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

(90) SAMPSONによる福島第一１号機RPV外の事象の感度解析

(90) Sensitivity analysis of Fukushima Daiichi unit 1 ex-vessel scenario by the SAMPSON code

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The phenomena taking place during a severe accident are complicated and difficult to predict using integral codes, especially during the ex-vessel phase of the accident, where the experimental database is still poor (particularly with respect to the scale), and the models have more modeling parameters, are less general and not well validated. Therefore a stand-alone analysis using as boundary and initial conditions the available data of the accident seems to be a more accurate approach than an integral calculation, 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 1F1 based on the best available information at this time were performed. The work 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

The results obtained has provided a basis for making judgments concerning a preliminary evaluation of the debris distribution inside the PCV and concrete mass eroded following the Molten Core Concrete Interaction (MCCI). The DSA1 code predicts a dissimilar spreading area for cases with a different initial debris mass and same initial debris temperature (Figure 1). The code predicts a clear anisotropic concrete ablation for siliceous/basaltic concrete. At about 90 h the D2, D4 cases of this sensitivity analysis reach the steel liner deepest level (-2.83 m), while for D1 and D3 calculations the debris maximum depth predicted is -2.52 m (Figure 2). The concrete ablation tends to develop along the diagonal on which the floor pits are located, where erodes the wall pedestal and reaches the D/W sump.

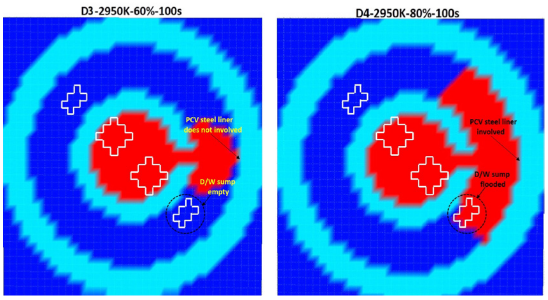

Figure 1: Debris spreading configuration, cases D3 and D4, 60% and 80% of fuel i.i. respectively

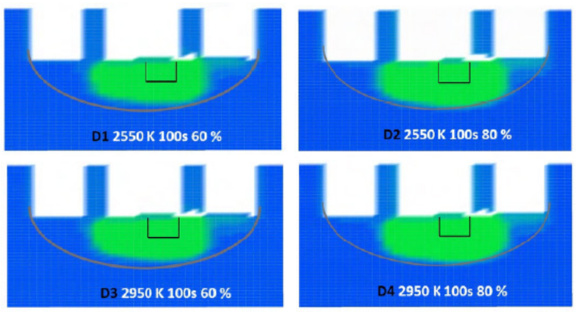

Figure 2: Concrete ablation, left to right, top to bottom. Cases D1, D2, D3 and D4

3. Conclusions

The debris mass poured in the pedestal zone is one of the parameters that most affects the debris spreading configuration: the cases with a higher amount of corium released from the RPV show a wider relocation area in the drywell outside the pedestal. This parameter also has a high impact on the amount of concrete ablated in the contaiment floor. A calculation involving 80% of fuel i.i. eroded about 18% more concrete than the same one involving the 60%.

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