

## Trace elemental analysis

## Driving productivity through reliable analysis with reduced complexity

Element Material Testing Group is one of the world's leading providers of testing, inspection, and certification. Element offers one of the most comprehensive ranges of materials testing services available in the Testing, Inspection, and Certification (TIC) sector that covers materials selection, application, and performance testing as well as failure analysis testing services. With over 9,000 employees and 270 laboratories, Element is providing their services worldwide to 55,000 customers working in diverse sectors including aerospace, energy, environmental, industrials, and life sciences.

The Element Edmonton laboratory is ISO 17025 accredited, specializing in inorganic analysis. With three ICP-MS and five ICP-OES systems, it analyzes for inorganic metals in soils and waters. Typical clients come from different industries such as oil and gas, construction, agriculture, municipal drinking water, and many more.

Alexsandra Robert is a senior scientist who has been working with the company for 20 years, with over 15 years of experience with ICP analysis. ICP-MS analyses performed at the Edmonton facility are primarily testing for heavy metal contaminant levels in soil and water. *"As the primary production lab for Element in Alberta, we currently analyze over 40,000 soils and 15,000 waters annually for metals,"* stated Alexsandra.

Analysis of soils and waters for elemental contaminants or minerals is typically performed using either Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) or Inductively Coupled Plasma – Optical Mass Spectroscopy (ICP-MS) to satisfy the different analytical and regulatory requirements of customers. *"The choice between ICP-OES and ICP-MS is largely driven by factors such as required detection limits, number of analytes, regulatory guidelines, and type of information requested by our clients,"* Alexsandra further illustrated.

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–Alexsandra Robert, Senior Scientist, Element Material Testing Group



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—Alexsandra Robert

Busy analytical testing laboratories experience tremendous workloads and need to ensure that reliable results are delivered to their valued customers in time. Alexsandra noted, *“Achieving reliable analytical results with minimum time and resources is very critical to the overall success of any analytical laboratory.”*

A Thermo Scientific™ iCAP™ MSX ICP-MS driven by Thermo Scientific™ Qtegra™ Intelligent Scientific Data Solution Software was added to the instrumental portfolio of the Element laboratory in Edmonton and has been in use for testing of environmental samples including ground waters, lake waters, surface waters, and different types of soil samples. Whereas the analysis of water samples is relatively straightforward, soil samples need to be acid digested either by microwave or hot plate digestion before introducing them into the ICP-MS for analysis. Samples are typically diluted off-line prior to analysis using ultrapure diluent to ensure that total dissolved solids in samples do not exceed the tolerance level of ICP-MS instruments. Alexsandra provided insight on the typical workflow of an environmental laboratory, *“For laboratories analyzing hundreds of samples every day, off-line liquid dilution is a tedious, error-prone, and expensive analytical step as it requires time, manual intervention, and expensive reagents and apparatus.”*

Alexsandra, who has had hands-on experience with legacy Thermo Scientific ICP-MS systems and other commercially available ICP-MS systems, stated, *“I am impressed with the changes made in the sample introduction system on the iCAP MSX ICP-MS. The magnets on the spray chamber cooling unit are very nice and make it much easier to see if there are any flow problems. I love the new peristaltic pump setup without the tension pins. No messing about or anxiety about the proper tension and the tubing is lasting twice as long as on comparable instruments.”*

Implementation of easyAGD argon gas dilution facilitates on-line sample aerosol dilution when analyzing heavy sample matrices like wastewaters, soil, and sediment digests. Alexsandra mentioned, *“I like the AGD setup and agree it reduces the number*

*of offline dilutions which are otherwise necessary. The LabBook-based internal cross-calibration feature is also great in extending the dynamic range. With the combination of these two abilities, metals in strong acid digestions can be analyzed more efficiently.”* As a result of these advancements with iCAP MSX ICP-MS, the laboratory is able to analyze soil digest samples without any additional liquid dilution, which is otherwise required with other ICP-MS systems in the laboratory. She further added, *“I believe the instrument stability over time with varying sample matrices is improved when using AGD, which allows for fewer recalibrations and therefore quicker run times. I also find that the cones require less cleaning, which will decrease downtime for maintenance, which is always a top priority for high-throughput laboratories.”*

The laboratory has analyzed more than 4,000 samples over a period of four months using the iCAP MSX ICP-MS instrument. Most importantly, the laboratory has been able to analyze this number of samples without the need for performing any kind of instrument maintenance, such as cleaning of cones, nebulizer, or any other part of the sample introduction system. Notably, the performance of the iCAP MSX ICP-MS instrument has passed the daily system suitability check consistently throughout this period.

