JN-HRD.NET NUCLEAR HUMAN RESOURCE DEVELOPMENT NETWORK

2019
Introduction of Training Programs Being provided by Japan for Newcomer Countries

Contents

Message

Taking the opportunity of completion of the pamphlet, I'd like to extend my warmest greetings to you all.

After the accident at the Fukushima Daiichi NPS, we have kept on making every possible effort to reassess and enhance nuclear safety.

Even after the accident, many countries around the world have worked to introduce or expand nuclear power from the view points of stable energy supply, global warming countermeasures, and stabilizing and reducing energy costs, Those countries have pinned high expectations on Japanese technology, and therefore it is our responsibility to share the lessons learned from the accident and to utilize them to improve the safety of nuclear facilities around the world. Also, we would like to contribute to human resources development in newcomer countries to make good use of Japanese rich experience of NPP construction during the past 50 years.

In order to offer how Japan can contribute to foster human resources and correspond to various demands from overseas, we have discussed periodically under a Sub-Working Group of the Japan Nuclear Human Resource Development Network (JN-HRD.Net) with cooperation among nuclear related organizations form industries, academia and the government. We have arranged HRD programs in Japan comprehensively and organized them into a database in matrix form for the purpose of visualization of all the HRD programs provided by Japan. By using this pamphlet and database available on our website, you will be able to find the most appropriate Japanese program for your country.

We will continue to carry out multifaceted efforts foster nuclear human resources in not only Japan but also every country seeking to benefit from the use of nuclear power. I greatly appreciate your continued cooperation with our activities.

Akio Takahashi

President, Japan Atomic Industrial Forum (JAIF) & JAIF International Cooperation Center (JICC)
Represent at Sub-Working Group for supporting nuclear HRD programs in newcomer countries,
Japan Nuclear Human Resource Development Network (JN-HRD. Net)

It is our great pleasure to publish the fourth version of the pamphlet of Japan Human Resource Development activity. We have collected the updated information of all the activities. As you know, there are several electric power utilities, production industries, research institutes and universities in Japan. In order to make those activities more visible, we established the Japan Nuclear Human Resource Development Network (JN-HRD Net) six years ago. Of course, all activities should be based on the lessons from TEPCO Fukushima Daiichi NPP accident happened in March 11, 2011. We have formed the roadmap of HRD for coming ten years. We opened and presented it, especially at the IAEA general conference in 2015. Each activity has its own and specialized mission/role. Among them, we have operated the Japan-IAEA Nuclear Energy Management School for three times so far and are going to host the 7th school this July in Tokyo and Fukui. IAEA knowledge management section of the energy department is leading INMA (IAEA Nuclear Management Academy) to form master courses on the nuclear management in the world. Japan and IAEA are developing the e-learning system in order to contribute to this task. Moreover, we have started the IAEA Training Course on Nuclear Power Infrastructure Development with the nuclear power plant simulators and site training for four weeks from November in 2016. We plan to continue it annually. As you can understand, we have decided to reform the HRD programs based on the Fukushima lessons more international. We are collaborating well with IAEA to let our programs more global. We hope many engineers, managers and students to refer to this pamphlet for upgrade of their knowledge, experience, confidence and safety culture.

Mitsuru Uesaka

Professor, Nuclear Professional School, School of Engineering, the University of Tokyo
Chief examiner, Sub-Working Group for supporting nuclear HRD programs in new comer countries, Japan Nuclear Human Resource Development Network (JN-HRD Net)
Chair of the steering committee of the Japan-IAEA Nuclear Energy Management School
Member of IAEA INMA (International Nuclear Management Academy)
Cooperation member of Science Council of Japan

The purpose of this pamphlet is to introduce the outline of current status of nuclear power in Japan and training organizations providing various kinds of education for newcomer countries.

For reference of details of training programs, please access to following website.
http://www.jaif-icc.com/english/jn-hrd.net/2019.html

You can download:

- **Matrix forms of training programs**
- **Outline of each training program**
- **Pdf data of this pamphlet**

Matrix forms:
Training programs provided by Japan are classified by subject (Vertical axis) and are also assorted into four target groups – 1) NEPIO, 2) Regulatory Staff, 3) R&D Organizations/Academics and 4) Nuclear Power Operators (Transverse axis). These matrix forms are prepared separately for phase Ⅰ and phase Ⅱ countries.

Also,you can find "Courses open for non-Japanese" at website below.
https://jn-hrd-n.jaea.go.jp/en/participation.php

We hope this pamphlet and data base would be a useful entrance for you to take advantage of Japanese resources effectively. If you are interested in some of training programs, please contact with the organization which provide the program directly or a secretariat (JICC) for your inquiry.

SAMPLE

Overall Matrix of Activities for Development of Human Resources
<Target: Phase Ⅰ Countries> [Basic Science / Basic Engineering]

Major Items / Objects	NEPIO- Administrative or Governmental Staff	Regulatory Staff	R&D Organizations, Academics	Nuclear Power Operators
Basic Science - Basic Radiation - Nuclear Physics - RI Utilizations - Testing Reactors - Radiation Measurements - Biological Impacts	ID:20 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Japan, English, 9 weeks	ID:36 Nuclear Safety Research Association (NSRA), Japan, English, 3-6 months	ID:20 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Japan, English, 9 weeks	ID:37 The Japan Atomic Power Company (JAPC) / Tokai Training Center, Japan, Local Language (Interpretation), 2 times (2 weeks each)
	ID:21 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Japan, English, 6 weeks	ID:37 The Japan Atomic Power Company (JAPC) / Tokai Training Center, Japan, Local Language (Interpretation), 2 times (2 weeks each)	ID:21 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Japan, English, 6 weeks	ID:40 The Wakasa Wan Energy Research Center (WERC) / Fukui International Human Resources Development Center for Atomic Energy, Japan, English (Interpretation), 4 weeks
	ID:23 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Japan, English, 2 weeks	ID:40 The Wakasa Wan Energy Research Center (WERC) / Fukui International Human Resources Development Center for Atomic Energy, Japan, English (Interpretation), 4 weeks	ID:23 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Japan, English, 2 weeks	
	ID:24 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Each Couuntry, English / Local Language, 1-2 weeks each		ID:24 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Each Couuntry, English / Local Language, 1-2 weeks each	
	ID:25 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Each Couuntry, English / Local Language, 1-2 weeks each		ID:25 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Each Couuntry, English/ Local Language, 1-2 weeks each	
	ID:26 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Each Couuntry, English / Local Language, 2 weeks each		ID:26 Japan Atomic Energy Agency (JAEA) / Nuclear Human Resource Development Center (NuHRDeC), Each Couuntry, English / Local Language, 2 weeks each	
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	ID:40 The (WERC) / Developm English (In		ID:40 The Wakasa Wan Energy Research Center (WERC) / Fukui International Human Resources Development Center for Atomic Energy, Japan, English (Interpretation), 4 weeks	
Basic Engineering - Mechanical Engineering - Electrical and Instrumentation Engineering - Water Chemistry, etc. - Thermal and Hydraulics - Structural Dynamics	ID:36 Nuc Japan, Engl	lear Safety Research Association (NSRA), Japan, English, 3-6 months	ID:36 Nuclear Safety Research Association (NSRA), Japan, English, 3-6 months	

Vertical axis: Major Subjects

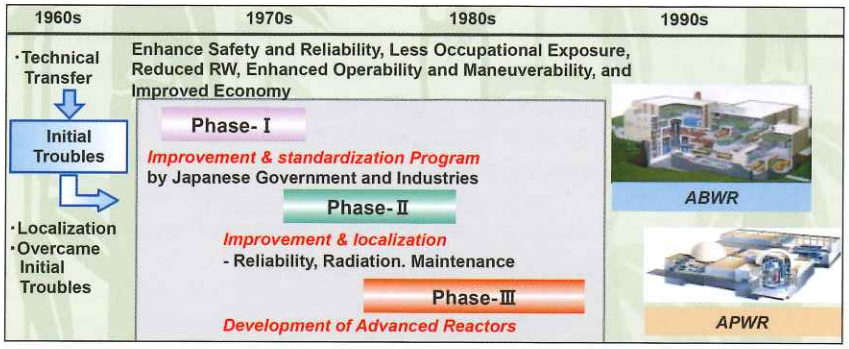
Transverse axis: Target Groups

Outline of current status of nuclear power in Japan

History of Nuclear Power Development in Japan

1953 “Atoms for Peace” : The US President, Mr. Eisenhower’s Speech in UN
1955 Atomic energy Basic Act of Japan
1956 JAERI (Japan Atomic Energy Research Institute)
1957 Inauguration of IAEA
1961 Long Term Plan of Nuclear Development and Utilization
1963 JPDR (Japan Power Demonstration Reactor) (BWR)
1967 JAPC Tokai (GCR -- First Commercial Use Reactor)
1970 JAPC Tsuruga-1 (BWR), KEPCO Mihama-1 (PWR)
1971 TEPCO Fukushima-1 (BWR)

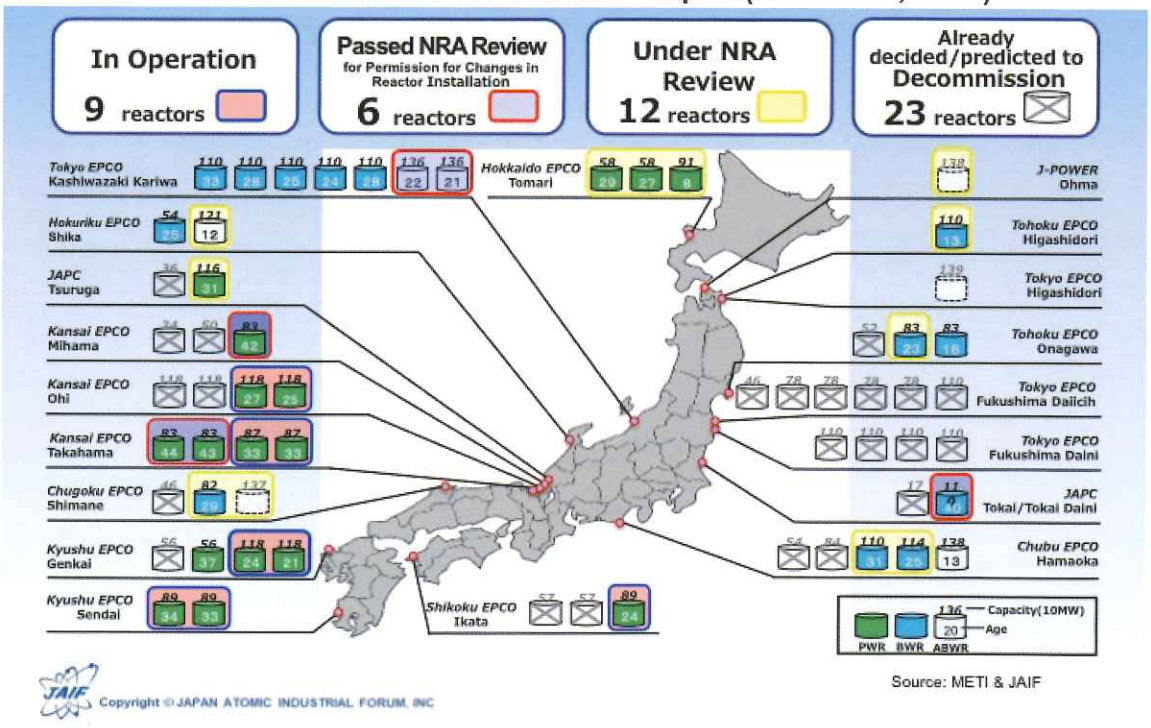
2011 Fukushima Daiichi Accident
2015 Sendai NPP restarted
2016 Takahama,Ikata NPPs restarted
2017
2018 Ohi,Genkai NPPs restarted



Current Status of the Nuclear Power Plants in Japan

* 9 plants at Sendai,Takahama,Ikata,Ohi and Genkai have restarted.
* 12 Units under NRA safety review.
* 6 Units have passed safety review.

