

## Domestic Regulation for Periodic Safety Review of Nuclear Power Plants

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### 1. Introduction

The increase in the operating years of a Nuclear Power Plants (NPPs) often raises public concern on their safety. In this regard, the comprehensive and systematic nuclear safety assessment is needed to verify that operating NPPs maintain high level of nuclear safety regardless of the operating year. The so-called Periodic Safety Review (PSR) has been carried out such safety assessment throughout its life, on a periodic basis.

In January 2001, the Atomic Energy Act and related regulations were amended to adopt the PSR institutional scheme from IAEA Nuclear Safety Guide 50-SG-O12. At that time the safety assessment was made to review the plant safety on 10 safety factors, such as aging management and emergency planning, where the safety factor indicates the important aspects of safety of an operating NPP to be addressed in the PSR. According to this legislation, the domestic utility, the KHNP has conducted the PSR for the operating NPP of 10 years coming up from operating license date, starting since May 2000[1]. Some revisions in the PSR rule were made to include the additional safety factors last year.

This paper introduces the current status of the PSR review and regulation, in particular new safety factors and updated technical regulation.

Comprehensive safety assessment for Korea Nuclear Power Plants have performed a reflecting design and procedure changes and considering the latest technology every 10 years [2]. This paper also examined the PSR system changes in Korea.

### 2. Periodic Safety Review

#### 2.1. Objective

A systematic safety reassessment of an operational nuclear power plant carried out at regular intervals to deal with the cumulative effects of plant ageing, modifications, operating experience and technical developments, and aimed at ensuring a high level of safety throughout the plant service life.

The objective of a PSR is to determine by means of a comprehensive assessment of an operational nuclear power plant, whether the plant is safe as judged by current safety standards and practices, and whether adequate arrangements are in place to maintain plant safety. This judgement in terms of current safety requirements does not imply that all those requirements have to be met[3].

#### 2.2. Time for PSR

Assessment base date is every 10 years from the date on operating license of the reactor facility.

Base date of subject to assess is the end of the year of launch for review report and the operator of nuclear power reactor have document of operating and maintenance by that date.

Base date on technical standard is six months in advance of the date of submitting due date on assessment report.

The review report shall be submitted within one year and six months from such review base date.

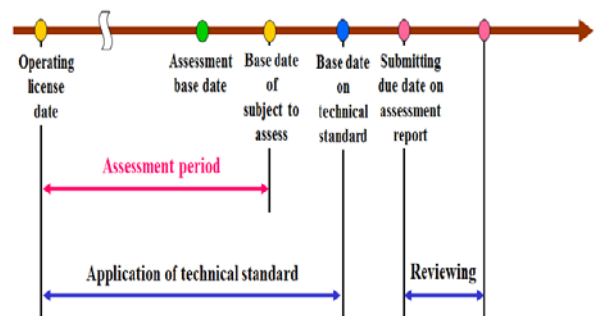


Fig. 1. PSR Time

#### 2.3. Regulation system change

Table I: Safety Factor change of PSR

Before	Now
Actual Condition of SSCs	Plant Design
	Actual Status of Safety-Related SSCs
Nuclear Safety Analysis	Deterministic Safety Analysis
	Probabilistic Safety Analysis
	Hazard Analysis
Organization and Administration	Organization, Management System, and Safety Culture

Nuclear Safety Commission decided on the basic frame for PSR on December 21, 1999. MOST issued 'Implementing Guidelines for PSR on May 30, 2000, after deliberation at the Nuclear Safety Commission on May 25, 2000. KHNP submitted a PSR Implementing

Plan for Kori unit 1 on May 30, 2000. In January 2001, the Atomic Energy Act was amended to stipulate the PSR provision. The enforcement decree and enforcement regulations of the nuclear safety act was revised to reflect 14 safety factor including PSA, external hazard analysis, and plant design by recently revision of IAEA's PSR Safety Guide SSG-25 in November 24, 2014.

Enforcement decree and enforcement regulations of the Nuclear Safety Act Enforcement revised to reflect 14 safety factors of the IAEA's PSR Safety Standards recently revised.

### 2.4. Legal framework

Legislative background is in nuclear safety act article 23. Interval, scope, method & standard, review period are enforcement decree of the nuclear safety act article from 36 to 39. Objectives and technical requirements of PSR are in the enforcement regulation of the nuclear safety act article 20, 21. Industrial codes and standards are to use detailed review requirements.

