



TACS University E-learning Webinar Series:

*Fast Analysis for
Mining, Mehlich-3, and
EPA 200.7*

Introduction to the ASXpress Plus

- ICP-OES and ICP-MS Accessory that enables faster sample uptake times and eliminates rinse times to allow more samples to be analyzed per day
- ASXpress has its own software separate from the instrument to specify operating conditions
- Minimal method development is required – delete flush and rinse times, adjust sample uptake time



Rapid Sample Introduction System

Valve Pump Module

- Contains metal free multiport valve and inert high speed liquid pump
- Pump is used to quickly load sample loop, reducing uptake time
- Valve allows for simultaneous analysis and rinsing, improving sample throughput

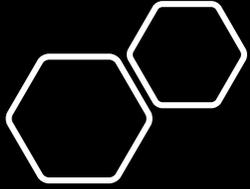


Electronics Module

- Handles all Communication to the autosampler and valve pump module
- Programmable to meet user needs
- “Invisible” to ICP software, handles all commands without directly communicating with the analyzer software.



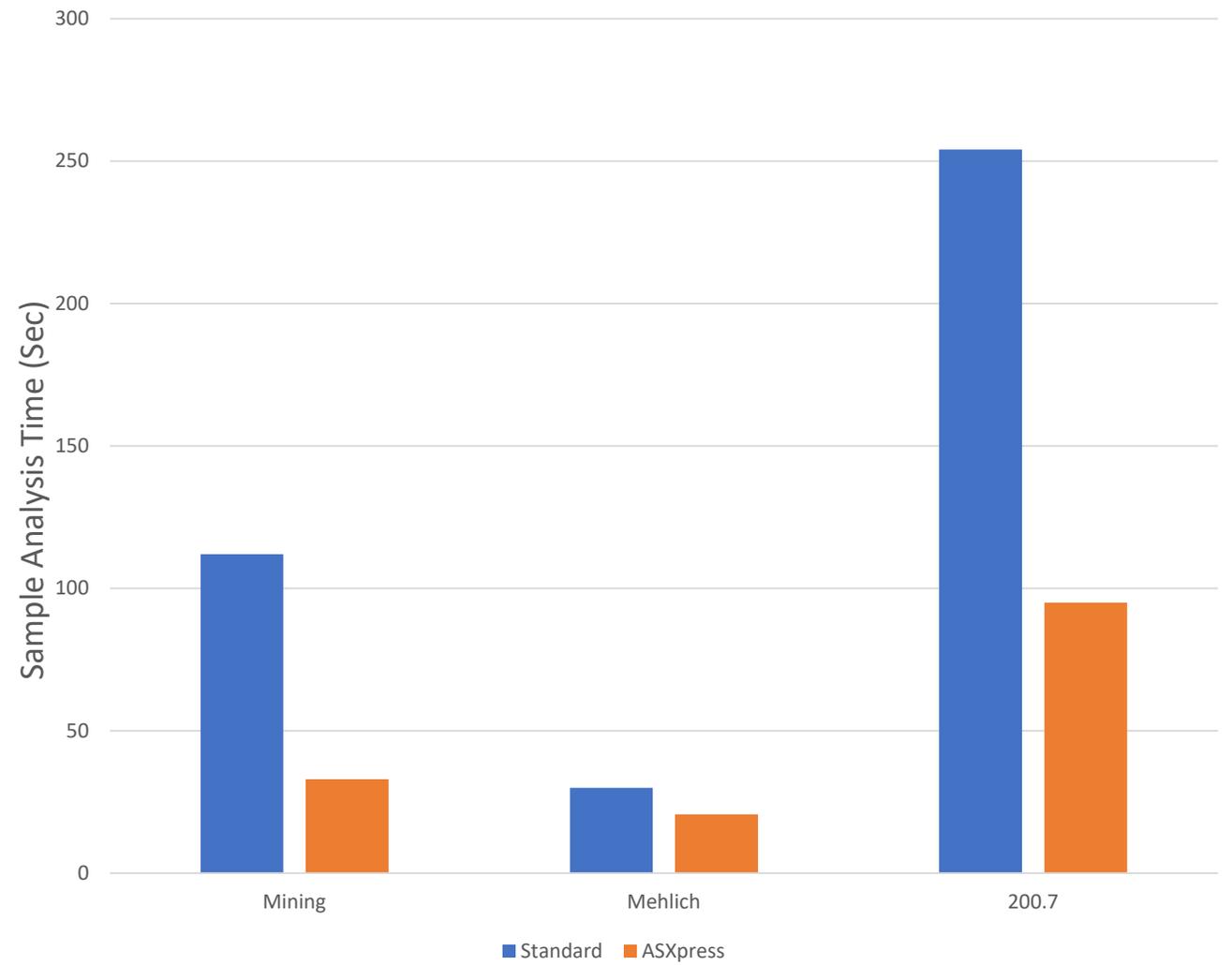




Applications

- Mining – Clients require superior accuracy
- Soils – Speed is most important
- EPA 200.7 – Speed and accuracy must be well balanced

Time Savings



Mining Industry



No promulgated method



Digestions can have final acid concentrations as high as 45%



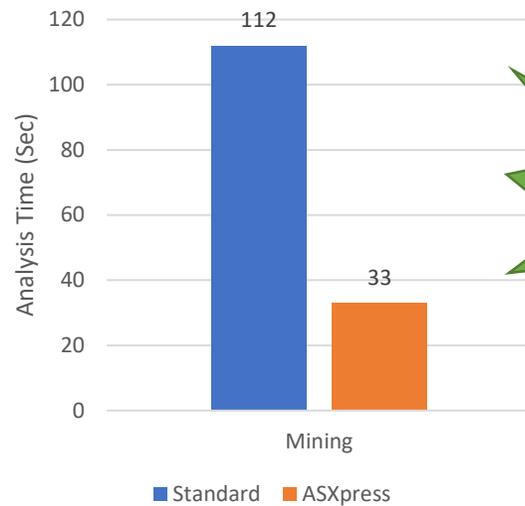
Speed is important, but accuracy is often more important.



