MS	3.55	0.719	1.60	2.18	1.31
110	ICP-MS/MS	3.21	0.753	1.50	2.16	1.28
116	ICP-MS/MS	3.54	0.793	1.83	2.47	1.50
147	ICP-MS	3.25	0.586	1.50	2.05	1.19
264	ICP-MS	3.10	0.75	1.57	2.21	1.27
293	DRC/CC-ICP-MS	3.23	0.63	1.62	2.12	1.19
324	ICP-MS	3.229	<1	1.556	2.166	1.289
597	ICP-MS/MS	3.09	0.713	1.71	2.28	1.40
605	ICP-MS	3.22	0.686	1.51	2.17	1.20
606	ICP-MS/MS	3.12	0.636	1.54	2.18	1.27
686	ICP-MS/MS	3.22	0.725	1.55	2.14	1.25

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 #3, 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:  
±1 µg/L or ±15% around the target value, whichever is greater; thus, it is fixed at ±1 µg/L at concentrations less than or equal to 6.6 µg/L.



### Results for Event #3, 2025: Summary Statistics

	Urine Co (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	1.00	9.17	2.07	3.87	20.8
<b>Upper Limit</b>	2.50	10.67	3.57	5.37	23.9
<b>Lower Limit</b>	0.00	7.67	0.57	2.37	17.7
<b>Robust SD (s*)</b>	0.05	0.23	0.09	0.13	0.8
<b>Robust RSD (%)</b>	4.9	2.5	4.3	3.4	3.8
<b>Number of Sample Measurements (N)</b>	10	10	10	10	10
<b>Standard Uncertainty (u)</b>	0.02	0.09	0.04	0.05	0.3

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



### Results for Event #3, 2025: Performance of Participating Laboratories

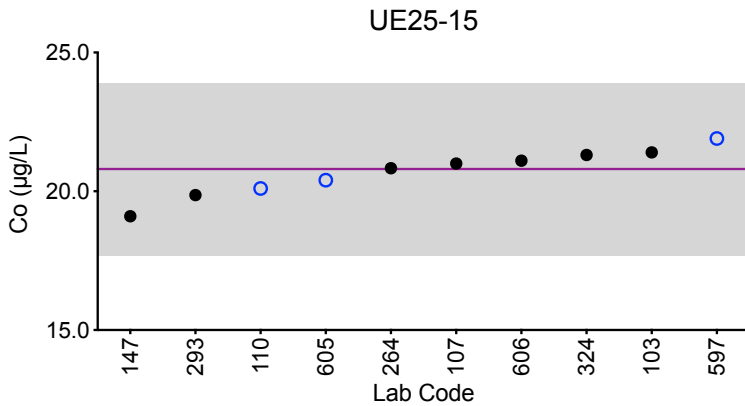
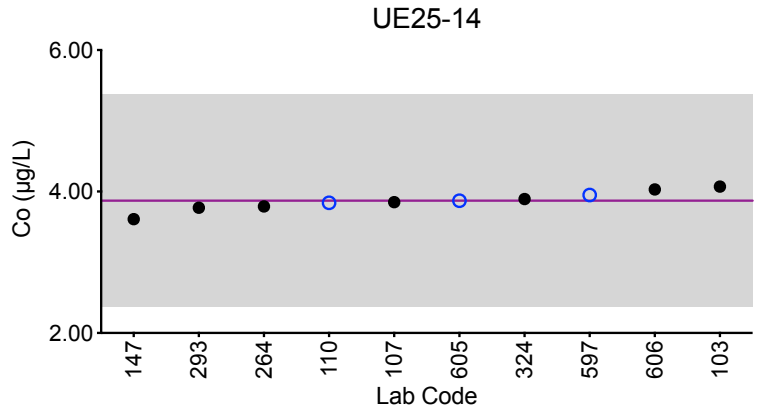
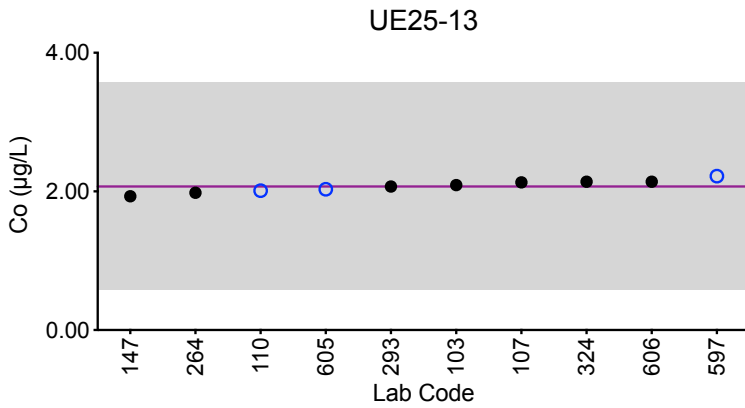
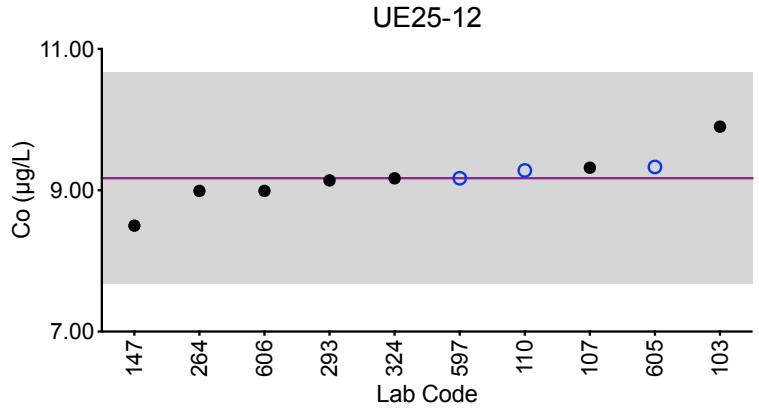
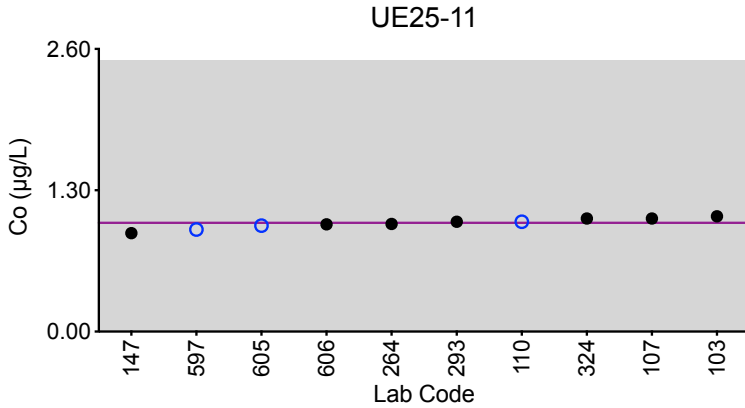
		Urine Co (µg/L)				
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	<b>Target</b>	<b>1.00</b>	<b>9.17</b>	<b>2.07</b>	<b>3.87</b>	<b>20.8</b>
103	ICP-MS/MS	1.06	9.90	2.09	4.07	21.4
107	DRC/CC-ICP-MS	1.04	9.32	2.13	3.85	21.0
110	ICP-MS/MS	1.01	9.28	2.01	3.84	20.1
147	ICP-MS	0.905	8.50	1.93	3.61	19.1
264	ICP-MS	0.99	8.99	1.98	3.79	20.83
293	DRC/CC-ICP-MS	1.01	9.14	2.07	3.77	19.86
324	ICP-MS	1.040	9.168	2.139	3.893	21.306
597	ICP-MS/MS	0.939	9.17	2.22	3.95	21.9
605	ICP-MS	0.974	9.33	2.03	3.87	20.4
606	ICP-MS/MS	0.986	8.99	2.14	4.03	21.1

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 #3, 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:  
 $\pm 1.5 \mu\text{g/L}$  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  $10 \mu\text{g/L}$ .



### Results for Event #3, 2025: Summary Statistics

	Urine Cr (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	1.04	5.3	2.72	3.67	0.61
<b>Upper Limit</b>	4.04	8.3	5.72	6.67	3.61
<b>Lower Limit</b>	0.00	2.3	0.00	0.67	0.00
<b>Robust SD (s*)</b>	0.07	0.4	0.09	0.23	0.11
<b>Robust RSD (%)</b>	6.7	7.5	3.3	6.3	18
<b>Number of Sample Measurements (N)</b>	10	10	10	10	7
<b>Standard Uncertainty (u)</b>	0.03	0.2	0.04	0.09	NA

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

An arithmetic mean, SD, RSD and n are provided for sample UE25-15.



### Results for Event #3, 2025: Performance of Participating Laboratories

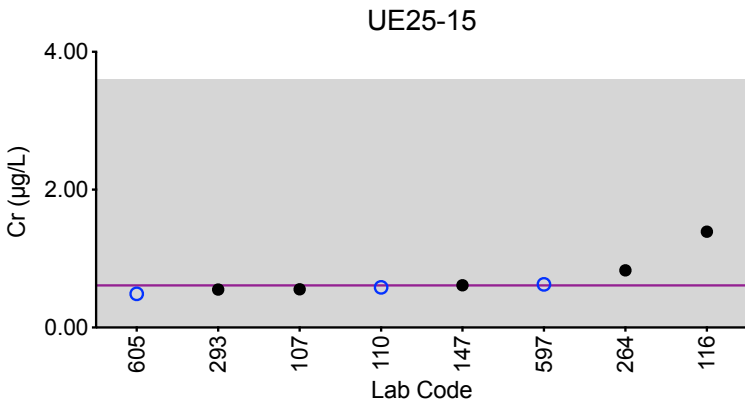
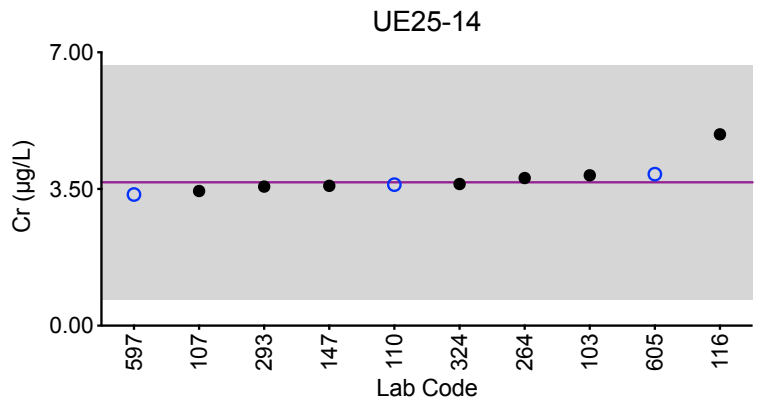
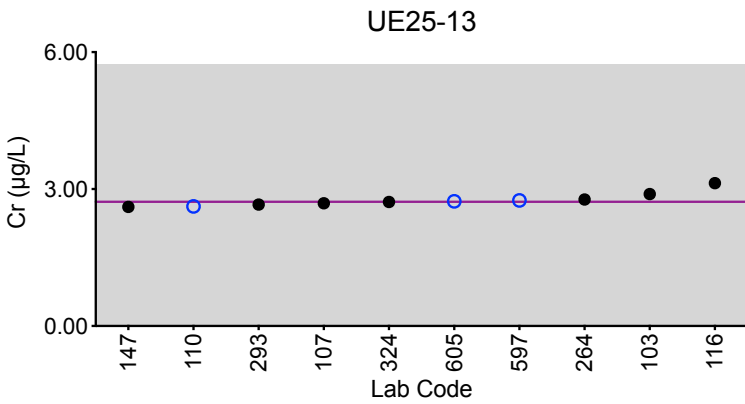
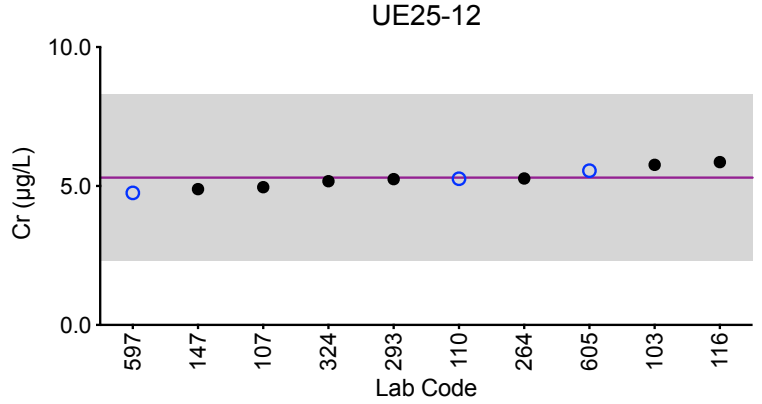
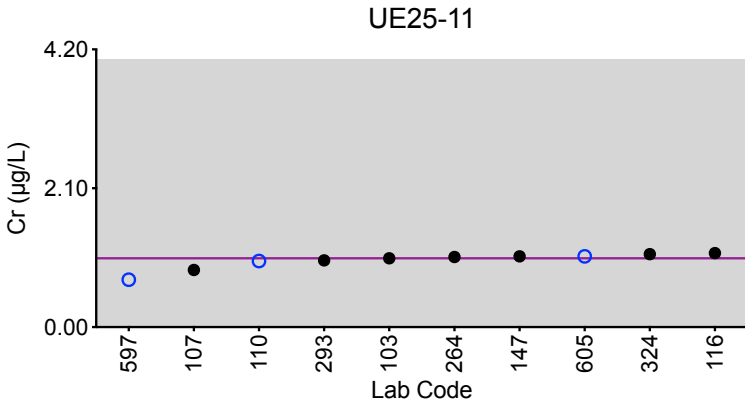
Lab Code	Method	Urine Cr (µg/L)				
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	<b>Target</b>	<b>1.04</b>	<b>5.3</b>	<b>2.72</b>	<b>3.67</b>	<b>0.61</b>
103	ICP-MS/MS	1.04	5.76	2.89	3.85	<0.600
107	DRC/CC-ICP-MS	0.864	4.96	2.69	3.45	0.554
110	ICP-MS/MS	1.00	5.26	2.62	3.61	0.582
116	ICP-MS/MS	1.12	5.86	3.13	4.90	*1.39
147	DRC/CC-ICP-MS	1.07	4.89	2.61	3.58	0.613
264	ICP-MS	1.06	5.27	2.77	3.78	0.83
293	DRC/CC-ICP-MS	1.01	5.25	2.66	3.56	0.55
324	ICP-MS	1.103	5.174	2.716	3.628	<1
597	ICP-MS/MS	0.717	4.75	2.75	3.36	0.625
605	ICP-MS	1.07	5.55	2.73	3.88	0.488

Based on the grading criteria for Cr 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 #3, 2025: Summary Figures

## Urine Cr



### 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  $\pm 20\%$  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 #3, 2025: Summary Statistics

	Urine Hg (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	15.6	2.10	5.2	9.4	0.32
<b>Upper Limit</b>	20.3	5.10	8.2	12.4	3.32
<b>Lower Limit</b>	10.9	0.00	2.2	6.4	0.00
<b>Robust SD (s*)</b>	1.1	0.23	0.5	0.8	0.10
<b>Robust RSD (%)</b>	7.1	11	9.6	8.5	31
<b>Number of Sample Measurements (N)</b>	11	11	11	11	6
<b>Standard Uncertainty (u)</b>	0.4	0.09	0.2	0.3	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 UE25-15.



### Results for Event #3, 2025: Performance of Participating Laboratories

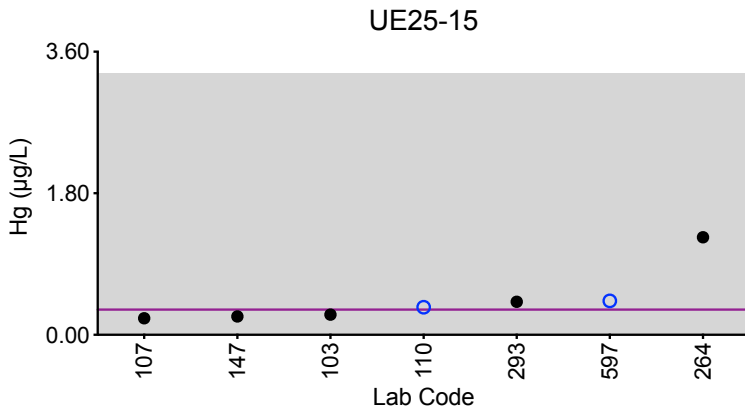
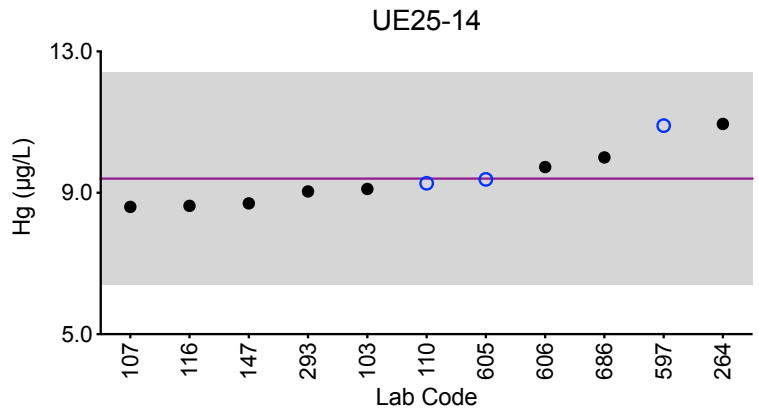
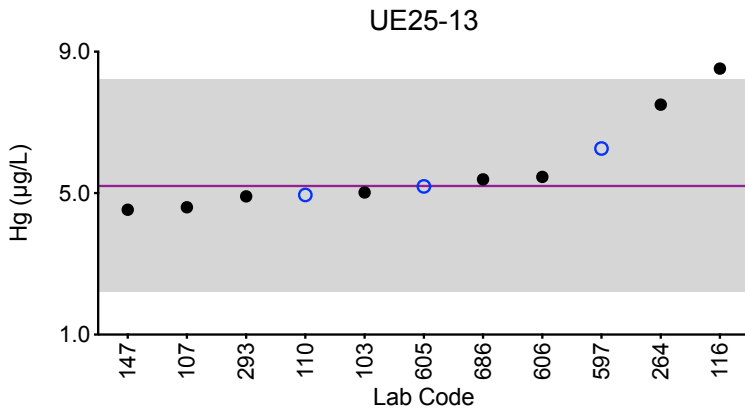
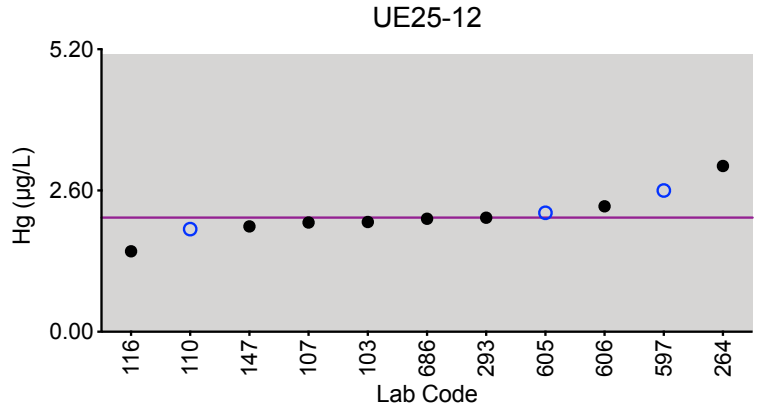
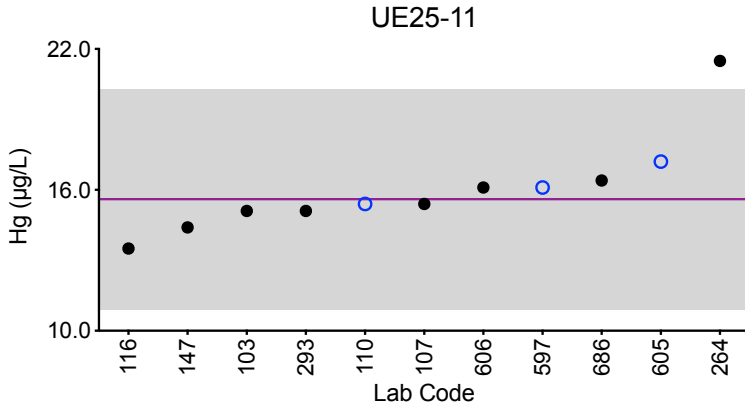
		Urine Hg (µg/L)				
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	<b>Target</b>	<b>15.6</b>	<b>2.10</b>	<b>5.2</b>	<b>9.4</b>	<b>0.32</b>
103	ICP-MS/MS	15.1	2.02	5.02	9.11	0.257
107	DRC/CC-ICP-MS	15.4	2.01	4.60	8.60	0.211
110	ICP-MS	15.4	1.89	4.95	9.27	0.35
116	ICP-MS/MS	13.5	1.48	8.52 ↑	8.63	<0.300
147	ICP-MS	14.4	1.94	4.53	8.70	0.233
264	ICP-MS	21.49 ↑	3.05	7.50	10.95	*1.24
293	DRC/CC-ICP-MS	15.1	2.1	4.91	9.04	0.42
597	ICP-MS/MS	16.1	2.60	6.26	10.9	0.432
605	ICP-MS	17.2	2.19	5.19	9.38	<1.00
606	ICP-MS/MS	16.1	2.31	5.46	9.73	<1.00
686	ICP-MS/MS	16.4	2.08	5.39	10.0	<1.00

Based on the grading criteria for Hg in Urine, 96% 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 #3, 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 #3, 2025: Summary Statistics

	Urine Mn (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	1.30	0.77	6.0	9.9	8.4
<b>Upper Limit</b>	1.85	1.32	7.5	12.4	10.5
<b>Lower Limit</b>	0.75	0.22	4.5	7.4	6.3
<b>Robust SD (s*)</b>	0.07	0.04	0.3	0.4	0.4
<b>Robust RSD (%)</b>	5.4	5.2	5.7	4.2	4.6
<b>Number of Sample Measurements (N)</b>	11	10	11	11	11
<b>Standard Uncertainty (u)</b>	0.03	0.02	0.1	0.2	0.1

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).



