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Establishment of novel monitoring methods for radioactive caesium in surface water in East Japan by passive samplers

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Pollution by radio caesium of the area surrounding the Fukushima Daiichi nuclear power plant is expected to be persistent for many decades in surface waters, soil, foodstuffs and in aquatic and terrestrial organisms. Following a nuclear accident, it is crucial to accurately measure, monitor, and model concentrations of radioactive caesium in the environment. Due to widespread dispersion of this radioelement across Japan, low -cost, simple (but accurate) monitoring methods are needed and these should be easy to interface with existing instrumental analytical techniques. We aim to develop a passive sampling device (Chemcatcher) to measure TWA (Time-Weighted Average concentration) concentrations of radioactive caesium in aquatic environments in East Japan. No passive sampler exists for measuring radioactive caesium before. Chemcatcher was developed and patented by the Portsmouth University team (UoP). It is proposed that UoP models be adapted to predict long-term contamination of freshwater ecosystems in Japan using Chemcatcher sampling data. Therefore we have developed new analytical procedure of radioactive caesium in surface water, which will take much shorter time to analyze the concentration. This presentation will show established novel monitoring methods, analytical procedure and results from field monitoring for radioactive caesium in surface water.

Our established monitoring method for radioactive caesium in surface water is passive sampling technic by using Chemcatcher and caesium rad disk (Empore disk). Firstly, we deploy them in rivers and lakes for several weeks. During their deployment, dissolved radioactive caesium could be on-site concentrated on disks. It can permit no laborious pretreatment such as mass volume concentration by heat in laboratories before measuring their radioactivity. It can also permit no transport of 100L water samples. Moreover trace level of radioactive caesium (approximately several mBq/L) in surface water can be measured by this method. Adding to that, TWA radioactivity of radioactive caesium in surface water can be calculated during the deployment duration. We can also recommend that NaI scintillation counters are available to our method in order to measure radioactivity absorbed on the disks besides Germanium semiconductor detectors.

We evaluated TWA concentration by our established passive sampling method and average concentrations by grab sampling at Ohori River during 5 days. The results indicated that the TWA concentration was in good agreement with the average concentration by grab sampling.

We conducted radioactive caesium monitoring in surface water at Kanto region where condensed large cities such as Tokyo and Yokohama is located. This is the first research which can reveal radioactive caesium contamination in surface water in metropolitan area in Japan. This monitoring method can be one of the effective techniques for rapid evaluation of wide range contamination by radioactive caesium.