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THE 2002 ACTIVITIES AND THE 4th WORKSHOP OF THE HUMAN RESOURCES DEVELOPMENT PROJECT IN FNCA

July 2003

Nuclear Technology and Education Center

日本原子力研究所
Japan Atomic Energy Research Institute

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The 2002 Activities and the 4th Workshop of the Human Resources Development Project in FNCA

Nuclear Technology and Education Center

(Tokai Site)
Japan Atomic Energy Research Institute
Tokai-mura, Naka-gun, Ibaraki-ken

(Received April 1, 2003)

In 1999, the Project for Human Resources Development (HRD Project) was initiated as defined in the framework of the Forum for Nuclear Cooperation in Asia (FNCA), organized by the Atomic Energy Commission of Japan. The objective of the HRD Project is to solidify the foundation of technologies for nuclear development and utilization in Asia by promoting human resources development in Asian countries. In the Project there are two kinds of activity; In-workshop activity and Outside-of-workshop activity.

The 4th Workshop on HRD Project was held on October 8-10, 2002, in Batangas, the Philippines. The Workshop was sponsored by the Department of Science and Technology (DOST) of the Philippines and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan. The Philippine Nuclear Research Institute (PNRI) and the Japan Atomic Energy Research Institute (JAERI) acted as the hosts. Participating countries were China, Indonesia, Republic of Korea, Japan, Malaysia, the Philippines, Thailand, and Vietnam.

This report consists of presentation papers and materials at the 4th Workshop as In-Workshop Activity, a review document of HRD Project for the 5th Coordinators Meeting of FNCA at Tokyo on March, 2003, a letter of proposal from the Project Leader of Japan to the Project Leaders of the participating countries, and training materials of participating countries as Outside-Workshop Activity.

Keywords : Human Resources Development, Nuclear Field, International Cooperation, Asian Countries, Workshop, Training, Education, FNCA

FNCA人材養成プロジェクトにおける 2002年度活動及び第4回ワークショップの開催

日本原子力研究所
国際原子力総合技術センター

(2003年4月1日受理)

人材養成プロジェクトの活動は、1999年8月に原子力委員会によって組織された「アジア原子力協力フォーラム（FNCA）」の枠組みの中で実施している。本プロジェクトの目的は、アジア諸国における人材養成を推進させることによって、アジア地域の原子力開発利用技術の基盤を整備することである。本プロジェクトは、ワークショップ（WS）内活動とWS外活動の2つに分けられる。

WS内活動として、「第4回原子力人材養成ワークショップ」が2002年10月8日から10日の3日間、フィリピンのバタンガスで開催された。本ワークショップの主催は、フィリピン科学技術省と日本の文部科学省である。参加国は、中国、インドネシア、韓国、日本、マレーシア、フィリピン、タイ及びベトナムである。

本報告書は、ワークショップ内活動として第4回ワークショップでの発表論文等の配布資料、ワークショップ外活動として第5回FNCAコーディネーター会合（東京、2003年3月）における人材養成プロジェクト活動の概要、日本側プロジェクトリーダーから参加国プロジェクトリーダーへの提案レター、人材養成に関する基礎データ調査結果等を収録したものである。

日本原子力研究所（東海駐在）：〒319-1195　茨城県那珂郡東海村白方白根2-4

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1. In-Workshop Activity

1.1 The 4th Workshop on Human Resources Development in the Nuclear Field

1.2 Agenda

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1.2.1 Program of "The 4th FNCA Workshop on Human Resources Development in the Nuclear Field"

October 8-10, 2002, Batangas, the Philippines

Tuesday, October 8

[10:45-12:00 Opening Session] *M.C.: Victoria Fe O. MEDINA*

10:45-10:50	**WELCOME ADDRESS** Alumanda M. dela Rosa Acting Director, Philippine Nuclear Research Institute (PNRI)
10:50-10:55	**OPENING ADDRESS** Shinya Takeuchi Director for International Nuclear Cooperation, Atomic Energy Division, Research and Development Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
10:55-11:00	**INTRODUCTION OF GUEST SPEAKER** Alumanda M. dela Rosa
11:00-11:05	**KEYNOTE ADDRESS** Hon. Estrella U. Alabastro Secretary, Department of Science and Technology (DOST)
11:05-11:30	Introduction of Participants Commemorative Photograph
11:30-12:00	"Review and Scope of Workshop on the Human Resources Development and Procedure for the 4th Workshop" Yasushi SEKI, Japanese Project Leader (PL) Director, Nuclear Technology and Education Center (NuTEC), Japan Atomic Energy Research Institute (JAERI)
12:00-13:30	*<Lunch>*

[13:30-17:20 Presentation Session - Country Report]

Presentation Session − 1 *VU Dang Ninh (Vietnam)*

(Presentations: 25 min. each country including 10 min. Q&A)

13:30-13:55	China, CHEN Gang
13:55-14:20	Indonesia, Guritno LOKOLLO

14:20-14:45	Korea, Eui-Jin LEE
14:45-15:15	*<Coffee Break>*

Presentation Session − 2 *CHEN Gang (China)*

15:15-15:40	Malaysia, Rapieh AMINUDDIN
15:40-16:05	The Philippines, Corazon C. BERNIDO
	The Philippines, Pilar C. ROCELES
16:05-16:30	Thailand, Warapon WANITSUKSOMBUT

Presentation Session − 3 *Guritno LOKOLLO (Indonesia)*

16:30-16:55	Vietnam, VU Dang Ninh
16:55-17:20	Japan, Yasushi SEKI

18:30-20:30 Reception hosted by DOST/PNRI and MEXT

Wednesday, October 9

Discussion Session − 1 *Warapon WANITSUKSOMBUT (Thailand)*
Rapieh AMINUDDIN (Malaysia)

9:00-11:30	Theme of Country Report: Subject for Development of Nuclear Training Technique and Exchange of HRD information"
11:30-12:00	Special Presentation; "Study on Human Resources Development in Nuclear Industry in Japan"
	Takashi YORI (JAPCO)
12:00-13:30	*<Lunch>*

Discussion Session − 2 *Eui-Jin LEE (Korea)*

13:30-16:40	"Survey of the Basic Data on Human Resources Development"
16:40-17:00	*<Coffee Break>*

Discussion Session − 3 *Corazon C. BERNIDO (the Philippines)*

17:00-18:00	Annual Action Plan for 2002
	3-year action plan proposed by Japan (2003-2005)
	Yasushi SEKI (Japan)

Thursday, October 10

Conclusion Session *Corazon C. BERNIDO (the Philippines)*
Yasushi SEKI (Japan)

8:30-10:00	Adoption of Minutes and Action Plans
10:00-10:15	*<Coffee Break>*
10:15-10:30	Check out from Evercrest Golf Club Resort
10:30-16:00	Leave for Metro Manila, and Technical Tour of the Philippine Nuclear Research Institute
	<Lunch in Metro Manila>
16:00-	CLOSING ADDRESS
	Alumanda M. dela Rosa, Acting Director, PNRI
	Reserved Hotel in Metro Manila

1.2.2 List of Participants

for the 4th Workshop on Human Resources Development in the Nuclear Field
October 8-10, 2002, Batangas, the Philippines

≪CHINA≫

Mr. CHEN Gang
(Project Leader)
Deputy Manager,
Management Training Center, Human Resources Department,
China Guangdong Nuclear Power Holding Co., LTD (CGNPC)

≪INDONESIA≫

Mr. (Dr.) Guritno LOKOLLO
(Project Leader)
Head of Planning Division,
Education and Training Center,
National Nuclear Energy Agency (BATAN)

≪KOREA≫

Mr. Eui-Jin LEE
(Project Leader)
Manager,
Education of Program Development,
Nuclear Training Center,
Korea Atomic Energy Research Institute (KAERI)

Mr. Young-Taek KIM
(Project Leader)
Principal Engineer,
Nuclear Training Center,
Korea Atomic Energy Research Institute (KAERI)

≪MALAYSIA≫

Ms. Rapieh AMINUDDIN
(Project Leader)
Director,
Human Resource,
Malaysian Institute for Nuclear Technology Research (MINT)

≪THE PHILIPPINES≫

Ms. (Dr.) Corazon C. BERNIDO
(Project Leader)
Head of Nuclear Training,
Division of Nuclear Services and Training,
Philippine Nuclear Research Institute (PNRI)

Ms. Pilar C. ROCELES
(Project Leader)
Supervising Science Research Specialist,
Head, Technical Assistance Unit,
Philippine Nuclear Research Institute (PNRI)

≪THAILAND≫

Ms. Warapon WANITSUKSOMBUT
(Project Leader)
Radiation Physicist,
Division of Radiation Measurement,
Office of Atomic Energy for Peace (OAEP),
Ministry of Science Technology and Environment

≪VIETNAM≫

Mr. VU Dang Ninh
(Project Leader)
Director,
Department of Administration and Personnel Development,
Vietnam Atomic Energy Commission (VAEC)

≪JAPAN≫

Mr. (Dr.) Yasushi SEKI (Project Leader)	Director, Nuclear Technology and Education Center (NuTEC), Japan Atomic Energy Research Institute (JAERI)
Mr. (Prof.) Masanori ARITOMI	Professor, Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology
Mr. Takashi YORI	Senior General Manager & General Manager, Corporate Planning Department, The Japan Atomic Power Company
Mr. Shinya TAKEUCHI	Director for International Nuclear Cooperation, Research and Development Bureau, Atomic Energy Division, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
Mr. Nobuyuki INOUE	Group Leader, Asia Cooperation Center, Japan Atomic Industrial Forum, Inc. (JAIF)

<Observer>

Ms. Victoria Fe O. MEDINA	FNCA Project Officer, Office of the Director, Philippine Nuclear Research Institute (PNRI)
Dr. Estrella D. RELUNIA	Senior Science Research Specialist, Nuclear Training, Division of Nuclear Services and Training, Philippine Nuclear Research Institute (PNRI)
Ms. Jocelyn L. DAVID	Science Research Specialist II, Nuclear Training, Division of Nuclear Services and Training, Philippine Nuclear Research Institute (PNRI)

-Secretariat-

Mr. Kiyoshi KATO	Senior Staff, Nuclear Technology and Education Center (NuTEC), Japan Atomic Energy Research Institute (JAERI)
Ms. Rei Ouchi	Secretariat, International Technology Transfer Division, Nuclear Technology and Education Center (NuTEC), Japan Atomic Energy Research Institute (JAERI)

1.2.3 Picture



From the left in the back row:

Guritno LOKOLLO, Young-Taek KIM, Eui-Jin LEE, Takashi YORI, Pilar C. ROCELES, Masanori ARITOMI, Rei OUCHI, Nobuyuki INOUE, CHEN Gang, VU Dang Ninh, Kiyoshi KATO

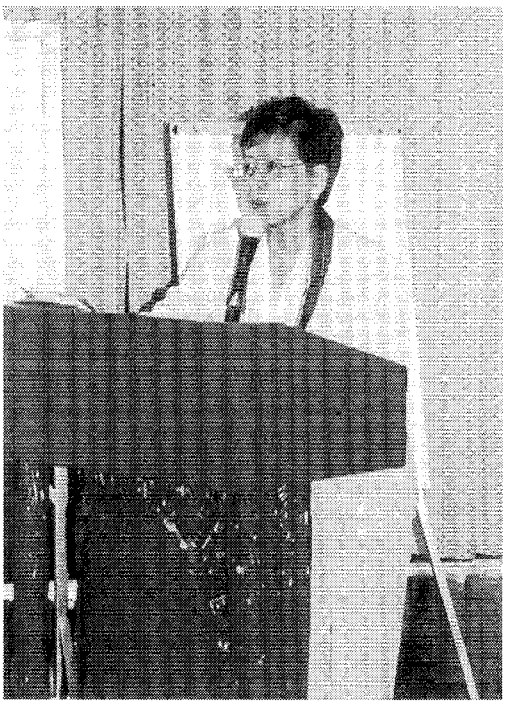


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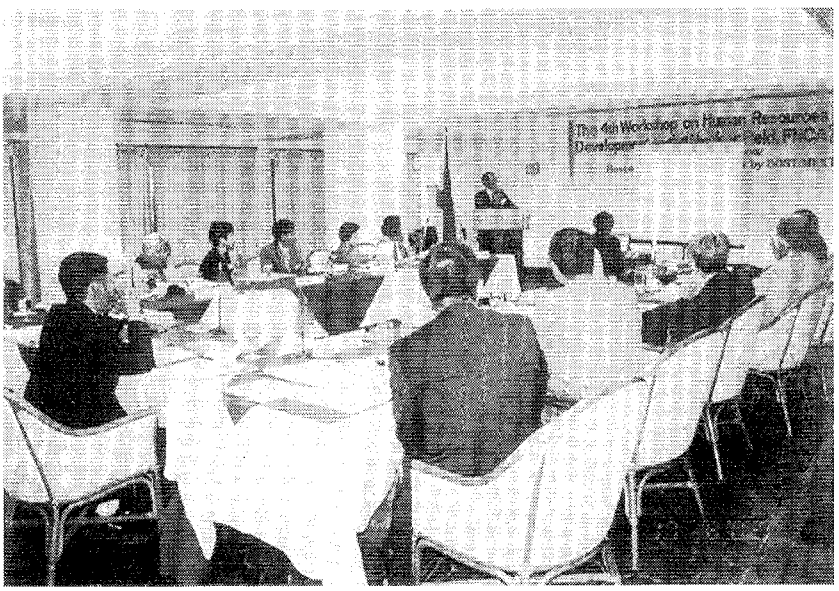
Warapon WANITSUKSOMBUT, Rapieh AMINUDDIN, Shinya TAKEUCHI, Estrella F. ALABASTRO, Alumand M. dela ROSA, Yasushi SEKI, Corazon C. BERNIDO



Alumanda M. dela ROSA
Acting Director,
Philippine Nuclear Research Institute (PNRI)



Hon. Estrella U. ALABASTRO
Secretar,
Department of Science and Technology (DOST)



