

00674

## Introduction on Recently Revised Legislations Related to Decommissioning of Nuclear Facilities in Korea

**Jungjoon Lee, Hongtae Kim, Daesik Yook, Sangmyeon Ahn**

Korea Institute of Nuclear Safety

Gwahak-ro 62, Yuseong-gu, Daejeon, 34142 Republic of Korea

### Abstract

There is no permanently shutdown nuclear power reactor and decommissioned or under decommissioning nuclear power reactor, although there are 25 units of nuclear power reactors in operation and 5 units of nuclear power reactors under construction in Korea as of July 2016. There are only 2 research reactors being decommissioned since 1997. It is realized that improvement of the regulatory framework for decommissioning of nuclear facilities has been emphasized constantly from the point of view of IAEA's safety standards. IAEA published the safety requirement on decommissioning of facilities on July 2014; its title is the "Decommissioning of Facilities", General Safety Requirement Part 6.

According to follow up action on the result of IAEA's Integrated Regulatory Review Service (IRRS) mission to Korea in 2011, regulatory framework for decommissioning of nuclear facilities in Korea was revised through comparing to IAEA safety standards. It was identified that items should be revised to improve the regulatory framework for decommissioning. Those are as follows: absence of legal definition of decommissioning, incomplete procedure for safety regulation after permanent shutdown, undetailed acceptance criteria for decommissioning plan, incomplete requirements for early preparing and periodic update of decommissioning plan, undetailed requirements on standard format and contents for decommissioning plan, and incomplete radiological criteria on site and building reuse after completion of decommissioning.

Nuclear Safety Act related to decommissioning of nuclear facilities was revised and promulgated on 21<sup>st</sup> July 2015. As the lower statute of Nuclear Safety Act, Enforcement Decree of the Nuclear Safety Act and Enforcement Regulation of the Nuclear Safety Act were also revised and promulgated on 21 July 2015.

In this paper, related to decommissioning of nuclear facilities such as nuclear power reactor, research or training reactor, and nuclear fuel cycle facility, it was introduced the main changes of the amended and promulgated Nuclear Safety Act on July 2015. It was also mentioned about the current issue in accordance with its implementation. The technical issue on the transportation and storage of radioactive waste including large components from decommissioning activity would be also considered for ensuring safe decommissioning of nuclear power plant.

Key words : Decommissioning, Nuclear Facilities, Shutdown, Regulation, Transportation, Storage

## Introduction

Since the 1990s, it has been emphasized that the regulation on decommissioning of nuclear facility should be improved. In addition, preparedness for early decommissioning became necessary after Fukushima Daiichi nuclear disaster. In July of 2011, IAEA's Integrated Regulatory Review Service (IRRS) was inspected in Korea and it was recommended that the regulatory framework for decommissioning should require decommissioning plans for nuclear installations to be constructed/operated and these plans should be updated periodically [1].

Status of nuclear facilities on operation and under construction in Korea are shown in Table 1. There are 25 units of nuclear power reactors in operation and 5 units of nuclear power reactors under construction in Korea as of July 2016 (Figure 1). However, there is no permanently shutdown nuclear power reactor and decommissioned or under decommissioning nuclear power reactor. There are only 2 research reactors (TRIGA Mark II & III) being decommissioned since 1997. It is realized that improvement of the regulatory framework for decommissioning of nuclear facilities has been emphasized constantly from the point of view of IAEA's safety standards. IAEA published the safety requirement on decommissioning of facilities on July 2014; its title is the Safe Decommissioning of Facilities, General Safety Requirement Part 6.

**Table 1. Status of nuclear facilities in Korea**

Facility	Status	Name
NPP	Under the review of construction permit	• 2 units; Shin-Hanul unit 3&4
	Under construction	• 5 units; Shin-Kori unit 4~6 and Shin-Hanul unit 1&2
	In operation	• 25 units; Kori unit 1~4, Wolsong unit 1~4, Hanbit unit 1~6, Hanul unit 1~6, Shin-Kori unit 1~3 and Shin-Wolsong unit 1&2
Research or Educational Reactor	Under the review of construction permit	• KJRR (RR)
	In operation	• HANARO (RR) • AGN (ER)
	Under decommissioning	• KRR 1 & 2
Nuclear Fuel Cycle Facility	Under the review of license	• Fuel Fabrication Plant No. 3
	In operation	• Fuel Fabrication Plant No. 1 & 2 • Fuel Fabrication Facility for RR • Post-Irradiation Examination Facility (PIEF)
	Decommissioned (released)	• Uranium Conversion Facility

