

## A sensitivity study on Baffle/Reflector effect for the cycle length of SMART

Bae Seong Man<sup>a\*</sup>, Koh Byung Marn<sup>b</sup>,

<sup>a</sup>Korea Electric Power Research Institute, 103-16 Munji-Dong, Yuseong-Gu, Daejeon, Korea

<sup>b</sup>USERS, 422 Room S-MECA, I3-6-3BL, Daedeok Technovalley, Gwanpyeong-Dong, Yuseong-Gu, Daejeon, Korea

\*Corresponding author: [smbae@kepri.re.kr](mailto:smbae@kepri.re.kr)

### 1. Introduction

A sensitivity analysis of baffle/reflector thickness effect was performed for cycle length of SMART (System-Integrated Modular Advanced Reactor) by using Westinghouse APA(ALPHA/PHOENIX-P/ANC) code package. The results were then compared to those of MASTER calculation performed by KAERI, the original SMART core designer.

### 2. Design Specification

The specification of SMART core was provided by KAERI except baffle/reflector size. For the other design spec., which were not provided, the default value of the APA package and RFA(Robust Fuel Assembly) were used.

#### 2.1 Core<sup>[1]</sup>

The reactor core is designed to generate 660MWth at hot full power condition with composing of 69 fuel assemblies and 32 control element assemblies. The system pressure and core inlet temperature are 2,175psia and 558.86F respectively. For more details spec. refer to reference.

#### 2.2 Fuel Assembly<sup>[1, 2]</sup>

The active length of fuel assembly is 300cm. It is comprised of 17x17 fuel rods and 25 guide tubes. The burnable poison material is Gd<sub>2</sub>O<sub>3</sub>-UO<sub>2</sub> with 1.8 w/o of U.

There are 2 types of fuel rod in assembly. The 2.20 and 4.52 w/o of fuel rods are used for the first cycle, And only 4.42 w/o of fuel rod is used for the other cycles.

#### 2.3 Burnable Absorber (BA)<sup>[1]</sup>

Two types of BA are used in the first cycle. One type of BA has 15cm of upper & lower axial cutback, another has 45cm of upper axial cutback and 15cm of lower axial cutback. For the remaining cycles, BA of 7.5cm of upper & lower axial cutback is used.

### 3. Calculation & Result

#### 3.1 Depletion

The each cycle of SMART has been depleted at HFP condition by using ANC 3-D core model with default baffle/reflector thickness of 1.5 inch. The results were compared to those of MASTER calculation. See Table I.

Table I: Cycle length of ANC and MASTER

Cycle	ANC		MASTER <sup>[1]</sup>	
	End BU (MWD/MTU)	CBC (ppm)	End BU (MWD/MTU)	CBC (ppm)
1	19700	10	21507	12
2	19550	10	20320	11
3	19800	10	21030	11
4	19630	10	20827	12
5	19680	10	20853	14

Each cycle length of ANC is shorter than that of MASTER. Also radial power distribution of ANC showed that the center region power was much higher than peripheral region power (See Fig. I). That is because of baffle/reflector effect.

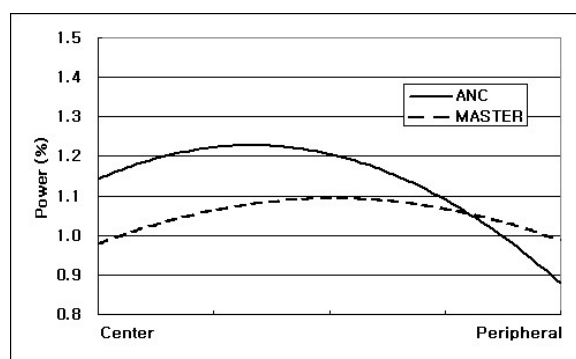


Fig. I: The Radial Power Distribution at BOC, First Cycle of ANC & MASTER.

#### 3.2 Baffle/Reflector Analysis

To analyze sensitivity of baffle/reflector effect, first, 5 inch of baffle thickness was applied. And the results showed similar cycle length and radial power distribution with MASTER calculation (See Table II & Fig. II). After this, baffle thickness was changed from 2cm to 28cm by 1cm increment. Fig. III show cycle length changes for increasing of baffle/reflector thickness.

Table II: Cycle length of ANC and MASTER (Baffle thickness is 5 inch)

Cycle	ANC		MASTER <sup>[1]</sup>	
	End BU (MWD/MTU)	CBC (ppm)	End BU (MWD/MTU)	CBC (ppm)
1	21620	10	21507	12
2	21130	10	20320	11
3	21480	10	21030	11
4	21360	10	20827	12
5	21330	10	20853	14

[5] Westinghouse Electric Company, PHOENIX-P User Manual.

[6] Westinghouse Electric Company, ANC User Manual.

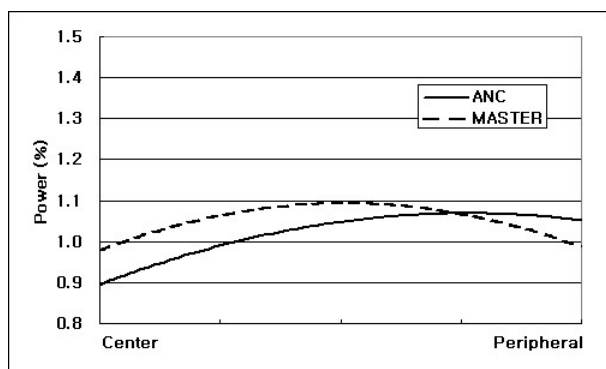


Fig. II: The Radial Power Distribution at BOC, First Cycle of ANC & MASTER. MASTER (Baffle thickness is 5 inch)

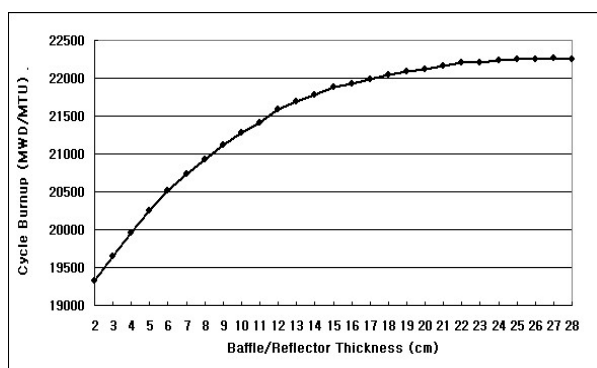


Fig. III: Cycle Length vs. Baffle/Reflector thickness

#### 4. Conclusions

In this study, the effect of baffle/reflector thickness to the cycle length and radial power distribution of SMART was evaluated by using Westinghouse APA code package. The results can be referred to SMART core design.

#### REFERENCES

- [1] Korea Atomic Energy Research Institute, The Core Design Spec. for SMAT PPS Project, 2007
- [2] Korea Hydro & Nuclear Power, The preliminary Assembly Design Data (17X17 RFA).
- [3] Westinghouse Electric Company, METCOM.
- [4] Westinghouse Electric Company, ALPHA User Manual.