

# A Study on Improving Korean Regulatory System on Decommissioning of Nuclear Power Plants

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## 1. Introduction

Nuclear power plant, has a life cycle like human. It has a series of stages such as design, construction, commissioning, operation, ongoing operation, permanent shutdown, decommissioning and ultimately, mitigation and remediation of the site.

It has not been long for Korea to specifically discuss on the decommissioning of nuclear power plants. The nuclear decommissioning has been discussed since 2008, the year in which Kori Unit 1, the first nuclear power plant in the Republic of Korea, reached its design life of 30 years after its commissioning in 1978. Also, the issue of continued operation and decommissioning was highly debated during the application of Wolsong Unit 1 for continued operation was on the table.

Since Korean nuclear community has focused on construction and operation of power plants before, the Nuclear Safety Act did not cover decommissioning in a detail. However, as the Fukushima Nuclear Power Plant accident in Japan in March 2011 raised domestic awareness on nuclear safety, it was seriously discussed whether to approve continued operation of a nuclear power plant whose design lifetime has reached expiration date.

At the time of the Fukushima accident in 2011, the Korean regulations required, for nuclear power plants reaching their end of life but still not applying for extended continued operation, to apply for permanent shutdown. In this case, it was obligated to remove the fuel from the reactor, store all of the fuel in the storage tank, make a decision to no longer operate the reactor, and get approval for the shutdown.

In June 2011, Korea received the International Regulatory Review Service (IRRS) mission of the IAEA. One of the recommendations from the IRRS was to review the decommissioning plan from the initial construction of the nuclear power plant, since the Nuclear Safety Act did not have any provisions on decommissioning at the time.

## 2. Korean Regulatory System on Nuclear Decommissioning

### 2.1 Decision to Decommission Kori Unit 1 and Safety Regulatory System

On June 12, 2015 the National Energy Commission of the Ministry of Commerce, Industry and Energy decided to recommend Korea Hydro & Nuclear Power (KHNP) for the permanent shutdown of Kori Unit 1 in pursuance of mid- and long-term development of the

nuclear power industry. On June 16, 2015, the KHNP Board of Directors accepted the decision from the Commission and decided not to apply for operation extension of Kori Unit 1. On June 19, 2015, the ministries concerned with the decommissioning of nuclear power plants had a meeting to discuss measures on decommissioning the power plant. The concerned ministries agreed to secure the decommissioning technology of the nuclear power plant so that the people could be relieved, and to steadily prepare for the future decommissioning market.

Due to the decision of as the board of KHNP, it must apply for a change in operating license (for permanent shutdown) over the original plan to the Nuclear Safety and Security Commission (NSSC). Following the approval of the NSSC, Kori Unit 1 will be shut down permanently from June 19, 2017.

The KHNP should establish a decommissioning plan five years before the permanent shutdown, which is by June 20, 2022, and submit it to the NSSC's approval.

The decommissioning process typically takes more than 15 years: after the permanent shutdown on June 19, 2017, the nuclear fuel will be cooled (more than 5 years) and the reactor will be decontaminated and decommissioned (more than 6 years). Thus, the process is scheduled to be completed by 2030.

The government determined to set up new regulations in consideration of the characteristics of the decommissioning sector whose technology development level and contents are greatly affected by the system and technical standards. The government endeavored to establish a system to help promote industrial development, while securing the safety of nuclear decommissioning. In this regard, the NSSC has established an internationally recognized regulatory framework and standards for nuclear decommissioning by 2015.

Table 1. Administrative Procedures for Decommissioning Kori Unit 1 in accordance with the Nuclear Safety Act

Time	Contents	Article & Clause
Before June 18, 2015	No application for continued operation	Article 23
Before June 18, 2017	Application for change of operating license * Operating NPP → permanent shutdown	Article 21 Clause 2

	Approval of change of operating license	
On June 19, 2017	Permanent shutdown	
Until July 21, 2018	Submission of preliminary decommissioning plan * Due to measures in accordance with the enforcement of amendment law	Law Additional Clause Article 2
Until June 18, 2022	Public hearing on decommissioning plan	Article 103
	Application for decommissioning (Submission of final decommissioning plan)	Article 28 (2)
After June 18, 2022	Approval of decommissioning	Article 28 Clause 1

## 2.2 Revision of the Nuclear Safety Act

Until the revision of Korea's Nuclear Safety Act on July 21, 2015, the relevant provisions on the decommissioning system, including the definition of "decommissioning", were not established yet. But after the revision in July 2015, Korea has established a framework of safety regulations on nuclear decommissioning.

As of March 2017, Korea is operating 25 nuclear power plants. Among them, Kori Unit 1, the original design life (30 years) has expired in 2007, but operation has been extended to additional 10 years, until 2017. In 2012, Reached its end of original design life of 30 years in 2012, Wolsong Unit 1 was shut down and also underwent a review for continued operation by means of the stress test.

