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Heat Transport and Afterheat Removal for Gas Cooled Reactors Under Accident Conditions

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FOREWORD

The Co-ordinate Research Project (CRP) on Heat Transport and Afterheat Removal for Gas-Cooled Reactors Under Accident Conditions was organised within the frame of the International Working Group on Gas Cooled Reactors (IWGGCR). This International Working Group serves as a forum for exchange of information on national programmes, provides advice to the IAEA on international co-operative activities in advanced technologies of gas cooled reactors (GCRs), and supports the conduct of these activities.

Advanced GCR designs currently being developed are predicted to achieve a high degree of safety through reliance on inherent safety features. Such design features should permit the technical demonstration of exceptional public protection with significantly reduced emergency planning requirements. For advanced GCRs, this predicted high degree of safety largely derives from the ability of the ceramic coated fuel particles to retain the fission products under normal and accident conditions, the safe neutron physics behaviour of the core, the chemical stability of the core and the ability of the design to dissipate decay heat by natural heat transport mechanisms without reaching excessive temperatures. Prior to licensing and commercial deployment of advanced GCRs, these features must first be demonstrated under experimental conditions representing realistic reactor conditions, and the methods used to predict the performance of the fuel and reactor must be validated against these experimental data. Within this CRP, the participants addressed the inherent mechanisms for removal of decay heat from GCRs under accident conditions.

The objective of this CRP was to establish sufficient experimental data at realistic conditions and validated analytical tools to confirm the predicted safe thermal response of advance gas cooled reactors during accidents. The scope includes experimental and analytical investigations of heat transport by natural convection conduction and thermal radiation within the core and reactor vessel, and afterheat removal from the reactor. Code-to-code and code-to-experiment benchmarks were performed for verification and validation of the analytical methods.

The following Member State national institutions participated in the performance of this CRP:

Institute of Nuclear Energy Technology (INET)	China
Commissariat a l'Energie Atomique (CEA)	France
Forschungszentrum Julich (FZJ)	Germany
Japan Atomic Energy Research Institute (JAERI)	Japan
Netherlands Energy Research Foundation (ECN)	The Netherlands
OKBM	Russian Federation
Oak Ridge National Laboratory (ORNL)	USA

This report has been edited by H. Niessen (FZJ) and S. Ball (ORNL), and documents the CRP activities with respect to the technical areas of code-to-code and code-to-experiment validation of code predictions for normal operation and loss of cooling accidents with and without simultaneous depressurisation. The tests and calculations addressed GCR heat transfer phenomena inside the reactor vessel as well as in the reactor cavity external to the reactor vessel.

EDITORIAL NOTE

In preparing this publication for press, staff of the IAEA have made up the pages from the original manuscript(s). The views expressed do not necessarily reflect those of the IAEA, the governments of the nominating Member States or the nominating organizations.

Throughout the text names of Member States are retained as they were when the text was compiled.

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