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Moss, a bioindicator of radium atmospheric deposition: a large scale and high resolution case study conducted in New Brunswick, Canada

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Radium is a naturally occurring radioactive element which its longest-lived isotope, ^{226}Ra, is characterized by a half-life of 1602 years. Anthropogenic activities such as mining, natural gas and oil production lead to its mobilization from the earth's crust to the surface environment. The ecological impacts of this radioelement are still poorly understood especially at low levels. Assessing its concentration, transformation and transportation remain a challenge. We developed a novel, fast, convenient and reliable method for radium measurement in moss and applied it to conduct a large scale and high-resolution bryomonitoring survey in New Brunswick, Canada. Due to their lack of roots, mosses rely on atmospheric deposition to obtain their nutriments. As other trace elements are uptake at the same time, mosses could serve as bioindicators of their atmospheric deposition[1]. A total of 205 sites were sampled in New Brunswick during the summers of 2021 and 2022 on public lands where *Pleurozium schreberi, Hylocomium splendens* and *Hylocomiadelphus triquetus*, were collected 205, 73 and 23 times, respectively. ^{226}Ra spatial distribution was quantified and mapped across the eastern Canadian province. Its concentration ranged between 6 to 410 fg/g with a mean of 40 ± 40 fg/g. Influences of environmental variables (e.g., precipitation, pH, lithology, forest type, anthropogenic activities, distance to the nearest road) and moss species on ^{226}Ra concentration were investigated allowing us to validate the ICP Vegetation sampling protocol currently used to monitor other trace elements[1] for radium.

1 Frontasyeva M., Harmens H., Uzhinskiy A., Chaligava, O. and participants of the moss survey (2020). Mosses as biomonitors of air pollution: 2015/2016 survey on heavy metals, nitrogen and POPs in Europe and beyond. Report of the ICP Vegetation Moss Survey Coordination Centre, Joint Institute for Nuclear Research, Dubna, Russian Federation, 136 pp. ISBN 978-5-9530-0508-1.