

Direction of Improvement for Licensing Advanced Fuel Cycle Facilities

Sung Il Kim* , Dae Sik Yook, Seung Yeong Jeong, Chan Woo Jeong
KINS, 62Gwahak-Ro, Yuseong-Gu, Daejeon 305-338, Republic of Korea

*Corresponding author: sikim@kins.re.kr

1. Introduction

Spent fuel generated by nuclear power plants (NPP) in South Korea has been temporarily stored on the sites themselves, which are expected to be saturated, starting in 2016, with the Kori Nuclear Power Plant. The problem of managing spent fuel is an important issue in terms not only of continued nuclear power generation, but also the safety management of the already generated spent fuel. The final spent fuel management method has yet to be established, and the South Korean government is expected to decide on the final spent fuel management method under a national consensus. In particular, two methods of spent fuel management are under consideration: Direct disposal in base rock several hundred meters underground and recycling. The present study reviewed the direction of improvement of the regulatory system that can be applied when an advanced fuel cycle for recycling spent fuel is adopted as the final management method.

2. Regulatory System in Foreign

It reviewed the regulatory system of Japan, which is equipped with commercial reprocessing facilities, and the past preparations of the Nuclear Regulatory Commission (NRC) for an advanced fuel cycle in accordance with the announcement of the GNEP.

2.1 U.S. NRC

As for the United States, it announced the GNEP under the Bush administration, and the NRC accordingly performed the establishment of a regulatory system in preparation for an advanced fuel cycle.

Table I: Regulatory options for advanced fuel recycle facilities

| Option | Advanced Fuel Cycle Facilities |
|--------|---|
| 1 | Revise Part 70 to include spent fuel reprocessing and revise Part 50 as appropriate |
| 2 | Develop a specific GNEP regulation applicable to fuel reprocessing, refabrication and recycling reactors (10 CFR Part XX) |
| 3 | Issue a Federal Register Notice (FRN) and consideration of public and stakeholder comments |

Because pyroprocessing research facilities in the United States are regulated by the Department of Energy (DOE), the NRC has reviewed a new legal system for the regulation of advanced fuel cycle facilities. As shown in the Table I, the NRC has presented three alternative methods. The NRC prefers to revise and to supplement the existing 10 CFR to 50 and 10 CFR to 70 and apply them to advanced fuel cycles.

2.2 Japan

Japan has focused on reprocessing in its spent fuel policy and, unlike South Korea's dry processing, possesses wet reprocessing facilities. In accordance with the Act on Nuclear Source Materials, Nuclear Fuel Materials, and the Regulation of Nuclear Reactors, which is the law on Japan's nuclear fuel cycle facilities, regulations including the Regulations on the Spent Fuel Reprocessing Business and the Regulations on Technical Standards for the Design and Construction Methods of Reprocessing Facilities (Ordinance of the Prime Minister's Office) have been established for the safety regulation of commercial reprocessing facilities.

3. Direction for Licensing in Domestic

As for regulations on nuclear fuel cycle facilities, while Chapter 4 of the Nuclear Safety Act includes the nuclear fuel cycle business, this is limited to refining business, conversion and fabrication businesses, and the spent fuel processing business. In the case of the spent fuel processing business, business is possible only for research and experimentation. Consequently, there exists no legal system that is applicable to reprocessing and enrichment for the advanced fuel cycle business.

3.1 Improvement of licensing regulation

For the establishment of an advanced fuel cycle regulatory system, three alternatives can be considered. First, there is the method of newly establishing the advanced fuel cycle business that links sodium-cooled fast reactors (SFR) and pyroprocessing facilities within the Nuclear Safety Act. Second, the reprocessing business can be newly established within the nuclear fuel cycle business. Third, the spent fuel processing business can be revised and expanded and then be applied to the existing nuclear fuel cycle business. as shown in the Table II, the present study reviewed the

direction of improvement for the third method, which is the most readily applicable one.