### Results for Event #3, 2025: Performance of Participating Laboratories

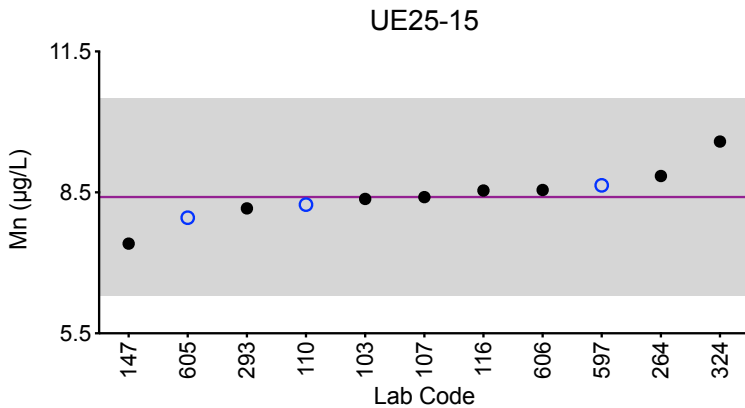
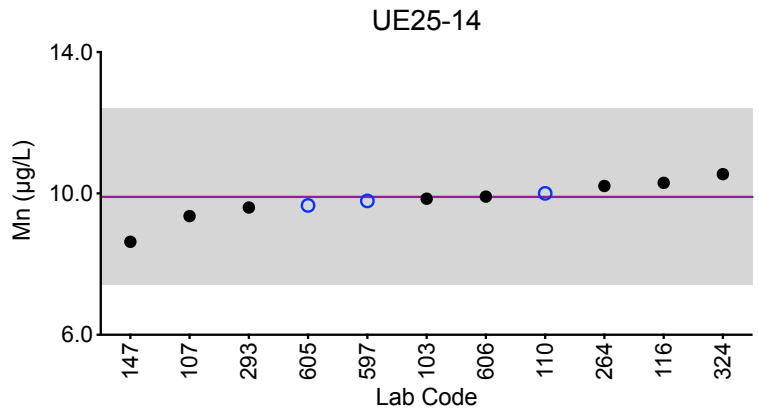
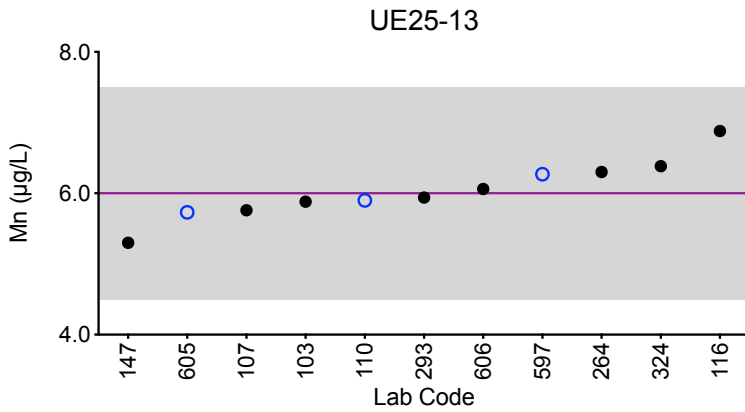
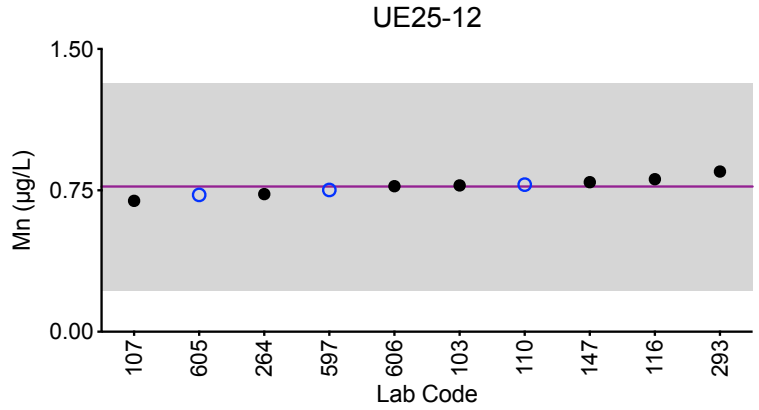
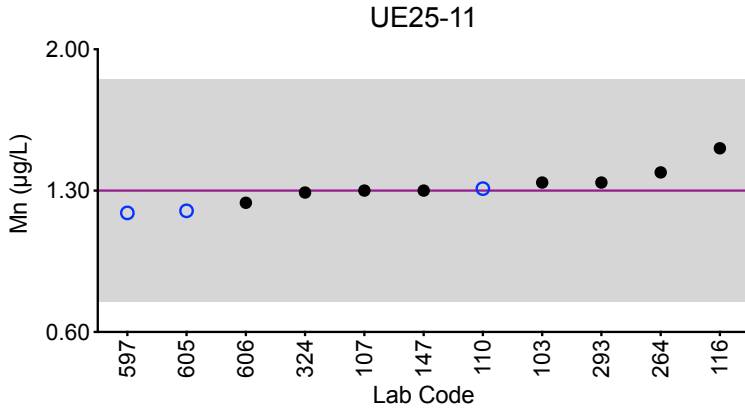
Lab Code	Method	Urine Mn (µg/L)				
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	<b>Target</b>	<b>1.30</b>	<b>0.77</b>	<b>6.0</b>	<b>9.9</b>	<b>8.4</b>
103	ICP-MS/MS	1.34	0.776	5.88	9.85	8.36
107	DRC/CC-ICP-MS	1.30	0.694	5.76	9.36	8.40
110	ICP-MS/MS	1.31	0.780	5.90	10.0	8.24
116	ICP-MS/MS	1.51	0.809	6.88	10.3	8.54
147	DRC/CC-ICP-MS	1.30	0.793	5.30	8.63	7.41
264	ICP-MS	1.39	0.73	6.3	10.21	8.85
293	DRC/CC-ICP-MS	1.34	0.85	5.94	9.6	8.16
324	ICP-MS	1.291	<1	6.383	10.544	9.582
597	ICP-MS/MS	1.19	0.752	6.27	9.79	8.65
605	ICP-MS	1.20	0.726	5.73	9.66	7.96
606	ICP-MS/MS	1.24	0.772	6.06	9.91	8.55

Based on the grading criteria for Mn 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 #3, 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 #3, 2025: Summary Statistics

	Urine Pb (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	2.58	4.52	3.74	8.02	0.684
<b>Upper Limit</b>	3.58	5.52	4.74	9.62	1.684
<b>Lower Limit</b>	1.58	3.52	2.74	6.42	0.000
<b>Robust SD (s*)</b>	0.07	0.12	0.13	0.21	0.024
<b>Robust RSD (%)</b>	2.7	2.7	3.5	2.6	3.5
<b>Number of Sample Measurements (N)</b>	12	12	12	12	11
<b>Standard Uncertainty (u)</b>	0.03	0.04	0.05	0.08	0.009

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 #3, 2025: Performance of Participating Laboratories

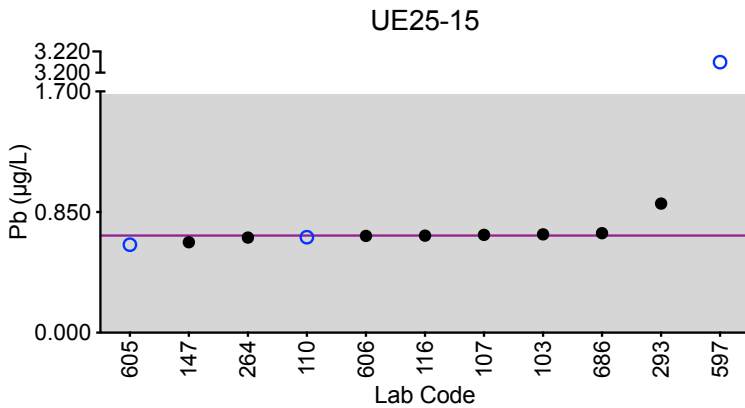
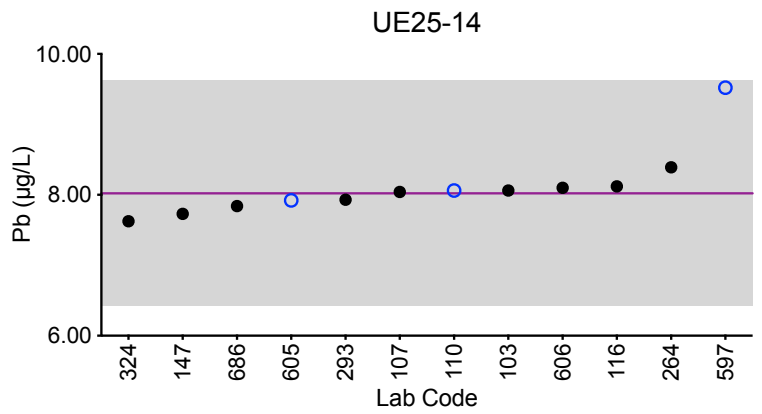
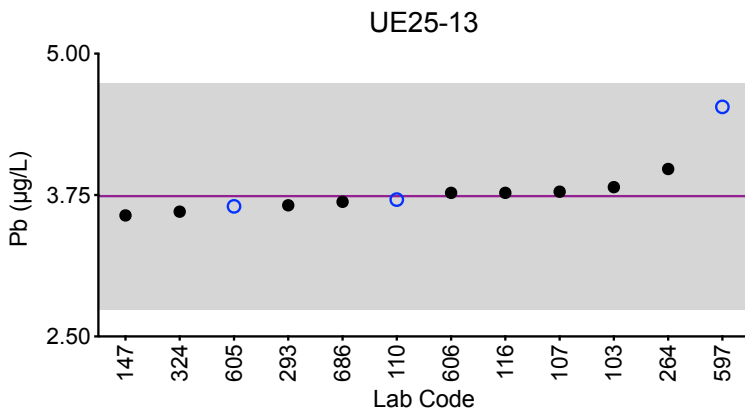
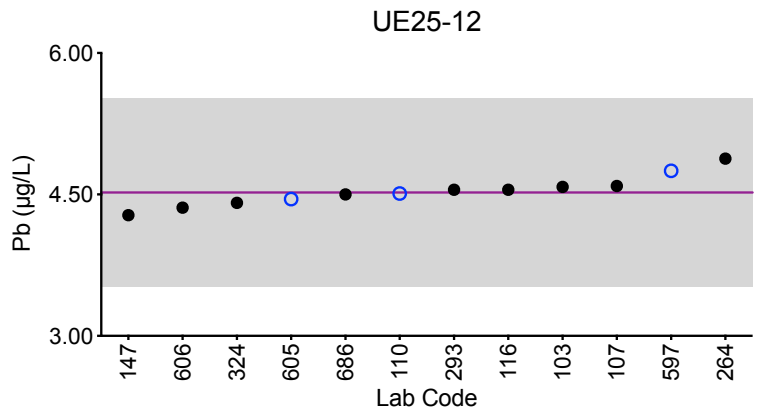
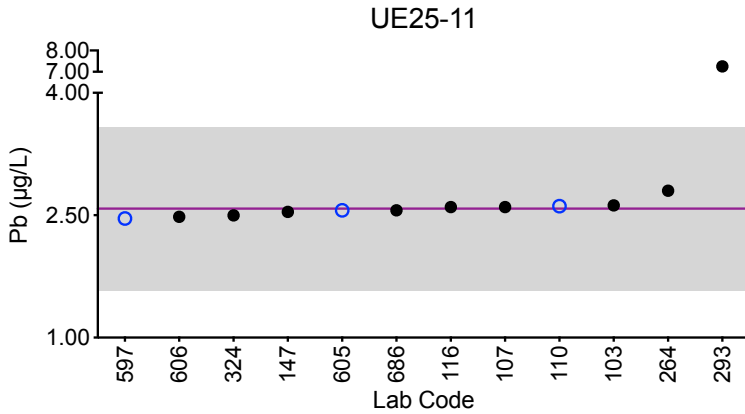
		Urine Pb (µg/L)				
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Target		2.58	4.52	3.74	8.02	0.684
103	ICP-MS/MS	2.62	4.58	3.82	8.06	0.693
107	ICP-MS	2.60	4.59	3.78	8.04	0.689
110	ICP-MS/MS	2.61	4.51	3.71	8.06	0.673
116	ICP-MS/MS	2.60	4.55	3.77	8.12	0.684
147	ICP-MS	2.54	4.28	3.57	7.73	0.637
264	ICP-MS	2.80	4.88	3.98	8.39	0.67
293	DRC/CC-ICP-MS	7.25 ↑	4.55	3.66	7.93	0.91
324	ICP-MS	2.498	4.410	3.603	7.625	<1
597	ICP-MS/MS	2.46	4.75	4.53	9.52	3.21 ↑
605	ICP-MS	2.56	4.45	3.65	7.92	0.620
606	ICP-MS/MS	2.48	4.36	3.77	8.10	0.682
686	ICP-MS	2.56	4.50	3.69	7.84	0.701

Based on the grading criteria for Pb in Urine, 97% 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 #3, 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 #3, 2025: Summary Statistics

	Urine TI (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	0.327	0.757	0.416	1.97	0.86
<b>Upper Limit</b>	0.527	0.957	0.616	2.36	1.06
<b>Lower Limit</b>	0.127	0.557	0.216	1.58	0.66
<b>Robust SD (s*)</b>	0.011	0.020	0.011	0.02	0.03
<b>Robust RSD (%)</b>	3.4	2.6	2.6	0.92	3.9
<b>Number of Sample Measurements (N)</b>	10	11	11	11	11
<b>Standard Uncertainty (u)</b>	0.004	0.008	0.004	0.01	0.01

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 #3, 2025: Performance of Participating Laboratories

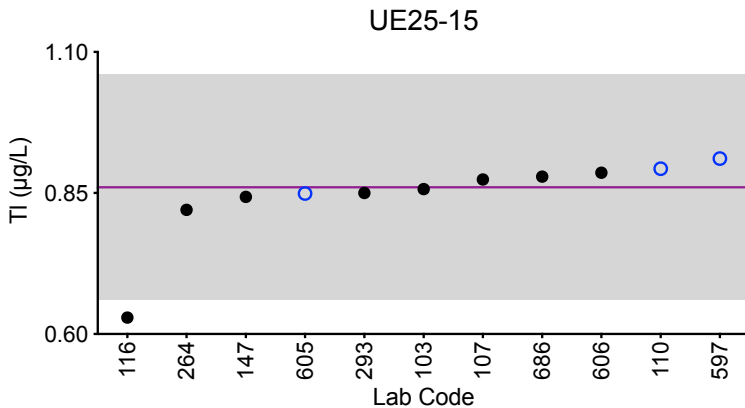
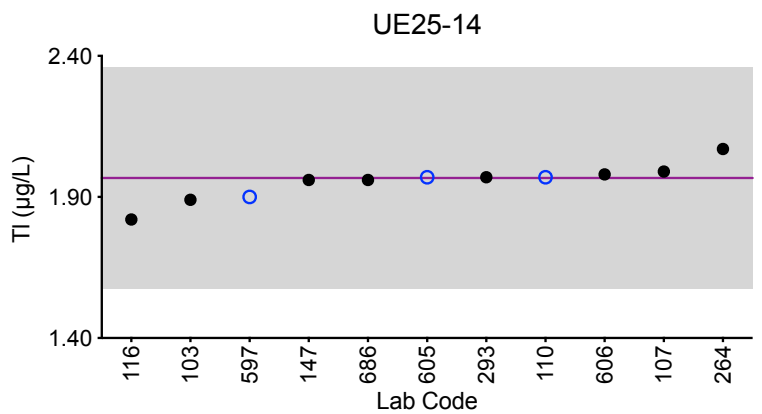
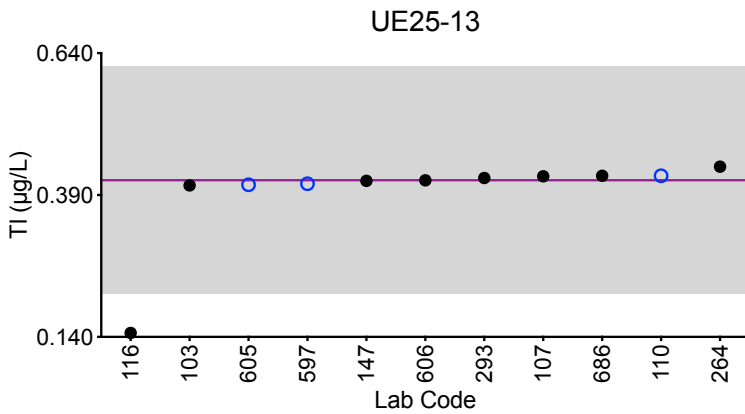
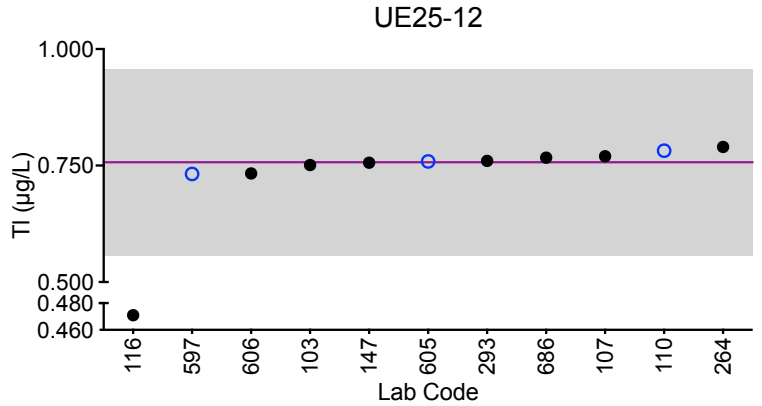
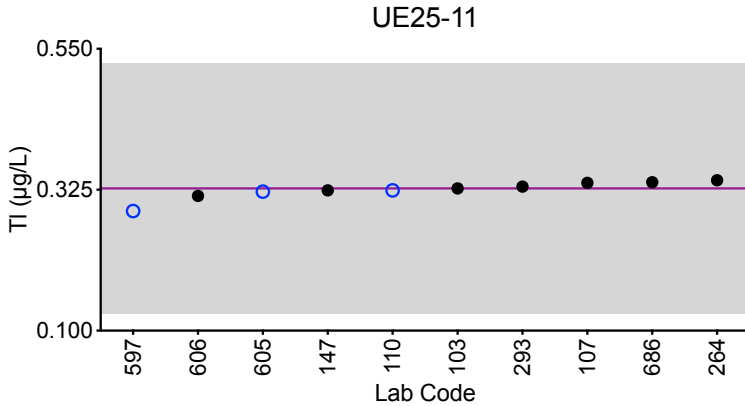
Lab Code	Method	Urine TI (µg/L)				
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	<b>Target</b>	<b>0.327</b>	<b>0.757</b>	<b>0.416</b>	<b>1.97</b>	<b>0.86</b>
103	ICP-MS/MS	0.327	0.751	0.407	1.89	0.857
107	ICP-MS	0.336	0.770	0.423	1.99	0.874
110	ICP-MS/MS	0.324	0.782	0.424	1.97	0.893
116	ICP-MS/MS	<0.120 ↓	0.471 ↓	0.147 ↓	1.82	0.629 ↓
147	ICP-MS	0.324	0.756	0.415	1.96	0.843
264	ICP-MS	0.34	0.79	0.44	2.07	0.82
293	DRC/CC-ICP-MS	0.33	0.76	0.42	1.97	0.85
597	ICP-MS/MS	0.291	0.732	0.410	1.90	0.911
605	ICP-MS	0.322	0.759	0.408	1.97	0.849
606	ICP-MS/MS	0.315	0.733	0.416	1.98	0.886
686	ICP-MS/MS	0.337	0.767	0.424	1.96	0.879

Based on the grading criteria for TI in Urine, 93% 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 #3, 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 #3, 2025: Summary Statistics

	Urine U (µg/L)				
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Target (Robust Mean (x*))</b>	0.0065	0.0231	0.138	0.036	0.092
<b>Upper Limit</b>	0.0365	0.0531	0.168	0.066	0.122
<b>Lower Limit</b>	0.0000	0.0000	0.108	0.006	0.062
<b>Robust SD (s*)</b>	0.0010	0.0017	0.009	0.003	0.006
<b>Robust RSD (%)</b>	16	7.4	6.5	8.7	6.5
<b>Number of Sample Measurements (N)</b>	6	10	11	10	10
<b>Standard Uncertainty (u)</b>	NA	0.0007	0.003	0.001	0.003

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 UE25-11.



### Results for Event #3, 2025: Performance of Participating Laboratories

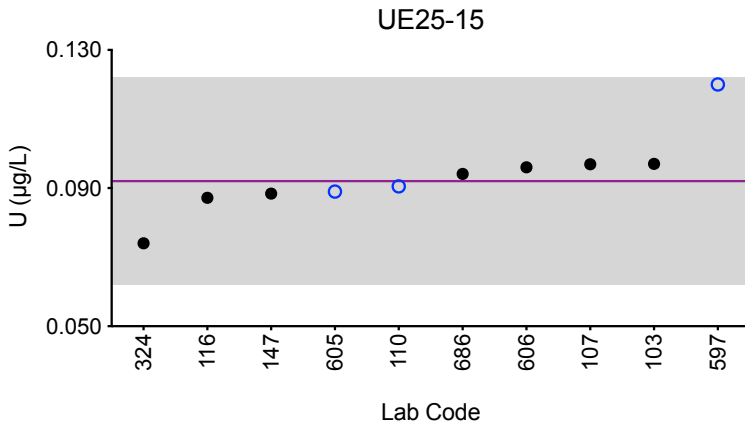
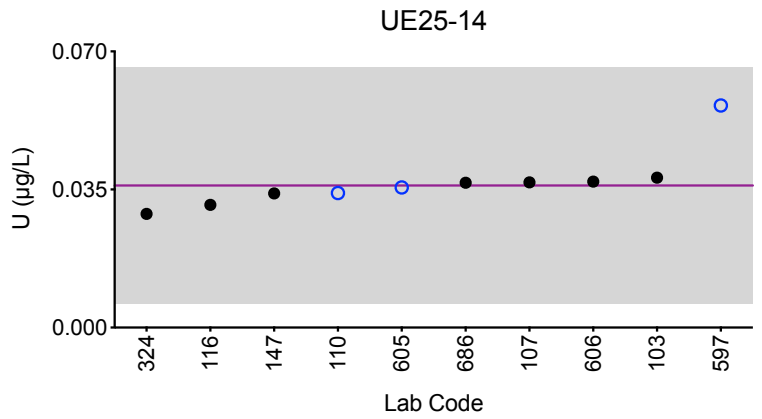
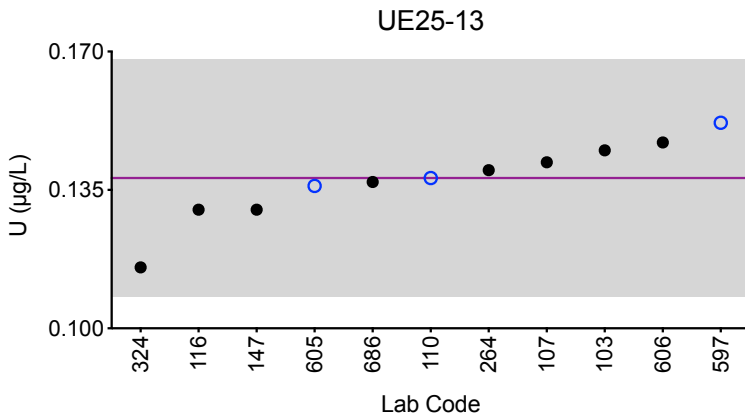
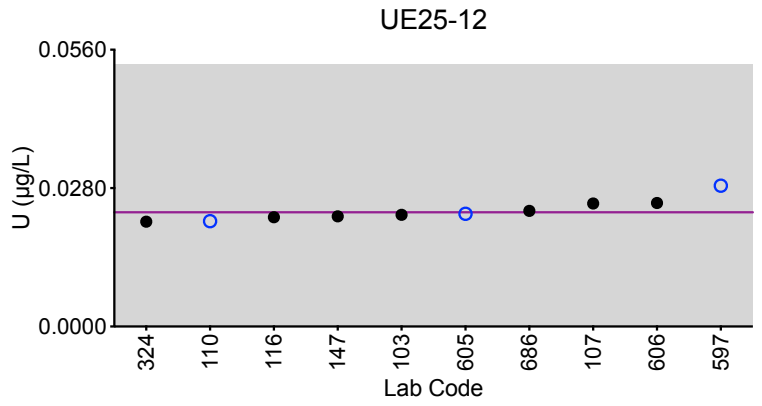
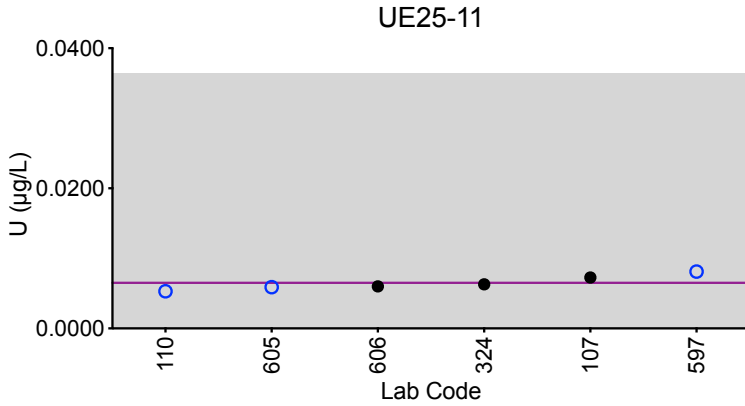
Lab Code	Method	Urine U (µg/L)				
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
	<b>Target</b>	<b>0.0065</b>	<b>0.0231</b>	<b>0.138</b>	<b>0.036</b>	<b>0.092</b>
103	ICP-MS/MS	<0.0100	0.0226	0.145	0.0380	0.0970
107	ICP-MS	0.00727	0.0249	0.142	0.0368	0.0969
110	ICP-MS/MS	0.0053	0.0213	0.138	0.0341	0.0905
116	ICP-MS/MS	<0.0150	0.0221	0.130	0.0311	0.0872
147	ICP-MS	<0.00738	0.0223	0.130	0.0340	0.0884
264	ICP-MS	<0.10	<0.10	0.14	<0.10	<0.10
324	ICP-MS	0.0063	0.0212	0.1154	0.0288	0.0740
597	ICP-MS/MS	0.00811	0.0285	0.152	0.0563	0.120
605	ICP-MS	0.00589	0.0228	0.136	0.0355	0.0890
606	ICP-MS/MS	0.006	0.025	0.147	0.037	0.096
686	ICP-MS/MS	<0.0150	0.0234	0.137	0.0367	0.0941

Based on the grading criteria for U 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 #3, 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:  
±0.03 µg/L or ±20% around the target value, whichever is greater; thus, it is fixed at ±0.03 µg/L at concentrations less than or equal to 0.15 µg/L.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Urine AI (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
147	ICP-MS	<13.5	<13.5	18.9	<13.5	<13.5
264	ICP-MS	12.17	5.85	16.37	9.04	8.92
293	DRC/CC-ICP-MS	13.76	5.94	19.43	10.25	8.9
324	ICP-MS	11.611	7.202	18.628	9.938	11.168
597	ICP-MS/MS	11.7	5.63	*42.8	9.06	8.51

