OVERVIEW OF PROGRESS IN THE CONTAINMENT AREA

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In the CONTAINMENT area three issues of severe accident phenomenology are treated which endanger the containment integrity by pressure increase due to fast heat transfer: hydrogen combustion, explosive melt water reaction, and direct containment heating. Although research on these issues started already shortly after the incident at TMI-2 in the 1980ies, a number of phenomena have been identified during the EURSAFE project in 2002 and 2003, which need more research effort to be resolved. At the start of the SARNET program tasks for the first year were defined, taking into account existing and planned experimental facilities and codes available in the participating European organizations. This paper gives an overview of the work performed in the first year: the performed experiments and the modeling efforts and achievements using available data.

The work within the hydrogen issue was subdivided into two subtopics. The first deals with the hydrogen combustion (HC) and the recombiner technique, while the second treats the problem of containment atmosphere mixing (CAM). Experiments were performed in the ENACCEF and REKO-3 facilities concerning the HC issue, and in the MISTRA and TOSQAN facilities concerning the CAM issue. Models in various CFD codes (TONUS-3D, COM-3D and REACFLOW for hydrogen combustion and GASFLOW for hydrogen recombination as well as TONUS-3D, FLUENT, GASFLOW, CFX and STAR-CD for hydrogen dispersion modeling) were validated using new and available data. The difficult task to transfer models from CFD codes into the lumped parameter modules of the ASTEC code has only started for parts of the combustion modeling (PROCO model).

Within the fuel-coolant-interaction (FCI) group experiments were performed in the ECO and MISTEE facilities. The KROTOS test facility is being re-installed at CEA, Cadarache, and a first test is expected for December 2005. For the FCI issue only specialized codes such as MATTINA, MC3D, COMETA and IKEMIX/IDEMO are available, which were further developed using experimental data. At present, there are no modules in ASTEC dealing with FCI, nor are there any plans to include such modules in the short term.

The direct containment heating issue (DCH) has been extensively studied for US-reactor plants in the past, and a large database is available for these geometries. For European reactors the only test facility still in operation is the DISCO facility. Several experiments have been performed and data are made available to the partners for the most part. Modeling of these experiments was done with the CFD codes AFDM and MC3D, and with the 1-D codes CONTAIN and RUPUICUV, which is a module of ASTEC. A number of model deficiencies has been identified, and it is planned to develop new models on the basis of the CFD code modeling achievements.

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