FOREWORD

Flame acceleration (FA) and deflagration-to-detonation transition (DDT) are important phenomena in severe accidents because they can largely influence the maximum loads from hydrogen combustion sequences and the consequential structural damage. The ultimate goal in hydrogen mitigation is to design countermeasures that allow operators to avoid FA and DDT. In current nuclear power plants, the load-bearing capacity of the main internal structures is jeopardized by flame speeds in excess of about 100 m/s. New containment designs could, in principle, be constructed to carry higher dynamic loads, however, at the expense of additional costs. To judge the potential for fast flames and DDT, the causes and underlying processes have to be understood. Criteria may then be derived that can be used in three-dimensional numerical containment simulations, testing the effectiveness of hydrogen mitigation methods, to decide whether FA or even DDT is possible.

A review of Flame Acceleration (FA) and Deflagration-to-Detonation Transition (DDT) in Containment had been prepared for the NEA Committee on the Safety of Nuclear Installations (CSNI) as a State-of-the-Art Report (SOAR) in 1992 [reference NEA/CSNI/R(92)3]. Since the issuing of that report, several very significant new experimental and theoretical projects had been initiated and had started to bear fruit, in the United States, Japan, Germany, France, Canada, the Russian Federation, and under the auspices of the European Commission. After discussions held at the September 1996 meeting of CSNI's Principal Working Group on the Confinement of Accidental Radioactive Releases (PWG4), the Committee agreed that a new report should be initiated with the objective of compiling information from these programmes for the benefit of Member countries.

Dr. W. Breitung (Forschungszentrum Karlsruhe, FZK) agreed to take the lead in the preparation of the new State-of-the-Art Report. A small Writing Group was set up; its members are listed in Annexes 1 and 2.

The Writing Group met twice in 1998 and twice in 1999. Lead Authors were appointed for the various chapters of the report. The final version was endorsed by PWG4 in September 1999 and by CSNI in December 1999.

The CSNI expresses its gratitude to the various governments and organizations that made experimental and analytical data available for the preparation of the report as well as the resources—time, staff, competence, effort and money—devoted to this substantial piece of work. The role of the Lead Authors was essential in preparing the document; they also deserve all our gratitude. Special thanks are due to the FZK, in particular to Dr. W. Breitung, who—in addition to preparing chapters—led and co-ordinated the efforts and produced the final draft. Without their generous and vigorous support, their competence and hard work, the report would have taken a much longer time to produce and its quality would necessarily have been lower.

Thanks are due also to Ms. A. Soonawala who expertly edited the report, improving its readability and its layout.