Goal: Demonstrate analysis with and without ASXpress produces similar quality data in a smaller amount of time

Instrument Settings

Parameter	Setting Standard Run	Setting Xpress Run
Pump Speed	1.5mL/min	2.5mL/min
Read delay	30 secs	14 secs
Flush speed	3.0mL/min	-
Flush time	30 secs	-
Rinse time	30 secs	-
Replicates	3	



Time Savings = 70%

3.4x Sample Throughput

84% Decrease in Non-Analysis Time



Oreas45f – Lateritic Soil from Australia

Digestion:

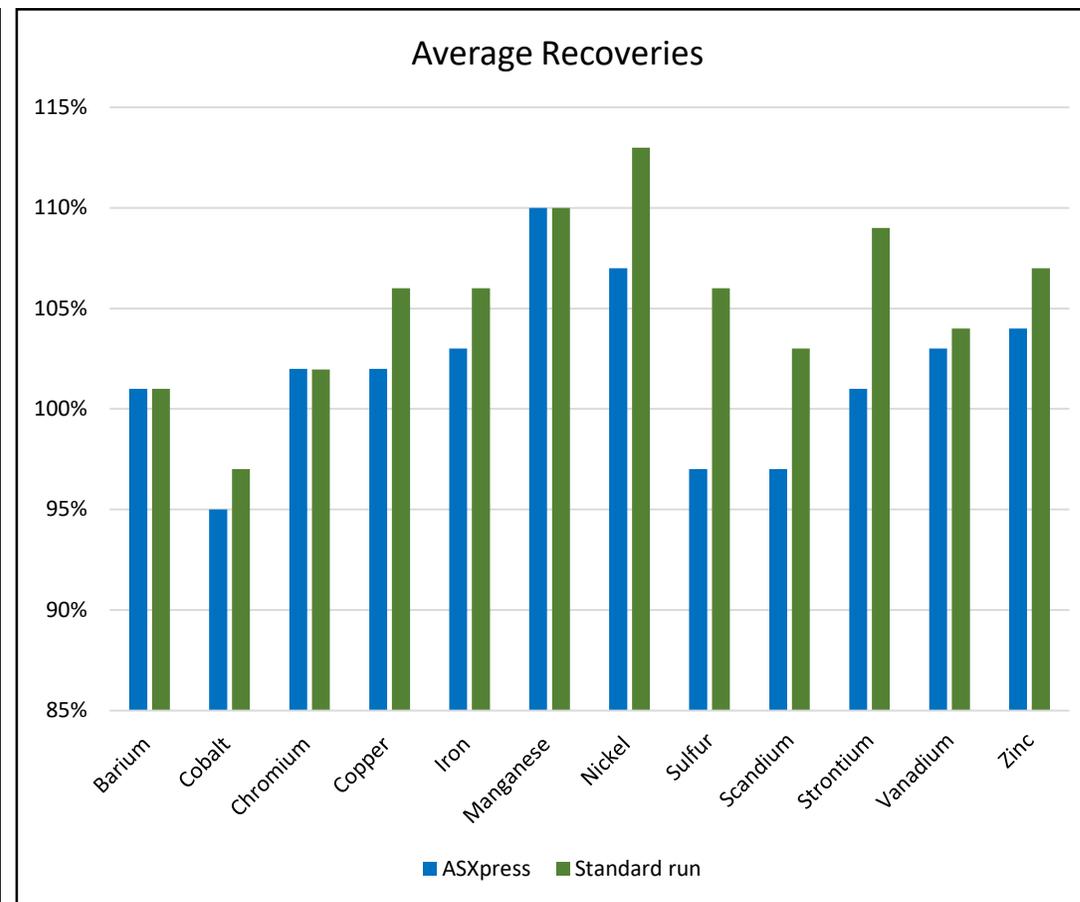
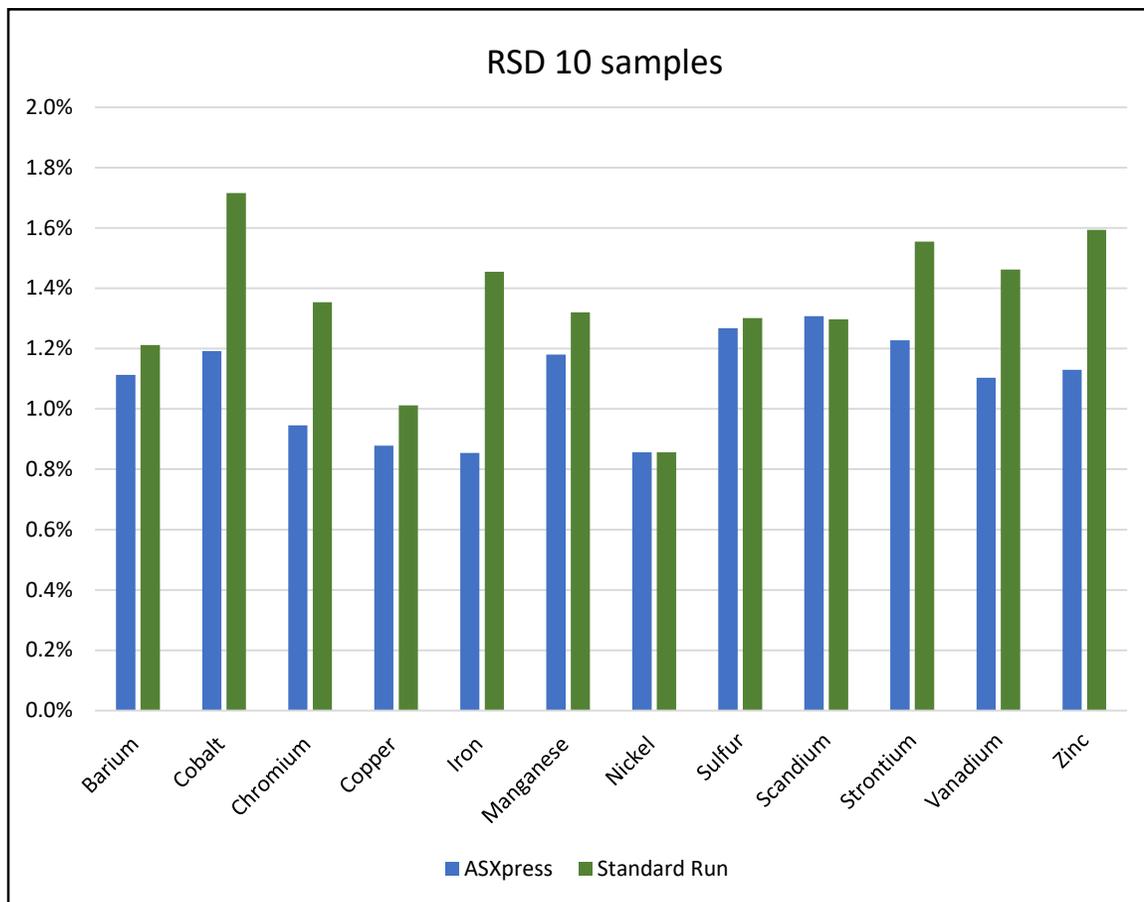
- 0.5g, 9mL HCl, 3mL HNO
- Heat at 95°C for 2 hours.
- Fill to final volume of 50mL
- Digestion dilution: 100x, 24% Aqua regia