Nuclear Electric Power Plants in Japan (AS of Dec, 2018)



Source: METI & JAIF

5th Strategic Energy Plan

We aim to contribute to further growth of the Japanese economy, improvement of the standard of living, and global development through energy supply that is stable, sustainable long term, and independent.
Following the 3E+S principles, realise an energy supply and demand structure that is stable, low-burden, and compatible with the environment.

3E+S	⇨	Sophisticated 3E+S
○ **S**afety	+	Safety innovation by technology/governance reform
○ **E**nergy security	+	Raise technical self-sufficiency rate and ensure diversity of choice
○ **E**nvironment	+	Work towards decarbonisation
○ **E**conomic efficiency	+	Enhance domestic industrial competitiveness

Changing circumstances
① Start of inter-technology competition for decarbonisation
② Geopolitical risk increased by technology changes
③ Intensified competition between nations and firms

Towards 2030

~ To reduce emission of greenhouse gases by 26% ~
~ To achieve energy mix target ~
– Currently halfway to the target
– Deliberate promotion
– Realistic initiatives
– Intensify and enhance measures

<Primary measures>

○ **Renewable energy**
- Lay foundations to use as major power source
- Cost reduction, overcome system constraints, secure flexibility of thermal power

○ **Nuclear power**
- Lower dependency on nuclear power generation to the extent possible
- Restart of nuclear power plants and continuous improvement of safety

○ **Fossil fuels**
- Promote independent development of fossil fuels upstream, etc.
- Effective use of high-efficiency thermal power generation
- Enhance response to disaster risks, etc.

○ **Energy efficiency**
- Continued thorough energy efficiency
- Integrated implementation of regulation of Act on Rationalizing Energy Use and support measures

○ **Promotion of hydrogen/power storage/distributed energy**

Towards 2050

~ Toward reducing GHGs by 80% ~
~ Challenges towards energy transitions and decarbonisation ~
– Possibility and uncertainty
– Ambitious multiple track scenario
– Pursue every option
– Choose priorities by scientific review

<Primary directions>

○ **Renewable energy**
- Aim to use as major power source, economically independent and decarbonised
- Start on hydrogen/power storage/digital technology development

○ **Nuclear power**
- One of the options for decarbonisation
- Pursuit of safe reactors, development of back end technologies

○ **Fossil fuels**
- Major power source during the transitional period. Enhance resource diplomacy
- Shift to gas, fadeout inefficient coal
- Start hydrogen development for decarbonisation

○ **Heat & transportation, distributed energy**
- Challenges for decarbonisation with hydrogen, power storage, etc.
- Distributed energy systems and regional development

(Combination of next generation renewables/ power storage, EV, micro grid, etc.)

Draw up strategic plan ⇨ All Japan's efforts (projects, international collaboration, financial dialogue, policy)

Outline of current status of nuclear power in Japan

Role of Nuclear Power

- Nuclear power is clean, safe, affordable and reliable energy source.
- Even after Fukushima Daiichi accident, role of Nuclear power is not changed.
- World energy demand increase would be inevitable.
- For sustainable future of the planet, we have to try to realize low carbon society.
- Nuclear power has played an important role for energy supply assurance and reduction of CO_2 emission.

International Cooperation

Japan will fully support development of oversea projects.

- Respond to expectation from oversea countries on the Japanese technologies.
- Securing 3S is the basic principle of Nuclear Policy of Japan.
- Commitment by our Prime Minister

Strength of Japan in nuclear Technology

- Continuous construction of NPPs during the past 50 years
- Supply chain of high quality and reliability materials and components
- Highly competent engineers and well-trained technicians
- Project management capability to maintain schedule and cost as planned
- High technology and experience of seismic design
- 1500 reactor-years of operation experience
- World class research and development

Japanese Industry is Good at Project Management – Japan Model –

- Industrial Safety, Quality, Schedule and Budget Control
- Coordination among utility, vendors and constructors
- To cooperate, even beyond a contract, among project participants, it is necessary to respect each other and share the common goal
- "Just in Time Delivery" of high quality components
  - Clean working circumstances
  - Simple working procedure
  - Organizations with "Safety Culture"

  Effort for "Just in Time Delivery" finally brings "On Time and On Budget".

*** Keeping questioning in every work for everlasting improvement**

- Sharing the lesson learned from Fukushima Daiichi accident and enhancement of safety are crucial for steady development of nuclear energy.
- For the sustainable development of the planet, nuclear power will play an important role. Without public confidence and support, nuclear technology cannot be deployed.
- International cooperation is crucial for secure development of nuclear power.
- Japan will continue to contribute for the future development of nuclear energy in the world.

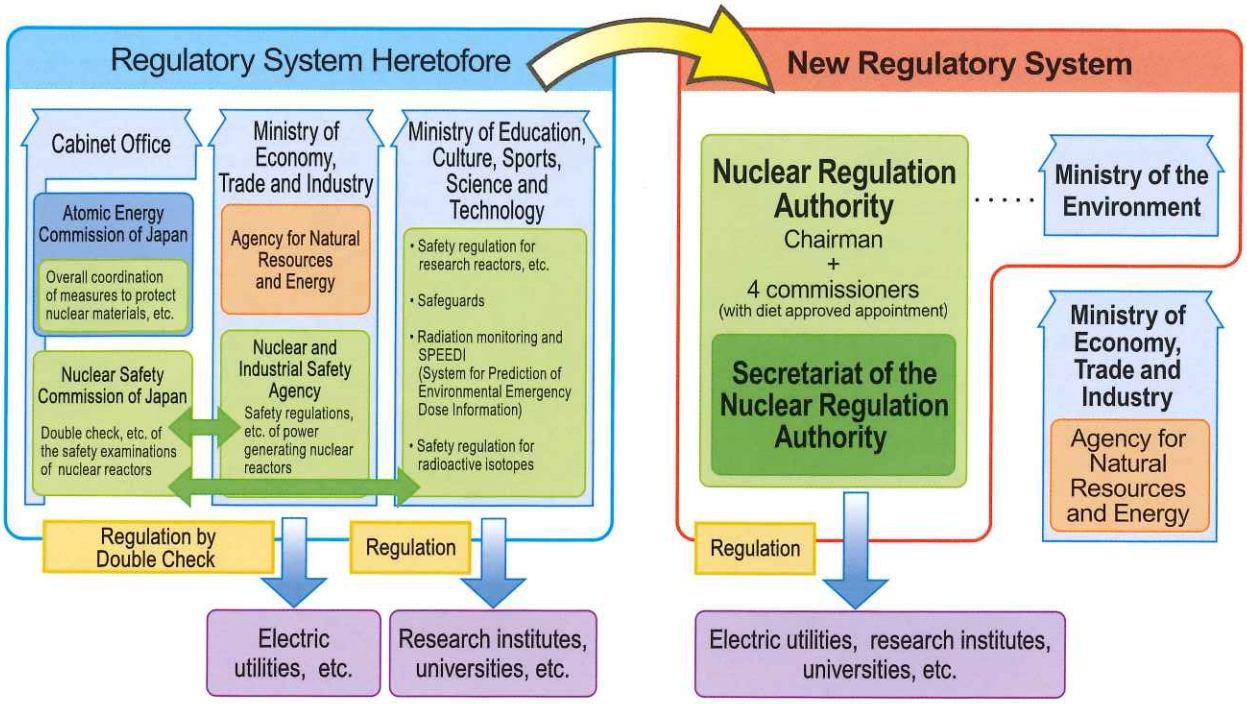
How to Prepare for Emergency

- Well prepared total management systems consist of:
  - Robust Hardware
  - Flexible Software
  - Capable Human Resources with Safety Culture
- Proactive performance by operators is the most crucial.

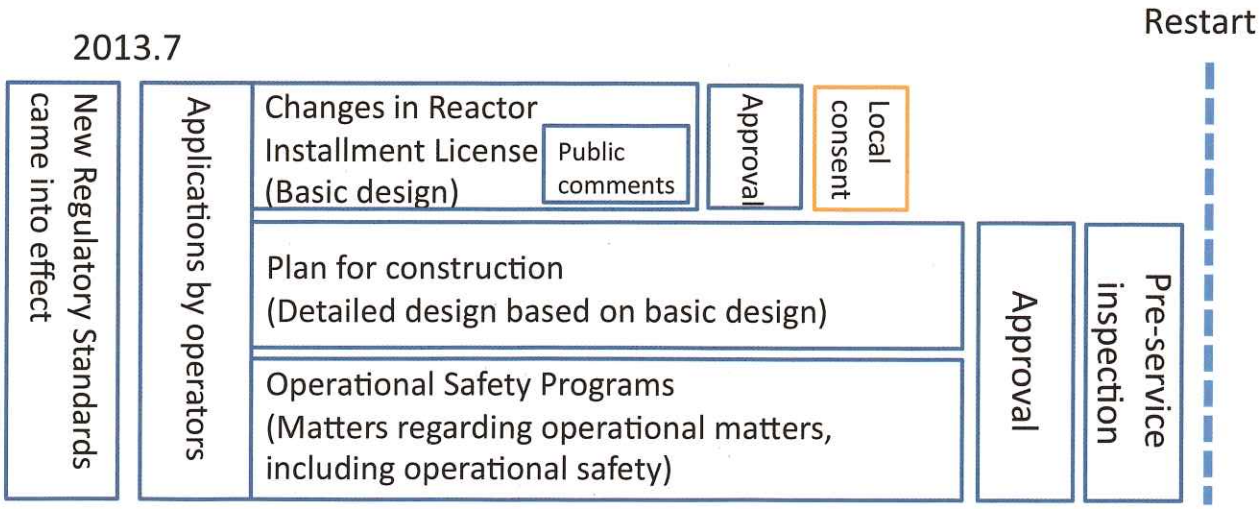
A lecture on Japan's current nuclear energy policy by the officer of METI

Construction view of Ohma NPP (Full Mox ABWR), J-Power (Electric Power Development Co., Ltd.)

