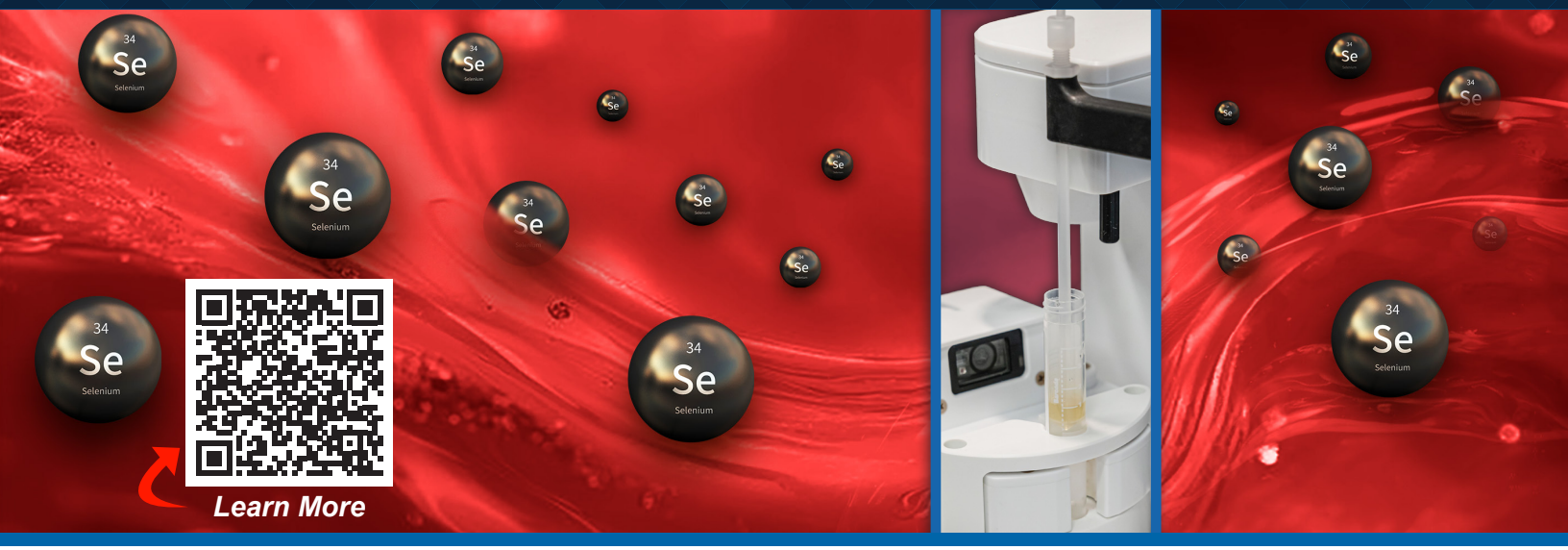
Elemental Scientific

Se in Serum
TRAXStation Clinical



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TRAXStation Clinical – Fully Automated Preparation of Serum Samples for the Analysis of Selenium

Introduction

Trace element analysis plays a critical role in modern clinical diagnostics, providing essential information for evaluating nutritional status, toxic exposures, and metabolic disorders. Traditionally, the workflow for preparing and analyzing clinical samples by inductively coupled plasma mass spectrometry (ICPMS) has relied heavily on manual liquid handling steps. These steps – such as uncapping, rocking, pipetting, and dilution are time-consuming, prone to operator variability, and present ongoing risks of contamination, especially at trace and ultra-trace concentrations. As clinical demand grows, laboratories processing hundreds to thousands of patient samples per day face the mounting pressure to increase throughput while maintaining uncompromising analytical quality.

TRAXStation Clinical directly addresses these challenges by automating routine sample preparation tasks in a controlled, contamination-free environment. Built with chemically inert materials, the platform is designed to handle clinical matrices reliably while eliminating common sources of error. Advanced features such as automated vial uncapping, liquid-level detection, barcode tracking, sample mixing and precise dilution routines ensure consistent preparation across large sample sets. For high-volume laboratories, this level of automation translates to improved reproducibility, reduced operator workload, and a streamlined path from original patient specimen to analysis-ready sample.

Figure 1. **TRAX**Station Clinical 422.

Introduction *(Continued)*

Figure 2. **TRAX**Station Clinical takes up a serum aliquot for automated preparation.

TRAXStation Clinical automates the full preparation workflow for serum samples collected in plastic metal free serum tubes. The compact platform integrates all key steps into a single system, improving laboratory efficiency, traceability, and operator safety while ensuring high-quality, reproducible results. By replacing labor-intensive manual steps, **TRAX**Station Clinical reduces errors, shortens turnaround times, and increases throughput while maintaining strict regulatory compliance and sample integrity.

TRAXStation Clinical Workflow

Barcode Reading & Sample Tracking
Integrated barcode scanning provides complete traceability and seamless connection to instruments and LIMS.

Automated Uncapping
Hands-free uncapping reduces manual handling, contamination risk, and biohazard exposure.

Sample Level Detecting
Sound waves are used to detect sample liquid levels. The probe will aspirate from just below the liquid surface.

Precision Sampling & Dilution
High-accuracy pipetting enables aliquoting into tubes or 96-well plates, with programmable dilutions for flexible assay workflows.

Mixing & Plate Preparation
Automated mixing ensures consistent sample readiness.

(Optional) Sample Tube Rocker
Gentle rocking of tubes prior to processing guarantees homogeneous samples for accurate downstream analysis.

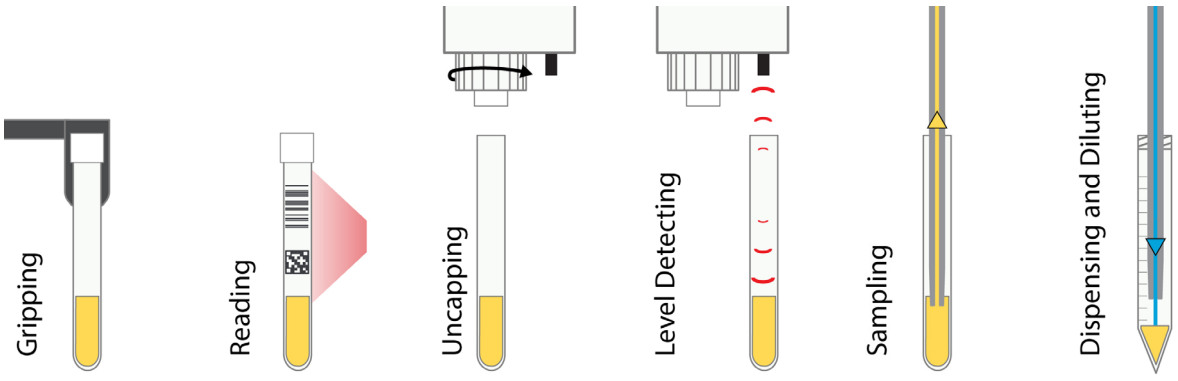


Figure 3. **TRAX**Station Clinical automated workflow for serum sample preparation.