Table 2. Certified Values, SD's, 95% Confidence and Tolerance Limits for OREAS 45f

Constituent	Certified Value	SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Aqua Regia Digestion (sample weights 0.15-50g)						
<u>Ba, Barium (ppm)</u>	158	7	155	161	154	162
<u>Co, Cobalt (ppm)</u>	39.2	3.44	37.9	40.5	38.2	40.3
<u>Cr, Chromium (ppm)</u>	341	25	332	351	333	349
<u>Cu, Copper (ppm)</u>	336	16	330	342	327	345
<u>Fe, Iron (wt.%)</u>	13.69	0.560	13.48	13.90	13.40	13.97
<u>Mn, Manganese (wt.%)</u>	0.015	0.002	0.014	0.015	0.014	0.015
<u>Ni, Nickel (ppm)</u>	192	14	186	198	186	198
<u>S, Sulphur (wt.%)</u>	0.027	0.004	0.025	0.028	0.026	0.027
<u>Sc, Scandium (ppm)</u>	31.4	2.26	30.6	32.3	30.3	32.5
<u>Sr, Strontium (ppm)</u>	13.2	1.11	12.7	13.6	12.7	13.7
<u>V, Vanadium (ppm)</u>	217	11	213	221	213	221
<u>Zn, Zinc (ppm)</u>	22.2	3.7	20.7	23.7	21.3	23.1

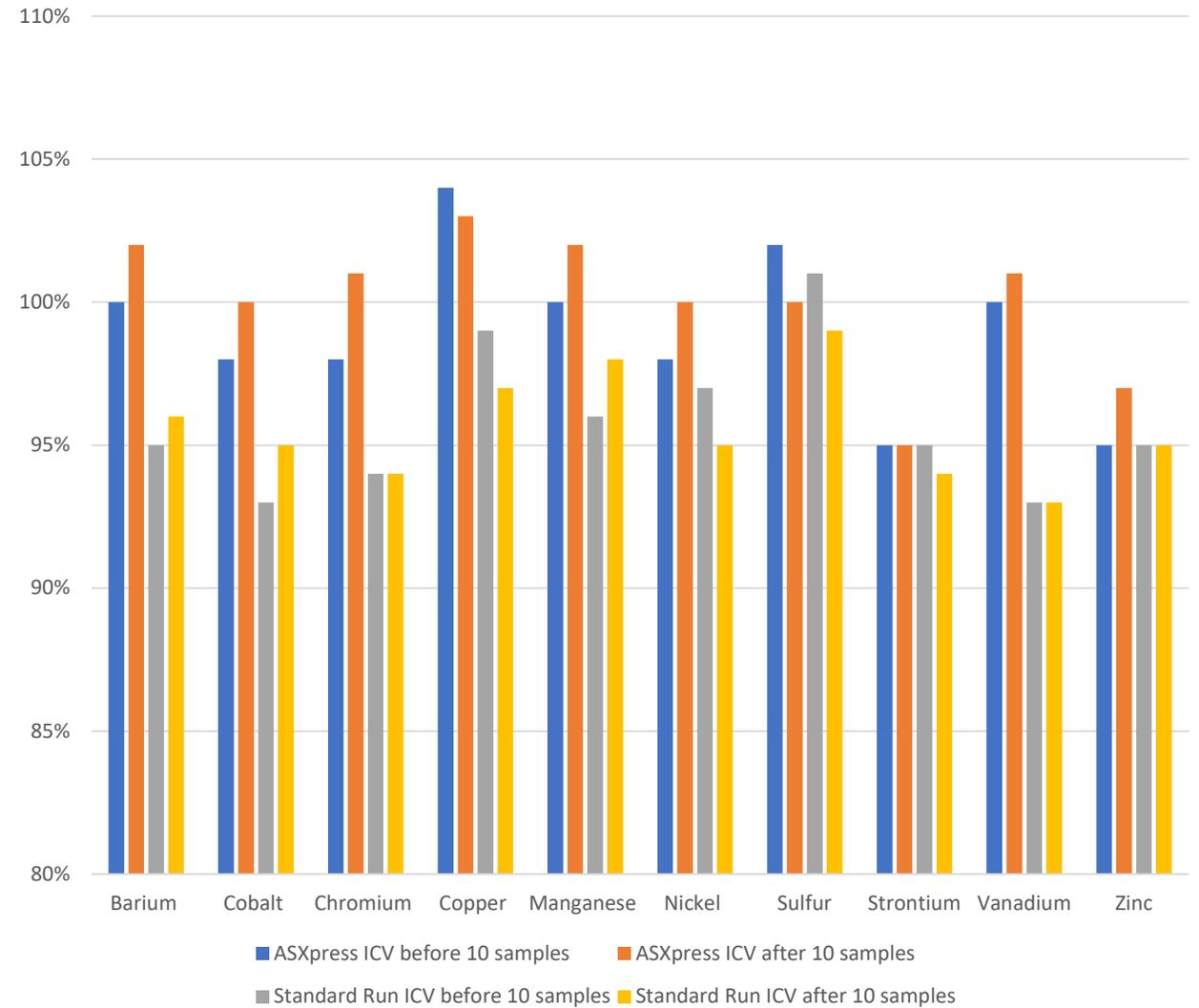


Oreas 45f Analysis – 10 aliquots



Second Source Calibration Verification

Second Source Recoveries



Improve Throughput, Maintain Accuracy

- Samples can be challenging with high acid content and high TDS
- Methods must be tailored to meet the needs of the individual lab
- Accuracy is Key

- ASXpress Plus maintains or improves data quality for ICP analysis
- RSD's are consistent with standard analysis
- Washout is improved
- Instrument drift is minimized

Time per sample reduced by 70%

An 8 hour shift allows for:

257 samples by standard method

OR 872 samples with ASXpress Plus

615 more
Samples!

