

Degree project for Master's student in environmental science, chemistry or physics

Determination of Tungsten, Tantalum and Hafnium levels in soils from the surroundings of the European Spallation Source (ESS) - Method development and measurement

Fall 2021 or Spring 2022

The Environmental Radiology group of the [Medical Radiation Physics Malmö](#) (MSFM) research group, Institution of Translational Medicine, Lund University, has conducted many research projects to predict potential radioactive releases from the European Spallation Source (ESS), a large neutron research facility under construction in Lund, Sweden. The ESS will produce neutrons using a powerful particle accelerator shooting protons on a tungsten target. The nuclear reactions in the target will also produce many radioactive by-products that may be released in the environment after a severe accident.

Recently, MSFM received funding from the Swedish Radiation Safety Authority (SSM) to investigate some of the radionuclides that would be the most harmful for health in case of accidental releases. In order to develop analytical methods to analyse the radionuclides of tungsten (W), tantalum (Ta) and hafnium (Hf), which are not produced yet but may be so once ESS is in operation, we intend to use the stable isotopes of these elements.

The goal of this thesis work will be to develop a method to extract and separate traces of these metals in soil (and eventually in plants) and to measure them by inductively coupled plasma Mass Spectrometry (ICP-MS). The student will work in the MSF laboratories in Malmö. The ICP-MS measurements will be performed at the Geology Department in Lund.

Desired qualifications are:

- Basic chemistry lab training (solution preparation, knowledge of safety rules)
- Strong interest for laboratory work
- Theoretical knowledge of analytical chemistry (chromatography, ICP-MS) and/or physics (radioactivity) is an advantage
- Good skills in written and spoken English

Work plan:

- Review of the literature to set an analytical method for W, Ta, Hf extraction in soil
- Preparation of soil samples doped with these metals
- Test of different methods to chemically extract and separate these metals of interest
- Measurement of the extracted elements by ICP-MS
- After optimisation on test samples, analysis of the current natural levels of elemental Hf, Ta and W
- Writing of a report summarizing the results

The degree project corresponds to 30 ECTS credits and can start during fall 2021 or spring 2022 (possibility to be extended to 60 credits).

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