Development of Measurement and Segregation System for Radioactive Soil

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1. Introduction

The decommissioning of the nuclear power plant will proceed to the D&D design, decontamination, demolition, waste disposal and site restoration. Site restoration is a process of removing the contaminated soil and returning the site to a green field before the installation of a nuclear power plant. The removed radioactive contamination soil is disposed of as radioactive waste, and a high amount of site restoration costs is generated from disposal of waste. Therefore, the site restoration cost can be minimized by minimizing the radioactive waste generated at site restoration [1]. This study will demonstrate the measurement and segregation system that can minimize the generation of radioactive waste through the process of active separation of real-time radioactive contamination.

2. Active real-time radiation measurement and separation system

The soil sorting system is technology that measures the radioactivity of soil that is transported by conveyor belts, and mechanically separates radioactive contaminated materials into clean and contaminated waste streams [2].

2.1 Soil measurement and segregation system

This is accomplished by passing the soil on a conveyor belt under an array of sensitive and rapidly reacting, radiation detectors that measure radionuclide concentrations. The contaminated soil above the desired cleanup limits is automatically diverted into a separate waste stream. As shown in Fig. 1, contaminants are removed by soil measurement and segregation system. Thus, it can significantly reduce the overall amount of contaminated soil requiring disposition as radioactive waste.

Typical radionuclides that can be measured by soil measurement and segregation system including Cs-137 and Co-60. The main factors for measurement on this system depend on the ambient radiation background, conveyor belt speed, thickness of the soil layer on the conveyor, and contaminant gamma ray energy and abundance [3].

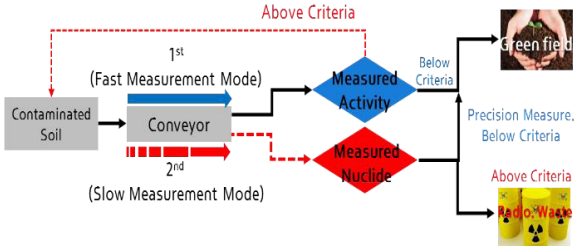

Fig. 1. Process diagram of soil measurement and segregation system.

2.2 Configurations of segregation system

The soil measurement and segregation system contained two detectors which are thallium-doped sodium iodide NaI(Tl) and four PVT scintillators housed in an environmentally controlled box for temperature stabilization and background radiation reduction. Gamma spectra in pre-defined energy ranges are collected over a fixed distance interval (60 cm) using a Multi-Channel Analyzer (MCA). The system includes a controller for conveyor belt speed and sensors for conveyed material depth, detector temperatures, belt speed, and reversing belt direction.

Fig. 2. Real-time measurement and segregation system.

2.3 Operation of soil measuring system

Prior to measuring by the system, excavated soil is pre-separated by method of wet multi particle separation through a vibrating screen.

The sized feed soil is loaded into the hopper. The soil height on survey conveyor are regulated by a "strike-off" bar which maintained a maximum belt fill depth of 10 cm. Depending on the operating conditions and data requirements, the soil move at typical conveyor speeds between 0.67 ~ 2 cm/s beneath the suspended NaI detector and PVT. The specific activity is automatically acquired for 60×60×10 cm of soil and compared to the segregation criteria 0.1 Bq/g.

Once the soil reached the end of the conveyer belt, a reversing conveyor divert the soil to either the above or below criteria depending on its specific activity.

3. Conclusion

The soil measurement and segregation system is a volume reduction and waste minimization process in which the particles that contain contamination are removed from the remaining relatively clean soil. The pilot test of this system isn't performed for a real radioactive contaminated soil. After the pilot test of a real radioactive contaminated soil, the correct separation efficiency for radioactive contaminated soil can be evaluated.

REFERENCES

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