As of November 2015, design lives of 12 units (Kori unit 1~4, Wolsong unit 1~4, Hanbit unit 1~2 and Hanul unit 1~2) among 24 units of nuclear power plants which are in operation in Korea will be expired by 2030. Kori Unit 1 which is the first commercial nuclear power plant in Korea acquired an approval for continued operation in 2007. Kori Unit 1 will be the first permanent shutdown NPP in Korea, according to the decision of no-application of 2<sup>nd</sup> continued operation, which is anticipated on 2017, in the 12<sup>th</sup> Energy Committee organized by MOTIE (Ministry of Trade, Industry and Energy) on June 2015. Wolsong Unit 1 got the authorization of continued operation in March 2015, and it will be expired in 2023 [2].

Introductions on recently revised nuclear safety legislations for decommissioning of nuclear facilities are mainly dealt with in this study. Regulatory safety issues on decommissioning of nuclear facilities, especially transportation, temporary storage, intermediate storage and permanent disposal of spent nuclear fuel, and transportation, treatment, storage and final disposal of radioactive waste being generated from decommissioning are also discussed to obtain further development items of safety regulation for decommissioning.



**Figure 1. Designed Lifetime of Nuclear Power Reactor Unit on Operation in Korea**

## Revision of Nuclear Safety Legislations Related to Decommissioning Imperfection of Previous Regulatory Framework on Decommissioning

Imperfection of the regulatory framework has been analyzed and the revision of nuclear safety legislations was performed in order to improve the regulatory framework for decommissioning of nuclear facilities in Korea.

Comparing this to IAEA’s safety standards [3, 4 and 5] and regulatory frameworks of major nuclear countries, inadequate items of the former regulatory framework in Korea were mentioned as follows:

- Absence of legal definition of “Decommissioning”
- Incomplete procedure for safety regulation after permanent shutdown
- Incomplete acceptance criteria for Decommissioning Plan
- Incomplete requirements for early establishment and periodic revision of Decommissioning Plan
- Incomplete details on entered items of Decommissioning Plan
- Incomplete radiological standard for site reutilization after decommissioning

**Table 2. Revision history of nuclear safety legislations related to decommissioning**

Legislation	Date	Revision History
<b>Nuclear Safety Act</b>		
	20 <sup>th</sup> Jan. 2015	• Partial amendment & proclamation (the provision on gathering public opinion was implemented from the date of proclamation)
	21 <sup>st</sup> Jul. 2015	• Implementation (from 6 months later after proclamation)
<b>Nuclear Safety Enforcement Decree &amp; Nuclear Safety Enforcement Regulation</b>		
	19 <sup>th</sup> Mar. 2015	• The 36 <sup>th</sup> Nuclear Safety Committee passed a vote of the draft revision on Nuclear Safety Enforcement Decree and Enforcement Regulation.
	25 <sup>th</sup> Mar. 2015	• Pre-announcement of partial amendment draft on Nuclear Safety Enforcement Decree and Enforcement Regulation (Mar. 25 ~ May 4)
	20 <sup>th</sup> Jul. 2015	• Partial amendment of Nuclear Safety Enforcement Decree
	21 <sup>st</sup> Jul. 2015	• Partial amendment of Nuclear Safety Enforcement Regulation & implementation of Nuclear Safety Enforcement Decree and Enforcement Regulation
<b>Regulations on Technical Standards for Nuclear Reactor Facilities, Etc. &amp; Notice of the Nuclear Safety and Security Commission (NSSC) No.2015-08 (reactor.41)</b>		
	23 <sup>rd</sup> Apr. 2015	• The 39 <sup>th</sup> Nuclear Safety Committee passed a vote of the draft revision on Regulations on Technical Standards for Nuclear Reactor Facilities, Etc. and passed a vote of the enacted draft on Notice of NSSC No.2015-08.
	13 <sup>th</sup> May 2015	• Pre-announcement of partial amendment draft on Regulations on Technical Standards for Nuclear Reactor Facilities, Etc. (May 13 ~ Jun. 3) • Pre-announcement of the enacted draft on Notice of NSSC No.2015-08 (reactor.41) (May 13 ~ Jun. 3)
	23 <sup>rd</sup> Jul. 2015	• Partial amendment & implementation of Regulations on Technical Standards for Nuclear Reactor Facilities, Etc. • Enactment & implementation of Notice of NSSC No.2015-08 (reactor.41)

