

# HYDROGEN RECOMBINERS TO ENSURE HYDROGEN SAFETY AT NPPs: ISSUES TO BE SOLVED

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Over the past thirty years, light-water-cooled nuclear power plants (NPPs) have been equipped with hydrogen passive autocatalytic recombiners (PARs). The latter are intended to remove hydrogen from the containment atmosphere in case of severe accidents with core uncover to eliminate the risk of hydrogen-containing steam-air mixture explosion. The data on PAR performance during such accidents are needed to determine the required PARs quantity and their optimal location inside the containment, as well as to justify the NPP safety. These data are obtained experimentally, with further justifying calculations, if needed. The gas propagation and hydrogen removal dynamics is calculated using computer codes based on PAR numerical models. Independent verification of PAR performance characteristics specified by manufacturer in technical specifications is a separate issue.

The independent studies of PARs performance at national NPPs were initiated 10–12 years ago [1, 2]. Significant distinction of domestic PAR performance characteristics from those of their foreign analogues posed several questions concerning testing procedures applied [3]. To rectify the deficiencies, RFNC – VNIITF has developed experimental procedures for PAR performance evaluation and carried out an integrated testing of the RVK-500 PAR [4]. These efforts helped determine the recombiner performance characteristics in a wide range of accident conditions and obtain data for PAR numerical model validation [5].

The findings of these efforts revealed some issues that require additional studies to totally resolve uncertainties in the NPP hydrogen safety justification. First, the testing excluded the late stage of accident when carbon monoxide is released. Second, the data on PAR operation in conditions of oxygen starvation were not complete. Experimental data on full-scale high-performance recombiners are needed since only the reduced or small-scale PAR models have been used in the world so far. It also remains unclear whether the recombiners perform worse after several days of operation. The most relevant issue is to release a standard that unifies the requirements for PARs, independent verification procedure, and PAR acceptance at NPP [6].

The paper presents the state of the art review and the issues that need to be solved to improve hydrogen safety at national NPPs.

## References

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