(Ref.)Reform of Nuclear Regulatory Body



(Ref.)Flow of NRA Examination for restart of plant



Legal requirements

Not a legal requirement (based on agreement)

Outline of current status of nuclear power in Japan

(Ref.)Examples of Proposed Safety Requirements

Blue: Strengthening of Design Basis
Red: Severe accident measures

Reinforcement of AC power source
- Connect to two or more substations located in different places through two or more transmission lines
- Continuous operation of emergency diesel generators (7 days)

Emergency response center
- Secure earthquake protection by a seismic isolation function
- Secure safe habitability even if emissions of radioactive materials which is equivalent to 1F accidents occur

Addition of natural disasters to be assumed
- Include volcanic eruptions, tornadoes, and forest fires into design consideration

Measures to cool and depressure containment vessel failure/Measures to cool damaged core
- Mobile water injection system

Water source to prevent severe accidents
- Secure water sources

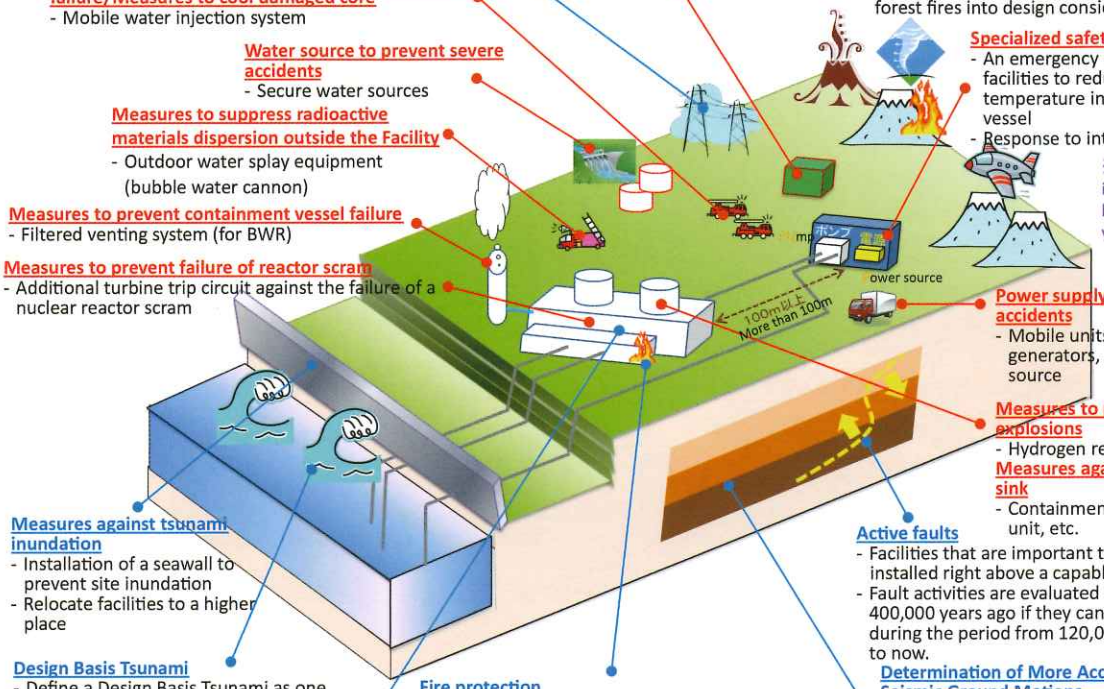
Measures to suppress radioactive materials dispersion outside the Facility
- Outdoor water splay equipment (bubble water cannon)

Measures to prevent containment vessel failure
- Filtered venting system (for BWR)

Measures to prevent failure of reactor scram
- Additional turbine trip circuit against the failure of a nuclear reactor scram

Specialized safety facility※
- An emergency control room back up facilities to reduce the pressure and temperature inside the containment vessel
- Response to intentional aircraft crashes

※Back-up facilities improving reliability will be ready within a five year period



Power supply against severe accidents
- Mobile units, emergency diesel generators, the third DC power source

Measures to prevent hydrogen explosions
- Hydrogen recombiner

Measures against loss of final heat sink
- Containment vessel recirculation unit, etc.

Measures against tsunami inundation
- Installation of a seawall to prevent site inundation
- Relocate facilities to a higher place

Active faults
- Facilities that are important to safety cannot be installed right above a capable fault.
- Fault activities are evaluated as far back as approx. 400,000 years ago if they cannot be clearly denied during the period from 120,000-130,000 years ago up to now.

Design Basis Tsunami
- Define a Design Basis Tsunami as one which exceeds the largest ever recorded

Fire protection
- Measures for fire protection and mitigation of influence in order not to spoil safety functions

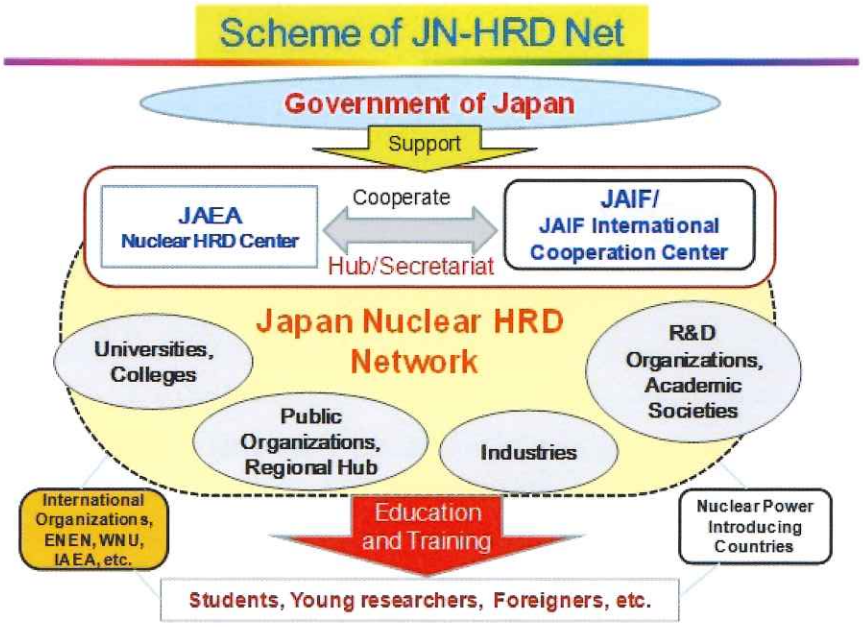
Determination of More Accurate Design Basis Seismic Ground Motions
- Three-dimensional evaluations of the subsurface structure
- A concept of ground motion without a specific seismic source

Internal flooding
- Introduce measures against internal flooding

Japan Nuclear Human Resource Development Network (JN-HRD.Net)

Japan Nuclear Human Resource Development Network (JN-HRD.Net) was established in November 2010 in order to conduct and promote various national and international HRD activities in strategic and integrated manner, effectively and efficiently.

With continued discussion under the Establishment Committee for Nuclear HRD Network in response to the call from the government, the JN-HRD Net, an all-Japan framework based on mutual beneficial relationship among nuclear-related organizations from industries, academia and the government was established.



At present, JN-HRD Net has five important subjects on nuclear HRD and each subject is now being discussed under Sub-Working groups for implementing the relative activities.

1. Supportive Activities for Elementary to High School Education (JAIF)
2. Nuclear Education at Universities and Colleges (JAEA)
3. HRD for Working Engineers (JAIF)
4. HRD to Internationalize National Human Resources (JAEA)
5. Supportive HRD Activities to newly NPP Introducing Countries (JICC)

( ) shows the Secretariat for the Sub-Working Group

Activities – JN-HRD.Net

To enhance international cooperation with related organizations of various countries, JN-HRD Net plans to hold an international conference once a year. And, especially for newly nuclear power introducing countries, new activities are planned in this framework of JN-HRD Net;

- Short term seminars led by Japanese university professors in each country
- Dispatch of Japanese experts to exchange knowledge and experiences with the engineers of each country
- International seminars and training courses in Japan including visit to nuclear power plants and nuclear facilities
- Consultation and support to establish nuclear HRD programs in each country, mostly in close collaboration with international organizations, such as IAEA and FNCA.

Sub-Working group which support nuclear HRD programs in newcomer countries is organized in July, 2012 under JN-HRD Net aiming to provide effective and efficient HRD program. This pamphlet is edited by the Sub-Working Group as part of their activities to introduce comprehensive HRD organization and training programs provided by Japan to the countries planning to introduce nuclear power.

Secretariat

Japan Atomic Energy Agency (JAEA) and **Japan Atomic Industrial Forum, Inc. (JAIF)** play a central role in coordinating participating organizations/institutions and local networks, and also in conducting inter-organ HRD activities. Especially, for countries introducing nuclear power, **JAIF International Cooperation Center (JICC)** acts as the contact office for inquiries concerning their HRD activities.

Contact

[For nuclear HRD in general]

Japan Nuclear HRD Network
2-2-2 Uchisaiwaicho, Chiyoda-ku, Tokyo, 100-0011 JAPAN
TEL: +81-3-3592-2185 FAX: +81-3-3592-2185
e-mail: jn-hrd.net@jaea.go.jp
URL: http://jn-hrd-n.jaea.go.jp/en/index.html

[For supporting nuclear HRD programs in newcomer countries]

JAIF International Cooperation Center (JICC)
5th Floor, Kowa Nibancho Building, 11-19 Nibancho,
Chiyoda-ku, Tokyo, 102-0084 JAPAN
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URL: http://www.jaif-icc.com/english/index.html

Training organizations providing various kinds of education for newcomers

Universities

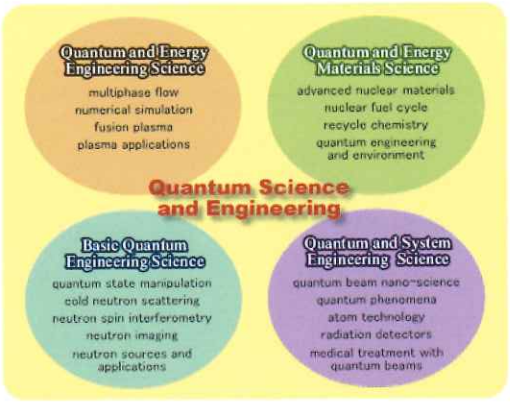
Training Organizations

Industries

A lecture scene

Technical Tour

Kyoto University Department of Nuclear Engineering



Overview

The aim of the Department of Nuclear Engineering is to explore quantum technologies leading to the frontiers of science such as quantum beams, nanotechnology, and atomic technology. This is done from a microscopic point of view based on the science of quantum phenomena relating to elementary particles, atomic nuclei, and atoms and molecules. The department also strives to construct recycling systems by developing technological applications in materials, energy, life sciences, and the environment.

