

# Comprehensive Human Resources Development Program for Nuclear Power at NuTEC/JAEA

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**Abstract.** Nuclear Technology and Education Center (NuTEC) of the Japan Atomic Energy Agency (JAEA) aims at comprehensive nuclear education and training activities, which cover 1) education and training for national nuclear engineers, 2) cooperation with universities and 3) international contribution and cooperation. The main feature of NuTEC's training programs is that the curricula place emphasis on the laboratory exercises with well-equipped training facilities, including research reactors, and expertise of lecturers mostly from JAEA. The wide spectrum of cooperative activities have been pursued with universities and also with international organizations, such as IAEA, ENEN, CEA/INSTN and FNCA countries. The present paper describes the overall HRD activities of NuTEC, especially in nuclear power field.

## 1. Introduction

Nuclear human resources development (HRD) in Japan has been identified as one of the most important issues these years in nuclear society, mostly due to the mass retirement and a large employment of nuclear engineers in industries with the coming peak of replacement of nuclear power reactors around 2030, the difficulties of technical transfers between experienced engineers and younger generations, and to internationally growing needs for newly introducing and expanding nuclear power programmes in the coming "nuclear renaissance". NuTEC was established as HRD division in 1957 and the first training course has been opened in 1958, soon after Japan Atomic Energy Research Institute was founded in 1956. The Japan Atomic Energy Agency (JAEA) established by the integration of JAERI and JNC in 2005 clearly identifies nuclear HRD as one of the missions of JAEA. NuTEC's HRD activities aim at comprehensive nuclear education and training program [1][2]. The main feature of the NuTEC's training program is that the curricula place emphasis on the laboratory exercises using well-equipped training facilities at JAEA, including research reactors, and expertise of lecturers mostly of JAEA's well-experienced staffs.

## 2. Overall HRD Activities of NuTEC

Figure 1 shows the overall HRD activities at NuTEC, which cover 1) Education and training for national nuclear engineers, 2) Cooperation for universities in Japan, and 3) International activities, including training for Asian countries, international cooperation under the scheme of FNCA and IAEA, and cooperation with ENEN and CEA/INSTN.

## 3. Education and training for national engineers outside of JAEA

There are 3 categories of training for national nuclear engineers outside of JAEA; courses for nuclear reactor engineers, radioisotope and radiation engineers, and national test examinees. Well-experienced lectures and specially prepared texts are used in each of the courses. Technical visits to related facilities including large-scale and advanced facilities, such as J-PARC, NUCEF, NSRR and HTTR, are arranged in most of the courses to enlarge trainee's experiences.

### 3.1 Training courses for nuclear reactor engineers

The Nuclear Engineering School was launched at JAERI-Tokai in 1959. Presently, 3 regular courses are provided for nuclear reactor engineers. The most significance of these courses is that on "Reactor Engineering". Since 1959, it has contributed in training nuclear reactor engineers for nuclear power plants, nuclear facilities and research institutes. This course provides comprehensive knowledge of nuclear engineering, nuclear fuel engineering, radiation management and related regulations/laws through various lectures, laboratory exercises and facility visits. Other 2 courses are available as introductory courses: "Nuclear Beginners" broadly guides through the field of nuclear energy,

“Introductory Neutron Experiment” provides fundamental knowledge required for the use of neutrons, and to familiarize the trainees to its application technology towards the use of J-PARC.

