CESAM
Code for European Severe Accident Management

OBJECTIVES

The Fukushima Daiichi accidents highlighted that both the in-depth understanding of such scenarios and the development or improvement of adequate Severe Accident Management (SAM) measures are essential in order to further increase the safety of the Nuclear Power Plants (NPP) operated worldwide. Within CESAM, the European reference code ASTEC, developed by IRSN (France) in close collaboration with GRS (Germany), is being improved for application in SAM analyses.

The goal is to assess ASTEC modelling capabilities especially with respect to the phenomena that were identified as most important during preliminary Fukushima Daiichi analyses. Where possible ASTEC will be improved or extended with newly developed models to address deficiencies identified during the assessment. Moreover the code capabilities of support to diagnosis during a severe accident will be extended.

The improved code will be applied to evaluate the impact of SAM analyses for the main NPP types operated in Europe, including accidents in Spent Fuel Pools. The results of these analyses can be used for future optimisation of SAM procedures.

DESCRIPTION OF WORK

The project objectives are reached by an assessment of the state-of-the-art of ASTEC models that are most relevant in the analyses of the Fukushima Daiichi accidents. The covered topics range from core degradation and behaviour of the reactor cooling system up to mitigation of consequences in the containment and estimation of source term to the environment.

The assessment is done by the IRSN and GRS partners by comparison with data from experiments addressing the different above phenomena. Based on outcomes of this assessment, existing physical models are improved or new models are developed and then implemented into ASTEC. In addition, an interface with tools predicting environmental consequences is developed and, for support to diagnosis during an emergency situation, a methodology based on Bayesian networks is investigated, for evaluating the probability of the different possible accident scenarios from the uncertain information provided by the plant instrumentation.

Further "generic" reference input decks are created for the main types of NPPs currently operated in Europe for guidance of ASTEC users that wish implementing their own plant models. These input decks are also used for severe accident analyses including the simulation of most important SAM procedures and systems and the results are compared with other computer codes (such as MELCOR, MAAP, ATHLET-CD, COCOSYS…).

MAIN RESULTS / HIGHLIGHTS

During CESAM lifetime, several ASTEC versions are being released, the latest one being V2.1 end of 2015. The assessment has covered more than 50 different experiments. The main modelling improvements have concerned the core degradation, in particular allowing a more realistic description of Boiling Water Reactors, and the source term in the reactor cooling system and the containment. Most of the V2.1 "generic" reference input decks are available mid-2016 and the CESAM partners recently started using them for the evaluation of SAM impact in different NPPs and spent fuel pools. The outcome will be recommendations for optimization of SAM as well as support to emergency response.

DURATION
1 April 2013 – 31 March 2017
4 years

PARTNERS
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