

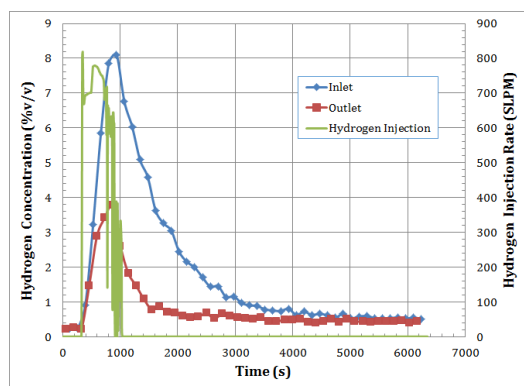
Hydrogen Recombiner Test Facility (HRTF), Tarapur

During a severe accident in water-cooled power reactors, large quantities of hydrogen can be released in steam condensing atmosphere of nuclear reactor containment. The main source of hydrogen generation is clad oxidation in presence of steam. The generated hydrogen got distributed in the containment and due to low density it has the potential to form high concentration hydrogen-air mixture in the containment. The integrity of the containment could be threatened due to hydrogen combustion. If composition of the hydrogen–steam–air mixture lay within a certain limits, the combustion would occur. The steam condensation phenomenon is important from hydrogen distribution point of view to locate the flammable region in the containment. The prediction of hydrogen behaviour at severe accident conditions may help in devising adequate accident management procedures.

As a part of hydrogen mitigation technology development program, Passive Catalytic Recombiner Device (PCRD) is developed at BARC. HRTF facility was built to perform experiments related to PCRD performance and qualifications. Three catalyst designs developed at BARC were evaluated for their performance in terms of removal rates, peak catalyst temperatures, etc. under dry and steam-laden conditions at HRTF Tarapur. Tests were performed upto 3 % (v/v) H₂ concentration under dry conditions and upto 8 % (v/v) H₂ concentration under steam-inerted conditions. The catalysts from BARC have been developed by Material Processing Division (MPD), Chemistry Division (ChD) & Technical Physics Division (TPD), BARC using three different techniques. On the basis of the experimental data generated from the various tests conducted in HRTF, a technical evaluation of the performance has been performed both at BARC and NPCIL. Analysis has been performed for two concentrations- 3.6 % (v/v) and 7.5 % (v/v) H₂ concentration. Besides the evaluation of the removal rates, T_{1/2}, T_{1/3} and T_{1/4} values have also been evaluated. The T_{1/2} value denoted the time required for the hydrogen concentration to drop to half of the peak concentration. Similarly T_{1/4} value denotes the time required for the hydrogen concentration to drop to one-fourth of the peak concentration. These values helped to evaluate the catalyst performance under depleting hydrogen concentrations and were good parameter to judge the catalyst performance at lower concentrations.



Hydrogen Recombiner Test facility at Tarapur



Hydrogen Concentration at PAR inlet and outlet and Hydrogen Injection Rate