25

A Guide to Trace and Ultra-Trace Mercury Testing in Water

Blair Easton, ALS Environmental

Mercury deposition into the global environment is a growing concern. Mercury contamination can threaten the health of humans and wildlife, from industrial sites to the most remote wilderness areas.

"As much as eighty percent of all anthropogenic mercury is attributable to energy production, especially coal combustion. Bituminous coal can contain relatively high levels of mercury and during combustion it is volatilized into gaseous elemental mercury vapor. Elemental mercury vapor emitted into the atmosphere will eventually be converted by photochemical oxidation into inorganic mercury and deposit, mostly through precipitation, onto land or into water bodies." (Brooks Rand 2010).

"Mercury is of particular concern in the northern rivers of Alberta. At the regional level mercury, is primarily emitted from coal power generation plants near Edmonton and in lesser amounts from the oil sands operations." (NREI 2002) As more research is required to determine how and why mercury levels are going up and the impact it's having on surrounding ecosystems, the need for accurate and reliable mercury testing intensifies.

Providing accurate and reliable mercury testing in water requires specific and rigid sampling and analysis procedures. Labs must know the required reporting level (detection limit) needed so as to match these sampling requirements and analysis procedures to the required level of sensitivity. Incorrect sampling and handling can lead to the loss of mercury and mercury contamination.

Low level mercury analysis is considered to be results from 5 to 50 ng/L (ppt), whereas, ultra-trace mercury analysis is considered to be results ranging from 0.1 to 5 ng/L (ppt). The lowest Alberta Tier I Groundwater Remediation Guideline (2014) limit for Total Mercury is now 5 ng/L and the Alberta Surface Water Quality guideline for the Long-Term (chronic) Protection of Freshwater Aquatic Life (PAL) is also 5 ng/L. The Alberta Regional Aquatics Monitoring Program (RAMP) database provides access to all the ultra-trace mercury results reported from various creeks and rivers in Alberta. The lowest reported result was 0.2 ng/L and the average result was 3 ng/L, which supports collection of mercury levels below the Total Mercury guideline of 0.5 ng/L. Furthermore, some industries are being asked to achieve waste water treatment discharge standards below 1 ng/L and as low as 0.1 ng/L Total Mercury.

Until recently, the most common container type and preservative used for routine or low level mercury analysis of waters was a High Density Polyethylene (HDPE) plastic container and nitric acid. However, recent studies have demonstrated that nitric acid is not sufficient to prevent significant losses of mercury at levels protective of human health (i.e. 1 µg/L or 1000 ng/L) in HDPE containers. In fact, the best container type and preservative used for routine or low level mercury analysis of waters is glass or Teflon® containers with HCl preservation. For ultra-trace mercury testing, ALS recommends that samples not be preserved at all, as the acid is a "magnet" for trapping mercury that can be present in the air and ambient sampling environment.

In addition, all field sampling equipment (including filters) should be tested for suitability prior to use in sampling for mercury, and the "clean hands/dirty hands" procedure followed while sampling, although not entirely if considering reporting results less than 0.5 ng/L.

Blair Easton, BSc

Blair Easton is the General Manager for the ALS Environmental Calgary location, responsible for the overall performance and service delivery for the Calgary laboratory that serves southern Alberta. He has over 24 years' experience within the environmental testing industry.

Prior to this position Blair was the Inorganics Department Manager for the ALS Environmental Vancouver location, where he was responsible for managing all aspects of laboratory technical development, quality control, production, and staffing in this department.

He has completed the International Register of Certified Auditors (IRCA) certified ISO 9000:2000 Series Auditor / Lead Auditor Training Course (Course No. A17020) and continues to work as a volunteer Quality Assessor for the Canadian Association for Laboratory Accreditation (CALA).

From 1994 to 2006, Blair was involved in international laboratory training and laboratory assessment operations under programs operating in South-East Asia, China and South and Central America. His involvement was primarily with two Canadian International Development Agency (CIDA) funded projects namely, the Cooperative Program in Marine Sciences - Phase II (CPMS-II) and Vietnam Canada Environment Project (VCEP).

Blair areas of expertise include: Laboratory operations management, Quality Systems and Assessments, inorganic