International Cooperation in the Field of Research Reactors using KAERI-ICERR

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***Keywords :** ICERR, HANARO and ancillary facilities, NTC

1. Introduction

According to the introductory statement of the IAEA board of governors, dated 15 September 2014, IAEA initiated a new initiative known as the "IAEA designated International Centre based on Research Reactor (ICERR)" which intends to help member states gain timely access to relevant nuclear infrastructure based on the research reactor and their ancillary facilities [1]. Korea Atomic Energy Research Institute (KAERI) was designated as an ICERR by the IAEA in 2019. KAERI has achieved numerous accomplishments while carrying out activities related to ICERR scheme during the ICERR designation period. The activities of KAERI-ICERR have ensured that the member states to access to the relevant nuclear infrastructure based on the research reactor and their ancillary facilities in a timely manner.

2. KAERI-ICERR

The facilities designated for KAERI-ICERR are the HANARO research reactor and ancillary facilities including Radioisotope Production Facility (RIPF), neutron beam Facility, neutron irradiation facility, Irradiated Material Examination Facility (IMEF), and Nuclear Training and education Center (NTC). The areas designated for KAERI-ICERR are hands-on training and Joint R&D projects [2].

2.1 HANARO

HANARO (High Flux Advanced Neutron Application ReactOr) is a 30 MW multi-purpose research reactor at KAERI designed for neutron beam applications, nuclear material testing, radioisotope production, neutron activation analysis, neutron transmutation doping, and so on. Its high neutron flux (fast neutron 2×10^{14} n cm^{-2} s^{-1}, thermal neutron 5×10^{14} n cm^{-2} s^{-1} at maximum) is essential for carrying out nuclear research and development.

2.2 RIPF

The RIPF is the facility for convenient processing and handling of irradiated radioactive objects. RIPF is equipped with four banks that consist of various numbers of hot cells depending on the functional requirements. Bank I has four concrete hot cells for sealed source handling such as Ir-192. Eleven lead hot cells in Bank II are dedicated for various research activities. Bank III has six lead hot cells and three of them are GMP hot cells. In the Bank III, medical purpose radioisotopes are produced. Bank IV has four lead hot cells in a clean room facility for radiopharmaceutical production.

Fig. 1. HANARO reactor hall.

2.3 Neutron Beam Facility

The neutron beam research facilities at HANARO have been widely opened to users from industries, academia, and research institutes both at home and abroad. The thermal neutron beam research facilities are installed in the reactor hall and the cold neutron beam research facilities are installed in the cold neutron guide hall.

2.4 Neutron Irradiation Facility

There are total of 36 vertical irradiation holes. These include CT, IR1, and IR2 and OR holes in the core of HANARO. In addition, there are a Large Hole (LH), holes with Hydraulic Transfer System (HTS) for Neutron Activation Analysis (NAA), two holes for Neutron Transmutation Doping (NTD) and Irradiation Position (IP) positions in the reflector region of the reactor for irradiation testing of nuclear fuels and materials, RI production and Si doping.

2.5 IMEF

IMEF has been performing the Post Irradiation Examination (PIE) for the capsule specimens of newly developed nuclear fuels and the reactor core structural materials irradiated at HANARO. Furthermore, the integrity of surveillance program specimens for core structural materials in nuclear power plants have been evaluated. The functions of hot cells are Non-Destructive Test (NDT), capsule dismantling and specimen fabrication, metallographic sample preparation and investigation, mechanical test, electro microscopic analysis and process demonstration.

2.5 NTC

NTC offers a diverse range of training programs for both domestic and international nuclear personnel from various sectors, including utilities, regulatory bodies, industries, universities, and R&D institutes, with courses covering a wide range of fields such as the utilization of radioisotopes, nuclear power applications, nuclear fuel technology, research reactor experiments, and non-destructive testing. The NTC has two buildings for educational facilities, namely the training institute building and the INTEC (International Nuclear Training and Education Center) Building. The NTC has various laboratories such as the nuclear power plant simulator training room, radiation measurement training room, and computer education room. The laboratories are equipped with radiation experimental equipment, nuclear power plant simulator equipment, e-learning systems, and more. In addition, the INTEC was established in 2002 to expand international nuclear workforce development, and it has an auditorium, an international conference room, seminar rooms, and other facilities that can accommodate up to 330 people. The NTC of KAERI develops and administers training courses in adherence to the Systematic Approach to Training (SAT) recommended by the IAEA, following the guidelines outlined in the course development and operation design manual. Moreover, the NTC had obtained the ISO 29990 certificate, an international standard for quality management of education and training. This ensures that the NTC maintains a high level of quality in the design, development, and delivery of training courses.

3. Activities of KAERI-ICERR

Due to the impact of COVID-19 pandemic, ICERR cooperation has encountered numerous challenges since the onset of 2020. Despite the COVID-19 pandemic, KAERI-ICERR has produced significant achievements while carrying out activities under the ICERR scheme during the KAERI-ICERR designation period. Notably, KAERI has supported the affiliates, the Philippine Nuclear Research Institute (PNRI) of the Philippines since 2021, and the Addis Ababa Science and Technology University (AASTU) of the Ethiopia since 2023. KAERI has accepted foreign scientists, engineers who want to cooperate using KAERI-ICERR facilities. KAERI has accommodated scientific visitors and research fellows, and has hosted training workshops, technical meetings, and research coordination meetings. Additionally, KAERI has organized many international conferences, workshops, symposia, seminars, and training courses. KAERI has maintained close collaboration with organizations from various countries and international organizations to enhance R&D activities. KAERI has continued its efforts to promote bilateral/multilateral cooperation in general and to exchange of information on matters of common interests.

NTC has operated quite a few international and regional training programs based on KEARI professionals and comprehensive R&D facilities for nuclear education and training. Also, KAERI NTC conducted the online training courses during the COVID-19 pandemic period.

4. Conclusions

KAERI has achieved numerous accomplishments while carrying out activities related to the ICERR scheme, including supporting member state's affiliates, R&D collaborations, hosting international conferences/ workshops/meetings, conducting international/regional training sessions, and accepting international/regional scientific visits during the ICERR designation period. Also, KAERI has been continuously making efforts to promote international cooperation. These efforts have enabled the member states to access relevant nuclear infrastructure based on the research reactor and their ancillary facilities effectively and appropriately.

REFERENCES

[1] Terms of Reference on the IAEA designated International Centre based on Research Reactor (ICERR), IAEA, Vienna, 2014.
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