Meeting Hall



VU Dang Ninh
Vietnam



Warapon WANITSUKSOMBUT
Thailand



Corazon C. BERNIDO
The Philippines



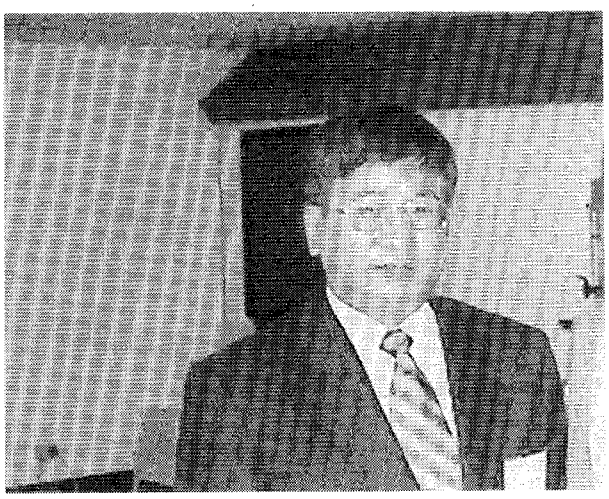
Pilar C. ROCELES
The Philippines



Rapieh AMINUDDIN
Malaysia



Eui-Jin LEE
KOREA



Young-Taek KIM
Korea



Guritno LOKOLLO
Indonesia



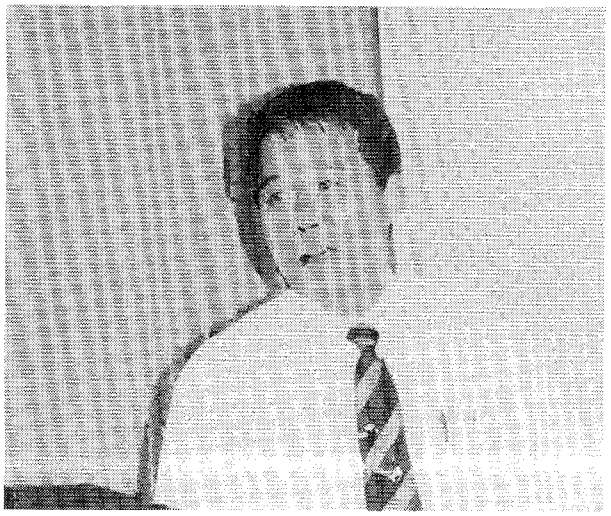
CHEN Gang
China



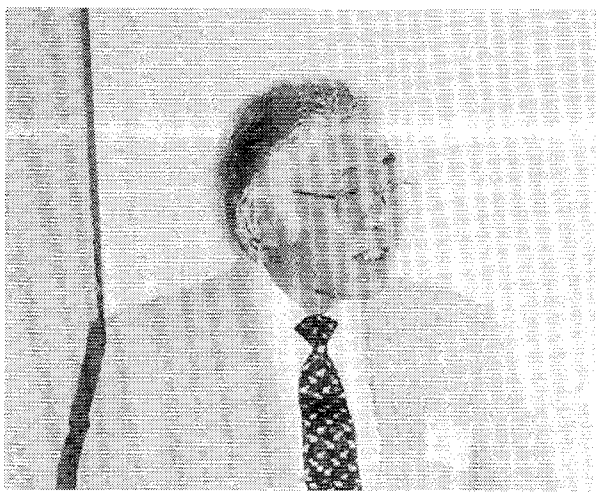
Yasushi SEKI
Japan



Takashi YORI
Japan



Nobuyuki INOUE
Japan



Masanori ARITOMI
Japan

1.3 Opening Session

1.3.1 Welcoming Address

Dr. Alumanda M. dela Rosa, Ph.D.
Acting Director, PNRI

The Honorable Secretary Dr. Estrella Alabastro, Mr. Shinya Takeuchi of the International Cooperation, Ministry of Education, Culture, Sports, Science and Technology of Japan, Project Leaders from the participating countries, China, Indonesia, Japan, Malaysia, South Korea, Philippines, Thailand, and Vietnam, colleagues from PNRI and DOST, a pleasant good morning to all.

In behalf of the Philippine government, the Department of Science and Technology and the Philippine Nuclear Research Institute, I wish to extend our warmest welcome and Mabuhay to the delegates from the FNCA Participating Countries.

The organizers have indeed chosen a very idyllic place for the 4th FNCA Workshop on Human Resources Development in the Nuclear Field where the Project Leaders can ponder and formulate the necessary Action Plan for Human Resources Development away from urban distraction.

As hands-on practitioners we know that science and technology including nuclear science and technology play key roles in making countries attain their goals of sustainable development. Where they hold comparative advantages, nuclear science and technology have become preferred solutions to many economic and social problems. Maintaining progress to overcome the major challenges of eradicating poverty, fighting diseases, and protecting the environment depends upon sustained and cooperative action among committed partners such as the FNCA.

As we move into the 21st century, there is growing awareness of the need to preserve nuclear knowledge and to pass on this knowledge to the next generation of scientists in order to maintain and sustain the abovementioned roles. This is a formidable task considering that the environment for nuclear S & T is no longer the same as three or four decades ago, and the propensity of the younger generation for things other than science and technology much less nuclear S & T.

Nonetheless, this is the challenge that confronts us who work in the nuclear field. I suppose this is the challenge that face the project Leaders during this workshop as they tackle the task of crafting a three-year Action Plan on Human Resources Development for the FNCA participating countries.

We therefore wish you the best while reminding you, lest you forget because of the work ahead,

to enjoy, the natural scenery around you and the Taal Volcano nearby.

Thank you and MABUHAY!

1.3.2 Opening Address

Mr. Shinya TAKEUCHI
Director for International Nuclear Cooperation
Atomic Energy Division
Research and Development Bureau
Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan

Honourable Secretary Estrella F. Alabastro.
Fellow Delegates.
Ladies and Gentlemen.

It is my great pleasure to have this opportunity of saying some words on the occasion of the 4th Workshop on Human Resources Development in the Nuclear Field.

First, on behalf of the Ministry of Education, Culture, Sports, Science and Technology (MEXT for short) of Japan, I would like to extend my sincere gratitude to the Philippine Nuclear Research Institute (PNRI) and the government of the Republic of the Philippines, especially to the Department of Science and Technology (DOST) for preparing this Workshop. Also, I would like to appreciate the contribution to this Workshop of Japanese partners, Japan Atomic Energy Research Institute (JAERI) and Japan Atomic Industrial Forum, Inc. (JAIF).

I recognize it is a vitally important and urgent issue for each of us FNCA countries to develop Human Resources in this field. I think strategic approaches are needed to tackle the challenging task. And it is needless to say that we cannot draw a future plan without knowing real present status. So I remember the 3rd Coordinators Meeting held in Tokyo agreed to implement a joint survey concerning Human Resources, which will be reported and discussed later in this Workshop. I believe the data collected through the survey will give us a good hint in formulating a national HRD strategy in each FNCA country, but also tell us which specific areas, what kind of actions to be targeted as the cooperative activities among FNCA countries.

Finally, it will be our greatest joy if all will be able to profit by listening to the opinions of others and by a lively exchange of ideas, and make this Workshop a worthwhile experience for all concerned.

Thank you very much for your attention.

1.4 Keynote Address

1.4.1 Introduction of Guest Speaker

Alumanda M. Dela Rosa, Ph.D.
Acting Director, PNRI

I am honored to introduce our Guest Speaker, Dr. Estrella Fagela Alabastro, the current Secretary of the Department of Science and Technology (DOST). Dr. Alabastro is the first woman to get the DOST portfolio. She is one among four lady members of the Cabinet of President Gloria Macapagal-Arroyo.

Dr. Alabastro earned her BS Chemical Engineering *cum laude* at UP Diliman in 1961. She went to Rice University in Houston, Texas for her MS Chemical Engineering (1965), and Ph.D. in Chemical Engineering (1967).

Throughout her professional career, she has excelled as a scientist, professor, and science administrator.

Dr. Alabastro was editor of several food-related publications, done extensive research works, principal author and co-author of numerous research papers and handbooks on food engineering and processing.

She is also a professorial lecturer at the UP College of Home Economics and UP Technology Management Center at the time of her appointment on March 12, 2001.

Dr. Alabastro was DOST Undersecretary for Research and Development in 1995-1998 and Executive Director of the Philippine Council for Industry and Energy Research and Development in 1991-1995.

Dr. Alabastro has been an active supporter of nuclear science and technology in the country. As a scientist, she undertook basic studies in food irradiation. As DOST Undersecretary she chaired the subcommittee on Nuclear Manpower Development of the Nuclear Power Steering Committee.

It is my pleasure to present Dr. Estrella F. Alabastro, Secretary of the Department of Science and Technology.

1.4.2 Keynote Address

ASSURING THE AVAILABILITY OF NUCLEAR KNOWLEDGE FOR FUTURE GENERATIONS[1]

by

Honorable DR. ESTRELLA F. ALABASTRO
Secretary, Department of Science and Technology
Republic of the Philippines

First of all, allow me to extend my warm welcome to the participants. I am deeply honored by this opportunity to address the 4th Workshop on Human Resources Development in the Nuclear Field which is being held within the framework of the Forum for Nuclear Cooperation in Asia (FNCA). The Department of Science and Technology is very pleased to co-sponsor this Workshop with the Ministry of Education, Culture, Sports, Science and Technology of Japan. The Philippines considers the FNCA as an important and effective mechanism to promote regional nuclear cooperation with the end in view of uplifting the quality of life of the people in the region.

Allow me to express my Government's appreciation for the consistent efforts of the Government of Japan to ensure the continued growth and development of the Cooperation. I must also make note of the demonstrated cooperation of the other participating countries in the FNCA, namely: Australia, Peoples' Republic of China, Indonesia, Republic of Korea, Malaysia, Thailand and Vietnam.

Even as our region is beset by economic turmoils, it is still expected that development in our region will proceed at a rapid pace. As such, our region faces many challenges, especially in the areas of energy and environment. It is widely accepted that there is a range of nuclear technologies that have great potentials to be utilized to address these challenges. The whole range of benefits includes that in human health, food and agriculture, water management, electricity supply and a host of other applications. It therefore becomes our responsibility to make sure that the benefits of nuclear energy remain available for use by this generation and future generations.

Like any highly technical endeavor, the use of nuclear technology relies heavily on a vast accumulation of knowledge. It also relies on an immense and complex reservoir of people with the requisite educational background, expertise and acquired insight to apply that body of knowledge safely and effectively.

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[1] Delivered during the 4th Workshop on Human Resources Development in the Nuclear Field, 6 October 2002, Nasugbu Batangas, Philippines

The importance, therefore, of human resource development cannot be overstated. I am pleased to recall that the Philippines recognizing the importance of human resource development was a proponent of the inclusion of human resource development as an area of cooperation in the FNCA. I am also pleased to note that the human resource development project of the FNCA has for its goal the solidification of the foundation of technologies for nuclear development and utilization in Asia by promoting human resources development in Asian countries. To a large extent, the competitiveness of nations in the next century will depend on the dynamism of their technological innovation systems based on the mastery of advanced technologies. It is only through human resource development that we can hope to master advance technologies like nuclear technology.

Nuclear science and technology has permeated the Filipino way of life. Although not readily known, this is a fact. Nuclear techniques and radiation have found their way in industry, food and agriculture, in the health sector, in the energy sector, and in the preservation of the environment. We continue to train the requisite manpower to meet the demand of current users and to avail of new applications. Even as we put our efforts towards this, we are also beginning to feel the effects of a nuclear workforce that is aging. More and more of our nuclear workers are approaching the retirement age, without the corresponding influx of appropriately qualified younger personnel to replace them. This situation has been exacerbated by a no recruitment policy of government in the past years. This has been lifted recently and we hope to be able to catch up with our training efforts.

Your efforts to formulate an HRD strategy for each participating country will go a long way in assuring sustainable nuclear technology development.. The survey that was undertaken within the framework of the Human Resources Development Project will no doubt yield information that will be very useful in assessing the actual situation in each country. The discussions on the results of each country of during this workshop will provide comparison and hopefully provide a better perspective in the drafting of the HRD plans for each country. I hope that the HRD strategy will keep on constant focus the aim to preserve and make available the nuclear knowledge as well as the qualified workforce that will ensure the availability of nuclear applications to the future generations.

Your emphasis on the young generation is a step in the right direction. We need to interest the younger generation to take up nuclear science and technology as their chosen career. It is my hope that your discussions on this issue will allow the formulation of a common strategy for the region taking into consideration the situation obtaining in each country.

I have no doubt that this workshop will serve as a good opportunity for promoting cooperation on the human resources development among the participating countries. I look forward to the recommendations of the workshop and commit the support of my Department to the activities that would foster the further growth and development of nuclear science and technology.

Again my warm welcome to you all. My wishes for a successful workshop.

1.4.3 Review and Scope of Workshop on the Human Resources Development and Procedure for the 4th Workshop

Yasushi Seki, Kiyoshi Kato and Rei Ouchi (JAERI)

The main points of the comments for future plans, and for proposal and opinions agreed and expressed by the participations at the Round Table Discussions include the following:

(1) Investigate Mutual Support for Problems and Needs on HRD

① The needs on human resources development, which had been identified in 2000, were revised.

② Some of these needs could be met utilizing the existing personnel exchange programs summarized in the HRD project reports in 2000 (JAERI-Review 2001-020). →**(See Annex. 4)**

Annex. 4 Table 1-1, 1-2, 1-3 Needs on HRD in Participating Countries
Table 2 International Training Courses in Japan

③ Participants agreed to produce training materials to be used commonly in each country.

→Producing training materials in radiation protection area in cooperation with member countries in FY2003 has been proposed. Discussion on the feasibility of the materials will be needed in the discussion session in the 2nd day of the WS connected with country reports.

(2) Investigate HRD Scenario to Secure Safety in RI and Research Reactor Utilization

① Productive information exchange on the HRD scenario to secure safety in RI and research reactor utilization was made.

② The infrastructure supporting human resources concept suggested in the presentation of Dr. Yoshikazu Yoshida is acceptable as a favorable model for HRD strategy to secure safety utilization of radioisotopes and research reactor.

→It is reported on JAERI−Review2002-015 p201

(3) Assist Formulation of HRD Strategy in Each Country

① HRD strategy for each country should be based on the development program for nuclear technology and also the common theme of each FNCA project.

② It needs to be discussed in high-level meetings such as the FNCA Coordinators Meeting.

The result of the Third Coordinators Meeting:

According to the minutes, the proposal of HRD strategy was deeply discussed during the meeting. It was decided to carry out as soon as possible, a survey of basic data on HRD in FNCA member countries. The Coordinators Meeting agreed to propose to the 3rd FNCA Meeting to modify the overall strategic plan to reflect the discussion of the Coordinators Meeting. Revised document is shown in Attachment 4.