• Notice of NSSC No.2015-08 (reactor.41) “Standard Format and Content of Decommissioning Plan for Nuclear Facilities”

### Revision history of Nuclear Safety Legislations

Revision history of nuclear safety legislation related to decommissioning is shown in Table 2. Due to the implementation of revised nuclear safety act, enforcement decree and enforcement regulation, 32 units of power reactors including in operation, under construction and under the review of construction permit, 2 research reactors in operation and under the review of construction permit, 1 educational reactor, and 4 nuclear fuel cycle facilities in operation and under the review of license as shown in Table 1, will be become getting the impact by the revised legislations.

The recently revised Nuclear Safety Legislations were considered about the imperfection mentioned above [6]. Table 3 shows the recently revised contents of legislations, especially what legislation is dealing with the each content.

**Table 3. Revision of regulatory framework in the decommissioning stage of nuclear facilities**

Decommissioning Stage	Description	Nuclear Safety Legislation		
		Act	Enforcement Decree	Enforcement Regulation
<b>Pre-decommissioning</b>				
Construction and operation	Definition of “Decommissioning”	O	-	-
	Obligation of DP (Decommissioning Plan) submission	O	-	-
Permanent shutdown, transition period	Periodic update of DP	O	-	O
	Detailed regulation on the application of license amendment for permanent shutdown	O	O	-
<b>Decommissioning</b>				
	Detailed regulation on the submission and approval of DP	O	-	O
<b>Post-decommissioning</b>				
	Regulation on the completion of decommissioning or license termination	O	-	O
<b>Etc.</b>				
	Disclosure of information and public involvement	O	O	O
	Site release criteria for nuclear facilities	(dealt with in the technical standards)		

### Changes in revised legislations

Revised Nuclear Safety Act defines “decommissioning” as “decommissioning is the whole activities taken for the release from regulatory control by dismantling and decontamination of the authorized site and facilities, after the licensee who is responsible for power reactor, research or educational reactor and fuel cycle facilities permanently shutdown the facilities.” This definition is referring to the definition of IAEA, OECD/NEA and USA [5, 7 and 8].

There are several significant changes according to the implementation of revised legislations (Figure 2).

(1) The entire licensee who has issued the license for power reactors, research or educational reactors and fuel cycle facilities should submit preliminary decommissioning plan within 3 years from the implementation date (21<sup>st</sup> Jul. 2015) as a grace period.

(2) The entire licensee who wants to apply the license for power reactors, research or educational reactors and fuel cycle facilities should also submit preliminary decommissioning plan when they submit the documents for the license approval. Regulatory body should also review the preliminary decommissioning plan submitted by licensee.

(3) Once submitted preliminary decommissioning plan should be updated every 10 years and be approved by regulatory body.

