Technical considerations and measures in the regulatory technology of OLM

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1. Introduction

Many of preventive maintenance (PM) tasks have been restricted for deterministic safety reasons to be performed only during a refueling outage of NPPs.

However, if the licensee has a reasonable expectation that OLM (On-line maintenance) will improve safety by making equipment more reliable, then the licensee may implement OLM even though it may increase the unavailability of equipment.

OLM implementation needs the development of the regulatory technology for confirming the adequacy of the licensee's OLM program and its performance.

As a part of regulatory technology of OLM, the regulatory and industrial documents published by foreign countries were investigated and analyzed [1]. In this paper, we provide technical elements which need to be considered in developing regulatory technology of OLM. Also we propose measures considered in the development of the regulatory guidance for OLM.

2. Summary on the regulatory and industrial documents of foreign countries for OLM

In USA, the regulatory requirements and guidances for OLM consist of 10 CFR 50.65, Reg. Guide 1.160, Reg. guide 1.174 and Reg. Guide 1.182. Especially, assessing and managing the risk associated with maintenance are governed by 10 CFR 50.65(a) (4). USNRC has a technical guidance for preventive maintenance, Inspection Manual Part 9900. For the detailed guideline of OLM implementation, Reg. guide 1.160 and 1.182 endorse an industrial guideline, NUMARC 93-01.

Spain established the rule based on the USNRC, 10 CFR 50.65. Spanish regulatory procedure for OLM is PT.IV.24. In USA and Spain, licensees are commonly permitted to do OLM after providing PSA results and the management capability for the risk increase due to the proposed activities.

In Finland, the guide such as YVL 1.8, TVL 5.5 and YVL 7.11 contains a provision concerning preventive maintenance for SSCs, electrical and instrumentation equipment and radiation measuring systems at nuclear facilities, respectively.

In Germany, OLM was licensed under a recommendation by the Reactor Safety Commission (RSK).

In actual, it is understood that generally most regulatory bodies do not have their own specific rule except USA, Spain, Finland and Germany.

Status of USA on the regulatory and industrial documents for OLM implementation is shown in Table 1 [2].

Table 1 Regulatory and industrial documents applied to OLM in USA

	Regulation	Regulatory Guide	Inspection procedure	Industrial guideline
USA	10 CFR 50.65(a) (4)	Reg. Guide 1.160, 1.174 and 1.182	Inspection Manual 9900	NUMARC 93-01 1)EPRI 1009708

Note. 1) This EPRI guideline was not endorsed by USNRC.

3. Technical elements considered in the regulatory technology of OLM

Regulatory body needs to prepare the regulatory technology in order to confirm the adequacy of the licensee's program and implementation results of OLM, considering technical elements embedded in the regulatory and industrial documents of foreign countries as described in section 2. Technical considerations in developing the regulatory technology of OLM primarily include the licensee's readiness such as a risk management, preparations of guidance/ procedure for OLM, and so on.

Through summary on the regulatory and industrial documents of foreign countries for OLM, major technical elements considered in the development of the regulatory technology for OLM are provided to the extent practicable, but are not limited to the following items [3].

- Interfaces between OLM and MR

  USA and Spain were oriented to implement OLM closely connected with MR. Therefore, in domestic case, it is expected that OLM needs to be properly connected with MR for effective OLM implementation

- Establishment of program, system and process for OLM implementation

  In USA, nuclear industry has proposed three essential elements such as configuration risk management, work management and maintenance process in order to effectively implement OLM. According to the industrial guideline given in table 1, the licensee needs to properly establish program, system and process for OLM implementation.

- Scope and selection process of SSCs (Structures, systems and components) subject to OLM

  In USA, if certain components can be shut-down for surveillance test, these components can be generally permitted for OLM implementation. In Germany and Spain, OLM is permitted for only predetermined systems. Accordingly, scope and selection process of equipment subject to OLM should be properly developed.

