Radiation Dose for Self-Disposal due to the Quantity of Radioactive Waste

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1. Introduction

There are several radioactive material disposal methods such as regulation exemption, decontamination and long term storage[1,2]. To acquire radiation dose under self-disposal from them, the study on decontamination of some uranium contaminated soil and concrete wastes was performed using electrokinectic-electrodialytic [3].

In this study, we evaluated resident radiation dose due to cover depth on contaminated zone such as uranium contaminated soil and concrete wastes under radiation dose limit using RESRAD Version 7.0. The uranium concentration of contaminated zone due to the cover depth are also analyzed. Possibility for self-disposal of uranium contaminated soil and concrete wastes is evaluated from these calculating data.

2. Simulation

2.1 Calculation

To perform self-disposal of the quantity (1000 drums≒300,000 kg, 1500 drums≒450,000 kg, 2000 drums≒600,000 kg) of contaminated zone, the calculating conditions of radiation dose on contaminated zone due to the cover depth are as follows. The area of contaminated zone on the quantity of radioactive waste is 100, 150 and 200 ㎡, respectively. The thickness of contaminated zone is 2 m. The length parallel to aquifer flow on the quantity of radioactive waste is 11.284, 13.820, and 15.958 m, respectively. The age of the residents on contaminated zone is 15 years old. The period of evaluation on the contaminated zone is from regulation exemption of uranium contaminated soil and concrete wastes till 1,000 years.

The external radiation dose, dust intake and secondary radiation dose on the workers of contaminated zone are regarded. All the radiation doses of the residents on contaminated zone are regarded with external radiation dose, dust intake, secondary radiation dose, fruit, vegetable and grain consumption, leaf vegetable consumption, milk consumption, meat and poultry consumption, fish consumption, other seafood consumption, soil ingestion, and drinking water intake.

2.2 Calculated Results

Table I shows calculating results (1000, 1500 and 2000 drums). The tolerable uranium concentration of 1000, 1500 and 2000 drums) showed about 1.91, 1.44, 1.15 Bq/g at cover depth (1 m), respectively. The tolerable uranium concentration of 1000, 1500 and 2000 drums) showed about 2.90, 1.93, 1.45 Bq/g above cover depth (1.5 m), respectively. The individual radiation dose of 1000, 1500 and 2000 drums) showed about 5.23, 6.95, 8.67 μSv/g at cover depth (1 m), respectively. The individual radiation dose of 1000, 1500 and 2000 drums) showed about 3.45, 5.17, 6.90 μSv/g above cover depth (1.5 m), respectively.

Table I: Calculated Results

Cover Depth (m)		1	1.5	2	3
Concen-tration (Bq/g)	1000 Drums	1.912	2.900	2.900	2.900
	1500 Drums	1.439	1.933	1.933	1.933
	2000 Drums	1.153	1.450	1.450	1.450
Individ-ual Radia-tion Dose (μSv/y)	1000 Drums	5.231	3.448	3.448	3.448
	1500 Drums	6.948	5.172	5.172	5.172
	2000 Drums	8.672	6.897	6.897	6.897

Fig. 1 showed the tolerable uranium concentration due to cover depth. As cover depth increases, the tolerable uranium concentration increases up to cover depth (1.5 m) and then it showed saturated uranium concentration above cover depth (1.5 m). Therefore, to carry out self-disposal on the quantity (1000 drums) of radioactive waste is easier than to carry out on the quantity (2000 drums) of radioactive waste owing to the large tolerable uranium concentration for self-disposal of radioactive waste.

Fig. 2 showed the individual radiation dose rate due to cover depth. As cover depth increases, the individual radiation dose decreased up to cover depth (1.5 m) and then it showed saturated individual radiation dose rate above cover depth (1.5 m). In case of performing self-disposal from the quantity (1000, 1500, 2000 drums) of radioactive waste, the individual radiation dose rate for a year is under regulation (10 μSv/y) at cover depth (1~3 m).

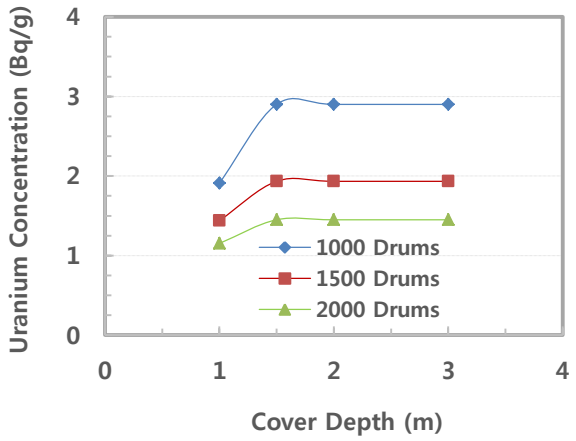

Fig. 1. Tolerable uranium concentration vs. cover depth.

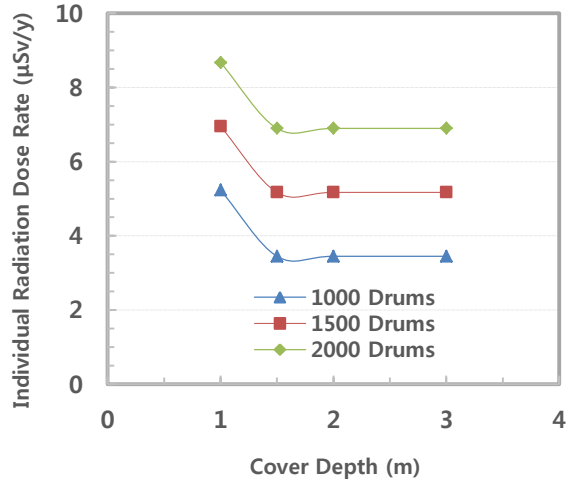

Fig. 2. Individual radiation dose rate vs. cover depth.

3. Conclusions

We evaluated radiation dose due to cover depth on contaminated zone such as uranium contaminated soil and concrete wastes under radiation dose limit using RESRAD Version 7.0. As cover depth increases, the tolerable uranium concentration increases up to cover depth (1.5 m) and then it showed saturated uranium concentration above cover depth (1.5 m). Therefore, to carry out self-disposal on the quantity (1000 drums≒300,000 kg) of radioactive waste is easier than to carry out on the quantity (2000 drums≒600,000 kg) of radioactive waste owing to the large tolerable uranium concentration for self-disposal of radioactive waste. As cover depth increases, the individual radiation dose rate decreased up to cover depth (1.5 m) and then it showed saturated individual radiation dose rate above cover depth (1.5 m). In case of performing self-disposal from the quantity (1000, 1500, 2000 drums) of radioactive waste, it is realized that the individual radiation dose rate for a year is under regulation (10 μSv/y) at cover depth (1~3 m).

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