Study on improvement direction for Regular Inspection of Nuclear Power plants (Focusing on the field of Operational Technology Capability)

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1. Introduction

Nuclear power plants are inspected to ensure safety from the construction stage to the operation stage.

In the construction stage, the Korean regulatory body confirms the safety of construction nuclear power plants through pre-use inspections, and during the operation stage, regular inspections and quality assurance inspections are conducted to confirm the safe operation of nuclear power plants.

Among the above inspections regulated as legal inspections through the Nuclear Safety Act, this paper introduces the regular inspections performed in the operation stage, and seeks to find the characteristics and improvements of the operational technical capability field among the current regular inspection items.
However, this is not the official regulatory position of KINS, but the author's personal research position.

2. Step-by-step Regulation of Power generation Reactor licenses

In order to construct and operate a nuclear power plant in Korea, a business operator applies for a construction permit and performs construction permit examination and pre-use inspection according to the application.

Applicant who has obtained a construction permit applies for an operating license for the operation of a power plant, and the regulatory body performs an operating license review and pre-use inspection at this stage.

During operation, audits are conducted on various altered permits and periodic safety review, and the safety operation of the power plant is checked through regular inspections. Two to five years before the design life of the power plant, it is decided whether or not to continue operation of the relevant reactor through soundness evaluation of major equipment, and after that, the regulatory body is involved in the review of permission for change for permanent suspension and approval for dismantling.

The figure 1 shows the step by step regulation at each level of licensing and approval[1]

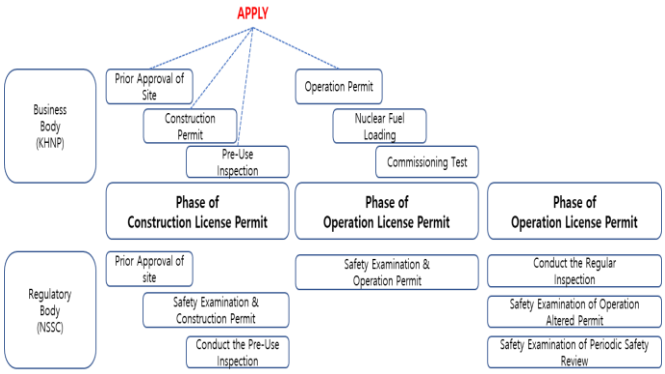

Fig. 1. Step-by-step Regulation at each level of licensing and approval

3. Regular Inspection

3.1 Regular Inspection System

After the operation permit, regular inspections are performed to check and confirm that all activities performed by the operator comply with the licensing requirements and technical standards of the Nuclear Safety Act, and that safety-related devices maintain the performance appropriate to the design requirements.

Regular inspections will be conducted in accordance with Article 22 of the Nuclear Safety Act, Article 35 of the Enforcement Decree of the Nuclear Safety Act, and Article 19 of the Enforcement Rules of the Nuclear Safety Act, and will be conducted on 11 items.

In addition, in accordance with Article 50 (2) of the Rules on Technical Standards for Nuclear Reactor Facilities, etc., the inspection in the field of operational technical capability is also included in the regular inspection. It was designated as a technical capability field item, and each item is as follows.

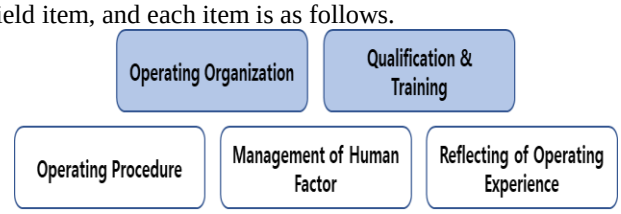

Fig. 2. Five Items of Technical Capabity Inspection

3.2 Performing Regular Inspection

Article 19 of the Enforcement Regulations of the Nuclear Safety Act stipulates that 11 facilities including the nuclear reactor body should be subject to document review, on-site inspection, witness inspection, or

interview with the examinee. It was prescribed to be received within 20 months after receiving the test.

In addition, the period of regular inspection was stipulated to be carried out from the day the reactor was stopped for periodic maintenance or replacement of nuclear fuel until the day full power operation was resumed. Accordingly, the current regular inspection is performed in accordance with the overhaul maintenance period for each power plant of Korea Hydro & Nuclear Power Co., Ltd., a nuclear power plant in Korea.

And, as mentioned earlier, an inspection in the field of operational technology capability, which is an item of regular inspection, is also carried out during the period.