- Operational conditions and criteria applicable for OLM implementation

  In USA and Spain, OLM is permitted if the licensees assess and manage the increase in risk that may result from the proposed maintenance activities and maintain defense-in-depth principle. In Germany, Sweden and Finland, the degree of redundancy and the number of redundant trains of safety systems are one of key factors which determine the possibility of performing OLM. In a similar manner, operational conditions and criteria for OLM implementation should be provided.

- Criteria for safety confirmation and evaluation method (Qualitative/Quantitative)

  In USA, NUMARC 93-01 provides criteria of safety confirmation to assess and manage the risk impact expected to

result from performance of maintenance activities. In France and Spain, the licensees perform evaluation for the risk impact occurred by OLM. Like this, criteria for safety confirmation and evaluation method should be established for OLM implementation.

● Maintenance duration, LCO application and its extension

In USA, the amount of time that should be allowed for routine OLM activities is based on TS LCO, considering administrative time limits. In Spain and Finland, the maximum time for OLM is specified. In domestic case, for the consistent implementation of OLM, the maximum preventive maintenance time should be specified, considering TS LCO.

● Criteria for permitting simultaneous out-of-service of multiple systems

In USA, while performing an OLM task, the licensee should avoid the states of other testing or maintenance that would increase the likelihood of a transient. In Spain, simultaneous OLM for more than one system is prohibited. Therefore the regulatory position on permitting simultaneous out-of-service of multiple systems should be provided.

● Scope and method of the regulatory inspection

Most countries perform the regulatory inspection in order to verify the adequacy of OLM activities implemented by the licensee. Accordingly the regulatory inspection procedure should be developed, including the scope and method of inspection.

4. Measures considered in the regulatory technology of OLM

All regulatory activities to OLM are legally based on the article 23-2 (Inspection) of the Atomic Energy Act. More detailed requirements will be specified in the Enforcement Decree of The Atomic Energy Act, Enforcement Regulation of The Atomic Energy Act and Notice of MEST [4].

The regulatory technology for OLM implementation should be developed for supporting the related ordinances. In this sense, the regulatory guidance will be developed, mainly based on the related USNRC Reg. Guide and industrial guideline. The guidance will include the following potential elements for OLM implementation [5]. It mainly focuses on the management of the risk resulting from performance of OLM activities.

● General assessment
- The assessment method such as the degree of redundancy, the duration of the out-of-service, etc.
- The assessment relating to the risk impact of performing the maintenance during shutdown with respect to performing the maintenance at power, etc
- The degree of depth for assessing and managing risk
- The assessment of restoration of the SSC's functions for the out-of-service SSCs under emergent conditions, and so on

● Scope of assessment
- Scope of SSCs covered by PSA
- Level of PSA

● Assessment methods
- Quantitative considerations
- Qualitative considerations

● Risk management
- Establishment of action thresholds based on qualitative considerations
- Establishment of action thresholds based on quantitative considerations
- Risk management actions
  - ▪ Actions to provide increased risk awareness and control
  - ▪ Actions to reduce duration of maintenance activity including contingency plan
  - ▪ Actions to minimize magnitude of risk increase

● Establishment of compensatory measures

Using the related ordinances and regulatory guidance to be developed, regulatory staff will be able to check and review the OLM program submitted by the licensee.

It is necessary to develop new inspection procedure in order to confirm the adequacy of OLM implementation.

For preparing the inspection procedure to OLM implementation, USNRC Inspection Manual will be referred. The inspection procedure will include at the least subject to be inspected, inspection methods, inspection periods and detailed success criteria. The procedure will also provide qualitative criteria and conservative safety principles to assist in recognizing abuses of OLM.

5. Conclusions

This paper summarizes the regulatory and industrial documents of foreign countries for OLM implementation. Through this summary, we have identified various technical elements which need to be considered in developing the regulatory technology of OLM. It is noted that there are several issues to be resolved by the regulatory body in the licensee's OLM implementation, including the development of the regulatory program.

As a regulatory aspect concerning these issues, we propose measures considered in the development of the regulatory technology for OLM. For example, these will include preparations of the regulatory document for safety review and regulatory inspection in confirming the adequacy of the licensee's OLM program and its implementation.

The results of this study can be given as the groundwork in supporting more robust regulatory technology of OLM.

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