### Summary Statistics

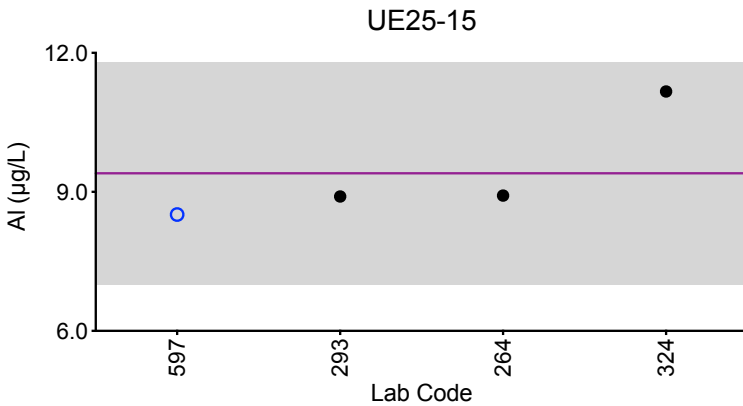
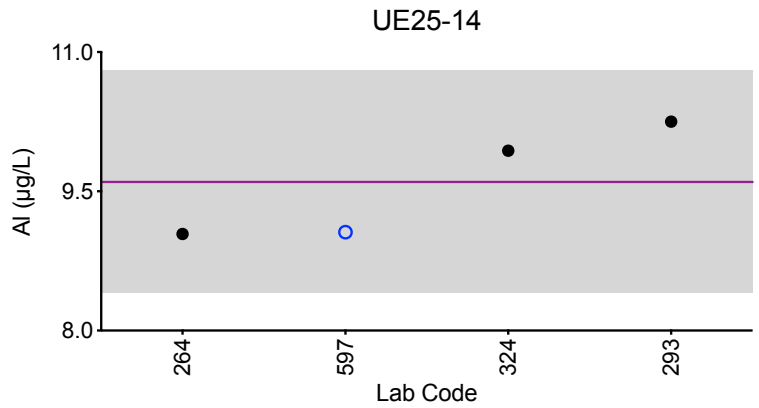
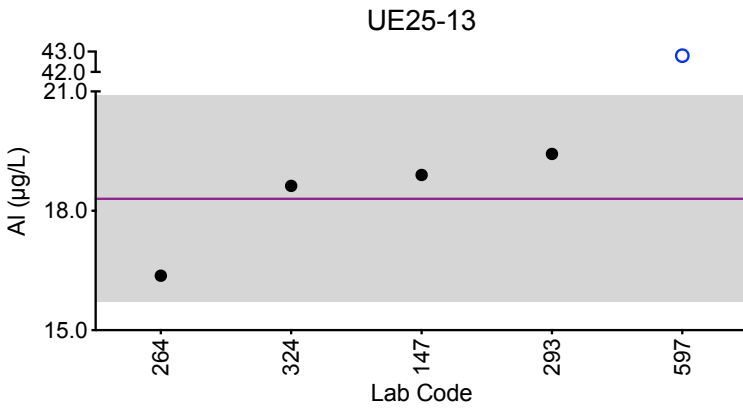
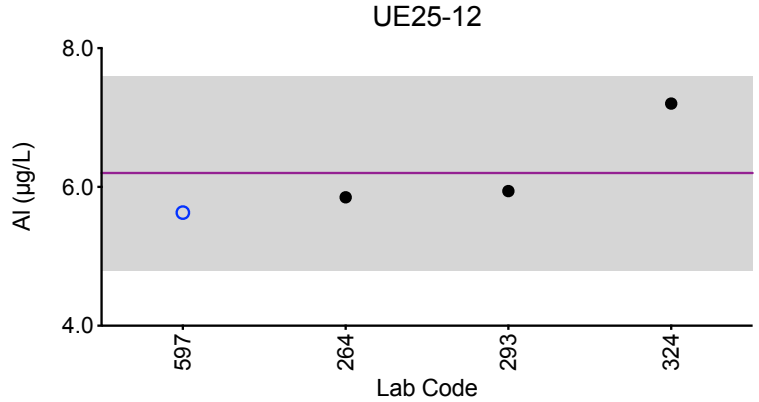
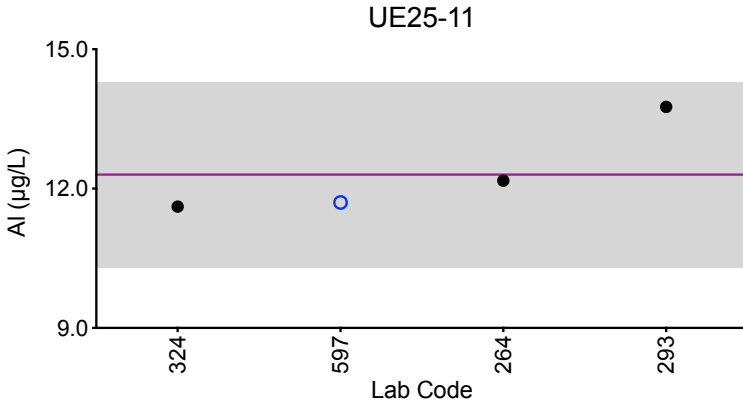
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Arithmetic Mean ( $\bar{x}$ )	12.3	6.2	18.3	9.6	9.4
Arithmetic SD (s)	1.0	0.7	1.3	0.6	1.2
Arithmetic RSD (%)	8.1	11	7.1	6.3	13
Number of Sample Measurements (N)	4	4	4	4	4

\*Denotes a statistical Outlier.



# Results for Event #3, 2025: Summary Figures

## Urine AI



### 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 #3, 2025: Laboratory Data and Summary Statistics

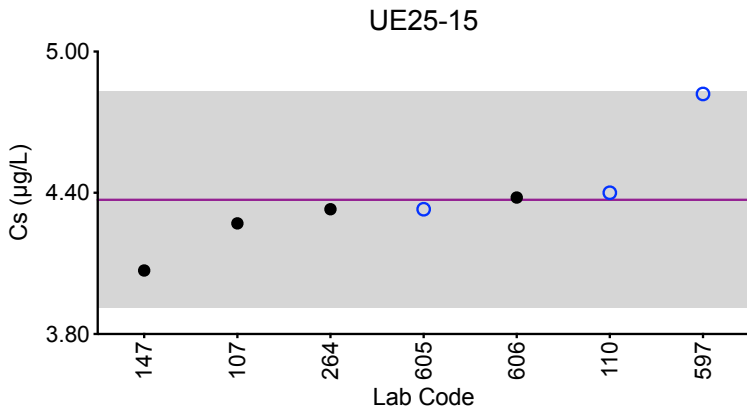
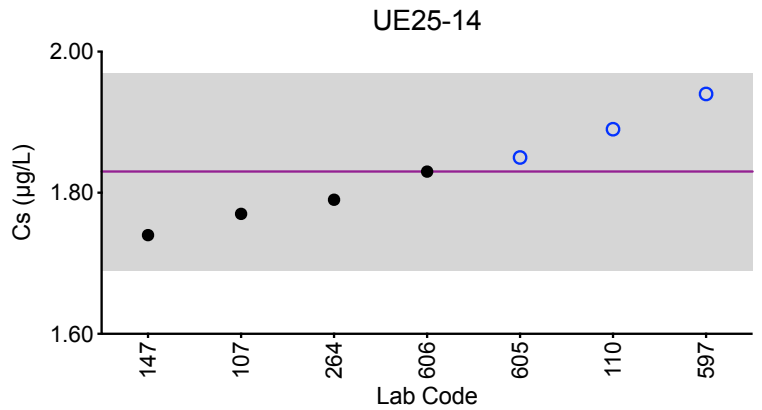
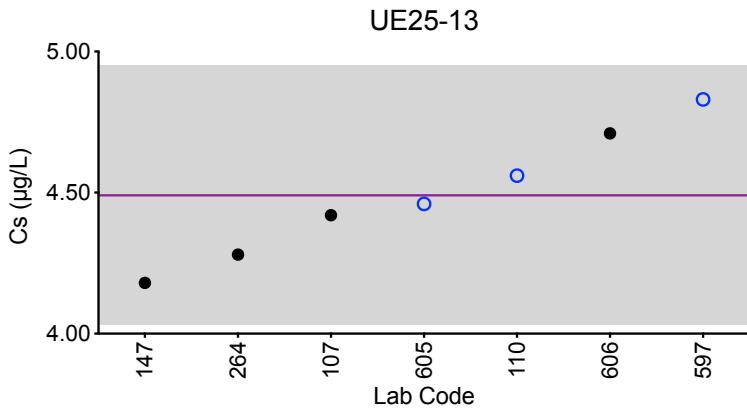
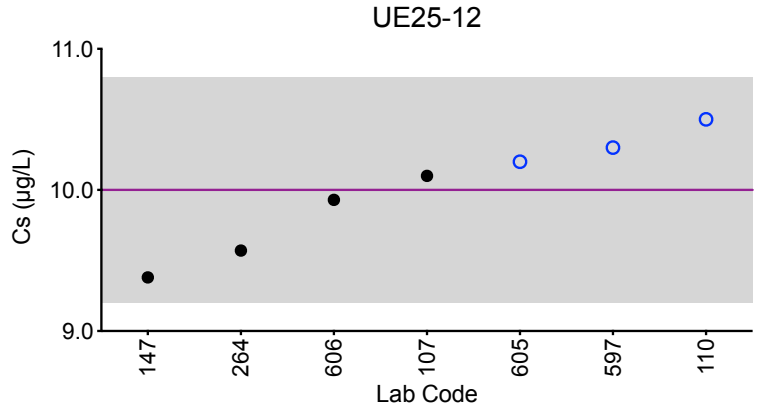
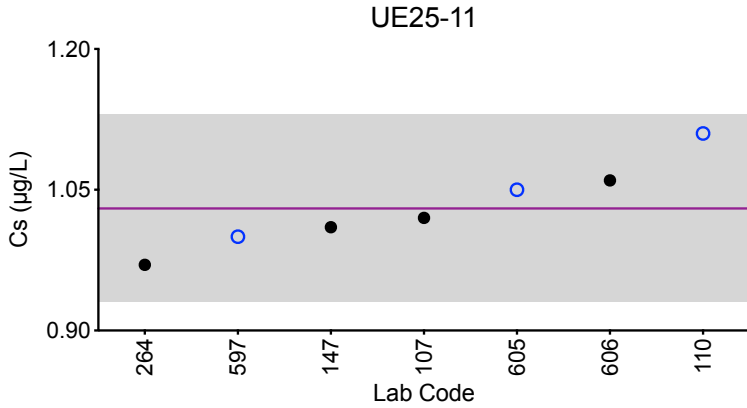
Urine Cs (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
107	ICP-MS	1.02	10.1	4.42	1.77	4.27
110	ICP-MS/MS	1.11	10.5	4.56	1.89	4.40
147	ICP-MS	1.01	9.38	4.18	1.74	4.07
264	ICP-MS	0.97	9.57	4.28	1.79	4.33
597	ICP-MS/MS	1.00	10.3	4.83	1.94	4.82
605	ICP-MS	1.05	10.2	4.46	1.85	4.33
606	ICP-MS/MS	1.06	9.93	4.71	1.83	4.38
Summary Statistics						
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Arithmetic Mean (<math>\bar{x}</math>)</b>		1.03	10.0	4.49	1.83	4.37
<b>Arithmetic SD (s)</b>		0.05	0.4	0.23	0.07	0.23
<b>Arithmetic RSD (%)</b>		4.9	4.0	5.1	3.8	5.3
<b>Number of Sample Measurements (N)</b>		7	7	7	7	7

\*Denotes a statistical Outlier.



# Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

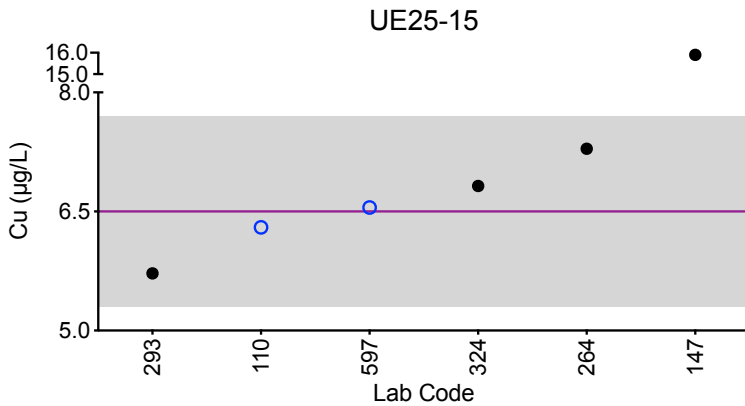
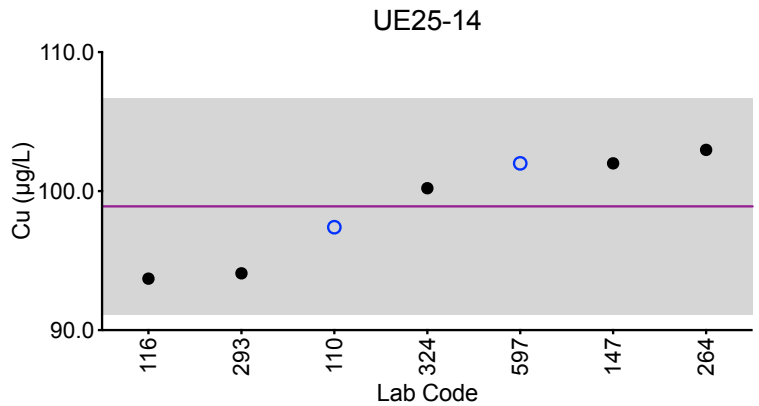
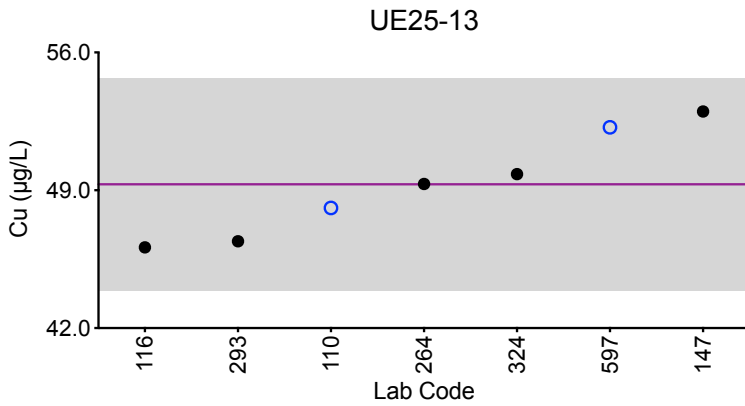
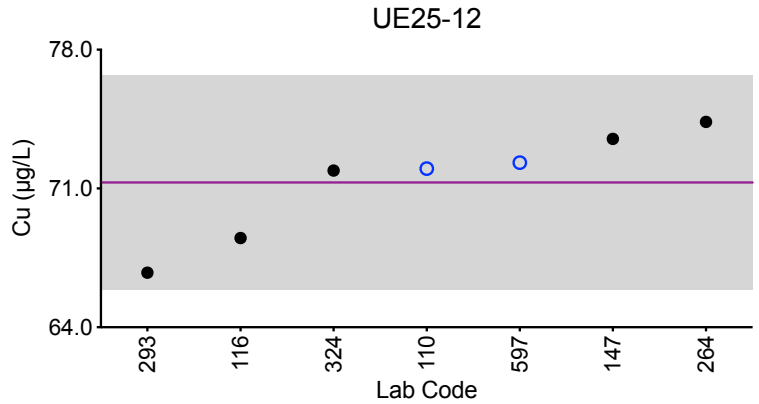
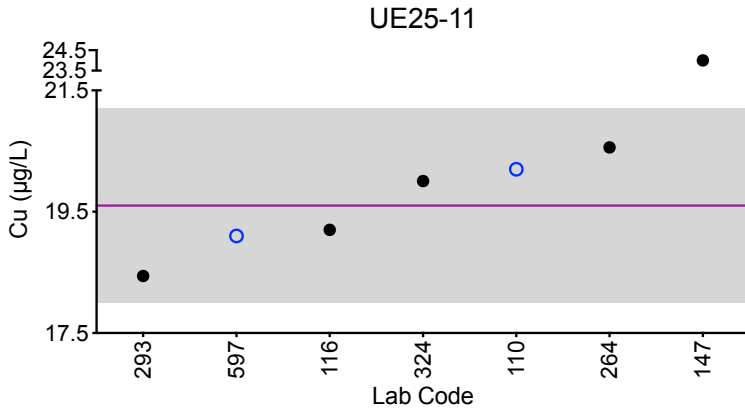
Urine Cu (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
110	ICP-MS/MS	20.2	72.0	48.1	97.4	6.3
116	ICP-MS/MS	19.2	68.5	46.1	93.7	<6.00
147	ICP-MS	*24.0	73.5	53.0	102	*15.9
264	ICP-MS	20.56	74.36	49.32	102.97	7.29
293	DRC/CC-ICP-MS	18.44	66.75	46.41	94.09	5.72
324	ICP-MS	20.005	71.900	49.820	100.209	6.821
597	ICP-MS/MS	19.1	72.3	52.2	102	6.55
Summary Statistics						
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Arithmetic Mean (<math>\bar{x}</math>)</b>		19.6	71.3	49.3	98.9	6.5
<b>Arithmetic SD (s)</b>		0.8	2.7	2.7	3.9	0.6
<b>Arithmetic RSD (%)</b>		4.1	3.8	5.5	3.9	9.2
<b>Number of Sample Measurements (N)</b>		6	7	7	7	5

\*Denotes a statistical Outlier.



# Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

Urine Mo (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
103	ICP-MS/MS	5.07	104	20.8	61.0	27.5
107	ICP-MS	4.95	101	21.0	60.4	28.5
110	ICP-MS/MS	5.1	104	20.9	61.4	27.6
147	ICP-MS	4.55	92.3	19.3	56.6	25.1
264	ICP-MS	*3.49	92.15	18.29	55.08	24.27
293	DRC/CC-ICP-MS	5.2	100.38	21.37	59.5	27.46
324	ICP-MS	4.802	99.801	19.534	56.858	25.693
597	ICP-MS/MS	4.62	103	22.2	62.6	28.8
605	ICP-MS	<9.00	101	19.5	60.4	26.3
606	ICP-MS/MS	4.93	101	21.3	61.9	27.6

Summary Statistics					
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Robust Mean (x*)</b>	4.9	101	20.5	60.0	27.0
<b>Robust SD (s*)</b>	0.2	3	1.3	2.1	1.5
<b>Robust RSD (%)</b>	4.7	2.6	6.3	3.5	5.6
<b>Number of Sample Measurements (N)</b>	8	10	10	10	10
<b>Standard Uncertainty (u)</b>	NA	1	0.5	0.8	0.6

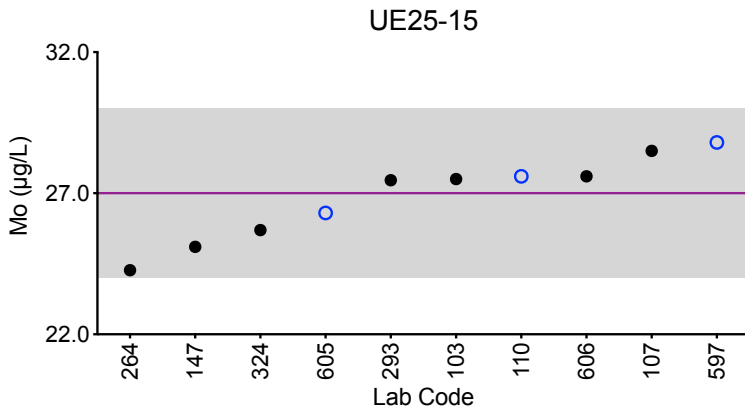
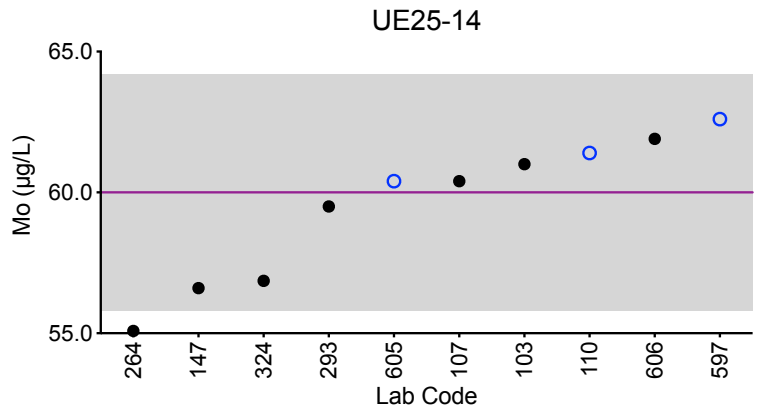
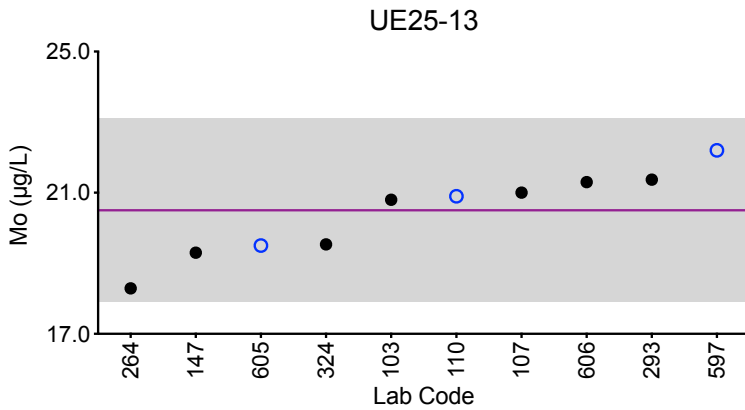
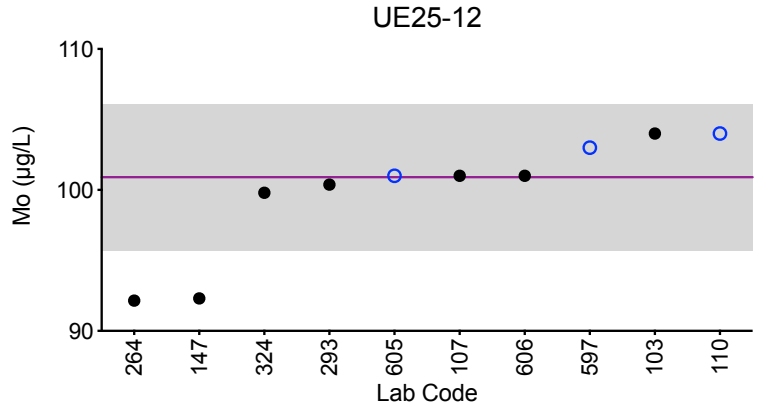
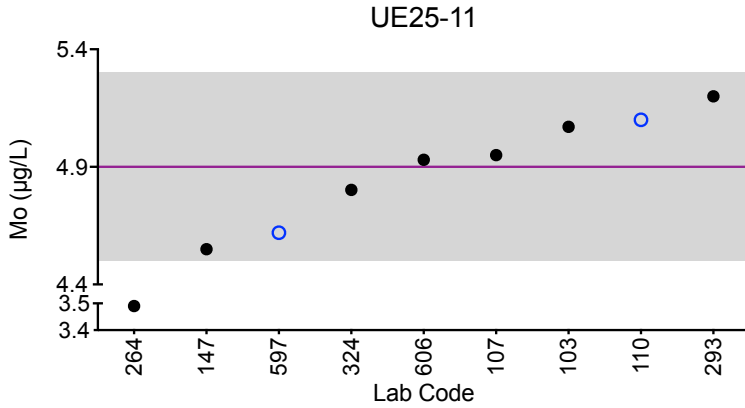
\*Denotes a statistical Outlier.

An arithmetic mean, SD, RSD and n are provided for sample UE25-11.



# Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

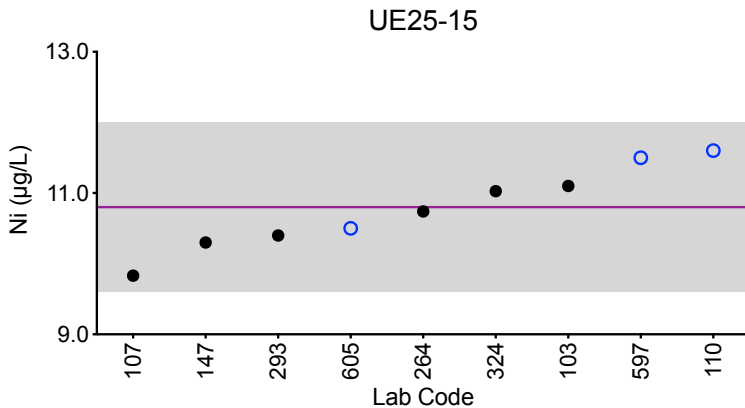
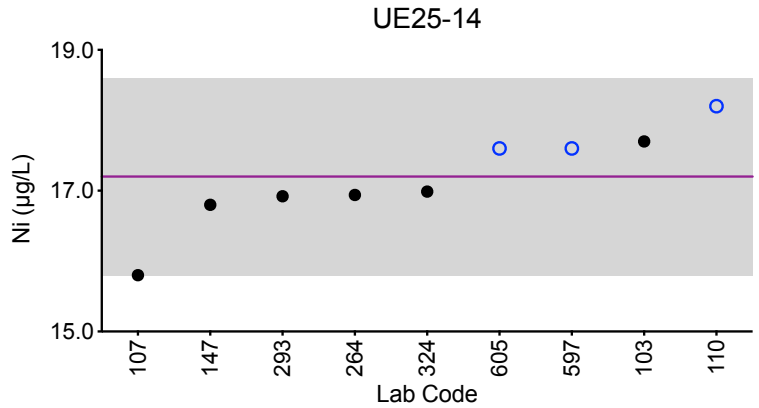
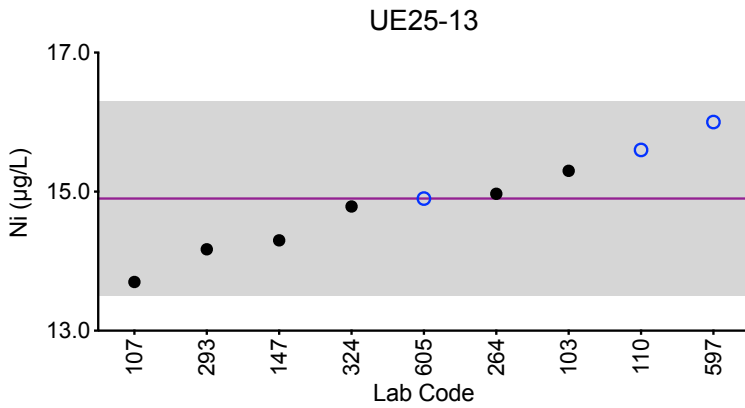
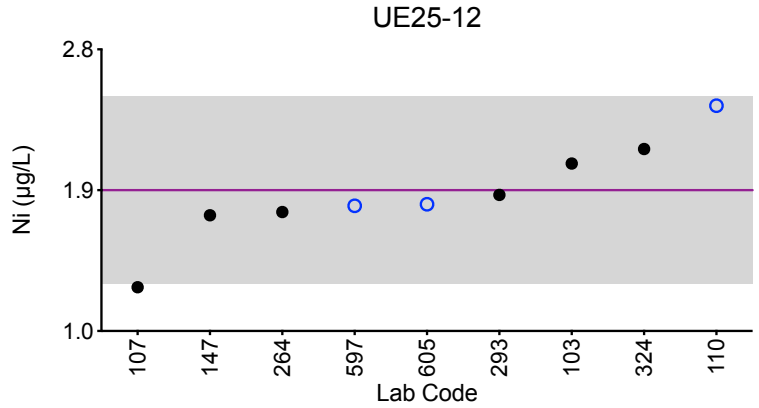
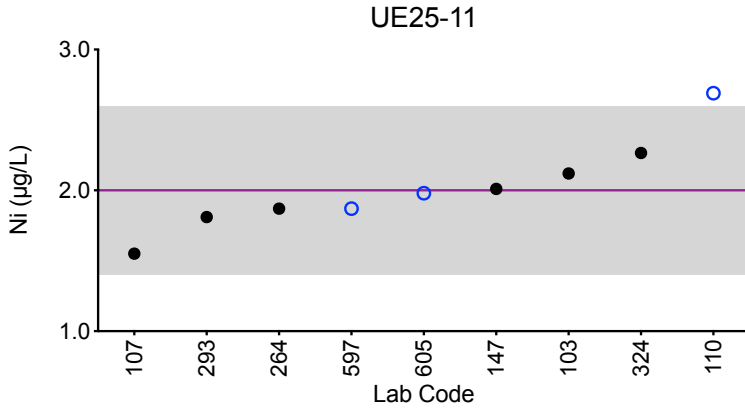
Urine Ni (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
103	ICP-MS/MS	2.12	2.07	15.3	17.7	11.1
107	DRC/CC-ICP-MS	1.55	1.28	13.7	15.8	9.83
110	ICP-MS/MS	2.69	2.44	15.6	18.2	11.6
147	ICP-MS	2.01	1.74	14.3	16.8	10.3
264	ICP-MS	1.87	1.76	14.97	16.94	10.74
293	DRC/CC-ICP-MS	1.81	1.87	14.17	16.92	10.4
324	ICP-MS	2.265	2.163	14.787	16.987	11.027
597	ICP-MS/MS	1.87	1.80	16.0	17.6	11.5
605	ICP-MS	1.98	1.81	14.9	17.6	10.5
Summary Statistics						
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15	
Arithmetic Mean ( $\bar{x}$ )	2.0	1.9	14.9	17.2	10.8	
Arithmetic SD (s)	0.3	0.3	0.7	0.7	0.6	
Arithmetic RSD (%)	16	17	4.7	4.1	5.6	
Number of Sample Measurements (N)	9	9	9	9	9	

\*Denotes a statistical Outlier.



# Results for Event #3, 2025: Summary Figures

## Urine Ni



### 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 #3, 2025: Laboratory Data and Summary Statistics

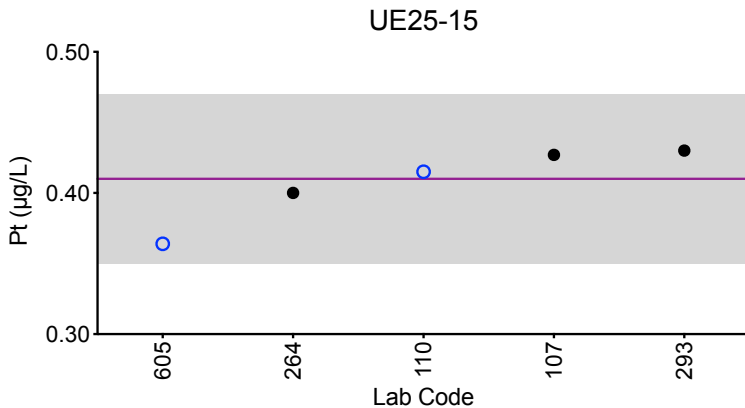
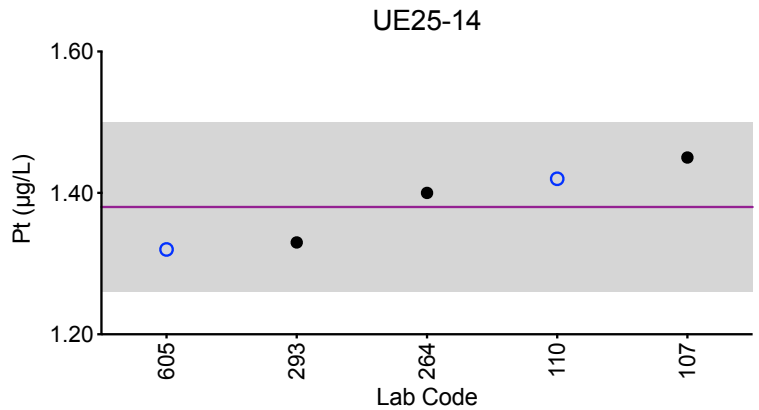
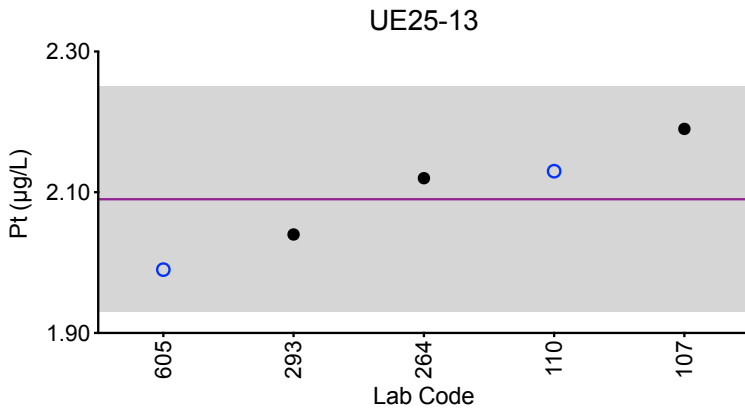
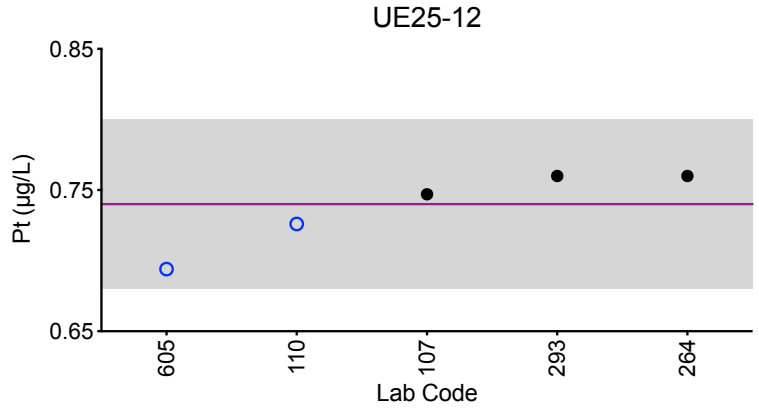
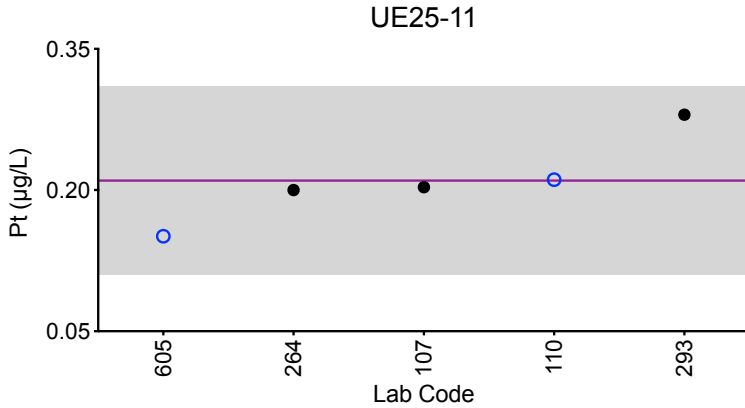
Urine Pt (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
107	ICP-MS	0.203	0.747	2.19	1.45	0.427
110	ICP-MS/MS	0.211	0.726	2.13	1.42	0.415
264	ICP-MS	0.20	0.76	2.12	1.40	0.40
293	DRC/CC-ICP-MS	0.28	0.76	2.04	1.33	0.43
605	ICP-MS	0.151	0.694	1.99	1.32	0.364
Summary Statistics						
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Arithmetic Mean (<math>\bar{x}</math>)</b>		0.21	0.74	2.09	1.38	0.41
<b>Arithmetic SD (s)</b>		0.05	0.03	0.08	0.06	0.03
<b>Arithmetic RSD (%)</b>		24	3.8	3.8	4.3	6.6
<b>Number of Sample Measurements (N)</b>		5	5	5	5	5

\*Denotes a statistical Outlier.



## Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

Urine Sb (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
103	ICP-MS/MS	1.22	0.914	1.91	0.262	0.543
107	ICP-MS	1.18	0.947	1.92	0.264	0.542
110	ICP-MS/MS	1.25	0.969	1.91	0.252	0.544
147	ICP-MS	1.16	0.912	1.79	0.267	0.573
264	ICP-MS	1.06	0.89	1.79	0.24	0.56
293	DRC/CC-ICP-MS	1.19	0.91	1.88	0.24	0.56
324	ICP-MS	1.182	<1	1.831	<1	<1
597	ICP-MS/MS	1.24	*1.14	2.19	*0.464	*0.753
605	ICP-MS	1.22	0.977	1.92	<0.800	<0.800
606	ICP-MS/MS	1.19	0.969	1.92	0.277	0.554

Summary Statistics					
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Arithmetic Mean ( $\bar{x}$ )	1.19	0.94	1.91	0.257	0.554
Arithmetic SD (s)	0.05	0.03	0.11	0.014	0.012
Arithmetic RSD (%)	4.2	3.5	5.8	5.4	2.2
Number of Sample Measurements (N)	10	8	10	7	7

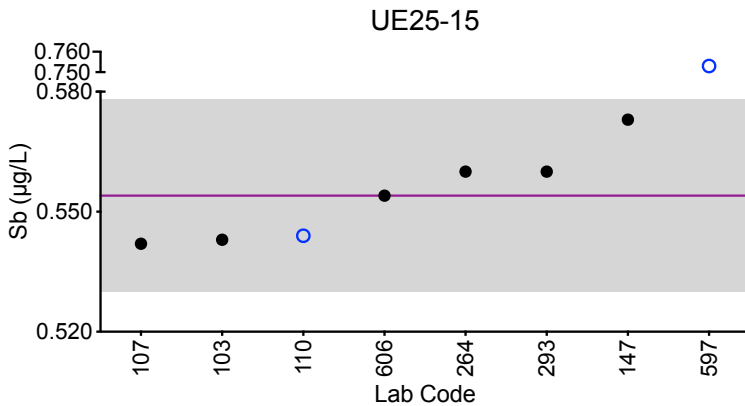
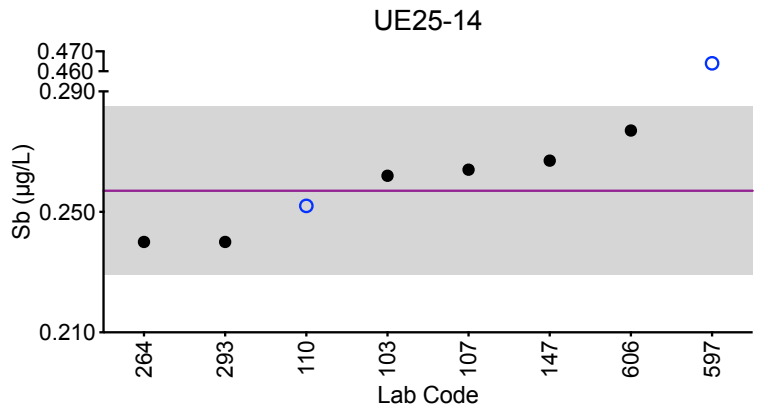
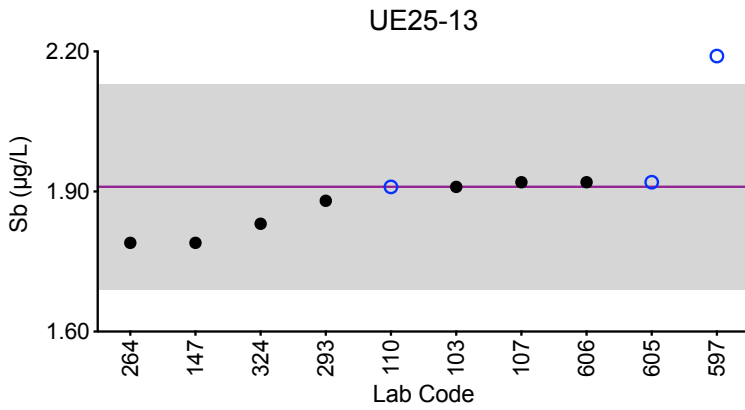
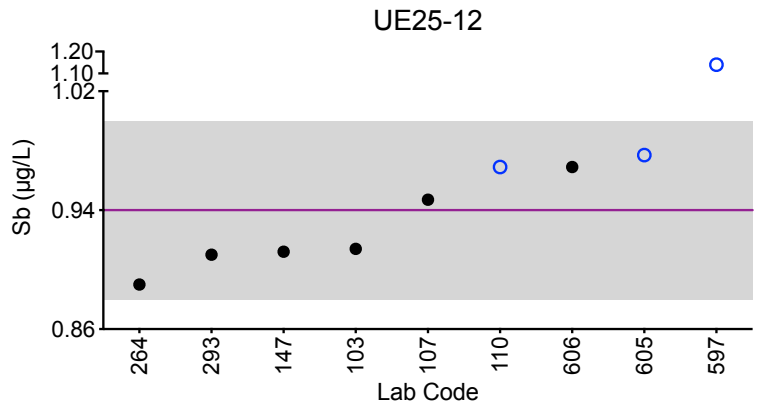
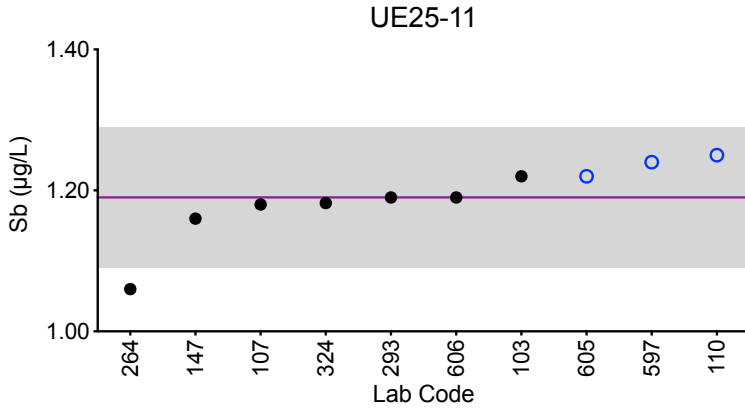
\*Denotes a statistical Outlier.

A robust mean, SD, RSD and n are provided for samples UE25-11 and UE25-13.



# Results for Event #3, 2025: Summary Figures

## Urine Sb



### 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 #3, 2025: Laboratory Data and Summary Statistics

Urine Se (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
103	ICP-MS/MS	11.4	120	56.2	21.2	254
110	ICP-MS/MS	7.6	92.6	52.1	18.9	200
147	ICP-MS	<9.48	97.7	53.7	20.7	206
293	DRC/CC-ICP-MS	7.9	94.79	55.29	16.59	195.89
597	ICP-MS/MS	8.19	113	62.7	21.3	253

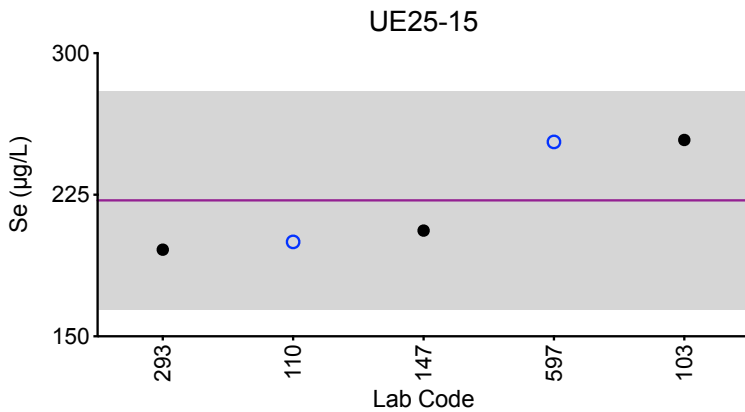
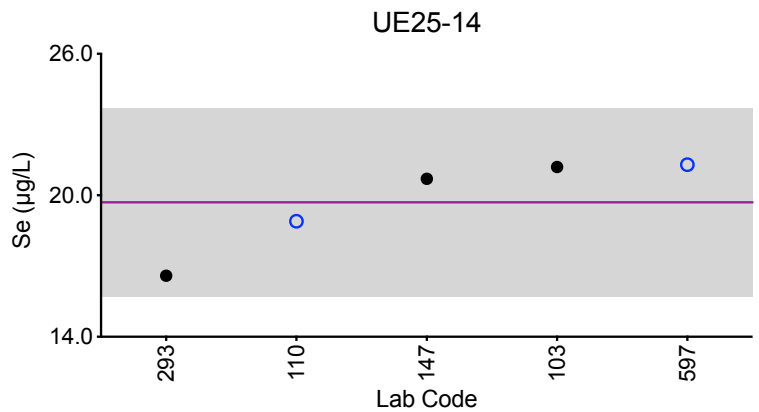
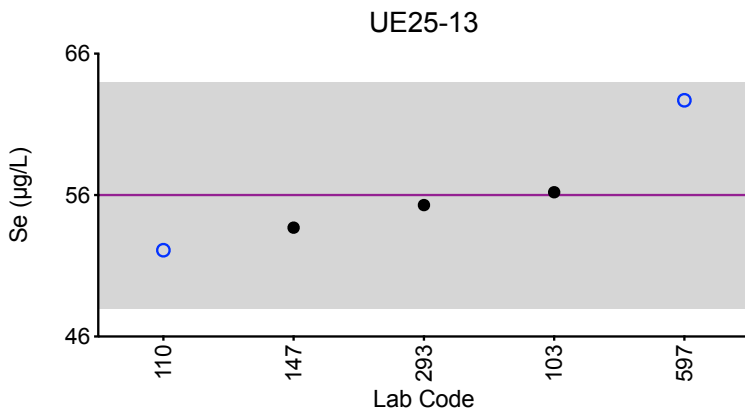
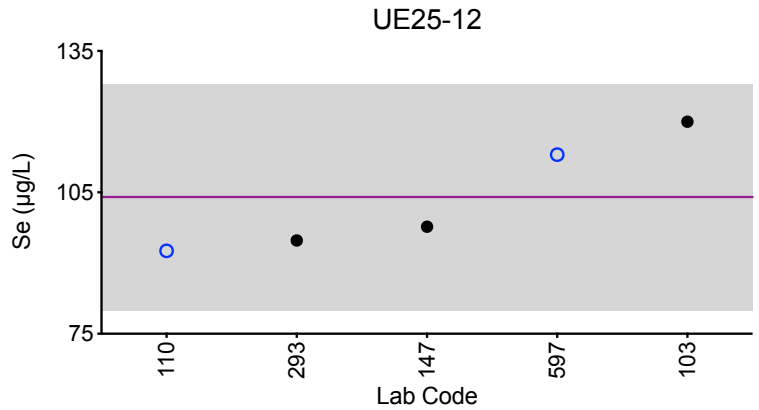
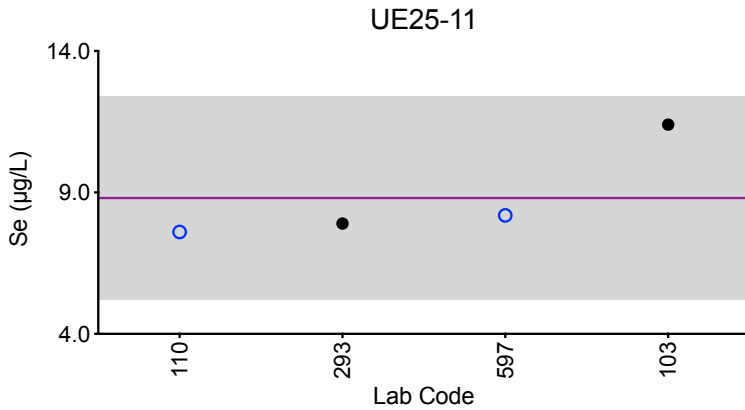
Summary Statistics					
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Arithmetic Mean ( $\bar{x}$ )	8.8	104	56	19.7	222
Arithmetic SD (s)	1.8	12	4	2.0	29
Arithmetic RSD (%)	20	12	7.1	10	13
Number of Sample Measurements (N)	4	5	5	5	5

\*Denotes a statistical Outlier.



