【別紙２】

論文名：Mechanism of absorption of irrigation water-derived radiocesium by rice plants
「灌漑用水由来の放射性セシウムの水稲による吸収機構」（要約）
Title of Doctoral Thesis:

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（以下要約を記入する）

After the TEPCO Fukushima Dai-ichi Nuclear Power Plant accident in 2011, radioactive materials were released into the atmosphere and descended mainly in Fukushima Prefecture. Among the released radionuclides, radioactive cesium (^{137}Cs) has a long-term impact over a wide area. Since large amounts of water are used for paddy field irrigation, one of the main concerns is indirect pollution from the transfer of ^{137}Cs through watersheds.

In this study, we elucidated the detailed dynamics of ^{137}Cs input through irrigation water to paddy fields, as well as the mechanism by which ^{137}Cs is transferred to rice and the increase in ^{137}Cs activity concentration in rice plants.

The study area is located in Namie Town, Fukushima Prefecture, about 10 km northwest of the FDNPP. Two model paddy field experiments and two surveys were implemented from 2019 to 2021: (1) In situ model paddy field experiment using non-contaminated soil was performed to confirm the hypothesis of influence on ^{137}Cs uptake by rice plants due to local runoff of exchangeable potassium (Ex-K) in soil. (2) Two surveys were carried out: I. estimation of the algae existing area in the irrigation channel and II. estimation of the inflow load of organic matter into the paddy field to confirm the hypothesis of local increase ^{137}Cs in soil and rice plants due to deposition of organic matter derived from the irrigation channel. (3) Paddy field experimental sites were performed to confirm the hypothesis of direct uptake of dissolved ^{137}Cs from irrigation water by rice plants and local increase ^{137}Cs in soil and rice plants due to deposition of particulate ^{137}Cs from irrigation water near the water inlet.

The main results are summarized as follows:

1) Intake of irrigation water reduced Ex-K concentration in soil near the water inlet by leaching and increased the ^{137}Cs concentration in rice by the deposition of the particulate ^{137}Cs in soil.

2) Inorganic matter (suspended solids) accounted for 90% (940 kBq), while organic matter (leaves, decomposed algae, other) was approximately 10% (109 kBq) of the total ^{137}Cs inflow load into paddy field through the irrigation channel. The local increase in the ^{137}Cs concentration in soil and rice plants was mainly due to the deposition of

suspended solids derived from the irrigation channel.

3) Dissolved ^{137}Cs concentration in water tends to decrease at a constant rate over the entire area from the water inlet to the outlet. The influence of the dissolved ^{137}Cs prevails in the entire paddy field, and the ^{137}Cs concentration in rice increases uniformly with bottom-up effect.

4) Most of the suspended solids containing particulate ^{137}Cs were deposited near the water inlet due to the rapid decrease in the flow velocity of the irrigation water immediately after the inflow into the paddy field, which caused the increase in soil ^{137}Cs concentration. Generally, the particulate ^{137}Cs is bound to minerals such as soil particles (suspended solids), but some of it is available through switching into organic bound and ion exchange forms and has a relatively high bioavailability for plant uptake. It was shown that the suspended solids contributed to the ^{137}Cs uptake by rice locally near the water inlet.