

Education and Training Program using HANARO

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Abstract

Abstract - This report will introduce the epitome about the subject, HANARO (Hi-flux Advanced Neutron Application Reactor designed by KAERI in early 1995) Utilization Education Training Program Development and Operation, which is one of the nuclear research basic expansion businesses executed from 1999. 12. to strengthen the usage of HANARO. This program consists of the basic reactor experiments program for university students who have specialty of nuclear and other engineering, and the special research education program for faculties from universities and researchers from industrial fields. Principle lessons are reactor operation, radioisotope production, neutron activation analysis, neutron radiography, radiation shield (health physics), nuclear fuel combustion measurement by gamma scanning arrangement, and CNS (Compact Nuclear Simulator) and so on.

INTRODUCTION

KAERI (Korea Atomic Energy Research Institute) designed and constructed a 30 megawatt class Hi-flux Advanced Neutron Application Reactor, or HANARO in early 1995. HANARO is used for reactor material research, nuclear fuel tests, research on neutron applications, and the ample production of radioisotopes for medical and industrials uses. The objective of our training and education program is to increase the actual and potential capabilities of the reactor (HANARO) and eventually to be greatly contributed to the national self-reliance program of nuclear technology and insurance of nuclear safety. Nuclear manpower development is one of the essential conditions for the successful implementation of nuclear programs. The Nuclear Training Center in KAERI has been providing various training courses, not only to

students from nuclear engineering, but also to faculties and researchers from university and the industrial sector. The Center is also widely recognized for its excellence in providing regional training programs in the Asia and Pacific region. We will plan to learn how to better involve university users and to better serve their needs in both teaching and research.

THE BASIC REACTOR EXPERIMENTS PROGRAM

Nuclear Engineering Department

Range : Nuclear Engineering Department of University in Korea KAIST(20), Seoul Natl Univ.(40), Kyung Hee Univ.(40), Cheju Univ.(20), Chosun Univ.(20), Hanyang Univ.(40), (about 200 students)

Duration : 1 week (5days)

Lesson : 2.5 days (lecture 2hours/course, 6courses)
(Introduction to Nuclear Engineering, Radiation Analysis, Neutron Beam Utilization, RI production, Nuclear Fuel Combustion, Compact Nuclear Simulator)

Experiment: 2.5 days (experiment 3.5hours/course, 5courses) (Neutron Activation Analysis, Neutron Beam Utilization, Radioisotope Production, Nuclear Fuel Combustion, Health Physics, Reactor Operation Practice (planning), Neutron Flux Measurement (planning), Compact Nuclear Simulator (planning))

Other Science and Engineering Department : planning

Radioisotope Production

KAERI has been producing radioisotopes for medical and industrial use and supplying them to radioisotope-using hospitals and industries. Development of new radio-pharmaceuticals for nuclear cancer therapy and treatment is one of the major achievements in this area.

The procedure of the radioisotope production is the choice of nuclear reaction, irradiation target material preparation, particle analysis, chemical management of target material, separation, refining, quality confirmation, packaging, and dispatching.

Neutron Activation Analysis

Activation is to make the unstable radionuclides through nuclear reaction by irradiation the sample to neutron, charged particle, and photon. This method is applied to the basis and usage of the broad fields because it has many good things. Detailed applicable examples are active tracer and quality assurance, environment research, generation determination, nondestructive testing, and so on.

The procedure of the neutron activation analysis is composed of neutron irradiation and activation analysis, nucleon analysis, data management and Analysis, and Quality and Assessment and warranty.

Neutron Radiography

Neutron Radiography is the detection method

to find deflection using material permeability through radiation. Application fields is nuclear and aeronautic industries, chemical and metallic engineering, biological and archaeology field, and so on.

Radiation Shield (Health Physics)

The purpose of radiation shield is to build up the technique and basic knowledge about radiation shield. The elementary principle to radiation shield is to prevent deterministic effect from radiation and to preserve the incidental probability from statistical effects as low as we can. To complete this purpose, we inspect radiation dose rate to distance and direction, air and surface contamination measurement.

Nuclear Fuel Combustion Measurement by Gamma Scanning Arrangement

Nuclear Fuel Combustion Measurement can be possible to measure the nuclear physical computation and nondestructive gamma scanning arrangement and chemical analysis. This method is characterized to nuclear fuel / core design code certification, depleted uranium control, safety demonstration for midterm storage.

THE SPECIAL RESEARCH EDUCATION PROGRAM (TUTORIAL, SPECIAL)

Neutron Beam Utilization

Range : Tutorial and Special

During : One day (Tutorial), Three-Four days (Special)

Lesson : Health Physics and Safety Control, Scattering theory and Scattering Institute, Neutron Diffraction, Diffraction Utilization, Actual Inspection. (total 6hours)

Method : Lecture and Experiments

Neutron Activate Analysis

Range: Special

During : Four Five days

Lessons: Health Physics and Safety Control,

Activate Analysis, Gamma Spectroscopy,
Gamma Measurement Statistics, Q/A,
Activate Analysis Application

Method : Lecture and Experiments

Irradiation Utilization

Range : Tutorial

During : One day

Lesson : Health Physics and Safety Control,
Irradiation Examination, Capsule
Irradiation, Actual Inspection, HANARO
and Irradiation Facility

Method : Lecture and Experiments

Radioisotope Production

Range : Tutorial

During : One day

Lesson : Health Physics and Safety Control,
Radioisotope Production for Research,
Sample Production for Neutron
Irradiation, Chemical Management and
Fabrication

Method: Lecture and Experiments

OPERATION RESULT AND FUTURE PLAN

In 1999, 127 students from five universities (KAIST, Seoul Natl Univ., Hanyang Univ, Cheju Univ., Chosun Univ.) were trained through our reactor experiments course, and we have the plan to increase the instruction courses to broaden a choice of lessons to the character of each university during the training in 2000. In the special research education program, we are developing and operating the general education course from above four parts in 2000. From 2001, we will fix regularly general education course and develop and operate the special education course.

CONCLUSIONS

Reactor experiments education course is operated regularly for student from universities having the nuclear engineering department to complement theoretical education. Also the special research education program is developed

and operated for university faculty and researcher this year(2000) and will strengthen utilization and research of the HANARO next year. In the year(2000), students from other science and engineering departments as well as students from nuclear engineering will attend the reactor experiment course. It is believed that reactor experiment education program will be greatly contributed to the national nuclear development programs, therefore, the project should be implemented continuously for the university students.

Finally, such a plan identifies the actual and potential capabilities of the reactor, as well as its current and potential future users. It then provides an action plan to keep the existing users and to increase new users for the long-term health and sustainability of the research reactor facility. We will also plan to learn how to better involve university users and to better serve their needs in both teaching and research.

REFERENCES

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