As the nuclear power plants with the design life span expired or imminent expiration emerged, it became necessary for governments and operators to devise procedures, reach public consensus, and develop technology related to nuclear decommissioning.

Therefore, the amendment of Nuclear Safety Act requires the nuclear power plant operators to submit the decommissioning plan at the time of construction permit and operating license, to periodically update it, and by allowing the NSSC to closely examine the decommissioning procedure at the time of decommissioning, and to raise the level of nuclear safety.

In addition, as the anxiety and concern about the safety of nuclear power plants have been increasing worldwide after the Fukushima accident, Korea also

experienced a Station Black Out Event at Kori Unit in 2012.

As a result of this event, there has been a growing debate on the safety of nuclear power plants, which are directly linked to the lives and safety of the people. In addition, it was necessary to clarify the role of the government to hear the voices of residents near the nuclear power plant site and to allow the head of the local government to request a public hearing during the process of collecting opinions of residents.

The outline of the revised Nuclear Safety Act is as follows:

i) Define 'decommissioning' as all activities decommissioning facilities and sites or removing radiological contamination after the operators of power reactors, research reactors, or nuclear fuel cycle facilities permanently shut down the operation of licensed or designated facilities. The 'decommissioning' activities are not subject to this Act. (Article 2, Clause 24 of the Act, newly added)

ii) Submit a decommissioning plan to the NSSC at the time of construction permit such as for nuclear reactors including power reactors and research reactors. (Articles 10 and 30 of the Act).

iii) Submit a decommissioning plan to the NSSC at the time of operating license for nuclear reactors including power reactors and research reactors. (Only the changes made in the submission of construction permit) (Article 20 and Article 30-2 of the Act)

iv) To obtain permission or designation of the nuclear fuel cycle business, submit the decommissioning plan of the facility to the NSSC. (Article 35 of the Act)

v) Operators of power reactors, research reactors,, and nuclear fuel cycle facilities should periodically update the decommissioning plan and report to the NSSC. (Article 92-2 of the Act, newly added)

vi) Operators of power generation reactors, research reactors, and nuclear fuel cycle facilities shall be approved by the NSSC at the time of decommissioning (Articles 28 Clause 1 and Article 42).

vii) Report the decommissioning status of nuclear power reactors and related facilities, the NSSC shall check and inspect it (Article 28 Clause 3 of the Act).

viii) When the decommissioning process of facilities is completed, report to the NSSC shall conduct the inspection (Article 28 Clause 4 to 6 of the Act).

ix) Upon completion of inspection for decommissioning, termination of operating license shall be notified (Article 28 (8) of the Act).

x) When the design life cycle of the reactors and related facilities of the power plants expires and you wish to obtain change permit to continue operation, allow to collect opinions of the residents on the draft radiation environmental impact assessment report (Article 103 of the Act).

Table 2. Expected Impact of Permanent Shutdown and Nuclear Decommissioning Regulations on Other Related Legislations

Related Laws	Expected Impact
I. Nuclear Safety Act	<ul style="list-style-type: none"> <li>◦ change in operating license for permanent shutdown                             <ul style="list-style-type: none"> <li>- Relaxation of regulatory standards, periodic review, organization / personnel / training, etc.</li> </ul> </li> <li>◦ Periodic safety review / reduced scope of Periodic inspection</li> </ul>
II. Nuclear Damage Compensation Law	<ul style="list-style-type: none"> <li>◦ Payment of deposit or securities for compensation of damages</li> </ul>
III. Nuclear Damage Compensation Contract Act	<ul style="list-style-type: none"> <li>◦ Expiration of contract period of compensation for nuclear damage compensation etc.                             <ul style="list-style-type: none"> <li>- Until the day when operation of reactor is abolished</li> </ul> </li> </ul>
IV. Act on Physical Protection and Radiological Emergency	<ul style="list-style-type: none"> <li>◦ Exempted physical protection when exporting spent fuel</li> <li>◦ Reduction of radiation emergency plan when exporting spent fuel</li> </ul>
V. Electricity Business Act	<ul style="list-style-type: none"> <li>◦ Application for change of electricity business license</li> <li>◦ Exempted subsidiary regulations, such as safety management obligations for electrical equipment, is possible.</li> </ul>
VI. Fisheries Act	<ul style="list-style-type: none"> <li>◦ Reduced fishery loss compensation standards due to decrease of hot water volume</li> </ul>
VII. Public Water Surface Management and Landfill Act	<ul style="list-style-type: none"> <li>◦ Reduced / exempted public water surface fee after permanent suspension                             <ul style="list-style-type: none"> <li>- Acceptance of drainage pump capacity and acceptance of drainage pipe diameter</li> </ul> </li> </ul>
VIII. Act on the Support of the Area around Power Plants	<ul style="list-style-type: none"> <li>◦ Exempted subsidy for the surrounding area                             <ul style="list-style-type: none"> <li>- Based on power generation (kWh) two years ago</li> </ul> </li> </ul>
IX. Local Tax Act	<ul style="list-style-type: none"> <li>◦ Exempted local resource tax payment duty                             <ul style="list-style-type: none"> <li>- Based on monthly power generation (kWh)</li> </ul> </li> </ul>

### 3. Conclusions

Following the decision to decommission Kori Unit 1, the revision of the laws and regulations for safety regulation of nuclear decommissioning has been completed.

