



## **Global transport of Fukushima-derived radionuclides from Japan to Asia, North America and Europe. Estimated doses and expected health effects**

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The earthquake and the subsequent tsunami that occurred offshore of Japan resulted in a serious accident at the nuclear facility of Fukushima. A large number of fission products were released and transported worldwide. We estimate that around 23% of the released  $^{137}\text{Cs}$  remained into Japan, while 76% deposited in the oceans. Around 163 TBq deposited over North America, among which 95 TBq over USA, 40 TBq over Canada and 5 TBq over Greenland). About 14 TBq deposited over Europe (mostly in the European part of Russia, Sweden and Norway) and 47 TBq over Asia (mostly in the Asian part of Russia, Philippines and South Korea), while traces were observed over Africa, Oceania and Antarctica. Since the radioactive plume followed a northward direction before its arrival to USA and then to Europe, a significant amount of about 69 TBq deposited in the Arctic, as well.

An attempt to assess exposure of the population and the environment showed that the effective dose from gamma irradiation during the first 3 months was estimated between 1–5 mSv in Fukushima and the neighbouring prefectures. In the rest of Japan, the respective doses were found to be less than 0.5 mSv, whereas in the rest of the world it was less than 0.1 mSv. Such doses are equivalent with the obtained dose from a simple X-ray; for the highly contaminated regions, they are close to the dose limit for exposure due to radon inhalation (10 mSv). The calculated dose rates from radiocesium exposure on reference organisms ranged from 0.03 to 0.18  $\mu\text{Gy h}^{-1}$ , which are 2 orders of magnitude below the screening dose limit (10  $\mu\text{Gy h}^{-1}$ ) that could result in obvious effects on the population. However, monitoring data have shown that much higher dose rates were committed to organisms raising ecological risk for small mammals and reptiles in terms of cytogenetic damage and reproduction.