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# Technical Issues and Proposes on the Legislation of Probabilistic Safety Assessment in Periodic Safety Review

Seok-Won Hwang*, Ho-Jun Jeon, Jang-Hwan Na
*Korea Hydro & Nuclear Power Co., Ltd. 70, 1312-gil, Yuseong-daero, Yuseong-gu, Daejeon, Korea, 305-343*
swhwang1221@khnp.co.kr

## 1. Introduction

Korean Nuclear Power Plants have performed a comprehensive safety assessment reflecting design and procedure changes and using the latest technology every 10 years. In Korea, safety factors of PSR are revised to 14 by revision of IAEA Safety Guidelines in 2003. In the revised safety guidelines, safety analysis field was subdivided into deterministic safety analysis, PSA (Probabilistic safety analysis), and hazard analysis. The purpose to examine PSA as a safety factor on PSR is to make sure that PSA results and assumptions reflect the latest state of NPPs, validate the level of computer codes and analytical models, and evaluate the adequacy of PSA instructions. In addition, its purpose is to derive the plant design change, operating experience of other plants and safety enhancement items as well.

In Korea, PSA is introduced as a new factor. Thus, the overall guideline development and long-term implementation strategy are needed. Today in Korea, full-power PSA model revision and low-power and shutdown (LPSD) PSA model development is being performed as a part of the post Fukushima action items for operating plants. The scope of the full-power PSA is internal/external level 1, 2 PSA. But in case of fire PSA, the scope is level 1 PSA using new method, NUREG/CR-6850[1]. In case of LPSD PSA, level 1 PSA for all operating plants, and level 2 PSA for 2 demonstration plants are under development. The result of the LPSD PSA will be used as major input data for plant specific SAMG (Severe Accident Management Guideline). The scope of PSA currently being developed in Korea cannot fulfill “All Mode, All Scope” requirements recommended in the IAEA Safety Guidelines. Besides the legislation of PSA, step-by-step development strategy for non-performed scopes such as level 3 PSA and new fire PSA is one of the urgent issues in Korea. This paper suggests technical issues and development strategies for each PSA technical elements.

## 2. Technical Issues for PSA Legislation

This paragraph, describes the technical issues about PSA presented in IAEA PSR Guideline (SSG-25) [2]. Those presented IAEA SSG-25 do~~es~~ not mean the implementation of PSA itself, but review whether PSA model meets the purpose of PSR or not. Also it is important to establish preferentially detailed guideline and clear criteria of analysis scope and technology level in long-term strategy for PSA as a new factor introduced. Major technical issues for newly introduced PSA as a new factor in PSR are as follows.

First, PSA model must reflect the latest state of the plant. In Korea, full-power level 1, 2 PSA was performed in 2007 following Severe Accident Policy. After Fukushima event, safety related equipment such as Containment Filtered Vent System (CFVS), Passive Autocatalytic Recombiners (PAR) is installed, and the reflection of this equipment into PSA models is needed. In Korea, full-power PSA model for operating plant revision and low-power shutdown PSA model development are currently performing, but this equipment installed recently is not reflected yet. In near term, it is necessary to apply this equipment in PSA models in conjunction with PSR revision cycle.

Second, PSA results must show that the risk of plant is sufficiently low, and require confirmation of risk balance between virtual initiating events and operation modes. All national nuclear power plants satisfy the safety goal of CDF and LERF as results of the full-power internal event PSA. However, some plants may not be able to satisfy safety goal when considering LPSD and external event in PSA. Its major cause is due to the increase of PSA scope. Method to utilize cumulative concept of PSA results in PSR is required cautious approach.

Third issue is about PSA scope. For Korean plants, only internal level 1, 2 PSA and some external PSA had been performed. Especially, external PSAs are not revised since the initial development, there is no level 3 PSA development experience for operating plants. Therefore, concerns about technical level, establishment of phased development strategy, and development of detailed guidelines for PSA scope are necessary.

Lastly, PSA revision carrying out in the proper scope and within the right time frame before next PSR is needed Current PSA revision is performed depending on plant operating history, large design improvement, and introduction of new technologies. Revision cycle by the regulation of PSA in PSR is 10 years basically. But PSA revision criteria, guidelines and schedules should be reviewed carefully for compliance with the PSA basic purpose.

## 3. Resolution alternatives and implementation strategy

In order to resolve the issues discussed in the previous section, this paper proposes two alternatives