

FOREWORD

All prototype, demonstration and commercial liquid metal cooled fast reactors (LMFRs) have used liquid sodium as a coolant. Sodium cooled systems, operating at low pressure, are characterised by very large thermal margins relative to the coolant boiling temperature and a very low structural material corrosion rate. In spite of the negligible thermal energy stored in the liquid sodium available for release in case of leakage, there is some safety concern because of its chemical reactivity with respect to air and water. Lead, lead-bismuth or other alloys of lead, appear to eliminate these concerns because the chemical reactivity of these coolants with respect to air and water is very low. Some experts believe that conceptually, these systems could be attractive if high corrosion activity inherent in lead, long term materials compatibility and other problems will be resolved. Extensive research and development work is required to meet this goal.

Preliminary studies on lead-bismuth and lead cooled reactors and ADS (accelerator driven systems) have been initiated in France, Japan, the United States of America, Italy, and other countries. Considerable experience has been gained in the Russian Federation in the course of development and operation of reactors cooled with lead-bismuth eutectic, in particular, propulsion reactors. Studies on lead cooled fast reactors are also under way in this country.

The need to exchange information on alternative fast reactor coolants was a major consideration in the recommendation by the Technical Working Group on Fast Reactors (TWGFRs) to collect, review and document the information on lead and lead-bismuth alloy coolants: technology, thermohydraulics, physical and chemical properties, as well as to make an assessment and comparison with respective sodium characteristics. This report considering these issues has been prepared in response to the recommendation from TWGFR.

The report has been reviewed by G. Heusener (Forschungszentrum Karlsruhe, Germany), Y. Nishi (Central Research Institute of Electric Power Industry, Japan), and D. Wade (Argonne National Laboratory, USA). A. Rineiskii and A. Stanculescu of the IAEA's Division of Nuclear Power were the IAEA officers responsible for the publication.

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