

## Sensitivity Analysis of Core Damage Frequency for Advanced Power Reactor Plus

H. R. Moon<sup>a\*</sup>, S.H. Kang<sup>a</sup>, Y.S. Park<sup>a</sup>

*KHNP, Central Research Institute, Yuseong-daero 1312-70, Yuseong-Gu, Daejeon, Korea, 305-343*

*\*Corresponding author: moonn@khnp.co.kr*

### 1. Introduction

The main design features of advanced power reactor plus (APR+) is shown in Figure 1. The electrical design characteristic of APR+ is that it is designed using N+2 concept. APR+ emergency power system has four EDGs and is designed with four-train that is electrically and mechanically completely independent.

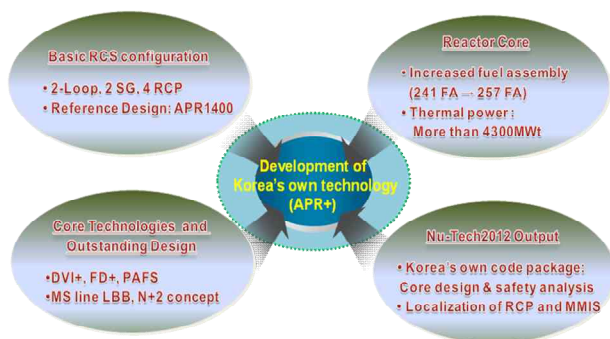


Fig. 1. Design features of APR+

Another major design feature is passive auxiliary feedwater system (PAFS), completely substitute active auxiliary feedwater system [1]. This system can supply cooling water using natural forces such as gravity.

### 2. Probabilistic Safety Assessment

In case of full power internal events, core damage frequency (CDF)'s goal for the APR+ standard design is less than  $1.0E-6$ /yr. Although probabilistic safety assessment (PSA) for APR+ is under evaluation, the result of PSA is expected to satisfy the goal of CDF.

Adopting of advanced safety features like four-train safety system and PAFS, the risk of APR+ is significantly reduced [2].

#### 2.1 Results

The estimated core damage frequency induced by internal events during full power is under  $1.0E-6$ /yr. Among the initial events, the total loss of components water (21.1%), small LOCA (20.4%), station black out (13.8%) and the loss of offsite power (8.6%) dominate

the core damage frequency. The total CDF of those four events accounts for approximately 63.9% of the total CDF. The relative contribution (percent of total) of the various internal events to the total CDF is illustrated in Fig. 2

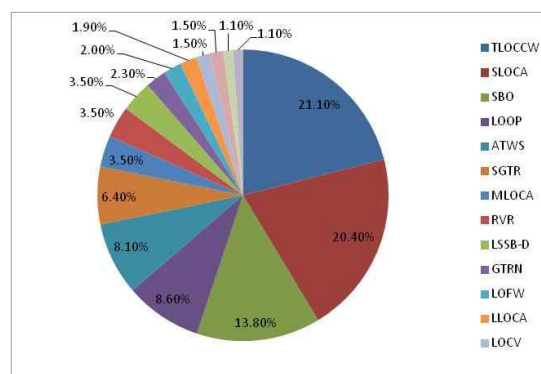


Fig. 2. Contributions to CDF

#### 2.2 Sensitivity Analysis

In Table I, the core damage frequency (CDF) is compared to APR+ and reference plant. In case of adopting four EDG (Case 1), CDF of APR+ is decreased to 16% than reference plant. In case of considering both Case 1 and PAFS (Case 2), CDF of APR+ is decreased to 26%.

Table I: Comparison of core damage frequency to APR+ and reference plant

Case	APR+ design feature	Improving rate of CDF for APR+
1	4 EDG	-16%
2	Case 1 + PAFS	-26%

### 3. Conclusions

Consequently, the CDF of APR+ was evaluated to be less than  $1.0E-6$ /yr. The CDF sensitivity analysis was evaluated to APR+ and reference plant. The reliability of emergency power supply for APR+ was improved, because of adopting four EDGs instead of two.

## **REFERENCES**

- [1] KHNP Central Research Institute, Evaluation Report on the Safety Analysis for the APR+ Development, 2011.
- [2] H. R. Moon, B. L. Park, Y. S. Park, "Sensitivity Analysis for Using Gas Turbine Generator to Provide Alternate Alternating Current in APR+", Trans. of the KSME(A), Vol. 36, No. 1, pp. 101-102, 2012.
- [3] KHNP Central Research Institute, APR+ Probabilistic Safety Assessment Technical Report, Vol. I, 2011.