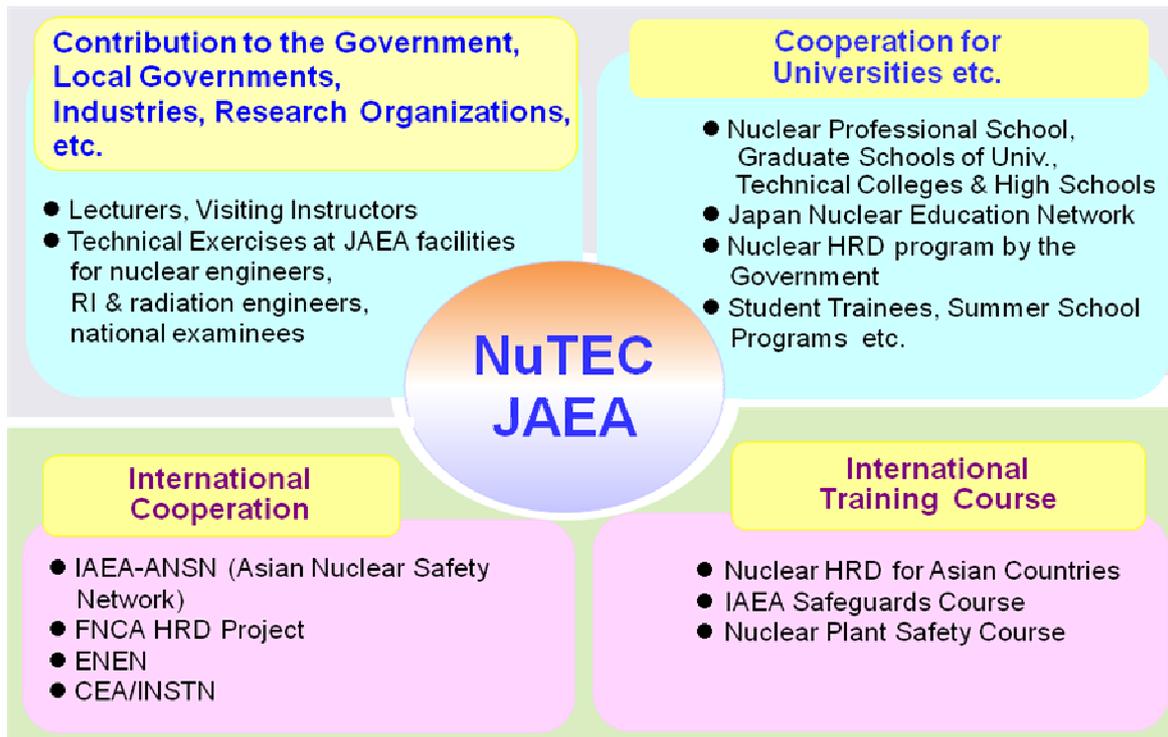


FIG. 1. Outline of JAEA-NuTEC Activities

It should be noted that besides regular courses described above, several extraordinary courses have been conducted, mostly in response to the needs of the government, such as course for nuclear special officers of Ministry of Education, Culture, Sports, Science and Technology (MEXT). Since 2008, the special course for nuclear safety inspectors of the Nuclear and Industrial Safety Agency (NISA) under Minister of Economy, Trade and Industry (METI) has been started.

### 3.2 Training courses for radioisotope and radiation engineers

Training courses for radioisotope and radiation engineers first begun at the Radioisotope School situated in JAERI-Tokyo in 1958. At present, NuTEC provides 6 courses for radioisotope and radiation engineers. All of these courses aim at systematic acquisition of wide variety of knowledge and handling techniques of radioisotopes and radiation through lectures and laboratory exercises.

### 3.3 Training courses for national test examinees

There are 3 courses in preparation of national examinations; “Principal Nuclear Reactor Engineer”, “1<sup>st</sup> Class Radiation Protection Supervisor” and “Chief Nuclear Fuel Handling Engineer”. The training aims at systematic acquisition of knowledge and consists mostly of lectures. Every course contains subjects on its related law/regulations. Participants are from electric utilities, nuclear fuel handling plants, RI/radiation handling facilities including staffs from JAEA. It may be noted that the course on “Principal Nuclear Reactor Engineer” has been very popular these years, since the reservation of licensed operators has become seriously important for utilities due to increased number of retiring experienced engineers.

## 4. Cooperation with universities

JAEA contributes to universities and technical colleges with dispatch of the lecturers, acceptance of experiments and the instruction of the articles on several programs.

#### ***4.1 Cooperation with Universities under Comprehensive Agreements with JAEA***

In response to the recent expanding needs in the nuclear field, NuTEC conducts cooperative activities with universities under comprehensive agreement, which includes seven universities, such as University of Tokyo and Ibaraki University.

#### ***4.2 Cooperative Graduate School Program***

Under an education system provided by MEXT, NuTEC has been cooperating with many graduate schools based on the agreements between JAEA and each university. Currently JAEA has cooperation agreements with 20 universities and technical colleges.

#### ***4.3 Japan Nuclear Education Network (JNEN)***

A new remote-education system, called Japan Nuclear Education Network (JNEN), has initiated in 2007 under the cooperation framework among JAEA and 3 universities. JNEN is a multi-directional education system connecting the remote sites of the participating universities and JAEA through Internet. Currently 6 universities have participated in JNEN. Many kinds of lectures are available through the system at real time. Through JNEN students of each participating university can take lectures from different universities or JAEA, such as reactor engineering, fuel reprocessing and geological disposal of nuclear wastes. Under this program, some laboratory exercises have been also performed using JAEA nuclear facilities to strengthen the educational effect. Such exercises are considered to be highly important and valuable to the participating students.

#### ***4.4 Cooperation with Nuclear HRD Program***

Nuclear HRD Program has been initiated in 2007 by MEXT and METI to support universities and technical colleges in the education of nuclear engineering and science. JAEA has conducted cooperation with adopted universities, such as dispatch of lecturers, laboratory exercises using nuclear facilities and facility visits.

