Options of Regulatory Framework for On-line Maintenance

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1. Introduction

It is well known that on-line maintenance (OLM) has some potential for safety enhancement of operating nuclear power plants [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]. The Korea Institute of Nuclear Safety (KINS) is developing the assessment technology of safety concerns for OLM under the auspices of MEST. This paper provides various options for accepting OLM within a regulatory framework, considering lack of domestic OLM experience [4].

2. Concept of On-line Maintenance

OLM is defined as a maintenance that is performed with the main generator connected to the grid [5]. In other words, it means preventive maintenance to be implemented during the allowable outage time (AOT) while crediting the operability of safety-related structure, system and components listed in the technical specifications [6].

3. Options of Regulatory Framework for On-line Maintenance

Three options to establish regulatory frameworks for OLM would be available in the domestic industrial environment as follows;

- Option 1: Voluntary OLM monitored by the Nuclear Regulatory Organization (NRO)
- Option 2: OLM controlled by the NRO
- Option 3: Combination of Option 1 and Option 2

3.1 Option 1: Voluntary OLM monitored by the NRO

It needs only to establish a set of safety criteria in the existing nuclear regulation. The set of draft safety criteria would contain a number of requirements as follows [4];

- Risk assessments before performing maintenance activities and management of the increase in risk that may result from the proposed maintenance activities.
- Safety principles for OLM performance as follows;

  - Decision to perform OLM should be based on the reasonable expectation of increased system and plant reliability and reduced plant equipment and system material condition deficiencies.

  - OLM program should be carefully planned to prevent such abuses that allow performing OLM by repeatedly entering and exiting limiting conditions for operation (LCOs) action statements in the technical specifications.

  - While performing OLM, removing other equipment from service should be decided by risk insights, and other testing or maintenance which would increase the likelihood of a transient should be avoided.

Licensee should implement OLM according to the above safety criteria. However, licensee does not need to submit an OLM program for the NRO pre-review at the planning stage of OLM. And the NRO (including resident inspector) will directly observe licensee's implementation and review result records. Figure 1 shows the regulatory flow of Option 1.

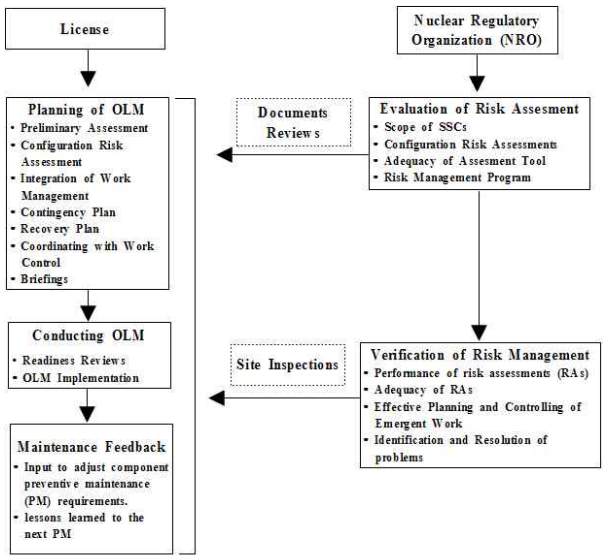

Figure 1 Voluntary OLM monitored by the NRO (Option 1)

3.2 Option 2: OLM controlled by the NRO

It also needs to establish the set of safety criteria mentioned in the Option 1. At the planning stage of OLM, if licensee submits OLM program to the NRO, then the NRO will check and review the licensee's OLM program. From the beginning stage of OLM implementation, the NRO (including resident inspector) will launch to check the preparedness and then inspect thoroughly the whole OLM process. 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 the regulatory inspection, the NRO notifies the inspection results to the licensee. Figure 2 shows the regulatory flow of Option 2.

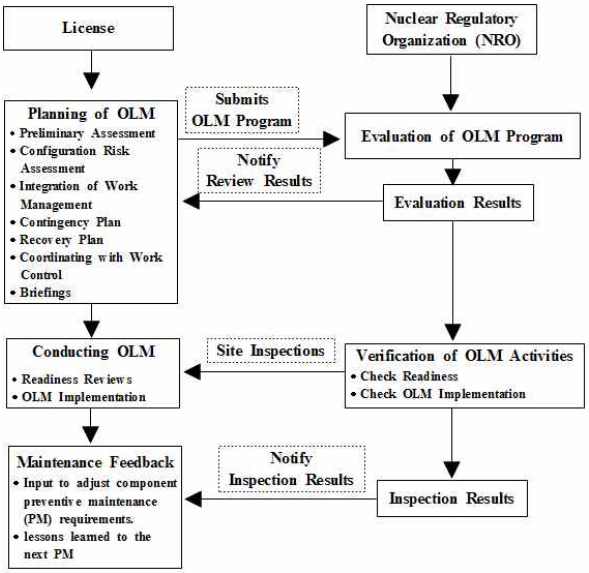

Figure 2 OLM controlled by the NRO (Option 2)

3.3 Option 3: Combination of Option 1 and Option 2

Before the settlement of OLM, Option 2 will be applied. Thereafter, if the NRO recognizes that OLM has matured, then the NRO will substitute Option 1 for Option 2. Also, no changes exist in the set of safety criteria.

3.4 Comparison of Options

The advantages and disadvantages of each option are analyzed in respect of rule-making and regulatory effectiveness as shown in the Table 1.

Table 1 Advantages and disadvantages of each OLM regulatory framework option

Options	Advantages	Disadvantages
Option 1: Voluntary OLM monitored by the NRO	• Less efforts to rule-making • Less regulatory burden to licensee • Less regulatory resources needed to pre-review	• Pre-review by the NRO is not available.
Option 2: OLM controlled by the NRO	• Pre-review by the NRO is available before OLM.	• More efforts to rule-making • Increasing burden to the both of licensee and NRO
Option 3: Combination of Option 1 and Option 2	• Pre-review by NRO is available until OLM becomes to be matured.	• Disadvantages of Option 2 exist during a certain period.

4. Conclusions

We are investing which option will provide more efficient regulatory framework for OLM to assure operating safety with a consideration of the technical elements of OLM. Also, a set of draft safety criteria for OLM is suggested to maintain operational nuclear safety against unintentional abnormal situations.

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