FNCA Coordinators and HRD Project Leaders were requested to carry out "the survey of the basic data on HRD in the nuclear Filed", dated August 9.

Each Project Leader is requested to report the result of the survey in the country report in the Workshop for discussion session.

(4) Investigate HRD Scenario for Young Generation

① It was confirmed that HRD strategy for young generation is a common issue for all member countries. Further cooperative actions such as exchange of information will be undertaken continuously.

② Nuclear Young Generation Network presented by Korea and Japan was recommended to member countries as a valuable mechanism to promote young generation's career and job opportunity.

(5) Requests on the Nuclear Research Exchange Program and Other Programs

① Review of Japan's HRD program for Nuclear Science and Technology, i.e. MEXT Nuclear Researchers Exchange Program, Seminar for Nuclear Administrators, International Seminar on Nuclear Safety, International Training Program for Atomic Energy Safety Technology and Nuclear Safety Expert Dispatching Program were presented.

→International Training Courses in Japan in FY2002 (revised Table) will be explained in the Country Report of Japan.

MEXT Nuclear Researchers Exchange Program has been for 17 years since it was started in FY1985. The program is being reexamined to adjust to the times.

Requests including improvement of HRD program mentioned above from member countries will be discussed among the domestic examination committee, which is organized by MEXT, and feasible one will be carried out.

(6) Proposal on Asian Institute of Nuclear Science and Technology (proposed by Indonesia)

① Indonesia explained the proposal of Asian Institute of Nuclear Science and Technology (AINST). Participants have expressed their sincere interests in the AINST. However, many participants mentioned that more elaboration might be necessary to figure out the feasibility of the AINST.

② Indonesia will make clarification on the proposal of AINST in term of exchange Experts / Lecturers with her high decision-makers. The revised proposal will be distributed to all FNCA (HRD) member countries for comments before the Coordinators Meeting. The revised proposal with comments from member countries will be reported to FNCA Coordinators Meeting in March 2002.

→Explanation of the present status of AINST is requested to Indonesian PL during the coming Fourth Workshop.

Future plan for HRD project will focus on the following topics.

1) To improve the efficiency of human resources development of each country, mutual support activities such as exchange of information by the project home page will be continued.
2) To present requests for personnel exchange program based on the actual needs in HRD of each country.
3) Further investigation and discussions on the Asian Institute of Nuclear Science and Technology.

Annual action plan of the year (from the 3rd WS to the next WS)

Action Items for FY2002

(1) Publication of JAERI-Review 2002-015

(2) Member countries shall provide the list of existing training materials in radiation protection area to JAERI/NuTEC (NuTEC: Nuclear Technology and Education Center) by the end of 2001. That information should include the level of trainees and the duration of the training. JAERI/NuTEC will collect the information, make integrated list and distribute it to all member countries. In the process, KAERI/NTC (NTC: Nuclear Training Center) will review the complete list to make sure about any duplication with the IAEA training materials. JAERI/NuTEC will then make distributions of the training materials upon member countries' requests.

→List of training materials in radiation protection area of member countries are reported in JAERI-Review 2002-015 mentioned above.

(3) JAERI/NuTEC will open its homepage to interlink member countries' homepage together. Member countries are to provide information in order to create the necessary links on the JAERI/NuTEC homepage.

URL of the Member Countries:

Japan: http://nutec.tokai.jaeri.go.jp/fnca-hrd/Activities.html
Indonesia: http://wwwfedu.uec.ac.jp/Batan/index.htm.
Korea: http://www.kntc.re.kr/learningweb/lwmle/index/shtml
Malaysia: http://www.mint.gov.my/
Philippines: http://www.pnri.dost.gov.ph
Thailand: http://www.oaep.go.th
Vietnam: http://www.vaec.gov.vn/
China: -

(4) Each member country shall provide the information to JAERI/NuTEC about the training courses conducted in English which are to be held in 2002 by the end of 2001. JAERI/NuTEC will then distribute the list of training courses to all member countries.

→List of training courses in FY2002 in member countries are reported in JAERI-Review 2002-015 mentioned above.

(5) The Philippines shall distribute CD ROMs of training materials for high school students to member countries upon requests soon after they are ready sometime in July 2002. The price of each CD ROM is US$10.

→It is still being finalized and is expected to be distributed the copies during the coming Workshop. (as of August 29, by e-mail from Dr. Bernido)

(6) Japan shall dispatch trainers (speakers) to seminars/workshops/training courses for high school students, college students, and other young generations of member countries upon their requests, when it is possible, in connection with Public Information of Nuclear Energy Project of FNCA.

→'Course on Dissemination of Nuclear Knowledge' in 'International Seminar of Nuclear Safety' will be implemented from FY2002 at International Nuclear Technology Cooperation Center, Radiation Application Development Association (RADA).

(7) JAERI/NuTEC shall distribute a textbook on "Thermal-Hydraulics of Nuclear Reactors" to member countries upon request, when the English translation is completed in FY2002.

→"Thermal-Hydraulics of Nuclear Reactors" written by Masaaki UCHIDA has been distributed to applicants (China, Indonesia, Korea, Thailand).

(8) Mutual support for the needs in HRD

- Internet homepage of the FNCA HRD Project will be produced to provide the information network for the HRD project. This homepage will provide a platform for information exchange on HRD in Asia Pacific Region with Newsletter of the HRD Project, NuTEC News, and Training curriculums. In future, training texts could be provided.
- Proposal of mutual support from other countries.

(9) Present requests for changes in the exchange programs based on the needs of each country.

Action Items for FY2003

(1) In connection with Action Item 1 of FY2002, Member Countries will initiate cooperation in FY2003 to produce training materials in radiation protection area to be used commonly in each country.

(2) JAERI/NuTEC will complete translation of a textbook on fundamental reactor physics focused on questions and answers (Q&A) into English within FY2003, and then distribute it to member countries upon request.

Review of Past Activities in Human Resources Development and the Scope of the 4th Workshop

Yasushi Seki, Kiyoshi Kato
and Rei Ouchi
Nuclear Technology and Education Center
Japan Atomic Energy Research Institute

1

JAERI/NuTEC

Objective of the HRD Project

To solidify the foundation of technologies for nuclear development and utilization in Asia by promoting human resources development in Asian countries

2

Past Activities in the Project for Human Resources Development (HRD)

3rd Workshop on HRD in Nuclear Field (KAERI, Daejon, October 2001)

1) Status of HRD in each country presented
2) HRD Needs identified and summarized
3) Confirmed mutual support in the future to meet HRD needs
4) Agreed to study the four items proposed by Japanese coordinator, Dr. Machi
5) FY2000 activities published as JAERI-Review 2001-020

3

Needs on HRD and Mutual Support

- List of Needs on HRD were updated
- Some of the needs could be met utilizing existing personnel exchange programs (See Annex 4 in the report)
- Participants agreed to produce training materials to be used commonly in the region (to be discussed in Discussion Session 1)

4

HRD Scenario to Secure Safety in RI and Research Reactor Utilization

- Productive information exchange on the HRD scenario to secure safety in RI and research reactor utilization was made
- The infrastructure supporting human resources presented by Dr. Yoshikazu Yoshida accepted as a favorable model for HRD strategy to secure safety utilization of radioisotopes and research reactor
- Reported in JAERI-Review 2002-015, p201

Assist Formulation of HRD Strategy

- HRD strategy for each country should be based on the development program for nuclear technology and also the common theme of each FNCA project
- It needs to be discussed in high-level meetings such as the 3rd FNCA Coordinators Meeting

6

Investigate HRD Scenario for Young Generation

- HRD strategy for young generation is a common issue for all member countries. Further cooperative actions such as exchange of information will be undertaken continuously
- Nuclear Young Generation Network recommended to member countries as a valuable mechanism to promote young generation's career and job opportunity

7

Request for Nuclear Research Exchange Programs and other Programs

- Better utilization and improvement of Japan's HRD program for Nuclear Science and Technology, i.e. MEXT Nuclear Researchers Exchange Program, Seminar for Nuclear Administrators, International Seminar on Nuclear Safety, International Training Program for Atomic Energy Safety Technology and Nuclear Safety Expert Dispatching Program

8

Proposal of Asian Institute of Nuclear Science and Technology

- Indonesia explained the proposal of Asian Institute of Nuclear Science and Technology (AINST). Participants have expressed their sincere interests in the AINST and asked for more elaboration of the AINST at the next Coordinator Meeting

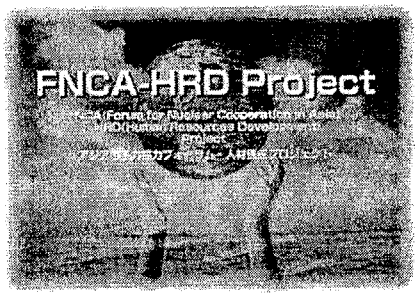
9

Action items for 2002

- Published JAERI-Review 2002-015
- Investigate available training materials in radiation protection in member countries
- Open the project homepage of the project
- Distribute available training materials in English (textbook, CD-ROM, etc.)
- Present requests for changes in the exchange programs based on needs of each country (Course on Dissemination of Nuclear Knowledge to be implemented)

10

FNCA-HRD Project



HRD Workshop (WS)

http://nutec.tokai.jaeri.go.jp/fnca/fnca.htm

11

3rd FNCA Coordinators Meeting (Tokyo, March 2002)

Past activities including the 3rd Workshop and Proposal for Future activities presented and reviewed

Asian Institute of Nuclear Science and Technology (AINST) proposal made by Indonesia

Better Coordination with IAEA-RCA activities recommended

12

Scope of this workshop

JAERI/NuTEC

Present country reports on HRD status and needs and Basic Data on HRD

Discussion Session 1

1) Training course and training material on Radiation Protection
2) Common training material?
3) Exchange of HRD information
4) E-learning, AINST, INU, ANSN?
5) Proposals and comments on exchange programs

13

Scope of this workshop

JAERI/NuTEC

Discussion Session 2

5) Survey of Basic Data on HRD
6) How the data could be used for the formulation of HRD strategy

Discussion Session 3

7) Future Plans and Conclusion
   5th HRD Workshop in Thailand

14

1.4.4

Document for the 3rd FNCA Coordinators Meeting

March 6-8, 2002, Tokyo, Japan

Human Resources Development

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Summary of the 3rd Workshop on Human Resources Development in the Nuclear Field

Dr. Yasushi Seki
Project Leader of Human Resources Development
Director of Nuclear Technology and Education Center
Japan Atomic Energy Research Institute

1. Activities to date in the Project for Human Resources Development (HRD)

In August, 1999, the Project for HRD was initiated as defined in the framework of the Forum for Nuclear Cooperation in Asia, organized by the Atomic Energy Commission based on a resolution of the 10th International Conference for Nuclear Cooperation in Asia , held in March, 1999. The resolution was adopted as a recognition that "human resources development" was an important area that should be added to the existing fields of cooperation. The Project was organized by Research and Development Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT) and is administrated by the Nuclear Technology and Education Center (NuTEC) of the Japan Atomic Energy Research Institute (JAERI).

The objective of the HRD Project is to solidify the foundation of technologies for nuclear development and utilization in Asia by promoting human resources development in Asian countries. Major cooperative activity of the Project is to hold a Workshop once a year. Two workshops have been held Japan in the fall of 1999 and 2000. The objective of workshops was to clarify the issues and needs in HRD of each country and to mutually support HRD activities of each country mainly through information exchange.

2. Workshop activities

The FNCA Workshop on Human Resources Development (HRD) took place on October 29 − November 1, 2001 at KAERI in Daejeon, Korea. This Workshop was sponsored by the Ministry of Science & Technology (MOST) of Korea and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan. The Korea Atomic Energy Research Institute (KAERI) and the Japan Atomic Energy Research Institute (JAERI) acted as the hosts.

The number of the participants in the Workshop totaled 38 people including the guests and observers. Opening Session and Presentations were conducted on the first day, and Round Table Discussions were conducted on the second and the third days.

The participants of the Workshop were two representatives, a Project Leader and a responsible person for development of technical & educational infrastructure, from each of the six member countries, i.e. China, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. Sixteen participants including Project Leader and one observer from the Republic of Korea, nine participants including Project Leader and one observer from Japan attended the Workshop. And also one from the

International Atomic Energy Agency (IAEA) attended.

Themes and Contents of the Country Reports for the 3rd Workshop were as follows, as agreed in the last Workshop and as proposed in the 2nd Coordinators Meeting held in March 2001.

(1) Investigate Mutual Support for Problems and Needs on HRD
(2) Investigate HRD Scenario to Secure Safety in Radioisotopes (RI) and Research Reactor Utilization
(3) Assist Formulation of HRD Strategy in Each Country
(4) Investigate HRD Scenario for Young Generation
(5) Requests on the Nuclear Research Exchange Program and Other Programs
(6) Investigate Plan for the Asian Institute of Nuclear Science and Technology (proposed by Indonesia)

At the Round Table Discussions on the second and the third days of the Workshop, discussions were made on the six themes to further regional cooperation. The Medium-Term Plan of the project on HRD was formulated and agreed upon.

The main points of the comments for future plans, and for the proposals and opinions agreed and expressed by the participants at the Round Table Discussions include the following:

(1) Investigate Mutual Support for Problems and Needs on HRD

① The needs on human resources development, which had been identified in 2000, were revised.
② Some of these needs could be met utilizing the existing personnel exchange programs summarized in the HRD project reports in 2000. (See Annex. 4)
③ Participants agreed to produce training materials to be used commonly in each country.

(2) Investigate HRD Scenario to Secure Safety in RI and Research Reactor Utilization

① Productive information exchange on the HRD scenario to secure safety in RI and research reactor utilization was made.
② The infrastructure supporting human resources concept suggested in the presentation of Dr. Yoshikazu Yoshida is acceptable as a favorable model for HRD strategy to secure safety utilization of radioisotopes and research reactor.

(3) Assist Formulation of HRD Strategy in Each Country

① HRD strategy for each country should be based on the development program for nuclear technology and also the common theme of each FNCA project.
② It needs to be discussed in high-level meetings such as the FNCA Coordinators Meeting.

(4) Investigate HRD Scenario for Young Generation

① It was confirmed that HRD strategy for young generation is a common issue for all member countries. Further cooperative actions such as exchange of information will be undertaken continuously.
② Nuclear Young Generation Network presented by Korea and Japan was recommended to member countries as a valuable mechanism to promote young generation's career and job opportunity.

