Temporal evolutions of the airborne ^{137}Cs level in Europe after the Fukushima and Chernobyl accidents

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1. Objective: Improve airborne radionuclide (RN) level forecasts regarding post-accidental situation and the way RN's last at an airbone contaminant status for vegetation and foodstuffs during the first year following the initial deposit.

2. Results and discussion: A rapid decrease of airborne radionuclide levels (typically one order of magnitude in first daily or weekly periods) attests a rapid homogeneization and fallout, by wet and dry deposition processes, after the Chernobyl and Fukushima releases. The magnitude of the peaks depends both on the emitted amount and on the travel time or distance from the emission point allowing deposition process to act along the route. In Europe, the Chernobyl ^{137}Cs peak level was 1000 to 10000 times higher than that of Fukushima whereas the release only differs by a factor 3. Moreover, it yielded to a lasting reload effect as it took about 10 years before reaching the yearly level prior to the accident. This belongs from 1)the radionuclide stock temporary stored in the atmosphere, 2) the extent of contaminated areas, 3) the deposited amount that can be subject to wind resuspension or biomass burnings events. This represents a delayed and secondary source of airborne radionuclides. At the european scale, an east-to-west decreasing gradient in the airborne level was still found several years after Chernobyl. Contrary, after the Fukushima accident, no « step effect » was found in Europe where it was considered that the releases were not detectable 3 months after the release. Airborne activities and RN deposition were thus not important enough in Europe compared to what was already present, to increase significantly the resuspension rate of radionuclides. Indeed, most of the RN's emitted spred over the Pacific ocean and highly contaminated areas are rather small compared to those for Chernobyl (20 times for area > 600 kBq m^{-2}). Additionally, the resuspension rate of deposited ^{137}Cs will gradually decrease with time as ^{137}Cs will migrate slowly down to the soil surface.

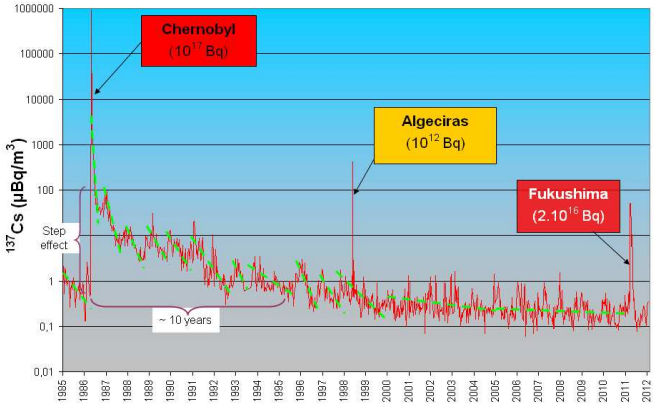

Figure 1: ^{137}Cs in air since Chernobyl in France (average value)

3. Conclusion: Except during the first 3 months after the arrival of the airborne ^{137}Cs from Fukushima, no change in the prevailing ^{137}Cs variability can be noticed in Europe. Deposition in Europe did not contribute significantly to the existing ^{137}Cs inventory in soil resulting from the Chernobyl and global fallout. In Japan, resuspension from contaminated areas will probably lead to the lasting persistence of airborne level that will not contribute most to the already deposited soil inventory. Even if it also occurs on vegetation this will be in no case the dominant transfer pathway of contamination.