Mehlich-3 Extracts



No promulgated method



Soil samples collected from farms are extracted with a solution appropriate to their soil type



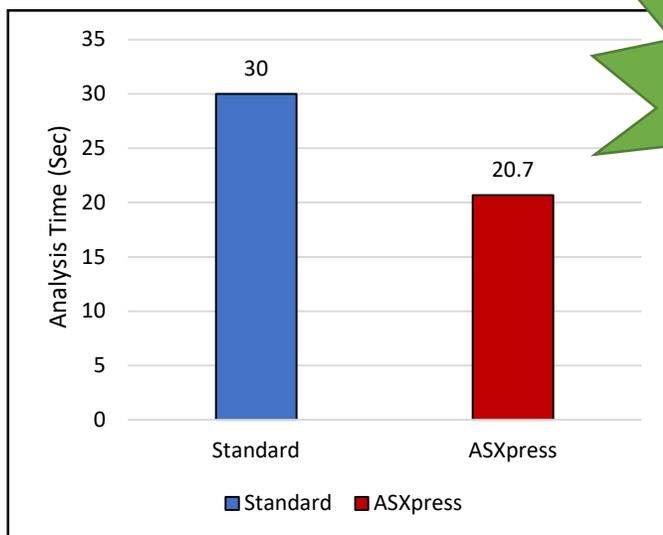
Results are compared to a range to determine fertilizer application.



Speed is much more important than accuracy.

Instrument Settings

Parameter	Setting Standard Run	Setting Xpress Run
Pump Speed	3.0mL/min	2.5mL/min
Read delay	20 secs	8 secs
Replicates	2	



Time Savings = 30%

47% Decrease in Non-Analysis Time

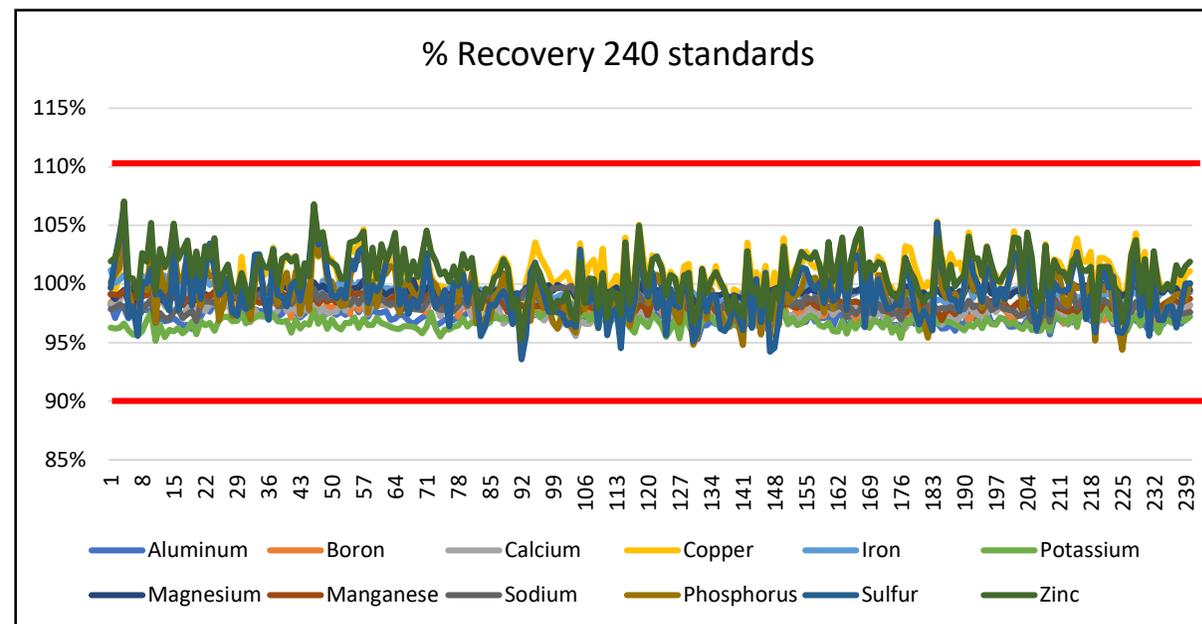
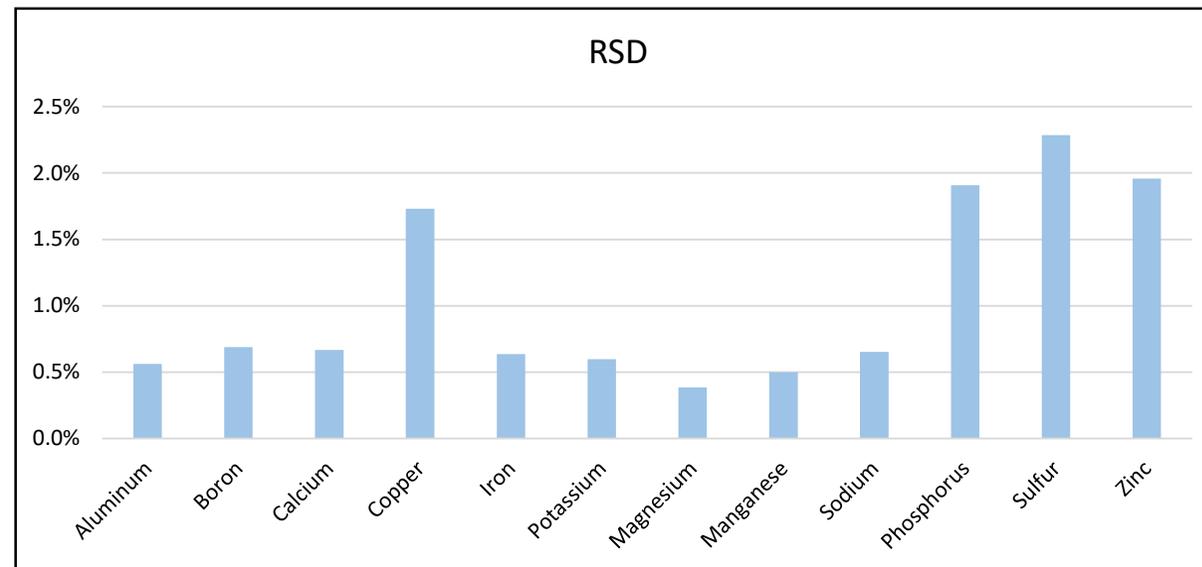
1.45x Sample Throughput

