

## A Pilot Study on Applying Risk Informed Application Option 2 to Six Systems in UCN 3

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### 1. Introduction

To reduce the unnecessary burden of a regulation, NRC prepared three options for the risk informed regulatory framework known as Option 1, Option 2 and Option 3[1]. In Option 2, all safety related Structure, System and Components (SSCs) and non-safety related SSCs are evaluated from a safety point of view, and the low safety significant SSCs belonging to the safety related group are called 'Risk Informed Safety Class (RISC) - 3' SSCs. The 'RISC-3' SSCs can be exempted from the special treatment requirements such as a seismic and environmental requirement, of 10 CFR 50.

Two years ago, a paper[2] was published which described the Option 2 method applied to the high pressure safety injection system (HPSI) and the essential service water system (ESW) of UCN 3. However, this paper describes the results when Option 2 is applied to the other 4 systems such as a low pressure safety injection system(LPSI), safety depressurization system(SDS), instrument air system(IAS), safety injection tank(SIT). First of all, this paper includes the results from the importance analysis in view of a Fire PSA and Level 2 PSA.

### 2. Methods and Results

SSCs of 6 systems of UCN 3 were categorized by the NEI Option 2 methodology [3,4] except for the calculating component RAW (Risk Achievement Worth)[5]. The detailed method used in the Option 2 applied to UCN 3 is described in the previous work[2].

In the categorization of the components, a component's contributions to a fire PSA, to a Level 2 PSA as well as to an internal PSA was considered by the importance analysis. However, in the previous work[2], the importance of a component in view of a fire PSA or Level 2 PSA, could not be quantitatively determined but only qualitatively determined.

Although the component's importance is considered in view of a Fire PSA or Level 2 PSA, only two components in HPSI are additionally added as the risk significant components in view of a Level 2 PSA.

#### 2.1 Evaluation of HPSI System

As shown in Table 1, there are 307 items in the HPSI among which 138 items are safety significant ones, and 169 items are low safety significant ones. Two valves (v659, v660) are added as risk significant items as result of an importance measure evaluation in view of a LERF.

Table 1. HPSI System Components of UCN 3

	Safety-related	Non-Safety-related	Total
Safety Significant	118	20	138
Low Safety Significant	159	10	169
Total	277	30	307

#### 2.2 Evaluation of the ESW System

As shown in Table 2, there are 285 items in the ESW among which 121 items are safety significant ones, and 164 items are low safety significant ones. Although an importance measure assessment was performed in view of a Fire PSA and LERF, no items were added into the safety significant items.

Table 2. ESW System Components of UCN 3

	Safety-related	Non-Safety-related	Total
Safety Significant	117	4	121
Low Safety Significant	121	43	164
Total	238	47	285

#### 2.3 Evaluation of the LPSI System

As shown in Table 3, 39 items are safety significant, and 109 items are low safety significant. Although an importance measure assessment was performed in view of a Fire PSA and LERF, no items were added into the safety significant items.

Table 3. LPSI System Components of UCN 3

	Safety-related	Non-Safety-related
Safety Significant	39	0
Low Safety Significant	109	0

#### 2.4 Evaluation of the SIT System

As shown in Table 4, all 341 items are low safety significant. Although an importance measure assessment was performed in view of a Fire PSA and LERF, no items were added into the safety significant items.

Table 4. SIT System Components of UCN 3

	Safety-related	Non-Safety-related
Safety Significant	0	0
Low Safety Significant	341	0

#### 2.5 Evaluation of the IA System

As shown in Table 5, all 821 items are low safety significant. Although an importance measure assessment was performed in view of a Fire PSA and LERF, no items were added into the safety significant items.

Table 5. IA System Components of UCN 3

	Safety-related	Non-Safety-related
Safety Significant	0	0
Low Safety Significant	217	604

#### 2.6 Evaluation of the SDS

As shown in Table 6, all 28 items are low safety significant. Although an importance measure assessment was performed in view of a Fire PSA and LERF, no items were added into the safety significant items.

Table 6. SDS Components of UCN 3

	Safety-related	Non-Safety-related
Safety Significant	0	0
Low Safety Significant	28	0

### 3. Cost/Benefit Analysis

If Option2 is applied to UCN 3, then the net benefit will be \$366,683~ \$367,383 for only SDS as

shown in Table 7. This benefit comes from the price differences between the safety-related and non safety-related items as shown in Table 8. It is assumed that the remaining lifetime of UCN 3 is 30 years.

Table 7. Net Benefit for SDS

Benefit by Using Non-Safety-related Items(\$)	Cost of Performing Option 2	Net Benefit(\$)
368,063	700~1,400	366,683~367,383

Table 8. SDS System Components of UCN 3

Component	Safety-related Price(\$)	Non-Safety-related Price(\$)
3" Gate Valve	7,000	130
6" Gate Valve	15,000	600
Pressure Indicator	9,000	4,000
Temp. Indicator	3,000	1,500

### 4. Conclusions

More than half of the safety-related equipment could be excluded from the special treatment requirements. Although Option 2 was applied to only six systems of UCN 3, the basic concept of Option 2 could be understood so that Option 2 could be easily applied to all the systems of UCN 3. The importance measure assessment in view of a fire PSA or LERF was performed easily since a method with which one top model in view of a fire PSA or LERF can be built and analyzed has been developed.

#### Acknowledgement

This project has been carried out under the Nuclear R&D Program by MOST. Authors thank Mr. Sangjun Lee and Sangduk Park in UCN 3 for their help.

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