

# Improvements of the Periodic Safety Review (PSR) System for Operating Nuclear Power Plants

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## I. Introduction

A PSR (Periodic Safety Review) for operating nuclear power plants is a comprehensive safety review of all important aspects of safety, against current safety standards and practices, carried out at regular intervals of ten years. The PSR has been implemented by European States such as the UK, France, etc., and Japan in earlier times. IAEA has strongly recommended its implementation in accordance with the Convention on Nuclear Safety.

Korea became a member of the Convention on Nuclear Safety in September 1995, and formally adopted the PSR system through revision of Atomic Energy Act in January 2001[1,2]. Recently the PSR results of Kori Unit 1 and Wolsong Unit 1 was approved by the regulatory body[3]. And, safety review of the PSR results for Kori units 3 and 4 is in progress.

Korea has successfully carried out the implementation of the PSR system despite little experience. However, some findings were derived through the process of PSR implementations. For resolving these findings, the implementation cases of UK and France which have plenty of experiences in PSR were analyzed and the newly revised IAEA safety standards No. NS-G-2.10, "Periodic safety review of nuclear power plants" was reviewed. Some improvements of the PSR system were proposed, based on this analysis and review.

## II. Findings derived from results of PSR implementation

The findings derived through the process of PSR implementations are summarized as follows:

- 1) Some personnel of the operating organization participated in the PSRs do not fully understand its basic intent and purpose.
- 2) Detailed scope, depth and technical standards for PSR implementation are not completely set-up.
- 3) Actual process of PSR implementation is a little different from that specified by the Atomic Energy Act.

## III. Main revisions of the IAEA's PSR Safety Standards

The main changes of the IAEA's PSR Safety Standards are summarized below[4].

- 1) The starting point and the end point of a PSR are clearly defined and its duration also specified as follows:

- The starting point of a PSR is the time of the agreement between the operating organization and the regulatory body on the general scope and requirements for the PSR and its expected outcome.
  - The end point of a PSR is the approval by the regulatory body of an integrated program of corrective actions and/or safety improvements.
  - The duration for PSR implementation should not exceed three years.
- 2) A PSA should be undertaken for every plant, should be kept up to date, and should be utilized in subsequent PSRs.
  - 3) The safety factors of a PSR are structured into five subject areas plus global assessment, and previous 11 safety factors are reorganized into 14 ones. (Refer to table 1.)
- Actual physical condition of the nuclear power plants is subdivided into plant design and actual condition of SSCs.
  - Safety analysis is subdivided into 3 factors, deterministic safety analysis, probabilistic safety analysis, and hazard analysis.

Table 1. Revision of safety factors of the IAEA's PSR Safety Standards

Before revision of the IAEA's PSR Safety Standards	After revision of the IAEA's PSR Safety Standards
1. Actual condition of SSCs	I. The Plant 1. Plant design
2. Equipment qualification	2. Actual condition of systems, structures and components
3. Aging	3. Equipment qualification
4. Safety analysis	4. Aging
	II. Safety analysis
	5. Deterministic safety analysis
	6. Probabilistic safety analysis
	7. Hazard analysis
5. Safety performance	III. Performance and feedback of experience
	8. Safety performance
6. Use of experience from other NPPs and of research findings	9. Use of experience from other plants and of research findings
7. Organization	IV. Management
8. Procedures	10. Organization and administration
9. Human factors	11. Procedures
10. Emergency planning	12. Human factors
11. Radiological impact on environment	13. Emergency planning
	V. Environment
	14. Radiological impact on the environment
	VI. Global assessment

#### IV. Current status of PSR implementation system of major nations

The review results of the PSR implementation system of the UK, France and IAEA's PSR guide are summarized as follows, in terms of the findings derived from the implementation of the PSRs in Korea [5,6,7,8,9].

- 1) In the UK, France and IAEA's PSR Safety Standard, the implementation process of PSRs is largely divided into 4 stages which are the preparation for the PSR project, the conduct of the PSR reviews, the preparation of a program of corrective actions and/or safety improvements, and the implementation of a program of corrective actions or safety improvements.
- 2) The regulatory body's activities are carried out the PSR project. In the UK and France, the regulatory body review and approve a program of the PSR, the PSR results, and a program of corrective actions and/or safety improvements. Finally, the regulatory body confirms the licensee's corrective actions or safety improvements.

#### V. Improvements of the Korean PSR system

Based on the analysis of the PSR implementation cases of the U.K. and France and the review of main changes of the IAEA's PSR Safety Standard recently revised, the improvements to resolve the findings identified in the PSR implementations are summarized below:

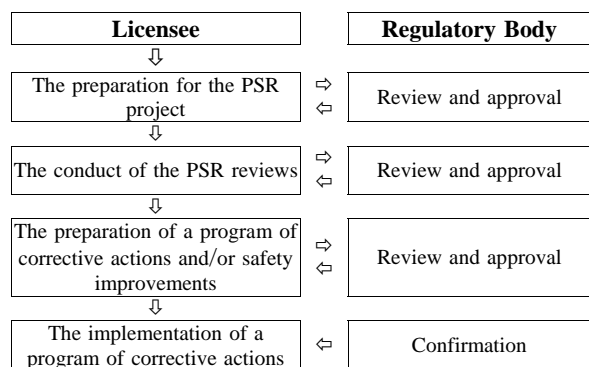
- 1) In order to maintain the consistency and effectiveness of PSR implementation, the basic purpose of PSR implementation should be specified in Enforcement Decree of the Act.
- 2) Detailed scope and depth of a PSR and technical standards for safety assessment should be agreed between the regulatory body and the licensee before work commences by inserting the approval prescription of the PSR implementation plan in the Atomic Energy Act.
- 3) The provisions on the approval (including review of Nuclear Safety Committee) regarding the PSR results and an integrated program of corrective actions and/or safety improvements should be specified in the Atomic Energy Act. (Refer to figure 1.)
- 4) Enforcement Regulations of the Act should be revised reflecting 14 safety factors of the IAEA's PSR Safety Standards recently revised.

#### VI. Conclusions

Regulatory body's safety reviews of the PSRs for Kori unit 1 and Wolsong unit 1 were successively finished and the implementation of a PSR gradually will be subject to all operating nuclear power plants hereafter. Especially, considering that the PSR will be repeatedly conducted for all nuclear power plants every ten years, it is significantly

meaningful to improve the PSR system reflecting lessons learned from experience of its implementations. Also, to improve the Korean PSR system reflecting recent revisions of the IAEA's PSR Safety Standards is in compliance with the trend of global standardization on nuclear safety, and will be able to display abroad our strong intention to attain nuclear safety of domestic nuclear power plants to the highest level. On the contrary, these proposed improvements are likely to appear as the reinforcement of regulation. Nevertheless, to settle firmly the basis of safety regulation through putting actual PSR process in the statutory form will greatly contribute to ensure the consistency, transparency, and effectiveness of the implementation of the PSR system.

Figure 1. Revised Process for PSR implementation of nuclear power plant



#### References

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- [2] The 27<sup>th</sup> Meeting Material of Nuclear Safety Committee (NSC), 2004.5.21
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