## 3. Applicable Regulation

### 3.1. Assessment method

The separate review of the matters set forth in each design of nuclear reactor facilities and actual status of safety-related SSCs and the combined review of matters related to each other shall be conducted. The matters concerning the quality assurance and the radiation protection shall be included (if any) in the review of the matters set forth in each design of nuclear reactor facilities and actual status of safety-related SSCs. The comprehensive safety of nuclear reactor facility shall be assessed taking into account the review of the matters set forth each design of nuclear reactor facilities and actual status of safety-related SSCs as well as safety measures resulting from such review. The safety of the nuclear reactor facility shall be assessed with respect to the technical standard effective at the time of the assessment[5].

### 3.2. The current technical standards

The following paragraphs of article 20 enforcement regulation of the nuclear safety act shall be considered the current technical standards.

- Matters regarding design of reactor facilities
- Information concerning deterministic safety analysis
- Information concerning risk assessment

The current technical standards may define the technical standards applied at the latest operating nuclear reactor facility.

## 4. PSR Implementation

### 4.1. Implementation Status

Korean utility has conducted PSR on all NPPs that have been operated for more than 10 years according to related regulations. The PSR implementation schedule and nuclear safety improvement items are shown in the figure 2. PSRs for eleven sets of 18 NPPs have been completed and PSRs for two sets of 4 NPPs are going to review. There were no PSRs for continued operation in the figure 2. The results came up 229 nuclear safety improvement items. And its implementation have been completed 165 of them.

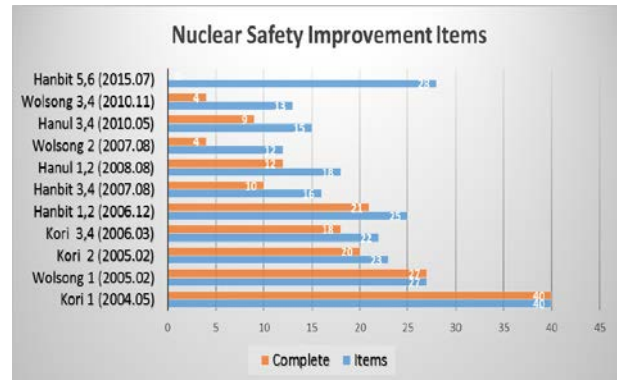


Fig. 2. Nuclear safety improvement items.

### 4.2. PSR effect

Figure 3 shows PSR conceptual diagram. Operating license technical standard has remained because of applied standard for the operation of the NPP. As time passes, the effective technical standard may increase because of added technical standard for operating and design changes. PSR base day is assessment base date to write the PSR. As increases operating years of NPP, its safety margin is decreased. But NPP's safety margin may be regained through safety improvement items of PSR.

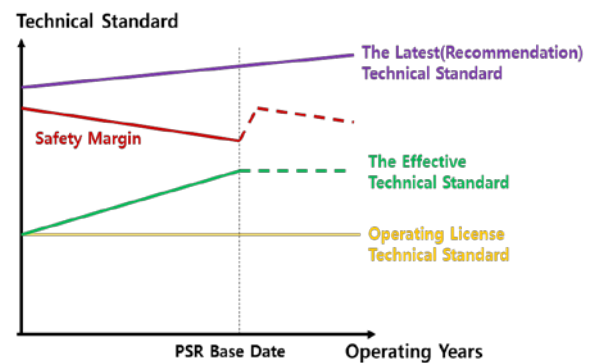


Fig. 3. PSR conceptual diagram.

## **5. Conclusions**

As of July 2015, reviews for PSR of 18 units have been completed, with 229 nuclear safety improvement items. And implementation have been completed for 165 of them. PSR system has been confirmed that it has contributed to improvement of plant safety. In addition, this paper examined the PSR system change in Korea. The composition of PSR review guide shall need to be changed according to reflect the changed enforcement decree and changed enforcement regulations of the nuclear safety act recently.

## **REFERENCES**

- [1] Tae Eun Jin, Heui Young Roh, Tae Ryong Kim and Young Sheop Park, Current Status and Prospect for Periodic Safety Review of Aging Nuclear Power Plants in Korea Nuclear Engineering and Technology, Vol.41 No.4 pp.545-548, May 2009.
- [2] Seok-Won Hwang, Ho-Jun Jeon, Jang-Hwan Na, Technical Issues and Proposes on the Legislation of Probabilistic Safety Assessment in Periodic Safety Review, Transactions of the Korean Nuclear Society Spring Meeting, May 2015.
- [3] IAEA Safety Series NO. 50-SG-012, Periodic Safety Review of Operational Nuclear Power Plants, 1994.
- [4] IAEA Safety Series NO. SSG-25, Periodic Safety Review for Nuclear Power Plants, 2013.
- [5] Nuclear Safety Act, Enforcement Decree of the Act, Enforcement Regulations of the Act.