Development of a Monitoring System Utilizing Artificial Intelligence Technology for Removed Contaminated Soil

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[Abstract]

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The rationalization of decontamination work for contaminated soil and proper management for removed soil that occurred due to radionuclide releases in the Fukushima Daiichi Nuclear Power Plant accident is required. However, the current depth distribution measurement utilizes a scraper plate to collect soil samples which are then measured in a laboratory. This means one week is spent in obtaining results. In this study, a portable radioactivity depth distribution measuring systems that can obtain results in-situ without soil collection was developed. Additionally, a stationary radioactivity depth distribution monitoring systems for the interim storage facility was developed.

A detector equipped with 20 CsI(Tl) scintillators with multi-channel analyzer was constructed which was able to measure radioactivity depth distribution to 40 cm depth in a one-time measurement. A convolutional Neural Network (NN) was used to convert from count rate to activity concentration. The machine learning was carried out using data obtained from field study and Monte Carlo simulation as input data and data obtained from the scraper plate technique and simulation data as output data. When unknown measurement data were inputted into the system, the accurate activity concentration could be provided. The validity of this system was estimated to be 100% when the error range was set to ±10%. The time spent in measuring the radioactivity depth distribution could be reduced to 10 - 30 min by using the radioactivity depth distribution measuring system. In the future, it is expected that rationalization of decontamination work and work for the interim storage facilities for contaminated removed soils will be possible based on the findings of this research.

[References]

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