Through systematic and comprehensive programs of education and research, we are training highly skilled researchers and engineers who are capable of working in their fields of specialization at advanced levels. In this way, we aim to contribute to the development of a more prosperous and sustainable society.

Introduction to Research

The Department of Nuclear Engineering is divided into four research groups, with cooperation between each divisions and sub-departments. Each group consists of members from the faculty (the Nuclear Engineering program of the Faculty of Engineering Science) and the graduate school (Department of Nuclear Engineering).

1. Quantum and Energy Engineering Science

Safe and efficient usages of nuclear energy are required to the nuclear energy system which suits environment. The purpose of the quantum and energy engineering science group is to contribute to the development of such energy system by the research of physics and basic engineering related to the nuclear energy generation and conversion.

Activities of our group include research for securing the safety of nuclear reactors (fission and fusion) and research of the fluid and thermal engineering relevant to the efficient use of generated nuclear energy. Moreover, aiming at realization of a nuclear fusion reactor, research is advanced by theory and the numerical simulation about the elucidation of the physical phenomenon in the magnetically confined high temperature plasma.

2. Quantum and Energy Materials Science

Materials are studied to ensure the safety of nuclear energy systems of power reactors and nuclear fusion reactors and to safely manage radioactive wastes which are produced from nuclear energy utilization. Advanced materials are developed by using nano-technology which becomes available in the field of nuclear engineering.

For the efficient utilization of nuclear energy, physicochemical properties and chemical processing of nuclear materials are studied in order to recycle limited resources and to achieve 'zero emission' from nuclear fuel cycles. These advanced technology will be extended to more general chemistry and technology which are needed to establish the recycling-based society.

3. Quantum and System Engineering Science

Material science and life science look very far fields of research each other, however, they have common elements if you study them in the dimension of micron, and in far smaller dimension, nano size.

With view point of state-of-the-arts, we are conducting comprehensive studies for a wide-spread research fields, and are performing basic studies and technology developments, which are common to numbers of research fields.

The tools of our study are ions, electrons, X-rays, and laser beams, which are quantum beams with high performance, to make super-high temperature, super-high pressure and super-high density of deposited energy. We are studying and utilizing non-equilibrium states in the extreme environments described above.

4. Basic Quantum Engineering Science

The quantum theory predicts a lot of peculiar phenomena. This peculiarity is not only interesting but also useful in constructing novel information protocols. For instance, the so-called uncertainty relation plays an essential role in quantum cryptography. We investigate such genuine quantum properties and the interface between quantum and classical theories.

X-rays and neutrons are effective tools for inspecting materials including human bodies. For X-ray computed tomography with energy information of X-rays, a novel detector system has been invented and studied for practical use. For effective use of neutron sources, high-intensity cold moderators, efficient neutron spectrometry and imaging methods are studied.

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e-mail : 090kryugakusei@mail2.adm.kyoto-u.ac.jp
URL : http://www.ne.t.kyoto-u.ac.jp/en?set_language=en

Kyoto University Institute for Integrated Radiation and Nuclear Science

Overview

Kyoto University Institute for Integrated Radiation and Nuclear Science (KURNS, whose previous name was Research Reactor Institute) was established in 1963 for the joint use program among Japanese universities to promote the research and education in the fields of nuclear energy and radiation application. Two nuclear reactors, the Kyoto University research Reactor (KUR) and the Kyoto University Critical Assembly (KUCA), and related research facilities have been being used since then, and nowadays greater expectations are being put on the research and education activities at our institute for the issues of energy and environment and for the innovative applications of radiation.

Actually, the issues of energy and environment are becoming more and more serious in the 21st century, The worldwide demand for energy is remarkably increasing with the development of Asian and African nations. On the other hand, natural resources such as oil and coal are finite, and moreover carbon dioxide emission limits are under consideration to conserve the global environment. Many issues thus queue up to be solved. Although the development and use of new energy sources such as solar batteries are pushed forward, those capacity is limited and insufficient. Therefore, there are movements to again promote the use of nuclear energy in Europe and America. In our country with poor energy resources, it has been extremely important to keep the stable energy supply, and the use of nuclear energy has been promoted. However it is now required to again ensure the safety of nuclear energy for its continuous use. As for the applications of radiation, in addition, various technologies have been established in combination with the development of nuclear energy use, and much more various and effective application technologies are expected to be realized in the fields such as medical care and materials development in the future.

In these situations, the importance of the research and education of nuclear energy in universities is recognized for personnel training from the viewpoint of a mid/long term, and greater expectations are being placed on the research and education activities using the research facilities with proper performances. To meet those expectations, it is necessary to operate the KUR as long as possible in our institute. Its significance and our responsibility are really large considering the use of such research facilities by students and researchers from all Japanese universities not only in the nuclear engineering field but also in various fields. In addition to the above activities, we have research activities in the fields of nuclear engineering science, material science, radiation life science, and radiation medical science. Basic and essential studies are being performed under the academic traditions of Kyoto University, of which results have been highly rated in a recent external evaluation. Based on these results, we are planning to further extend neutron utilization studies centering the KUR, and to promote essential studies on safe nuclear energy systems including nuclear fuel cycles and next generation reactors in perspective.

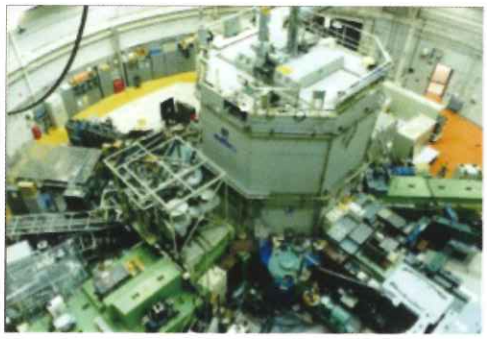
Research Divisions and Centers

KURNS has several divisions and centers for scientific research: Division of Nuclear Engineering Science, Division of Quantum Beam Material Science, and Division of Radiation Life Science, Research Center for Safe Nuclear System and Particle Radiation Oncology Research Center. Division of Nuclear Engineering Science is comprised seven research laboratories for material research laboratories for nuclear engineering research.

Division of Quantum Beam Material Science comprises seven research laboratories for material research. Division of Radiation Life Science and Radiation Medical Science comprises four research laboratories.

These departments and centers conduct progressive studies in various research fields, such as nuclear physics, nuclear engineering, radiation utilization, beam science, nano-technology, material science, life science, and radiation oncology etc., and these serve as the basis for the collaborative researches done by the researchers coming from other universities and institutes.

All research laboratories cooperate in educating students of five Graduate Schools of Kyoto University: Graduate School of Engineering, Graduate School of Energy Science, Graduate School of Science, Graduate School of Energy Science, Graduate School of Agriculture, and Graduate School of Medicine.



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e-mail : misa@rri.kyoto-u.ac.jp
URL : http://www.rri.kyoto-u.ac.jp/en

Nagaoka University of Technology
Department of Nuclear System Safety Engineering

Overview of University
Nagaoka University of Technology (NUT) is unique national university that leads the graduates of various types of educational institute, especially the KOSEN (5 years education for engineering) program in Japan and the bachelor on engineering in foreign countries, to farther research and education.

Nuclear Education Program
The Department of Nuclear System Safety Engineering (NSSE) is a master program that provides intensive education on nuclear engineering in two years. Students with background in various basic engineering fields advance to the NSSE, such as mechanical engineering, electric electronics and information engineering, material science, biology, civil and construction, and management engineering. The curriculum is based on the concept of "system safety", and students are expected to acquire the skill of risk-based thinking. Most of the lectures are provided both English and Japanese. Some researches and exercises are held in accelerator facilities and radioisotope center in the NUT. There are a lot of chances to visit nuclear power plants because the NUT is located near TEPCO Kashiwazaki-Kariwa Nuclear Power Station. Our education program has been selected as a regulatory human resource development program supported by the Nuclear Regulatory Authority, Japan, from 2016 to 2020.
< http://sdfrs.nagaokaut.ac.jp/sdfrs/nuclearregulatory>

Research Activities
The NUT requires writing thesis to master students. Our students belong to one of the eight laboratories in the NSSE and are engaged in research activities. Though the NUT is a new department established in April 2012 after the accident at Fukushima Daiichi Nuclear Power Station, the research related to nuclear science and technology in the NUT has a long history. The accelerators and radioisotope center in the NUT has been utilized for many collaborators, both domestic and international. Majority of the graduates of NSSE from abroad continues their research in the Ph. D program in the same laboratory.

Life in Nagaoka
Nagaoka city is located less than two hours by Shinkansen from Tokyo. International students from 27 countries are enrolled in the NUT attracted by fulfilling research environment and lower living cost. < http://www.nagaokaut.ac.jp/j/annai/ryugakusei.html>

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FAX : +81-258-47-9882
e-mail : nsse@vos.nagaokaut.ac.jp
URL : https://whs.nagaokaut.ac.jp/nsse/

Nagaoka University of Technology
Extreme Energy-Density Research Institute

Linear Induction Accelerator "ETIGO III",


Electrostatic Accelerator

Extreme Energy-Density Research Institute (EDI) was founded in 1999 for the researches on development and application of Extreme Energy-Density State (EEDS). EEDS is a state of extremely high temperature, density and pressure, which is only presented on fixed stars or in the earth. After carrying out former researches, it was possible to obtain artificial EEDS. By using EEDS, we have opened frontiers on researches including syntheses of novel functional materials, low cost production of next generation nanotechnology materials, and production of apparatus for sterilization and flue gas treatment. Further, we have been performing both basic and application researches under collaboration with local, domestic and international universities, laboratories and industries.