431 additional samples per 8 hour shift



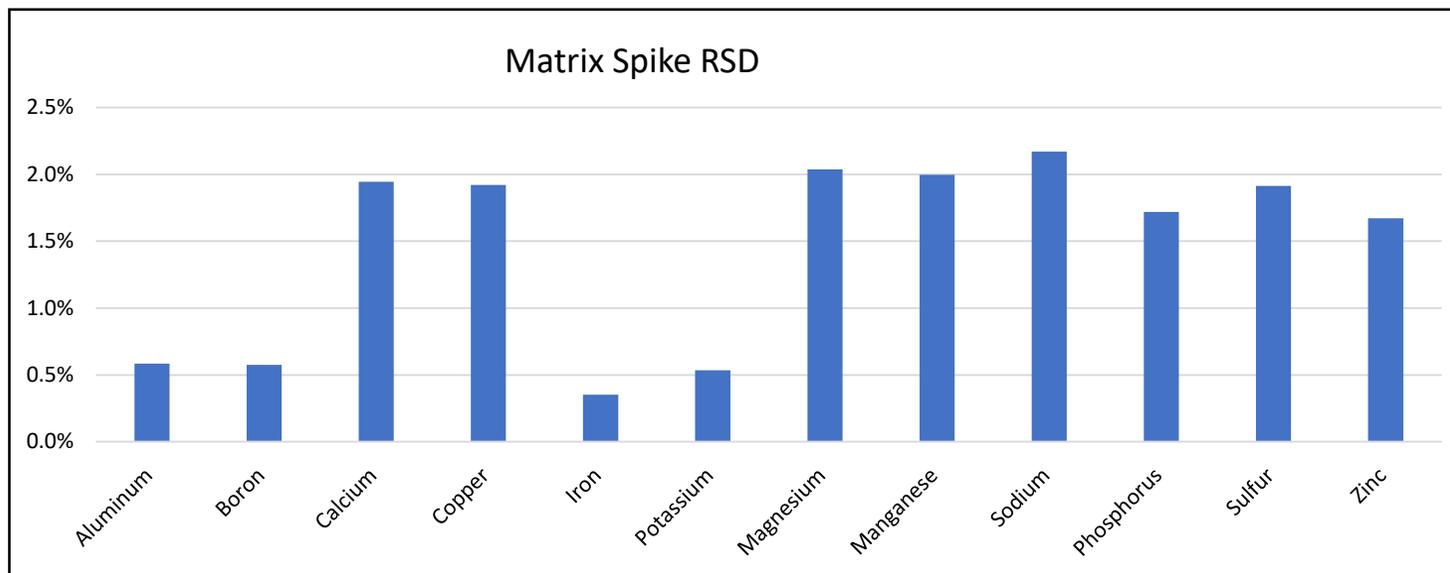
Analysis 240 aliquots

Element	mg/L
Aluminum	50.0
Boron	5.0
Calcium	50.0
Copper	0.5
Iron	5.0
Potassium	20.0
Magnesium	50.0
Manganese	2.0
Sodium	20.0
Phosphorus	5.0
Sulfur	2.0
Zinc	2.0