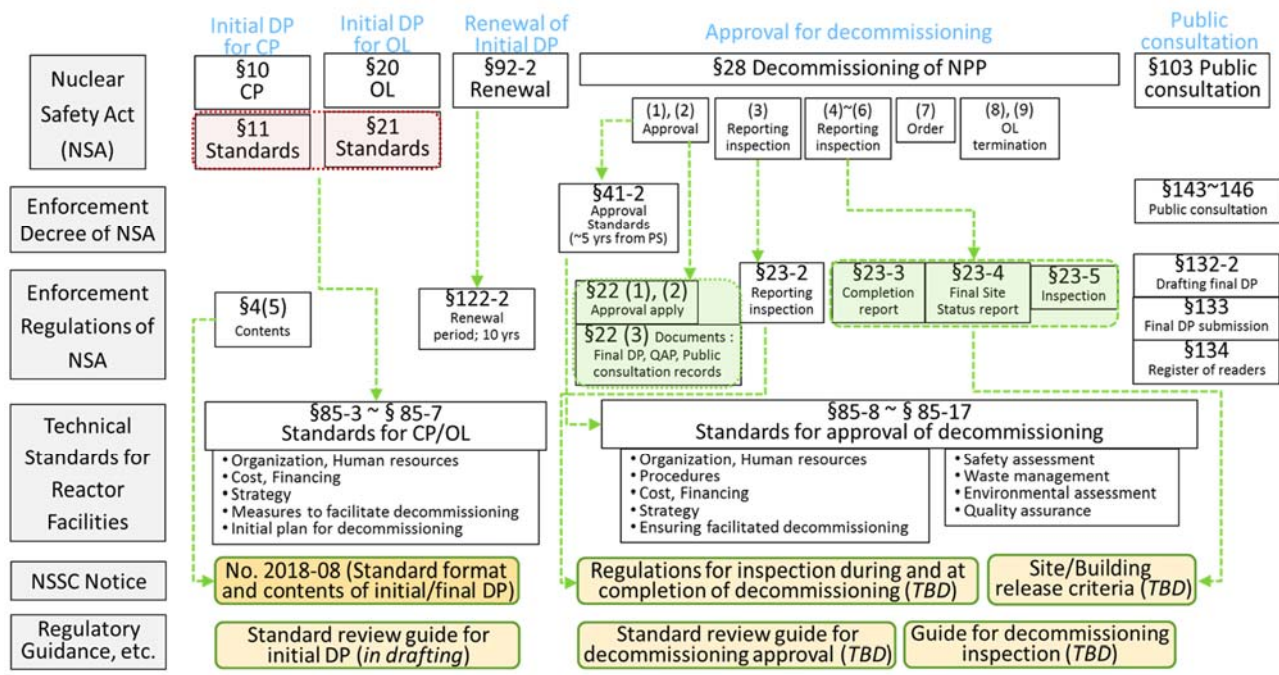
(4) When the licensee is going to start decommissioning, they should submit final decommissioning plan with the document such as QA, public opinion for final decommissioning plan and the result of public hearing. Regulatory body should also review the final decommissioning plan and the related documents submitted by licensee. Licensee should submit the final decommissioning plan within 5 years for power reactor and research/educational reactor and within 2 years for fuel cycle facility after their permanent shutdown.

(5) Licensee who is responsible for decommissioning of power reactor should report the status of decommissioning every 6 months, and then regulatory body should perform the confirmation and inspection against decommissioning status of facility.

(6) When Licensee who is responsible for decommissioning complete decommissioning, they should report and submit documents related. Regulatory body should conduct the confirmatory inspection.

(7) When the confirmatory inspection is completed, regulatory body announces the license termination to the licensee.

Further requirements and technical standards will be developed and applied such as “Inspection standards during decommissioning” and “Radiological standard for site release after the completion of decommissioning”.



**Figure 2. Established provisions for decommissioning regulations**

Regulatory considerations on transportation, storage and disposal of SNF and radioactive waste generated from decommissioning

Considering revised nuclear safety legislations related decommissioning of nuclear facilities, potential regulatory safety issues could obtain as Table 4.

**Table 4. Potential issues for decommissioning safety regulation**

Contents	Safety issues
SNF	Transshipment between neighbouring units* Installation of high-density storage racks (re-racking)* Installation of additional racks* Temporary storage facilities (Canister and MACSTOR for CANDU SNF)* Additional installation of temporary storage facilities (MACSTOR for CANDU SNF)* Installation of intermediate storage facility Installation of permanent repository facility
Radioactive waste	Characterization, treatment, transportation, storage and disposal of radioactive waste generated from decommissioning Storage, transportation, treatment and disposal of large-scale radioactive waste such as reactor vessel head and steam generator Material release of large-scale radioactive waste such as concrete blocks and metallic components

\* : already adapted or being adapted

## **Conclusions**

From the aspects of regulatory framework for decommissioning of nuclear power plant, the revisions of NSA and relevant regulations for decommissioning have been done successfully based on the IAEA safety standards. We have thought that this was the first step for the improvement of regulatory framework on the safe decommissioning. The next step would be the development of detailed technical standards and regulatory guides on decommissioning. Those would be necessary for preparation for decommissioning and developed in a timely manner.

## **Acknowledgments**

This study was carried out as a part of the Nuclear Safety Research and Development Project of Nuclear Safety and Security Commission.

## **References**

1. IAEA, Integrated Regulatory Review Service Report, 2011
2. Operational Performance Information System for Nuclear Power Plant, <http://opis.kins.re.kr/>
3. IAEA, General Safety Requirement Part 1, 2010
4. IAEA, General Safety Requirement Part 5, 2009
5. IAEA, General Safety Requirement Part 6, 2014
6. Nuclear safety legislations in Korea, 2015
7. OECD/NEA report, Improving nuclear regulation, 2009
8. USA 10CFR50 (Domestic Licensing of Production and Utilization Facilities)