Development of a Depth Distribution Monitor of Radioactivity Concentration in the Soil

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We have developed a monitor to measure cesium-radioactivity depth distribution in radioactive contaminated soil.1) This monitor is used to determine appropriate thickness of soil on decontaminating radioactive contaminated soil (Fig. 1). In this report, the configuration of the monitor and the estimation method of soil-radioactive depth distribution are described. The monitor consists of multi-layered CsI(Tl) and single NaI(Tl) scintillation detectors, as shown in Figs. 2 and 3.

1) Detection efficiencies of each CsI(Tl) detector, which views side face of soil at 1 to 5 cm depth from the top of soil sample, and the NaI(Tl) detector are simulated using MCNP2) code.

2) Relative radioactivity contained in the each soil layer is obtained by unfolding the counts measured by the CsI(Tl) detectors using SAND-II3) code.

3) Absolute radioactivity corrected with the depth radioactivity distribution is estimated from the results measured by the NaI(Tl) detector and the depth distribution, provided in 2).

For calibration of the detector efficiency, 137Cs reference sources contained in the disk cases, as shown in Fig. 4, were used. The radioactivity in the five sources is closed to simulate the soil sample.

Fig. 5 shows the experimental results of the measurement of radioactivity of 137Cs reference sources. The measurement

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result is in good agreement with the referenced radioactivity. From this result, if these reference sources are assumed to be a radioactive contaminated soil, it was found that the soil of 2 cm thickness from the ground surface should be removed under the regulation, in order that over 8,000 (Bq kg⁻¹) of radioactive cesium.

Based on the measurement of radioactive reference sources, this monitor is useful to determine the soil thickness for radioactive decontamination. It could help to decrease extra radioactive soil at storage areas and to speed up radioactive soil decontamination.

![Graph comparing experimental results and contained radioactivities of reference 137Cs sources.](image)

**Fig. 5** Comparison of the experimental results and contained radioactivities of reference 137Cs sources.

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**References**

