

Development of Review Guidelines and Regulatory Review System for PWR Power Upgrades

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1. Introduction

A power uprate is a process to increase the maximum power level at which an operating nuclear power plant (NPP) may operate. It is widely implemented to enhance operation efficiency of operating NPPs. Power uprates can be classified in three categories: (1) MURPU (measurement uncertainty recapture power uprates, $\leq 2\%$), (2) SPU (stretch power uprates, $\leq 7\%$), and (3) EPU (extended power uprates, $\leq 20\%$) on the basis of the increased power level. In USA, the USNRC (United State Nuclear Regulatory Commission) has completed reviews of the 112 applications for power uprates. In Korea, KHNP (Korea Hydro Nuclear Power) is to apply the license amendment request for the 4.5% power uprating for Kori units 3 & 4 and Yonggwang units 1 & 2. KINS(Korea Institute of Nuclear Safety) has been developing the regulatory requirements and review guidelines for the licensing review of power uprate applications.[1]

The regulatory requirements or review guidelines have to be developed in a consistent manner and of high-level accomplishment in order to ensure that its original safety functions could be satisfactorily met after successful power uprating of operating NPPs. They have to enhance regulation effectiveness as well as to reduce economic costs for power uprate licensing process. Therefore, the purpose of this study is to develop the review guideline for the power uprate licensing process under the consideration of domestic regulation environments.

2. Review of Overseas Regulatory Guidelines

USNRC has been conducting power uprate reviews since the 1970s and has completed over 112 such reviews. Most of these reviews have been for the applications of lower power increases such as MUR or SPU. The first EPU for PWR plant was approved for Arkansas Nuclear One Unit 2 in April 2002. However, a dedicated guidance for power uprate licensing process has not been developed until 2002.

USNRC had considered issuing a Standard Review Plan (SRP) section to provide guidance for a staff conducting power uprate reviews.[2] But USNRC has concluded that the development of an SRP would be impractical as it would not be completed in time for the EPU's expected in the near term.[3] Instead of SRP section, standardization of review process for power uprate applications is preferred in order to enhance the

consistency, quality, and timeliness of the reviews. As a result of these activities, Regulatory Issue Summary (RIS) 2002-03 for MURPU [4] and Review Standard (RS)-001 for EPU [5] were issued and has been used guidance for review of power uprate applications and approval of license amendment of operating NPPs.

However, the domestic environment of regulation has reached to a phase for a submittal of license amendment applications. Considering power uprate of operating NPPs that will change or modify plant design or operation characteristics, it will be appropriate to develop a review guideline such as SRP because it is license amendment application.

3. Review Guidelines for Power Uprate Applications

The purpose of the review guideline is to provide guidance for the KINS staff's review of power uprate applications to enhance consistency, quality, and completeness of reviews. The review guideline for power uprate applications has to be developed to help adequate reviews of power uprate applications and to clarify to the public and licensees the adequate criteria for power uprate applications. Considering these points of view, a draft review guideline applicable to power uprate of operating PWR plants was developed. The draft review guideline for power uprate applications was based on the format and the content of KINS-G-001[6] and with reference to the review scope and the review criteria of RS-001.

Each section of the draft review guideline is composed of four subsections: Area of Review, Acceptance Criteria, Review Procedures, and Evaluation Findings. The area of review was specified to include a review area to be surely confirmed for power uprate of operating NPPs. The acceptance criteria is based on the KINS-G-001 and the related regulatory requirements. Mainly, review criteria in RS-001 are referred to develop the review guideline. SRP procedure of KINS-G-001 was utilized as the review procedure. The evaluation findings were specified to include the essential issues to be surely evaluated for power uprate of operating NPPs.

4. Regulatory Review System for Power Upgrades Applications

The advent and the ready availability of the internet environment can be applied to the effective review process through website. Based on internet technology,

a web-supported review process system has been developed in order to increase a utilization of the newly developed review guideline for power uprate applications. As a first step, a writing system of evaluation report in the web of the web-supported review process system has been developed.

