Experimental and Numerical studies for Containment Thermal Hydraulics, helium and aerosol distribution in Containment Studies Facility (CSF)

The CSF consists of a Primary Heat Transport System, a Containment System model (CM) and a control and instrumentation room. The containment model is approximately 1:200 volumetrically scaled down model of the prototype 220 MWe PHWR containment of Kaiga Atomic Power Plant. A schematic of the facility is given in Fig. 1. The experiments which are either already performed or planned in this facility will generate a large database for the validation of computer codes for containment thermal hydraulics, aerosol and hydrogen transport. Besides this, the experimental studies will provide a better understanding of several complex physical/chemical phenomena occurring inside the containment of nuclear power plants in the event of design basis and beyond design basis accidents.

(i) BLOWDOWN STUDIES: Experimental validation of computer codes for containment behaviour under simulated LOCA conditions
(ii) HYDROGEN BEHAVIOUR STUDIES: Hydrogen Transport/recombiner behaviour in multi-compartment geometry, Validation of analytical tools, Helium distribution pattern in presence of Heat source
(iii) AEROSOL BEHAVIOUR: Study of aerosol behaviour in multi-compartment geometry under dry and wet atmospheric conditions
(iv) SPRAY EFFICACY: Efficacy of spray system, hydrodynamic loads in Suppression Pool.

Blow-down experiments at different initial vessel pressure conditions were recently conducted at CSF and the vessel and containment parameters such as pressure, temperature and level transients have been recorded during the experiments. The experimental results have been used for benchmarking of numerical procedure adopted for evaluating LOCA/MSLB conditions in nuclear containment.

Detailed helium distribution tests have also been performed in CSF facility to generate database for validation of CFD codes and study of stratification phenomenon. Helium was used as a surrogate to hydrogen due to similarity as both are light gas and their laminar Schmidt number is also close to each other. Various size of injector, release rate, release duration was used to generate useful data base for validation of CFD codes.

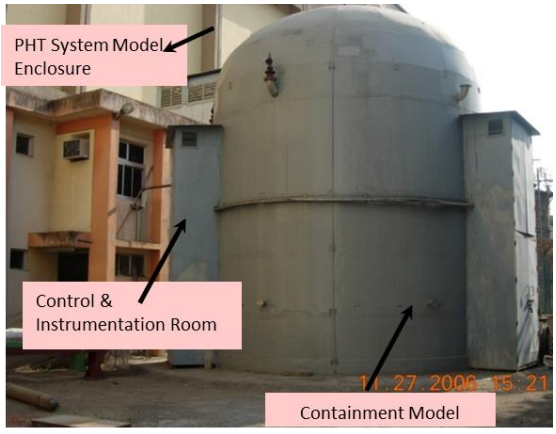

Fig.1.a. Containment Studies Facility (CSF)

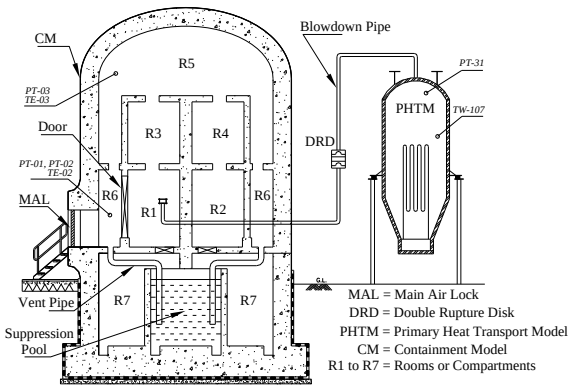

Fig.1.b. Schematic View of Containment Studies Facility (CSF)