However, future improvements are suggested as follows:

#### 3.1. Obligation to Approve Decommissioning Plans for Nuclear Power Plants under Construction or Operation

The constructing or operating of a nuclear power plant for power generation purposes requires to submit decommissioning plan of the facility to the Commission within three years from the effective date of the Nuclear Safety Act and obtain approval accordingly.

This provision is a measure which considers the decommissioning plan of a nuclear power plant under construction or operation to be a permissible document seemingly approved by the construction permit or operating license, by submitting the decommissioning plan within three years from the effective date of the law.

However, it is unreasonable for the approval of the preliminary decommissioning plan to be mandatory for nuclear power industry operators within three years as a matter of concern to the NSSC, the regulatory body.

This is because the period of the approval process is difficult to predict, and if there is a delays in review by the regulatory body, it is possible to violate the act due to un-approval within specified period. Therefore, it is required to revise the Nuclear Safety Act for nuclear operators to only "submit" the preliminary decommissioning plan within three years.

#### 3.2. Elimination of Overlapping Application for Renewal of Preliminary Decommissioning Plan and Relaxation of Regulation Level

In case of any change in the contents of the preliminary decommissioning plan, it requires approval for changes in plan and notification for minor changes. The Article 92-2 of the Nuclear Safety Act calls for periodic renewal of the plan.

However, although the preliminary decommissioning plan is not a document to be applied in actual decommissioning, this plan is subject to more reinforced redundant regulations (occasional plus periodic renewal) than the application documents which are required for construction permit and operating license or final decommissioning plan at the time of application for decommissioning approval.

Therefore, it is necessary to change the preliminary decommissioning plan to a voluntary document, not a compulsory document for the permit and license, since

it is not an actual plan to be applied when operating a nuclear power plant. Only in the case of periodic renewal, it is necessary to require approval for changes in plan and notification for minor changes.

### 3.3. Priority Decommissioning of Non-radioactive Facilities

Although non-radioactive facilities such as turbines and generators are not related to nuclear safety, it is defined as reactor related facilities and it is possible to be decommissioned after the approval of decommissioning (Article 28 Clause 2 of the Nuclear Safety Act and Article 9 Clause 8 of the Act).

However, non-radioactive facilities such as power conversion system after permanent shutdown are not related to nuclear safety and can be excluded from reactor facilities.

If the non-radioactive facilities are designated as reactor-related facilities and it is possible to decommission them after the approval of the NSSC, thus, the decommissioning of non-radioactive facility and radioactive facility will proceed simultaneously, which makes the decommissioning work increase for a certain period of time. This heavy workload is expected to cause difficulties in decommissioning work.

In order to avoid delays in decommissioning, it is necessary to modify the definition of 'related facilities after permanent shutdown' to exclude non-radioactive facilities.

### 3.4. Change in the End of Operating License

The decommissioning legislative system of Korea combined American system with European system. Korea's decommissioning regulation is supposed to duplicate US operating license regulations and European dismissal approval regulations.

In the case of decommissioning nuclear power plants, it is reasonable to receive a mitigated regulation compared to the operating nuclear power plants, but in Korea, it is regulated at a level that is higher than that of operating nuclear power plants.

In the current system, decommissioning plants requires not only the decommissioning inspections following decommissioning approval, but also the submission of periodic safety evaluation report and regular inspection.

It is necessary to end the existing regulation under the operating license and apply the regulation under the decommissioning approval only at the time of initiating decommissioning process, because the unnecessary regulation should be avoided.

### 3.5. Definition of Permanent Shutdown and Clarification of Application Period

The Nuclear Safety Act contains a provision on permanent shutdown but there is no clear definition on permanent shutdown (Article 21, Clause 2 and Article 26, Clause 5 of the Act).

This lack of definition on permanent shutdown can cause confusion in the clear sense on the concept, especially at the point of application. Generally, in Korea, the expiration of the design life span is misunderstood as a 'permanent shutdown'.

In addition, if the application of the change of operating license due to permanent shutdown is unclear, there is a possibility of violation of the operating technical manual due to the exemption of related periodical tests and inspection requirements. Therefore, it is desirable to establish a definition on permanent shutdown in the Article 2 of the Nuclear Safety Act.

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