Design and of Performance Test Facility of Final cover for Near-Surface Disposal Facility

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1. Introduction

The disposing method of the low-intermediate-level radioactive waste, near-surface disposal facilities are generally used. This disposal method refers to a method of constructing a concrete structure on the surface of the ground, putting radioactive waste in it, and covering it with an engineered barrier to isolate human life. Among these, engineered barriers mean covering multiple layers of heterogenous materials such as sand, clay, and gravel.

In this study, the design and construction method of the facility to demonstrate the performance of the engineered barrier that isolates the surface disposal facility from nature was described. In addition, the design and construction method of monitoring technology that can monitor the safety of engineered barriers by measuring information such as moisture, temperature, and slope safety in real time was also explained.

2. Final cover of Near-surface disposal facility

2.1. Near-surface disposal facility in KOREA

Located on the upper part of unsaturated rock based on Sedimentary-rock

- Amount of disposable Radioactive waste (volume) : 32,875m^3
- Disposal Facility Vault : Concrete structure 20
- Post-Closed : Construction of Final-Cover

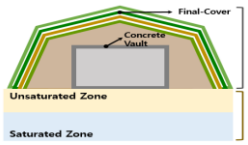
Construction *Facility operation* *Post - Closed*

2.2. Final-Cover of Near-surface disposal facility

▷ Closed : Covered by multiple layers

▷ Functions of the final cover

- Minimize radioactive nuclide release
- Prevent human intrusion
- Harmony with the natural landscape



Concept of Post-closed

3. *Construction of Test Facility of Final-cover*

3.1 Designs of Test Facility

▷ Design information of the multiple layers

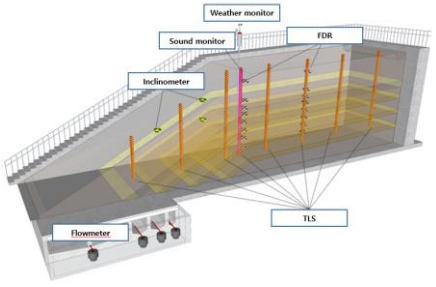
- Top soil : Prevention of the rainfall penetration, Human intrusion (Silty sand)
- Protective layer : Prevention of damage by animal, Prevention of plant stems penetration (Gravelly sand, Pea gravel)
- Drainage layer : water drains (Sand)
- Infiltration layer : Impermeable wall (Clay)

Layer information	Thickness
Top soil	2m
Protective layer (Ⅰ)	0.5m
Protective layer (Ⅱ)	0.5m
Drainage layer	0.3m
Infiltration layer	0.8m
Drainage layer	0.3m
Infiltration layer	0.8m
Drainage layer	0.3m

Multiple layer of cover

▷ Measurement plan of the Test Facility

- FDR(Frequency Domain Reflectometry) : Flow rate, Relative humidity
- TLS(Thermal Line Sensor) : Temperature at each layer, Water flow direction
- Inclinometer, Sound monitoring : Slope deformation stability
- Flowmeter : Seepage Quantity
- Weather monitor : Field Weather Data Collection



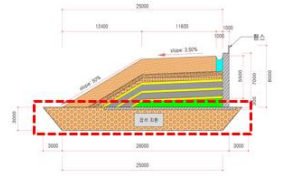
Measurement of the Test Facility

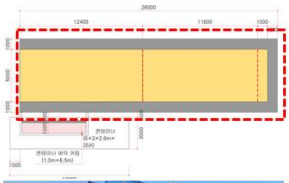
3.2 Construction of Test Facility

▷ Construction information

- Facility Size : 7m(H) x 25m(L) x 7m(W)
- Slope : 3.5%(upper), 50%(side part)
- Multiple layer : Composed of 8 layers of 5 materials
- Sensor(Quantity) : FDR(16), TLS(402), Inclinometer(3), Sound monitor(1), Flowmeter(4), Weather monitor(1)
- Construction period : 5 months

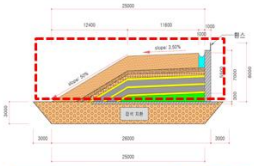
Test Facility of Final-cover

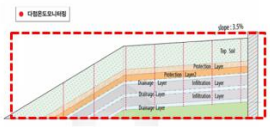




Footing with cut stone

Retaining wall construction





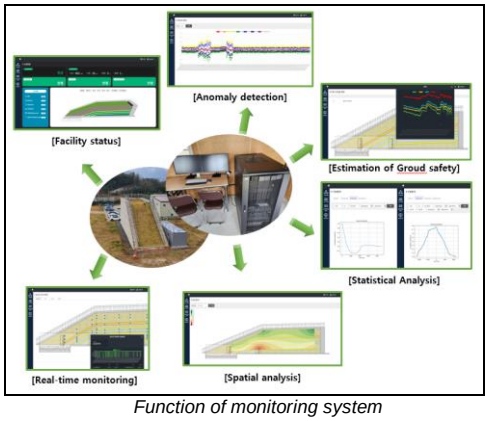
Fill-up layer(ex. Sand)

Measuring sensor installation

3.3 Configuration of the monitoring system

▷ Three-dimensional monitoring system

- Function : monitoring data collection, analysis and visualization
- Estimation Function : Anomaly data correction and estimation of safety By Deep learning-based



Function of monitoring system

4. Conclusions and Acknowledgements

The test facility presented in this study can identify the status of disposal covers in real time and predict the risks in advance. It can contribute to the safe management of radioactive waste by applying it to near-surface disposal facilities

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