Table II: Summary

| Direction of improvement for licensing advanced fuel cycle facilities | |
|---|--|
| 1 | Revision of the definition of radioactive waste and spent fuel processing |
| 2 | Turning into the two-step licensing procedure and a matter of permission(not designated) |
| 3 | Strengthening of the documents submitted (SAR, Preliminary decommissioning plan) |

- Revision of Article 2 (Definitions) of the Nuclear Safety Act: First, for spent fuel to be an object not of disposal but of recycling, spent fuel currently included in radioactive waste must be excluded from radioactive waste. In addition, the definition of spent fuel processing must not be limited to research and experimentation, but must be expanded to make possible the reprocessing business and the enrichment and processing of spent fuel as nuclear fuel.
- Revision of Article 35 (Permission for the Nuclear Fuel Cycle Business, etc.) of the Nuclear Safety Act: While it is stipulated that current spent fuel processing operators must be designated by the ministers of the government ministries in charge, this must be changed to a matter of permission to secure the transparency and safety of the business. In addition, the authorization and permission system, which consists of one step, must be turned into a two-step licensing procedure where, as with NPP, construction and operation are separated.

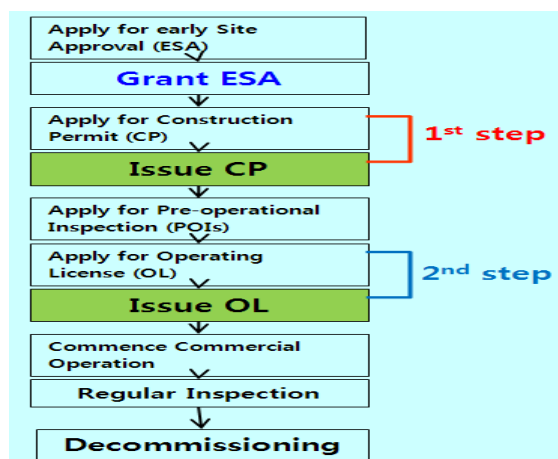


Fig. 1. Two-step licensing process

- Strengthening of the documents submitted in accordance with Article 35 (Permission for the Nuclear Fuel Cycle Business, etc.) of the Nuclear Safety Act: The safety analysis report (SAR) and the preliminary decommissioning plan must be included among the documents that are currently submitted. In the case of the United States, nuclear cycle facilities must submit the integrated safety analysis (ISA), and it will be possible to construct the SAR system by referring to the review guidelines NUREG-1520, which reflect the ISA.

It is necessary to refer to DOE documents, which regulate pyroprocessing research facilities. In the case of reprocessing facilities, a distinction must be made from the safety analysis of NPP, which only considers radiation risks, and a method that links and analyzes all related risks, including radiation, criticality, fire protection, and chemical risks, which is necessary. By including the preliminary decommissioning plan in the application documents, it will be possible to reflect the ease of decommissioning from the design stage.

Table III: Contents of SAR

| |
|--|
| Chapter 1. General Information |
| Chapter 2. Status of Site |
| Chapter 3. Organization and Administration |
| Chapter 4. Materials and Components Safety |
| Chapter 5. Risk Assessment |
| Chapter 6. Radiation Protection |
| Chapter 7. Nuclear Criticality Safety |
| Chapter 8. Chemical Process Safety |
| Chapter 9. Fire Protection |
| Chapter 10. Radioactive Waste Management |
| Chapter 11. Emergency Management |
| Chapter 12. Physical Protection |
| Chapter 13. Environmental Protection |

4. Conclusions

For recycling to be adopted as the domestic final spent fuel management method, there remains the task of having to overcome the stumbling blocks of a national consensus and the Agreement for Cooperation between the Government of the Republic of Korea and the Government of the United States of America concerning the Civil Use of Atomic Energy (Korea-US Atomic Energy Agreement). To resolve this and to construct and operate advanced fuel cycle facilities, it is necessary to establish an applicable legal system, which the present study reviewed. The results of the present study are expected to be used as the basic data in improving the legal system after the realization of advanced fuel cycles in the future. In addition, research on the development of technical standards and safety requirements for advanced fuel cycle facilities will continue to be necessary.

REFERENCES

- [1] NUREG-1909, "Background, Status, and Issues Related to the Regulation of Advanced Spent Nuclear Fuel Recycle Facilities", 2008.
- [2] NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility", 2010.
- [3] NUREG-1513, "Integrated Safety Analysis Guidance Document", 2001.
- [4] KINS/GR-500, "Development of Regulatory Technology for Advanced Fuel Cycle", 2012.
- [5] Nuclear Safety Act, 2011.