Current Status on Decommissioning Plan of Nuclear Facilities in Korea

Seung Haeng Lee

2018. 10. 25.
Moon addresses the Kori 1 closure ceremony…19 June 2017 (image: presidential website)
New Government of President Moon declare the Gradual Phase-Out of Nuclear Power in 2017

- Plans for New NPP will be canceled
  - Shin-Kori 5,6 will be constructed in accordance with the outcome of the public debate
- Operating Periods of existing units will not be extended
- Kori unit 1 has been permanently shutdown (June 2017)
- Early Closure of Wolsung 1
  - Prior to the Expiration of Its Operating Licence in 2022
- Existing plants close at a 40~60 years end-of-life
  - Last NPP may close at the middle of 2080’s
Major Nuclear Facilities in Korea

- Nuclear Power Plants (NPPs)
  - 24 units in operation and 2 units under construction
  - 3 units under preoperational inspection
  - 1 unit in permanently shut down

- Research Reactors (RRs)
  - HANARO (RR)
  - KRR 1 and 2 (RR, under decommissioning)

- Nuclear Fuel Cycle Facilities (FCs)
  - Fuel Fabrication Plant for NPP
  - Fuel Fabrication Facility for RR
  - Post-Irradiation Examination Facility (PIEF)
  - Uranium Conversion Facility (released from regulation)

- Radioactive Waste Management Facilities (RW)
  - RI Waste Management Facility
  - Wolsong LILW Disposal Center (WLDC)
  → in operation since 2015

(As of Oct. 2018)
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<th>Plant</th>
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**OPR-1000**: Improved KSNP (Korea Standard NPP, 1000MW PWR Type)

**APR-1400**: Advanced Pressurized Reactor (1400MW PWR Type)
### Standards for CP/OL

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<thead>
<tr>
<th>Section</th>
<th>Description</th>
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| $85-3$ to $85-7$ | - Organization, human resources  
- Cost, financing  
- Strategy  
- Measures to facilitate decommissioning  
- Initial plan for decommissioning |

No.2015-8 (Standard Format and Contents of Initial/Final DP)

### Standards for Approval of Decommissioning

<table>
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| $85-8$ to $85-17$ | - Organization, human resources  
- Procedures  
- Cost, financing  
- Strategy  
- Ensuring facilitated DECOM  
- Safety assessment  
- Waste management  
- Environmental assessment  
- Quality assurance |

No. 2016-32 (Safety Inspection for Decommissioning)  
No. 2016-33 (Site & Building Release Criteria after Decom.)

### Provisions for Decommissioning Regulation

- **NSA**
  - Enforcement Decree of NSA
  - Enforcement Regulations of NSA
  - Technical Standards for Reactor Facilities
  - NSSC Notice
  - Regulatory Guidance, etc.

- **Public Consultation**
  - §103 Public Consultation
  - §143~146 Public Consultation
  - §132-2 Drafting Final DP
  - §133 Final DP submission
  - §134 Register of Readers

- **Stds. Review Plan for IDP**
  - (published in July 2017)

- **Std. Review Guide for DECOM Approval**
  - (to be developed)

- **Guide for DECOM Inspection**
  - (to be developed)
The term “decommission” means all actions or measures taken to exclude any facilities licensed or designated pursuant to this Act from the scope of application of this Act, through removal of the facility and the site or through decontamination thereof after permanent cessation of the operation of the facilities by those who have been granted permit.

Target facilities: Article 20 (1) power reactor, 30-2 (1) research & education reactor, Article 35 (1) or (2) nuclear fuel cycle business (refining, fabricating, reprocessing)
Initial Decommissioning Plan

- Target Facilities for IDP
  - Legal based documents at construction permit, operating or designating license:
    - **Power & Research/Education Reactor**: (Construction Permit) NSAct article 10(2) & 30(2)
      (Operating License) NSAct article 20(2), 30(2)
    - **Nuclear Fuel Cycle Business**: (Permit) NSAct article 35(3)

- Description in IDP
  - Enforcement regulation article 4(5) & Notice of NSSC “format & contents on DP”
    - Decom. strategy, schedule, measures to protect radiation hazard, decontamination

- Periodic revision for IDP
  - 10 ys renewal - NSAct 92(2) & enforcement regulation 122(2)
Summary for IDP

- Permit/License/Designation
- Prevention of Hazard to Environmental
- Location/structure/installation/performance
- QA/Accident Management
- Technical Capability
- (Initial) Decom. Plan

Enforcement Decree §174

Enforcement Reg. §4
Reg. on technical standards

Enforcement Reg. §4(5)
Reg. on technical standards
§85(3) to §85(7)

Notice of NSSC

- Organization, human resources
- Cost, Financing
- Strategy
- Measures to facilitate decom.
- Initial plan
Decommissioning Regulations

Final Decommissioning Plan

- **Decommissioning Approval**

  - Application (licensee): as to decommission the utilization facilities, submit the application of decom. approval with FDP + doc.*