Research Apparatus for Collaborative Research

• Intense Pulsed Power Generator "ETIGO-II"

Rated output
Accelerating voltage: 3MV, Current: 460kA,
Pulse width: 50ns
Application
Pulsed ion beams, High power microwave

• Linear Induction Accelerator "ETIGO III"

Rated output
Accelerating voltage: 8MV, Current: 5kA,
Pulse width: 30ns
Application
Pulsed intense relativistic electron beam for R and D on environmental improvement

• Repetitive Pulsed Power Generator "ETIGO IV"

Rated output
Accelerating voltage: 400kV, Current: 13kA,
Pulse width: 150ns, Frequency: 1Hz
Application
High power microwave

• Electrostatic Accelerator

Rated output
Accelerating voltage: 1.7MeV
Application
Rutherford backscattering spectroscopy,
Elastic recoil detection analysis

Research Topics

1. Generation and Applications of Pulsed Power, Charged-Particle Beam and High-Power Electromagnetic Radiation
   1) Repetitive pulse high-voltage generator for industrial applications
   2) High-power microwave generation and applications
   3) Pulsed particle beam generation and applications
   4) Intense pulsed X-ray source development
   5) Water Treatment Application of Pulsed Power

2. Novel Functional Compounds Synthesized by using Pulsed Power Technologies
   1) Development of compositionally gradient thin film preparation methods with simultaneous dual-ablation and new hard oxynitrides and luminescent oxides
   2) Synthesis and development of novel functions in oxides by molecule dipole, high pressure and plasma
   3) Development of metal nanosized powders and nano-structures and their industrial application

3. Development of Novel Functional Composite Materials using Energy Density Field
   1) Development of due sensitized solar cells using TiO_2 nanotubes and natural dyes
   2) Particle alignment and orientation technology in organic-inorganic composite materials using electro-magnetic fields
   3) Fabrication of patterned ceramics by nanoimprint methods and development of anisotropic nanostructures
   4) Development of nanocomposite ceramics with high specific strength

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TEL : +81-258-47-9891
FAX : +81-258-47-9890
e-mail : kyokugen@etigo.nagaokaut.ac.jp
URL : http://etigo.nagaokaut.ac.jp/index.html

The University of Tokyo

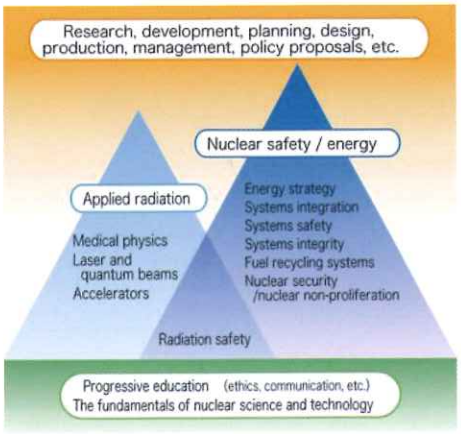
Department of Nuclear Engineering and Management, School of Engineering

Education and Research Policies

1. Incorporating Social Science Knowledge in the Engineering Framework
2. Balance between conceptual skills and a panoramic perspective

Human resources this Department aims to foster

1. Human resources who have a good understanding of people and society
2. Human resources who have built upon a progressive education to acquire knowledge and a systematic way of thinking about nuclear safety, energy, and the basics of radiation science and their applications
3. Human resources who can handle research, development, planning, design, production, management, policy proposals, etc. in an academic setting and how to make use of academics in various fields in a responsible manner with an international perspective
4. Human resources who can contribute to the sustainability and development of society by becoming pioneers in unexploited fields and boldly pursue research that can lead to new technological innovation



Brief Introduction of Our Department

1. Excellent Environment for Research and Education
2. Welcoming Students from Diverse Backgrounds
3. Global Networks and International Collaboration

Curriculum

Lecture courses in this Department are categorized as

(1) Nuclear engineering core courses

(2) Specialist foundation courses

(3) Advanced courses

All courses are generally taught in English. In addition to the lecture courses, there are

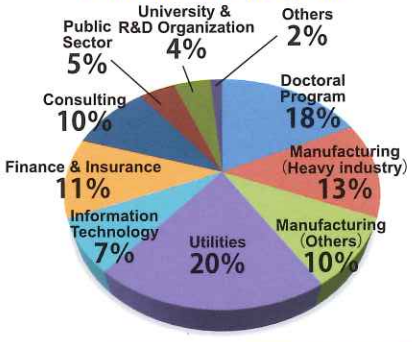
(4) Course seminars/exercises/labs

to give hands-on learning experience. From time to time, special omnibus-format lectures may be given by external lecturers.

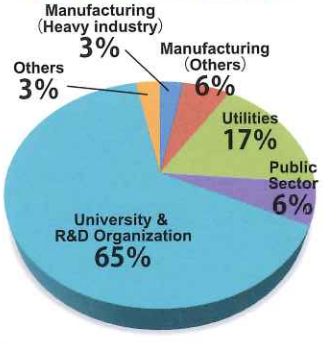
(5) IAEA INMA(International Nuclear Management) endorsed Nuclear Technology Management Program (IAEA certificate is issued)

Career Paths (2014-2018)

After Masters program



After Doctoral program



Address : 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, JAPAN
TEL : +81-3-5841-6015
FAX : +81-3-5841-8713
URL : http://www.n.t.u-tokyo.ac.jp

The University of Tokyo Nuclear Professional School

東京大学 THE UNIVERSITY OF TOKYO

Nuclear Professional School

Purpose

- To meet the needs of highly educated professionals such as chief licensed reactor engineers of nuclear power plants
- To establish comprehensive schooling of nuclear engineering

Administration

- Located in Tokai-mura
- A type of professional school, like a law school
- Jointly operated with JAEA (Japan Atomic Energy Agency).

Education in Nuclear Professional School

Characteristics

- One-year graduate school providing extensive schooling, but requiring no thesis study
- Giving master's degree of nuclear professional

Contents

- Lectures, Exercises* and Experiments** of full 5 days of summer and winter semesters
- Exercises* and Experiments** and Internship between the semesters

* at the international training center of JAEA
**at the plant simulator of JAPC (Japan Atomic Power Company)
**at the facilities of the University of Tokyo and JAEA such as research reactors, critical assemblies and thermal hydraulics loops

Students and Professors

Students

- Capacity:15
- Language: Japanese (at present)
- Most students from utilities, vendors, research institutes and governments
- A few students who are not the employees

Professors

- Professors (P5 AP4 L1) of the University of Tokyo,
- 3 Guest professors from JAEA, and 36 part-time lecturers and 39 special guest lecturers from JAEA and Japanese industries

Curriculums of Nuclear Professional School

Fundamentals of nuclear engineering:
- reactor physics,
- thermal hydraulics,
- structural mechanics,
- fuels, and
- materials

Practical subjects:
- nuclear power plants,
- safety,
- maintenance, and
- waste

Social science subjects:
- law for engineers,
- communication,
- human management,
- ethics for engineers,
- risk and crisis management, etc.

The first comprehensive nuclear education curriculum including social science aspects

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TEL : +81-29-287-8400
FAX : +81-29-287-8488
e-mail : jimu@nuclear.tokai.t.u-tokyo.ac.jp
URL : http://www.tokai.t.u-tokyo.ac.jp/english.html

Tokai University

Establishment

Tokai University promote education and research for the peaceful use of nuclear energy. The founder of Tokai University, Dr. Shigeyoshi Matsumae, contributed to the establishment of the Atomic Energy Basic Law in 1955 when Tokai University established the first ever nuclear engineering course in Japan.

Nuclear Engineering Education

[1] In the Department of Nuclear Engineering, we nurture people who not only have specialized knowledge in advanced nuclear technology, safety, and radiation application but also a common sense and conscience regarding energy issues.
The curriculum consists of three fields: 1) Nuclear reactor engineering (completion of nuclear fuel cycle), 2) radiation application (for medical and industrial use), and 3) energy application (development of materials related to nuclear technology).

[2] In addition to classroom lectures, students conduct various experiments and receive practical training including opportunities to handle an actual reactor (research reactor) and radioactive substances.

Japanese Language Skill

To support international students to attain their goals, Tokai University offers special support courses for international students on mathematics, physics, and chemistry. Students who have completed the Japanese Language Course may enter the undergraduate course by passing an examination especially conducted for those students.

Students from Vietnam Electricity

Address : TOKAI UNIVERSITY
International Education Center
4-1-1 Kitakaname, Hiratsuka, Kanagawa,
259-1292, JAPAN
TEL : +81-463-58-1211
FAX : +81-463-50-2467
e-mail : international@ml.tokai-u.jp
URL : http://www.u-tokai.ac.jp/international/

Tokyo Institute of Technology (Tokyo Tech)
Department of Nuclear Engineering

Tokyo Tech main building

<Overview>

Department of Nuclear Engineering at Tokyo Tech, established in 1957, is one of the oldest Nuclear Engineering graduate programs in Japan. It offers students of various backgrounds from different undergraduate schools the education and research opportunities in nuclear engineering. The nuclear engineering course defines its education and research programs in collaboration with Department of Energy Sciences, Interdisciplinary Graduate School of Science and Engineering. As a whole, the Nuclear Engineering Department undertakes a broad view of the graduate curriculum including nuclear fission and fusion power engineering and safety, nuclear fuel cycle, radioactive wastes, materials science and engineering, radiation technology, bio-medical areas, and a recent addition of the back-end process engineering in collaboration with industries and national institutes.

In 2003, the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) had selected our Department as one of the 21st Century COE (Center of Excellence). Our department was granted a Support Program for Improving Graduate School Education on "Special Program for Nuclear Education" (GP-ATOM) from MEXT for 2008-2010 FY.

One of our continuing educational programs is "Academy for Global Nuclear Safety and Security Agent" (U-ATOM), which is a MEXT program on leading graduate schools for 2011-2017 FY. The educational goal is to develop global human resources for nuclear safety, security and safeguards: personnel who can serve as international leaders in industry, government and academia with respect to nuclear power in Japan and abroad. Recently, "Decommissioning Basic Research: Human resource development program" supported by MEXT starts from 2014 FY.

As for 2014 FY, 30 students for Master course and 14 students for Doctor course were newly enrolled, respectively. 11 students (5 in Ms, 6 in Dr) were from overseas.

<International Graduate Programs>

Our institute provides the following programs for students from abroad, who wish to study in Graduate Schools to pursue a Master's or Doctor's degree. Lectures and seminars are given in English. Each applicant is required to directly contact the prospective academic advisor of his/her preference. Before sending the application to the Admission Division, the applicant should obtain the consent of a faculty member who will agree to become his/her academic advisor, in the event that he/she passes the entrance examination.

1. International Graduate Program (A)

In this program, applicants with outstanding academic results are recommended for Japanese Government (MEXT) Scholarship. Students selected as recipients as the MEXT Scholarship are provided with a monthly allowance and one round trip air ticket to and from Japan and are exempted from paying the entrance examination, admission, and tuition fees. For this program, our department accepts students only for Integrated Graduate Program. All students are enrolled in the Master's Program (Pre-Doctoral Program), regardless of pre-received Master's degree.

2. International Graduate Program (B)

2-1. Preliminary Selection for Receiving Government and Other Scholarships

This program aims to recruit qualified students who are expected to apply for government and other scholarships before admission and who need a letter of acceptance issued in mid-March in order to receive the above scholarships.

