

Status of Technical Requirements Development for Maintenance Effectiveness Management

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1. Introduction

It is well known that proper maintenance at nuclear power plant is essential to plant safety and that there is a clear link between effective maintenance and safety as it relates to such factors as the number of transients and challenges to safety systems and the associated need for operability, availability, and reliability of safety equipment [1]. Good maintenance is also important in providing assurance that failures of non-safety related structures, systems, and components (SSCs) that could initiate, adversely affect, or mitigate a transient or an accident are also minimized. Maintenance is also important to ensure that design assumptions and margins in the original design basis are maintained and are not degraded to an unacceptable level. Therefore, good maintenance practice at nuclear power plants is of utmost importance in protecting public health and safety [1].

This paper introduces the status of the development of regulatory technical requirements (Drafts) for utility's management of maintenance effectiveness [2]. The process of Maintenance Effectiveness Management is shown in Figure 1.

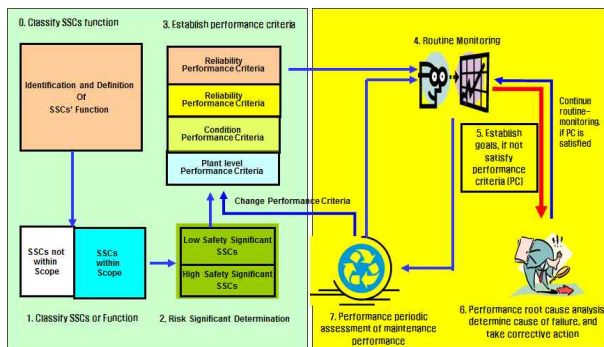


Figure 1 Flow chart of the Maintenance Effectiveness Management

2. Hierarchy of Technical Requirements (Drafts) for Management of Maintenance Effectiveness

Hierarchy of technical requirements for Maintenance Effectiveness Management is shown in Table 1. First, a new set of criteria for Maintenance Effectiveness Management will be defined in Article 63 of the Regulations on Technical Standards for Nuclear Reactor Facilities. Second, the Maintenance Effectiveness Management Regulation (Draft) will be announced as a

Notice of the Nuclear Safety and Security Commission (NSSC) to implement the criteria. Finally, several KINS guides (Draft) will be issued to support the regulatory review of the licensee's Maintenance Effectiveness Management.

Table 1 Hierarchy of Technical Requirements (Drafts) for Maintenance Effectiveness Management

Technical Standards (NSSC Order)	Regulations on Technical Standards for Nuclear Reactor Facilities, Article 63 (Testing, Monitoring, Inspection and Maintenance) (3) : <i>Define a set of criteria for Maintenance Effectiveness Management</i>
NSSC Notice	Maintenance Effectiveness Management Regulation (Draft)
KINS Guides	<ul style="list-style-type: none"> • Reg. Guide(Draft) for Review of the Maintenance Effectiveness Management Program • Specific Reg. Guide(Draft) for Maintenance Effectiveness Management • Reg. Guide(Draft) for Inspection to Maintenance Effectiveness Management

3. Criteria for Maintenance Effectiveness Management

The criteria for Maintenance Effectiveness Management would require the licensee to establish and implement maintenance management program to ensure that effective maintenance is conducted. In this criteria, maintenance includes not only activities traditionally associated with identifying and correcting actual or potential degraded conditions, i.e., repair, surveillance, diagnostic examinations, and preventive measures; but extends to all supporting functions for the conduct of these activities.

4. Maintenance Effectiveness Management Regulation (Draft)

Maintenance Effectiveness Management Regulation (Draft) would describe the requirements to be satisfied by the licensee for assuring effective implementation of its maintenance program. The scope of the regulation is expected to include the following SSCs as follows.

- (1) Safety-related SSCs.
- (2) Non safety related SSCs:
 - (i) that are relied upon to mitigate accidents or transients or are used in plant emergency operating procedures (EOPs); or
 - (ii) whose failure could prevent safety-related SSCs from fulfilling their safety-related function; or
 - (iii) whose failure could cause a reactor scram or actuation of a safety-related system.

The requirements would consist of 15 articles as shown in Table 2.

Table 2 Contents of the Maintenance Effectiveness Management Regulation (Draft)

Article 1	Purpose
Article 2	Scope
Article 3	Definitions
Article 4	Maintenance effectiveness management
Article 5	SSCs in the scope of maintenance effectiveness management
Article 6	Equipment classification of safety significance
Article 7	Establishing performance criteria
Article 8	Monitoring performance
Article 9	Performance goal setting and monitoring
Article 10	Periodic evaluation of maintenance effectiveness
Article 11	Keeping and preserving maintenance data
Article 12	Preparation and submission of maintenance effectiveness management program
Article 13	Application to a nuclear power plant which does not yet start operation
Article 14	Expert panel
Article 15	Due date of reconsideration

As described in Article 6, determination of SSC's safety significance shall be performed, by considering plant-specific probabilistic safety analysis (PSA) information, critical safety functions, and operating experience. The requirements to establish and monitor performance criteria, in Articles 7 and 8, in conjunction with the requirements in Article 6 demonstrate that this regulation can be referred to as a risk-informed and performance-based regulation.

5. Regulatory Guides (Draft) for Maintenance Effectiveness Management

5.1 Reg. Guide (Draft) for Review of the Maintenance Effectiveness Management Program

The purpose of this guide is to support regulatory review of the licensee's Maintenance Effectiveness Management Program. This guide would provide regulatory position and guideline for such items as selection of SSCs in the scope of Maintenance Effectiveness Management; equipment classification of safety significance; establishment of performance criteria; performance monitoring; periodic evaluation of maintenance effectiveness; expert panel; and monitoring program for new constructing nuclear power plant.

5.2 Specific Reg. Guide (Draft) for Maintenance Effectiveness Management

This guide would provide detailed methodology for the licensee to implement the Maintenance Effectiveness Management Regulation (Draft). The detailed methodology would describe regulatory positions for several major topics such as selection of SSCs, equipment classification of safety significance, failure, establishment of performance criteria, performance monitoring, performance goal setting and monitoring, periodic evaluation of maintenance effectiveness, and

balancing performance criteria (between reliability and availability).

5.3 Guide (Draft) for Inspection to Maintenance Effectiveness Management

This guide would consist of inspection requirements, inspection scope, inspection methods, main inspection items, specific inspection guidance, and precautions. This guide would also provide Maintenance Rule terminology, general & specific inspection guidance, inspection guidance for periodic evaluation of maintenance effectiveness, and inspection guidance for identification of violation to the Maintenance Effectiveness Management Regulation.

6. Conclusions

Draft requirements for Maintenance Effectiveness Management have been developed through several research steps [2,3,4]. The technical requirements have been developed as risk-informed and performance-based regulations, and are therefore expected to enhance safety while avoiding unnecessary conservatism in practicing effective maintenance at nuclear power plants. Specially, the drafts of regulatory guides would be helpful for the regulator to review and inspect licensee's maintenance activity, as well as licensee's implementation of Maintenance Effectiveness Management.

ACKNOWLEDGMENT

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