東京電力福島第一原子力発電所炉内状況把握の解析・評価
Assessment of Core Status of TEPCO's Fukushima Daiichi Nuclear Power Plants
(105) 3D-MCCI analysis for 1F Unit 2 and 3 using SAMPSON code

*D. Concu[1], M. Pellegrini[1] and M. Chaki[1]
([1]エネルギー総合工学研究所)

The phenomena taking place during a severe accident are complicated and difficult to predict using safety analysis codes, where the experimental database is still poor (particularly with respect to the plant scale), and the models have many parameters and not well validated. Therefore, a more meaningful alternative to an integral calculation is to perform a stand-alone analysis using as boundary and initial conditions the available data of the accident, even if for this procedure the quality of information is essential.
KEYWORDS: MCCI, Severe Accident, Sensitivity Analysis, 3D simulation

1. Introduction

In this paper, a sensitivity study on the ex-vessel accident progression in the 1F Unit 2 and 3, based on the available information at the current time, was performed. The study has been carried-out coupling the Debris Spreading Analysis (DSA1) and the Containment Vessel Phenomena Analysis (CVPA) modules of SAMPSON code. Different sets of boundary conditions have been selected for each test case, in order to perform the sensitivity analyses within a broader spectrum of possible scenarios.

2. Results

With the purpouse of establishing the best estimate case, the measured pressure marks of the containment has been set as baseline for the Unit 2 and 3 calculations. This was attempted in order to define the most likely accident evolution informing the debris distribution inside the PCV and concrete mass eroded in the basemat during the MCCI phase. The calculation has shown that for the Unit 3 case, a continuous relocation of debris from the lower head, leads to an over-predicted estimation of the pressure trend inside the PCV after failure. A non-continuous relocation, instead, produces a more accurate pressure evolution (Figure 1).
A similar sensitivity analysis has been carried out for the Unit 2 case.

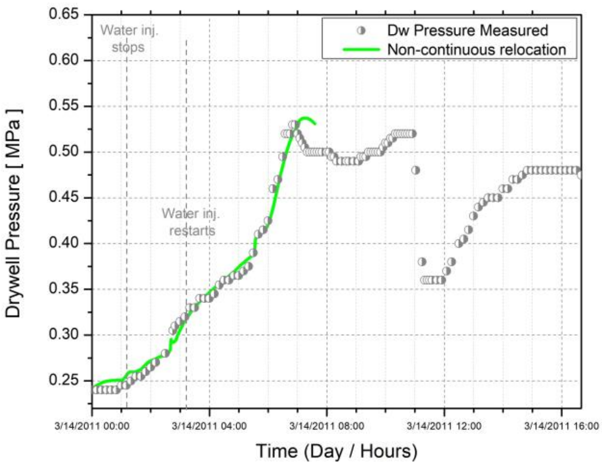

Figure 1: Unit 3 containment pressure trend for the best estimate, non-continuous relocation case

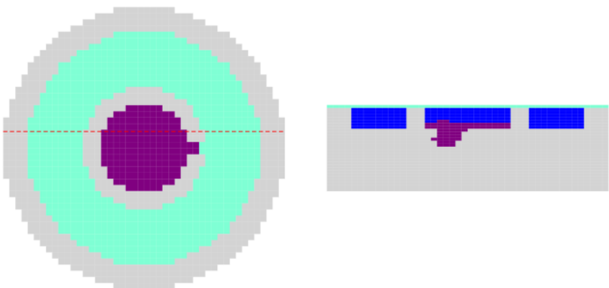

Figure 2: Debris spreading and basemat erosion at around 6 hour simulation for the non-continuous relocation of Unit 3

3. Conclusions

Regarding the Unit 3 case, according to the best estimate case in Figure 1 and the relative spreading analysis in Figure 2, the debris is confined inside the pedestal for the first 6 hours following the reactor failing. Only in a second phase the debris flows in the drywell, not reaching the steel liner at the end of the 12 hours analysis.
The erosion is mainly localized in the pedestal floor and the internal sumps walls, while the drywell area is only lightly affected.

－Acknowledgement－
This work has been financially supported by the Japanese government’s Ministry of Economy, Trade, and Industry. Technical support from the project team is greatly appreciated.