

PREFACE

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The accident at Three Mile Island Unit 2 (TMI-2) shocked the world at large, had a serious negative impact on nuclear utilities in the United States and abroad, and emphasized that even with reliable engineered safeguards a severe accident could occur in a nuclear power plant. No one was significantly harmed by the TMI-2 accident because the molten core was confined within the reactor pressure vessel (RPV), and, except for noble gases and a small amount of iodine, the fission products released from the reactor core were confined within the containment building. Public institutions from the local level to the highest levels in the United States and other governments were challenged, and the regulatory impact of the accident was far-reaching. However, the large negative impact of the accident will be overshadowed by the wealth of information gained from the careful, intensive scientific investigation of the TMI-2 reactor during the past 10 years.

As can be observed on the cover of this issue, a large fraction of the TMI-2 core melted. Initially, the control rod, structural, and fuel rod cladding metals melted and relocated to lower core regions but froze when they reached the water level and formed a crust. This lower crust contained the egg-shaped, central core region that formed when the ceramic fuel melted later in the accident. The central, molten region continued to grow and finally broke through the peripheral part of the crust, whereupon 20 tonnes of molten core material relocated to the lower plenum and challenged the integrity of the lower RPV. The water in the lower plenum cooled the relocated molten debris and the RPV remained intact. The details of materials interactions; fission product release and transport; calculation of the accident progression; health physics effects; and advances in remote technology, defueling techniques, and waste management for this real accident are contained in this special volume, thereby providing a valuable resource for the development of future, inherently safe reactors. I am proud of this special volume and grateful for my involvement in its preparation.