Development on the Methodology of Debris DB construction for ECCS Strainer Capacity assessment.

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1. Introduction

If we evaluate and assess the effect of strainer volume capacity for the emitted jetting coolant during long-term cooling after LOCA(Loss of coolant accident) at nuclear power plants, specific information of debris that are generated from domestic plant where-in in-service and new NPP(Nuclear Power Plant) should be prepared.

Therefore, base on the on-site inspection data of the domestic in-service NPP, our study is presented to investigate the criteria of debris classification that applied to establishment of debris database, and with this result, to suggest the alternative own method about generation rate, mass transfer, strainer head loss and volume capacity calculation of debris after set up the debris DB.

2. Methods and procedures

Actually, in order to examine the impact as followed by debris type and its displacement condition with Kori-1's data, we will provide basic criteria of DB and will reflect the field data in DB.

2.1 Requirement on the construction of debris DB

Target for in-service and new built NPP, criteria of debris classification is previewing with likewise table 1, include practical data and functionality.

○ On-site date : drawings, photos and all other collected data during on-site inspection performed.

○ Construction of debris DB : debris production mass rate and mass transfer that obtained by calculating the possible need for the classification of database set-up.

○ Calculation function of debris generation rate : calculation of debris mass with concerning area under own selective condition

○ Calculation of debris production mass : calculation of debris mass with concerning area under own selective condition.

○ Calculation function of strainer head loss : with pre-programmed head loss equation and input factor(filter area), Head loss calculations and a new correlation equation will provide two type of correlation equation in accordance with developed NUREG/CR-6224 and own future new strainer.

○ Evaluation Function of strainer volume capacity : calculation of strainer volume capacity to be required to guarantee the allowed head loss.

Main Category	Locations of debris generation	Kinds of debris
1	Each plants	Paint material
2	Each floor of containment buildings	Thermal insulation material
3	Each compartment rooms	Latent debris

Table 1. Criteria of the debris classification

2.2 Construction methodology of the debris database

As shown in figure 1 to step 5, debris data is collected through the in-service inspection results targeted for all domestic NPP. And this acquired data is changed to database-form according to the classification according to each of reactors, locations, debris.

This is resulted to the mass of debris production and debris transfer. Finally, by calculating strainer head loss, it will select the strainer capacity is required.

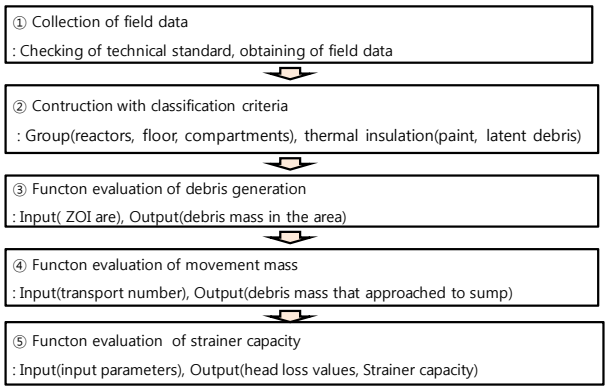

Fig. 1. Procedure of debris DB construction

Location of debris production divided by each of plant, containment building floor, compartment room with field standard of classification that target by whole area of NPP building. Figure 2 shows the example of Kori Unit 1 containment area (zone) .

2.3 Evaluation function construction of debris production mass

In order to find the mass of debris that is produced after LOCA occurring, first of all, ZOI of each of debris shall be selected. As shown in Figure 3, all existing of the value of substances in the area of plant would be considered

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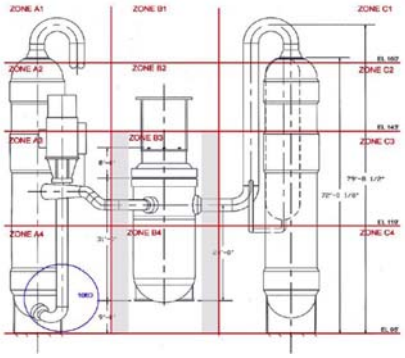

Fig. 2. Selection of containment building zone (Kori 1 NPP)

As shown in Figure 3, all existing of the value of substances in the area of plant would be considered.

○ Estimation of the debris mass that is mapped by piping / equipment to the layout of the ZOI.

○ Debris size : arrangement with small and large piece of debris chip.

- Small debris size : Available debris size to satisfy possible movement motion by force of fluid, to allow debris movement to the cooling pool after fluid jetting and LOCA.
- Large debris size : available debris size that is unable to move debris by force of fluid, to allow debris to penetrate that grating, trash rack and other radiation barriers.

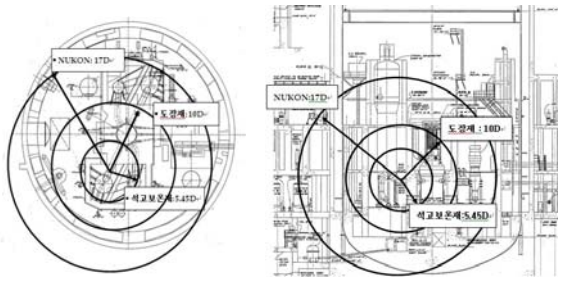

Fig. 3. Settlement of ZOI with Debris distribution

2.4 Evaluation function of debris mass transfer

Movement of debris is separated by the debris motion with blow down, wash down, pull fill and recirculation as below. And transport number will be applied to the debris DB construction by using the debris logic tree and additional flow analysis as shown figure 4.

○ Blow-down : Blow-down : debris move by the jetting of pipe fracture

○ Wash-down : debris vertical move by the fracture flow and water spray of reactor building.

○ Pool-fill : debris horizontal move by the fracture flow and water spray of reactor building.

○ Recirculation : debris horizontal move by Recirculation of fluid in the bottom of the reactor building.

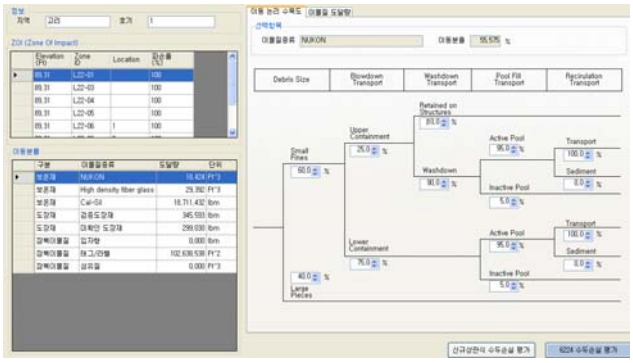

Fig. 4. Debris Logic Tree

2.5 Construction of evaluation function for the calculation of head loss and strainer capacity

Debris DB is to assess the head loss calculation and strainer volume capacity by using reference equation for NUREG/CR-6224, as well as to acquire the desired correlation equation for users and developers. So the function of strainer volume capacity and new requirement variables shall be included with head loss correlation equation familiar with user-interface.

3. Conclusions

For the issue of strainer installation in domestic in-service or new built nuclear plant, debris impact and influence such as head loss on the strainer is analyzed and optimized with various procedure and methodological approach, lead to acquire the debris information and develop the debris DB.

4. Acknowledge

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REFERENCES

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