(5) Requests on the Nuclear Research Exchange Program and Other Programs

① Review of Japan's HRD program for Nuclear Science and Technology, i.e. MEXT Nuclear Researchers Exchange Program, Seminar for Nuclear Administrators, International Seminar on Nuclear Safety, International Training Program for Atomic Energy Safety Technology and Nuclear Safety Expert Dispatching Program were presented.
② Requests from member countries to participate in the above mentioned programs will be seriously considered and feasible ones will be implemented in the future exchange programs.

(6) Proposal on Asian Institute of Nuclear Science and Technology (proposed by Indonesia)

① Indonesia explained the proposal of Asian Institute of Nuclear Science and Technology (AINST). Participants have expressed their sincere interests in the AINST. However, many participants mentioned that more elaboration might be necessary to figure out the feasibility of the AINST.
② Indonesia will make clarification on the proposal of AINST in term of exchange Experts / Lecturers with her high decision-makers. The revised proposal will be distributed to all FNCA (HRD) member countries for comments before the Coordinators Meeting. The revised proposal with comments from member countries will be reported to FNCA Coordinators Meeting in March 2002.

Future plan for HRD project will focus on the following topics.

1) To improve the efficiency of human resources development of each country, mutual support activities such as exchange of information by the project home page will be continued.
2) To present requests for personnel exchange program based on the actual needs in HRD of each country.
3) Further investigation and discussions on the Asian Institute of Nuclear Science and Technology

Remarks

The Philippines tentatively offered to host the 2002 Workshop on HRD at the 2nd FNCA Coordinators Meeting. All participants appreciated the offer and agreed the Philippines as the venue for 2002 Workshop.

The Workshop included technical tours to the institutions, i.e. HANARO Reactor, Radioisotope Production Facility (RIPF) and Irradiated Materials Examination Facility (IMEF) in KAERI, KEPCO Nuclear Fuel Company, Ltd (KNFC) and Yonggwang Nuclear Power Plants (YGN). The participants expressed their sincere gratitude to the organizers and hosting institutions.

The Minutes were discussed and agreed upon by all participants in the Workshop. This will be reported at the 3rd FNCA Coordinators Meeting to be held in March 2002 in Tokyo, Japan.

Annex 1. Proposal on Future Activities in the Human Resources Development Project

Annex 2. Program of "The 3rd Workshop on Human Resources Development in the Nuclear Field "

Annex 3. Participants' List in the 3rd Workshop on Human Resources Development in the Nuclear Field

Annex. 4 Table 1-1, 1-2, 1-3 Needs on Human Resources Development in Participating Countries
Table 2 International Training Courses in Japan

Annex 1

Proposal on Future Activities in the Human Resources Development Project

This proposal summarizes long-term objectives and an action plan of FNCA HRD Project for the coming three years, i.e. from 2002 to 2004.

The identified needs show that there seems to be a large difference among the Asian countries in the use of nuclear power and hence the plan for the HRD in nuclear field. However, it is very important for the steady and safe progress of nuclear power and radiation application in Asian region to mutually recognize the status and needs in the HRD in each country and to carry out mutual support utilizing the available experience and human resources. In the first workshop, it has been agreed among the participants to carry out the mutual support on the identified needs.

1. Medium-term objectives of cooperative activities in HRD

In order to promote HRD in nuclear field in each country, the problems and needs on the development are extracted and classified and the effective procedures of mutual support are discussed at the Workshop to be held every year. The practically achievable items of mutual support will be included in the annual action plan and will be conducted as project activities.

2. The 3-year plan for FY2002-2004

The Workshop consists of general presentation and round table discussion as in the past workshops and will be managed according to the proposed 3-year plan described below. At the general presentation, present status, problems, needs and experiences in the Member Countries will be reported and discussed. At the round table discussion, mutual support procedures corresponding to the problems and the needs in the Region will be discussed and the annual action plan of the year (from the workshop to the next workshop) will be determined. Even after the workshop, the information exchange will be continued between the Project Leaders and the Experts in order to complete the task given in the annual action plan by the next Workshop.

The proposed 3-year plan of the Workshop for FY2002-2004 (also shown in Table 1) is as follows:

(1) The Third Workshop (FY2001: Korea)

Target: Conduct mutual support activities for problems and needs in each country and also support HRD strategy formulation and study HRD scenario

a. General presentation
   - Report of the present status, additional problems and needs in each country and also report status of HRD strategy and scenario
   - Information exchange and proposal for the problems and needs in each country

b. Round table discussion
   - Report mutual support activities for the problems and the needs in each country
   - Review HRD strategy and scenario
   - Propose items for personnel exchange (such as Nuclear Research Scientists Exchange Program)
   - Develop 3 years plan (2002-2004)

- Develop annual action plan of the year

(2) The Fourth Workshop (FY2002: The Philippines)
Target: Evaluate the achievements of 3 years and conduct mutual support activities
a. General presentation
- Evaluate the achievements of mutual support of 3 years
- Report of mutual support activities
- Information exchange on HRD in each country

b. Round table discussion
- Review and revise medium-long term targets
- Report of mutual support activities
- Develop 3-year plan for FY 2003-2005
- Develop annual action plan

(3) The Fifth Workshop (FY2003: to be discussed)
Target: Conduct mutual support activities
a. General presentation
- Report of mutual support activities
- Information exchange on HRD in each country

b. Round table discussion
- Review mutual support activities
- Develop 3-year plan for FY2004-2006
- Develop annual action plan

(4) The Sixth Workshop (FY2004: to be discussed)
Target: Conduct mutual support activities
a. General presentation
- Report of mutual support activities
- Information exchange on HRD in each country

b. Round table discussion
- Review mutual support activities
- Develop 3-year plan for FY2005-2007
- Develop annual action plan

3. Annual action plan of the year (from this workshop to the next workshop)

Action Items for FY2002

(1) Publication of JAERI-Review Report
• The proceedings of the third workshop will be published as the "Annual Activities of FNCA HRD Project for FY 2001".

(2) Member countries shall provide the list of existing training materials in radiation protection area to JAERI/NuTEC (NuTEC: Nuclear Technology and Education Center) by the end of 2001. That information should include the level of trainees and the duration of the training. JAERI/NuTEC will collect the information, make integrated list and distribute it to all member countries. In the process, KAERI/NTC (NTC: Nuclear Training Center) will review the complete list to

make sure about any duplication with the IAEA training materials. JAERI/NuTEC will then make distributions of the training materials upon member countries' requests.

(3) JAERI/NuTEC will open its homepage to interlink member countries' homepage together. Member countries are to provide information in order to create the necessary links on the JAERI/NuTEC homepage.

(4) Each member country shall provide the information to JAERI/NuTEC about the training courses conducted in English which are to be held in 2002 by the end of 2001. JAERI/NuTEC will then distribute the list of training courses to all member countries.

(5) The Philippines shall distribute CD ROMs of training materials for high school students to member countries upon requests soon after they are ready sometime in July 2002. The price of each CD ROM is US$10.

(6) Japan shall dispatch trainers (speakers) to seminars/workshops/training courses for high school students, college students, and other young generations of member countries upon their requests, when it is possible, in connection with Public Information of Nuclear Energy Project of FNCA.

(7) JAERI/NuTEC shall distribute a textbook on "Thermal-Hydraulics of Nuclear Reactors" to member countries upon request, when the English translation is completed in FY2002.

(8) Mutual support for the needs in HRD
- Internet homepage of the FNCA HRD Project will be produced to provide the information network for the HRD project. This homepage will provide a platform for information exchange on HRD in Asia Pacific Region with Newsletter of the HRD Project, NuTEC News, and Training curriculums. In future, training texts could be provided.
- Proposal of mutual support from other countries.

(9) Present requests for changes in the exchange programs based on the needs of each country.

Action Items for FY2003

(1) In connection with Action Item 1 of FY2002, Member Countries will initiate cooperation in FY2003 to produce training materials in radiation protection area to be used commonly in each country.

(2) JAERI/NuTEC will complete translation of a textbook on fundamental reactor physics focused on questions and answers (Q&A) into English within FY2003, and then distribute it to member countries upon request.

Table 1 Tentative Three-Year Plan (FY2000-2002) of the Project on Human Resources Development

	FY2000	FY2001	FY2002	FY2003	FY2004
Master schedule of FNCA	1st Forum (Nov.) (Thailand) 2nd CRD	2nd Forum (Japan) 3rd CRD	3rd Forum (Korea) 4th CRD	4th Forum (Japan) 5th CRD	5th Forum (Place: to determined) 6th CRD
Annual target	-Clarification of mutual recognition on the present status and needs in each country -Development of basic policy of mutual support procedures	-Adjustment of mutual support procedures for the problems and the needs in each country -Assist formulation of HRD strategy -Investigate HRD scenario	-Evaluation for the achievements in 3 years, revision of the medium-long term targets -Adjustment of mutual support procedures for the problems and the needs in each country	-Adjustment of mutual support procedures for the problems and the needs in each country	-Adjustment of mutual support procedures for the problems and the needs in each country
On-workshop activities General Presentation	2nd Workshop (Japan) -Report of present status, problems and needs -Information exchange and proposal for problems and needs	3rd Workshop (Korea) -Report of present status, problems and needs -Report of present status of HRD strategy and scenario -Information exchange and proposal for problems and needs	4th Workshop (Philippines) -Evaluation for achievements of cooperative support in 3 years -Report of mutual support activity procedures for needs -Information exchange and proposal for problems and needs	5th Workshop (Place: to be determined) -Report of present status, problems and needs -Information exchange and proposal for problems and needs	6th Workshop (Place: to be determined) -Report of present status, problems and needs -Information exchange and proposal for problems and needs
Round Table Discussion	-Promotion of mutual recognition for needs and discussion for mutual support procedures -3-year schedule for FY2001 - FY2003 -Annual action plan	-Mutual support activity procedures for needs -Investigate HRD strategy and scenario -Proposal for international training plan -3-year schedule for FY2002 - FY2004 -Annual action plan	-Review and revision of medium-long term targets -Mutual support activity procedures for needs -3-year schedule for FY2003 - FY2005 -Annual action plan	-Mutual support activity procedures for needs -3-year schedule for FY2004 - FY2006 -Annual action plan	-Mutual support activity procedures for needs -3-year schedule for FY2005 - FY2007 -Annual action plan
Off-workshop activities	-Execution of annual action plan -Issue of JAERI-Report on activities in FY2000	-Execution of annual action plan -Issue of JAERI-Report on activities in FY2001	-Execution of annual action plan -Issue of JAERI-Report on activities in FY2002	-Execution of annual action plan -Issue of JAERI-Report on activities in FY2003	-Execution of annual action plan -Issue of JAERI-Report on activities in FY2004

Annex 2

Program of "The 3rd Workshop on Human Resources Development in the Nuclear Field"

- FNCA -

October 29 − November 1, Nuclear Training Center, KAERI, Korea

Monday, October 29

[OPENING SESSION] *M.C.: In-Suk Suh*

08:30~09:00 REGISTRATION

09:00~09:05 WELCOME ADDRESS, *In-Soon Chang, President of KAERI*

09:05~09:15 OPENING ADDRESS

- *Tsutomu Imamura, Director-General, Research and Development Bureau, MEXT (Deputy; Shinya Takeuchi, Director for International Nuclear Cooperation, Research and Development Bureau, Atomic Energy Division, MEXT)*
- *Chung-Won Cho, Director General, Atomic Energy Bureau, MOST*

[KEYNOTES ADDRESS] *Kojiro Nishina*

09:15~09:30 · Activities of FNCA
Sueo Machi, Japanese Coordinator, FNCA

09:30~09:45 Commemorative Photograph

09:45~10:00 Introduction of Participants

10:00~10:15 · Past Activities on the Project of Human Resources Development and Procedure for the 3rd Workshop, *Yasushi Seki, Japanese PL*

10:15~10:30 Coffee Break

[PRESENTATION OF COUNTRY REPORT I] *Liu Yue E, Chinese PL*

10:30~11:00 · VIETNAM, *Vu Dang Ninh and Pham Quoc Hung*

11:00~11:30 · THAILAND, *Warapon Wanitsuksombut*

11:30~12:00 · PHILIPPINES, *Corazon C. Bernido and Jocelyn G. Alvarado*

12:00~13:00 Lunch

[PRESENTATION OF COUNTRY REPORT II] *VU Dang Ninh, Vietnamese PL*

13:00~13:30 · MALAYSIA, *Rapieh Aminuddin, Ainul Hayati and Noraishah Pungut*

13:30~14:00 · KOREA, *Jong-Kyun Park and Eui-Jin Lee*

14:00~14:30 · JAPAN, *Yasushi Seki and Kiyoshi Kato*

14:30~15:00 Coffee Break

[PRESENTATION OF COUNTRY REPORT Ⅲ] *C.C. Bernido, Philippine PL*

15:00~15:30 · CHINA, *Liu Yue E and Yang Lin*
15:30~16:00 · INDONESIA, *Jeni Ruslan and Sudarmadi*
16:00~16:30 Q & A
18:00~20:00 Reception by KAERI

Tuesday, October 30

[SPECIAL PRESENTATION] *Rapieh Aminuddin, Malaysian PL*
Jeni Ruslan, Indonesian PL

09:00~09:30 · Human Resources Development Programme of IAEA / RCA
C. R. Aleta, IAEA RCA Coordinator

[ROUND TABLE DISCUSSION Ⅰ] *Rapieh Aminuddin, Malaysian PL*
Jeni Ruslan, Indonesian PL

09:30~12:00 · Theme: Formulation of HRD Strategy
· Theme: HRD Scenario for Young Generation
Coffee Break for 15 min
· Theme: Proposal and Comment for the Personnel Exchange Programs and Training Programs Implemented in Japan
· Theme: Plan for "The Asian Institute on Nuclear Science and Technology" proposed by Indonesia
12:00~13:00 Lunch

[ROUND TABLE DISCUSSION Ⅱ] *Warapon Wanitsuksombut, Thai PL*

13:00~13:15 · Presentation: HRD to secure safety in Research Reactor and RI in Japan
Yoshikazu Yoshida and Yasushi Seki
13:15~15:00 · Theme: HRD Scenario to Secure Safety in Utilization of Radioisotopes and Research Reactors
15:00~15:30 Coffee Break