Background

Laboratories routinely test for selenium levels in serum because it is an essential trace element that plays a critical role in human health, and imbalances can signal significant clinical conditions. By measuring serum levels, laboratories provide clinicians with crucial information for diagnosing deficiencies, toxicity, monitoring disease progression, and guiding nutritional or therapeutic interventions.

Selenium in Serum

Selenium is an essential trace element required for human health. It is a key component of selenoproteins, such as glutathione peroxidase and thioredoxin reductase which protect cells from oxidative stress. Measuring serum levels helps determine if a person has deficiency, adequacy, or excess intake.

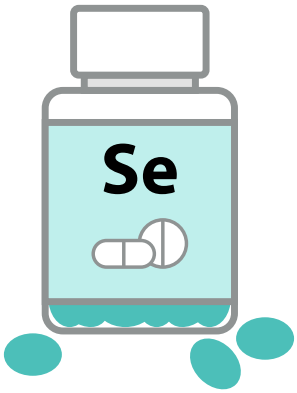
Low selenium levels can be associated with Keshan disease (cardiomyopathy linked to deficiency seen in selenium-poor regions), Kashin-Beck disease (a type of osteoarthropathy), weakened antioxidant defenses, increased oxidative stress and possible increased cancer risk. Patients on long-term parenteral nutrition are often monitored since they may not get enough through diet alone.

High selenium exposure can cause selenosis, with symptoms like gastrointestinal upset, hair and nail brittleness, hair loss, skin rash and neurological effects. Serum testing can confirm toxicity in cases of industrial exposure, contaminated supplements, or environmental sources.

Selenium concentrations are measured in nutritional research to evaluate its role in immune function, fertility, and thyroid metabolism. In some cases, it is measured alongside zinc and copper to assess trace element balance in chronic illness, malnutrition, or metabolic disorders.

Table 1. Serum/plasma selenium reference values.

Selenium Status	Concentration (µg/L)	Description
Normal Range	70-150	Expected levels in healthy individuals
Clinical Deficiency	40-70	Suboptimal selenoprotein activity may reduce glutathione peroxidase activity
Severe Deficiency	<40	Associated with disorders like Keshan disease (endemic cardiomyopthy)
Elevated Levels	>150	Often due to supplementation or high intake
Toxicity (Selenosis)	>400	Chronic exposure with symptoms including brittle hair/nails, hair loss, skin rash, garlic odor breath, neurological signs



Experimental – TRAXStation Automated Sample Prep

Evaluation that the combinaton of **TRAX**Station preparation & ICPMS measurement produces acceptable precision (repeatability and reproducibility) and accuracy (bias vs assigned concentrations) for selenium across the clinical range using three pooled sample levels: Low (below normal levels), Normal (clinically relevant mid-range), and High (above normal range that may represent toxicity).

Table 2. Materials and manual preparations.

Item	Description
Matrix	Bovine Serum (pooled)
Pool Levels	Low, Normal, and High (based on reference range) Prepare and homogenize three independent serum pools
Target Conc.	Low ≈ 50 µg/L Normal ≈ 100 µg/L High ≈ 200 µg/L
Aliquoting	Aliquot each pool into 25 identical tubes
Calibrators	Aqueous – 6 Levels from 25 µg/L to 1000 µg/L
Diluent	1% Nitric Acid (v/v) 2% Methanol (v/v) 10 ppb Tellurium (Internal Standard)
Additional Materials	UPW, Calibration Standards, Blanks, and Negative

Table 3. Run structure and experimental design.

Item	Description
Samples per Run	83 (25 each level + Calibration)
Total Runs	25 (1875 data points) Multiple runs per day
Run Format	Blank, Calibrators, Negative, 25 Low, 25 Mid, 25 High
Data Collection	Accuracy and Precision monitored within and across runs
Data Analysis	Inter and Intra Assay Performance presented as a percent CV. (See Data Analysis Criteria below)

Table 4. **TRAX**Station Clinical sample automation.

Item	Description
Rinse 1	DI Water
Rinse 2	DI Water
Diluent	(See Table 2 for prep) Connect and prime system
“Source” Samples	Load all calibrators and serum samples to “source” racks
Destination Racks	Load all destination racks with 12 mL plastic conical tubes
Dilution Factor	50x
Aspiration Volume	40 µL sample
Diluent Volume	1960 µL

Data Analysis Criteria

For clinical serum selenium testing, good precision and accuracy are demonstrated through rigorous statistical validation consistent with CLIA, CAP, and CLSI guidelines. Precision is evaluated by repeated analysis of serum pools at low, normal, and high concentrations, with 25 replicates per level over 25 runs/batches and expressed as coefficient of variation (%CV). For trace metals such as selenium, intra-assay and inter-assay %CVs should generally be ≤5% at normal and high levels and ≤10% at low levels. Accuracy is verified by comparison with mean recovery required to fall within ±10% of target values. According to CLIA proficiency testing criteria, there is no established allowable total error (TEa) for selenium serum; however, we will use 15% as it is established for both copper and zinc. Both short-term and long-term reproducibility must be assessed across runs, days, and operators to ensure robustness. Adherence to Good Laboratory Practice (GLP) principles and use of trace-element-free collection and processing materials are essential to minimize contamination. Together, these statistical and procedural controls ensure that serum selenium results are analytically valid, reproducible, and compliant with regulatory standards for clinical testing.

ICPMS Instrument Parameters

All samples were prepared using **TRAX**Station Clinical, and analyzed using 4DXCi SampleSense *FAST* UHT-C autosampler in combination with a single quad ICPMS.

Table 5. Instrument information.

Parameter	Value
Sample Introduction System	ESI 4DCXi Autosampler SampleSense *FAST* UHT-C **TRAX**Station Clinical
Instrument	Single Quad ICPMS
Valve	Magnetically-Coupled Inert 6-port Valve
Probe	Blue Carbon Fiber Probe
Nebulizer	High Solids PFA Microflow Nebulizer
Rinse 1	1% Nitric Acid (v/v)
Rinse 2	1% Nitric Acid (v/v)
Carrier	1% Nitric Acid (v/v) 2% MEOH (v/v)
Method Time	**24 sec/sample analysis**

Table 6. Instrument parameters.

Parameter	Value
Analytes	Se (m/z 82)
ISTD	Te (m/z 130)
ICPMS Mode	Standard Mode
Sweeps per Replicate	20
Replicates per Sample	3
Dwell	100 ms

Figure 4. AutoBench4 with SampleSense *FAST* UHT-C system was used to hold the single quad ICPMS.

