AIR-SFP

Spent Fuel Pool behaviour in loss of cooling or loss of coolant accidents

OBJECTIVES

The accident at the Fukushima Daiichi Nuclear Power Plants (NPP) has highlighted the vulnerability of nuclear fuels that are stored in spent fuel pools (SFPs) before their evacuation and final disposal or possible reprocessing. Studies of accident scenarios in SFPs, simulated with different Severe Accident (SA) codes, have raised questions about the reliability of the results obtained since these codes were developed for reactor applications. For follow up activities the AIR-SFP project has two main objectives:

- To assess more precisely the applicability of SA codes to the calculation of transients in SFPs by carrying out a benchmark with different SA code, including a criticality risk assessment.
- To elaborate a roadmap for further R&D on SFP accidents.

DESCRIPTION OF WORK

The achievement of benchmarks on a large range of accident scenarios was one of the main recommendations of the recent Status Report of the OECD/NEA/CSNI on SFP. The AIR-SFP project aims at following this recommendation by determining the uncertainties in the assessment of transients in SFPs with SA codes and identifying the needs of modeling improvements. Analyses on criticality risk will also be carried out.

The roadmap aims at reviewing experimental data on air/steam oxidation in order to identify the data that are still missing to improve modelling in SA codes. It also aims at discussing about the use of CFD or system codes to bring elements for recommendations and validation of SA codes. Finally, this roadmap will be useful as input to the CSNI project on a PIRT (Phenomena Identification and Ranking Table) on SFP accidents that has started in February 2016.

The conditions for the benchmark (geometry, power…) are similar to those in the Unit 4 of the Fukushima Daiichi Nuclear Power Plant when the accident happened. Two scenarios are investigated: loss of cooling and loss of coolant.

Concerning the roadmap, this includes discussions about the use of CFD or system codes to bring elements for recommendations and validation of SA codes, the definition of R&D needs on different topics like large-scale flow convection, impact of partial dewatering and impact of air flow on thermal runaway and fuel degradation.

MAIN RESULTS / HIGHLIGHTS

Computations have been carried out by 11 partners with three different SA codes (ASTEC, MELCOR and RELAP). A preliminary review of the results show that the description of the geometry has a strong influence. The main impact of the project will be to share a common knowledge on SFP issues and specifically on the level of uncertainty of SA codes when they are used for SFPs studies. The project's outcome of the Air-SFP project will be used in the frame of the OECD/NEA SFP PIRT and will be disseminated towards the widest community as possible through publications in journals or presentations in conferences.

DURATION

1 March 2015 – 31 August 2016
18 months

PARTNERS

IRSN / CIEMAT / ENEA / ENGIE / GRS / IJS / IVS / KIT / LEI / NRG / NUBIKI / PSI / REL / SSTC NRS / UJV

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