## Results for Event #3, 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.

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 #3, 2025: Laboratory Data and Summary Statistics

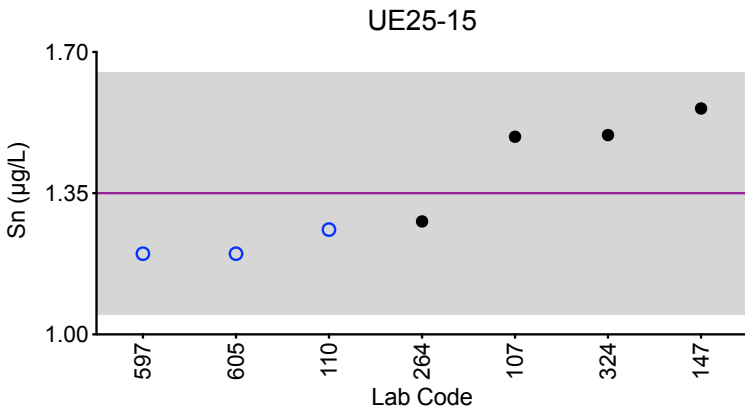
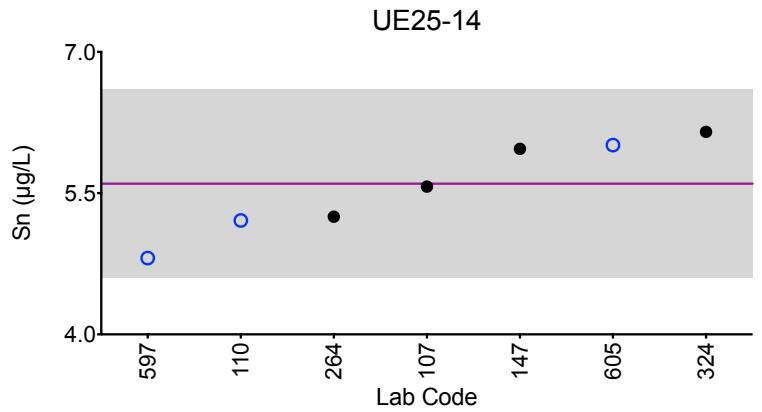
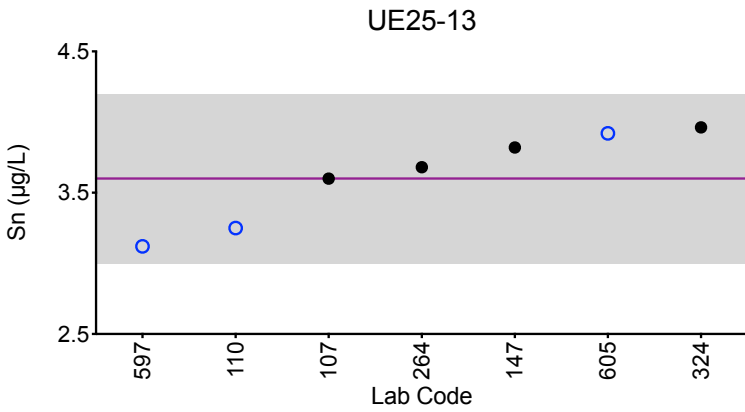
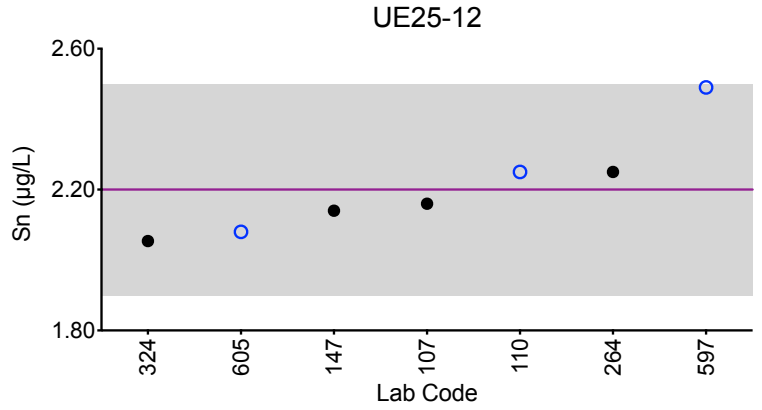
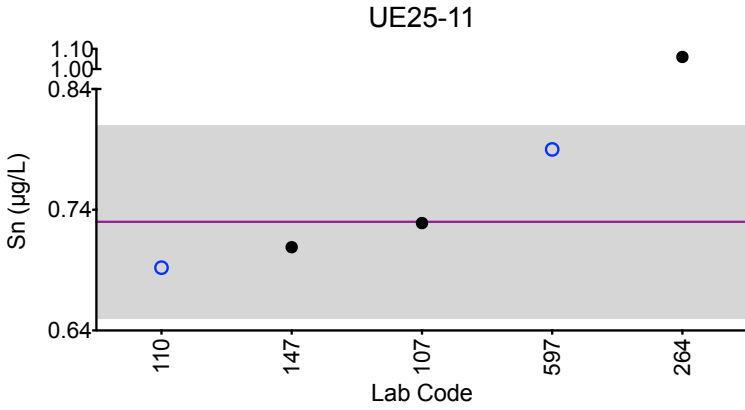
Urine Sn (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
107	ICP-MS	0.729	2.16	3.60	5.57	1.49
110	ICP-MS/MS	0.692	2.25	3.25	5.21	1.26
147	ICP-MS	0.709	2.14	3.82	5.97	1.56
264	ICP-MS	*1.06	2.25	3.68	5.25	1.28
324	ICP-MS	<1	2.054	3.962	6.151	1.494
597	ICP-MS/MS	0.790	2.49	3.12	4.81	1.20
605	ICP-MS	<0.900	2.08	3.92	6.01	1.20
Summary Statistics						
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Arithmetic Mean (<math>\bar{x}</math>)</b>		0.73	2.20	3.6	5.6	1.35
<b>Arithmetic SD (s)</b>		0.04	0.15	0.3	0.5	0.15
<b>Arithmetic RSD (%)</b>		5.5	6.8	9.1	8.9	11
<b>Number of Sample Measurements (N)</b>		4	7	7	7	7

\*Denotes a statistical Outlier.



# Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

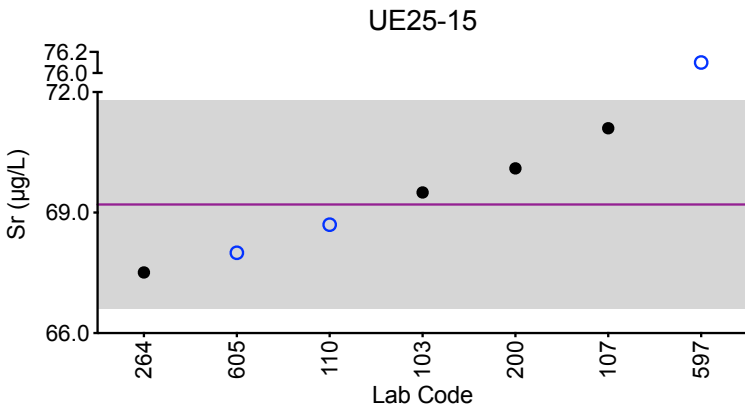
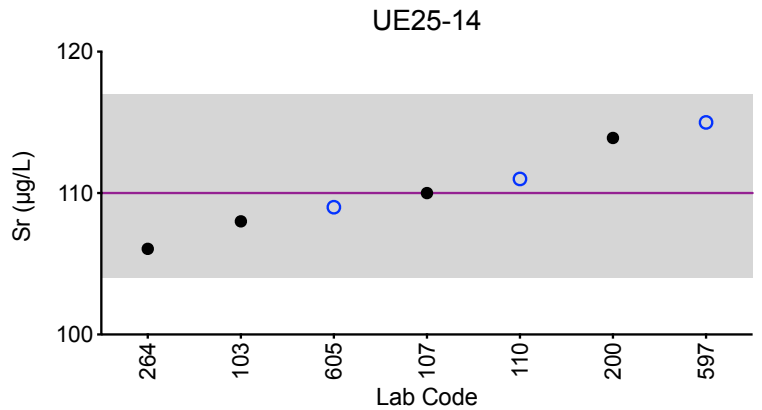
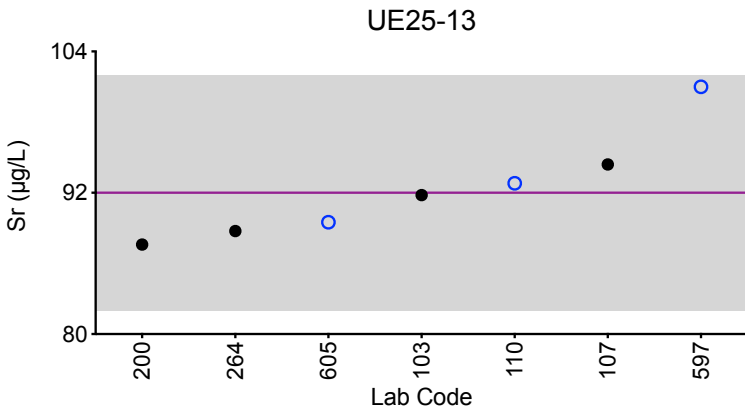
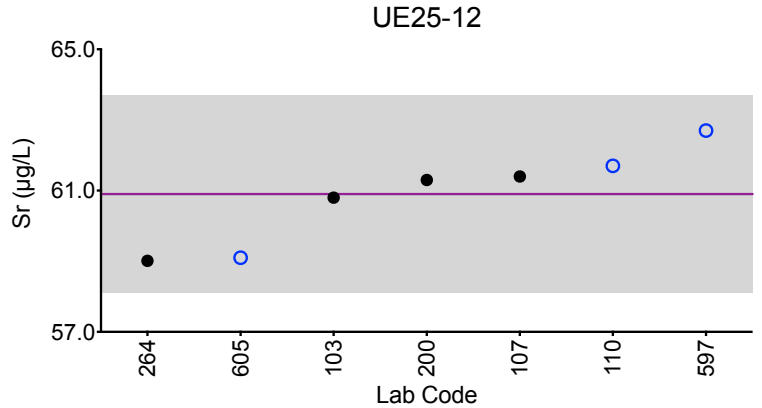
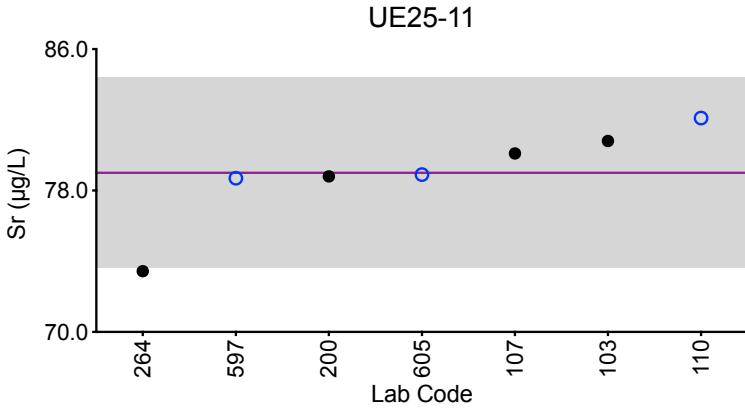
Urine Sr (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
103	ICP-MS/MS	80.8	60.8	91.8	108	69.5
107	ICP-MS	80.1	61.4	94.4	110	71.1
110	ICP-MS/MS	82.1	61.7	92.8	111	68.7
200	ICP-MS	78.8	61.3	87.6	113.9	70.1
264	ICP-MS	73.44	59.01	88.75	106.06	67.51
597	ICP-MS/MS	78.7	62.7	101	115	*76.1
605	ICP-MS	78.9	59.1	89.5	109	68.0
Summary Statistics						
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Arithmetic Mean (<math>\bar{x}</math>)</b>		79.0	60.9	92	110	69.2
<b>Arithmetic SD (s)</b>		2.7	1.4	5	3	1.3
<b>Arithmetic RSD (%)</b>		3.4	2.3	5.4	2.9	1.9
<b>Number of Sample Measurements (N)</b>		7	7	7	7	6

\*Denotes a statistical Outlier.



# Results for Event #3, 2025: Summary Figures

## Urine Sr



### 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 #3, 2025: Laboratory Data and Summary Statistics

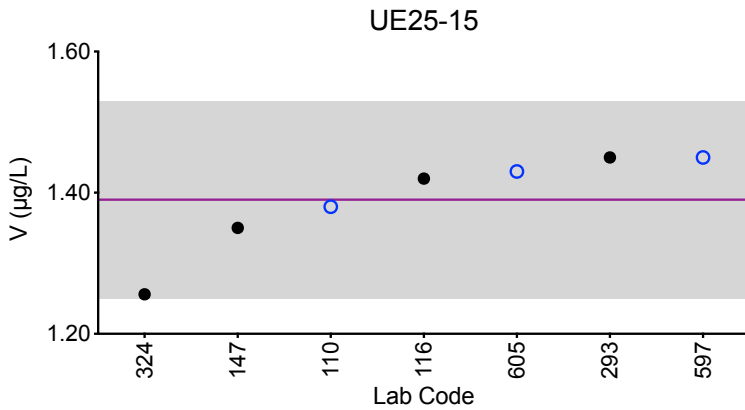
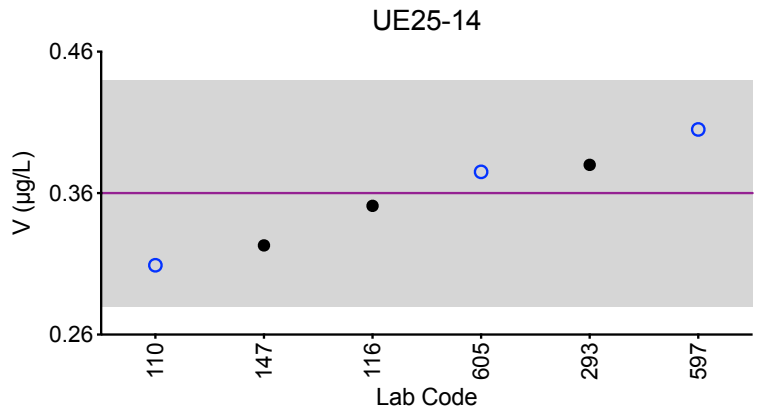
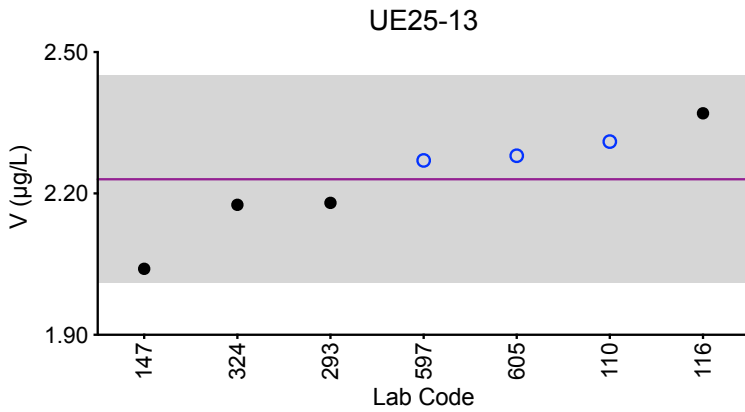
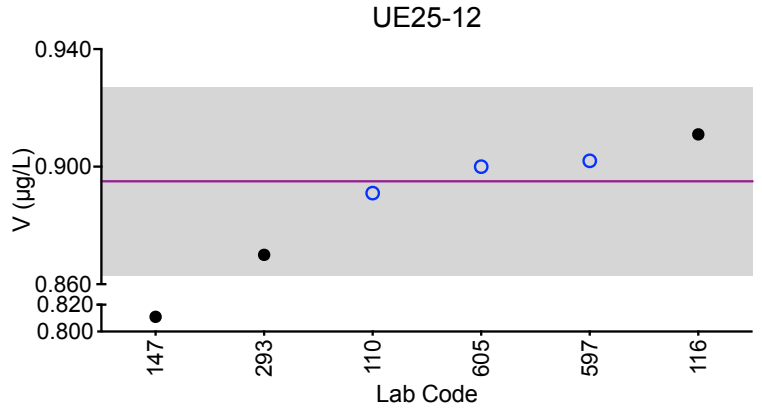
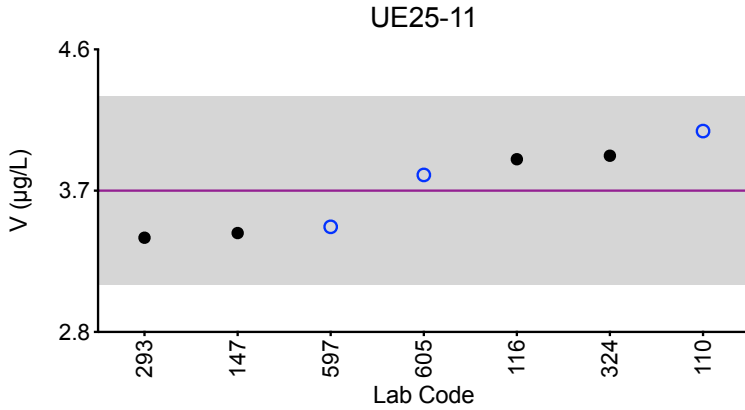
Urine V (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
110	ICP-MS/MS	4.08	0.891	2.31	0.309	1.38
116	ICP-MS/MS	3.90	0.911	2.37	0.351	1.42
147	DRC/CC-ICP-MS	3.43	*0.811	2.04	0.323	1.35
293	DRC/CC-ICP-MS	3.4	0.87	2.18	0.38	1.45
324	ICP-MS	3.923	<1	2.176	<1	1.256
597	ICP-MS/MS	3.47	0.902	2.27	0.405	1.45
605	ICP-MS	3.80	0.900	2.28	0.375	1.43
Summary Statistics						
		UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
<b>Arithmetic Mean (<math>\bar{x}</math>)</b>		3.7	0.895	2.23	0.36	1.39
<b>Arithmetic SD (s)</b>		0.3	0.016	0.11	0.04	0.07
<b>Arithmetic RSD (%)</b>		7.5	1.8	4.9	10	5.0
<b>Number of Sample Measurements (N)</b>		7	5	7	6	7

\*Denotes a statistical Outlier.



# Results for Event #3, 2025: Summary Figures

## Urine 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 #3, 2025: Laboratory Data and Summary Statistics

### Urine W (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
107	ICP-MS	0.645	0.494	0.0698	0.209	0.117
110	ICP-MS/MS	0.712	0.455	0.059	0.185	0.108
147	ICP-MS	0.636	0.454	<0.178	0.204	<0.178
264	ICP-MS	0.61	0.46	<0.10	0.19	0.11
324	ICP-MS	<1	<1	<1	<1	<1
597	ICP-MS/MS	0.556	0.525	0.0760	0.222	0.128
605	ICP-MS	0.640	0.500	<0.180	0.210	<0.180
606	ICP-MS/MS	0.631	0.485	0.061	0.236	0.113

### Summary Statistics

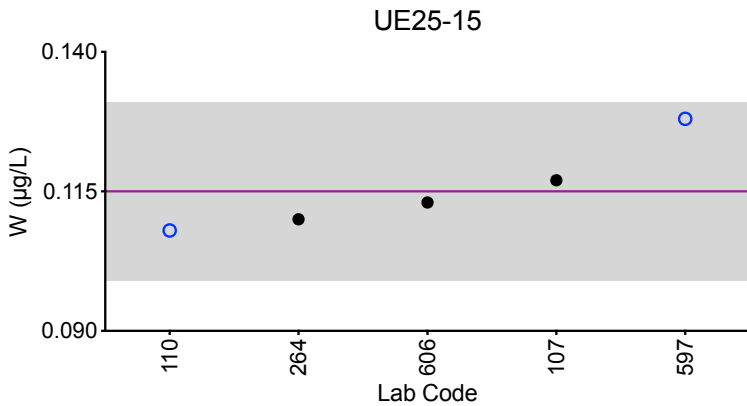
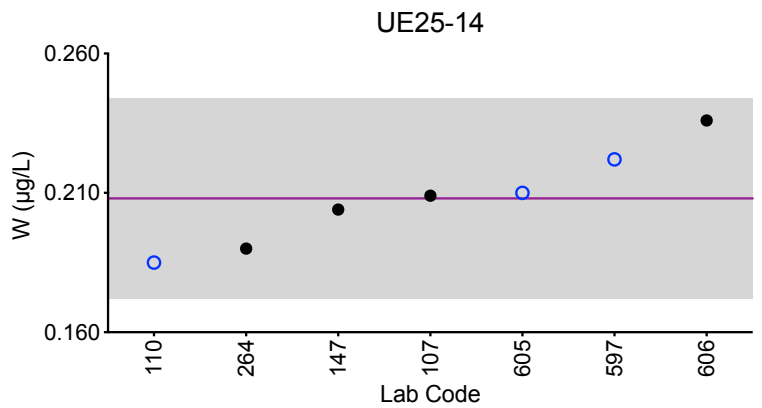
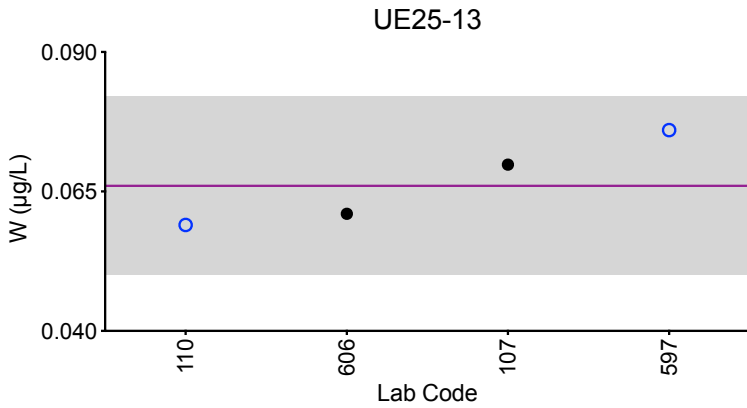
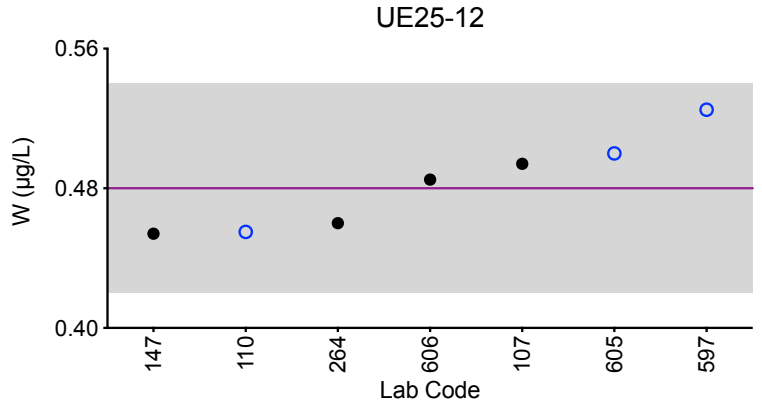
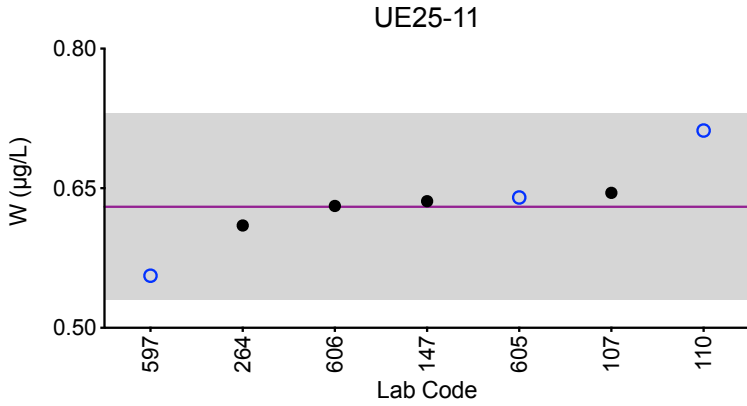
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Arithmetic Mean ( $\bar{x}$ )	0.63	0.48	0.066	0.208	0.115
Arithmetic SD (s)	0.05	0.03	0.008	0.018	0.008
Arithmetic RSD (%)	7.9	5.6	12	8.7	7.0
Number of Sample Measurements (N)	7	7	4	7	5

\*Denotes a statistical Outlier.



# Results for Event #3, 2025: Summary Figures

## Urine W



### 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 #3, 2025: Laboratory Data and Summary Statistics

### Urine Zn (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
110	ICP-MS/MS	83	622	415	248	280
147	ICP-MS	97.8	650	437	264	287
264	ICP-MS	94.26	674.84	458.09	266.36	297.25
293	DRC/CC-ICP-MS	90.2	617.65	413.07	249.67	276.47
324	ICP-MS	88.007	618.539	434.668	255.741	300.815
597	ICP-MS/MS	88.1	648	450	242	314

### Summary Statistics

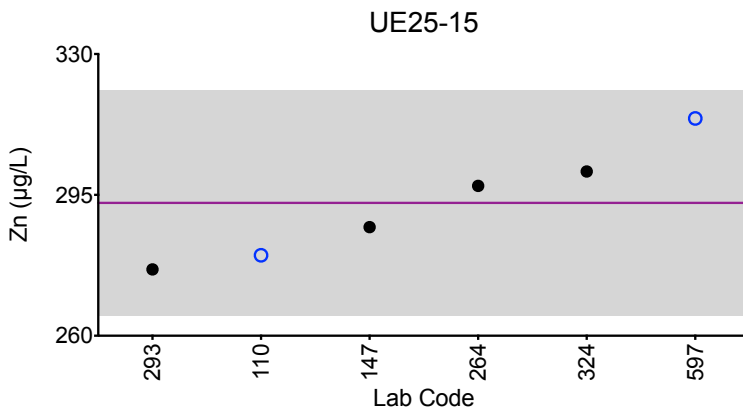
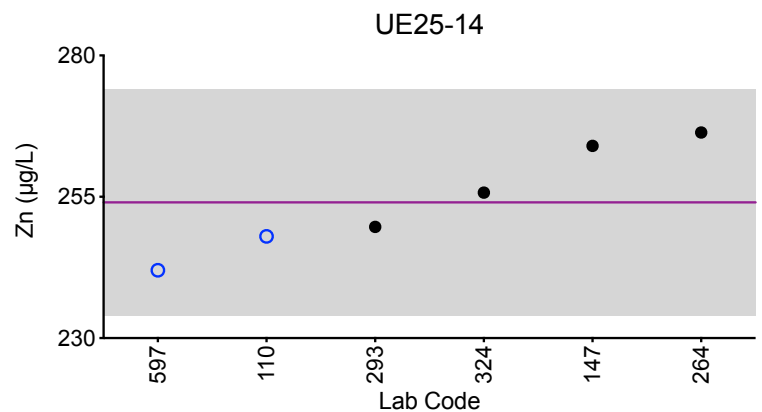
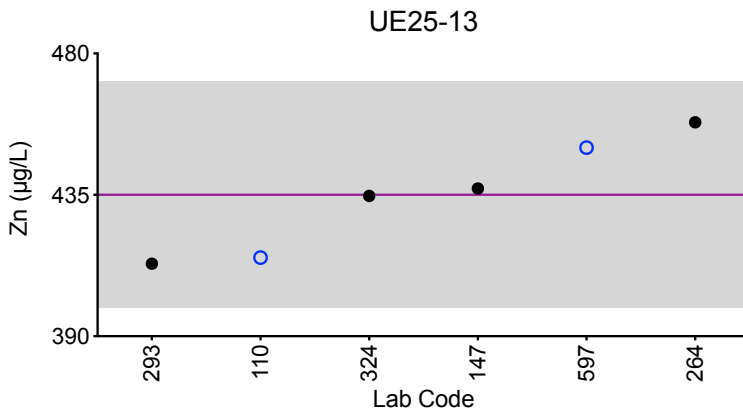
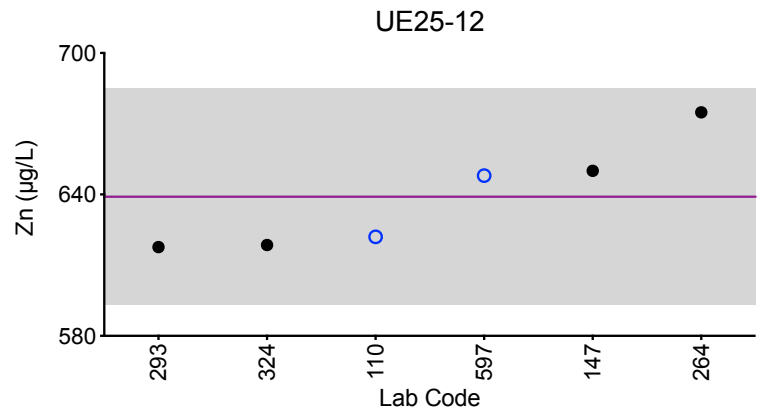
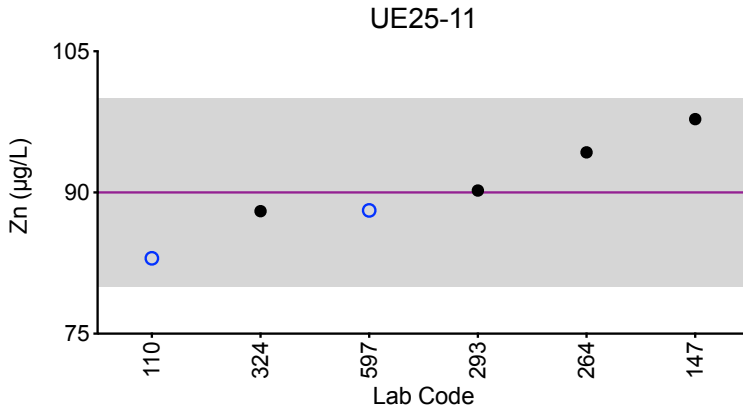
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Arithmetic Mean ( $\bar{x}$ )	90	639	435	254	293
Arithmetic SD (s)	5	23	18	10	14
Arithmetic RSD (%)	5.6	3.6	4.1	3.9	4.8
Number of Sample Measurements (N)	6	6	6	6	6

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Summary Figures

### Urine Zn



#### 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 #3, 2025: Laboratory Data and Summary Statistics

Urine I (µg/L)						
Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
147	ICP-MS	<25.3	<25.3	126	135	68.3
597	ICP-MS/MS	12.5	18.0	137	140	75.9

Summary Statistics						
	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15	
Arithmetic Mean ( $\bar{x}$ )	NA	NA	132	138	72	
Arithmetic SD (s)	NA	NA	8	4	5	
Arithmetic RSD (%)	NA	NA	6.1	2.9	6.9	
Number of Sample Measurements (N)	NA	NA	2	2	2	

\*Denotes a statistical Outlier.

