

## Development of Residual Radioactivity Exposure Scenario and Pathway for Clearance Media of Decommissioning Nuclear Power Plant

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### 1. Introduction

Kori 1 and Wolsong 1 permanent shutdown in 2017, 2019, respectively. In Korea, Final Status Survey (FSS) result must be lower than the Derived Concentration Guideline Level (DCGL) in order to complete the decommissioning. Depending on the site reuse scenario after decommissioning, all facilities may be dismantled, and some facilities may remain. In case of overseas NPPs that were completed decommissioning, DCGL were derived for various media. Kori unit 1 and Wolsong unit 1 are planned as brown field, but there is a possibility of green fields in the future. Therefore, in this study, based on the analysis of overseas cases, clearance media, exposure scenarios, and exposure pathways of Kori 1 and Wolsong 1 were developed.

### 2. Materials & Methods

Zion, Connecticut Yankee (CY), Rancho Seco (RS), Humboldt Bay (HB) NPPs were analyzed to select media subject to clearance of Kori 1 and Wolsong 1. Table 1 shows the media subject to clearance of four NPPs[1][2][3][4].

NPPs	Clearance Media
Zion	<ul style="list-style-type: none"> <li>• Soil</li> <li>• Underground Pipe (Buried, etc.)</li> <li>• Underground Concrete Structure</li> </ul>
Connecticut Yankee	<ul style="list-style-type: none"> <li>• Soil</li> <li>• Building</li> <li>• Underground Concrete Structure</li> <li>• Groundwater</li> </ul>
Rancho Seco	<ul style="list-style-type: none"> <li>• Soil</li> <li>• Building</li> <li>• Buried Pipe</li> <li>• Embedded Pipe</li> </ul>
Humboldt Bay	<ul style="list-style-type: none"> <li>• Soil</li> <li>• Building</li> </ul>

It was found that buildings, underground concrete structures, buried pipes, and groundwater were considered according to the decommissioning plan of each NPP, and soil was commonly considered. For example, in the case of the Zion NPP, it was decided to dismantle all buildings on the ground surface, so the buildings were excluded from the clearance media. In general, it was found that groundwater was excluded because no significant contamination was found through continuous monitoring.

### 3. Results

Table 2 shows the clearance media and exposure scenarios of Kori 1 and Wolsong 1. Six media (soil, groundwater, underground concrete structure, buried pipe, building, embedded pipe) were selected based on overseas cases, and exposure scenarios and exposure pathways for each medium was developed.

Table 2. Clearance Media and Exposure Scenario of Decommissioning NPPs

Media	Reuse criteria <sup>1)</sup>	Exposure Scenario
Soil	Unrestricted	Resident Farmer
	Restricted	Industrial Worker
Groundwater	Unrestricted	Resident Farmer
Underground Concrete Structure	Unrestricted	Excavation
		Groundwater
Buried pipe	Unrestricted	Excavation
		Insitu
Building	Unrestricted	Building Occupancy
	Restricted	Building Renovation
Embedded pipe	Unrestricted	Building Occupancy
	Restricted	Building Renovation

Exposure scenarios for each medium were classified unrestricted and restricted according to the Nuclear Safety and Security Commission notice. The dose criteria for both scenarios were the same as 0.1 mSv/yr. And unrestricted scenarios, 6 age groups (age 0, 3 months, 1, 5, 15, adult) were considered.

The resident farmer scenario assumes that they reside on the site and intake food produced from the site. The industrial worker scenario assumes that they work on the site, and food intake is restricted. The excavation scenario assumes that activity is mixed with the surface soil by excavating underground concrete and buried pipes to the ground. It is assumed that exposure pathway is the same as that of the resident farmer. The groundwater scenario assumes that underground concrete structures remain underground and activity is released into the groundwater. The insitu scenario assumes that buried pipes remain underground.

The building occupancy scenario assumes that the general public uses the building as an office. The building renovation scenario assumes that the workers perform remodeling, etc. in the building. The exposure pathways in both scenarios are external, inhalation, and ingestion exposure. However, in the building renovation scenario, indirect ingestion is excluded, in which radioactive materials are deposited in food and ingested.

hydrogeological surveys and available information such as potential contaminants and Structure, Systems, and Components.

#### 4. Conclusions

In this study, based on the analysis of overseas cases, clearance media, exposure scenarios, and exposure pathways of Kori 1 and Wolsong 1 were developed. Six media (soil, groundwater, underground concrete structure, buried pipe, building, embedded pipe) were selected and exposure scenario and exposure pathways were developed according to the characteristics of each medium. The results of this study are expected to be used as basic data when deriving DCGL for each medium.

#### REFERENCES

- [1] ZionSolutions, Zion Station Restoration Project License Termination Plan, 2018
- [2] SMUD, Rancho Seco License Termination Plan, 2008
- [3] CYAPC, Haddam Neck Plant License Termination Plan, 2006
- [4] PGEC, Humboldt Bay Power Plant License Termination Plan, 2020

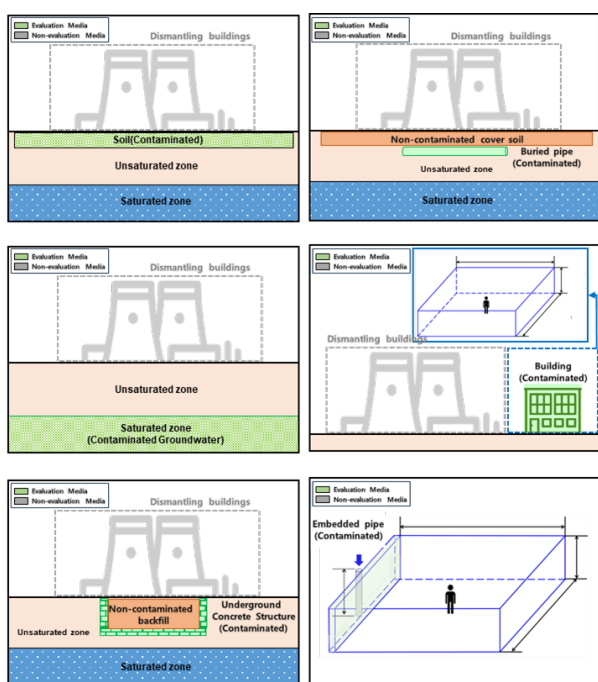


Fig 1. Site Conceptual Model for Each Medium of Decommissioning NPPs

Figure 1 shows the Site Conceptual Model (SCM) for each medium. The SCM conceptualizes and presents the geological and hydrogeological characteristics of the site, and constructs an integrated hypothesis that explains groundwater flow, source range, distribution and migration routes of contaminations by integrating the results of