

## EXECUTIVE SUMMARY

Following a request from the Authority of Nuclear Safety and Radiation Protection (ANVS), the IAEA conducted a Follow-up Integrated Safety Assessment of Research Reactors (Follow-up INSARR) mission at the HFR research reactor. The objective of the mission was to review the implementation of the recommendations provided by the main INSARR mission, which was conducted in October 2016. The mission also followed up on the implementation of the recommendations of the INSARR 2011 mission that remained open.

The follow-up INSARR mission was conducted in parallel with the Follow-up Independent Safety Culture Assessment (ISCA) mission. The main ISCA mission was conducted in 2017. The two follow-up missions mutually benefited from each other, including by consolidating the team conclusions on the implementation of the recommendations of the review areas that were covered by the scope of both missions - specifically the management system, safety committee, and training and qualification.

The mission team was composed of an IAEA staff member: Mr A. M. Shokr (Head, Research Reactor Safety Section (RRSS) - team leader) and three international experts: Mr D. Rao (India), Mr H. Abou Yehia (France), and Mr G. Storr (Australia). The main technical counterpart of the mission was Mr O. Wouters, HFR Reactor Manager. The discussions during the mission were held with the participation of NRG and HFR senior managers and staff. Staff members of ANVS attended almost all the sessions of the missions as observers. Representatives from JRC also participated in the entry and exit meetings.

For the conduct of the mission, the following activities were performed:

- Examination and assessment of technical documentation;
- A detailed walkthrough of the reactor facility;
- Discussions with the NRG and HFR management and the reactor operating personnel;
- Discussions among IAEA team members;
- Preparation of the mission summary report.

The IAEA team noted a high level of implementation of the recommendations of the main INSARR mission. The team assessed that a total of 17 out of 20 recommendations have been either fully implemented or where minor actions remain (and their full implementation is ongoing). Actions have been taken and some others are planned for the three remaining recommendations. The team also assessed that five out of the eight INSARR 2011 recommendations have now been implemented, and work is ongoing to complete the implementation of the remaining three recommendations.

The team also noted the continued implementation by NRG of an effective integrated management system covering the HFR operation, and following the INSARR recommendations, the adoption of a policy on periodic assessment of safety culture and establishment of relevant procedures within the management system. The team also noted the conduct of training on application of the system for the HFR staff. These actions, in addition to those taken or planned in responding to the recommendations of the ISCA mission, will provide for further development and maintenance of a strong culture for safety.

The team concluded that this high level of implementation of the INSARR recommendations contributes to further enhancement of the reactor operational safety, through improved organizational effectiveness, operating programmes, documentation, and safety aspects of technical modifications of the facility.

The team assessed that the following measures have been taken by NRG, following the INSARR recommendations, to enhance the reactor organizational effectiveness that include revision of the HFR operating organizational structure and appointment of the maintenance manager; improvement of the effectiveness of the reactor safety committee; and coordination and cooperation with JRC with respect to development of the decommissioning plan (2017 revision); and improvement of the training and qualification programme.

With respect to operational safety programmes and documentation, the team assessed that the measures that have been taken by NRG, following the INSARR recommendations, included revision of OLCs, revision of the management system processes to facilitate timely revision of the reactor documents important to safety and to improve the modifications process; improvement of the contents of operation cycle reports; completion of the safety assessment aiming at minimizing accidental water leakage through the sub-pile room and the pipes penetrating the reactor pool; and revision of the maintenance programme.

In responding to INSARR recommendations, several actions aimed at safety improvements have also been taken by NRG with respect to technical modifications of the facility. These included installation of a new trolley of the polar crane qualified to nuclear standards; confirmation that safety margins are available in the seismic capacity of pipes in the safe shutdown paths; renewal of the radiation monitoring and alarm system at the beam tubes that are still in operation; determination and control of the water leakage rate and paths from the reactor pools. In this regard, the team highlighted the importance of continued monitoring and investigating leakage paths and rates and implementing, if needed, corrective actions.

Some of the INSARR recommendations have not yet been implemented, although some actions have been taken (or planned) in this regard. These recommendations remain valid and further actions need to be taken by NRG to implement them. These are related to:

- Classification of the reactor structures, systems and components with respect to safety and establishment of the associated quality and seismic requirements;
- Revision of the safety analysis report in accordance with the IAEA safety standards;
- Implementation of the technical and administrative measures that have been identified to prevent uncovering of spent fuel in the case of accidental situations that may occur during mis-handling of heavy loads and which affect the integrity of the pool floor;
- Implementation of the results of seismic walkdown, and installation of an automatic shutdown signal in the case of seismic events;
- Inclusion of HFR specific knowledge in the training of the staff of the Research and Development and Irradiation Solution Units; and
- Consideration of establishment of practical arrangements to ensure the independence of the radiation protection function during the reactor operation shifts.

Two additional recommendations were also provided by the IAEA team to further enhance coordination between JRC and NRG on HFR decommissioning and the effectiveness of the safety committee.

The IAEA team appreciated the openness and transparency of the NRG staff and HFR operating personnel and acknowledged their technical knowledge and excellent preparation for the mission. The team also would like to express its appreciation to the ANVS, NRG and HFR management for their commitment to safety and continuous improvement.