Review of Radiological Impact Assessment Model in Disposal of NORM waste

Do Yeon Lee, Seong Yeon Lee, Hyun Jun Na, Seong Hun Jeon, Kwang Pyo Kim*
Kyung Hee University

ALhPS 경희대학교 KyungHee University

INTRODUCTION

■ Generation of NORM waste

- Naturally occurring radioactive material (NORM) industries deal with a variety of raw materials such as phosphate, zircon.
- In this process, by-products and residues such as scale are generated.

■ Necessity of developing radiological impact assessment model in disposal of NORM waste

- The IAEA has mentioned that the wastes may cause radiological impacts on residents near the industries and disposal workers.
- In Korea, a standard assessment model for radiological impacts in disposal of NORM waste has not yet been clearly established.
- Therefore, it is necessary to develop the standard radiological impact assessment model in disposal of NORM waste.
- In this study, we investigated the assessment model related to NORM waste.

OBJECTIVE

■ Review of Radiological Impact Assessment Model in disposal of NORM waste

- To compare exposure scenarios of foreign assessment model
- To compare exposure factors in the assessment model

Comparative analysis of exposure scenarios

■ Analysis of Exposure scenario

- The IAEA presents a landfill worker scenario and a landfill nearby resident scenario related to the disposal of NORM waste.
- The IAEA assumes that the landfill worker considers external exposure, internal exposure through inhalation, ingestion.
- In the case of residents nearby landfills, the IAEA assumes that radioactive material is deposited on nearby crops due to the landfill facility and that residents ingest the deposited crops.
- However, the IAEA assumes that the residents are exceptionally not considered for external exposure.
- The EC presents a landfill disposal worker scenario and a landfill nearby resident scenario related to the disposal of NORM waste.
- The EC assumes that the landfill disposal worker scenario includes NORM waste disposal such as landfill surface profiling, as well as normal work procedures.
- In the scenario of residents nearby landfills, the EC assumes that landfills not covered with a cover layer.
- The NRC presents landfill and incineration scenario related to the disposal of NORM waste.
- The NRC presents scenarios for residents nearby the landfill and residents on the landfill site after the landfill operation is closed.
- The NRC classifies scenarios related to incineration into those for waste collector, incinerator workers, and offsite members.

Table 1. Comparison of exposure scenarios

	Exposure scenario	
IAEA	• Landfill worker • Landfill nearby resident	
EC	• Landfill disposal worker • Landfill nearby resident	
NRC	Disposal in municipal landfill	• Waste collectors • Landfill worker • Offsite members of the public following landfill closure • Future onsite resident at landfill
	Disposal in municipal incineration	• Waste collector • Incinerator worker • Offsite members of the public

Comparative analysis of exposure factor

■ Analysis of Exposure factors in the assessment model

- In the external exposure model, the IAEA and EC consider exposure time, dilution factor, etc., And the NRC considers the number of landfills in operation, the shielding of heavy equipment, etc.
- In the case of dose coefficient considered in all pathways, IAEA and EC used ICRP 72 and 68 as dose coefficient, but the NRC used FGR 11 suggested by EPA as a dose coefficient.
- Therefore, the exposure factors of each exposure model were found to be different from each other.

CONCLUSION

- **In this study, we reviewed the NORM waste-related assessment model proposed by IAEA, EC, NRC**
- **As a result of the investigation, each institution assumes different exposure scenarios and exposure pathways.**
- **Therefore, it is expected that it is necessary to select a model suitable for the assessment purpose and target.**
- **The results of this study can be used as background data when developing a standard assessment model for radiological impacts in the disposal of NORM waste.**

ACKNOWLEDGEMENT

This work was supported by the KoFONS using the financial resource granted by NSSC. (No. 2105035)

Table 2. Comparison of exposure factors in the assessment model

Pathway	IAEA	EC	NRC
External Exposure	• Radiation dose rate • Exposure time • Dilution factor • Decay time • Decay time before exposure • Decay time after exposure	• Average dose rate during the year of exposure • Exposure time • Dilution factor • Decay time	• Number of waste landfills • Weight of waste • Fraction of exposure • Coefficient of shielding of heavy equipment • DCF for external exposure
Internal Exposure (Inhalation)	• Dose coefficient • Dilution factor • Exposure time • Decay constant • Inhalation rate • Concentration of dust • Specific activity concentration	• Dose coefficient • Exposure time • Inhalation rate • Coefficient of active concentration of inhalable dust • Effective dust concentration	• Number of landfill sites • Weight of waste • Atmospheric mass loading of waste • Inhalation fraction • Inhalation rate of workers • Exposure time of workers • DCF for inhalation exposure
Internal Exposure (Ingestion)	• Dose coefficient • Dilution factor • Annual intake • Exposure time • Decay constant • Specific activity concentration • Transition coefficient	• Dose coefficient • Intake rate • Exposure time	• Number of landfill sites • Amount of waste • Waste intake rate • Exposure time of workers • DCF for ingestion exposure