Selenium Calibration – Analytical Measurement Range (AMR) 25-1000 µg/L

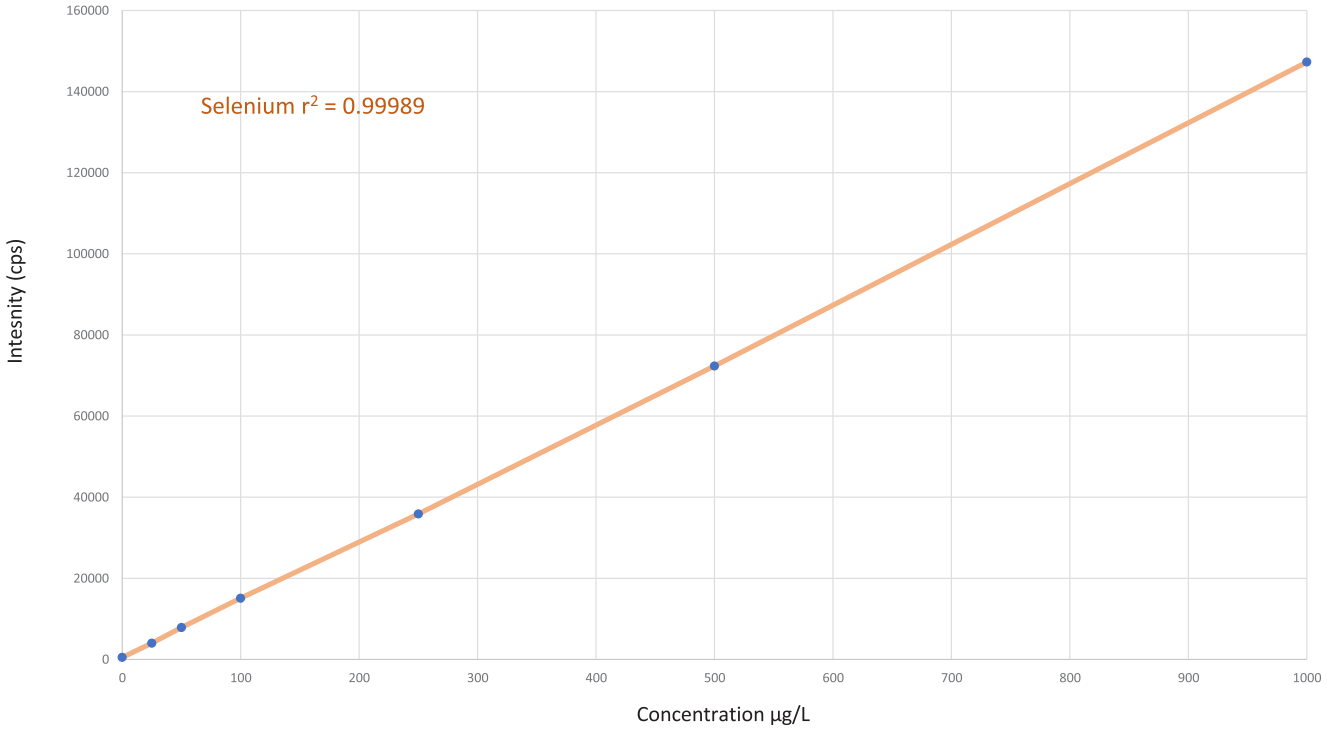


Figure 5. Calibration results demonstrated excellent precision and accuracy for selenium when aqueous calibrators were pipetted and prepared using the **TRAX**Station Clinical automated platform. Measured concentrations closely matched target values, and all correlation coefficients were 0.999 or better, indicating minimal bias and strong agreement with expected results. Together, these findings validate that **TRAX**Station Clinical delivers consistent, contamination-free preparation, ensuring reliable quantitation of selenium in clinical testing workflows.

Summary Results

Serum selenium (Se) was quantified using validated ICPMS methodology following automated preparation on the **TRAX**Station Clinical platform. Results demonstrated exceptional analytical performance, showing excellent precision and accuracy across the reportable range.

Table 7. Selenium serum results.

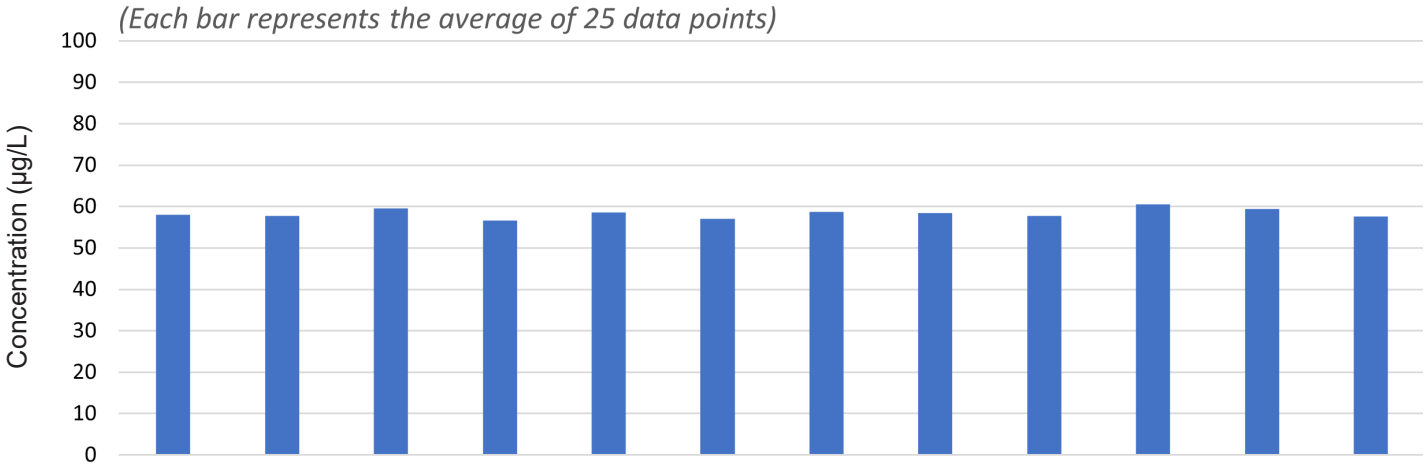
	Low Concentration	Normal Concentration	High Concentration
Average (µg/L)	58.3	104.4	212.2
Standard Deviation (µg/L)	1.17	2.27	5.52
Intra-Assay Precision	3.23% CV	2.22% CV	2.08% CV
Inter-Assay Precision	2.01% CV	2.18% CV	2.60% CV

The **TRAX**Station Clinical 221 platform was used in this experiment. This compact version delivers the full power of automated sample preparation in a smaller footprint – ideal for laboratories with limited bench space. It automates uncapping, mixing, pipetting, and dilution steps to eliminate manual variability, improve reproducibility, and protect sample integrity through contamination-free, metal-inert processing. With intuitive LabSymphony software, barcode tracking, and flexible rack configurations, the **TRAX**Station Clinical 221 integrates seamlessly into existing ICPMS workflows while reducing labor, consumable costs, and operator exposure. It provides high-throughput performance, superior consistency, and enhanced laboratory safety – all in a compact, efficient design.

Figure 6. **TRAX**Station Clinical 221.