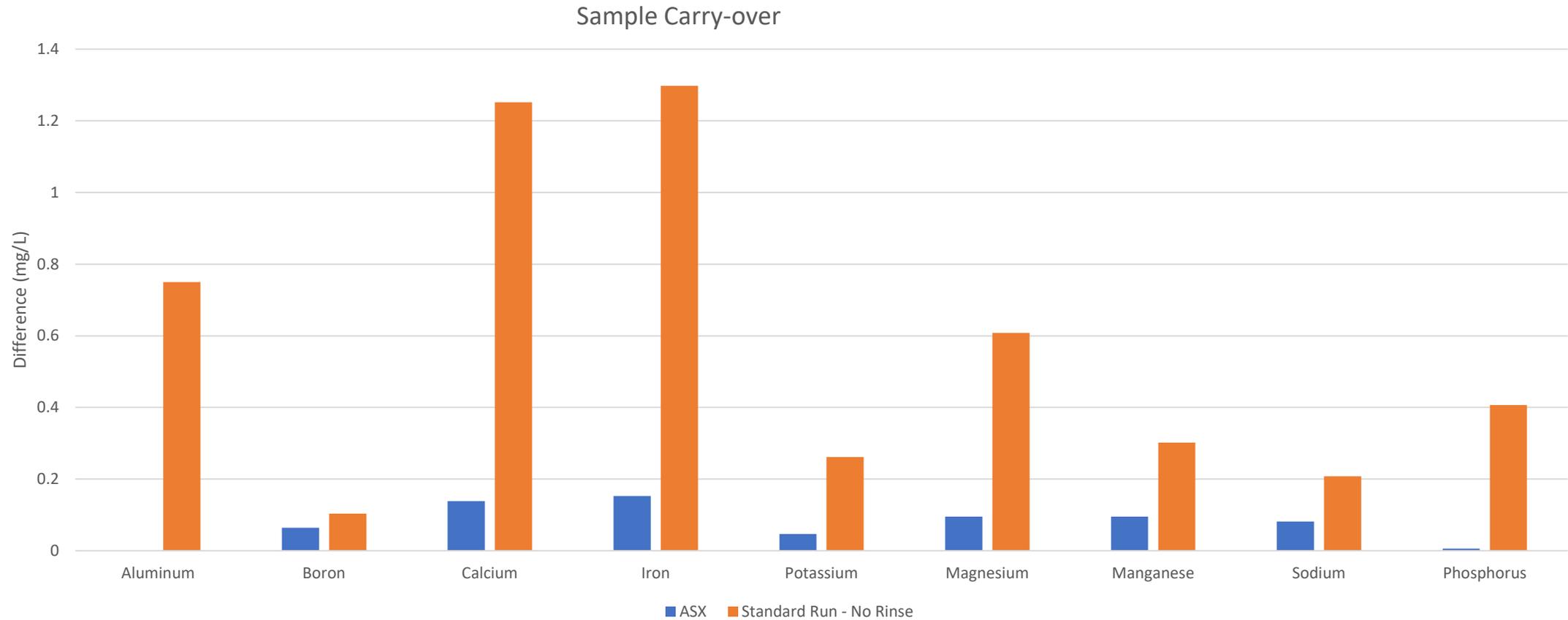


10 Analyses sample matrix spike

Element	Result (mg/L)
Aluminum	180
Boron	9.2
Calcium	320
Copper	1.1
Iron	63
Potassium	51
Magnesium	110
Manganese	90
Sodium	41
Phosphorus	11
Sulfur	23
Zinc	5.6



Importance of Rinse



Every Second Counts!

- Time is limited during the busy season
- Labs must adapt prep to match local soil conditions
- Turnaround time is critical!

- ASXpress Plus maintains or improves data quality for ICP analysis
- Uptake time is reduced by 47%
- Carryover is improved without sacrificing time
- Performance is maintained over many samples

Time per sample reduced by 30%

An 8 hour shift allows for:

960 samples by standard method

OR 1391 samples with ASXpress Plus

431 more
Samples!

EPA 200.7



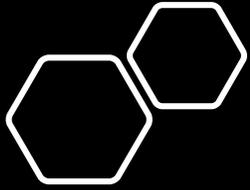
Drinking water and
Wastewater Samples



QC requirements strictly
regulated



Balance accuracy and speed



Instrument Settings

Parameter	Setting Standard Run	Setting Xpress Run
Pump Speed	1.0mL/min	1.5mL/min
Read delay	30 secs	15 secs
Flush speed	3.0mL/min	-
Flush time	30 secs	-
Rinse time	SmartRinse®	-
Replicates	3	