The writing system is based on Apache Cocoon [7] that is a web development framework built around the concepts of separation of concerns and component-based web development. With strong foundations in XML-based server-side web application frameworks of Apache Cocoon, a program of the writing system of evaluation report is also based on XML documents as shown in Figure 1.

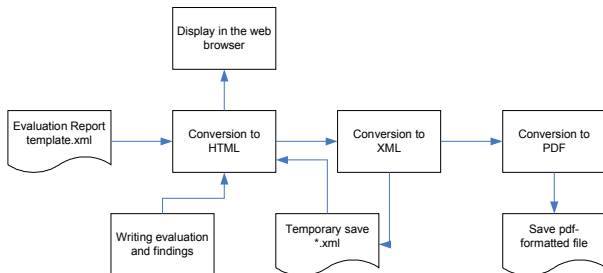


Figure 1. Program structure for the writing system of evaluation report

Main program to communicate with Apache Cocoon provides conversion process of XML to HTML, HTML to XML, and XML to PDF. Template evaluation report for each section of the review guideline has been developed as XML document. This document is converted into HTML document and is displayed at a web browser in the framework of Apache Cocoon. On the web browser, the reviews can edit the subsection of evaluation and findings with results of reviews then convert the edited HTML-formatted template into XML document. This document is saved as temporary file and is converted into PDF document for submission or print-out. An example of this process is shown in Figure 2.

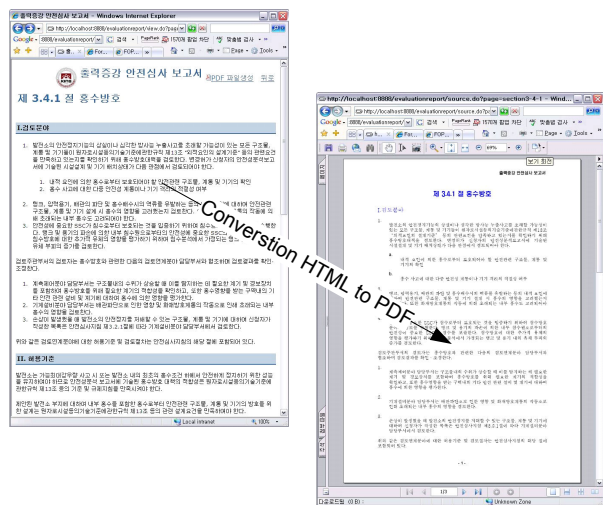


Figure 2. An example of web-supported writing system of evaluation report

In the web-supported review process system, the reviewers also look for the preferred section of the review guideline in web browser or print out that in the way of reviewing the power uprate applications because the review guideline for power uprate applications could be supplied as XML document. With utilizing the template evaluation report, the reviewers will only edit the evaluation and findings of each area of the review on the web browser. Therefore, a utilization of this system and the review guideline for power uprate application will help the reviewer achieve its goal to conduct power uprate reviews in the most effective and efficient manner while maintaining safety.

5. Conclusion

Regulatory guidance development methodology including basic approach for plant specific applications has been established by investigating overseas regulatory guidances and related technical documents. Considering that power uprate of operating NPPs will change or modify plant design or operation characteristics, the draft review guideline for power uprate applications has been developed on the basis of the format and the content of KINS-G-001 and with reference to the review scope and the review criteria of RS-001. In the draft review guideline, the review area to be surely confirmed and the issues to be surely evaluated have been added to the corresponding subsection of each section in the draft review guideline as against KINS-G-001. The reviewers should confirm them during the review of power uprate applications.

With development of the draft review guideline for power uprate application, web-supported review process system has been devised and partly developed on the basis of web development framework, Apache Cocoon. This system will help out with the enhancement of efficiency in the license review process under IT environment.

REFERENCES

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