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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Xenon-133 and caesium-137 releases into the atmosphere from the Fukushima Dai-ichi nuclear power plant: determination of the source term, atmospheric dispersion, and deposition" *by* A. Stohl et al.

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We have found an explanation for the origin of the xenon-133 in excess of the calculated inventory of the units 1-3 of the Fukushima Daiichi NPP that was found in the inverse modelling. Iodine-133 (half-life 20.8 h) decays into xenon-133 (half-life 125.8 h). The inventory of I-133 is almost the same as that of Xe-133 at the time of the chain reaction stop according to our ORIGEN calculations. As the half-lives of mother and daughter nuclide have a ratio of 1:6, this means that the additional activity of Xe-133 that is generated by the decay of the I-133 inventory is about 16.5% of the original Xe-133

when normalised to the time of chain reaction stop, as we do in our work.

Because of the half-life of less than a day, most of the I-133 is converted to Xe-133 in the first days of the accident. The Xe that has been produced before the main release from each reactor unit will of course be released together with the originally present Xe, while Xe being produced soon after will most likely still be released to the environment from the molten core as the reactor pressure and containment vessels obviously don't constitute barriers anymore.

The inversion yielded a total Xe-133 release of 16.7 EBq, while the calculated inventory was 12.6 EBq. If we multiply the inventory with a factor of 1.165 to account for the Xe-133 from total decay of the I-133 inventory, we obtain 14.7 EBq. Then the overestimation is reduced to about 12%. This can be explained by the uncertainty of the inversion. The fact that the inversion "discovers" the additional xenon though it was not present in our fist-guess is a further support for our methodology.

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