[ROUND TABLE DISCUSSION Ⅲ] *Yoshio Murao, ex-Japanese PL*

15:30~17:30 · Theme: Implementation of Mutual Support for Problems and Needs on HRD

Wednesday, October 31

[CONCLUSION AND GENERAL DISCUSSION] *Jong-Kyun Park, Korean PL*

09:00~10:00	· Plan for FY2001 · Propose Activity Plan for HRD Project in the Future, *Yasushi Seki, Japanese PL*
10:00~11:00	Draft and Deliberation on Minute
	Coffee Break for 15 min
11:00~11:30	Adoption of Minutes
	CLOSING ADDRESS, *Yasushi Seki, Japanese PL*
12:00~13:00	Lunch

[TECHNICAL TOUR] *Guide: Hyun-Je Cho*

13:00~16:00	Technical Visit to KAERI Research Facilities
	Technical Visit to Korean Nuclear Fuel Company Facility (KNFC)
18:00~20:00	Reception by JAERI

Thursday, November 1

[TECHNICAL TOUR] *Guide: Hyun-Je Cho*

07:30~10:00	Leave Hotel for Yonggwang Nuclear Power Plant
10:00~12:00	Technical Visit to Yonggwang NPP and its Simulator Training Center
12:00~13:00	Lunch
13:30~16:30	Move to Korean Folk Village
16:30~18:30	Visit to Korean Folk Village
18:30~19:30	Move to Tower Hotel in Seoul

Annex 3

PARTICIPANTS' LIST

for the 3rd Workshop on Human Resources Development in the Nuclear Field
October 29 − November 1, 2001, Daejeon, Korea

≪CHINA≫	
Prof. (Ms.) Liu Yue E **(Project Leader)**	Deputy Director Division of Training Nuclear Industry Training Center
Ms. Yang Lin	Deputy Director Division of International Cooperation China National Nuclear Corporation (CNNC)
≪INDONESIA≫	
Mr. Jeni Ruslan **(Project Leader)**	Director Bureau For Manpower Resources National Nuclear Energy Agency (BATAN)
Mr. Sudarmadi	Head of Education and Training Center Education and Training Center National Nuclear Energy Agency (BATAN)
≪KOREA≫	
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Mr. Yung-Hwa Shin	Instructor Simulator Training Center Younggwang Nuclear Power Plant Korea Hydro & Nuclear Power Co., Ltd. (KHNP)
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Dr. (Mr.) Yoshikazu Yoshida	Scientific Adviser Institute of Radiation Measurements (IRM)
Dr. (Mr.) Yoshio Murao	Technical Counselor for Nuclear Safety Secretariat of Nuclear Safety Commission, Cabinet Office
Mr. Shinya Takeuchi	Director for International Nuclear Cooperation Research and Development Bureau Atomic Energy Division Ministry of Education, Culture, Sports, Science and Technology (MEXT)
Dr. (Mr.) Sueo Machi	Senior Managing Director Japan Atomic Industrial Forum, Inc.
≪IAEA≫	
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for the 3rd Workshop on Human Resources Development in the Nuclear Field
October 29 − November 1, 2001, Daejeon, Korea

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<Secretariat for the Workshop>

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Mr. Jin-Pyo Lee	Assistant, Nuclear Training Center Korea Atomic Energy Research Institute (KAERI)

Annex 4

Table 1-1 Needs on Human Resources Development in Participating Countries

Country	Training type	Table2*
China	• Senior manager training on nuclear technology (NPPs and RI)	E, A, C, F, H(1),(2),(3)
	• Leader training (senior engineers, researchers, scientists on nuclear fields)	E, A, C, M, D
	• Technician training (for NPPs and RI)	E, H(2),(3)
Korea	-	
Indonesia	• Leader training	E, A, B, C, D(*1)
	− Management training	
	− Scientific and technology training	M
	• Instructor training	E, M, B(2)
	− Training material development & Training Method development	
	• R&D expert training (Training of young engineers and trouble-shooters)	E, A, B(3), D(*2)
	The training covers the following areas:	
	− Research Reactor, Nuclear Safety, Energy, Nuclear Fuel Technology	
Malaysia	• Researcher training and dispatch of expert in the area of reactor utilization in particular neutron beam application, and of research reactor engineering support and maintenance	E, M
	• Researcher training and dispatch of expert in radiation and radioisotope application in medicine, industry, agriculture and environment	E, J, K, H(4),(5)
The Philippines	• Researcher and expert training (researchers in radioisotope applications; nurturing MS and PhD holders in Nuclear Engineering & Medical Physics)	E, J, L, M, D(*3), A
	• School teacher training (Nuclear Science & Technology for high school)	-
Thailand	• Researcher and expert training	E, B(1), A
	• Instructor training (Social, economic, and political lectures at universities)	E
	• School teacher training (Nuclear energy, Nuclear Technology and Applications)	-
Vietnam	• Leader training (administrative officers, project leaders, etc.)	E, A, B, C, M, D
	• Researcher and professor training	E, L, M, D
	• Instructor training for radiation application (industries, agriculture and medical fields)	E, H(5), J, K
	• Training of legislative and bureaucratic officials	E, A, H(3), G

Table2* International Training Courses which can be met each countries' needs
D(*1) Especially regarding training for scientist and expert
D(*2) Especially regarding nuclear safety
D(*3) Especially regarding nuclear Technology

Table 1-2 Needs on Human Resources Development in Participating Countries

Country	Training techniques development issues
China	• Development of training materials (creating a standard materials) • Development of training courses (exchanging instructors and experts)
Korea	• Development of training materials (exchanging materials and creating common textbooks) • Development of training techniques (exchanging information on training courses, mutually visiting training facilities, organizing seminars, and exchanging training experts). • Development of computer-based training techniques (multi-media)
Indonesia	• "On The Job" Training and "Off The Job" Training • Experts reviews
Malaysia	• Development of training materials for application of nuclear technology in medicine, industry, agriculture and environment • Development of e-learning system and facilities (information/knowledge sharing, virtual forum, training delivery)
The Philippines	• Development of training courses (RI use in agricultural, biological, and medical fields, and training in Japan) • Development of training materials for use by high school teachers (Cloud chamber, videos, visual materials, and CAI), and exchanging training experts
Thailand	• Development of training courses (Using research reactors, creating curriculums, dispatching Japanese lecturers, providing materials and equipment) • Development of training materials for school teachers (Cloud chamber, videos, visual materials, and CAI on the social and economic aspects of Nuclear Energy, Nuclear Technology and Applications), and exchanging training experts
Vietnam	• Development of training courses (Reactor engineering, and RI use in agricultural and medical fields) • Development of training materials and techniques

Table 1-3 Needs on Human Resources Development in Participating Countries

Country	Infrastructure development issues
China	-
Korea	-
Indonesia	• Establishment education program - Polytechnic Institute of Nuclear Technology (PoINT) • Establishment training program - Regional Government - Universities; Industrial Societies - Other Institution • Establishment of Facilities - PoINT, and ETC
Malaysia	• Development of education infrastructure using the internet
The Philippines	-
Thailand	• License system for radiation protection officers (RPO) (Exchanging information, and dispatching Japanese experts)
Vietnam	• Countermeasures for the outflow of trained people (brain drain) • Minimum configuration of nuclear experiment

Table 2 International Training Courses in Japan in FY2001

Sponsor	Training Course	Host	Purpose	Duration & Participants
MEXT	A. Intl. Seminar of Nuclear Safety	RADA		(per year)
	(1)Intl. seminar on nuclear safety for Asia (1992~)		To provide an overall scope on safety technology	3 weeks, 15
	(2)Intl. seminar on management of radwaste and spent fuel (1994~)		To provide information of the current Japanese situation for radwaste and spent fuel management	3 weeks, 19~20
	(3)Intl. seminar on safety analysis (1998~)		To provide a scope on safety analysis technology for nuclear power plants	3 weeks, 13~14
	B. Intl. Atomic Energy Safety Technology Training Project	NuTEC, JAERI		
	(1) Bilateral Joint Training Course (JTC)			
	1) JTC at BATAN • Radiation Protection Course (1997~) • Radiation Measurement and Nuclear Spectroscopy Course (1998~)		To enhance technical skills of trainees to be familiar with safety culture	2 weeks, 20/course
	2) JTC at OAEP • Radiation Protection Course (1998~) • Nuclear Technology and Application Course (1999~)		To develop personnel who work in facilities handling radiation and/or radioactive materials	2 weeks, 20/course
	(2) Instructor Training Program (ITP) • Radiation Protection Course (1998~) • Nuclear Technology and Application Course (1996~)		To develop instructors who will be engaged in JTC	2 months, 1~2/country
	(3) Safeguards Training Course (1996~)		To provide structure, procedure and activities of IAEA safeguards & particular techniques of Non Destructive Assay(NDA) and Containment/Surveillance(C/S), & State System of Accounting for and Control of Nuclear Material (SSAC)	3 weeks, 16
	C. Seminar for Nuclear Administrators (1987~)	JAIF	To introduce Japanese experience in nuclear energy development and utilization for middle-level administrators	2 weeks

Sponsor	Training Course	Host	Purpose	Duration & Participants
MEXT	D. Nuclear Safety Experts Dispatching Program (in Asian region) (1994~)	NSRA		
	(1) Long-term program		To improve nuclear safety systems through exchange of technical knowledge	1.2~4 months/ person/ country
	(2) Short-term program		To discuss on the specified topics with experts from various organizations	1 week, 1~9
	E. The Scientist Exchange Program in Nuclear Energy Research (1985~)	JAERI JNC NIRS NRIM JCAC ETL	To invite foreign scientists at national nuclear institutes in Japan and to dispatch Japanese scientists to foreign countries for joint study on related subjects	Invitation: 2 months~ 1 year, Maximum dispatch: 2 months
MITI	F. Intl. Invitation Program for Safety Management at NPPs (1992~)*1	JEPIC	To enhance nuclear safety of NPPs	15 courses/y 17~20 days/ course, 8~9/course
	(1) Managers and Supervisors Course			
	(2) Maintenance Personnel Course			
	(3) Seismic Designers Course			
	G. Long-term Training on Safety Regulation for Nuclear Power (1996~)*2	Nuclear Power Engi-neering Corpora-tion	To experience OJT (On the Job Training) on Safety Analysis or Inspection	3 months, 4~8
	(1) Course on Safety Regulation and Safety Analysis			
	(2) Course on Safety Regulation and Safety Analysis/ Inspection			

*1 4-personel-training course is concluded in FY2001. New training course (5-year-plan) is for European and Asian countries.

*2 There is a plan for changing Participating countries from FY2002.

Sponsor	Training Course	Host	Purpose	Duration & Participants
JICA	H. Training Courses in the Nuclear Field			
	(1) Nuclear Technology (1985~)*3			
	1) A Group	NuTEC at Tokyo	To acquire Radioisotope and Radiation handling skill	1.5 months, 6~10
	2) B Group	NuTEC at Tokai	To Acquirer Nuclear Reactor engineering skill	
	(2) Nuclear Power Generation (1985~)	JEPIC JAPC	To improve planning, design, construction and operation of NPP	2 months, 5~7
	(3) Seminar on Nuclear Safety and Regulation (1987~)	JAIF	To enhance nuclear safety and regulation in general for safety control of radiation	1 month, 5~10
	(4) Environmental Radioactivity analysis and Measurement (1990~)	JCAC	To acquire practical knowledge of environmental radioactivity analysis and measurement	1 month, 4~6
	(5) Human-Radiation Interface; Application in medical Science ~A Course of Radiation Therapy~ (1997~)	NIRS	To acquire knowledge on Human-Radiation Interface in view of medical, biological and environmental sciences	1 month, 8~9
IAEA / RCA	I. Enhancement and Harmonization of Radiation Protection RAS/9/018 (1992~)	NIRS JAERI at Tokai JNC	To acquire knowledge and techniques required in the radiation protection	
	J. RCA Project on Medical and Biological Application of Radiation and Radioisotopes (1983~)	NIRS		STA: 3~12 months, 10~15
	K. On the Job Training on Radiation Processing (1978~)	TRCRE		Bilateral cooperation: 3~12 months, 5~10
MEXT	L. Graduate Course in Dept. of Nuclear Engineering	Tokyo Institute of Technology	To acquire fundamental knowledge of Nuclear Engineering and to master professional ability	
	(1) General Graduate Course			
	(2) Intl. Graduate Course			

*3 It is discontinued from FY2002.

Sponsor	Training Course	Host	Purpose	Duration & Participants
Japan Society for the Promotion of Science	M. Graduate School Educations (1) Invitation Fellowships for Research in Japan (Requirement: To hold a doctorate degree, which must have been received within six years) (2) Post Doctoral Fellowships for Foreign Researchers (Requirement: To hold a doctorate degree, which must have been received within six years) (3) Ronpaku (Dissertation Ph.D) Program (Requirement: To have excellent research activities)	Tokyo Institute of Technology	Short-term: To exchange scientific and technical information Long-term: To develop excellent professors and researchers through cooperative research To develop young excellent professors and researchers through cooperative research To get a doctoral degree through the dissertation research Period Up to five years	14~60 days 6~10 months 12~24 months Up to five years The Rnpaku fellow makes one visit of up to 90 days per year

ETL: Electrochemical Laboratory

JAERI: Japan Atomic Energy Research Institute

JAPC: The Japan Atomic Power Company

JAIF: Japan Atomic Industrial Forum, Inc.

JCAC: Japan Chemical Analysis Center

JEPIC: Japan Electric Power Information Center, Inc.

JICA: The Japan International Cooperation Agency

JNC: Japan Nuclear Cycle Development Corporation

MEXT: Ministry of Education, Culture, Sports, Science and Technology

MITI: Ministry of International Trade and Industry

NIRS: National Institute of Radiological Sciences

NRIM: National Research Institute for Metals

NSRA: Nuclear Safety Research Association

NuTEC: Nuclear Technology and Education Center

RADA: Radiation Application Development Association

TRCRE: Takasaki Radiation Chemistry Research Establishment

1.5 Presentation Session (Country Report)

1.5.1 China
1.5.2 Indonesia
1.5.3 Korea
1.5.4 Malaysia
1.5.5 The Philippines
1.5.6 Thailand
1.5.7 Vietnam
1.5.8 Japan

1.5.1 China

Training Materials of Radioprotection and E-Learning System

CHEN Gang
CHINA Guangdong Nuclear Power Holding Co., Ltd

Due to the rapid development of the technology, it is of vital importance for engineers and managerial personnel to keep up with the new technology. The purpose of training management is to refresh them with the latest knowledge and skill relevant to their work. Training and training management are more and more important in Human Resources Development in the 21st century. With the development of science and technologies, the world has changing greatly, particularly with the popular application of the computer technology. The atomic science also has encountered much development. It is helpful to share the training experience among the Asian countries promote human resources development. We are also very interested in the coming topics of FNCA raised on the 3rd HRD workshop and are willing to exchange views with all membership experts.

