Status of Decommissioning Preparation for Kori #1

December 6, 2017
Establishment  April 2, 2001, spin-off from KEPCO

Business  Nuclear, Hydro, Pumped Storage, Renewables

Staff  11,513 Persons

Assets  50 Billion USD

Credit Rating  AA (S&P), Aa2 (Moody’s)
Power Plants Operational status in Korea

- **Nuclear**
  - Unit: 24
  - Capacity: 22,529 MW

- **Hydro**
  - Unit: 35
  - Capacity: 600 MW

- **Pumping-Storage**
  - Unit: 16
  - Capacity: 4,700 MW

- **Renewables**
  - Unit: 20
  - Capacity: 28 MW

- **Total**
  - Unit: 81
  - Capacity: 27,857 MW

- **In Construction**
  - Unit: 5
  - Capacity: 7,000 MW

- **Hanbit NPP**
  - Unit: 6
  - Capacity: 5,900 MW

- **Shin Hanul #1~2**
  - Unit: 2
  - Capacity: 1,400 MW each

- **Hanul NPP**
  - Unit: 6
  - Capacity: 5,900 MW

- **Wolsong and Shin Wolsong #1,2 NPP**
  - Unit: 6
  - Capacity: 4,779 MW

- **Kori #2~4 & Shin Kori #1~2 NPP**
  - Unit: 5
  - Capacity: 4,550 MW

- **Shin Kori #3 NPP**
  - Unit: 1
  - Capacity: 1,400 MW

- **Shin Kori #4~6**
  - Unit: 3
  - Capacity: 1,400 MW each

- **Kori #1**
  - Permanent Shutdown

Under construction
History of Kori 1

Background

- June 16, 2015: KHNP: Decision on the permanent shutdown of Kori 1
- Oct. 5, 2015: Government: Establishment of the master plan for decommissioning of Kori 1
- Nov. 28, 2015: KHNP: Establishment of the master plan for decommissioning of Kori 1
- Dec. 11, 2015: KHNP: Permanent shutdown of Kori 1
- June 18, 2017: Permanent shutdown of Kori 1

Background:

- May 31, 1972: Approval for construction and operation
- Apr. 29, 1978: Commercial operation
- Jun. 18, 2007: End of design life
- Dec. 11, 2007: Approval for life extension
- Jun. 18, 2017: Permanent shutdown
Overview of Kori-1 Decommissioning

- **Decommissioning Option:** Immediate Dismantling
- **End Site State:** Brown Field (site release criterion: 0.1 mSv/yr)
- **Total Decommissioning Period:** 15.5 years
  - Transition Period: 5 years
  - Decontamination & Dismantling (D&D): 8.5 years
  - Site Remediation: 2 years
- **Others**
  - Ensuring of safe operation of Kori-2
  - Initiation of demolition of radioactive System-Structure-Components (SSCs) after completion of Spent Fuel transfer
Permanent shutdown (June 2017)

Application for approval of permanent shutdown

Operation

Stage I

- Shutdown management and cooling/removal of spent fuel
  - Approval for decommissioning
  - Preparation for decommissioning

- Removal of radioactive systems and structures
  - Establishment of waste treatment facility
  - Treatment of radioactive wastes
  - Removal of non-radioactive systems & structures, and demolition of other areas, etc.

Stage II

- Approval for decommissioning
- Preparation for decommissioning

Stage III

- SF transfer complete (2025)

Stage III-1

- Public hearing with residents

Stage III-2

- DP preparation
- Report on completion of decommissioning

Stage IV

- completion of decommissioning (2032)

Site restoration

In connection with Kori 2 operation

Completion of decommissioning (2032)

Dismantling complete (2030)
Main Schedule for Decommissioning of Kori 1 (Cont’d)

**Stage I**
- NPP operation
- Preparing the Permanent shutdown
- Establishing decommissioning strategies and plan

**Stage II**
- SF safety management.
- Comprehensive decommissioning design
- Final decommissioning plan

**Stage III-1**
- Commencement of decommissioning process
- Dismantling of the non-radioactive facilities
- Installing radioactive waste treatment facilities
- Removal of spent fuels in the SFP

**Stage III-2**
- Site restoration work
- Final status survey
- Termination of operation license

**Stage IV**
- Site restoration and completion of the decommissioning processes
- Dismantling contaminated facility and Radwaste treatment
- Removal of radioactive systems and structures
- Radwaste treatment (decontamination, cutting, volume reduction, packing, etc.)
Project Conditions

Lack of Infrastructure
- Developing technologies not in possession,
- No supply chain in the decommissioning market in Korea

Regulatory Standards/guidelines
- Developing regulatory standards, review/inspection guidelines, etc.
- Need to establish regulatory standards for the management of shutdown NPPs

