Licensing Trends for Construction of New Nuclear Plants

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1. Introduction

Leading nuclear nations in the world are developing Gen-IV (Generation-IV) reactors pursuing four major goals: safety, economics, sustainability, and nuclear proliferation resistance [1]. Currently in Korea, an SFR (Sodium-cooled Fast Reactor) technology proving stage reactor called PGSFR (Prototype Gen-IV SFR) is being developed by KAERI and KEPCO E&C to be constructed by 2028.

After the accident of the Fukushima nuclear power plants, how to regulate and license newly developing nuclear reactors requiring higher safety goals has been issued. As a result, in leading nuclear nations developing new reactors, the close cooperation between the developer and the regulator is becoming very important. In this study, the licensing processes of leading nuclear countries [2] were surveyed and compared with that of Korea [3-5], and a new licensing direction for PGSFR was suggested.

2. Investigations

2.1 Pre-Safety Review

A pre-safety review is not a legal licensing process but a review or assessment process of a new reactor design. The pre-safety review of a new reactor design is an optional service provided by the regulatory authority when requested by a vender, as shown in Table 1. This is not formal or legally binding. As a result, the applicant cannot rely on such reviews for licensing purposes.

Table 1: Pre-safety review by countries

Country	Pre-safety review process
US	PSID(Preliminary Safety Information Document)
UK	GDA(Generic Design Assessment)
Canada	Design Review
France	Review of Safety Options
Ukraine	Safety Review of a Design

- In the US, the vendor required to submit a PSID (Preliminary Safety Information Document) for the pre-safety review process. A PSID is specified in the "Regulation of Advanced Nuclear Power Plant, Statement of Policy" provided by US NRC.
- In the UK, pre-safety review process is called a GDA (Generic Design Assessment). A Generic Design Assessment was created by the regulator without legislation.
- In Canada, a pre-safety review process is called a "Design Review". A pre-project design review of a new reactor design is an optional service provided by the CNSC (Canadian Nuclear Safety Commission) when requested by a vender.
- In France, a pre-safety review process is called a "review of the safety options". The "review of safety options" is created by the ANS (Autorité de Sûreté Nucléaire) without legislation.
- In the Ukraine, a pre-safety review process is called a "safety review of a design".

2.2 Pre-Licensing

The pre-licensing has a certain legal and binding effect which stays valid for a certain number of years. This means that the pre-licensing approved by a regulator does not include a specific site to actually construct a nuclear plant, but rather a comprehensive site. The applicant of the pre-licensing can apply for the purpose of licensing to construct a nuclear plant. Therefore, as shown in Table 2, DC and SDA are legally binding on the comprehensive site to construct a nuclear plant and they are design approvals without the actual site for the construction.

Table 2: Pre-licensing by countries

Country	Pre-licensing process
US	DC(Design Certification)
Korea	SDA(Standard Design Approval)

2.3 Licensing Steps

The licensing steps are the main licensing process to construct a nuclear plant. These licensing steps are composed of one step or multiple steps by the countries, as shown in Table 3. A typical example of a one-step process is COL (combined construction and operating license) of the US. Multi-step processes vary from two to four steps by country. The multi-step process is basically a two-step process composed of the construction license and the operation license. The classification of a multi-step process is only the difference in the classification viewpoint in each country since the construction license includes the site license, the preparation phase, the first nuclear concrete, and so on.

Table 3: Licensing steps by countries

Country	Licensing steps
US	・10CFR52 1. COL(combined construction and operating license) ・10CFR50 1. Construction license 2. Operation license
UK	Nuclear site license. Establishes hold points/consent points, typically: ・First nuclear concrete ・First nuclear island construction ・First fuel brought to site ・Start of active commissioning
Canada	1. license to prepare site 2. license to construct 3. license to operate
France	1. Authorization decree for the creation of a basic nuclear installation 2. license for the commissioning of the installation
Ukraine	1. Construction license 2. Operating license
Korea	1. Construction Permit 2. Operating license
Japan	1. Site selection phase 2. Preparation phase 3. Construction phase 4. Operation phase

3. Results

The licensing for construction is getting more important as the development of new nuclear reactors requires the higher safety. As shown in Table 4, there are roughly four kinds in three-step licensing processes for new nuclear reactor construction worldwide.

Table 4: Licensing process by countries

Type	Pre-safety review	Pre-licensing process	Licensing steps	country
1	1. Review		2. Construction 3. Operation	US, UK, Canada, France, Ukraine
2	1. PSID	2. DC	3. COL	US
3		1. SDA	2. Construction 3. Operation	Korea
4			1. Preparation 2. Construction 3. Operation	Japan

- Type 1 is the most commonly used in most countries. Prior to the licensing process, the review of new reactor safety is required by the regulator. The construction permit and operation license are followed.
- Type 2 is the US licensing process. Prior to the licensing process of a new reactor, the design review of a new reactor is required in the form of a PSID. DC and COL follow.
- Type 3 is the Korean regulation process. Different from other countries, there is no official process for a pre-safety review. A construction permit and an operation license are included. An SDA is an optional process for a standard design.
- Type 4 is a Japanese licensing process. Even though there is no official process for a pre-safety review, it is distinctive to have a reactor installation license, safety examination, and construction plan for the preparation phase.

4. Conclusion

Reviewing licensing processes for newly developing reactors of other countries, the first step of the licensing process is the pre-safety review, which is to review the reactor design. This process is not legally binding, but is a review process for a better understanding of newly applied technologies by regulators prior to starting the legally binding licensing process as the construction and operation licensing. This process provides an opportunity for the reactor developer to adopt the regulator's licensing direction and a goal to designing newly developing reactors to meet the safety requirements.

Currently in Korea, an SFR technology proving stage reactor, a PGSFR, is being developed by KAERI and KEPCO E&C to be constructed by 2028. However, there are no suitable regulations or guidelines to review new technologies of newly developing reactors. In other words, there is no official communication channel between the new reactor developer and the regulator prior to the construction licensing process in the Korean Nuclear Safety Law. As a result, it is practically difficult to have an official review of the regulatory body before the construction licensing process is started.

For the development of new reactors, intensive safety reviews from the regulator's point of view from the early stage of design are crucial. Therefore, the pre-safety review process is required from the development stage just before the construction licensing stage through the close cooperation of the developer and the regulator. The pre-safety review process is considered to bring about the following advantages:

- Improved reliability of the reactor safety through safety review by the regulator from the reactor development stage.
- Early set-up of the regulatory direction of the regulatory authority by a safety review of newly developing reactors.
- Enhanced reliability on the regulatory authority.
- Enhanced public acceptance to the newly developing reactors at the time of the site selection.

REFERENCES

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