Technical Background Analysis of Existing Regulations on Technical Standards for Light Water-based SMR

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1. Introduction

Small Modular Reactors (SMRs), which are currently planned to be licensed in Korea, are light-water reactor (LWR) types and are expected to be able to apply the current regulatory requirements based on LWR. The US Nuclear Regulatory Commission (NRC) has also reported that the basic licensing LWR SMRs will follow the existing licensing process for large nuclear power plants, applying 10CFR50 and 10CFR52, and that the current GDC will be applicable without difficulty. In the case of NuScale in the U.S., the company applied the current GDCs and applied for exemptions or developed new principal design criteria.

Similarly, South Korea is considering applying the existing regulatory requirements but applying an exception clause if an exception is needed. In the case of domestic exception clauses, Article 3(2) and Article 11(2) of the *Regulations on Technical Standards for Nuclear Reactor Facilities, Etc* state that "Among the technical standards as provided in the foregoing Paragraph (1), certain standards may not apply in those cases where it is acknowledged by the Nuclear Safety and Security Commission (NSSC) that such standards are not directly applicable to the relevant reactor facilities due to the difference in the purpose of, the operational principle of, or the design features of such facilities, or that safety is not affected even if such standards are not applied". In order for the NSSC to recognize exceptions, it is important to know the background of each provision and the purpose of the regulatory requirement.

This study compared the background of the existing *Regulations on Technical Standards for Nuclear Reactor Facilities, Etc*, and the referenced overseas regulatory requirements to better understand the purpose of the regulatory requirements.

2. Methods and Results

This study examined the *Regulations on Technical Standards for Nuclear Reactor Facilities, Etc*, the IAEA's TECDOC-801 and the NRC's 10 CFR 50 Appendix A, and examined the technical background of the regulations.

Among the requirements constituting the U.S. regulatory requirements system, the requirements corresponding *to Regulations on Technical Standards for Nuclear Reactor Facilities* are the general design standards of 10 CFR 50 Appendix A (GDC: General Design Criteria) It has been referred to or applied as a basic requirement for nuclear power plant design not only in Korea but also around the world. Regulations on Technical Standards for Nuclear Reactor Facilities have also been amended by referring to or applying IAEA TECDOC-801. Therefore, it is important to compare and analyze the reactor rules with the *TECDOC-801, GDC*. This is because it has been used as a reference document as the most basic basis for developing safety regulations in Korea

Table 1 Example of Comparison of the Regulations, TECDOC-801, and 10 CFR 50 Appendix A

Regulations on Technical Standards for Nuclear Reactor Facilities, Etc	**General Design Criteria (GDC)**	**IAEA**
Article 12 (Safety Classes and Standards)	*GDC 1— Quality standards and records.*	TECDOC-801 119 Classification of components, structures, and systems
Article 16(*Sharing of structures, systems, and components(SSCs)*)	*GDC 6— Sharing of structures, systems, and components*	-

Table 1 provides examples of provisions in the *Regulations on Technical Standards for Nuclear Reactor Facilities, Etc* that relate to Article 12, Safety Classes and Standards and Article 16, *Sharing of SSCs*. In Article 12, the rationale for this provision is that safety-significant structures, systems, and components must be designed, fabricated, installed, tested, and inspected in accordance with appropriate quality standards to perform the required safety functions. For reference, the quality standards in the provisions of this regulation refer to the Electric power industrial codes and reference standards applied by the NSSC to confirm

the safety of nuclear reactor facilities based on the technical standards under Articles 12 through 80 of the Amendment to the *Regulations on Technical Standards for Nuclear Reactor Facilities, Etc*. In order to determine the appropriate quality standard, a classification of safety-significant SSCs may be performed.

In Article 16, the rationale for this provision is that safety-significant SSCs should not be shared between two or more reactor facilities. However, even if safety-significant SSCs satisfy all safety requirements for each shared facility or an accident occurs at a shared reactor facility, facilities can be shared if the remaining other reactor facilities are sequentially shut down, cooled, and residual heat.

From Table 1, it can be seen that the provisions of Article 12 regarding safety classes and standards are based on GDC 1 of the US NRC and clause 119 of the IAEA TECDOC 801. This shows that an understanding of the technical background, GDC-1, and IAEA TECDOC-801 is necessary to determine the exact meaning of this provision when applying the exceptions in practice.

3. Conclusions

This study examined the technical background of the *Regulations on Technical Standards for Nuclear Reactor Facilities, Etc*, and the underlying foreign regulatory requirements. It can be utilized to improve understanding of each provision when dealing with exceptions. It can also be used for reference when it is necessary to revise *Regulations on Technical Standards for Nuclear Reactor Facilities*.

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