Statistical data was not calculated for UE25-11 and UE25-12 based on a lack of consensus among participating labs.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Urine Li (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
110	ICP-MS/MS	25.6	61.0	32.9	16.7	41.2
147	ICP-MS	22.0	53.9	30.8	15.7	40.2
597	ICP-MS/MS	22.2	57.7	35.2	16.1	45.6

### Summary Statistics

	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Arithmetic Mean ( $\bar{x}$ )	23.3	58	33.0	16.2	42
Arithmetic SD (s)	2.0	4	2.2	0.5	3
Arithmetic RSD (%)	8.6	6.9	6.7	3.1	7.1
Number of Sample Measurements (N)	3	3	3	3	3

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Urine Te (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
110	ICP-MS/MS	0.129	1.07	0.702	0.353	1.05
147	ICP-MS	<0.128	0.225	0.694	0.453	0.845

### Summary Statistics

	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
Arithmetic Mean ( $\bar{x}$ )	NA	NA	0.698	0.40	0.9
Arithmetic SD (s)	NA	NA	0.006	0.07	0.1
Arithmetic RSD (%)	NA	NA	0.86	18	15
Number of Sample Measurements (N)	NA	NA	2	2	2

\*Denotes a statistical Outlier.

Statistical data was not calculated for UE25-11 and UE25-12 based on a lack of consensus among participating labs.



Results for Event #3, 2025: Additional Elements in Urine

Urine Ag (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
147	ICP-MS	<0.108	<0.108	<0.108	<0.108	<0.108

Urine B (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
597	ICP-MS/MS	106	163	567	568	1070

Urine Bi (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
147	ICP-MS	<0.0773	<0.0773	<0.0773	<0.0773	<0.0773
597	ICP-MS/MS	<0.00942	<0.00942	<0.00942	0.0132	0.0209

Urine Br (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
597	ICP-MS/MS	746	994	825	837	1650

Urine Cl (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
597	ICP-MS/MS	946000	1310000	1920000	1940000	4900000

Urine Fe (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
324	ICP-MS	3.016	6.356	11.599	9.044	11.086

Urine Mg (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
597	ICP-MS/MS	9500	15900	33400	30900	41300

Urine S (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
597	ICP-MS/MS	420000	604000	708000	713000	941000

Urine Th (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
147	ICP-MS	<0.0951	<0.0951	<0.0951	<0.0951	<0.0951
597	ICP-MS/MS	0.0166	0.0176	0.0378	0.0351	0.0546

Urine Ti (µg/L)

Lab Code	Method	UE25-11	UE25-12	UE25-13	UE25-14	UE25-15
597	ICP-MS/MS	3.71	3.71	1.96	2.39	6.79



**Department  
of Health**

**Wadsworth  
Center**

**Event #3, 2025**

**Trace Elements in  
Serum**

**Wadsworth Center**  
NEW YORK STATE DEPARTMENT OF HEALTH  
*Trace Elements Laboratory*



## Event #3, 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 1<sub>2</sub> and HIV-1 RNA, and non-reactive to HBsAg, HCV3 and STS. Units of serum were filtered into polypropylene containers through cheesecloth to remove particulates and supplemented with aluminum (Al), cobalt (Co), chromium (Cr), copper (Cu), selenium (Se), zinc, (Zn), arsenic (As), beryllium (Be), cadmium (Cd), mercury (Hg), manganese (Mn), molybdenum (Mo), nickel (Ni), lead (Pb), platinum (Pt), antimony (Sb), tin (Sn), strontium (Sr), titanium (Ti), thallium (Tl), uranium (U), vanadium (V) and tungsten (W). Serum samples were homogenized overnight prior to aliquoting 2-mL into polypropylene vials. PT samples were stored at -80°C until the week of the PT event, when they were thawed at 4°C prior to circulation to laboratories for analysis.

### Graded Elements

Six elements in serum are formally graded: Al, Co, Cr, Cu, Se, and Zn. Target values for the graded elements are assigned to these pools based on (a) the robust mean calculated from data reported by all laboratories, or (b) if a robust mean is not possible, the arithmetic mean after outlier deletion.

### Additional Elements

An additional 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 #3, 2025: Summary Statistics

	Serum AI ( $\mu\text{g/L}$ )				
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	74	23	42	57	27.3
<b>Upper Limit</b>	89	28	50	68	32.8
<b>Lower Limit</b>	59	18	34	46	21.8
<b>Arithmetic SD (s)</b>	6	6	6	6	1.4
<b>Arithmetic RSD (%)</b>	8.1	26	14	11	5.1
<b>Number of Sample Measurements (N)</b>	5	5	5	5	4

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 #3, 2025: Performance of Participating Laboratories

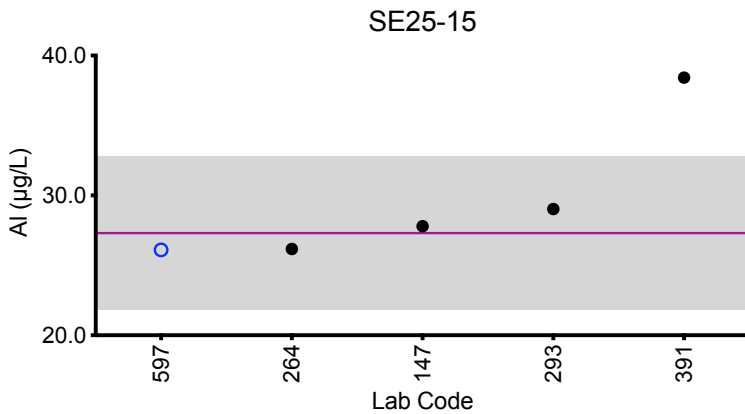
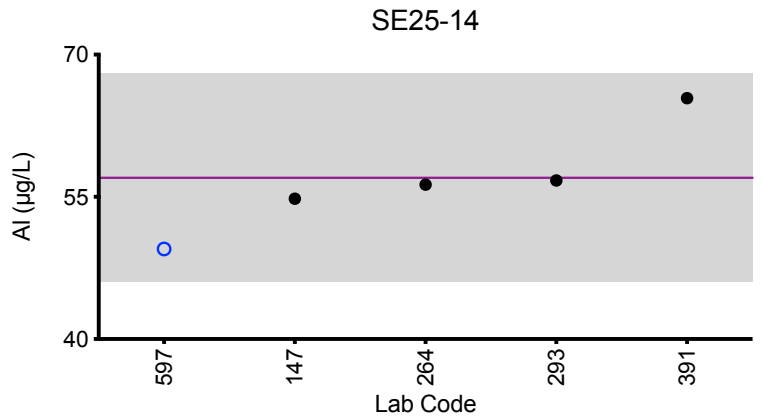
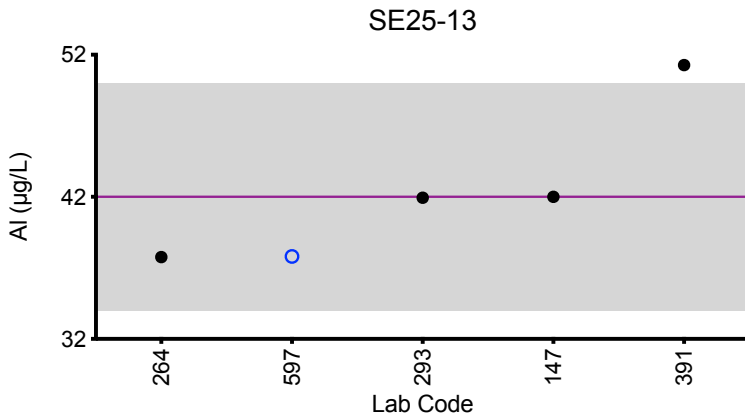
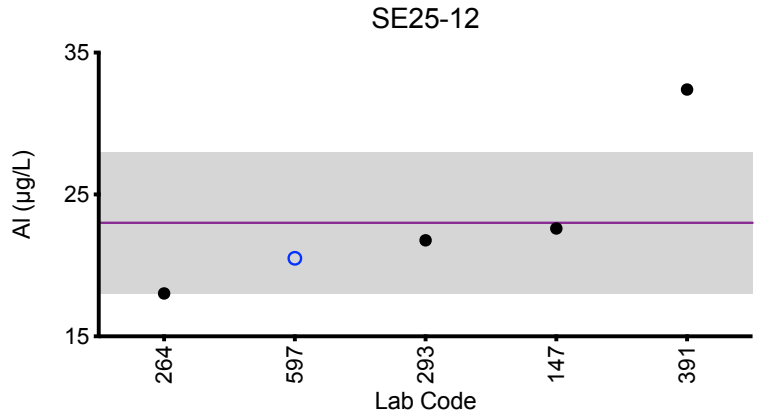
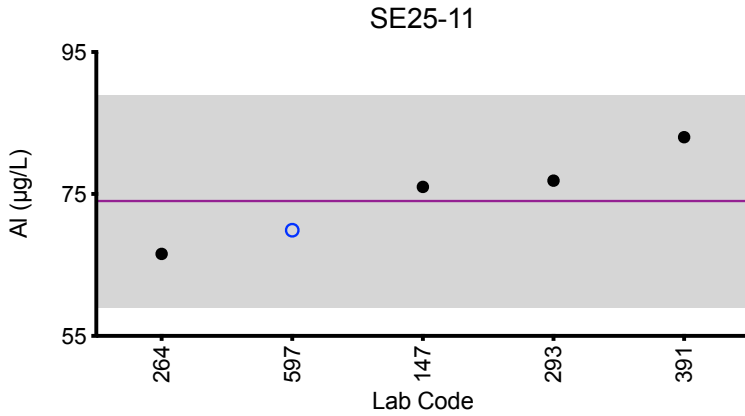
		Serum AI (µg/L)				
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
	<b>Target</b>	<b>74</b>	<b>23</b>	<b>42</b>	<b>57</b>	<b>27.3</b>
147	ETAAS-Z	76.0	22.6	42.0	54.8	27.8
264	ICP-MS	66.56	18.02	37.76	56.28	26.17
293	DRC/CC-ICP-MS	76.88	21.77	41.94	56.72	29.03
391	ETAAS-Z	83.01	32.4 ↑	51.27 ↑	65.4	*38.42 ↑
597	ICP-MS/MS	69.9	20.5	37.8	49.5	26.1

Based on the grading criteria for AI in Serum, 88% of results were satisfactory, with 1 of the 5 laboratories reporting 2 or more of the 5 results outside of the acceptable ranges.



## Results for Event #3, 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 #3, 2025: Summary Statistics

	Serum Co (µg/L)				
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	3.7	0.635	6.32	18.3	4.62
<b>Upper Limit</b>	5.2	2.135	7.82	21.0	6.12
<b>Lower Limit</b>	2.2	0.000	4.82	15.6	3.12
<b>Arithmetic SD (s)</b>	0.3	0.022	0.07	0.8	0.04
<b>Arithmetic RSD (%)</b>	7.6	3.5	1.1	4.4	0.87
<b>Number of Sample Measurements (N)</b>	6	6	5	6	5

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 #3, 2025: Performance of Participating Laboratories

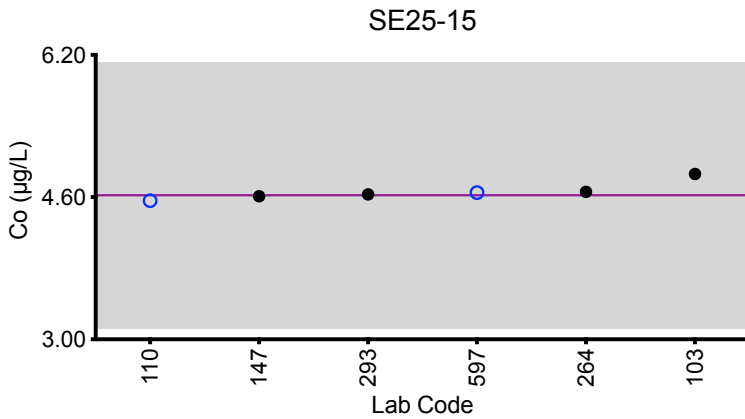
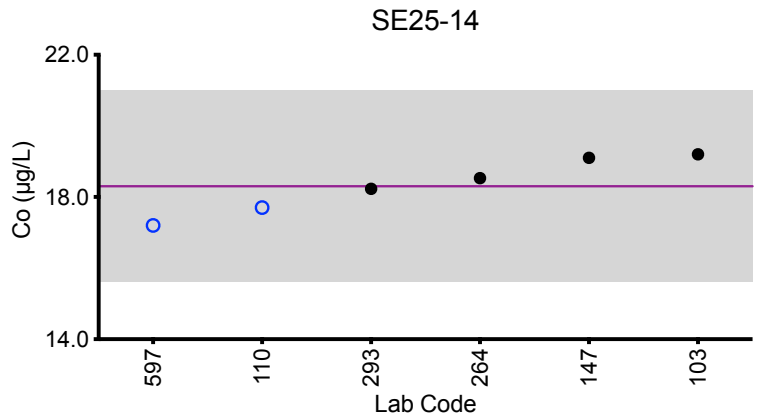
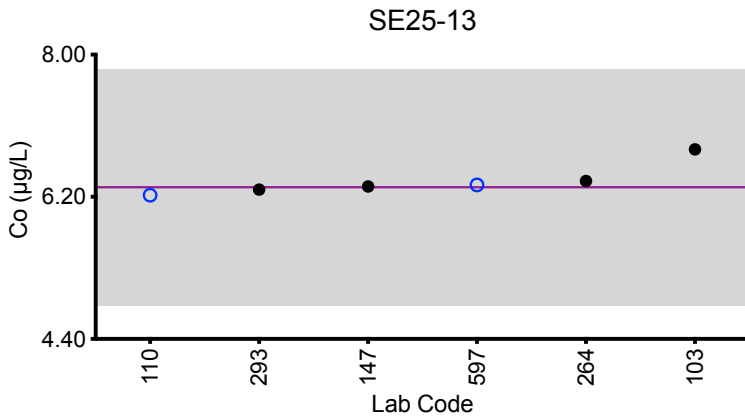
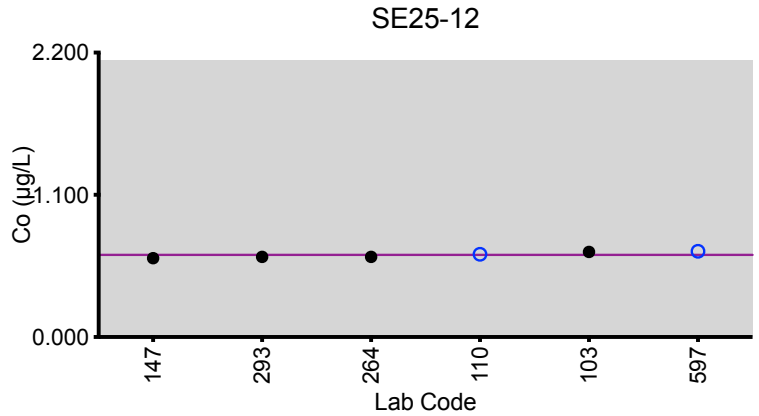
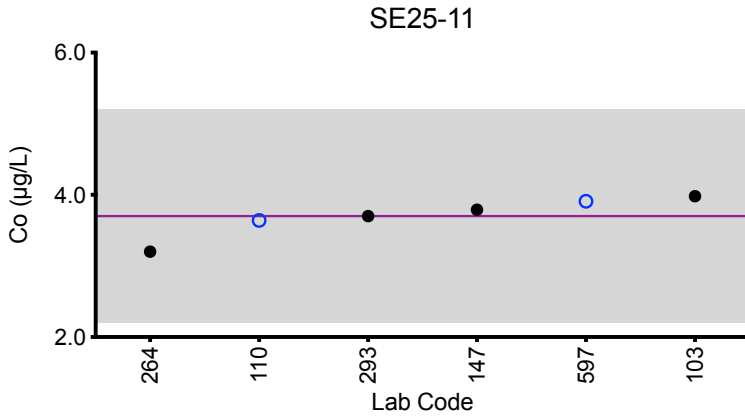
Lab Code	Method	Serum Co (µg/L)				
		SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
	<b>Target</b>	<b>3.7</b>	<b>0.635</b>	<b>6.32</b>	<b>18.3</b>	<b>4.62</b>
103	ICP-MS/MS	3.98	0.658	*6.80	19.2	*4.86
110	ICP-MS/MS	3.64	0.64	6.22	17.7	4.56
147	DRC/CC-ICP-MS	3.79	0.610	6.33	19.1	4.61
264	ICP-MS	3.20	0.62	6.40	18.53	4.66
293	DRC/CC-ICP-MS	3.7	0.62	6.29	18.23	4.63
597	ICP-MS/MS	3.91	0.663	6.35	17.2	4.65

Based on the grading criteria for Co in Serum, 100% 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 #3, 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:

$\pm 1.5 \mu\text{g/L}$  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  $10 \mu\text{g/L}$ .



### Results for Event #3, 2025: Summary Statistics

	Serum Cr (µg/L)				
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	0.56	3.02	1.37	0.97	2.29
<b>Upper Limit</b>	2.56	5.02	3.37	2.97	4.29
<b>Lower Limit</b>	0.00	1.02	0.00	0.00	0.29
<b>Arithmetic SD (s)</b>	0.10	0.21	0.16	0.09	0.14
<b>Arithmetic RSD (%)</b>	17	7.0	12	9.4	6.1
<b>Number of Sample Measurements (N)</b>	5	6	6	6	6

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 #3, 2025: Performance of Participating Laboratories

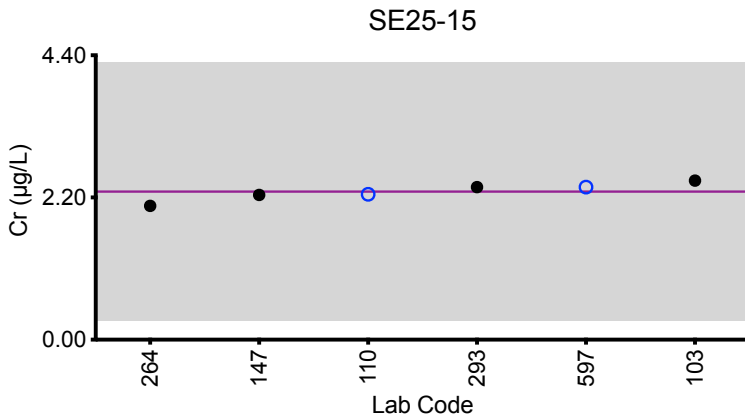
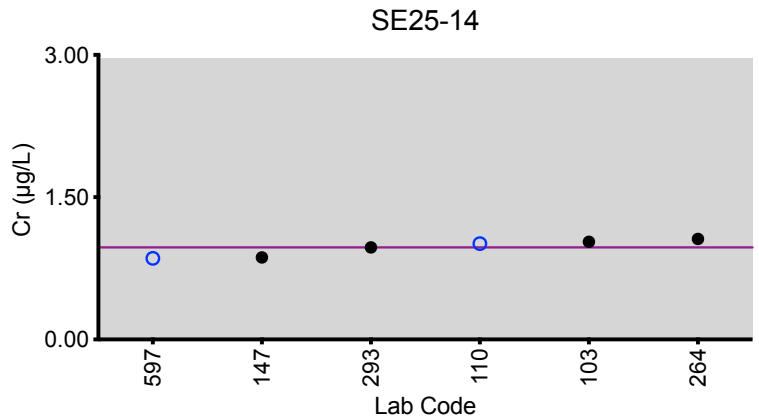
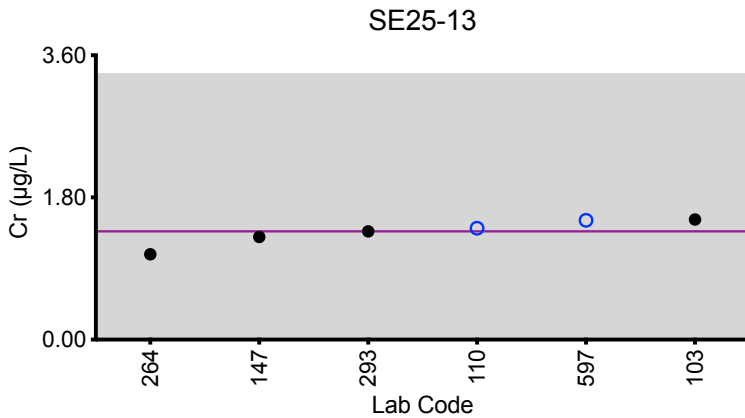
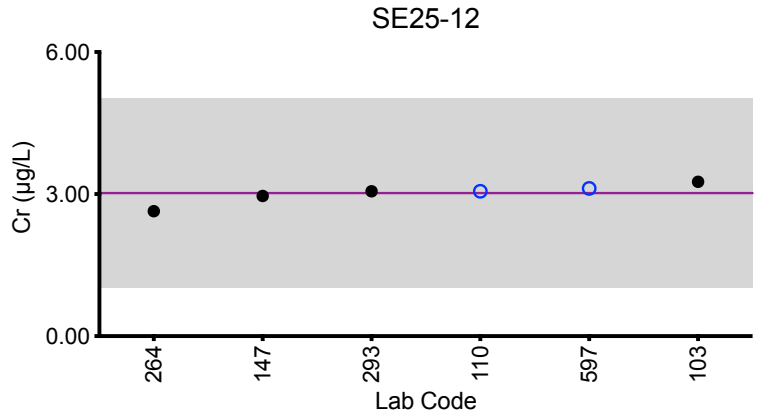
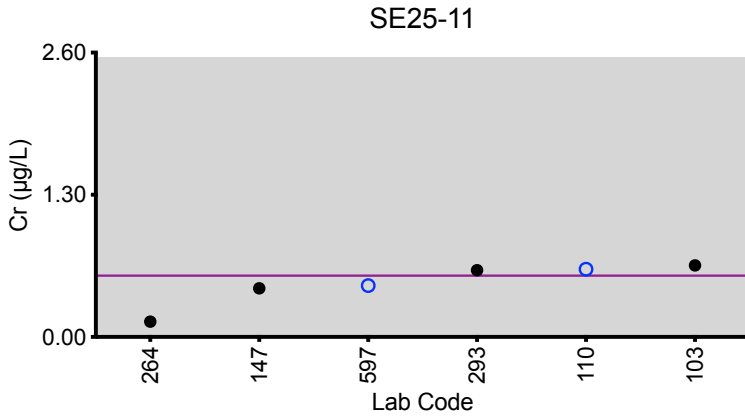
Lab Code	Method	Serum Cr (µg/L)				
		SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
	<b>Target</b>	<b>0.56</b>	<b>3.02</b>	<b>1.37</b>	<b>0.97</b>	<b>2.29</b>
103	ICP-MS/MS	0.654	3.26	1.52	1.03	2.46
110	ICP-MS/MS	0.62	3.06	1.41	1.01	2.25
147	DRC/CC-ICP-MS	0.445	2.96	1.30	0.865	2.24
264	ICP-MS	*0.14	2.64	1.08	1.06	2.07
293	DRC/CC-ICP-MS	0.61	3.06	1.37	0.97	2.36
597	ICP-MS/MS	0.470	3.12	1.51	0.855	2.36