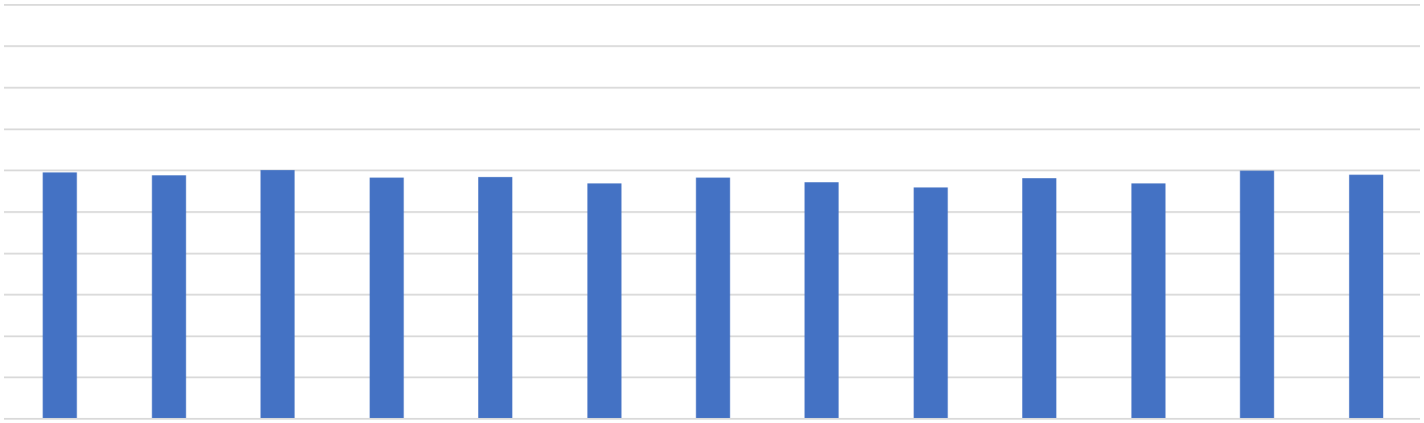
See raw data on the following pages.

Selenium Inter and Intra-Assay Data – Low Concentration (625 data points)



	1	2	3	4	5	6	7	8	9	10	11	12
	56.6	56.2	57.8	54.8	56.0	55.7	56.6	53.7	58.8	57.9	62.4	57.8
	59.2	56.7	59.4	58.1	60.4	58.1	64.6	56.6	57.7	58.5	60.5	60.4
	59.5	55.4	60.3	59.1	59.2	58.6	60.0	57.8	57.8	62.1	59.3	56.8
	58.0	58.8	59.6	55.5	57.6	55.4	59.3	58.5	56.8	58.0	58.8	55.8
	58.1	59.0	61.2	57.5	58.1	57.2	60.2	59.5	60.2	61.1	59.4	56.7
	59.7	58.1	62.1	57.5	58.9	57.6	57.2	58.3	56.8	61.3	60.8	60.6
	55.4	58.6	60.1	56.9	58.3	57.7	56.9	58.2	58.3	58.5	60.8	58.9
	56.3	55.1	60.0	58.4	57.0	59.6	58.9	58.1	56.9	62.0	67.5	55.0
	58.3	58.6	59.9	57.6	59.0	56.9	57.9	58.9	57.1	58.5	58.2	56.0
	56.9	57.9	59.2	54.5	58.4	54.9	58.9	57.1	58.0	57.9	59.9	54.8
	55.3	57.3	58.8	58.0	66.3	54.0	55.4	57.7	56.0	58.9	58.7	58.9
	57.8	56.5	57.7	57.4	58.7	57.8	57.3	57.3	58.1	58.6	60.7	56.0
	57.6	55.6	57.0	56.8	54.1	57.6	61.0	58.7	56.2	58.4	57.9	56.4
	57.6	56.4	58.3	54.8	59.7	56.7	57.0	58.9	58.7	61.9	55.8	56.8
	56.4	57.2	59.0	58.6	59.0	57.0	57.2	58.5	57.3	62.5	60.1	57.3
	59.7	57.3	58.7	55.5	57.9	56.8	59.3	61.5	57.2	61.4	57.1	58.8
	57.0	56.2	59.2	53.4	58.8	58.2	59.7	58.4	57.5	64.1	58.3	57.2
	58.9	58.8	61.7	58.1	55.9	56.7	58.2	60.6	57.7	61.9	60.8	60.6
	58.0	59.7	59.7	55.3	57.6	55.1	57.9	60.9	58.1	63.4	55.4	58.2
	59.1	60.1	62.2	58.4	62.8	56.1	60.1	58.5	60.7	63.8	61.8	58.3
	59.9	59.9	58.8	55.0	57.5	58.9	60.2	60.6	58.6	62.1	55.0	57.4
	58.3	57.5	58.9	56.5	58.1	56.8	60.6	58.6	57.1	59.7	58.5	58.8
	58.0	58.4	57.7	55.1	57.0	56.6	57.2	59.5	57.0	60.3	57.4	58.9
	59.8	57.2	61.1	56.2	57.4	55.4	57.9	56.3	57.8	60.8	61.4	56.7
	57.5	59.5	60.4	56.7	62.0	60.7	56.9	59.5	55.8	59.6	59.0	56.0
Ave.	**58.0**	**57.7**	**59.5**	**56.6**	**58.6**	**57.0**	**58.7**	**58.5**	**57.7**	**60.5**	**59.4**	**57.6**
SD	**1.33**	**1.45**	**1.39**	**1.54**	**2.41**	**1.52**	**1.92**	**1.63**	**1.14**	**1.98**	**2.57**	**1.63**
CV	**2.30%**	**2.51%**	**2.33%**	**2.72%**	**4.12%**	**2.67%**	**3.27%**	**2.79%**	**1.98%**	**3.27%**	**4.33%**	**2.84%**

Selenium Inter and Intra-Assay Data – Low Concentration (625 data points) *(Continued)*



