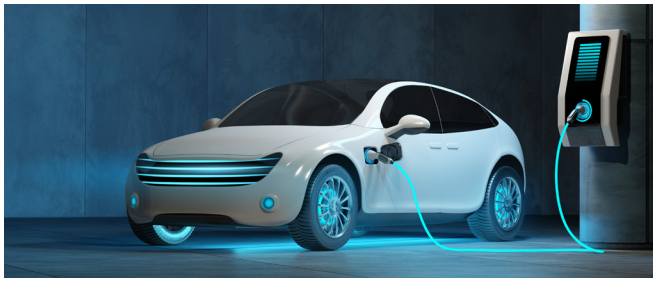
Rare Earth & Precious Metals – Critical Elements for a Sustainable Future

Why are Rare Earth and Precious Metals important?

Rare Earth Elements (REEs) and Precious Metals are widely recognized as being crucial to Canada's transition to a sustainable low-carbon economy. Notable Rare Earth Element applications with importance to sustainable energy and climate change reduction include batteries for electric and hybrid cars, wind turbines, solar panels, and permanent magnets. In fact, REEs are known as green-tech metals because of their importance to clean energy technologies. They also have important uses within modern electronics such as cell phones, TVs, computers, as well as in aerospace and defense. Precious Metals include gold, silver, and the six platinum group elements, which have important functions as catalysts within catalytic converters, which minimize pollution produced by internal combustion engines.

Canada is the 3rd largest producer of mined platinum group elements in the world. Canada has some of the largest proven REE reserves, but was not a producer of mined REEs until June 2021, when its first REE mining project began production in the Northwest Territories. Globally, most REEs are produced as by-products from other mined elements, particularly titanium and tin. Because of their increasing global importance to clean technologies, analytical testing of REEs and Precious Metals has become far more important in recent years, both for geochemical exploration purposes and for environmental monitoring within the mining industry.



REEs: Important for Electric Cars, Wind Turbines, Solar Power

Analysis of Rare Earth and Precious Metals by QQQ-ICPMS

The preferred analytical technology for environmental analysis of Rare Earth and Precious Elements is Triple Quadrupole ICPMS (QQQ-ICPMS); this is partly because QQQ-ICPMS eliminates interferences of rare earth oxides on other rare earth elements that cannot be addressed with classical collision/reaction cell ICPMS technology, and partly because of the higher sensitivity and low detection limits afforded by this instrumentation, which permits detection at ultra-trace and background levels for trend monitoring or exploration purposes.

The key technological advancement with QQQ-ICPMS is the additional quadrupole placed between the sample introduction interface and the collision/reaction cell (CRC), which gives very selective control over the ions that enter the reaction cell. This permits the use of reactive gases like oxygen and ammonia, which are far better at removing interferences compared to the use of hydrogen on standard CRC-ICPMS. Reaction gases may be selected either to change the mass of an interfering substance, or to change the mass of the target element to an interference-free mass (mass-shifting). These techniques effectively eliminate REE interferences that cannot be fully addressed with standard CRC-ICPMS.

Analyte Lists for REEs and Precious Metals

The ALS Environmental laboratory in Vancouver has over three decades of experience with ultra-trace metals testing and sample preparation techniques, and is accredited to the ISO 17025 standard for analysis of the rare earth and precious metals listed in Tables 1 & 2 using QQQ-ICPMS. Limits of Reporting (LORs) for most elements in these groups are 0.005 µg/L (5 parts per trillion). Routine Trace Metals analytes may also be analyzed from the same sample.

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Table 1: Rare Earth Metals in Water (Total/Dissolved)

ANALYTE	LOR(µg/L)	ANALYTE	LOR (µg/L)
cerium	0.005	neodymium	0.005
dysprosium	0.005	praseodymium	0.005
erbium	0.005	samarium	0.005
europium	0.005	scandium	0.005
gadolinium	0.005	terbium	0.005
hafnium	0.005	thulium	0.005
holmium	0.005	ytterbium	0.005
lanthanum	0.005		

Table 2: Precious Metals in Water (Total/Dissolved)

ANALYTE	LOR(µg/L)	ANALYTE	LOR (µg/L)
gold	0.005/0.02[1]	rhenium	0.005
iridium	0.005	rhodium	0.005
palladium	0.005	ruthenium	0.005
platinum	0.005/0.02[1]	silver	0.005

[1] Dissolved/Total LORs listed for gold and platinum

Sampling Considerations for Rare Earth and Precious Metals

The use of suitable sampling equipment and supplies is a crucial component of quality assurance for the testing of any ultra-trace metals. ALS has conducted extensive testing to identify suitable sampling supplies, including sample containers and other sampling materials such as gloves, syringes, and syringe filters, which we offer to our clients by request.

For Dissolved Metals, ALS strongly recommends field filtration, together with submission of field filtration blanks, especially where client-supplied filtration media is used. To minimize opportunities for contamination, ALS recommends lab-preservation for both Total and Dissolved (field-filtered) Metals.

For these tests, ALS provides 60-120 mL HDPE sample collection bottles, proofed for cleanliness to ultra-trace levels for all routinely analyzed trace metals. Preserved samples are stable for 6 months. Samples for Rare Earth Elements and Precious Metals testing may be submitted to any ALS Canada location or service centre.

For further information, please contact the specialty metals group at the ALS Vancouver laboratory (Trace Metals Laboratory Manager or Client Services Manager).

Periodic Table of the Elements with Trace Metal Categories Offered by ALS Canada