

Development of Reactor Trip Database Management System

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1. Introduction

The generic reference of initiating event frequency for domestic PSAs has been used by “Advanced Light Water Reactor (ALWR) Utility Requirements Document (URD)” issued by EPRI. The needs for specific database of the initiating event for domestic nuclear power plants arise as their operating experience has accumulated. Generally, the data for initiating event are collected by the analysis of unplanned reactor scram. Therefore, a database program for systemic collection of reactor trip event was present for the efficient management of those data. Recently, NUREG-5750 was published and provides state-of-art initiating event data as well as new manner in data classification. The specific database developed in this work is determined to follow the basic structure of NUREG-5750. The approach presented in this work was to: (1) review current data structure and state, (2) establish a proper DB structure, (3) analyse new generic data with the specific data which are collected in the developed DB. Particularly, the developed DB for initiating events would be incorporated into the overall DB project which includes all kinds of components data used in PSA.

2. Methods and Results

The initiating event DB named Reactor Trip Database Management System consists of four main modules as shown in Fig.1, reactor trip data, generalized data/initial event, project-wise initial event analysis, and reactor trip related codes.

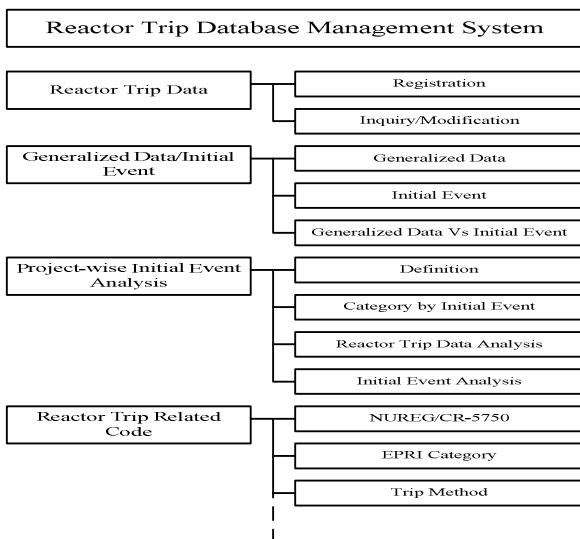


Fig. 1. Reactor Trip Database Management System

2.1 Reactor Trip Data Module

In this module, first user determines the target plant for the analysis. The detailed information of trip history of the plant is provided in this module. Original raw data or information associated with trip events established in Enterprise Resource Planning (ERP) system. The analyst searches the detailed information, i.e., occurred time, duration, type of scram, conditions after trip, failure cause, failure component and corresponding action, and then the analyst customizes events according to the data table provided in this module, which follows NUREG-5750.

2.2 Generalized Data/Initial Event Analysis Module

This module provides generic data of NUREG-5750. The customized reactor trip events in the above are listed by NUREG-5750 inquires as shown in table 1.

Table 1: Initial Event Classification

NUREG/CR-5750	Initial Event in K34
B1	11 TP-Loss of Offsite Power
B1	12 SB1- Station Blackout (EDG fail to operate)
B1	13 SB2-Station Blackout (EDG fail to run)
C1	23 LOKVA
C1	24 LOKVB
C2	00 #N/A
C3	21 LODCA
C3	22 LODCB
D1	25 LOIA
E1	17 TC1-1Loss of CCWS
E1	18 TC2-1Loss of NSCWS
E2	00 #N/A
F1	04 TR-SGTR
G1	07 T1-General Transient
G2	02 S1- Medium LOCA
G3	03 S2-Small LOCA
G4	03 S2- Small LOCA
G5	02 S1- Medium LOCA
G6	02 S1-Medium LOCA
G7	01 A-Large LOCA
G8	03 S2-Small LOCA

Main issues in this module are the way of mapping from real reactor trip event to NUREG-5750 inquiries. Because the real events and NUREG inquiries do not correspond each other completely, analysts or experts

subjective judgments should be required when one event associates with several NUREG inquiry items.

The comparison between generic data source and specific initiating frequency are presented and evaluated in this module.

2.3 Project-wise initial event analysis module

A practical data analysis for the application of PSA has performed in this module. First, the object of project is defined with a designated plant and then the scope of analysis is determined depending on initial events. Generally, initial events occur scarcely, thus analysis scopes can be expanded to applicable range which includes the reactor trip events taking place at other domestic plants considering their design characteristics and reactor trip features. Verification and corrective work proceeds with the analyzed data. Finally, the data are updated with generic source of NUREG-5750 with a methodology of Bayesian analysis. Since the number of collected data from real events is mostly small, thus there is a tendency that generic data may have substantial impacts on the final data results.

2.4. Reactor Trip Related Code Module

Since several types of codes are implemented in data design structure such as trip type, cause for manual trip, operation status during trip, failure ranking, failure parts, failure cause, and corrective action, user can customize their views using the codes.

3. Conclusions

An attempt to establish a systemic database for initiating events has been done so far. This paper described tentative design structures and data classification policies of the developing DB. Comprehensive approaches have been investigated for maximize data manipulation efficiency. This DB can be used for not only PSA applications but also plant trip trend analysis. Furthermore, it can provide significant insights in preventing reactor trip and improving reactor safety.

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