13	14	15	16	17	18	19	20	21	22	23	24	25
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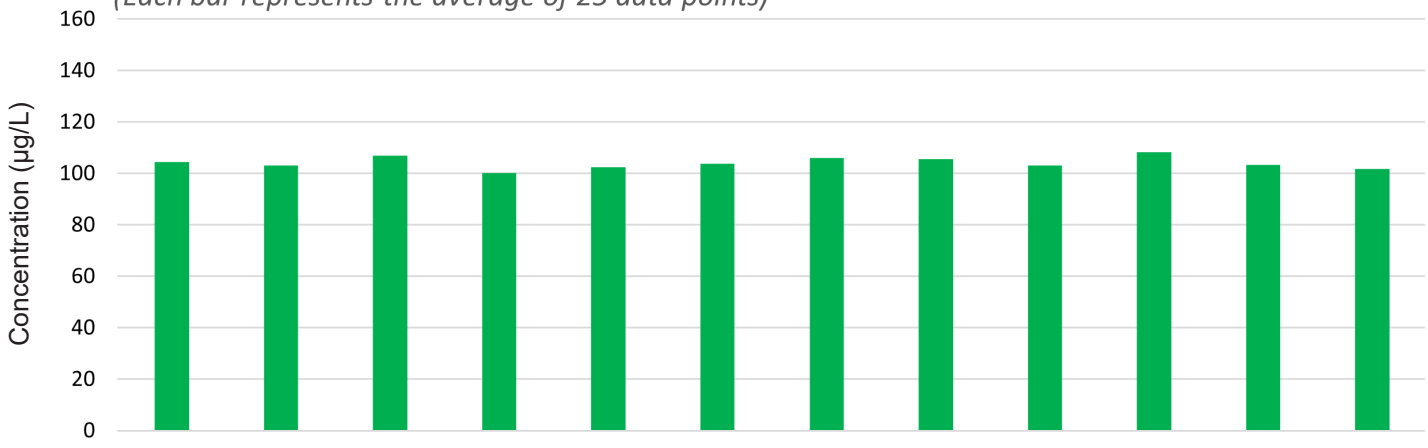
59.1	59.6	63.3	55.9	59.6	58.6	59.6	61.1	57.7	54.4	57.8	64.7	62.4
60.9	55.5	64.3	57.2	61.5	60.5	60.1	57.7	56.7	55.3	57.6	62.7	56.3
61.5	59.1	61.8	61.9	57.3	57.5	61.4	58.2	57.0	58.4	57.7	64.1	63.0
59.6	55.1	60.6	59.3	59.3	55.2	58.3	57.2	56.5	61.1	55.9	56.1	61.2
61.1	58.7	59.2	61.6	57.8	59.5	60.0	56.4	58.1	59.5	55.5	60.0	60.0
57.5	60.2	61.3	58.6	59.8	59.1	60.6	59.9	58.1	61.7	57.7	58.2	59.0
57.7	55.3	60.9	59.3	57.2	57.2	57.8	59.3	54.5	57.3	55.9	59.5	59.2
62.8	55.7	60.7	57.6	57.8	53.6	55.4	56.7	53.8	57.7	59.2	60.9	56.1
59.2	59.4	61.8	58.8	59.5	56.8	59.3	56.4	59.2	59.5	59.1	60.3	59.2
60.4	60.9	57.0	59.3	55.1	55.4	61.5	58.7	55.4	59.2	53.4	60.2	59.2
61.1	57.6	58.7	59.8	58.1	54.8	56.4	54.1	57.2	54.8	56.9	59.6	57.4
60.8	59.3	58.9	56.1	59.7	56.0	58.3	53.4	53.8	58.9	55.6	57.0	60.2
57.2	58.6	60.3	56.3	59.3	58.4	59.2	59.3	53.9	59.1	56.8	56.2	60.5
62.2	58.5	63.0	52.5	54.7	56.2	55.8	56.6	55.6	55.4	58.7	60.3	60.9
56.6	60.5	57.8	58.3	60.0	55.5	55.8	57.2	57.1	58.7	56.9	62.5	61.7
61.4	59.8	60.1	58.1	56.8	58.5	60.7	57.9	55.5	61.6	58.7	63.9	64.0
58.8	60.9	60.7	60.9	56.9	57.4	57.1	57.4	55.9	61.9	54.9	57.2	58.1
57.6	59.9	57.1	57.3	56.4	59.3	58.8	56.7	56.8	56.7	51.7	60.6	58.5
60.0	57.8	57.6	58.5	59.2	60.1	57.3	58.3	55.4	56.7	58.7	57.7	60.7
61.6	59.3	60.5	54.6	58.0	56.0	56.9	56.7	54.4	57.8	57.2	59.5	53.4
60.2	59.7	58.4	59.1	57.5	54.1	54.6	55.1	53.8	58.7	56.8	57.9	56.6
57.7	60.6	58.4	56.9	60.6	56.0	57.9	55.0	52.4	57.3	58.9	59.9	58.4
57.2	60.8	60.0	61.8	62.2	55.5	59.6	54.5	55.7	60.8	56.1	61.3	58.8
56.9	58.9	57.7	57.2	58.4	54.8	59.6	59.6	54.8	59.2	59.2	61.9	52.4
59.5	**58.8**	**60.2**	**58.3**	**58.4**	**56.9**	**58.3**	**57.2**	**55.9**	**58.2**	**57.0**	**60.0**	**59.0**
1.85	**1.77**	**2.09**	**2.27**	**1.81**	**1.91**	**2.03**	**1.90**	**1.69**	**2.30**	**1.85**	**2.44**	**2.74**
3.11%	**3.00%**	**3.48%**	**3.89%**	**3.10%**	**3.36%**	**3.48%**	**3.33%**	**3.03%**	**3.95%**	**3.24%**	**4.07%**	**4.65%**

Figure 7. Results of low concentration selenium measured by ICPMS (m/z 82). Each number 1-25 corresponds to a batch. The graph above each number shows the average, and the numbers below it show the individual sample data from the batch.

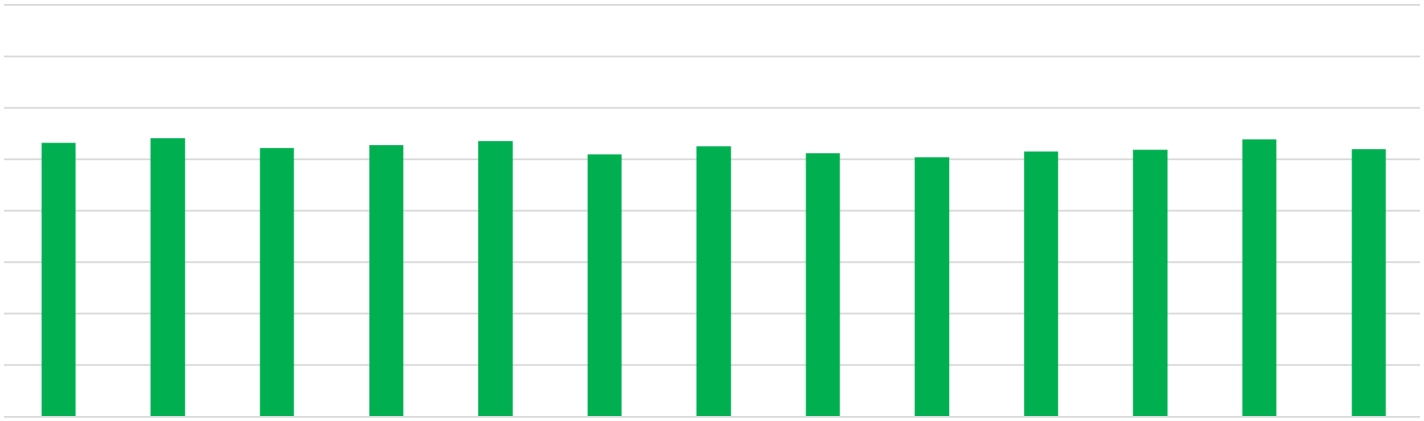
Selenium Inter and Intra-Assay Data – Normal Concentration (625 data points)

(Each bar represents the average of 25 data points)



