水田の畦畔や法面に残存する放射性セシウムが周囲の線量や下流環境に及ぼす影響

Effects of remaining radiocesium in bunds and slopes of paddy fields on ambient dose and downstream environment.

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After the devastating contamination by radionuclides in IItate Village, removal of the contaminated surface soil from the farmlands was performed over the village. However, the paddy bunds, banks or slopes of the irrigation/drainage canals have not been subject to the removal of contaminated surface soil because of the cost to recover them. This study aimed to show the quantitative influence of these ‘semi-contaminated ground’ as the source of gamma beam and the contamination of downstream water.

First, we analyzed the dose rates regularly monitored by Iitate village every two weeks since 2011 at 18 points within the village, where the decontamination works were conducted during the period. From the temporal change of the dose rate, the decrease in dose rate due to the decontamination work was evaluated at each point. The spherical views around the monitoring points of dose rate was captured by a 360-degree camera (Ricoh Theta), to evaluate the ratio of solid angle for the contaminated and decontaminated surface. The woods, paddy bunds, banks or slopes were regarded as the contaminated surface, while the buildings, farmlands or paved roads were classified to the decontaminated surface.

The percentage of the dose rate reduction by the decontamination works ranged between 31% and 83% depending on the land use around the points. The dose rate reduction is negatively correlated to the ratio of the solid angle of the contaminated surfaces from the monitoring points. Thus, the bunds, banks, or slopes, where the decontamination have not covered, are functioning as the ambient source of gamma beam to the monitoring points.

Second, we measured radiocesium effluence from the slopes of a drainage canal beside paddy fields in Iitate Village. The four of five slopes were covered with weeds which have been regularly cut; the other is bushed and has trees. The contaminated surface soil of the all slopes was not removed. The total radiocesium inventory estimated by scintillation survey meter ranged between 350 and 400 kBqm^{-2}. The radiocesium was mainly distributed within upper 5cm of the mineral soil layer. Metal gutters were installed at the bottom of the slopes, from which the water flowing over the slopes was collected and led to the storing tanks. The water in the tank was collected to the other tanks and taken to the laboratory on 10 Aug. 2018 and 26 Oct 2018. The water samples containing contaminated sediments were filtrated by glass filters with 440 μm opening followed by membrane filter with 0.45μm opening. The dissolved form of radiocesium in the filtrates were removed by the special cartridge. After drying and weighing, the radiocesium on the filters and cartridges were measured by Ge semi-conductor detector run by RI Research and Education Center in the Graduate School of Agricultural and Life Sciences, The University of Tokyo.

The radiocesium effluence rate from the slopes under 550 mm of total rainfall during the measured period ranged from 0.13 to 1.50 Bqm^{-2}. The effluence rate of suspended particles ranged as little as 0.08 gm^{-2}. Corresponding to this result, the ratio of particulate form of radiocesium tended to be less although the water flow over the slopes probably occurred under the intense rainfalls. Although the measured radiocesium effluence rate was too little to affect the radiocesium concentration in the downstream river water, it should be noted that we should monitor the radiocesium effluence from bared or collapsing slopes which can be the potential source of radiocesium to the downstream area.

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