Figure 1 provides an overview of how the instrument has performed over this 4-month period where actual analysis was performed on thirty-seven days. This comparison of instrument performance has been made against the acceptance criteria recommended by Thermo Fisher Scientific. As can be seen, the instrument met performance criteria comfortably throughout the period under investigation.

Powerful software packages that control instrument operation, data acquisition, and data reporting are equally important to analytical testing laboratories like Element. The Qtegra ISDS Software offers features and workflows to automate daily operation in the laboratory, eliminating or minimizing the need for manual interventions by lab technicians. Alexsandra explained her expectations from instrument software, *“It is important for us to train new technicians on new software in a short time, as an analyst generally operates multiple instruments.”*

“I am impressed with the iCAP MSX ICP-MS in general and would highly recommend it to other analytical laboratories.”

—Alexsandra Robert

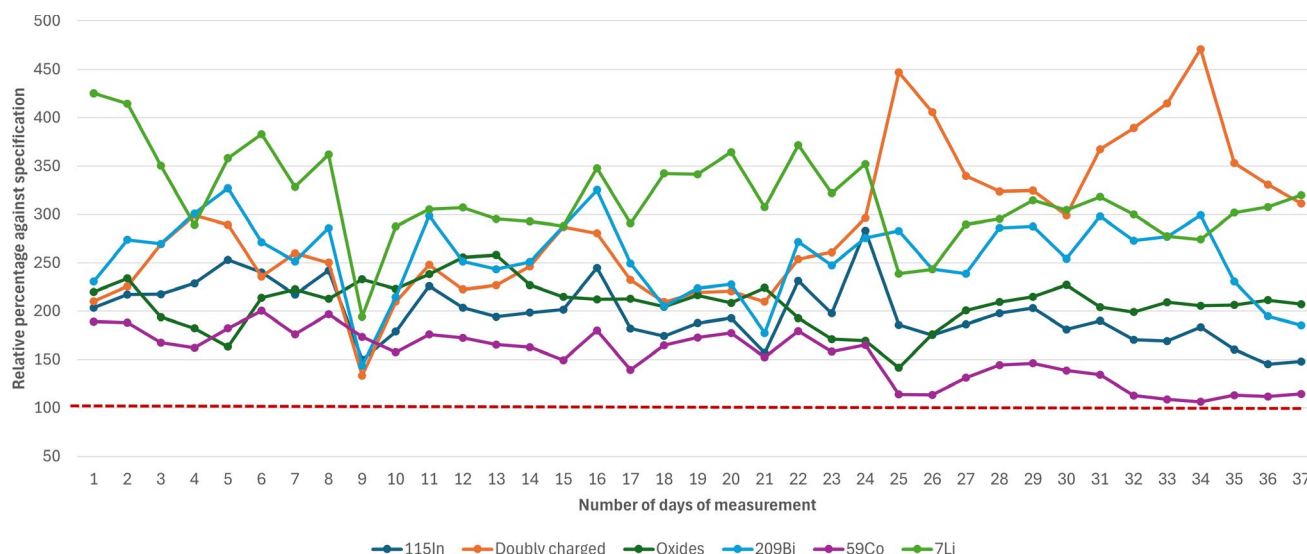


Figure 1. Instrument performance trend over a period of four months against performance specifications

She also commented on Qtegra ISDS Software and its newly introduced features such as “Dashboard”, which provides a quick overview of the current instrument status; “Get Ready”, for automated and scheduled instrument readiness; Thermo Scientific™ Hawk™ Consumables and Maintenance Assistant, which facilitates effective management of consumables inventory and helps avoid unplanned instrument downtime with proactive alerts; and Instrument Performance Monitoring (IPM), which provides trends of instrument performance over time.

She noted, “This Qtegra ISDS Software would be a great tool for new ICP-MS users.”

With the overall improvements in hardware and software, Element is now analyzing more samples every day with minimum instrument downtime and maintenance requirements. Alexsandra concluded, “I am impressed with the iCAP MSX ICP-MS in general and would highly recommend it to other analytical laboratories.”

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