**Assessment of metal distribution in algae used as bioindicators for the environmental monitoring of Swedish nuclear power plants**

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Marine macroalgae are an essential part of the environmental monitoring program of nuclear power plants (NPPs) thanks to their ability to efficiently absorb waterborne pollutants, such as radionuclides and heavy metals. *Fucus serratus* (toothed wrack) and *F. vesiculosus* (bladderwrack), are two brown algae species that grow on the Swedish coast, permanently attached to rocks and stones. Both species are commonly used as bioindicators, to monitor the levels of radionuclides in sea water around Swedish NPPs. *Fucus* spp. are particularly reflective over long period of environmental conditions such as the salinity, the water temperature and the concentration of metal in water. These environmental conditions and the growth cycle of the plant influence the algae uptake, turnover and retention of radionuclides and heavy metals released by NPPs. These mechanisms are not fully understood and can affect the results of radiological monitoring based on algae bioindicators. The concentration of radionuclides in *Fucus* spp. is usually assessed by gamma-ray spectroscopy using representative samples of dried and ground algae as part of the regular environmental monitoring at NPPs. In order to access the concentration of stable elements, other techniques like inductively coupled plasma mass spectrometry (ICP-MS) or X-ray fluorescence (XRF) have to be used. However, since elements are not homogeneously distributed in the plant tissues, these two conventional approaches are sensitive to the sampling collection method.

In this work, *Fucus* spp. samples were collected at different times and at various distances from the discharge point of the cooling water of the Ringhals NPP (Sweden). Gamma spectroscopy, XRF and ICP-MS measurements were performed on segmented algae samples to determine the differences in radionuclide and heavy-metal concentrations, between the blade (leaf equivalent) and the stipe (stem equivalent). These conventional methods were then complemented with elemental mapping techniques, to fully assess the distribution of elements at the tissue- and cell-scale. Maps of the metal distributions in *Fucus* spp. were obtained by micro-XRF, laser ablation ICP-MS and micro particle-induced X-ray emission (micro-PIXE). Results confirm the heterogeneous distribution of heavy metals in the plants and highlight the influence of the dilution of the source term on the elemental distribution.