2-2. Tokyo Tech - RIKEN International School

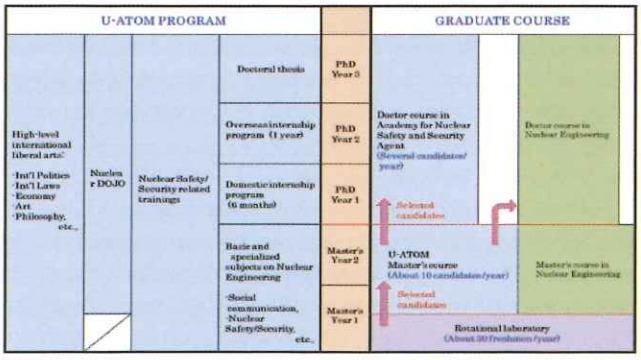
Tokyo Tech and RIKEN, a leading advanced research institute in Japan, have inaugurated Tokyo Tech-RIKEN International School on April 1st, 2007.

3. International Graduate Program (C)

This program is for students not applying to or not applicable to International Graduate Program(A)or(B). Master's Program and Doctoral Program are offered and there are two periods of enrollment. Students who are living abroad at the time of application should apply to Overseas Application and those living in Japan at the time of application should apply to Domestic Application.

<Non-degree Programs>

There are some non-degree programs, such as European Japanese Exchange Project in nuclear disciplines (EUJEP), Young Scientist Exchange Program (YSEP), Academic Cooperation Agreement Program (ACAP), and Young Scientist and Engineer Advanced Study Program (AYSEAS).



Educational system consisting of Normal Graduate Course and U-Atom Program

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FAX : +81-3-5734-2959
e-mail : chair@ne.titech.ac.jp, office@ne.titech.ac.jp
URL : http://www.ne.titech.ac.jp

JAIF International Cooperation Center (JICC)

2018 IAEA Interregional Training Course

Establishment

On March 18, 2009, JAIF International Cooperation Center (JICC) was founded by Japan Atomic Industrial Forum, Inc. (JAIF). To provide cooperation for countries planning to introduce nuclear power in effective and efficient manner, JICC plays a key role as a one-stop window and a facilitator to promote concrete cooperative activities.

Services

JICC coordinate and implement a variety of cooperative activities in introducing nuclear energy development in foreign countries such as:

(a) Support of Human Resources Development (HRD)
Providing all Japan training system and tailor-made arrangement and coordination of various practical trainings and education programs implemented in Japan according to demands of recipient countries

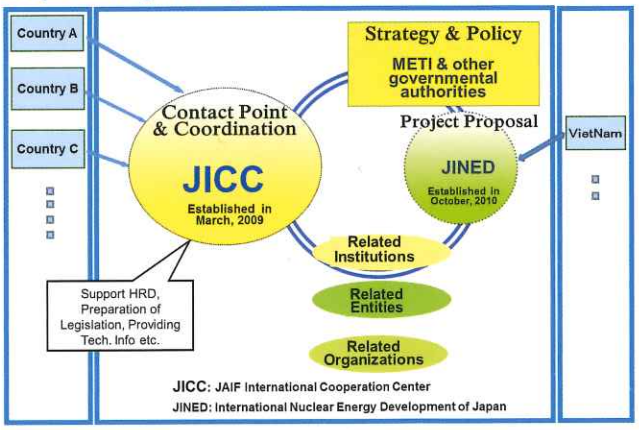
(b) Dissemination of nuclear knowledge
Sharing the experience and knowledge accumulated during the past half century of peaceful uses of nuclear energy in Japan as well as lessons learned from the Fukushima Nuclear Accident to enhance the safety and foster safety culture in newcomer countries

(c) Support of infrastructure development for introducing new nuclear power programs
Addressing common challenges and demands for newcomers such as the establishment of legal systems, etc.

Methods

- Delegating Japanese or overseas nuclear experts
- Inviting VIPs and trainees to Japan
- Hosting or co-hosting seminars and workshops in Japan and newcomer countries
  e.g., JICC Infrastructure Seminar

Cooperation Regime of Japan with Newcomers for Nuclear Power



Address : 5th Floor, Kowa Nibancho Building, 11-19 Nibancho, Chiyoda-ku, Tokyo, 102-0084 JAPAN
TEL : +81-3-6367-0114
FAX : +81-3-6367-0115
e-mail : info@jaif-icc.com
URL : http://www.jaif-icc.com/english/index.html

Human Resource Development Activities of Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN)

ISCN's Physical Protection Exercise Field

ISCN's Virtual Reality System

Group Exercise at ISCN's training course

Establishment

The Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN) is a Center of Excellence established in 2010 under the Japan Atomic Energy Agency (JAEA) in response to the statement of Japan' s Prime Minister at the First Nuclear Security Summit held in Washington DC. ISCN aims at providing support to capacity building efforts for strengthening the implementation of nuclear safeguards and nuclear security in the Asian region.

ISCN Training Courses

ISCN holds various international/regional training courses on: 1) nuclear security and 2) international safeguards and the State System of Accounting for and Control of nuclear material (SSAC).

1) Nuclear Security

Regional Training Course on Physical Protection (PP) of Nuclear Material and Facilities

- A comprehensive course for learning the process of designing and evaluating PP systems
- 1/ year, 2-week period, in Tokai

Training Courses and Workshops on Other Topics

- Insider threat, transport security, cyber security, RI security, nuclear security culture, physical security inspection, nuclear forensics, etc.
- Occasionally, 2-day to1-week period, usually in Tokai

2) International Safeguards and the State System of Accounting for and Control of Nuclear Material (SSAC).

International/ Regional Training Course on SSAC (jointly conducted by IAEA and ISCN)

- Basic course for understanding the non-proliferation regime and safeguards implementation by national SSACs
- 1/ year, 2-week period, in Tokai

Training Courses on Other Topics

- Small Quantities Protocol (SQP), Non-Destructive Assay (NDA) systems, Reprocessing Course for IAEA inspectors, etc.
- Occasionally, 1-week period, in Tokai and other locations

Demonstration of C/S and use of IAEA NDA system

Features of ISCN Training Courses

Needs Oriented Approach

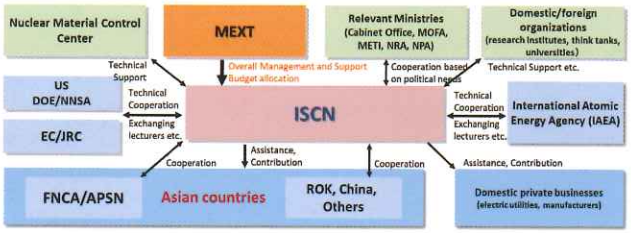
All the ISCN training courses are tailored on the needs of the targeted audience, which to ensure the effective delivery of the courses.

Practical Knowledge and Experiences

ISCN provides hands-on trainings utilizing its own training infrastructures such as the Physical Protection Exercise Field, equipped with actual PP devices, and Virtual Reality System using a hypothetical nuclear power plant in a virtual (3D) space. ISCN also provides participants the unique opportunities to visit JAEA' s nuclear fuel cycle facilities complemented with lectures and exercises.

High standard Lectures with International/Domestic Support

Based on JAEA' s accumulated knowledge and experiences in the operation of a complete nuclear fuel cycle for peaceful purposes, ISCN delivers high standard lectures and exercises with the support of the IAEA, US DOE, EC/JRC and all the relevant ministries and entities in Japan.



Bilateral Cooperation

ISCN maintains a close cooperation with partner countries in the Asian region like Vietnam, Thailand, Indonesia, Malaysia, etc. ISCN applies a Step-by-Step Approach ensuring the effectiveness of its support to the partner countries, as follows.

1. Conduct needs survey on the status of the partner country
2. Identify the needs and cooperative areas through seminars
3. Carry out needs-oriented, tailor-made cooperation and,
4. Take follow-up actions through a review process

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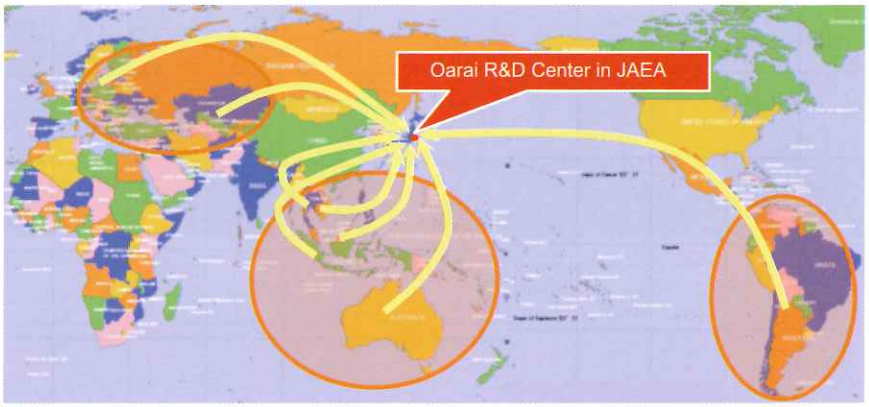
TEL : +81-29-282-0495
FAX : +81-29-282-0155
e-mail : iscn-info@jaea.go.jp
URL : https://www.jaea.go.jp/04/iscn/index_en.html

Japan Atomic Energy Agency(JAEA)

Japan Materials Testing Reactor (JMTR)



Establishment

The JMTR (Japan Materials Testing Reactor) is expected to be a key infrastructure to contribute the nuclear Human Resource Development (HRD) by research and On-the-Job-Training (OJT) in order to support global expansion of nuclear power industry. This training program for young researchers and engineers was started from FY 2011.

Using the JMTR and its facilities, the training program are performed for domestics and foreign researchers, engineers and students.

Contents of activities

This program includes lectures on the bases of nuclear energy, the irradiation research and safety management at the JMTR, and the practical training about neutronic and thermal design, the reactor operating of the JMTR facility using simulation system. Having completed the two-weeks course, the participants also experience various technical tour such as, other research reactor, the HTTR and JOYO.

(a) Lecture and Practical Intern Training

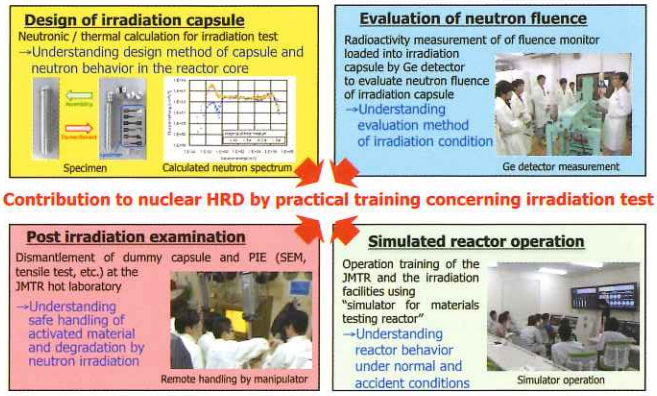
This program is intended to acquire basic understanding on irradiation tests and post irradiation examinations by overall and practical training such as the neutronic and thermal designs of irradiation capsule, evaluation of neutron fluence and post irradiation examinations, etc.

(b) Training of Neutronic Calculation

An analysis procedure using Monte Carlo method has been carried out in irradiation tests of the JMTR to evaluate irradiation field at each specimen by using MCNP code.

