Effects of Site Characteristics on Dose Assessment in NPP Decommissioning

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1. Introduction

In the decommissioning of a nuclear power plant (NPP), the principal objective of a site remediation is to prevent contamination occurring. According to IAEA's Safety Guide [1], the site release and the reuse are considered as the final step of NPPs decommissioning. The six phases for the remediation are listed in Table 1 [2]. These phases are based on the data of a site characterization which requires a site-specific suite of radionuclides. For the NPP decommissioning, the characterization survey, which is consisting of identifying the environmental problems, collects the appropriate data necessary to demonstrate that the site meets the release criterion. In the case of advanced countries, a contractor is experienced and will leverage lessons learned from other decommissioning projects. In Korea, however, there is a limit to the use of base information.

This study aims at selecting the parameters of the site characterization for the NPPs decommissioning. To that end, the effects of the parameters are investigated by using RESRAD.

Table 1. Project Phases for NPP Decommissioning [2]

Phases	Actions
1	Problem definition
2	Remedial investigation
3	Remedy planning
4	Remedial action
5	Project closeout
6	Institutional control

2. Parameters based on site characterization

A dose modeling for the site release involves using radiological exposure pathways to determine the dose to an individual from residual radioactive material as shown in Fig. 2. In this study, a resident farmer scenario, which is more conservative than other scenarios, is considered for the critical population group. For comparison, four parameters are selected and tabulated in Table 2.

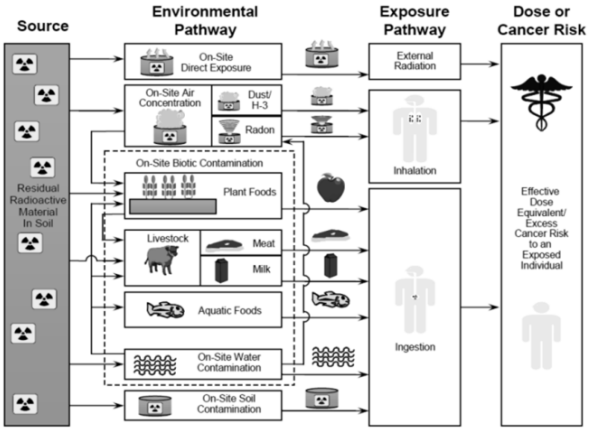

Fig. 1. Exposure Pathways Considered in RESRAD [3].

Table 2. Parameters for Case Studies

Case	Parameters
A	Area of contaminated zone
B	Thickness of contaminated zone
C	Initial concentration of radionuclide
D	Cover depth (Erosion rate 0)

3. Case studies and results

To examine the effect of the parameters, the reference model used by KINS-GR-297 [4] is considered by using RESRAD-ONSITE code. Fig. 2 shows the total effective dose equivalents (TEDE) of each case for four parameters.

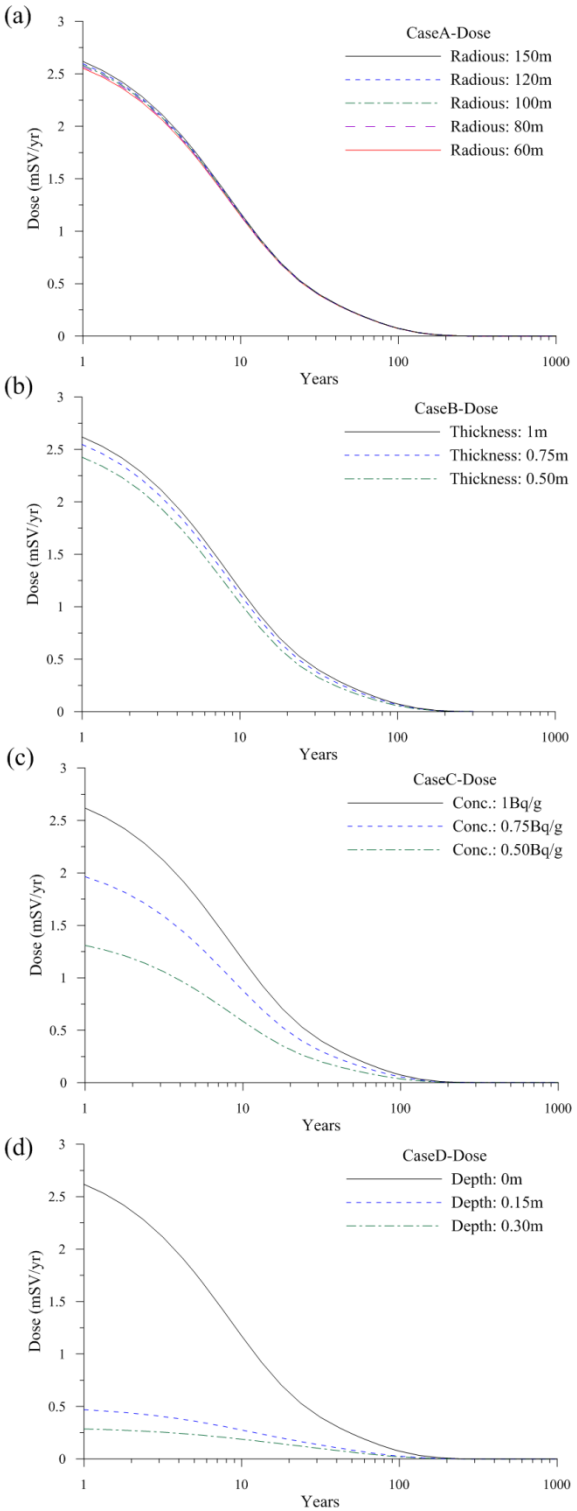

Fig. 2. TEDEs for All Pathways: (a) Area, (b) Thickness, (c) Cover depth, (d) Concentration of Radionuclide.

It is shown that, the area (Case A) and the thickness (Case B) of the contaminated zone have little effect on the dose assessment. On the other hand, the initial concentration of radionuclide (Case C) and the cover depth (Case D) can significantly reduce the TEDE. When the cover depth is increased to about 30 cm, it is possible to reduce the exposure dose most effectively and to shorten it to about 31 years in order to satisfy the site release criterion (0.1 mSv/yr).

4. Conclusion

In this study, the effects of the site characteristics for NPP Decommissioning are investigated by using RESRAD code which includes Co-60 and Cs-137. Through the case studies, it is shown that the cover depth for the site remediation is greatly influenced to the dose assessment. This is because the cover is reduced the external exposure to the contaminated soil. In addition, to restore the NPP site to Greenfield, an appropriate dose assessment should be performed on the cover condition.

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