FOREWORD

Some types of nuclear reactor, such as the heavy water reactor and the large liquid metal fast reactor (LMFR), have a positive void reactivity effect. This effect arises if coolant is removed from the core.

In the LMFR, an increase of the coolant temperature will initiate an expansion of the absorber rod guide structure, of the fuel in the axial direction and of the core grid plate in the radial direction, resulting in negative reactivity coefficients counteracting the positive sodium reactivity coefficient. Nevertheless, there is a strong incentive to reduce the positive sodium void coefficient in large LMFRs.

This document investigates whether it is possible to reduce the void reactivity coefficient without affecting any other reactivity coefficient.

At the IAEA Specialists Meeting on Passive and Active Safety Features of Liquid Metal Fast Reactors held at the Oarai Engineering Center, Japan, from 5 to 7 November 1991, it was agreed to prepare a calculational model representing a proposed sodium plenum concept and to perform calculations of the apparent void worth. The specialists participating in the meeting recommended to the International Working Group on Fast Reactors (IWGFR) to arrange an information exchange on the results of the calculations under the auspices of the IWGFR. To facilitate this work on a broader international basis and to share expenses it was agreed to organize this work jointly with the Commission of the European Communities (CEC).

The aim was to investigate the capability of reducing to nearly zero the sodium voiding feedback reactivity of an axially heterogeneous fast breeder reactor when a sodium plenum is introduced above the core instead of the upper axial blanket. In addition to the sodium void reactivity calculation, it was decided to investigate a series of core neutronic performance characteristics, such as breeder ratios, burnup swing, peak linear power, power peaking factor, regional power fractions and control rod worths. The calculational model of this BN-800 core was distributed to all participants by the IAEA.

This document is based on papers presented at the meeting by participants from India, Japan, Germany, the Russian Federation, the United Kingdom and the United States of America. A. Rinejski of the IAEA was responsible for the final drafting of the document.