1. Training Materials in Radioprotection

The Chinese government lays great emphasis on radioprotection since radiation has the potential risk for health and environment. National Nuclear Safety Administration established the regulation HAF0300 "Code on the Nuclear Power Plant Operation" and HAF0301 "Staffing of nuclear power plants and the recruitment, training and authorization of operation personnel – Regulations on the nuclear safety of The People's Republic of CHINA" which indicate that staff performing the work on radio protection field must know the radiological knowledge and radioprotection skill. All the staff that work in this area must be trained such knowledge and skill especially in nuclear power industry.

1.1 Radioprotection training and authorization

Besides common industrial risk, there is also radiation risk in nuclear industry. Over dose rate acceptation will probably cause serious disease or even death. Therefore, it is necessary to fully understand the radiation risk adopt suitable methods to avoid or decrease the hazards to health. All staff in this field must abide by the radioprotection regulation, so it is necessary for them to receive good training. This training has been well organized especially in nuclear power plants. There are 5 nuclear power units in commercial operation in the mainland of China. Radiation control area working authorization is the key of managing a nuclear power plant.

Authorization is the granting of a written permission by the manager or his representative to his

subordinates to perform the duties and responsibilities in a designated period based on demonstrated competence and safety & quality awareness. The radioprotection regulation to authorize the staff that will work in radiation control area. The authorization is valid for one year, which define as RP1 and RP2 authorization.

RP1 authorizations: Received the radioprotection levels I course training and proved qualified. The staff clearly understands the safety work order in radiation environment and has the ability to protect himself in control area.

RP2 authorizations: Received the radioprotection level II course training and proved qualified. The staff can protect himself and supervise a group of staff working in the control area.

Radioprotection training has been defined as a compulsory training course before being authorized to work in the nuclear power plant. All the staff (including sub-contractors) that works in control area must receive the radioprotection training.

1.2 Radioprotection training courses

1) Radioprotection level I training course:

This course is designed for operators to help enrich knowledge of radioprotection and the radiation risk on site, to familiarize with the safety regulation in the control area. They are trained to use radioprotection-inspecting gauges and have the capability of self-protection. Only the staff passes RP1 training course and examination can they apply for radioprotection level one authorization.

Contents: 1. Basic knowledge of radioprotection. 2. Common parameters use in radioprotection. 3. Nature radiation and artificial radiation. 4. Biologic reaction under radiation. 5.The basic purpose, principle and standard of radioprotection. 6.External radiation and its protection. 7.Internal radiation and its protection. 8. Surface contamination and its protection. 9. Control area setup and arrangement. 10.Use of radioprotection equipment and dress. 11. Visiting radiation control area.

2) Radioprotection level II training course:

This course is designed for the supervisor and the above, based on the RP I training. The trainees learn how to understanding the source of the risk, to follow the principle of ALARA, and to supervise a working zone and act properly.

Only the staff passes RP2 training course and examination can they apply for radioprotection level two authorization.

Contents: 1. Advanced knowledge of radioprotection. 2. Radiation effect on human beings. 3.The purpose, principle and standard of radioprotection. 4. Radiation risk in a nuclear power plant. 5. Radiation inspecting method and control technique. 6. Optimized method and measure for radioprotection. 7. Response to radiation events and alarm.

3) Radioprotection retraining course:

All RP1 and RP2 authorization staff must be retrained each year periodically. This is the precondition

for the next period authorization in order to refresh and develop the staff radioprotection knowledge and skills. This training course is for the purpose to strengthen, renew and develop the learnt knowledge and skill of radioprotection through experience feedback, case analyze and discussion. This course will enhance the staff's awareness of radio risk and radioprotection. The trainees are composed of RP1 and RP2 authorization staff.

Contents: 1. Common parameter for radioprotection and the dose rate condition of last outage. 2. Common radioprotection instrumentation and gauge usage. 3. Radioprotection means. 4. Radioprotection regulation. 5. Case analysis of radioprotection related incident.

Besides the above training courses, those who work in the control area must learn the following training course as well: 1) The basic NPP theory training: General staff course, PWR principle course, Basic operation course. 2) The advanced NPP theory training: NPP systems and operation course, Advance operation course. 3) Authorization training: Nuclear safety culture, Industry safety, First aid, Fire-fighting, Environment protection, Emergency response, Quality control & quality assurance, Work process, Safety during outage, Final safety analysis, etc.

These training materials are updated with the experience feedback. In the future, it is necessary to enhance the radioprotection training not only for those working in nuclear power plants but also in all for all the staff working in radiation-related environment.

2. E-Learning System Used in Nuclear Field

Aiming at becoming one of the international nuclear power plants, we consider that human resources development outstanding is one of the main factors. Much attention has been paid to the training in nuclear power plant. An effective training system serves for the operation of the plant and enhancement of staff's qualities. This training system follows the IAEA's SAT (Systematic Approached to Training). The definition by IAEA of SAT is: A logical progression from the identification of the competencies required performing a job to the development and implementation of training to achieve these competencies, and subsequent assessment of this training. Training need analysis, training course design, preparation, implementation and assessment are fundamental processes of SAT. The training management always follows this process. Nowadays, the e-learning method is being introduced in this system due to the development of information technology and computerized training methods.

There are two fields of e-learning system being developed: E-training management and On-line training system.

2.1 E-training Management

The whole process of training management includes training plan; course design, trainee records and information exchange can be managed by a computer system, which is called "Training Management System (TMS)". A well-programmed e-training system can help perform the training with high standards

and handle the database properly. This computerized training management system can handle a large number of trainees in a long-term period. And it can also handle the detail schedule and daily arrangement with high efficiency.

We have developed this system on the company's website which consists of 3 main modes. 1. The Training Information mode. 2. The Training Schedule mode. 3. The Training Data Process mode.

1) The Training Information mode provides the latest training information, training management regulation, training organization introduction and personal training records.

2) The Training Schedule mode provides daily, monthly and yearly training plans of the training organization.

3) The Training Data Process mode provides data treatment function for the files coming from each training course.

The website can be easily accessed on the company intranet by all the staff.



The home page of the training management system (TMS)

2.2 On-line training system:

The training courses in nuclear power plants are used to classified in the following items:

1) Pre-job Training: Basic technology training and on-the-job training for the new employees before taking their jobs.

2) Authorization Training: Initial training or retraining courses for all staff to get the authorization of

nuclear safety, industry safety and radioprotection.

3) Position Qualification Training: Training for staff to get technical specification or license related to their position requirement.

4) Career Enhancement Training: Training for staff to enhance their knowledge of advanced technology, high altitude and preparation for future positions.

Part of these courses has been produced as "Course Issue" which can be trained on the computer system. Trainees can easily access this E-training system at any time and anywhere, which is different from traditional training way. We are still evaluating the effectiveness of this kind of training due to the new technology is sometimes wonder by our trainees. We are also designing more new "Course Issue" which simulates the plant operation on the basis of experience feedback.

3. Conclusion

We have made some progress in the radioprotection training material and e-training. We have found that such trainings are very helpful in running our nuclear power plants and upgrade the effectiveness and safety of nuclear power plants. The training can not only promote the management of operation, but also enhance the quality of our staff. We have benefited from the training. But there are 3 aspects we need to make more efforts in the future: 1) To update what we have done without ceasing the researching steps in these topic. 2) To share our training experience with our fellow colleagues in China for the human resource development purpose. 3) To exchange views with Asian countries and learn from each other to better the performance of training and training management.

Survey of the Basic Data on Human Resources Development in the Nuclear Field in CHINA

Investigation Field	Data
A − 1 Administrative Government and Government Research Development Institution	
1. Personnel of Administration ・ Nuclear Development Research Radiation Application Nuclear Electric Power Generation	300-350 (person)
・ Nuclear Regulation Development Research Radiation Application Nuclear Electric Power Generation	200-250 (person)
2. Personnel of General Nuclear Development Organization	-
A − 2 The number of institutions and personnel in Radiation Application Field	
1. Agriculture Application (mainly for Research Development) 1.1 Plant Mutation Breeding 1.2 Sterile Insect Technique, food irradiation, etc.	500 (person)
2. Medical Application 2.1 The number of doctors using radiation diagnostic 2.2 The number of therapeutic / diagnostic equipments using radiation (Co-60, accelerators, etc.)	 5000 (person) 470 (person)
3. Industrial Application (Cardinal number of Co-60, accelerators, etc.)	2500-3000 (person)
A − 3 Personnel of Nuclear Electric Power Generation	
1. Personnel of Electric Power 2. Personnel except Electric Power	7000 (person) 20000 (person)
A − 4 Investigation of Universities	
1. List of National / Private Universities with school of engineering and science, and the number of their courses	13 National Universities
2. The number of courses	-
3. Quota of students (Bachelor, Master, Doctor)	-

4. The number of faculties (Professor, Assistant Professor, Lecturer, etc.)	-
5. Cumulative number of graduates	-
A − 5 Investigation of Nuclear Training facilities (Special training for personnel engaged in nuclear energy)	
1. List of training organizations and functions	Nuclear Graduate School, Beijing—master and doctor courses on nuclear related science and technologies, various training courses for nuclear professionals Business Administration Institute for Nuclear Industry—Degree education and continuing education and training courses for management level personnel in nuclear industry Training Centres in NPPs—training for operation, maintenance, technical support personnel in NPPs.
2. Course names, durations, Maximum trainees	-
3. Cumulative number of trainees	-
A − 6 The number of personnel passing a national examination related to nuclear energy	The National examination in Chinese nuclear field are Senior Reactor Operators and Reactor Operators
1. Second class Supervisor of radiation Protection (Radiation Application / Sealed sources)	Licensed Senior Reactor Operators: 180-200 Licensed Reactor Operators: 380-400
2. First class Supervisor of Radiation Protection (Radiation Application / Sealed Sources)	-
3. Chief Engineer (Reactors / Nuclear Fuel)	-
4. Chief Engineer of Nuclear Fuel (Fuel Processing, Uranium Enrichment, Reprocessing, Reactor)	-
5. Clinical Radiation Technician (Medical Application)	-
6. Medical Physicist (Public License)(the same as above)	-
A − 7 The number of Radiation Application Users	(No statistics)
1. Hospital & Clinics	-
2. Educational Organizations	-
3. Research Institutions	-
4. Industrial Firms	-
5. Other Organizations	-

Training Materials of Radioprotection and E-Learning System

CHEN Gang
CHINA Guangdong Nuclear Power Holding Co., Ltd

The 4th Workshop on Human Resources Development in Nuclear Field of FNCA
October 8 – 10, 2002, Philippine

Training Materials in Radioprotection

Staff performing the work on radiation field must know the radiological knowledge and radioprotection skill.

HAF0300: Code on the Nuclear Power Plant Operation

HAF0301: Staffing of nuclear power plants and the recruitment, training and authorization of operation personnel

National Nuclear Safety Administration

Radioprotection Authorization

- There are 5 nuclear power units in commercial operation in the mainland of China. Radiation control area working authorization is the key of managing a nuclear power plant.
- **Authorization:** The granting of a written permission by the manager or his representative to his subordinates to perform the duties and responsibilities in a designated period based on demonstrated competence and safety & quality awareness.
- **RP1 authorizations:** Received the radioprotection levels I course training and proved qualified. The staff clearly understands the safety work order in radiation environment and has the ability to protect himself in control area.
- **RP2 authorizations:** Received the radioprotection level II course training and proved qualified. The staff can protect himself and supervise a group of staff working in the control area.

Radioprotection level I course:

- For operators enrich knowledge of radioprotection and the radiation risk on site, to familiarize with the safety regulation in the control area. They are trained to use radioprotection-inspecting gauges and have the capability of self-protection.
- Only the staff passes RP1 training course and examination can they apply for radioprotection level one authorization.

Contents:

1. Basic knowledge of radioprotection.
2. Common parameters use in radioprotection.
3. Nature radiation and artificial radiation.
4. Biologic reaction under radiation.
5. The basic purpose, principle and standard of radioprotection.
6. External radiation and its protection.
7. Internal radiation and its protection.
8. Surface contamination and its protection.
9. Control area setup and arrangement.
10. Use of radioprotection equipment and dress.
11. Visiting radiation control area.

Radioprotection level II course

- For the supervisor and the above, based on the RP I training. The trainees learn how to understanding the source of the risk, to follow the principle of ALARA, and to supervise a working zone and act properly.
- Only the staff passes RP2 training course and examination can they apply for radioprotection level two authorization.

Contents:

1. Advanced knowledge of radioprotection.
2. Radiation effect on human beings.
3. The purpose, principle and standard of radioprotection.
4. Radiation risk in a nuclear power plant.
5. Radiation inspecting method and control technique.
6. Optimized method and measure for radioprotection.
7. Response to radiation events and alarm.

Radioprotection retraining course:

- All RP1 and RP2 authorization staff must be retrained each year periodically. This is the precondition for the next period authorization in order to refresh and develop the staff radioprotection knowledge and skills. The trainees are composed of RP1 and RP2 authorization staff.

Contents:

1. Parameter for radioprotection and the dose rate condition of last outage.
2. Common radioprotection instrumentation and gauge usage.
3. Radioprotection means.
4. Radioprotection regulation.
5. Case analysis of radioprotection related incident.

E-Learning System Used in Nuclear Field

IAEA's SAT (Systematic Approached to Training)

A logical progression from the identification of the competencies required performing a job to the development and implementation of training to achieve these competencies, and subsequent assessment of this training.

Training need analysis, training course design, preparation, implementation and assessment are fundamental processes of SAT.

The E-learning method is being introduced in this system due to the development of information technology and computerized training methods.

