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

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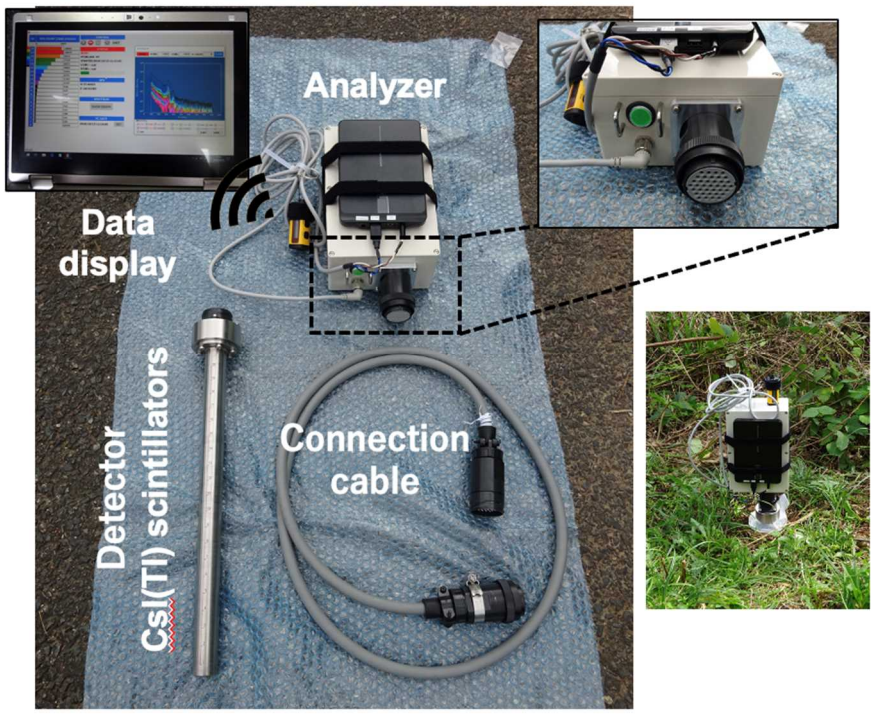
There is a need for rationalization of soil-decontamination work and proper management of soil removed because of radionuclide contamination from the Fukushima Daiichi Nuclear Power Station accident. However, current depth distribution measurements utilize a scraper plate to collect soil samples which are then analyzed in a laboratory. As a result it takes one week to obtain results. In this study, a portable radioactivity depth distribution measuring system was developed that could obtain results in-situ without soil collection. Additionally, a stationary radioactivity depth distribution monitoring system for interim storage facilities was developed.

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



Portable monitoring system for measuring radioactivity depth distribution.