Based on the grading criteria for Cr in Serum, 100% 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 #3, 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 #3, 2025: Summary Statistics

	Serum Cu (µg/L)				
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	588	1791	1125	1261	931
<b>Upper Limit</b>	680	2060	1290	1450	1070
<b>Lower Limit</b>	490	1520	960	1070	790
<b>Arithmetic SD (s)</b>	110	170	60	60	40
<b>Arithmetic RSD (%)</b>	19	9.5	5.3	4.8	4.3
<b>Number of Sample Measurements (N)</b>	6	6	5	5	5

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 #3, 2025: Performance of Participating Laboratories

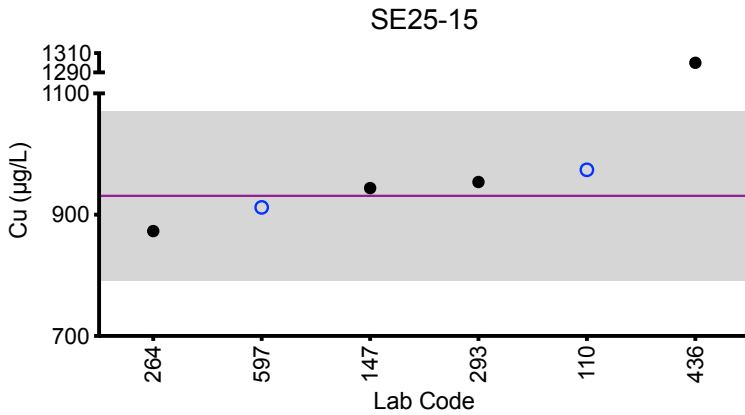
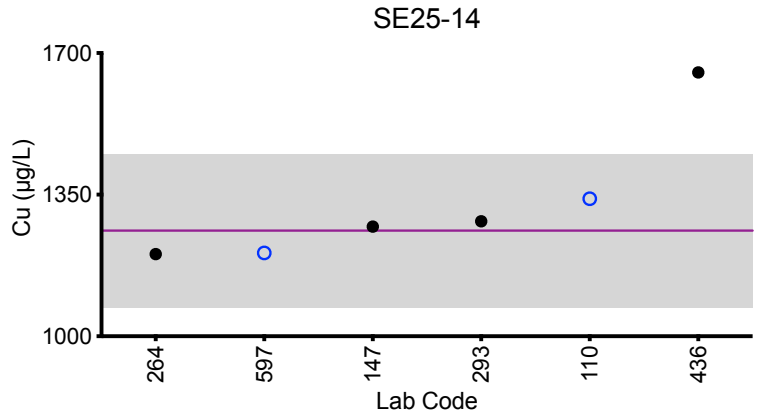
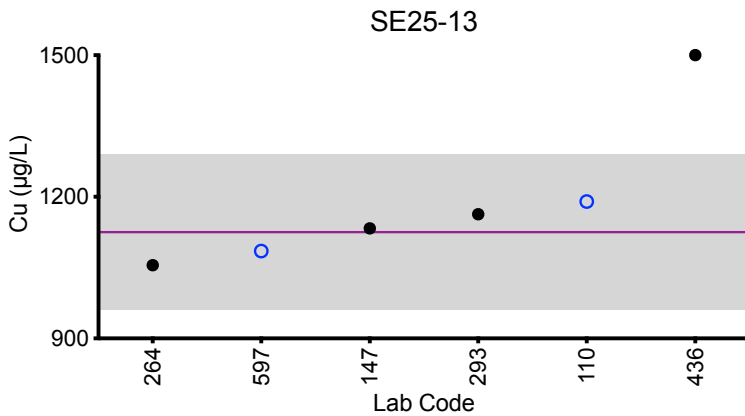
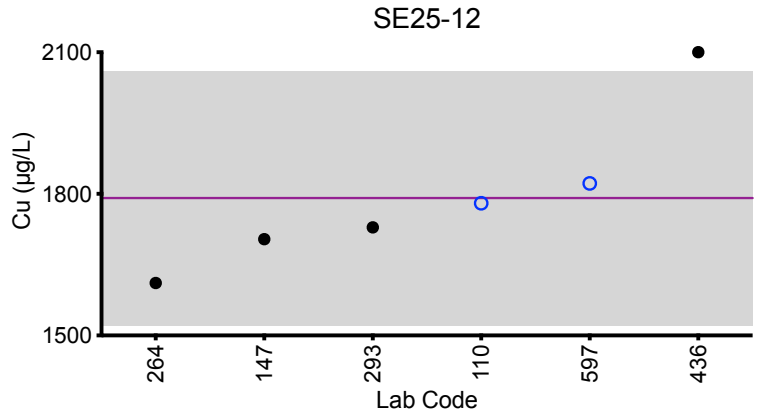
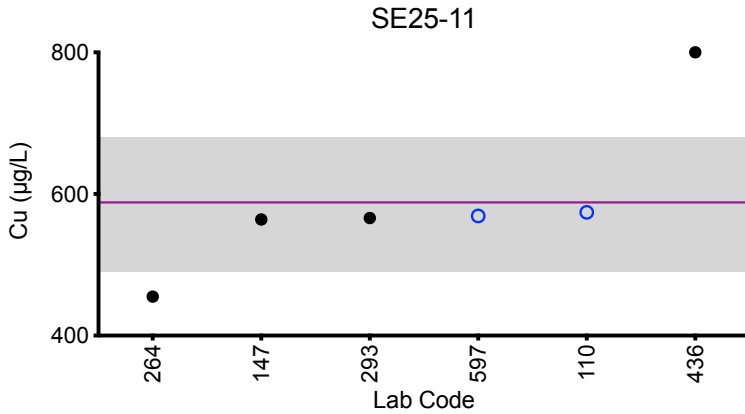
		Serum Cu (µg/L)				
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
	<b>Target</b>	<b>588</b>	<b>1791</b>	<b>1125</b>	<b>1261</b>	<b>931</b>
110	ICP-MS/MS	574	1780	1190	1340	974
147	DRC/CC-ICP-MS	564	1704	1133	1271	944
264	ICP-MS	455 ↓	1611	1055	1203	873
293	DRC/CC-ICP-MS	566	1729	1163	1284	954
436	FAAS	800 ↑	2100 ↑	*1500 ↑	*1652 ↑	*1300 ↑
597	ICP-MS/MS	569	1822	1085	1206	912

Based on the grading criteria for Cu in Serum, 80% 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 #3, 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 #3, 2025: Summary Statistics

	Serum Se (µg/L)				
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	144	140	281	186	126
<b>Upper Limit</b>	173	168	337	223	151
<b>Lower Limit</b>	115	112	225	149	101
<b>Arithmetic SD (s)</b>	11	11	17	11	8
<b>Arithmetic RSD (%)</b>	7.6	7.9	6.0	5.9	6.3
<b>Number of Sample Measurements (N)</b>	7	7	7	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 by New York State Department of Health's Wadsworth Center, the PT Program organizer.



### Results for Event #3, 2025: Performance of Participating Laboratories

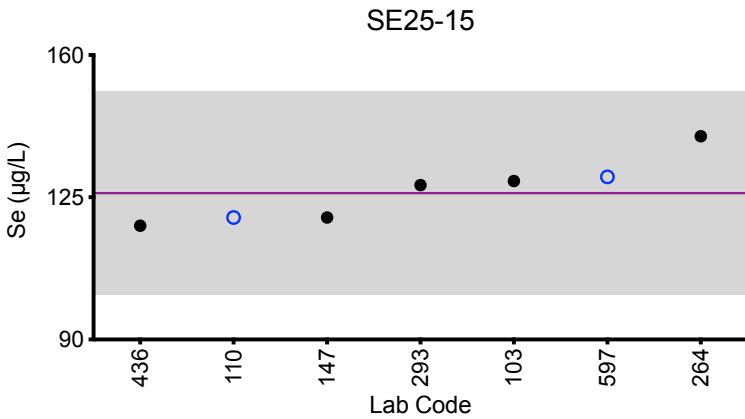
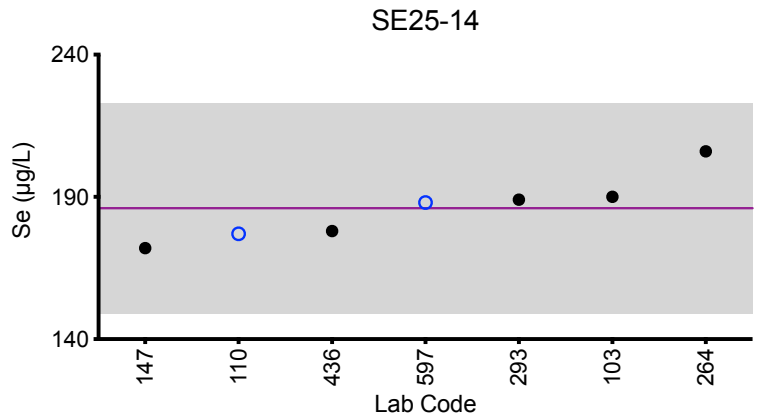
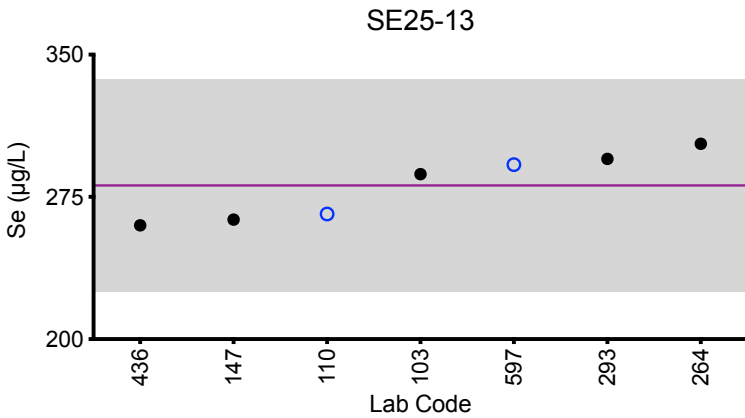
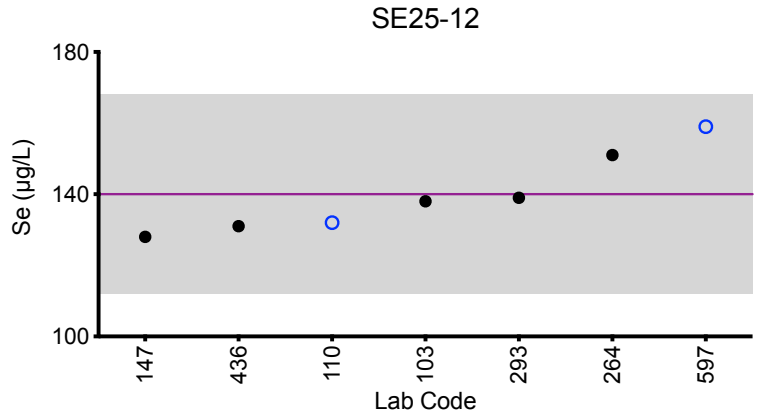
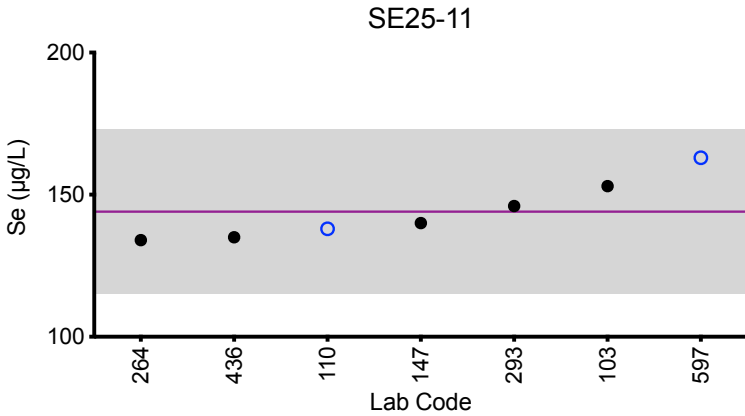
		Serum Se (µg/L)				
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
	<b>Target</b>	<b>144</b>	<b>140</b>	<b>281</b>	<b>186</b>	<b>126</b>
103	ICP-MS/MS	153	138	287	190	129
110	ICP-MS/MS	138	132	266	177	120
147	DRC/CC-ICP-MS	140	128	263	172	120
264	ICP-MS	134	151	303	206	140
293	DRC/CC-ICP-MS	146	139	295	189	128
436	ETAAS-Other	135	131	260	178	118
597	ICP-MS/MS	163	159	292	188	130

Based on the grading criteria for Se 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 #3, 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:

$\pm 2 \mu\text{g/L}$  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 #3, 2025: Summary Statistics

	Serum Zn ( $\mu\text{g/L}$ )				
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
<b>Target (Arithmetic Mean (<math>\bar{x}</math>))</b>	779	718	1458	1134	1925
<b>Upper Limit</b>	900	830	1677	1300	2210
<b>Lower Limit</b>	660	610	1239	960	1640
<b>Arithmetic SD (s)</b>	60	30	10	30	50
<b>Arithmetic RSD (%)</b>	7.7	4.2	0.69	2.7	2.6
<b>Number of Sample Measurements (N)</b>	5	5	4	5	5

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 #3, 2025: Performance of Participating Laboratories

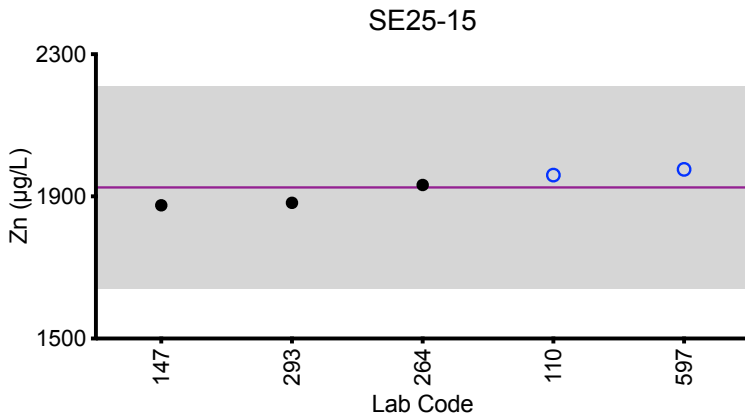
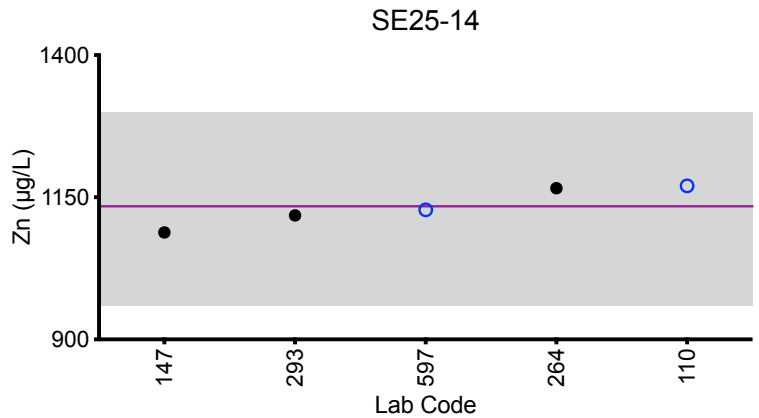
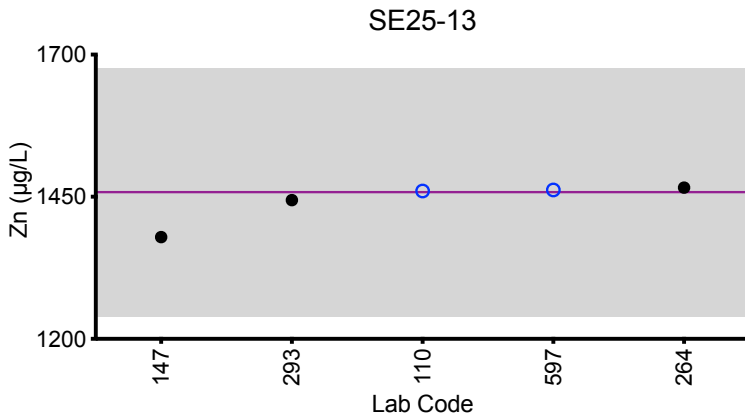
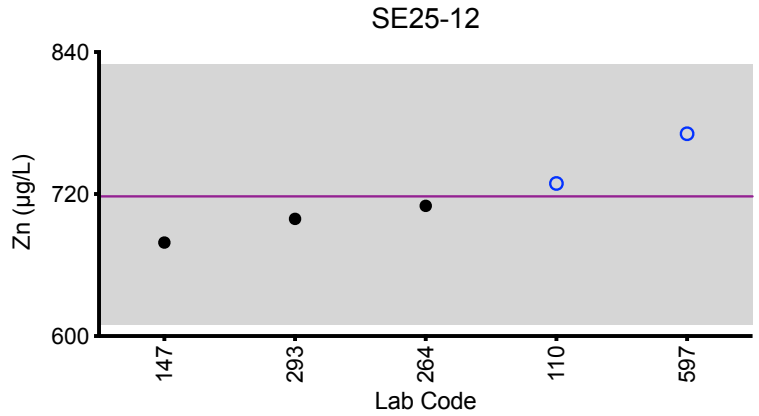
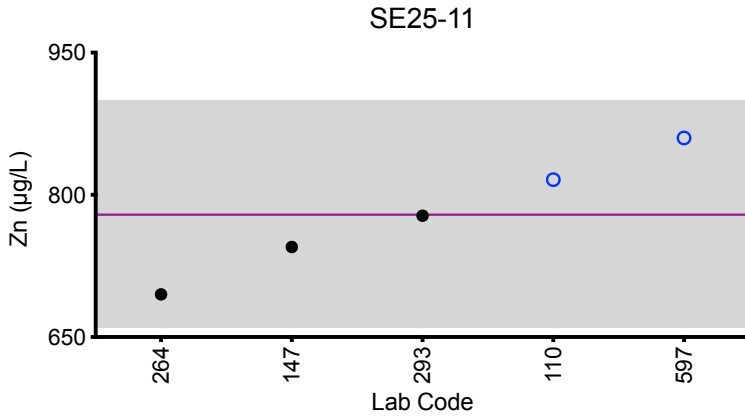
		Serum Zn (µg/L)				
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
	<b>Target</b>	<b>779</b>	<b>718</b>	<b>1458</b>	<b>1134</b>	<b>1925</b>
110	ICP-MS/MS	816	729	1460	1170	1960
147	DRC/CC-ICP-MS	745	679	*1379	1088	1875
264	ICP-MS	695	710	1466	1166	1932
293	DRC/CC-ICP-MS	778	699	1444	1118	1882
597	ICP-MS/MS	860	771	1462	1128	1976

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



## Results for Event #3, 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:

$\pm 15 \mu\text{g/L}$  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  $100 \mu\text{g/L}$ .



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

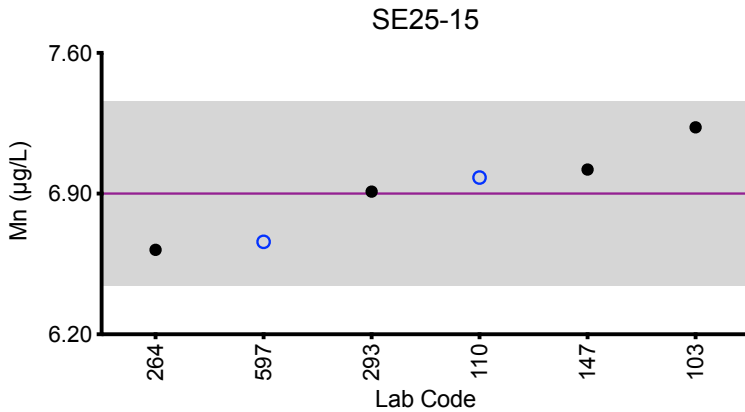
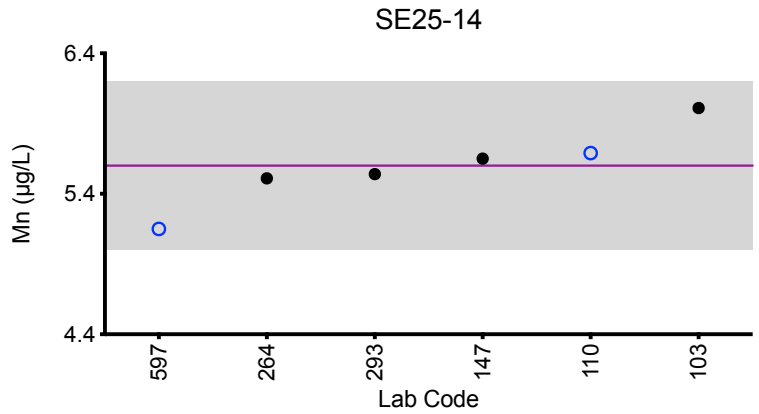
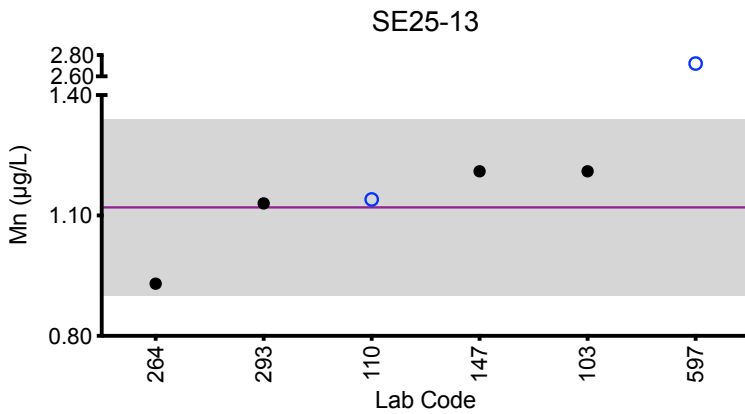
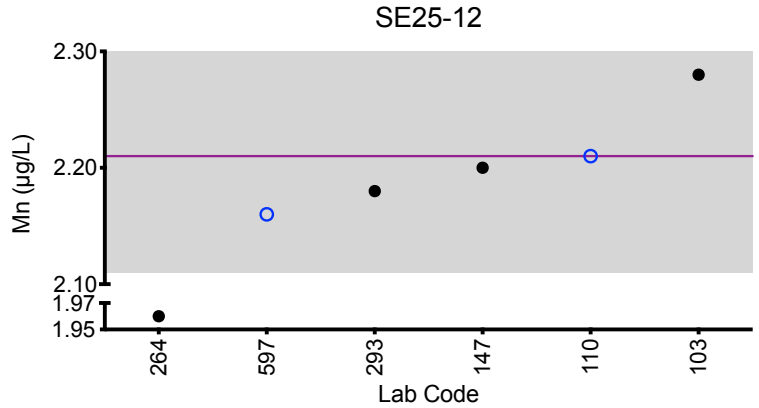
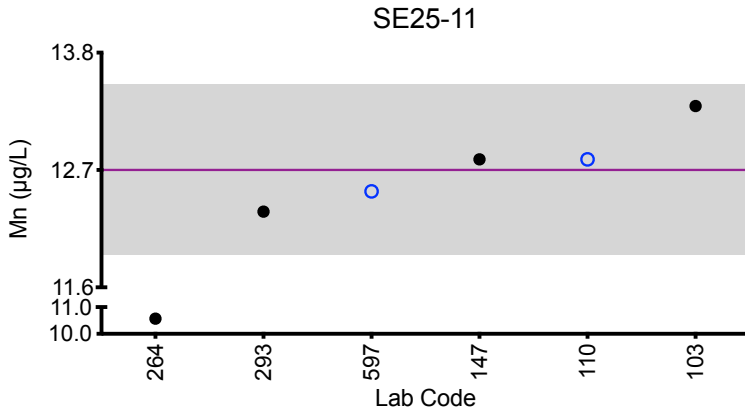
Serum Mn (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	13.3	2.28	1.21	6.01	7.23
110	ICP-MS/MS	12.8	2.21	1.14	5.69	6.98
147	DRC/CC-ICP-MS	12.8	2.20	1.21	5.65	7.02
264	ICP-MS	*10.57	*1.96	0.93	5.51	6.62
293	DRC/CC-ICP-MS	12.310	2.18	1.13	5.54	6.910
597	ICP-MS/MS	12.5	2.16	*2.72	5.15	6.66
Summary Statistics						
		SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
<b>Arithmetic Mean (<math>\bar{x}</math>)</b>		12.7	2.21	1.12	5.6	6.90
<b>Arithmetic SD (s)</b>		0.4	0.05	0.11	0.3	0.23
<b>Arithmetic RSD (%)</b>		3.1	2.3	9.8	5.0	3.3
<b>Number of Sample Measurements (N)</b>		5	5	5	6	6

\*Denotes a statistical Outlier.