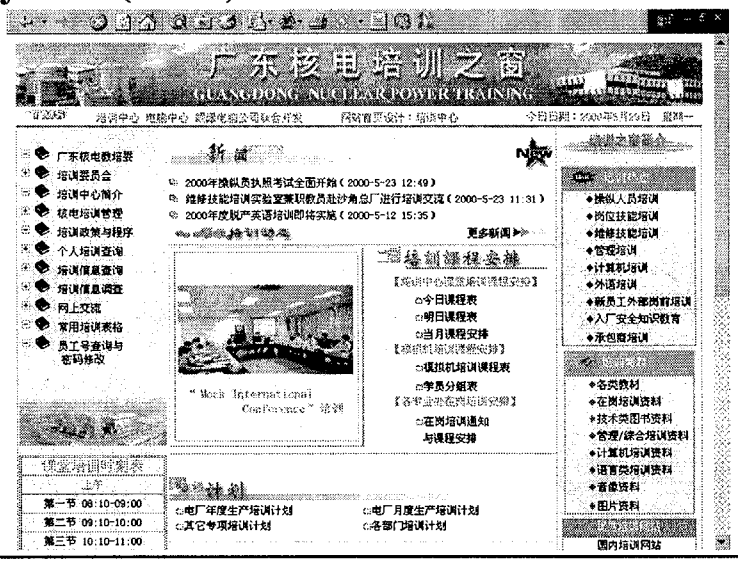
E-training Management

- Training Management System: The whole process of training management includes training plan; course design, trainee records and information exchange are managed by a computer system. A well-programmed e-training system can help perform the training with high standards and handle the database properly.
- It can handle a large number of trainees in a long-term period. and it can also handle the detail schedule and daily arrangement with high efficiency.

TMS website:

- **The Training Information mode** provides the latest training information, training management regulation, training organization introduction and personal training records.
- **The Training Schedule mode** provides daily, monthly and yearly training plans of the training organization.
- **The Training Data Process mode** provides data treatment function for the files coming from each training course.

The Home Page of Training Management System (TMS)



On-line training system

- The training courses in nuclear power plants are used to classified in the following items:
  1) Pre-job Training: Basic technology training and on-the-job training for the new employees before taking their jobs.
  2) Authorization Training: Initial training or retraining courses for all staff to get the authorization of nuclear safety, industry safety and radioprotection.
  3) Position Qualification Training: Training for staff to get technical specification or license related to their position requirement.
  4) Career Enhancement Training: Training for staff to enhance their knowledge of advanced technology, high altitude and preparation for future positions.

Course Issue -- trained on the computer system. Trainees can easily access this E-training system at any time and anywhere, which is different from traditional training way.

Conclusion

- We have made some progress in the radioprotection training material and e-training. We have found that such trainings are very helpful in running our nuclear power plants and upgrade the effectiveness and safety of nuclear power plants. We have benefited from the training.

- There are 3 aspects we need to make more efforts in the future:

1) To update what we have done without ceasing the researching steps in these topic.

2) To share our training experience with our fellow colleagues in China for the human resource development purpose.

3) To exchange views with Asian countries and learn from each other to better the performance of training and training management.

THANK YOU.

1.5.2 Indonesia

Guritno Lokollo
National Nuclear Energy Agency (BATAN)

Organization

1. Training on Radiation Protection in Indonesia
2. Investigation of basic data on Human Resources Development Program
3. Present state of AINST

1. Training on Radiation Protection in Indonesia

Nuclear technology was officially recognized in 1954 through the founding of Dewan Tenaga Atom Nasional (National Atomic Energy Board). The application of nuclear technology in research was started in 1963. In addition to the application of nuclear technology in research, there are two major sectors in the utilization of nuclear technology in Indonesia. One is the application of nuclear technology in industries, and the other is the utilization of radiation and radioisotopes in medical therapy and diagnostic Table 4 (Attachment 1) shows the application of nuclear technology in Indonesia based on the mode of application. It implies the manpower need, especially in the area of radiation protection. Training course on radiation protection officer for industry and medical purposes was started in the early 1980's consisting of in house training, in class training (65 batches) and distance training (phase trial). Material of the course changed and improved from time to time.

1.1. Instructional materials

Education and Training Center make provisions for continues upgrading and renewal of the courses and instructions by assigned expert to examine course and instruction. Instructional materials usually were developed and revised by an expert or a group of experts assigned to each lecture. Especially for radiation protection topics, materials were designed by a group of experts and the content were revised every other year. Table 5 (Attachment 2) shows current regulation issued by BAPETEN that are become source of literature given to the participant. Table 6 (Attachment 3) shows the radiation protection curricula that designed in conjunction with current national regulation issued by BAPETEN.

1.2. The qualification of trainers

The qualification of trainer is measures based on their curriculum vitae and recommendation from his/her supervisor. Most of trainer in nuclear-related subject has nuclear-related academic degree and several domestic and international training experiences. Annually, ETC conduct train for trainer or

workshop on radiation protection and NDT instructors to improve their training performance and the teamwork. Accreditation of trainer is in progress. International technical co-operation has played a key role in developing nuclear program, especially in the training of manpower. Unfortunately, the number of person involved in this co-operation was only a few percent of the total work force. There is an obligation that after his/her return from attending international training, they have to share their knowledge and experience to others through seminar or training.

1.3. Media of training

ETC of BATAN equipped with experimental laboratories adequate to conduct comprehensive training on radiation protection. In the area of Radiation Protection, at least 6 in class training and 4 in-house training for public are conducted in ETC in addition 2 training for BATAN personnel annually. Cooperation with controlling agency was always excellence which enabling participants to directly taking licensing test after the training.

2. Investigation of Basic Data on Human Resources Development Program

2.1. Survey of Administrative Agency

In recognition of the need to develop a viable nuclear regulatory infrastructure in order to proceed with the development of nuclear power, the government of Indonesia has issued the new basic nuclear energy act on April 1997 (Act No. 10 of 1997) to replace the Act No. 31 of 1964. In this new Act, the authority in executing and regulating nuclear energy is separated into two different institutions to avoid the overlapping of activities on the use and control as well as to optimize the control of nuclear energy in order to improve nuclear safety. In April 1998 the new President Decree No.76 of 1998 was issued to established the Nuclear Energy Control Board (NECB, also known as BAPETEN) which has responsibility to regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials in Indonesia. The President Decree No.197 of 1998 was also issued to establish the National Nuclear Energy Agency (NNEA, also known as BATAN) which has responsibility to execute, and to promote the research and the use of nuclear energy in Indonesia. The following Table 1 lists the government administrative institutions in nuclear related area.

Table 1
List of National Administrative Agency

Agency / Institutes	Role	Total Manpower
Nuclear Energy Control Board (BAPETEN)	regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials	
National Nuclear Energy Agency (BATAN)	to execute, and to promote the research and the use of nuclear energy	**3818**

2.2. Survey of National Education

Overview of National Education and Training

Indonesia has developed very rapidly during the past three decades. The average annual growth rate of GDP in the last decade before the crisis hit in 1996 is more than 7 percent and the inflation rate is relatively low, below 10 percent. The path of development in Indonesia has been disturbed by the economic crisis since mid-1996. The impacts seen among others are the declining pattern of investment in human capital, the increasing drop out rate at primary to tertiary level and the reduction of quality of education. These problems are critical, since the disturbance of investment in human capital will affect the future national output. Based on the Human Development report (UNDP, 1998) the human resource development in Indonesia can be represented by the human development index. Using the 1995 data, Indonesia is categorized as a country with medium human development. The human development index for Indonesia is 0.579. The human development index represents three indicators (UNDP, 1996). First, longevity which is measured by life expectancy at birth. Second, educational attainment that is measured by a combination of adult literacy (two-third weight) and combined primary, secondary and tertiary enrollment ratios (one-third weight). Third, standard of living which is measured by real GDP per capita.

Six Years Universal Basic Education

In early 1970s government introduced education subsidy for basic education which is called Inpres SD (Presidential Instruction for Elementary School). The program has successfully increased the Gross School Enrolment Rate from 1970 to 1993. In early 1990, the World Bank study which titled is the East Asian Miracle: economic Growth and Public Policy (World Bank, 1993) stated that the successful growth in these High Performing Asian countries is due to the balanced investment in human capital especially in primary education level.

Nine Years Universal Basic Education

In 1994, government of Indonesia plan to expand the universal basic education into nine years. The expansion of universal education from six years to nine years has required huge financial resources. After crisis in 1996 the education funding is very limited. The study (ADB, 1996) shows that the quality of most public schools, both primary and secondary schools, is very low. Therefore, the challenge in public basic education is increasing the quality of education, more than the expansion of universal basic education. According to present policy, most of education funds are allocated by the central government. The allocation has proven to be inefficient (ADB, 1996). The discussion of fiscal decentralisation in Indonesia has developed the ability of local government in improving the efficiency of human capital investment in education. The local government, both provincial level and district level, will have more capacity in improving the efficiency and the effectiveness of education funding allocation in its area than the central government.

Higher Education Institutes

Indonesia currently has about 50 public universities institutes. The World Bank stated three main risks that threatened the human resource development in the present condition. First, the declining of enrolment at the basic education level, especially in the lower income group. Second, the deterioration of school quality at all levels of education. Third, compounding resource wastage due to existing inefficiencies. The reduction of income by 10 percent will reduce the number of enrolment by 115,000 to 260,000 for 7 to 12 year olds, 173,000 to 270,000 for 13 to 15 year olds (World Bank, 1998). Ministry of Education and Culture predicts more severe impacts for dropping out rate at primary and secondary level. Major infrastructure contribute directly to the education of nuclear technology program in Indonesia are very limited.

Table 7 (Attachment 4) lists the state universities with engineering and science department while Table 8 (Attachment 5) lists the private universities with engineering and science department. Table 2 lists school with specific field in the nuclear-related area. In line with the statements of the World Bank, the decreasing of Indonesia economy will also impose some severe implication, especially in manpower development to support nuclear program. The reduction in the number of enrollment in higher education will also reduce the prospective manpower number to be involved in nuclear program. In the other hand, the decline in the economy will also imply decline of quality of manpower graduated from all level of education. Therefore, the national nuclear program will have quite heavy work to improve quality of the manpower.

Table 2

List of School with Specific Program

School Names	Program Offered	Number of Students	Note
Medical Physics Physics Department University of Indonesia	Bachelor and Master	Checking	Opened in the year 1999
Industrial Safety Engineering Department University of Gajah Mada	Bachelor and Master	Checking	Opened in the year 2000
Nuclear Engineering Engineering Department University of Gajah Mada	Bachelor and Master	Checking	Closed in 2000
School for X-rays Operator	Bachelor	Checking	Ministry of Health
School of Nuclear Medicine University of Pajajaran	Master Program		Private University

2.3. Survey of Radiation and Radioisotopes Application

Table 4 (Attachment 1) shows the profile of radiation and radioisotopes application in Indonesia. Table 3 summarizes the total number of radioactive and radiation source. Calculation on the total radioactivity is in progress.

Higher Education Institutes

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Table 3.
List of Nuclear Application Distribution in Indonesia

SECTORS	NUMBER OF INSTITUTION	NUMBER OF PERMIT	RADIO ACTIVE SOURCES	RADIATION SOURCES
Medical	1451	1896	794	3490
Industrial	107	335	4013	249
Research	6	23	46	2
Total	2108	2999	4843	3741

2.4. Survey of Nuclear Training Courses

Education and training activities were initiated in the year of 1981 with the forming of the Education and Training Center. Since then, Table 9 (Attachment 6) list about 804 times domestic training conducted in the center in which involved 11274 participation. Note that the participants in these domestics training are also coming from public, medical and industrial sectors. It was learned that 278 out of 298 personnel with Master Degree and 109 out of 128 personnel with Doctor degree have participated in domestic training experiences. Table 10 (Attachment 6) and Table 11 (Attachment 7) list BATAN/BAPETEN participation in international training.

2.5. Survey of Licensees of National Examination Related to Nuclear Energy

Education and Training Center of BATAN accredited by BAPETEN as the nuclear training institutes for Radiation Protection Officer Certification and in process of accreditation by National Accreditation Board as training institute for Non Destructive Test Personnel Certification. Annually ETC conduct 5 RPO training and 5 NDT Level I and 3 NDT Level II training. Table 1 shows that there are at least 2999 RPO in Indonesia whom responsible for the safe operation of 4843 radioactive sources and 3741 radiation sources.

2.6. Survey of BATAN Manpower

BATAN manpower is consisting of technical and administrative manpower, where the technical manpower can be grouped into reactor manpower and non-reactor manpower. The aging of manpower and the government policy on zero growth would result in the discontinuity of knowledge transfer within the organization and may be in the future of nuclear technology implementation. Table 12 and 13 in Attachment 7 shows the necessity of launching efficient and effective human resource development to ensure safety use and sustainability of nuclear technology.

3. Present State of AINST

1. The Objective

The primary objective of AINST is to develop an educational and training institute to fulfill the qualified nuclear manpower needs in Asian countries, especially in technical level in Indonesia. The objective can be described as the following:

- To develop qualified nuclear human resources for nuclear energy program, industrial and medical purposes in technical level within the framework of peaceful utilization of nuclear science and technology in Asia,
- To ensure better public acceptance and public appreciation toward nuclear science and technology application in the region.
- To ensure sustainable nuclear human resource development in the region, especially in technical level.

2. The Organization of AINST

Asian Institute of Nuclear Science and Technology (AINST) is a joint research institute located in the Polytechnic Institute of Nuclear Technology (PoINT). As a research counterpart of PoINT, AINST is consist of many centers and serve as focal points for multidisciplinary scientists, researchers, faculty and student research. The academic department is the connection between the student and the center.

The following lists are tentative study centers within AINST to be established and operated with the PoINT:

- Center for Reactor Science and Technology (CRST)
- Center for Non Destructive Test (CNDT)
- Center for Industrial and Environmental Nuclear Safety (CIENS)
- Center for Nuclear Instrumentation (CNI),
- Center for Applied Nuclear Science and Technology (CANST)

3. The Activities

As design, AINST should take the role of the manpower infrastructure development to face the future expectation in launching the nuclear power program and set better role of nuclear science and technology in national industrial axis as major infrastructure for human resource development of nuclear technology within the national nuclear HRD framework (Fig. 1). To do so, AINST suggested to consider the following actions (roles):

Media for Asia Pacific and International Cooperation

Centers are designed as academic commitment to national and international studies. It is a vehicle to foster academic and research cooperation in the region. Through the centers, students and faculty and researcher from FNCA countries may study or

conduct research in associated science and technology. Director and member of the centers may be researcher from FNCA countries.

