

Study on the Management for the Nuclear Power Plant Maintenance and Equipment Reliability

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1. Introduction

The maintenance and equipment reliability are the essential elements for securing the safety of nuclear power plants(NPP) and have largely impacts on the plant reliability and efficiency. In the case of other countries, they were established the relevant regulatory requirements in 1990' s and that led the utility company to adopt the optimized maintenance for the plant safety.

In our country, many studies on the regulatory policy of the plant maintenance have ever been performed since 1998, but the relevant regulatory requirements were not established yet. These background mentioned above request us to study on the regulation policy and maintenance plan to improve the safety, reliability and efficiency of NPP.

To solve these problems, in this study, we deduct the management methodology for the improvement of NPP maintenance and equipment reliability that is essential to secure the safety and efficiency of the commercial NPP.

2. Contents and Scope

For effective accomplishment in this study, we investigated overseas regulation and technical trend related to NPP maintenance and Korean regulation. We deducted an effective maintenance and equipment reliability management for application to Korean NPP.

2.1 Overseas Regulation and Technical Trend

In case of other countries that recognized the importance of regularization and systematization of NPP maintenance, they implemented the study and technical development actively in early 1990's as regards NPP maintenance methodology and regulation direction, utilized actively to regulation and maintenance methodology that is related to their NPP maintenance.

- USNRC established 10CFR50.65 as maintenance rule and defined all commercial NPP should apply it.
- CNSC(Canadian Nuclear Safety Commission) established regulation rule that is related to

maintenance. They established and operated maintenance management program and reliability program.

- France regulatory agency established major safety purpose about NPP maintenance.
- England regulatory agency(Office for Nuclear Regulation : ONR) established "Nuclear Installations Act"
- German demanded preventive maintenance, inspection and test through federal government safety standard and operated optimized maintenance system application and maintenance management program through regulation guideline.

Conditions of technical development that is related to maintenance management program and equipment reliability management process, maintenance methodology, maintenance regulation plan are IAEA technical report TECDOC⁽¹⁾²⁾³⁾⁴⁾⁵⁾⁶⁾, INPO report⁽⁷⁾, EPRI technical report⁽⁸⁾⁹⁾¹⁰⁾¹¹⁾, NEA report⁽¹²⁾, etc.

2.2 Development of Korean NPP maintenance technology and the regulation

In Korean, there were progressed several studies and technical developments from 1990's, implemented mainly maintenance regulation and law study, maintenance methodology, on-line maintenance methodology, maintenance program.

- Validity of maintenance regulation application, study of maintenance regulation imposition, and development of regulation technique
- Strategy study of on-line maintenance and technical development of safety assessment
- Study of maintenance regulation program and development of maintenance effectiveness monitoring program

The maintenance management system in Korean NPP is assessed to applying optimized maintenance system(step II). But application scope and content is measured on the unsatisfactory condition as comparing with overseas NPP. Maintenance management is applying such of preventive maintenance template development, reliability centered maintenance application, predictive maintenance application, on-line maintenance demonstration application, maintenance management program operation and equipment reliability management process operation.

Classification	1930~	1980~	1990~	1995~
Maintenance Management System	First Generation Maintenance (Run-to-Failure System)	Second Generation Maintenance (Planned Maintenance System)	Third Generation Maintenance (Optimized Maintenance System)	
			Step I	Step II
Maintenance Methodology	- Run-to-Failure	- Run-to-Failure - Periodic	- Run-to-Failure - Periodic - Reliability Centered	- Run-to-Failure - Periodic - Reliability Centered - Predictive (Condition Based) - On-line - Proactive - Total Productive

Fig. 1. Development of Maintenance Management System

2.3 A new and effective maintenance management methodology

Maintenance management for Korean NPP is assessed on initial stage that is applying optimized maintenance system(step II). Application scope should be expanded and operated systematically. For that, licensee should develop and operate a proper maintenance program, there is necessary to review and supervise about licensee's maintenance methodology and program operation. For improvement of safety, reliability, economics and on-line maintenance should apply in Korean NPP. Quantitative assessment for effectiveness of application maintenance methodology with maintenance performance indicators is necessary.

3. Conclusion

For analysis the maintenance and equipment reliability management methodology in overseas NPP. We studied maintenance and equipment reliability of USA, Canada and Europe(France, England, German). We also studied status and application condition of Korean NPP maintenance management technical development. We deducted an effective maintenance methodology that is needed to Korean NPP, as a result of comparison on the technical trend of the maintenance management between overseas and Korean, such like following.

- Regulation form
 - Specific provision of regulation requirement and application of form that is clarifying application standard
- Maintenance management methodology
 - Optimized maintenance management system(step II)
- Maintenance management program
- On-line maintenance

- Operation of maintenance performance indicators

This results of study could be applied for regulation policy, law and guideline establishment of NPP maintenance, operation, supervision and a system establishment for maintenance management, education data about maintenance for NPP employees.

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