Chapter VII: CONCLUSIONS AND PERSPECTIVES

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CONCLUSION AND PERSPECTIVES FOR THE NEXT TWO YEAR PERIOD

The safe usage of hydrogen is feasible provided the particular properties of this energy carrier are accounted for. As for any other energy carrier the associated safety management requires knowledge in many different disciplines. Material compatibilities, CFD calculations for dispersion, detailed chemistry for ignition, reactive flows in transitional states like flame acceleration and deflagration-detonation-transition and structural integrity considerations encounter new applications, operational modes and new materials in the hand of the public user.

Hydrogen safety is not a barrier for the introduction of this new energy vector provided the available experience is shared. Integration of the knowledge fragments from many different fields of experience, like large chemical production schemes involving hydrogen, internal combustion engine design, nuclear safety and petrochemical processes provided a reasonable basis for this first issue of this handbook.

However, some knowledge gaps have been identified in the course of editing this first issue. The most prominent are the following.
Knowledge on the material compatibility of the new compound materials, especially under pressures up to 800 bar or at temperatures of the liquid hydrogen, is missing, whereas metallic materials are well studied for these applications.
Ignition behaviour especially of cold clouds in atmospheric conditions is not well understood. For a reliable stochastic ignition model useful for risk assessments the required database is not yet available. The behaviour of liquid hydrogen in particular with respect to accidental releases is largely unknown. Transitional phenomena like flame acceleration and deflagration to detonation transition are well studied under ideal conditions (perfectly premixed, simple geometry), but for realistic scenarios (with inhomogeneous mixtures, realistic geometry) there is a lack of knowledge.
Many specific or generic rules applied successfully to risk assessments related to traditional gaseous energy carriers are not yet fully proven to be conservative if applied to hydrogen. These gaps immediately involve difficulties in designing appropriate mitigation including sensor techniques. If, when and how to use active measures, like forced ventilation or water sprays, in accidental conditions not to induce even worse consequences is not straight forward on the current basis.

The second issue of the report will close some gaps and iterate its outer appearance. As an IPHE recognised project HySafe will not restrict its view on its consortium level rather welcomes the opportunity to mirror the international expertise in the Biennial Report for Hydrogen Safety. Therefore the responsible team strives for even stronger inclusion of worldwide expertise in the second issue.
If such further existing know-how, the results of complementary, coordinated research and the new experience generated in the early demonstration projects are integrated in this public document the developers of the innovative hydrogen technologies might concentrate on communicating the actual advantages of this energy vector in a free energy market.