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
(86) SAMPSON コードによる福島第一原子力発電所 3 号機の長時間の感度解析

Assessment of Core Status of TEPCO's Fukushima Daiichi Nuclear Power Plants

(86) Long term sensitivity analysis of Fukushima Daiichi Unit 3 by the SAMPSON code

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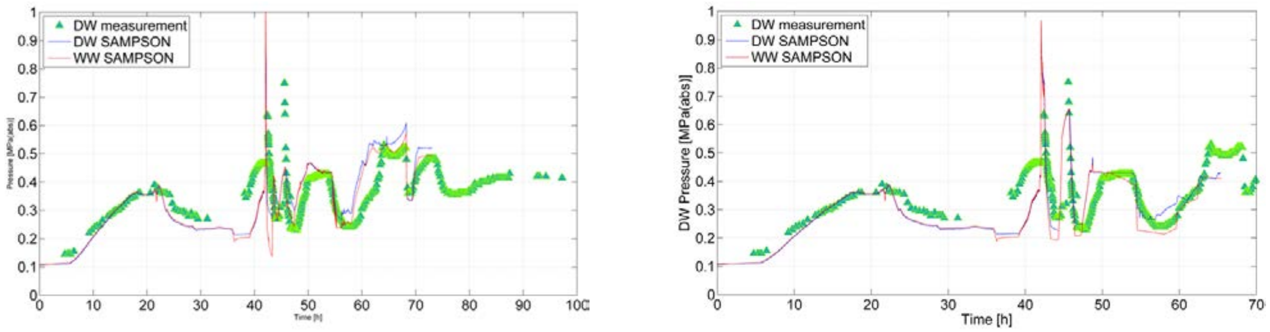
The accident at the Fukushima Daiichi unit 3 has been studied extensively in the last years but still large uncertainty exists on the final state of the core and debris state. Such uncertainties reflect on the difficulty to create strategies for debris removal. In current Japanese national project we have organized all the available information in order to clarify the known condition of the power plant. Based on such information a best estimate current condition of the plant has been proposed in which MCCI played a major role in the accident determining the large hydrogen generation for the explosion of Unit 3 and Unit 4. Based on the analysis of the temperature measurements at the plant a relatively large amount of debris is supposed to remain in the vessel. The estimated results are confirmed with the analysis of the SAMPSON code.

Keyword：Fukushima Daiichi Nuclear Power Plants, Severe Accident, Meltdown, SAMPSON

1. Introduction In Fukushima Daiichi unit 3 DC batteries remained available until around two days after scram, so that operator could employ emergency systems in the attempt to avoid core meltdown. Nonetheless core level could not be maintained and core boiled off when the reactor depressurized. Several minutes after the depressurization alternative water injection started with the goal to reflood the core with external water. The events happening in the core at this time are still not well understood and purpose of the work is to explain them through the employment of SAMPSON severe accident code Molten Core Relocation Analysis module.

2. Results In the present result the core has not yet started degradation before the reactor depressurization and water injection is limited because of the relatively large pressure and assumed deviation of the water to the condenser. The main difference in the calculations is the water injection and influencing the temperature of the debris in the lower head after core plate failure. This is assessed comparing the pressure rise in the PCV with available measurement. In case B Figure 2 we could obtained a better reproduction of the pressure spike by injecting little amount of water in the RPV, compared with the case A in Figure 1. Two cases were also tested regarding the PCV pressure decrease around 55 h either by head flange leak or RPV failure. In both cases the pressure was reproduced correctly so that further information needs to be gathered with comparison by FP release in the environment.



a) b)

Figure 1 PCV transient in case A (a) and case B (b)

3. Conclusions The SAMPSON code was applied to the accident of the Fukushima Daiichi Unit 3 and variation in the input geometry for modeling the lower core structures was tested. It was found that both assumptions lead to some coherent predictions. For example retaining the corium on the core plate creates larger pressure spikes representing the debris slumping while core drainage presents a more realistic failure of the lower head and MCCI progression. In the future analyses the combination of the two models, that is to say retention with capabilities to slump debris, will be applied.

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