# 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
# (62) SAMPSON コードによる福島第一原子力発電所 3 号機の事故進展解析

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

(62) Accident Analysis of Fukushima Daiichi Unit 3 by SAMPSON Severe Accident Code

* Marco Pellegrini[1], Hiroaki Suzuki[1], Masanori Naitoh[1]

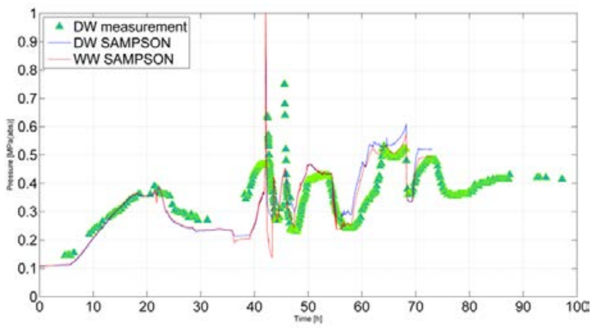
([1] エネルギー総合工学研究所)

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 the present analysis the SAMPSON code has been applied to the whole accident in order to identify and discuss one the largest uncertainties, which is the effect of the lower structures on the debris relocation into the lower head. The results have shown that the modeling of the lower structures can largely influence the mass of debris that relocate into the lower plenum and the possibility of lower head failure.

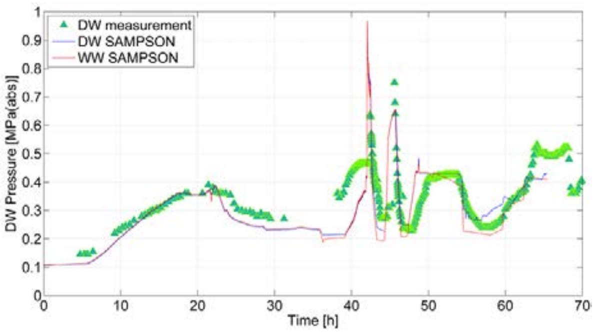
**Keyword**：Fukushima Daiichi Nuclear Power Plants, Severe Accident, Meltdown, SAMPSON

**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 capability to retain fuel at the core plate or drain it into the lower head. Allowing the core debris to drain into the lower head (case A in Figure 1) boils off the water early and creates a large number of particulate debris that delays the failure of the lower head, which happens around 55 h in the present calculations. Retaining debris on the core plate (case B in Figure 1) presents a more coherent core melt progression and much larger temperature in the core region for long time so that the core melts almost totally once the core plate fails and the debris is poured into the lower head. The immediate discharge of molten debris downwards leads to almost immediate failure of the RPV by wall melt and subsequent discharge into the pedestal at 48 hours. After PCV failure MCCI starts in both calculations and due to the large gas generation and PCV head leak it is possible to reproduce the measured pressure transient.




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.

**－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.