A Study on the Regulatory Requirement of Event Frequency Change By Facility Improvement and Modification in Wolsong unit 1

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1. Introduction

As a process of periodic safety review(PSR)[1], the safety of Wolsong 1 nuclear power plant(NPP) has been enhanced by many facility improvement and modification. The improvement and modification causes the frequency changes of events including initiating events(IEs), and it is required to check whether the event frequency changes are still within the regulation limit.

This paper presents what is the regulatory requirements and how the changed event frequency satisfies the regulatory requirements. However, only the interim results are shown in this paper.

2. Methods and Results

2.1 The effect of the facility improvement

The first of all, it should be derived how much the facility improvement and modification affects the frequencies of events. Important IEs affected by the facility improvement and modification are shown in Table 1. For example, in Table 1, the pressure tube replacement would affects the following IEs; IE-PTR, IE-PCTR, IE-SL. However, since many IEs use CANDU generic data, it is not easy to reflect the facility improvement effect. Also, very detailed analysis data are required to reflect the facility improvement effect on the IEs based on the plant specific data.

2.2 Regulatory Requirement

The regulatory requirement of CANDU is shown in Table 2-3. Postulated events are categorized as 5 classes depending on the exposure dose in Table 2. Since the higher class event causes more serious damage, the higher class event should be more safely protected and mitigated. Thus, the occurrence frequency of the higher class event should be much smaller. This concept is shown in Table 3.

FSAR of Wolsong 1

In Wolsong 2/3/4 FSAR, all postulated events were reviewed, and also it was verified whether the results of the events do not exceed the acceptance level as shown in Table 2. However, detailed analysis does not exist in Wolsong 1 FSAR. Although the facility improvement and modification would affect the plant safety, it seems that the current facility improvement does not deteriorate the Wolsong 1 safety.

IEs of Wolsong 1

In the Wolsong 2/3/4 PSA report, it is verified whether the frequency of each IE exceed the acceptable level assigned to the C-6 event class. If Wolsong 2/3/4 C-6 frequency range is used, several IEs of Wolsong 1 exceed the acceptable range as shown in Table 4. Thus, new C-6 range should be prepared for the IEs.

3. Conclusions

The facility improvement and modification to enhance the safety of Wolsong unit 1 should be reflected on the FSAR and PSA of Wolsong unit 1. Regulatory requirement was reviewed in view of FSAR and PSA. If the living PSA of Wolsong unit 1 is being well performed, the effect of the facility improvement and modification would be easily reflected on the living PSA. However, the current PSA of Wolsong unit 1 is not so easy to be updated in response to the facility improvement and modification. Acceptable C-6 frequencies for the several IEs should be renewed.

REFERENCES

[1] IAEA, "*Periodic Safety Review of Operational Nuclear Power Plants, Safety Series No. 50-SG-012, A Safety Guide*", Vienna, 1994.

[2] "Requirements for the Safety Analysis of CANDU Nuclear Power Plant", AECB Consultative Document C-6, 1980 June.

[3] Darlington Board Member Document, 1989 January. (Also AECB Presentatin in CANDU Technology Symposium, Seoul, Korea, 1991 May.)

Table 1. IEs affected by the facility improvement

No	Facility Improvement and Modification	Effect on I.E
1	pressure tube replaced	IE-PTR, IE-PCTR, IE-SL
2	control computer replaced	IE-DCC
3	old items replaced in the main and the 2nd control room	IE-T
4	old relay module replaced in the safety related systems	IE-T
5	13.8kV/4.16kV switch gear breaker replaced	IE-CL4

Table 2. AECB Consultative Document C-6[2]

Postulated Event class	Reference Dose Limit (mSv)	
	Whole Body	Thyroid
1	0.5	5
2	5	50
3	30	300
4	100	1000
5	250	2500

Table 3. Event Frequency for C-6 Event Class[3]

C-6 Event Class	Freq. range (per RY)
1	$10^{-2} \le f < 1$
2	$10^{-3} \le f < 10^{-2}$
3	$10^{-4} \le f < 10^{-3}$
4	$10^{-5} \le f < 10^{-4}$
5	$f < 10^{-5}$

Table 4. Event Frequency for C-6 Event Class

Event Name	Frequency (Events/yr)	Wolsong C-6 Freq. (/yr)	Deriving Method
IE-IA	2.82E-02	$0.1 < f < 0.3$	FT Modeling
IE-MCTL	2.57E-03	$10^{-2} < f < 0.1$	FT Modeling
IE-FWPV	2.61E-01	$10^{-3} < f < 10^{-2}$	
IE-FWB2	8.60E-05	$10^{-3} < f < 10^{-2}$	
IE-HPFP	5.53E-02	$f < 10^{-3}$	Wolsong Experience
IE-LRVO	4.27E-02	$f < 10^{-3}$	FT Modeling