Decommissioning Funds
- Use the accumulated funds toward the project expenses

Global Decommissioning Market
- Growing the overseas decommissioning market 2020
- Need to develop the necessary capabilities
Site-Specific Issues

1. **Spent Fuel**
   - Final disposal site for high-level wastes has not been decided yet
   - Spent fuel needs to be stored in onsite dry storage system after at least 5 years cooling
   - The Storage site should be discussed with the regulatory body

2. **SSCs shared by Units 1 & 2**
   - Needed to delete connection of those SSCs between units 1 & 2

3. **Proximity of Units 1 & 2**
   - Decommissioning activities of Unit 1 can affect the safe operation of Unit 2
   - Not easy to secure a sufficient on-site space for handling, packing and transport of wastes produced; leading to a delay in decommissioning schedule
Decommissioning Organizations

- Restructuring and expanding the Headquarter decommissioning organization
  (Office (Feb. 2013) → Department (Dec. 2015))
- Newly establish Decommissioning Team (Central Research Institute) and the Decommissioning Preparation Team (Kori Site)

**Decommissioning Organizations**

- **CRI**
  - Research on end-of-life technology for NPPs

- **Headquater**
  - Manage the decommissioning project and develop technologies
  - Manage the storage facilities for SF

- **Kori 1**
  - Manage the NPP and prepare for decommissioning

**Decommissioning Team**
- Prepare a Final decommissioning plan
- Research tasks related to decommissioning

**Decommissioning Technology Team**
- Development of decommissioning technologies
- Supply chain for decommissioning

**Decommissioning Project Team**
- Manage decommissioning projects
- Engineering work for decommissioning

**Decommissioning Preparation Team**
- Preparation for decommissioning of Kori 1

**Post-decommissioning Management Strategy Team**
- International convention
- Education and training
- Management of decommissioning fund
Development of NPP Decommissioning Technologies

- Establishment of a roadmap for developing commercialized NPP decommissioning technologies (Dec. 2015) and a detailed implementation plan (March 2016)
- Identified the necessary commercialized technologies for decommissioning and technologies not yet in possession.
- Currently pursuing the development of 13 out of the 17 technologies not yet in possession → To launch the development projects for the rest

- Establishment of a decommissioning equipment development plan reflecting the as-is analysis of the domestic and overseas situations (March 2017)
Development of NPP Decommissioning Technologies (Cont’d)

Approval of decommissioning / Preparation of decommissioning plan
- Development of a final decommissioning plan for Kori 1
- Development of technologies for analyzing the decommissioning risks and assessing difficulty level of the process

Decontamination & decommissioning
- Development of system and component decontamination technologies
- Development of technologies for cutting the reactor vessel (RV), reactor vessel internals (RVI) and activated concrete

Waste treatment & site restoration
- Development of technologies for reducing and treating radioactive wastes
- Development of technologies for site restoration and assessing the possibility of reusing the site

Equipment
- Development of equipment for cutting the RV/RVI and activated concrete
- Development of waste treatment facilities and equipment of measuring radioactivity
- Development of soil decontamination and automatic classification equipment
Establishment of a plan to develop a FDP for Kori 1

- Development of the initial draft for the FDP
- Collect opinions from residents and apply for approval

Legal matters related to the shutdown of Kori 1 (within 5 years of shutdown)

Need to prepare a comprehensive plan for safe and economical decommissioning work

Final decommissioning plan (FDP)

A decommissioning plan to request approval of the NPP decommissioning project in accordance with Article 28 (1) of the Nuclear Safety Act

- Establishment of a plan to develop a FDP for Kori 1
- Development of the initial draft for the FDP
- Collect opinions from residents and apply for approval
- Approval of decommissioning of Kori 1
Secure channels for the exchange of technologies and information

- Hosted a nuclear decommissioning business forum: April 2016 / Busan
- KHNP-EPRI nuclear decommissioning workshop: Nov. 2016 / Daejeon
- Registered in the decommissioning cooperation program under OECD/NEA: Jan. 2017
- Signed MOUs with overseas decommissioning organizations: NDA (UK, April 2017) ENRESA (Spain, Mar. 2017)

Provide information on the domestic industries

Acquire information on overseas decommissioning technologies

Formation of networks with international organizations

Formation of networks with overseas decommissioning organizations
Nurture professionals in the decommissioning field

Establish and implement education and training programs

- Establishment of HR development programs at domestic decommissioning enterprises
  - Dec. 2016 / SMEs

- Establishment of an education & training program at KHNP and commissioned education at domestic & foreign institutes
  - 2016 / Domestic and overseas educational institutes

Paving the foundation for the decommissioning sector

A total of 11 programs

- Development of a comprehensive database on the decommissioning enterprises
  (Sept. 2016; 63 enterprises)

- Plans to update the database and to establish a potential supplier management system
  (Oct. 2017)
Thank you.