(c) Training of Reactor Operation using Simulator

This program can simulate events and action on normal and accident condition in the reactor and the irradiation facilities of the JMTR



Achievements

The number of trainees and countries of this program were 11 trainees and six countries such as Indonesia, Kazakhstan, Malaysia, Mongolia, Thailand and Vietnam in FY2018.

FY	2011	2012	2013	2014	2015	2016	2017	2018
Countries	2	5	7	7	7	7	6	6
Trainee	10	16	18	19	17	13	10	11

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e-mail : nitrc-usersupport@jaea.go.jp

Japan Atomic Energy Agency (JAEA)
Nuclear Human Resource Development Center (NuHRDeC)

Nuclear Technology Seminar on Basic Radiation Knowledge for School Education

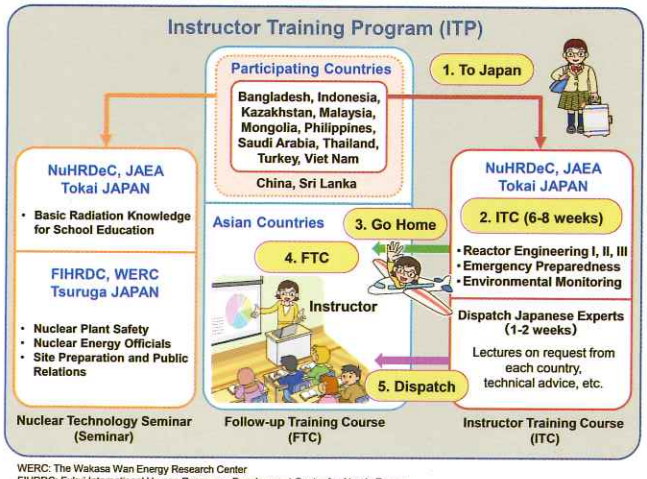
NuHRDeC
NuHRDeC of JAEA has conducted human resource development activities in the field of radiation utilization for peaceful uses of nuclear energy in Japan and overseas since 1958.

Instructor Training Program (ITP)
ITP is conducted by NuHRDeC since 1996 under contract with the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) to contribute to human resource development in the field of nuclear technology in Asian countries. ITP consists of the following training courses and seminar.

Instructor Training Course (ITC)
ITC consists of 5 courses: Reactor Engineering I, II, III, Environmental Radioactivity Monitoring and Nuclear/ Radiological Emergency Preparedness. The purpose of ITC is to foster technical instructors in ITC participating countries through 6-8 week courses in Japan.

Follow-up Training Course (FTC)
FTC is held in each ITC participating country. The ITC participants give lectures in FTC. They become an excellent instructor by the accumulation of teaching experiences year by year through FTC and develop human resources in their country.

Nuclear Technology Seminar (Seminar)
Seminar is designed to cultivate engineers and specialists in the specific area of nuclear technology. Four seminars: Nuclear Plant Safety, Nuclear Energy Officials, Basic Radiation Knowledge for School Education, Site Preparation, and Public Relations are held in Japan for 1-4 weeks.



WERC: The Wakasa Wan Energy Research Center
FIHRDC: Fukui International Human Resources Development Center for Atomic Energy

Address : 2-4 Shirakata, Tokai-mura, Naka-gun, Ibaraki, 319-1195, JAPAN
TEL : +81-29-282-6748
FAX : +81-29-282-6543
e-mail : nakano.yoshihiro@jaea.go.jp
URL : http://nutec.jaea.go.jp/nutec/English.htm

Japan Electric Power Information Center, Inc.

International Cooperation Department

JEPIC

Training Course in Japan

International Cooperation Department

Japan Electric Power Information Center, Inc. (JEPIC) was established in 1958 by Japan's electric power companies with the aim to implement a comprehensive and specific study systematically and continuously on electric power situation of foreign countries. It also commenced international cooperation program in the field of training of personnel from developing countries' power utilities.

After JEPIC's establishment, as the international reputation and interest in business management and cutting-edge technology of Japan's electric power companies had increased, the necessity of providing technical assistance and cooperation to developing countries by Japan's electric power companies has been risen. Under the circumstances, "International Cooperation Center" (JEPIC-ICC) was established in 1989 as its internal organization, in order to expand and reinforce its international cooperation activities. JEPIC-ICC was reorganized to International Cooperation Department in July 2015. International Cooperation Department is carrying out the activities, such as "Cooperation with Power Utilities of ASEAN Countries", "Technical Cooperation under JICA Programs", "Technical Cooperation in Nuclear Power Safety", "Exchange of Information with Foreign Power Utilities" and "Study of Electric Power Situation in Foreign Countries."

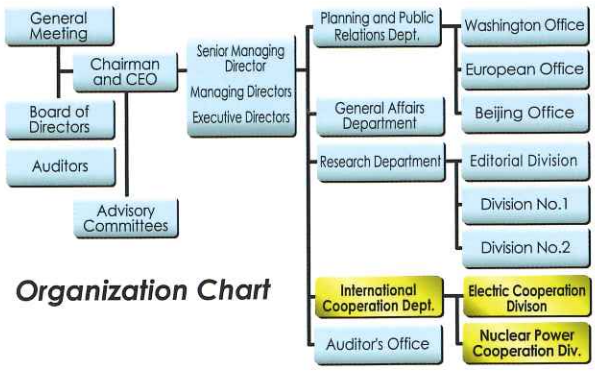
Technical Cooperation in Nuclear Power

Based on the understanding that securing nuclear safety is a global task, Japanese Government carries out activities to secure and improve nuclear safety worldwide through international organizations, bilateral agreements, etc.

In line with such policy, JEPIC has implemented cooperation programs on nuclear power generation since FY 1985 under the contracts with or subsidy from government / agency.

From FY1985 to FY2018, JEPIC has invited 2,470 participants from over 30 countries/region in the training courses and the technical information exchange meetings held in Japan, and dispatched 629 experts from Japan to the training courses held in overseas.

In addition, JEPIC has dispatched total 288 personnel to 17 countries for coordination meeting and project assessment from FY 1985 to FY 2018.



Organization Chart

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Tokyo, 108-0023, JAPAN
TEL : +81-3-6361-8300
FAX : +81-3-3455-0994
URL : https://www.jepic.or.jp/en/

Nuclear Safety Research Association(NSRA)

Establishment

Nuclear Safety Research Association (NSRA), established under the auspices of the Prime Minister and the Minister of International Trade and Industry of June 1, 1964, is an independent, non-profit research organization on the nuclear safety. NSRA was newly re-authorized by the Prime Minister in April, 2011, under the new public interest corporation system.

Major Activities in Recent Years

NSRA, since its establishment, has carried out activities in various fields related to nuclear safety. The results and the outcome of these activities have been fully appreciated and highly evaluated by every side of nuclear related people. To perform these activities, various expert committees in which total several hundreds scientists and experts from the government, academic society and industry participate are organized in NSRA. To come up with the expectation of the people of nuclear industry, regulators of the governments and the other nuclear related people, we will continue the science-based challenges in the wide range of topics of peaceful use of nuclear energy. Main activities of NSRA in recent years are as follows:

◆ Survey and Research

Emergency preparedness, Radioactive waste disposal, Radiation protection, Radiation effects on human being, IAEA safety standard, Environmental effect, Safety of nuclear installations, International cooperation research ("The Nuclear Researchers Exchange Program" for Asian countries(MEXT/NSRA), Forum for Nuclear Cooperation in Asia (MEXT/CAO/NSRA),), etc.

◆ Activities to reduce radiation influence, the health Uneasiness in Fukushima area

Setting of the support base, Human resource development of local trainers, Risk communication, Personal dosimetry of local residents, etc.

◆ Management and Dissemination of Information

World nuclear information, Publication of research reports, text books, etc.

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URL : http://www.nsra.or.jp/index-e.html

The Japan Atomic Power Company (JAPC)
Tokai Training Center


A Whole View of the Tokai Training Center

Introduction

The purpose of the Tokai Training Center is to develop the human resources necessary for the reinforcement of management foundation of our company as well as for the achievement of the operation of nuclear power plants by the following education and training programs.

(1) General Training for all JAPC employees
(2) Specialized Training for technical staff
- From design, construction, operation, maintenance to decommissioning
- Practical training for operation and maintenance
- Radiation protection-Labor safety-Quality management system, etc.

(3) Training for obtaining qualification

Not only for our employees, we also provide training courses for engineers from electric utilities, affiliated companies and many others including students. And we accept foreign engineers through external institutions such as Japan International Cooperation Agency (JICA) and cooperate observation tours to the local community people.

Seminar Room

Water loop Facility

Full Scope Simulator Room (BWR)

Educational Simulator of Nuclear Power Generation (BWR/PWR)

Major Facilities

(1) Water Loop Facility
The water loop consists of pipes, pumps, valves,tanks, instruments, etc.

(2) Electrical Equipments
Metal-clad switchgears, large scale motors,motor-operated valves, protective relay panels,sequencer panels, nuclear instrumentation panels, radiation monitoring panels, etc.

(3) Components Unique to Nuclear power plants
Hydraulic control unit for rod drive, safety- relief valve, mechanical seals of primary circuit recirculation pump, etc.

(4) Experimental Equipment of water, steam and heat
The equipment for understanding the behaviour of water, steam and heat (water flow, boiling, two phase flow, heat transfer, etc.)

(5) Inspection Equipment
Non-destructive inspection (ultra-sonic, radiation,magnetic particle, liquid penetrant, eddy current) and various instruments for system diagnosis

(6) Welding Equipments
Equipments for ARC welding and TIG welding

(7) Others
Pumps, valves, and cutaway models, etc

(8) Tokai No.2 Power Station Full Scope Simulator (BWR)
Operation Training Facilities modeled the main control room of Tokai No.2 Power Station

(9) Educational Simulator of Nuclear Power Generation
Using the Educational Simulator with Large Display, the training is carried out to understand easily the characteristics of BWR and PWR, and each behavior.

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TEL : +81-29-287-0111
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URL : http://www.japc.co.jp/english

The Japan Atomic Power Company (JAPC)
Tsuruga Training Center

A Whole View of the Tsuruga Training Center

Introduction

Tsuruga Training Center was established in Kutsumi, Tsuruga-city in 2012 as a training facility to provide systematic training. Trainees can learn safety culture and safety technology related to nuclear power through lectures and workshops.
As well as JAPC associates, this center is also opened for engineers from local companies, electric utilities, affiliated companies and students in Japan and from the overseas.

Seminar Room

Laboratory

Full Scope Simulator Room (PWR)

Educational Simulator of Nuclear Power Generation (BWR/PWR)

Major Facilities

(1) Water loop facilities
Water loop facilities consist of pipes, pumps, valves, tanks, heat exchangers, support structures, instruments, and other devices.