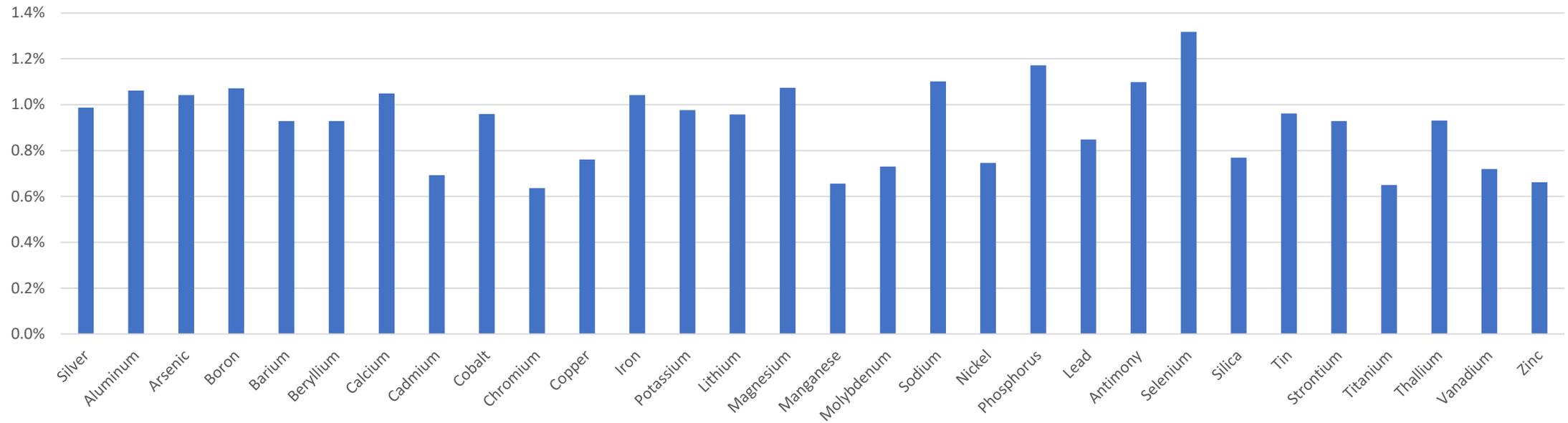
75%+ Decrease in
Non-Analysis Time

Time Measurement

Batch

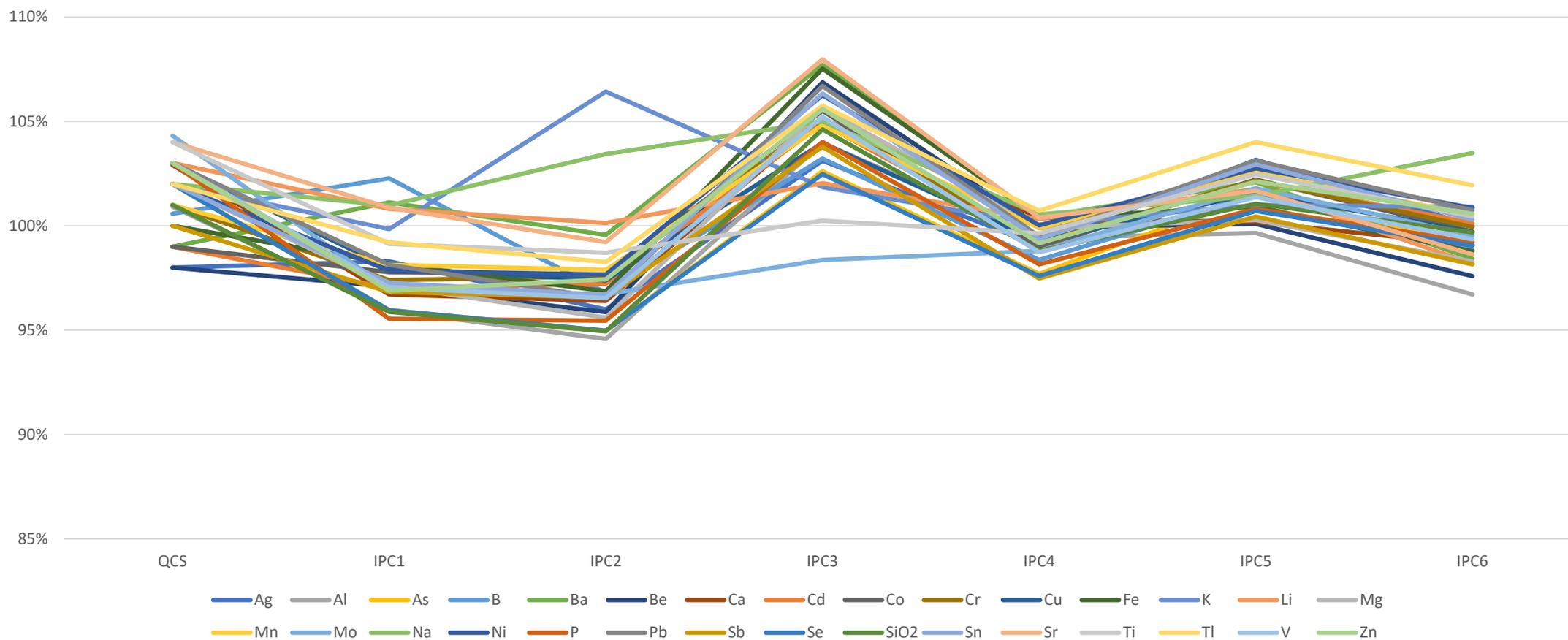
- Blank
- LCS
- Stream
- Stream MS
- Stream MSD
- Influent
- Influent MS
- Influent MSD



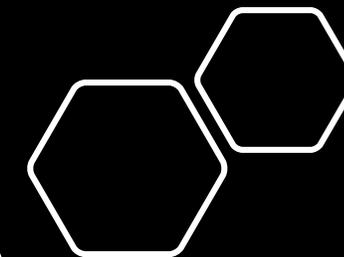


Instrument Performance Check (IPC) RSD

Instrument QC Recoveries



	1640a			1643f		
	True Value (µg/L)	Measured (µg/L)	% Recovery	True Value (µg/L)	Measured (µg/L)	% Recovery
Ag	8.081	7.414	91.7	0.9606	1.001	104.2
Al	53.0	51.0	96.3	132.5	129.8	97.0
As	8.075	8.101	100.3	56.85	62.56	109.0
B	303.1	314.1	103.6	150.8	160.6	105.4
Ba	151.8	151.3	99.7	513.1	525.6	101.4
Be	3.026	3.078	101.7	13.53	14.09	103.1
Ca	5,615	5,563	99.1	29,140	28,859	98.1
Cd	3.992	3.694	92.5	5.83	6.27	106.1
Co	20.24	19.08	94.2	25.05	24.16	95.5
Cr	40.54	39.20	96.7	18.32	19.11	103.3
Cu	85.75	83.47	97.3	21.44	21.10	97.4
Fe	36.8	38.4	104.3	92.51	98.56	105.5
K	579.9	596	102.8	1,913.3	2,079	107.6
Li	-	-	-	16.42	17.75	107.0
Mg	1,058.6	1,072	101.3	7,380	7,594	101.9
Mn	40.39	40.68	100.7	36.77	37.73	101.6
Mo	45.6	44.7	98.0	114.2	121.3	105.2
Na	3,137	3,183	101.5	18,640	19,763	105.0
Ni	25.32	23.88	94.3	59.2	57.0	95.2
Pb	12.101	12.693	104.9	18.303	19.987	108.1
Sb	5.105	4.782	93.7	54.90	55.38	99.9
Se	20.13	18.53	92.0	-	-	-
SiO₂	5,210	4,757	91.3	-	-	-
Sr	126.03	125.61	99.7	311	327	104.2
Tl	-	-	-	6.823	6.644	96.4
V	15.05	14.590	96.9	35.71	37.98	105.0
Zn	55.64	54.461	97.9	73.7	77.3	103.9



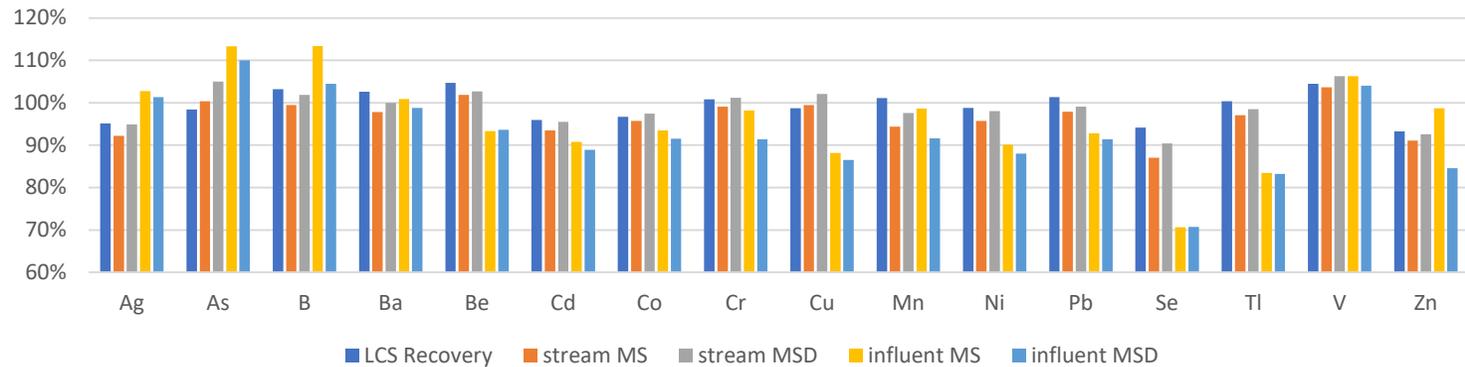
NIST Certified Standards

- 1640a – Trace Elements in Natural Water
- 1643f- Trace Elements in Water

Sample Spike Recoveries

	Ag	As	B	Ba	Be	Cd	Co	Cr	Cu	Mn	Ni	Pb	Se	Tl	V	Zn	
LCS		95%	98%	103%	103%	105%	96%	97%	101%	99%	101%	99%	101%	94%	100%	104%	93%
Stream MS		92%	100%	99%	98%	102%	93%	96%	99%	99%	94%	96%	98%	87%	97%	104%	91%
Stream MSD		95%	105%	102%	100%	103%	95%	97%	101%	102%	98%	98%	99%	90%	98%	106%	93%
Influent MS		103%	113%	113%	101%	93%	91%	93%	98%	88%	99%	90%	93%	71%	83%	106%	99%
Influent MSD		101%	110%	104%	99%	94%	89%	92%	91%	86%	92%	88%	91%	71%	83%	104%	85%