4. Operational Technology Capability field Inspection (Operating Organization, Qualification and Training)

4.1 Current Inspection Method

Since regular inspections are performed on a per reactor basis, they are performed for each reactor unit, whereas, due to the characteristics of a nuclear power plant in Korea that operates two units in one power plant, the operation technology capability field is inspected by power plants rather than reactor units.

This is because the organization, staff qualifications, procedures, etc. dealt with in the field of operational technology capabilities are not organized by unit, but are organized on a power plant basis, and education and training are also implemented for workers at the power plant level, not the nuclear reactor unit.

4.2 Inspection of Operating Organization

The operating organization is an item that checks whether or not it satisfies Article 54 of the Rules on Technical Standards for Reactor Facilities, etc. Final Safety Analysis Report Chapter 13[2], Technical Specification 3rd edition and ANSI/ANS 3.2 1994[3] are used as the inspection standard. The inspection verifies the adequacy of the organization and department composition, the appropriateness of the responsibilities and authority setting of each organization and department, securing of qualified workers, and the appropriateness of the engineering and technical support organization. In the detailed inspection items, check the power plant operation organization, operation support organization, technical support organization, maintenance organization, etc., and the responsibilities and authorities of managers and practical managers, including the plant manager.

In addition, it is checked whether the number of license holders for the operation of the reactor meets the criteria set in the above criteria.

However, all these inspections are carried out at the power plant unit, and there is currently no inspection at the headquarters, which is responsible for organizing and assigning responsibilities, and managing license holders through personnel from all employees. This is because the operational technical capability inspection is included as a field of regular inspection, and as previously stated, the regular inspection is an inspection conducted ‘on a nuclear reactor basis’ during a ‘determined period’. In the Final Safety Analysis Report reflecting the requirements of ANSI/ANS 3.2, it is stipulated that the organization for supporting the operation of power plants is confirmed, which is mostly installed at the headquarters of Korea Hydro & Nuclear Power. Of course, the inspection can be performed through the organizational structure or various documents, but since the current regular inspection system cannot directly perform inspection on the head office, this is necessary to supplement this.

4.3 Inspection of Qualification and Training

Qualifications and training is an item that checks whether or not Article 55 of the rules on technical standards for nuclear reactor facilities is satisfied, and the Final Safety Analysis Report and Tec-spec are based on the same chapter as the 'Operating Organization', and ANSI/ANS3.1 1993[4] are used as the inspection. In this field, the appointment of a worker with the knowledge and experience required to perform the job, the status of the employees engaged in the job requiring a license, education and training for power plant workers, and whether or not drugs are used for nuclear power sources, and diagnosis of mental disorders are confirmed. In the detailed inspection items, the appropriateness of the qualification evaluation of power plant workers and the evaluation criteria meet the requirements of the technical standards, the appropriateness of the establishment of education and training plans, and the implementation status through the result report is confirmed. In addition, it is checked whether the reactor operator's drug and mental health check-ups are periodically conducted, and whether the person who received abnormal findings is engaged in operating work. However, in the case of qualifications and training, most of the technical standards or requirements established by the licensee are stipulated to conduct education on a yearly basis and to evaluate qualifications, whereas the current regular inspection is carried out within 20 months after the previous regular inspection. If the cycle is not correct, it is sometimes necessary to check the implementation status for two years beyond the year. For example, if an error is identified in the employee qualification evaluation two years ago, it will be necessary to re-evaluate the work and actions performed by the person concerned from that point to the time of the inspection. There is a possibility that something will happen.

5. Conclusions

The operating organization of the regular inspection and the areas in need of inspection and improvement in qualification and training fields were examined. In order to improve the inspection of the operating organization, it is believed that inspection at the headquarters of the operator is necessary rather than the inspection centered on the power plant. It will be able to further strengthen the adequacy of the organization installed in the unit power plant by controlling the confirmation of the functions of the headquarters that manages and controls the entire organization. For inspection in qualification and training fields, it is judged that annual examinations should be performed rather than regular inspection periods. As stated above, it is believed that only if annual inspections are carried out, appropriate monitoring of qualification evaluation and education and training planned and implemented by business operators can be achieved. To this end, it is believed that legal and institutional improvements, such as separating the inspection in the field of operational technology capability from the regular inspection into a separate inspection, should be accompanied.

REFERENCES

[1] Safety Disclosure Forum 2019, KINS
[2] YGN FSAR Chapter 13. Conduct of Operation
[3] ANSI/ANS-3.2-1994 Administrative controls and quality assurance for the operational phase of Nuclear Power Plants
[4] ANSI/ANS-3.1-1993 Selection, Qualification, and Training of personnel for Nuclear Power Plants