	1	2	3	4	5	6	7	8	9	10	11	12
	101.3	102.7	107.8	97.3	102.6	104.8	104.3	108.2	102.8	108.4	105.5	100.1
	102.4	103.1	105.3	100.4	103.7	102.8	104.7	102.5	102.7	106.2	108.1	106.4
	105.4	101.2	107.0	102.1	103.8	104.9	104.9	103.3	101.3	109.0	106.4	101.2
	103.2	100.6	104.8	97.1	101.3	105.2	108.5	104.3	101.9	107.1	104.7	100.1
	105.7	103.3	106.6	98.5	101.5	100.5	104.9	105.6	101.3	110.4	104.1	99.4
	103.0	101.5	105.4	98.6	101.6	101.9	107.2	105.9	100.8	109.1	108.9	103.4
	103.6	106.5	113.2	102.5	104.2	101.1	106.3	104.5	105.7	109.5	106.6	101.5
	108.3	102.6	107.7	97.8	104.3	104.8	105.5	102.5	102.3	109.1	103.5	103.2
	104.4	104.1	107.7	101.6	104.9	106.4	104.6	101.8	106.4	105.8	101.9	102.7
	106.1	104.9	105.4	102.8	102.1	102.3	109.0	112.6	103.5	107.3	102.2	97.6
	102.7	102.4	106.9	98.1	100.4	101.4	108.6	103.7	102.5	105.5	103.5	101.4
	103.0	104.5	106.6	104.3	103.1	103.3	105.9	108.6	102.8	108.6	100.9	102.6
	105.9	99.4	108.7	98.1	102.8	104.7	110.5	109.0	101.8	108.5	102.6	99.5
	104.5	103.8	106.2	99.6	103.1	101.8	103.0	107.2	101.4	107.9	97.6	98.9
	107.7	106.5	107.8	102.6	99.7	108.5	105.9	106.2	102.6	109.9	100.1	102.1
	104.1	100.7	105.5	99.6	100.1	103.8	105.6	105.0	102.8	106.3	104.8	99.9
	104.6	102.0	107.5	100.3	100.5	101.1	104.3	104.1	102.3	107.7	103.9	103.6
	104.9	103.4	104.1	103.0	100.4	105.5	106.3	106.9	100.2	109.9	103.1	103.2
	104.5	104.6	106.3	100.9	102.5	104.6	104.7	105.6	102.1	110.2	106.7	106.8
	103.5	101.2	107.3	96.6	102.1	102.7	105.1	107.3	103.8	110.5	99.8	102.5
	102.7	98.4	105.1	103.2	104.8	103.1	108.3	103.8	105.1	107.9	102.3	98.8
	106.9	103.7	106.5	97.1	103.8	105.1	104.7	103.6	101.7	107.8	101.7	100.1
	103.8	105.1	109.3	101.3	102.4	102.4	103.5	106.5	107.6	110.8	102.2	102.9
	107.1	104.9	107.6	100.1	104.6	102.0	105.1	104.7	101.7	108.6	100.0	103.4
	101.3	103.7	106.4	101.1	103.0	107.1	106.3	104.9	112.4	105.3	102.8	99.9
Ave.	**104.4**	**103.0**	**106.9**	**100.2**	**102.5**	**103.7**	**105.9**	**105.5**	**103.2**	**108.3**	**103.4**	**101.6**
SD	**1.83**	**1.99**	**1.78**	**2.20**	**1.51**	**2.01**	**1.81**	**2.38**	**2.56**	**1.58**	**2.65**	**2.23**
CV	**1.75%**	**1.93%**	**1.66%**	**2.20%**	**1.47%**	**1.93%**	**1.70%**	**2.26%**	**2.48%**	**1.46%**	**2.57%**	**2.19%**

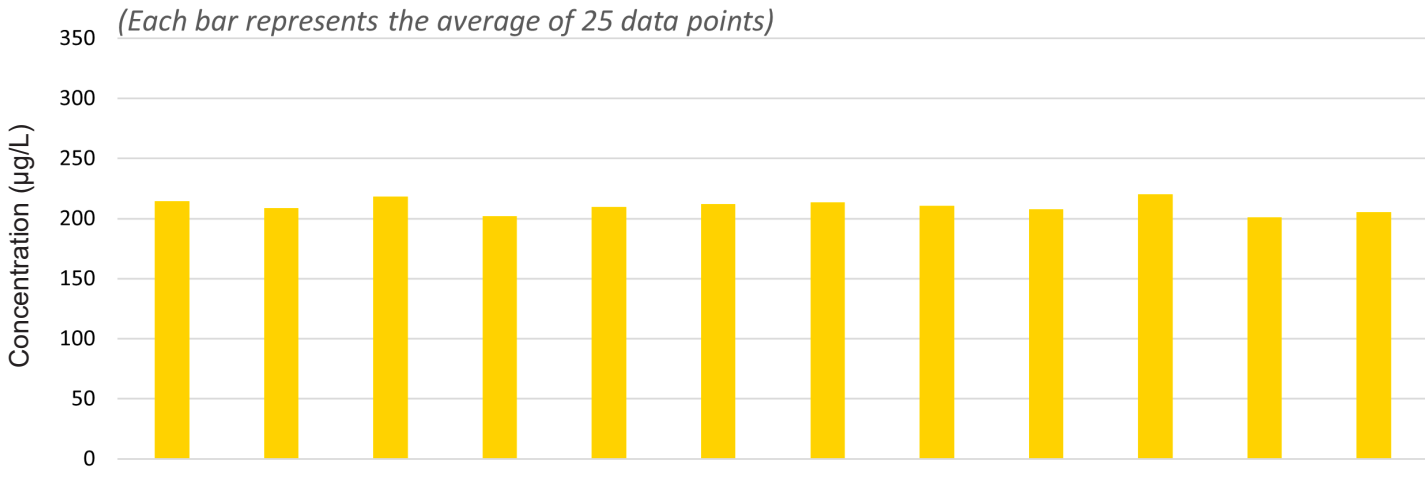
Selenium Inter and Intra-Assay Data – Normal Concentration (625 data points) *(Continued)*



13	14	15	16	17	18	19	20	21	22	23	24	25
103.9	107.8	106.4	102.1	105.1	101.9	107.8	100.4	98.2	102.5	101.4	108.5	102.6
113.7	106.4	104.5	109.7	104.8	100.9	106.2	106.5	101.1	101.8	100.8	112.6	109.7
102.8	108.5	101.5	105.2	108.7	102.9	104.9	104.5	99.2	103.4	101.9	107.3	101.3
111.1	110.4	101.7	105.9	104.1	104.9	103.8	101.3	96.7	102.1	101.1	114.8	102.1
103.3	109.9	103.3	105.0	105.0	102.4	106.7	103.8	102.7	99.0	104.7	108.2	104.2
102.3	105.8	109.0	101.9	109.8	105.3	100.9	100.2	102.5	97.3	104.6	107.9	106.8
105.6	110.8	101.9	104.1	108.5	101.7	103.4	100.1	97.2	104.5	103.0	105.4	106.1
107.9	108.6	106.0	106.7	106.2	100.5	103.7	104.3	104.7	104.7	104.6	114.5	104.3
106.3	104.2	105.3	109.5	109.2	100.6	104.3	104.4	103.5	103.6	101.3	108.6	100.7
108.6	111.8	103.6	101.7	104.4	99.6	108.6	100.2	102.7	96.9	106.1	103.7	111.6
113.3	111.8	113.3	106.2	108.5	98.0	107.1	101.3	98.0	109.6	107.2	108.3	102.5
110.0	106.9	105.1	104.8	106.8	99.0	103.4	104.3	99.8	103.8	98.2	110.0	102.7
106.3	107.4	107.1	105.6	106.4	102.8	102.2	101.1	100.8	106.9	108.2	103.6	101.6
107.1	107.8	100.6	105.9	107.1	102.1	102.6	97.5	100.3	104.6	94.0	108.1	101.3
108.7	108.3	103.6	102.1	108.3	101.4	103.8	103.1	101.3	104.2	105.9	105.7	101.1
105.9	109.9	106.0	108.1	105.1	105.1	105.5	105.2	100.8	109.0	104.9	103.2	105.2
105.0	113.0	102.3	107.6	106.4	101.3	105.1	102.5	101.3	102.2	107.0	111.4	108.5
106.2	108.9	101.2	104.6	109.7	104.1	105.4	103.5	103.4	102.1	106.0	108.3	105.0
106.8	108.9	106.9	106.6	107.4	103.0	103.4	101.6	102.2	105.6	104.9	110.0	102.3
106.2	108.5	104.3	104.4	109.7	100.2	109.7	102.5	100.5	103.7	108.6	110.0	103.9
104.1	106.0	103.4	105.6	110.0	101.5	101.4	99.2	100.8	104.1	106.6	102.4	103.2
107.9	106.6	103.6	108.1	104.5	100.3	108.0	101.8	104.0	102.6	102.0	106.3	101.4
104.1	105.0	99.6	107.2	106.6	103.9	107.1	104.9	99.1	98.3	105.1	105.3	100.3
105.5	106.4	108.1	102.6	107.9	100.4	105.2	104.6	101.3	101.4	103.6	105.2	104.5
101.8	106.8	100.9	106.5	110.7	107.3	105.7	104.6	98.9	101.3	103.3	106.3	105.7
106.6	**108.3**	**104.4**	**105.5**	**107.2**	**102.0**	**105.0**	**102.5**	**100.8**	**103.0**	**103.8**	**107.8**	**103.9**
3.04	**2.18**	**3.02**	**2.22**	**1.97**	**2.14**	**2.22**	**2.18**	**2.07**	**3.04**	**3.19**	**3.22**	**2.84**
2.86%	**2.02%**	**2.89%**	**2.11%**	**1.84%**	**2.10%**	**2.11%**	**2.13%**	**2.06%**	**2.95%**	**3.08%**	**2.99%**	**2.73%**

