Draft Regulatory Rule-making for On-line Maintenance of Nuclear Power Plants

Sang-Kyu AHN*, Kyu-Myung OH, Chang-Ju Lee, Gun-Hyun Chang
Korea Institute of Nuclear Safety, 34 Gwahak-ro, Yuseong, Daejeon, Korea, 305-338
**Corresponding author:* k052ask@kins.re.kr

1. Introduction

Internationally, on-line maintenance (OLM) of nuclear power plants under the operation is prevailed to enhance nuclear safety and economics [1, 2]. In recent years, Korea Hydro & Nuclear Power Co. Ltd. (KHNP) is eager to apply OLM. Ministry of Education, Science and Technology (MEST) has established the related technology development program as an item of "Overall Planning on Nuclear Safety(2010-2014)" through acceptance to the request of KHNP in 2009 [3].

OLM is defined as maintenance that is performed with the main generator connected to the grid [4]. In other words, it means a preventive maintenance to be implemented during the allowable outage time (AOT) with ignoring inoperability of safety-related equipments listed in the technical specifications.

The Korea Institute of Nuclear Safety (KINS) is developing the assessment technology of safety concerns for OLM under the auspices of MEST. Draft regulatory rule-making for OLM is devised as a part of the development of the assessment technology.

2. Draft Regulatory Process of OLM

In this section, how to establish a draft regulatory process for OLM is described. A typical OLM flowchart is shown in Figure 1 which summarizes key elements of the strategy and presents them as a process for determining which maintenance activities can be performed on-line and which should be performed during an outage [5].

A process of OLM can be divided in 3 main stages, such as planning, implementation, and feedback. A regulatory process for OLM is established along by each stage of OLM. The main purpose of OLM regulatory process is to protect plant personnel and public health by confirming that a plant's overall risk is well managed by the licensee. The draft regulatory process for OLM is shown in Figure 2 and consists of the execution time and contents of each regulatory activity as follows.

2.1 Planning Stage of OLM

At the planning stage of OLM, the licensee should submit the inspection application of OLM along with OLM program, a contingency plan, a recovery plan, etc. Then, the regulatory body checks and reviews the licensee's OLM program, and notifies the licensee whether it needs to be corrected or not.

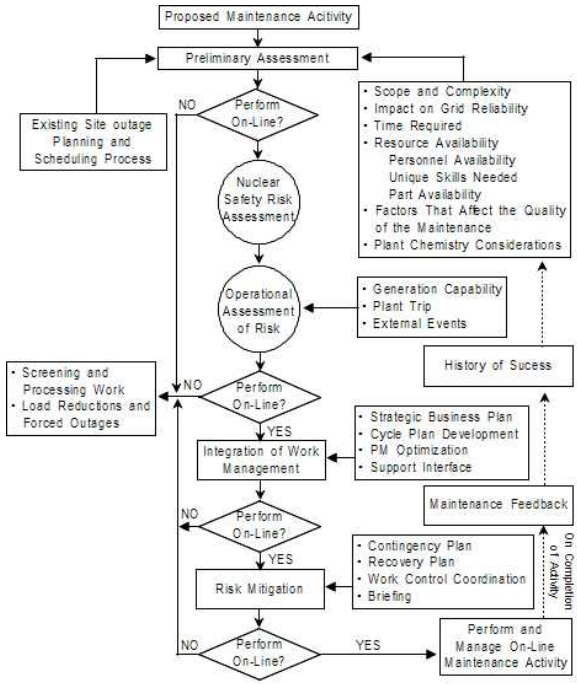

Figure 1 Summary of On-Line Maintenance Planning and Implementation [5]

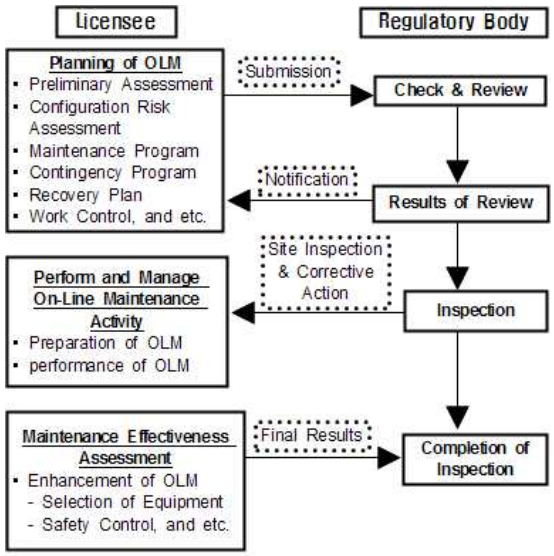

Figure 2 Regulatory Process of On-Line Maintenance

The licensee's OLM program should include descriptions of the following:

- ○ Preliminary assessments
  - ▪ Screening and processing work
  - ▪ Consideration and evaluation of issues and factors
- ○ Nuclear safety risk management

- ▪ Configuration risk management
- ▪ Additional considerations for nuclear safety risk assessment

○ Primary elements of the operational risk assessment
- ▪ Risk to generation capability
- ▪ Risk of a plant trip
- ▪ External event considerations (industrial safety, environmental risk, corporate risk)

○ Integration of work management
- ▪ Preventive maintenance optimization
- ▪ Interface with supporting organizations

A contingency plan is for mitigating the loss of a key safety function. All high safety impact evolution should have a contingency plan. A recovery plan is for the restoration of a key safety function, and should be developed if conditions degrade to any of the scenarios postulated during the contingency planning process. Its plan allows for the safe and timely restoration of a key safety function if an emergent condition arises [5].

2.2 During and After OLM performance

A regulatory inspector inspects the preparedness and performance of OLM at the site. The scope of OLM inspection includes work management process that is used to identify, select, plan, schedule, and execute work in a manner that helps to ensure high levels of safe and reliable plant operation.

After completion of OLM, the licensee should report the final results of OLM, including maintenance effectiveness assessment, to the regulatory body.

3. Draft Rule-making of the Regulatory Program for OLM

All of regulatory activities to OLM will be performed at the operating nuclear power plant, and maintenance of equipment important to safety is subject to regulatory inspection. Specially, equipment important to safety is included in the scope of the periodic regulatory inspection. When failure of the standby equipment important to safety is found by surveillance test specified in the technical specification, the licensee should immediately repair the failed equipments within AOT. It is subject to routine regulatory inspection when the nuclear power plant is operating. Therefore, it is desirable that all of regulatory activities to OLM should be performed by means of regulatory inspection.

Considering the characteristics of regulatory activities to OLM, draft institutionalization of a regulatory framework for OLM is presented in Table 1. All regulatory activities to OLM are legally based on the article 23-2 (Inspection) of the Atomic Energy Act. More detailed requirements would be specified in the Enforcement Decree of the Atomic Energy Act, the Enforcement Regulation of the Atomic Energy Act and Notice of MEST, as shown in Table 1. The legal basis of regulatory inspection, application requirements and success criteria to OLM implementation would be defined in the Enforcement Decree of the Atomic Energy Act. More detailed requirements, such as subject to be inspected, inspection methods and periods, etc., would be described in the Enforcement Regulation of the Atomic Energy Act. Specific detail requirements would be issued as a Notice of MEST.

Table 1 Draft Regulatory Rule-making for OLM

Atomic Energy Act	Enforcement Decree of The Atomic Energy Act	Enforcement Regulation of The Atomic Energy Act	Notice of MEST
Inspection (Article 23-2)	OLM Inspection (Article 42-6; New) ▪ Base of Inspection ▪ Success Criteria	OLM Inspection (Article 19-4: New) ▪ Subject to be Inspected ▪ Inspection Methods ▪ Inspection Periods ▪ Contents of Application ▪ Success Criteria in detail ▪ Notification of Success	(201X-X) ▪ Detailed Subject to be Inspected ▪ Criteria, Principle, and etc. of OLM

4. Conclusions

The draft regulatory process for OLM is established along by the typical process of OLM. Also, draft regulatory rule-making for OLM is presented, considering the characteristics of regulatory activities to OLM. This paper proposes the major potential elements of the licensee's OLM program, such as preliminary assessments, nuclear safety risk management, and primary elements of the operational risk assessment, etc.

Hereafter, to enhance regulatory effectiveness, it is necessary to develop regulatory guides in which review and inspection methods of the utility's OLM program are described.

REFERENCES

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