### **5. International contribution and cooperation**

Soon after its foundation, NuTEC organized an international training course, the UNESCO Isotope Training Course, in 1958. NuTEC continued to conduct International Basic Courses for Radioisotope and Radiation for Asian countries. From 1977, under the sponsorship of MEXT, NuTEC has been conducting International Training Project to strengthen the training system of nuclear engineers in Asian countries. The project includes three training programs: Instructor Training Program, Nuclear Plant Safety Course, and Safeguards Training Course.

#### ***5.1 International training courses for Asian countries***

NuTEC has conducted Instructor Training Program (ITP) as more effective and efficient method for developing instructors in a self-sustainable manner for Indonesia, Thailand and Vietnam since 1998. To develop teaching ability and techniques as an instructor, several participants are first invited to NuTEC to join the ITP for 4 to 6 weeks. They will learn teaching techniques and then join the training as co-instructors with NuTEC's instructors in their countries. Until now, about 100 trainees were trained as instructor-candidates. Through this system, participants accumulate training experiences in their own country to become main instructors. The theme of the courses is based on the needs in the steering committee meeting, but all the courses place emphasis on the laboratory exercise with well-equipped training facilities at JAEA. It should be noted that the reactor engineering course was newly initiated in 2008 in response to the need for the introduction of nuclear power. Since 2007 Nuclear Plant Safety Course has been conducted and totally about 40 participants have participated. Since 1996 Safeguards Training Course, which is the joint course with IAEA, has been conducted and totally about 190 trainees have participated. The accumulated number of trainees of international training courses is close to 3,000.

#### ***5.2 International Cooperation***

Since 1999, NuTEC has organized a workshop to promote HRD activities in Asian countries under the framework of FNCA (Forum for Nuclear Cooperation in Asia). Currently the project focuses on ANTEP (Asia Nuclear Training and Education Program) activity, a network system by utilizing existing nuclear training and education resources in 10 member states, i.e., training and

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education programs, nuclear research facilities and experts to meet each country's HRD needs. Based on the agreement at the FNCA Panel Meeting in 2007 the database on HRD toward nuclear power is being established. NuTEC has been contributing to IAEA's ANSN (Asian Nuclear Safety Network) as an Extra Budgetary Program of IAEA supported by Japanese government. ANSN aims to strengthen nuclear safety of nuclear power plants and research reactors in this region by sharing existing and new technical knowledge and practical experiences for the Asian nuclear facilities. Within this framework, NuTEC, in cooperation with Radiation Application Development Association in Japan, has contributed to the ANSN activities by providing the database with a variety of information in the field of nuclear safety. NuTEC also has close cooperation with other international organizations, such as IAEA, ENEN and CEA/INSTN.

### **6. Vision of NuTEC**

NuTEC is expected to conduct effective and efficient correspondence to the nuclear HRD needs by industries, universities and government offices in Japan. Also NuTEC should contribute to the nuclear HRD needs, which is growing all over the world, especially in Asian region. In response to these needs, NuTEC is to prepare for the followings:

- (1) Conduct more effective HRD programs for engineers inside and outside Japan, utilizing the JAEA resources such as research institutions and talented personnel in maximum with strong cooperation of Government, JAIF, Univs, etc. in Japan.
- (2) Configure the international nuclear HRD network with educational organizations such as IAEA, ENEN and CEA/INSTN, and promote the nuclear HRD of Asian countries corresponding to their engineering needs.
- (3) Be a core organization of the nuclear HRD in Asia with exchanging the national and international information of nuclear HRD, analyzing it and contribute in a valuable manner such as definite proposals to the upcoming needs.

In this context it should be noted that Japanese Government has recently initiated a new HRD program, named Global Human Resources Development Initiative. This is a nuclear HRD network supported by Japanese Government, involving universities and colleges, public organizations and regional hubs, industries, and R&D organizations and academic societies, for the education and training of students, young researchers in Japan and foreigners mostly of Asian countries, under the close cooperation with IAEA.

### **7. Summary**

- (1) NuTEC aims at comprehensive nuclear education and training activities in response to the national and international need, based on 53 years experiences and educational know-hows.
- (2) HRD activities for young generation are quite important. The wide spectrum of cooperative activities have been pursued with universities, which include newly developed remote-education system, and with international scheme or organizations, such as IAEA and FNCA.
- (3) JAEA has wide varieties of experimental facilities and talented staffs, but resources are limited. With more extended and close cooperation with national and international organizations, NuTEC's HRD activities will further be conducted in more effective and efficient manner.
- (4) Under the close cooperation with JAIF, JAEA aims at playing a central role of the Nuclear HRD network in Japan and also in Asia with promoting networking with national industries, universities, related organizations and international organizations, such as IAEA and ENEN.

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