Figure 8. Results of normal concentration selenium measured by ICPMS (m/z 82). Each number 1-25 corresponds to a batch. The graph above each number shows the average, and the numbers below it show the individual sample data from the batch.

Selenium Inter and Intra-Assay Data – High Concentration (625 data points)



	1	2	3	4	5	6	7	8	9	10	11	12
	210.6	208.5	212.2	200.7	205.1	204.1	209.0	213.6	209.6	221.7	204.3	206.3
	214.1	216.6	212.8	198.3	208.9	209.7	210.2	213.6	210.5	217.9	200.8	204.1
	209.0	209.4	213.2	200.3	208.2	210.9	213.6	212.8	204.5	217.7	196.1	204.9
	213.2	209.3	222.1	191.9	210.8	212.4	216.2	211.2	204.9	216.2	206.3	208.2
	217.8	201.0	224.8	201.8	204.9	210.2	214.2	210.0	199.3	218.9	205.4	207.8
	214.4	207.9	222.1	199.4	206.0	215.8	208.8	208.3	203.0	222.2	208.4	205.5
	212.5	210.0	224.4	201.6	204.6	216.5	217.5	215.0	206.1	228.4	204.8	203.2
	215.2	208.0	213.5	208.9	211.2	209.8	212.0	214.0	210.8	215.4	198.0	205.2
	218.4	208.3	212.5	202.7	209.8	207.5	214.1	212.5	215.9	220.8	203.8	202.9
	213.3	207.8	214.1	200.3	208.3	213.8	209.7	211.0	207.2	218.5	201.3	209.7
	216.5	207.3	215.3	200.3	230.1	213.9	214.6	215.5	221.2	218.9	203.5	203.1
	217.1	206.4	214.7	209.9	207.6	207.7	213.4	210.5	206.6	219.5	202.1	200.7
	211.4	207.6	209.3	198.6	213.0	208.2	208.7	206.5	208.4	218.4	201.5	201.8
	213.1	207.4	229.9	199.1	206.9	212.2	215.0	212.2	202.6	219.7	199.1	202.2
	212.9	207.2	214.1	199.9	209.0	215.5	209.6	209.6	204.2	220.5	195.5	204.1
	215.9	218.0	220.8	198.4	208.9	209.5	212.6	207.8	208.3	221.6	194.9	207.9
	213.5	217.8	220.8	199.8	206.3	214.8	206.5	205.2	207.0	232.5	199.6	198.8
	213.1	212.6	222.4	202.5	207.3	212.7	218.7	210.7	204.5	224.7	195.9	201.0
	214.4	203.8	232.0	202.0	215.3	218.2	213.9	211.1	208.9	226.8	196.2	206.9
	212.4	206.0	217.7	196.3	207.5	207.8	210.0	215.3	202.7	220.1	196.1	204.6
	219.4	204.5	212.7	211.6	208.0	221.0	211.5	212.2	207.1	212.0	212.5	225.2
	219.7	204.1	209.4	200.1	207.2	218.4	220.0	205.0	208.9	216.2	200.8	203.7
	216.0	207.0	227.8	213.7	223.6	217.4	223.8	205.5	210.2	215.1	199.2	207.3
	216.6	211.1	221.9	202.6	209.2	207.9	212.4	213.0	205.7	218.2	203.2	205.6
	209.0	211.9	213.6	205.5	205.7	208.1	217.1	206.6	219.6	219.4	194.1	206.6
Ave.	**214.4**	**208.8**	**218.2**	**201.8**	**209.7**	**212.2**	**213.3**	**210.7**	**207.9**	**220.1**	**200.9**	**205.5**
SD	**2.84**	**4.06**	**6.27**	**4.75**	**5.68**	**4.19**	**3.95**	**3.15**	**4.95**	**4.31**	**4.51**	**4.78**
CV	**1.32%**	**1.94%**	**2.87%**	**2.35%**	**2.71%**	**1.97%**	**1.85%**	**1.50%**	**2.38%**	**1.96%**	**2.25%**	**2.33%**

Selenium Inter and Intra-Assay Data – High Concentration (625 data points) *(Continued)*