(2) Electrical and measuring equipments
High or low switch-gears, motors, motor-operated valves, uninterruptible power supply equipment, sequencer panels, ex-core nuclear instrumentation panels, radiation monitoring panels, and other devices.

(3) Equipment forpractical training on water & steam (heat)
Equipment for understanding the behavior of water, steam and heat (water flow, boiling, two-phase flow, heat transfer, etc.), performance of pumps, and cavitations

(4) Welding equipments
Equipments for ARC welding and TIG welding

(5) Others
Pumps, valves, and cutaway models, and other materials

(6) Educational Simulator of Nuclear Power Generation
Educational Simulator installed with simulation software of Tsuruga Power Station Unit 2 and Tokai No.2 Power Station Full Scope Simulator to understand the characteristics and behavior of each plants.

(7) Plant Model
Panoramic view of the nuclear power plant, reactor, steam generator, fuel assembly, and other devices

(8) Radiation meters
Ge semiconductor measuring devices, survey meters of scintillation dose rate, GM model contamination survey meters

(9) Chemical analysis equipments
pH meters, electrical conductivity meters, digital microscope

(10) Inspection devices
Inspection devices and measuring instruments for equipment diagnosis (vibration, motor oil, and infrared) such as magnetic particle examination and ultrasonic examination

(11) Tsuruga Power Station Unit 2 Full Scope Simulator (PWR)
Operation Training Facilities modeled the main control room of Tsuruga Power Station Unit 2

Address : 165-9-6, Kutsumi, Tsuruga-city, Fukui Prefecture, 914-0823, JAPAN
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The Wakasa Wan Energy Research Center
Fukui International Human Resources Development Center For Atomic Energy

THE WAKASA WAN ENERGY RESEARCH CENTER

Establishment

Fukui International Human Resource Development Center (FIHRDC), which was founded in April 2011, has intended to be the focal point of human resource development (HRD) in the field of nuclear energy in the Western Japan. To achieve this goal, the center has established close cooperation with not only research institutes and training centers in the Fukui prefecture but also universities and other related organizations in its neighboring regions such as Kansai and Chukyo. The activities of the center always aim to improve nuclear technology and human resources in the world, beginning with Asia, through fostering competent human resources to meet needs from home and abroad.

Activities

International Activities for Nuclear HRD

- Offering training programs for nuclear human resources from abroad
- Accepting overseas researchers/research students
- Dispatching Japanese lecturers to provide training courses in foreign countries
- Enhancing HRD programs in closer cooperation with the International Atomic Energy Agency (IAEA)

Domestic Activities for Nuclear HRD

- Offering training programs for nuclear human resources from Japan
- Supporting domestic human resources in the area of nuclear energy to become more familiar with international environment

Strengthening the network with domestic/foreign organizations for HRD by holding international meetings and other activities.

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TEL : +81-770-24-7272
FAX : +81-770-24-7288
e-mail : international@werc.or.jp
URL : http://fihrdc.werc.or.jp/

Hitachi-GE Nuclear Energy, Ltd. HITACHI

Corporate Information

Hitachi-GE Nuclear Energy was established in 2007 by Hitachi ltd., and the General Electric Co., of U.S. as a means of participation in nuclear energy business. Hitachi-GE Nuclear Energy Ltd., having inherited the technologies and the experiences of both companies, each with a half-century of experience in the nuclear energy business, has been working for progress in that field, while promoting highly reliable manufacturing practices. Furthermore, through synergistic collaboration with the supporting company in the U.S., we offer global services of consistently high quality ranging from research and development to design, manufacturing and construction, as well as the maintenance of advanced boiling water reactors, fast reactors and nuclear fuel cycle facilities, etc. Hitachi Group's overall strength is dedicated for support the robust and sustainable supply of energy to realize affluent and comfortable future in global basis, in addition to the contribution for low carbon society.

Nuclear Human Resource Development Program

As a support for the nuclear power and as a part of CSR (Corporate Social Responsibility) activity, Hitachi-GE is committed to nuclear Human Resource Development services to who involved in nuclear academy and industry as well as potential customers.

(a) Trainings for nuclear operators

Based on the service agreement, we provide a training program for users or potential nuclear energy users, especially for our clients. This is not limited to Japanese, but also for users in foreign countries.

(b) Internship for university students

We provide a short or middle term internship program for engineering students or young faculties based on request from universities or other educational or industrial entities.

(c) Technical Seminar

We provide the chances for technical seminar on the nuclear energy at universities, not only in Japan but also in foreign countries.

(d) Professional Mission

Temporary mission of professionals or lecturers on nuclear energy is provided to the educational or training institutes, even for overseas.

(e) Job Shop Tour

We provide factory tour based on request.

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Contact website : http://www.hitachi.com/contact/index.html
URL : http://www.hitachi-hgne.co.jp/en/index.html

MITSUBISHI HEAVY INDUSTRIES

ATMEA1 (The mid-sized Generation III+ PWR)

Corporate Information

- Integrated, Comprehensive Technology to Meet Society's Needs, from Developing New Technologies to Design, Production, Service -

All three of Mitsubishi Heavy Industries, Ltd. (MHI)'s operating business domains, our research and development centers throughout Japan, and our manufacturing facilities mesh together to develop the next generation of technologies from design and manufacturing to the provisional of services. Moreover, all of our technologies and expertise built within each of our fields are forged into an organic whole, into a global deployment of manufacturing writ large, to create new value.

Nuclear Power Generation

As a leading manufacturer of nuclear power plants, MHI is active across the entire nuclear power industry by way of supplying pressurized water reactor (PWR) nuclear power plants, developing fast breeder reactors (FBR) and engaging in nuclear fuel cycle related business.

MHI has supported the successful operation of all of 24 PWR nuclear power plants in Japan with a total output of more than 20,000 MWe since 1970. MHI is continuously contributing to a stable electricity supply with our extensive experience and practical accomplishments.

Sophisticated Production Capabilities Contribute to a Low-Carbon Society

Based on the customers' excellent trust in our abundant experience and capability with high technologies, MHI has been the No.1 Supplier, among other Japanese suppliers in the field, of major heavy components for the overseas market such as the United States, Europe, and other overseas countries.

In response to the increasing global demand for nuclear power plants, along with the momentum to control emission of greenhouse gas, MHI is promoting export business of PWR nuclear power plants and the major components required to contribute to the realization of a low-carbon society.

Nuclear Power Plants

- PWR (Pressurized Water Reactor)
- APWR (Advanced Pressurized Water Reactor)
- ATMEA1 (Mid-sized PWR jointly developed with EDF Group)
- Next Generation PWR

Advanced Reactors

- Fast Breeder Reactors (FBR)
- Nuclear Fusion Reactors (ITER)
- High Temperature Gas-cooled Reactors
- Small modular reactor

Nuclear Fuel Cycle, etc.

- Fuel fabrication
- Spent Fuel Reprocessing Equipment
- Spent Fuel Transportation/Storage Cask
- Spent Fuel Interim Storage Facility
- MOX Fuel Fabrication Plant
- Various Disaster Support Robot, etc.

Post-Operational Services

- Statutory Periodic Inspection
- Replacement
- Repair
- Degradation Prevention and Mitigation
- Long-Term Maintenance Planning
- Operational Support, etc.

Head Office : 〈Mitsubishi Heavy Industries Head Office Building〉
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URL : www.mhi.com

TOSHIBA Toshiba Energy Systems & Solutions Corporation

Corporate Information

Toshiba Energy Systems & Solutions Corporation offers not only the large scale power generation systems of thermal and nuclear, but also of the renewables such as hydro power, PV, geothermal and wind power. We have expertise in transmission & distribution systems as well.

Together with autonomous hydrogen energy supply system to enable local energy production for local consumption, and the smart grid integrating power infrastructure and the communications infrastructure, we can offer the best energy solutions the suit every customer.

Our advanced technologies for nuclear energy is now applied to healthcare domain as well, offering an innovative way of Heavy-ion therapy system for cancer treatment.

Main activities

We provide solutions for improving high levels of safety, reliability, and economic efficiency of nuclear facilities by using our abundant experiences in plant construction and continuous efforts in technology development.

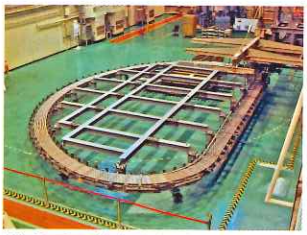
We also offer new solutions in the field of energy, environment and healthcare by using our advanced technologies which are based on R&D for fusion, accelerator and superconducting magnet.

Main Products and Systems

- Light Water Reactor(LWR)
  - Advanced Boiling Water Reactor (ABWR)
  - Boiling Water Reactor (BWR)
- Steam turbine and auxiliary Equipment
- Digital instrumentation, control and electrical systems
- Service and maintenance for operating plant
  - Laser Peening System for SCC mitigation
  - Laser Welding System
- Decommissioning
- Fast Reactors (FR)
- Nuclear fuel
- Reprocessing facilities
- Advanced Technology Application
  - Fusion Reactor Equipment
  - Accelerator
  - Superconducting Applications
  - Heavy-ion Therapy Equipment

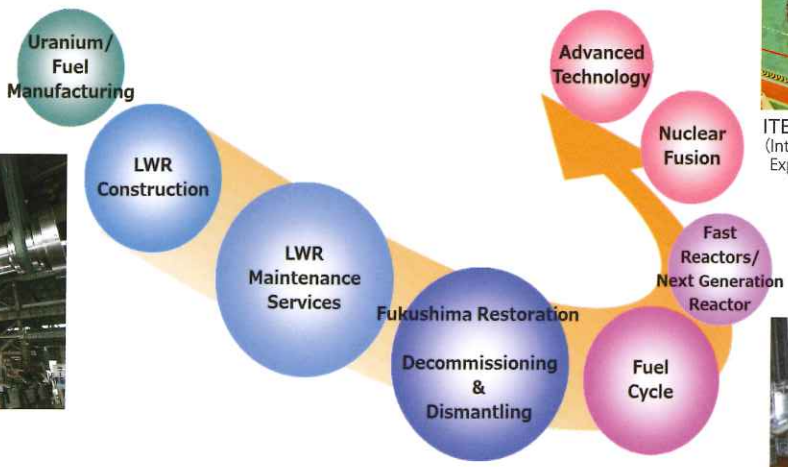
ABWR
(Kashiwazaki-Kariwa Nuclear Power Station unit No.6 and No.7 : Tepco)

Heavy-Ion Therapy System for Cancer Treatment
(Courtesy of NIRS/QST)



ITER Toroidal Field Coil
(International Thermonuclear Experimental Reactor)

High Performance Turbine



Nuclear energy business domain

MRRS™
Multiple Radio-nuclides Removal System

Laser Peening Equipment

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Contact

[Secretariat of Sub-Working group for supporting nuclear HRD programs in newcomer countries]

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