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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurements and modelling of airborne plutonium in Subarctic Finland between 1965 and 2011" *by* Susanna Salminen-Paatero et al.

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We thank the reviewer for her/his careful reading and constructive criticism towards our work. As a consequence of these comments, the forthcoming modifications of the manuscript will improve greatly the quality of the final version.

General Comments: The manuscript lists concentrations of radionuclides and isotope ratios sampled at Rovaniemi in Finnish Lapland between 1965 and 2011, and reports on daily 48 hour-duration radionuclide dispersion simulations from hypothetical accidents at planned nuclear power plants (NPP) over one year (2010) using the SILAM model. Overall, the manuscript does not represent a substantial contribution to scien-

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Discussion paper

tific progress (there are no substantial new concepts, ideas, or methods).

Response: Only few long time series of atmospheric radioactivity exist from Subarctic and Arctic regions, and most of the existing time series contain only gamma emitters or fission products 137Cs and 90Sr. Producing atmospheric data of Pu isotopes is more laborious as they need to be radiochemically separated from the air filter matrix prior to activity measurement or isotope ratio determination. However, Pu isotope ratios provide important information about the nuclear contamination source in Subarctic and Arctic areas as they act like fingerprints in contamination identification. Finland is one exceptional example of significant unevenness of atmospheric nuclear contamination across a single state, since as was found out in this study, the large northern part of the country was mostly saved from the Chernobyl-derived transuranium deposition while the central and southern parts were more or less contaminated by the Chernobyl accident. The presence of plutonium isotopes in the air of high northern latitudes after the Fukushima accident has not been studied either. We see that due to all the listed reasons, it is meaningful to publish these results, preferably in ACP, and they will complete other observations and studies of plutonium sources and atmospheric contamination level in northern latitudes. Obviously, we have not expressed these justifications clearly enough in the current Introduction part and they will be now summarised to the Introduction for the revised version.

In particular, the model simulations of potential NPP at specific locations fall outside the scope of Atmospheric Chemistry and Physics. In my view the modelling part of the manuscript should be eliminated. The observations are discussed in a more balanced way (with consideration of related work, including appropriate references). The two parts (observations and model) are disjoint and in particular the modelling component is not motivated scientifically and the description of calculations is not sufficiently complete and precise to allow their reproduction as the model setup and out-comes are not discussed in detail.

Response: We believe that the modeling part of the manuscript completes the obser-

vational part, because 1) it provides risk estimates and reference contamination levels related to future nuclear activities in and close to Arctic regions that can be compared to earlier actual releases, and 2) it shows with the Fukushima case how important accurate information on the source term is for the prediction of resulting activity concentrations in the air following an atmospheric release of radioactivity. We will add a note on this justification to the manuscript. What comes to the description of calculations we have given the appropriate literature references concerning the model, the source of the meteorological data and the release parameters. We think that with the information provided, the dispersion calculations can be repeated with any similar computer models.

The presentation quality of the manuscript (in particular the use of the English language but also the quality of figures and tables) is not of the standard required for publication in ACP.

Response: Language re-check will be performed for the revised version as well as all figures and tables will be edited for the final published version according to the requirements by the editorial office.

2 Specific Comments: The abstract provides a concise and complete summary. I propose that the tables listing concentrations are moved to a Supplement, as they are not directly referenced and their inclusion along with the timeline plots in Figures is superfluous.

Response: In Results & Discussion part, both tables have been referenced several times in case of each nuclide and activity or mass ratio. However, the tables can be published as a separate Supplement part, if the Editor agrees with this modification.

3 Technical Corrections: There are numerous editorial corrections required to reach publication standard, the authors should carefully follow the ACP guide for authors in editing the manuscript before re-submission.

Response: Any typos or expressions not in line with the ACP manuscript format will be corrected first by the authors and eventually by the editorial office before publishing the final form.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-954, 2019.