	Ag	As	B	Ba	Be	Cd	Co	Cr	Cu	Mn	Ni	Pb	Se	Tl	V	Zn	
Stream spike RPD		3%	5%	2%	1%	1%	2%	2%	2%	2%	2%	2%	1%	4%	1%	2%	1%
Inf spike RPD		1%	3%	4%	2%	0%	2%	2%	4%	1%	4%	2%	2%	0%	0%	2%	6%



Satisfy Stringent Requirments, Improve your Workflow

- EPA tightly regulates high standards of performance
- Sample volume is high
- Price per sample is low

- ASXpress Plus maintains or improves data quality for ICP analysis
- QCS, IPCs and Matrix Spikes all pass
- Instrument drift is minimized allowing more samples between calibrations

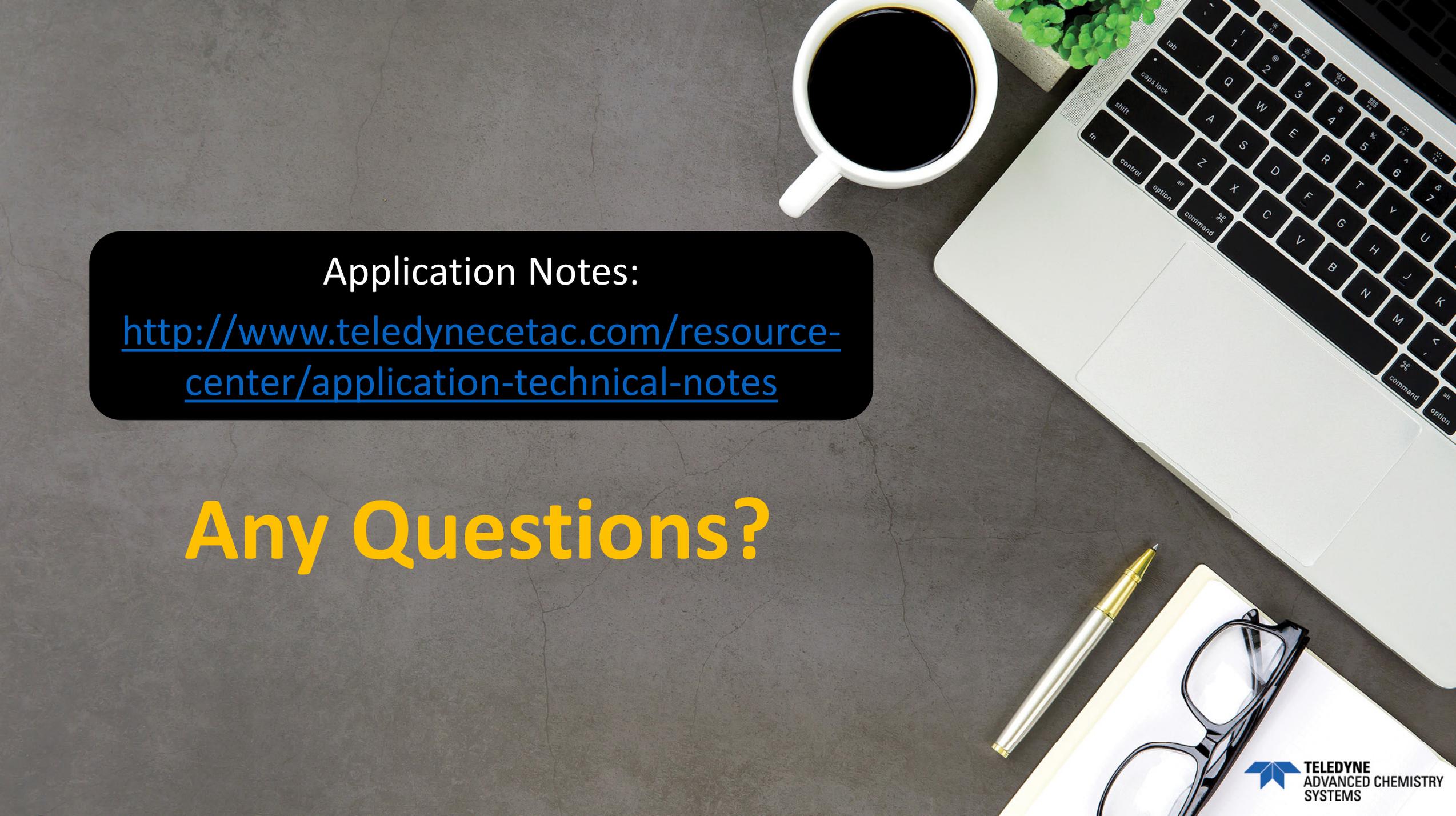
Time per sample reduced by 62%
An 8 hour shift allows for:
113 samples by standard method
OR 303 samples with ASXpress Plus

2.7X as
many
Samples!



ASXpress Plus Rapid Sample Introduction System

Accurate	Maintain the highest standard of performance for your ICP/ICP-MS
Fast	Decrease sample to sample times by as much as 70%
Clean	Reduce carryover between samples by rinsing during analysis
More	Run more samples per day and more samples per calibration

A top-down view of a desk with a laptop, a cup of coffee, a pen, and glasses. The laptop is silver and open, showing the keyboard. A white cup of black coffee is next to it. A gold pen and a pair of black glasses are on a white notepad in the bottom right. The background is a dark, textured surface.

Application Notes:

<http://www.teledynecetac.com/resource-center/application-technical-notes>

Any Questions?