Radiocesium accumulation and plutonium source identification in sediments from Lake Inba after the Fukushima Daiichi Nuclear Power Plant accident

LIGUO CAO[1,2], NOBUYOSHI ISHIII[2], JIAN ZHENG[2*], KEIKO TAGAMI[2], SHIGEO USHIDA[2], MAIKO KAGAMI[3], SHAOMING PAN[1]

[1]Nanjing University, Nanjing 210023, China
[2] National Institute of Radiological Sciences, Chiba 263-8555, Japan (*correspondence: jzheng@nirs.go.jp)
[3]Toho University, Chiba 285-0841, Japan

Due to the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident in March 2011, approximately 6.4 PBq of ^{137}Cs from the accident were deposited on the land surface in Japan [1], and 1.0-2.4 × 10^9 Bq $^{239+240}$Pu were released into the environment [2]. Due to the long half-lives of released radiocesium and Pu isotopes, their radioactive contamination in the environment became a great concern for public safety. Lake Inba, extensively utilized as a source of water for irrigation and industrial and urban waterworks, could be contaminated by radioactivity from the accident. Therefore, it is highly required to investigate the vertical distribution of radiocesium and Pu in order to understand their long-term environmental behavior in the lake.

The obtained ^{134}Cs/^{137}Cs activity ratios for the sediment samples were overall around 1, indicating that radiocesium in these sediments originated from the FDNPP accident. For the four sediment cores collected from 2011 to 2015, the estimated ^{137}Cs inventories were higher than 20700 ± 410 Bq/m^2 (decay corrected to 15 March 2011), thus most of the Fukushima-derived radiocesium were accumulated in the sediments after their deposition. The vertical distribution of radiocesium showed severe mixing and rapid downward migration in the sediment column. As for the measured Pu, ^{240}Pu/^{239}Pu atom ratios in the core samples ranged from 0.161-0.210, within the range of global fallout (0.18 ± 0.014) [3], which suggested that global fallout was the main source for Pu contamination.

[1] Stohl et al (2012) *J. Atmos. Chem. Phys* **12**, 2313-2143. [2] Zheng et al (2014) *Environ. Sci. Technol* [3] Kelley et al (1999) *Sci. Total Envrion* **237**, 483-500.