A Development of Interfacing System between Level 2 and Level 3 PSA for Integrated Analysis of Full Scope PSA

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1. Introduction

An integrated assessment of full scope and entire level PSA including level 1, 2 and 3 PSA is an essential issue of the current PSA implementation for operating and developing nuclear power plants. In order to perform an integrated assessment under restricted resources for PSA, integrated and automation assessment tools are essentially required. For this purpose, KAERI is in the development of an integrated PSA assessment software package named by OCEANS. As a part of OCEANS, an interfacing system linked between level 2 and level 3 PSA was developed [1].

The purpose of this paper is to introduce an overview of the currently developing interfacing system with a concept of link method. This interfacing system was designed as a subsidiary tool of SARA program which is a supporting utility of level 3 PSA with Microsoft Window based- program.

2. Overview of SARA Program

Currently, the essential function to implement an efficient way of level 3 PSA is to provide adequate supporting programs which help analyzers to work conveniently under their working environment such as a personal computer.

SARA program developed by KAERI was designed to support level 3 PSA, which has following functions (Fig. 1).

- Project management
- Control of input files of a level 3 code
- Control of level 3 code execution
- Output management
- Subsidiary tools to process the input data of a level 3 PSA including processing level 2 PSA results

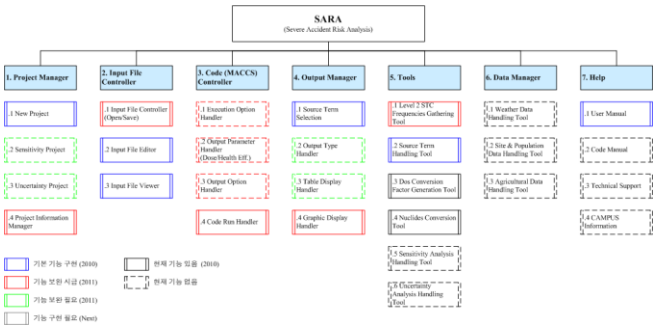

Fig.1. Main functions of SARA Program

The modularity technique was adopted as an essential approach to develop SARA program, so the most parts of including functions were design according to this method. Currently, while the major parts of SARA program were developed, but the additional functions will be developed. Fig. 2 shows a main screen of SARA program. Most of all, the project explorer as a convenient way of the management of each analysis case was adopted in SARA program.

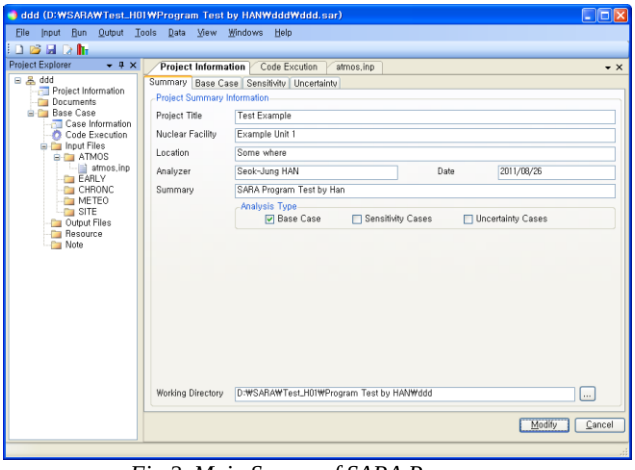

Fig.2. Main Screen of SARA Program

The interfacing system of level 2 and level 3 PSA as a subsidiary tool of SARA program was designed to process the results of a level 2 PSA.

3. Interfacing Method of Level 2 and Level 3 PSA

In order to perform a level 3 PSA, the essential information of level 2 PSA, i.e., accident sequences information and radiological source term information, should be provided as a basic information. Thus, the essential interfacing method of level 2 and level 3 PSA were to assign these informations between the arranged programs of level 2 and level 3 PSA.

Because these two informations depend on the PSA approaches and relevant procedures, the required informations have a large degree of variance between individual PSAs. In this study, the interfacing method was designed by a specified procedure of level 2 PSA such as

an approach to current domestic level 2 PSA [2] and a level 3 PSA approach by using MACCS code [3].

In order to perform a level 3 PSA by using MACCS code, the level 2 PSA information should be specified by the requirement of MACCS code as shown in Table 1.

Table 1. Parameters liked between level 2 and level 3 PSA

Linked Data Source	Parameters	Unit
Source Term Release Category	Frequency	/yr
Core Inventory	Nuclide Inventory	Bq
Release Fraction for each Source Term Group	Nuclide Group	
	Nuclide Elements	
	Release Fractions	
Related Parameters	Release Height	m
	Sensible Heat	Watts
	Start Time	sec
	Duration	sec
	Alarm Time	sec

Whereas the level 2 PSA information in the domestic approach developed by KAERI was provided by the CONPAS [4] and MAAP codes [5].

As considering these aspects, the data process to link level 2 PSA data provided by CONPAS and MAAP codes to level 3 PSA input data was designed as shown in Fig. 3.

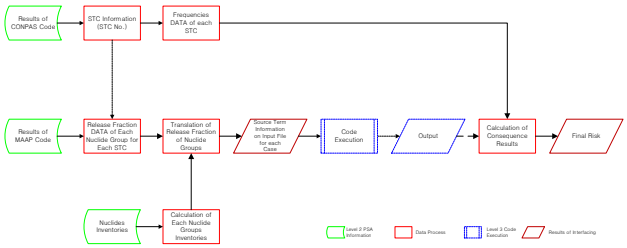

Fig. 3. Data flow to link between level 2 and level 3 PSA

Firstly, analysis cases in a level 3 PSA were classified by the source term release categories (STC) as the considered accident sequences and related STC frequencies were used in the final risk estimation for each analysis case.

Secondly, the source term information was chosen by the MAAP code simulation results for each STC. This data process has some complexness because the difference of considering nuclides groups between MAAP and MACCS code. The source term release fractions of MAAP code nuclide groups were translated as the release fractions of MACCS code nuclide groups by mass balance of each nuclide inventory. For this translation, the initial nuclide inventories were used to calculate each release fraction.

Last process in this method was to write the translated data in this data process on the input file of MACCS code. By the code execution controller in SARA program, a case of level 3 PSA will be obtained by the revised data.

Finally, the consequence risk results were calculated by the obtained execution results combined with a given scenario frequency.

4. Development of Interfacing System

A concept of the link method as a including tool of SARA program was developed. Fig. 4 shows a screen shot of the developed interfacing process.

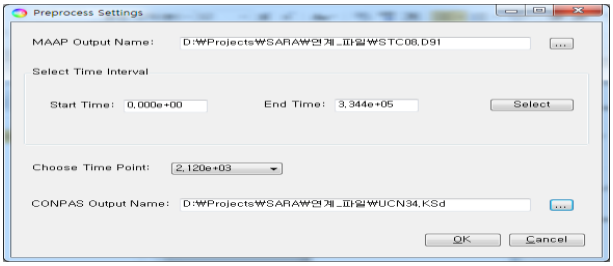

Fig. 4. Screen shot of the developed interfacing process.

The developed system will be finalized by fixing known-bugs and the verification and validation process.

4. Concluding Remark

An overview of the currently developing interfacing system of level 2 and level 3 PSA with the proposed concept of link method according to a specific PSA approach was introduced. This interfacing system was designed as a subsidiary tool of SARA program.

This study showed that the integrated approach to link between level 2 and level 3 PSA could be realized by the computerized methods. The obtained results will be utilized in the integrated software package of PSA developed by KAREI (OCEANS).

ACKNOWLEDGEMENT

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