    * QAM on decom., resident opinion & public hearing results

  - should apply the decom. approval within 5 ys after permanently shutdown

    (enforcement decree §41-2)

  - Decom. Approval : NSAAct §28(1)/28(2)/42(1)/42(2), enforcement decree §22/48-2 (reactor + fuel cycle)

  - Public access/opinion/hearing : NSAAct §103(2), enforcement decree §143 ~ §145 (only for reactor)
Decommissioning Regulations

Summary for FDP

• Requirement for Decom. Approval

- Enforcement Decree §41-2(2)
- Technical capability on decom.
- Suitability of Standards on DP
- < Dose limit
- Reg. on Technical Standards §85-8 ~ §85-17 (insert)
- Enforcement Decree §2 sub.4 & form 1

- Organization/human resource
- Decom. Procedures
- Cost/Finance
- Strategy/Methodology
- Ensuring facilitation on decom.
- Safety Assessment
- Radiation Protection
- Waste Management
- Environmental Assessment
- Quality Assurance
Decommissioning Regulations

Report & Inspection on Decom. Status

• Periodic Report (decom. status)
  • Licensee Report (NSAct article 23(3))
    ⚫ Semi-annual reporting on decom. status: ① facilities status, ② decontamination status, ③ radiation safety management status, ④ radio-waste management status (Reg. on technical standards §23(2))

• Periodic Inspection (Confirmation & Check)
  • NSSC Inspection (NSAct article 23(3))
    ⚫ Notice of NSSC, “Regulation on items and methods on inspection for decom. Status” article 3(3)
    7 areas (17 items): decontamination activity, decom. activity, environmental radiation management, waste management, fire protection, QA activities
Decommissioning Completion Report & Inspection

• Decom. Completion Report & NSSC Review
  • Licensee Report (NSAct article 28(4)/(5))

    - DCR: Strategy, progress, (before/after) site & facilities status, final
      radiation/activity status, waste management status, occupational
      dose status, abnormal event/accident on decom.
    - FSSR: Investigation plan/method/results for final radiation/activity on site,
      site reuse plan

• Inspection for Decom. Completion
  • NSSC Inspection (NSAct article 28(8), Enforcement Reg. article 23-5)
  ➤ Compliance with DP, DCR, FSSR and criteria on site reuse
  • Notice of NSSC “Regulation on standards on site & building reuse"
According to Nuclear Safety Act (NSAct), the phase of NPP could be categorized with construction permit (CP), operating license (OL), license termination (LT).

Permanently shut-down and decommissioning was considered as parts of operating license (OL).

- **Construction Permit**
  - Act article 10 (1) - Approval of construction

- **Operating License**
  - Act article 20 (1) - Operation Approval of operation
  - Act article 21 (2) - Permanently shut-down License amendment (Change Permit)
  - Act article 28 (1) - Decommissioning Approval of decommissioning

- **License Termination**
  - Act article 28 (8) & (9)
  - Notification of termination in written form
  - Reuse of the site
If the operator intends to permanently shut-down & decommission, the operator apply a license amendment & submit a decommissioning plan (DP) to regulatory body before the start of their activities under operating license.

**Operation**
- Shut-down (expiration of design life)
- Application for life extension
- Fuel removal & Storage in SFP

**Permanently Shut-down (PS)**
- Approval of PS
- Transition Activity
  - Application for license amendment after PS decision
  - Application for DP
  - (Transitional inspection for PS NPP)
  - Inspection

**Decommissioning**
- Safe Enclosure or immediately dismantling
- Dismantling activity
- Confirmation & Examination (CE) of the decommissioning status
- Fuel removal & Storage in SFP
- Submission on decom. completion report
- Periodic inspection in case of fuel removal from site

**Expiration date of design life**
- = or ≠ PS date
- Review pursuant to disapproval of life extension
- Review for license amendment for PS
- When the licensee decide PS and apply for license amendment?
IAEA’s Safety Standards for Transitional Phase (2)

IAEA TRS No. 420 Fig. 1  Decommissioning related activities during the life cycle of an NPP
### Further Plan

#### Regulation Plan on Kori unit 1 NPP

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**1st PS Inspection**

- (Optimal modification)

**Final Inspection on power operation**

- (Review & inspection guides)

**1st PS Inspection**

- (PS Mark, contents of DSAR, inspection item)

**Additional Review**

- (DSAR & DTS peer review)

**Final PS Inspection**

- (Fuel transport or disposal to independent facility after 5 y)

**Expiration of design life**

- Fuel removal from site

**Decommissioning**

- (Deferred dismantling < 60 y)

**Application & Review of DP**

- (Deferred dismantling < 60 y)

**CE of dismantling status**

- (Deferred dismantling < 60 y)

**Final inspection & license Termination**

- (Deferred dismantling < 60 y)
Thank you so much for your attention!