# Results for Event #3, 2025: Summary Figures

## Serum Mn



### 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 #3, 2025: Laboratory Data and Summary Statistics

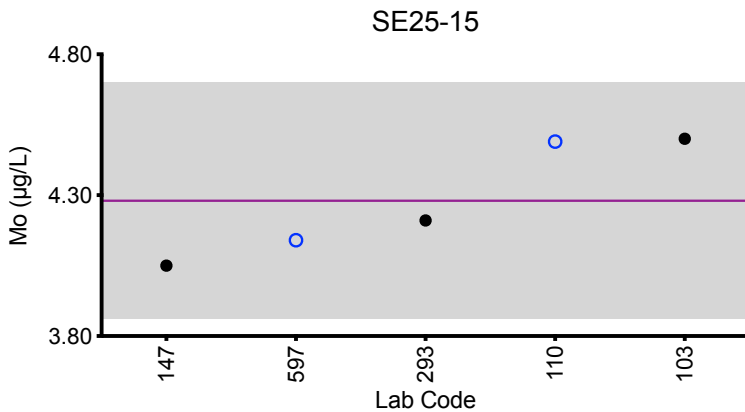
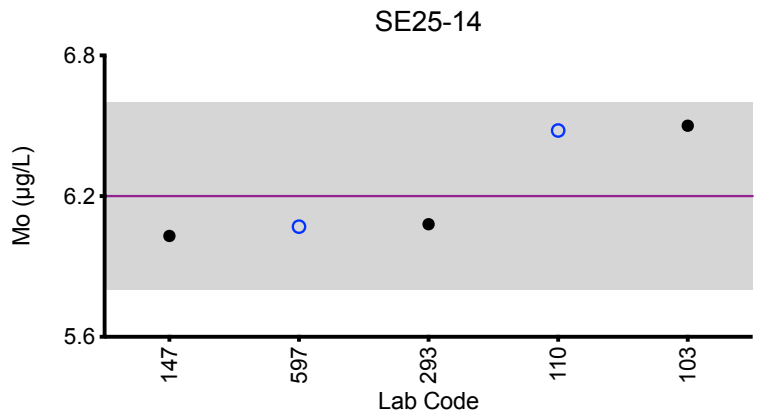
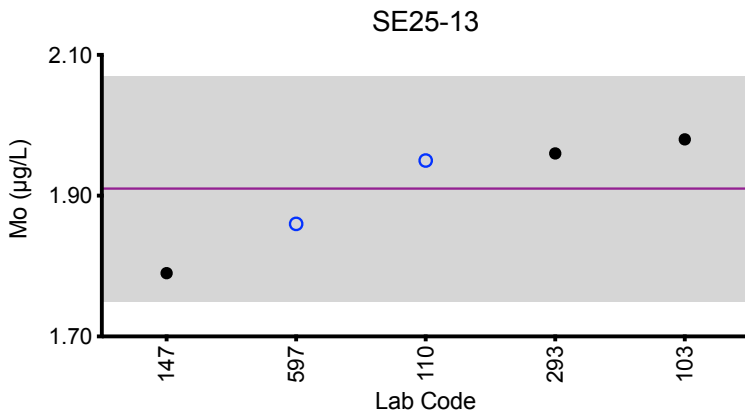
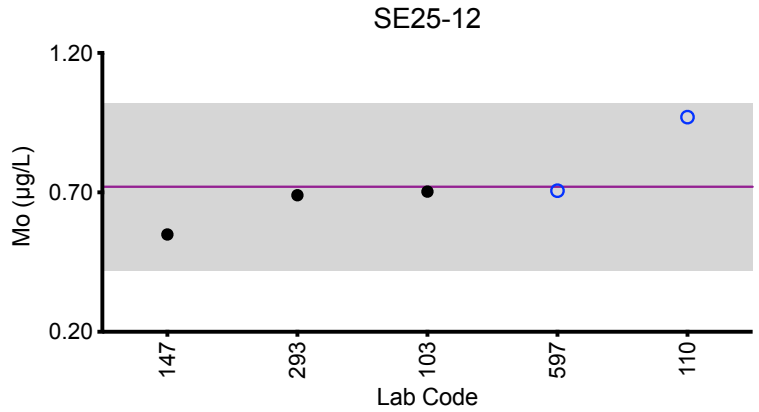
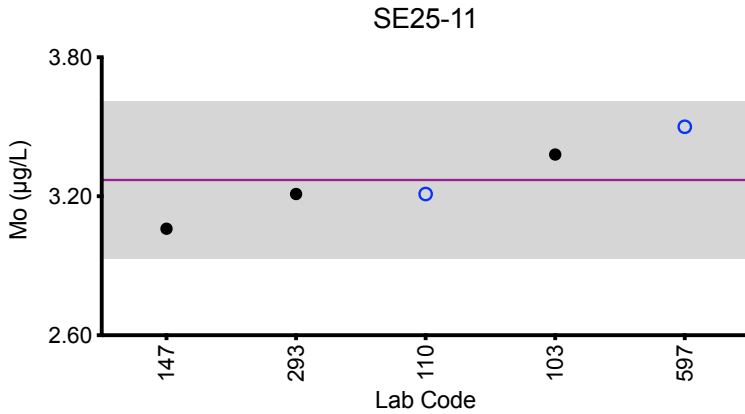
Serum Mo (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	3.38	0.703	1.98	6.50	4.50
110	ICP-MS/MS	3.21	0.97	1.95	6.48	4.49
147	DRC/CC-ICP-MS	3.06	0.549	1.79	6.03	4.05
293	DRC/CC-ICP-MS	3.210	0.690	1.960	6.080	4.210
597	ICP-MS/MS	3.50	0.706	1.86	6.07	4.14
Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	3.27	0.72	1.91	6.2	4.28	
Arithmetic SD (s)	0.17	0.15	0.08	0.2	0.21	
Arithmetic RSD (%)	5.2	21	4.2	3.9	4.9	
Number of Sample Measurements (N)	5	5	5	5	5	

\*Denotes a statistical Outlier.



## Results for Event #3, 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 #3, 2025: Laboratory Data and Summary Statistics

Serum Ni (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	9.80	3.96	3.24	4.93	1.45
110	ICP-MS/MS	9.91	4.27	3.34	7.43	1.79
147	DRC/CC-ICP-MS	9.48	4.28	2.75	4.47	1.18
293	DRC/CC-ICP-MS	9.25	3.71	3.19	4.64	1.43
597	ICP-MS/MS	9.57	3.79	*5.33	5.41	1.26

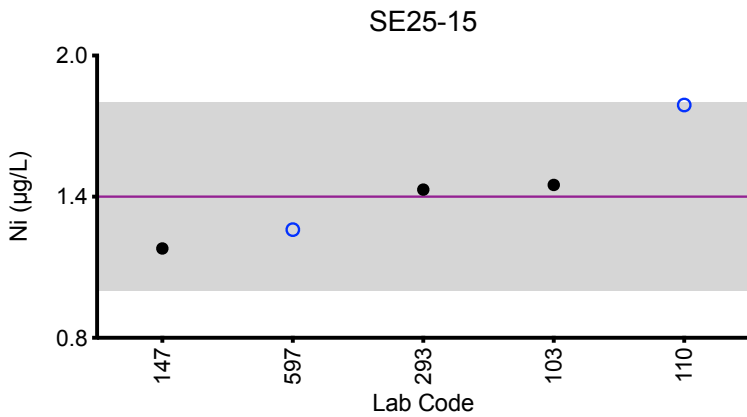
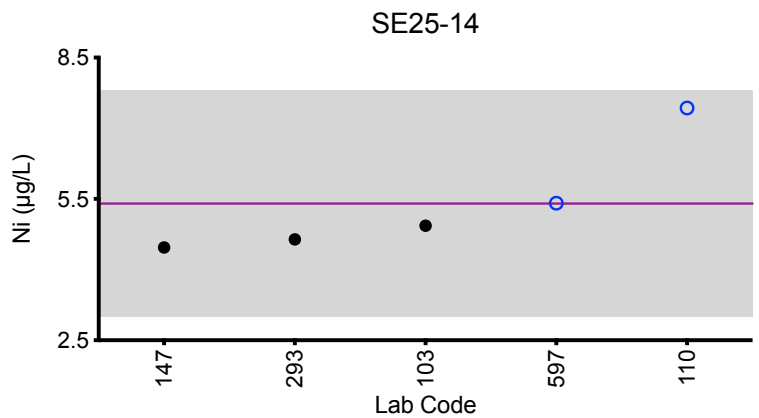
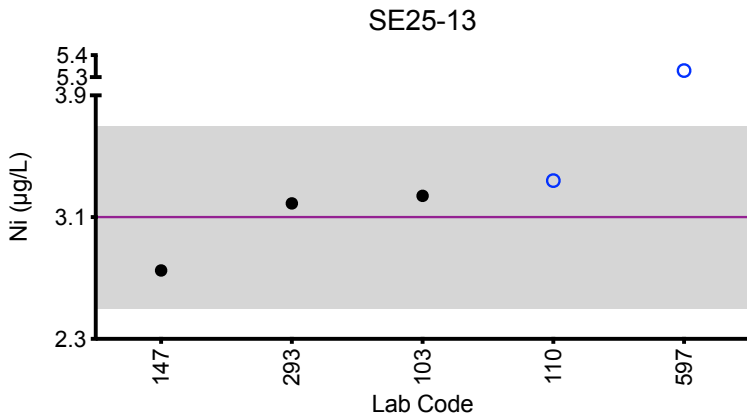
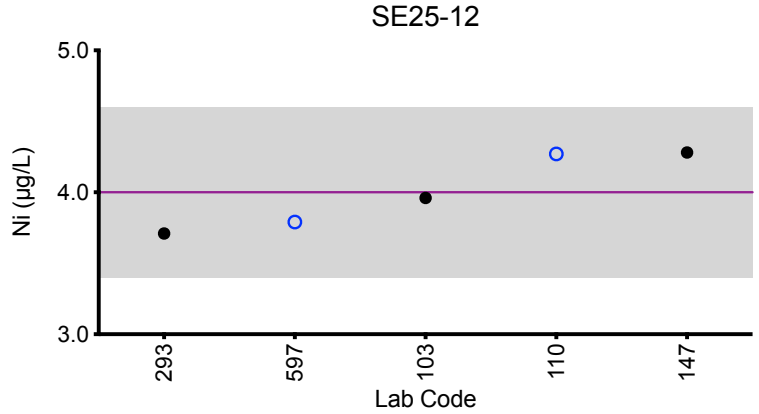
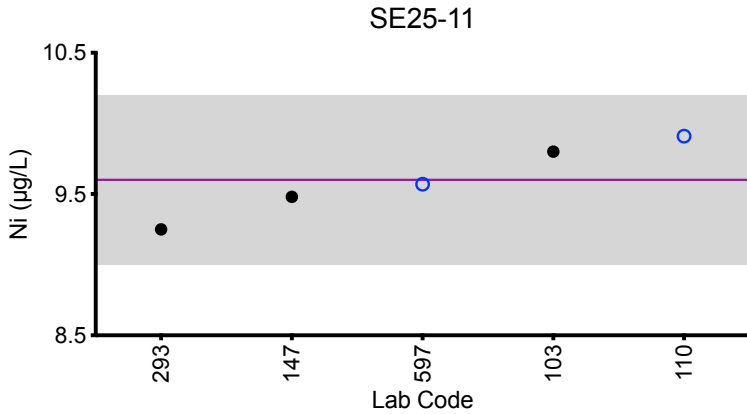
Summary Statistics					
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )	9.6	4.0	3.1	5.4	1.4
Arithmetic SD (s)	0.3	0.3	0.3	1.2	0.2
Arithmetic RSD (%)	2.7	6.8	8.3	22	17
Number of Sample Measurements (N)	5	5	4	5	5

\*Denotes a statistical Outlier.



# Results for Event #3, 2025: Summary Figures

## Serum Ni



### 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 #3, 2025: Laboratory Data and Summary Statistics

Serum As (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	1.12	7.42	2.69	23.7	4.26
110	ICP-MS/MS	0.98	7.24	2.43	22.3	3.96
147	DRC/CC-ICP-MS	1.01	6.77	2.48	20.9	3.87
597	ICP-MS/MS	1.33	8.06	2.85	22.9	4.34
Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	1.11	7.4	2.6	22.5	4.1	
Arithmetic SD (s)	0.16	0.5	0.2	1.2	0.2	
Arithmetic RSD (%)	14	6.8	7.3	5.3	5.6	
Number of Sample Measurements (N)	4	4	4	4	4	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Ba (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
110	ICP-MS/MS	2.78	0.84	0.81	0.89	3.15
147	ICP-MS	2.29	0.523	0.612	0.466	2.59
597	ICP-MS/MS	2.84	0.839	0.789	0.695	3.10
Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	2.6	0.7	0.74	0.7	2.9	
Arithmetic SD (s)	0.3	0.2	0.11	0.2	0.3	
Arithmetic RSD (%)	12	25	15	31	10	
Number of Sample Measurements (N)	3	3	3	3	3	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Be (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
110	ICP-MS/MS	0.76	2.31	0.79	0.37	2.68
147	ICP-MS	0.904	2.20	0.804	0.325	2.40
293	DRC/CC-ICP-MS	0.72	2.32	0.79	0.31	2.47
597	ICP-MS/MS	0.742	2.55	0.786	0.279	2.490
Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	0.78	2.35	0.792	0.32	2.51	
Arithmetic SD (s)	0.08	0.15	0.008	0.04	0.12	
Arithmetic RSD (%)	10	6.4	1.0	13	4.8	
Number of Sample Measurements (N)	4	4	4	4	4	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Serum Bi (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
147	ICP-MS	<0.0397	<0.0397	<0.0397	<0.0397	0.127
597	ICP-MS/MS	<0.00477	<0.00477	<0.00477	<0.00477	0.140

### Summary Statistics

	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )	NA	NA	NA	NA	0.134
Arithmetic SD (s)	NA	NA	NA	NA	0.009
Arithmetic RSD (%)	NA	NA	NA	NA	6.7
Number of Sample Measurements (N)	NA	NA	NA	NA	2

\*Denotes a statistical Outlier.

Statistical data was not calculated for SE25-11 through SE25-14 based on a lack of consensus among participating labs.



### Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Cd (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	0.770	2.36	0.277	3.70	1.16
110	ICP-MS/MS	0.75	2.29	0.25	3.62	1.12
147	ICP-MS	0.728	2.29	0.181	3.42	1.06
597	ICP-MS/MS	0.861	2.60	0.275	3.68	1.14
Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	0.78	2.38	0.25	3.61	1.12	
Arithmetic SD (s)	0.06	0.15	0.04	0.13	0.04	
Arithmetic RSD (%)	7.7	6.3	16	3.6	3.6	
Number of Sample Measurements (N)	4	4	4	4	4	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Cs ( $\mu\text{g/L}$ )						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
110	ICP-MS/MS	0.49	0.38	0.34	0.83	0.72
597	ICP-MS/MS	0.513	0.415	0.371	0.787	0.716

Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	0.50	0.40	0.36	0.81	0.718	
Arithmetic SD (s)	0.02	0.02	0.02	0.03	0.003	
Arithmetic RSD (%)	3.2	5.0	5.6	3.7	0.42	
Number of Sample Measurements (N)	2	2	2	2	2	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Serum Fe (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
264	ICP-MS	1054	10334	1220	4657	5130
597	ICP-MS/MS	178	1119	165	490	554

### Summary Statistics

	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )	NA	NA	NA	NA	NA
Arithmetic SD (s)	NA	NA	NA	NA	NA
Arithmetic RSD (%)	NA	NA	NA	NA	NA
Number of Sample Measurements (N)	NA	NA	NA	NA	NA

\*Denotes a statistical Outlier.

Statistical data was not calculated for SE25-11 through SE25-15 based on a lack of consensus among participating labs.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Hg (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	4.82	1.96	0.483	0.924	3.45
110	ICP-MS/MS	4.59	2.04	0.49	0.91	3.22
597	ICP-MS/MS	4.92	2.11	0.416	0.800	2.77
Summary Statistics						
		SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )		4.8	2.04	0.46	0.88	3.1
Arithmetic SD (s)		0.2	0.08	0.04	0.07	0.3
Arithmetic RSD (%)		3.6	3.9	8.7	8.0	9.7
Number of Sample Measurements (N)		3	3	3	3	3

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum I ( $\mu\text{g/L}$ )						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
147	ICP-MS	50.8	44.2	55.2	48.7	47.8
597	ICP-MS/MS	60.0	52.9	64.8	58.8	56.8

Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	55	49	60	54	52	
Arithmetic SD (s)	7	6	7	7	6	
Arithmetic RSD (%)	13	12	12	13	12	
Number of Sample Measurements (N)	2	2	2	2	2	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Serum Li (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
147	ICP-MS	0.398	1.26	0.200	0.786	0.560
597	ICP-MS/MS	0.405	1.38	0.200	0.754	0.568

### Summary Statistics

	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )	0.402	1.32	0.200	0.77	0.564
Arithmetic SD (s)	0.005	0.08	0.000	0.02	0.006
Arithmetic RSD (%)	1.2	6.1	0.0	2.6	1.1
Number of Sample Measurements (N)	2	2	2	2	2

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Mg (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
264	ICP-MS	16367	16947	21424	15933	16320
597	ICP-MS/MS	19600	17500	21690	15230	16620

Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	18000	17200	21560	15600	16500	
Arithmetic SD (s)	2000	400	190	500	200	
Arithmetic RSD (%)	11	2.3	0.88	3.2	1.2	
Number of Sample Measurements (N)	2	2	2	2	2	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Pb ( $\mu\text{g/L}$ )						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	8.48	3.20	1.67	0.839	5.35
110	ICP-MS/MS	8.60	3.30	1.63	1.17	5.43
597	ICP-MS/MS	8.72	3.38	1.63	0.780	5.13

Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	8.60	3.29	1.64	0.9	5.30	
Arithmetic SD (s)	0.12	0.09	0.02	0.2	0.16	
Arithmetic RSD (%)	1.4	2.7	1.4	23	3.0	
Number of Sample Measurements (N)	3	3	3	3	3	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Pt (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
110	ICP-MS/MS	0.373	*0.170	1.47	0.112	0.353
264	ICP-MS	0.66	0.46	1.58	0.14	0.40
293	DRC/CC-ICP-MS	0.39	0.49	1.46	0.10	0.43
Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	0.47	0.48	1.50	0.12	0.39	
Arithmetic SD (s)	0.16	0.02	0.07	0.02	0.04	
Arithmetic RSD (%)	34	4.5	4.7	18	10	
Number of Sample Measurements (N)	3	2	3	3	3	

\*Denotes a statistical Outlier.



### Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Sb (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	0.691	1.37	4.29	3.14	6.00
110	ICP-MS/MS	0.68	1.37	4.32	3.27	6.27
147	ICP-MS	0.630	1.26	3.93	2.88	5.67
597	ICP-MS/MS	0.670	1.29	4.03	3.09	5.79
Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	0.67	1.32	4.1	3.10	5.9	
Arithmetic SD (s)	0.03	0.06	0.2	0.16	0.3	
Arithmetic RSD (%)	4.0	4.5	4.6	5.2	4.4	
Number of Sample Measurements (N)	4	4	4	4	4	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Serum Sn (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
110	ICP-MS/MS	0.95	4.73	0.79	3.17	1.76
597	ICP-MS/MS	0.925	4.81	0.656	2.90	1.60

### Summary Statistics

	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )	0.94	4.77	0.72	3.0	1.68
Arithmetic SD (s)	0.02	0.06	0.09	0.2	0.11
Arithmetic RSD (%)	1.9	1.3	13	6.3	6.5
Number of Sample Measurements (N)	2	2	2	2	2

\*Denotes a statistical Outlier.



### Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Sr (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	128	52.7	55.4	75.6	51.3
200	ICP-MS	114.000	44.00	52.60	70.10	52.600
597	ICP-MS/MS	127	51.4	50.4	68.4	48.5

Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	123	49	52.8	71	50.8	
Arithmetic SD (s)	8	5	2.5	4	2.1	
Arithmetic RSD (%)	6.5	10	4.7	5.6	4.1	
Number of Sample Measurements (N)	3	3	3	3	3	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum Ti ( $\mu\text{g/L}$ )						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
200	DRC/CC-ICP-MS	6.70	4.60	8.45	3.89	3.65
597	ICP-MS/MS	6.13	5.97	7.48	2.14	2.59

Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	6.4	5.3	8.0	3.0	3.1	
Arithmetic SD (s)	0.4	0.1	0.7	1.2	0.7	
Arithmetic RSD (%)	6.3	19	8.8	40	23	
Number of Sample Measurements (N)	2	2	2	2	2	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum TI (µg/L)						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	0.875	1.29	2.75	0.573	1.89
110	ICP-MS/MS	0.854	1.24	2.69	0.568	1.83
147	ICP-MS	0.796	1.17	2.48	0.524	1.75
597	ICP-MS/MS	0.921	1.32	2.58	0.560	1.82
Summary Statistics						
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15	
Arithmetic Mean ( $\bar{x}$ )	0.86	1.25	2.63	0.56	1.82	
Arithmetic SD (s)	0.05	0.07	0.12	0.02	0.06	
Arithmetic RSD (%)	5.8	5.6	4.6	4.0	3.3	
Number of Sample Measurements (N)	4	4	4	4	4	

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

Serum U ( $\mu\text{g/L}$ )						
Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
103	ICP-MS/MS	0.0472	0.0844	0.226	0.133	0.0783
110	ICP-MS/MS	0.045	0.087	0.223	0.133	0.074
597	ICP-MS/MS	0.0495	0.0954	0.212	0.129	0.0740

Summary Statistics					
	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )	0.047	0.089	0.220	0.132	0.075
Arithmetic SD (s)	0.002	0.006	0.007	0.002	0.002
Arithmetic RSD (%)	4.9	6.7	3.2	1.7	3.3
Number of Sample Measurements (N)	3	3	3	3	3

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Serum V (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
110	ICP-MS/MS	0.54	2.94	0.83	4.07	1.91
147	DRC/CC-ICP-MS	0.406	2.60	0.661	3.50	1.72
293	DRC/CC-ICP-MS	0.58	2.75	0.84	3.66	1.9
597	ICP-MS/MS	0.715	3.25	0.826	4.00	1.93

### Summary Statistics

	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )	0.56	2.9	0.79	3.8	1.87
Arithmetic SD (s)	0.13	0.3	0.09	0.3	0.10
Arithmetic RSD (%)	23	9.7	11	7.1	5.3
Number of Sample Measurements (N)	4	4	4	4	4

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Laboratory Data and Summary Statistics

### Serum W (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
110	ICP-MS/MS	0.23	0.69	0.14	1.26	0.38
597	ICP-MS/MS	0.233	0.736	0.127	1.22	0.350

### Summary Statistics

	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
Arithmetic Mean ( $\bar{x}$ )	0.232	0.71	0.134	1.24	0.37
Arithmetic SD (s)	0.002	0.03	0.009	0.03	0.02
Arithmetic RSD (%)	0.91	4.2	6.7	2.4	5.8
Number of Sample Measurements (N)	2	2	2	2	2

\*Denotes a statistical Outlier.



## Results for Event #3, 2025: Additional Elements in Serum

### Serum B (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
597	ICP-MS/MS	12.1	19.8	3.90	17.3	22.3

### Serum Br (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
597	ICP-MS/MS	3170	1950	3030.00	1500	2190

### Serum Ca (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
597	ICP-MS/MS	89800	94900	85700	83600	83300

### Serum Cl (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
597	ICP-MS/MS	5110000	4670000	4750000.	4720000	4860000

### Serum Ga (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
597	ICP-MS/MS	<0.0184	<0.0184	<0.0184	<0.0184	<0.0184

### Serum S (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
597	ICP-MS/MS	1070000	1160000	1080000.	1040000	1040000

### Serum Te (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
110	ICP-MS/MS	<0.02	<0.02	<0.02	<0.02	<0.02

### Serum Th (µg/L)

Lab Code	Method	SE25-11	SE25-12	SE25-13	SE25-14	SE25-15
597	ICP-MS/MS	0.00776	0.00183	0.00170	0.00100	0.00150



## References

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