13	14	15	16	17	18	19	20	21	22	23	24	25
219.7	220.5	202.9	221.9	219.8	193.2	213.7	210.0	211.8	208.2	215.5	210.5	202.5
219.1	218.6	209.8	216.1	219.7	204.1	213.9	209.6	209.2	210.7	207.7	210.8	205.0
212.3	216.3	205.0	226.4	219.1	213.9	223.1	213.9	205.4	208.4	205.9	215.4	201.0
212.8	224.7	210.8	216.5	224.2	205.7	213.5	214.9	208.3	223.9	206.5	222.9	198.2
214.0	221.5	206.8	223.6	219.7	206.6	210.5	207.5	207.7	210.4	213.0	224.1	204.2
214.6	219.6	207.4	218.5	216.3	210.4	214.5	214.4	205.4	206.2	213.7	218.0	204.5
218.8	217.0	209.3	213.8	210.9	206.9	216.5	212.4	206.7	203.0	212.9	216.4	202.7
218.9	219.2	217.2	221.8	223.3	203.1	213.5	207.6	208.8	207.1	214.8	210.6	205.4
212.4	216.3	211.5	220.6	223.2	203.8	210.0	212.9	205.0	218.6	207.5	221.1	202.6
217.8	217.5	203.8	213.0	219.9	210.0	214.8	214.3	210.2	214.2	213.5	222.6	204.5
217.0	217.9	209.8	212.5	219.0	207.8	213.4	217.3	206.1	210.0	212.7	225.4	205.9
207.7	213.7	206.1	210.7	217.1	207.7	212.9	213.5	209.3	211.3	213.7	217.8	215.2
221.9	220.0	204.0	223.8	215.7	207.7	212.2	210.1	207.3	214.2	216.5	216.7	206.3
215.4	215.8	210.5	217.8	222.2	210.2	212.4	214.0	213.2	215.2	225.5	219.0	193.6
215.3	219.1	212.7	219.3	221.1	207.5	213.9	211.2	209.8	227.0	220.0	222.9	206.4
221.4	215.6	213.6	220.0	220.9	207.9	215.3	210.6	200.5	219.6	206.2	222.9	203.1
228.7	216.8	225.6	213.2	222.9	209.2	221.8	213.2	212.9	208.6	204.2	223.0	202.3
226.6	214.4	211.6	216.3	224.0	204.3	204.8	210.0	213.6	219.8	218.4	219.3	204.1
216.0	221.9	217.5	211.1	212.8	202.0	219.5	216.4	210.5	215.1	216.0	222.4	213.2
218.4	222.4	217.1	211.9	217.3	207.5	213.0	211.6	209.2	216.4	222.2	210.5	212.4
223.4	217.5	225.7	217.8	220.6	210.7	216.8	210.3	203.7	221.8	218.0	227.9	215.1
220.5	214.3	219.2	211.9	220.3	201.6	218.4	218.4	203.5	223.4	219.1	220.5	211.5
222.6	219.8	211.9	214.3	217.6	208.6	213.9	210.7	206.6	224.2	211.8	224.7	211.0
224.7	215.3	207.0	214.6	215.4	212.9	213.7	210.8	204.3	219.8	214.0	223.2	211.9
218.0	214.2	215.1	222.5	221.3	207.0	216.7	212.4	205.4	219.0	216.0	227.2	205.6
218.3	**218.0**	**211.7**	**217.2**	**219.4**	**206.8**	**214.5**	**212.3**	**207.8**	**215.1**	**213.8**	**219.8**	**205.9**
4.74	**2.81**	**6.03**	**4.42**	**3.30**	**4.12**	**3.65**	**2.70**	**3.23**	**6.39**	**5.21**	**5.10**	**5.12**
2.17%	**1.29%**	**2.85%**	**2.03%**	**1.51%**	**1.99%**	**1.70%**	**1.27%**	**1.55%**	**2.97%**	**2.44%**	**2.32%**	**2.49%**

Figure 9. Results of high concentration selenium measured by ICPMS (m/z 82). Each number 1-25 corresponds to a batch. The graph above each number shows the average, and the numbers below it show the individual sample data from the batch.

Conclusion

The **TRAX**Station Clinical Automated Multifunctional Liquid Handling System demonstrated performance that surpassed expected analytical targets for both accuracy and precision. Measured values consistently aligned over extended periods of time indicating minimal systematic error and confirming high method accuracy. Replicate analyses showed very low variability, with relative standard deviations well below acceptance criteria, reflecting exceptional precision. Collectively, the data provide strong evidence of method robustness and reliability, exceeding established quality benchmarks and reinforcing confidence in both the measurement process and resulting conclusions.

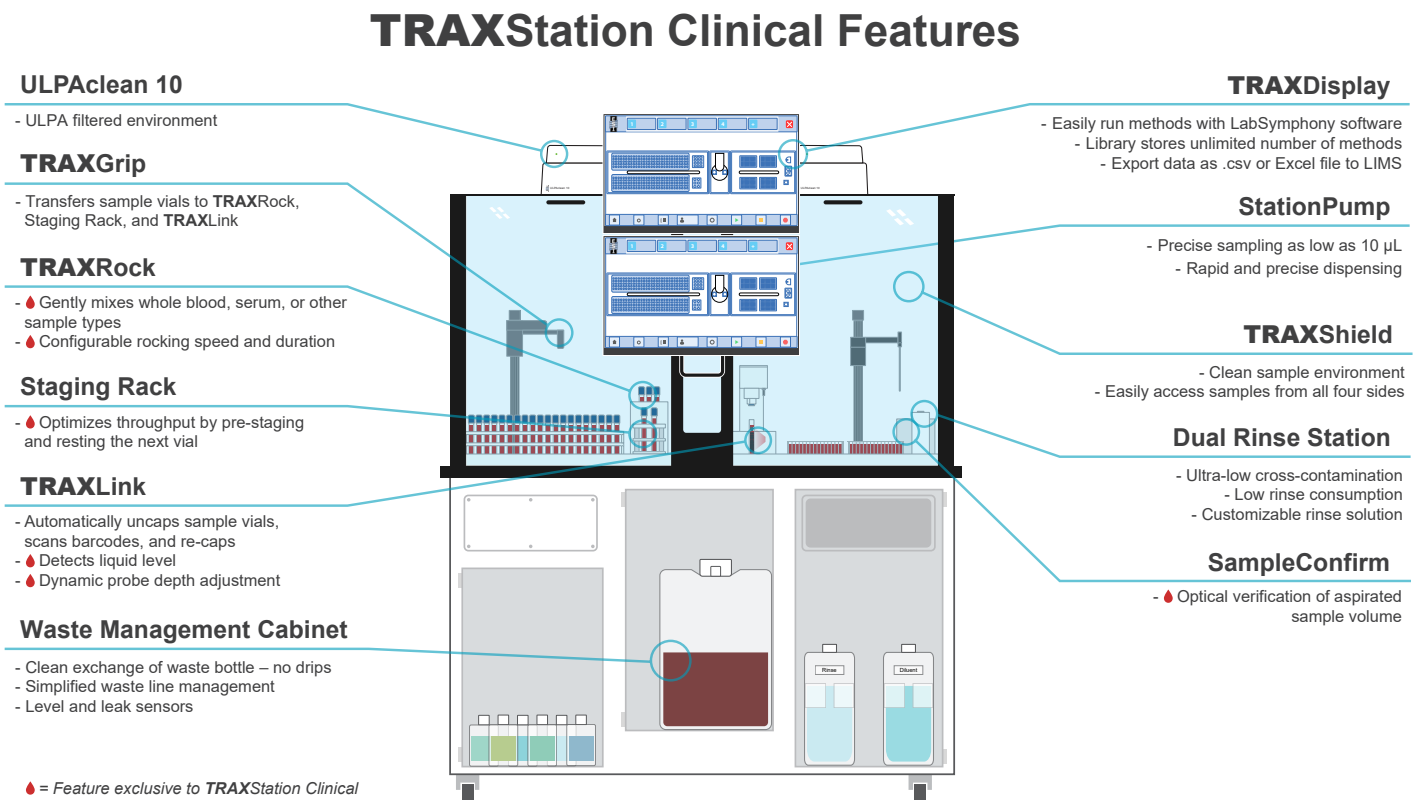


Figure 10. **TRAX**Station Clinical features diagram. **TRAX**Station Clinical is available in several models and configurations to match laboratory methods and throughput requirements. These include **TRAX**Station 221, 422, and 442 models.

Notes