Student Research and Academic Development

Centers should also be designed to enable students and faculty to work on research problems at PoINT or at the research facilities of BATAN and FNCA members. Once students admitted by the department, they will then be offered research or study opportunities and funding if possible. Centers should also be designed to help make available appropriate annual academic program of PoINT that fit to the industrial needs.

Nuclear Science and Technology Implementation in Medical and Industries

The overall aim of the centers is thus to make possible the solution of industrial problem that requires academic and scientific expertise and to make these capabilities accessible to all academic activities. Cooperation with industries should also be encouraged to further link and match the overall educational program.

As an academic-research institute, AINST aimed to foster talents needed by nuclear application in energy, industrial and medical sectors. AINST existence shall inspire the educational program through involvement in educational and related research program in nuclear. Effective cooperation between AINST and PoINT is essential if the maximum use is to be made of the available human and resources toward achieving the goals of the nuclear program.

4. Polytechnic Institute of Nuclear Technology (PoiNT)

As the counterpart for AINST, Indonesia offers PoINT, a Polytechnic Institute of Nuclear Technology in Jogjakarta since August 2001, formerly School for Nuclear Technician founded in 1985. This school has graduated 531 students while currently conducts education for 234 students and prepares to start program for 87 new students. The school offers specialization program on (a) Nuclear Technophysics: Electromechanics, Electronics and Instrumentations, and (b) Technochemistry.

As an educational institute under BATAN organization, the school main objective is to provide educational and training facilities to support human resource development program, especially in enhancing manpower capabilities in dealing with nuclear science and technology. Students mainly were BATAN employees. Curricula of the program are set to match research and industrial demand on manpower in nuclear technology, with emphasize on competence and quality. Instructors of the school are scientist and experts from BATAN. Some instructors and teachers are coming from nearby universities. Starting August 2001, the school conducts educational program not only for BATAN employees, but also from public interested in achieving higher education in nuclear technology.

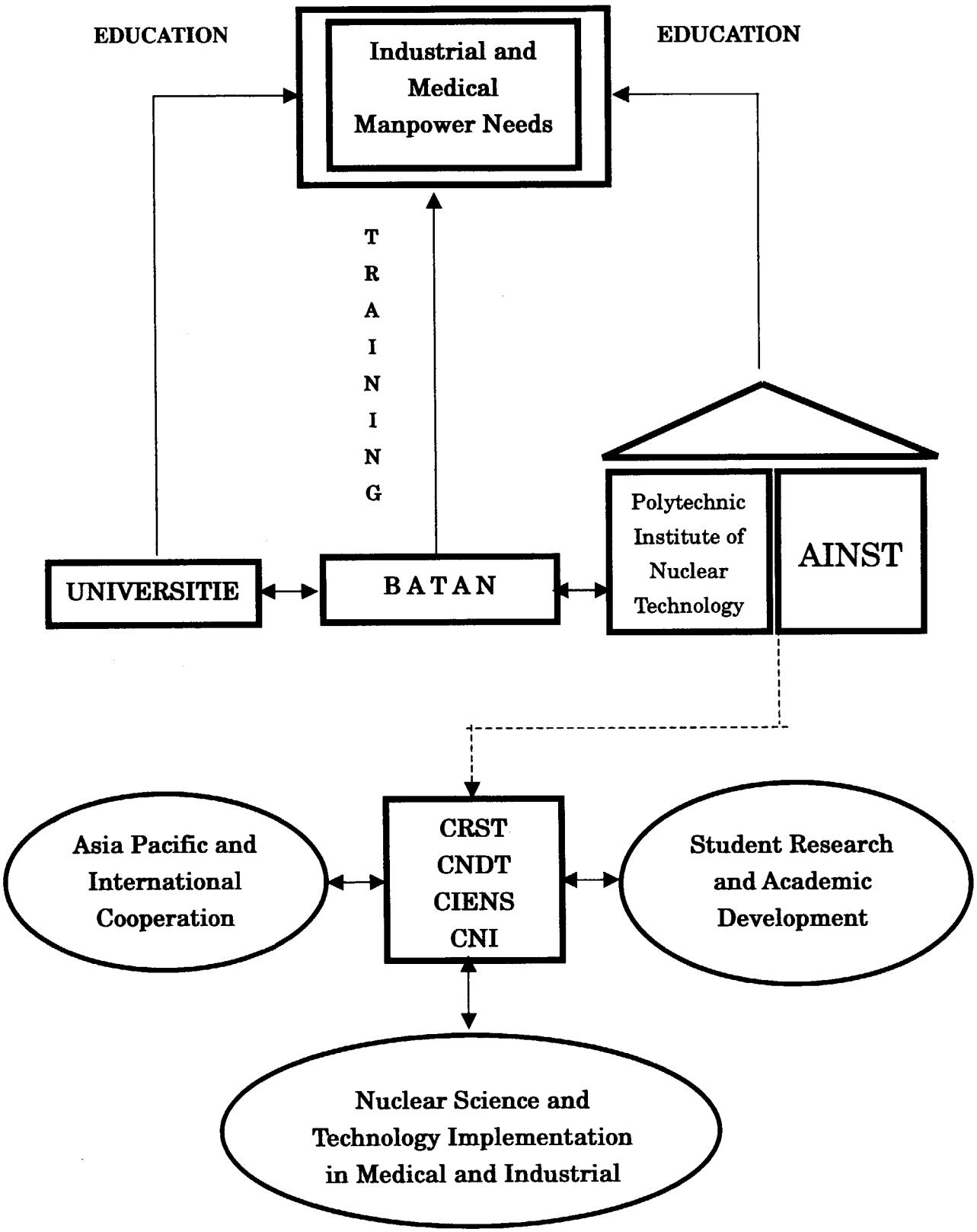


Figure 1 AINST Schematic Diagram

Attachment 1

Table 4

List of Nuclear Application Distribution in Indonesia

SECTORS	APPLICATION MODES	NUMBER OF INSTITUTION	NUMBER OF PERMIT	RADIO ACTIVE SOURCES	RADIA TION SOURCES
Medical	Diagnostic	1451	1896		3215
	Therapy	24	60	374	50
	Nuclear Medicine	20	23		
	Import/Distributor	31	31		
	Storage	148	160	420	225
				794	**3490**
Industrial	Radiography	107	335	335	41
	Logging	19	47	1115	
	Gauging	167	232	1967	4
	Analysis	52	91	150	88
	Irradiator	2	2	61	
	Tracer	2	3		
	Baggage Fluoroscopy	3	5		88
	Container Examiner	3	3		4
	Import/Distribution	2	2		
	Calibration	4	4		
	Storage	64	79	375	24
				4013	**249**
Research	Research / Education	6	23	46	2
	TC-99m Production	1	1		
	Radioisotopes Production	1	1		
	Waste Management	1	1		
				46	**2**
Total		2108	2999	4843	3741

Attachment 2

Table 5

List of Regulation on the Nuclear and Radiation Safety

NO	SUBJECT
Government Decree	Act No. 10 Year 1997 on Nuclear Energy
Government Regulation No. 63 Year 2000	Safety and Health in the Application of ionizing Radiation
Government Regulation No. 64 Year 2000	Licensing in the Use of Nuclear Energy
Government Regulation No. 26 Year 2002	Safe Transport of Radioactive Material
Government Regulation No. 27 Year 2002	Radioactive Waste Management
01/KA. BAPETEN/V-99	Regulation on Radiation Safety
02/KA. BAPETEN/V-99	Standard of Environmental Radioactivity Level
03/KA. BAPETEN/V-99	Safety Regulation on Radioactive Waste Treatment
04/KA. BAPETEN/V-99	Safety Regulation on Radioactive Transportation
05/KA. BAPETEN/V-99	Safety Regulation on Design of Research Reactor
06/KA. BAPETEN/V-99	Nuclear Reactor Construction and Operation
07/KA. BAPETEN/V-99	Quality Assurance of Nuclear Installation
08/KA. BAPETEN/V-99	Safety Regulation on Radiography Industry
09/KA. BAPETEN/V-99	Radiation Safety Regulation on Logging (Drilling Hole Cross Section)
10/KA. BAPETEN/V-99	Safety Regulation on Research Reactor Operation
11/KA. BAPETEN/V-99	Construction and Operation Licensing of Irradiator
12/KA. BAPETEN/VI-99	Safety Regulation on Mining and Handling of Radioactive Exploration
13/KA. BAPETEN/VI-99	SSAC
14/KA. BAPETEN/VI-99	Regulation on Kerosene Light (Kaos Lampu)
17/KA. BAPETEN/IX-99	Qualification of Radiation Officer Licensing
18/KA. BAPETEN/II-2000	Certification and Accreditation of Laboratory Using Radioisotope and Radiation Source
01-P/KA. BAPETEN/VI-99	Guideline of Nuclear Reactor Site
02-P/KA. BAPETEN/VI-99	Guideline of Nuclear Material Physical Protection

Attachment 3

Table 6

Training Course Curricula for Radiation Protection Officer

NO.	Courses	Hours
I.	**Main Courses**	
1	Radiation Physics	4
2	Dosimetry	2
3	Radiation Detection	4
4	Radiation Effects	2
5	Introduction to Radiation Protection	2
6	Radiation Safety Regulation	2
7	Nuclear Related Regulation	2
8	Radioactive Transport	2
9	Nuclear Emergency and Preparedness	2
10	Permit Procedures	2
11	X-rays Application in Industries	2
12	Radioactive Application in Industries	2
13	Design Shielding	2
14	Waste Management	2
15	Standard Operation Procedures Development	3
II.	**Supplement**	
1	Equipment and Video Presentation	1
2	Practice on Theory	3
3	Practice on Exams	3
4	Mid Test I	1
5	Discussion I	1
6	Mid Test II	1
7	Discussion II	1
8	Discussion on Exams	2
9	Capita Selecta	2
10	Experiment Briefing	1
III	**Experiments**	
1	Radiation Emergency	3
2	Radiation Shielding	3
3	Contamination and Decontamination	3
4	Calculation and Evaluation on Shielding for X-rays	3
5	Radiation Safety	3
6	Counting Techniques	3
7	Source Replacement	3
IV.	**Others**	
1	Post and Pre Test	1
2	Exams (written and oral)	5
3	Course Evaluation	1
	Total	**74**

Attachment 4

Table 7

List of State (Public) Universities with Engineering and Science Departments

Island	Name of the University
SUMATRA	1. Universitas Syiah Kuala (UNSYIAH)
	2. Politeknik Negeri Lhokseumawe
	3. Universitas Sumatra Utara (USU)
	4. Politeknik Medan-USU
	5. Universitas Negeri Medan
	6. Universitas Andalas (UNAND)
	7. Politeknik Padang-UNAND
	8. Politeknik Pertanian Negeri Payakumbuh
	9. Universitas Negeri Padang
	10. Universitas Riau (UNRI)
	11. Universitas Jambi (UNIJA)
	12. Universitas Sriwijaya (UNSRI)
	13. Politeknik Palembang-UNSRI
	14. Universitas Bengkulu
	15. Universitas Lampung (UNILA)
JAWA	1. Universitas Indonesia (UI)
	2. Politeknik Jakarta-UI
	3. Universitas Negeri Jakarta
	4. Universitas Terbuka (UT)
	5. Institut Pertanian Bogor (IPB)
	6. Institut Teknologi Bandung (ITB)
	7. Politeknik Negeri Bandung
	8. Universitas Padjajaran (UNPAD)
	9. Universitas Negeri Bandung
	10. Universitas Jendral Soedirman (UNSOED)
	11. Universitas Dipenogoro (UNDIP)
	12. Universitas Negeri Semarang
	13. Universitas Sebelas Maret (UNS)
	14. Universitas Gajahmada (UGM)
	15. Universitas Negeri Yogyakarta
	16. Universitas Airlangga (UNAIR)
	17. Institut Teknologi Sepuluh Nopember (ITS)
	18. Politeknik Elektronika Negeri Surabaya
	19. Universitas Negeri Surabaya
	20. Universitas Brawijaya (UNIBRAW)
	21. Politeknik -UNIBRAW
	22. Universitas Negeri Malang
	23. Universitas Jember (UNEJ)
BALI	1. Universitas Udayana (UNUD)
	2. Politeknik Negeri Bali
	3. STKIP Singaraja

Attachment 4 (Cont.)

Table 7

List of State (Public) Universities with Engineering and Science Departments

Island	Name of the University
KALIMANTAN	1. Universitas Tanjungpura (UNTAN)
	2. Politeknik Negeri Pontianak
	3. Universitas Lambung Mangkurat (UNLAM)
	4. Politeknik Negeri Banjarmasin
	5. Universitas Mulawarman (UNMUL)
	6. Politeknik Negeri Samarinda-UNMUL
SULAWESI	1. Universitas Samratulangi (UNSRAT)
	2. Politeknik Manado
	3. Universitas Negeri Manado
	4. Sekolah Tinggi Keguruan dan Ilmu Pendidikan Gorontalo
	5. Universitas Hasanuddin (UNHAS)
	6. Politeknik Negeri Ujung Pandang
	7. Politeknik Pertanian Negeri Pangkep
	8. Universitas Haluoleo
	9. Universitas Tadulako
NUSA TENGGARA TIMUR	1. Universitas Nusa Cendana (UNDANA)
	2. Politeknik Kupang- UNDANA
	3. Politeknik Pertanian -UNDANA
NUSA TENGGARA BARAT	1. Universitas Mataram (UNRAM)
AMBON	1. Universitas Pattimura (UNPATTI)
	2. Politeknik -UNPATTI
IRIAN JAYA	1. Universitas Cendrawasih (UNCEN)

Attachment 5

Table 8

List of Private Universities with Engineering and Science Departments

Name of the University
1. Institut Sains dan Teknologi Nasional Jakarta
2. Institut Teknologi Budi Utomo
3. Institut Teknologi Indonesia
4. Sekolah Tinggi Tehnik Jagakarsa
5. Sekolah Tinggi Teknik Budiluhur
6. Sekolah Tinggi Teknik Jakarta (STTJ)
7. Sekolah Tinggi Teknologi "YPLN" Jakarta
8. Sekolah Tinggi Teknologi Indonesia
9. Universitas 17 Agustus 1945
10. Universitas Bina Nusantara
11. Universitas Borobudur
12. Universitas Darma Persada
13. Universitas Gunadarma
14. Universitas Ibnu Chaldum Jakarta
15. Universitas Indonesia Esa Unggul
16. Universitas Islam As Syafiiyah
17. Universitas Jayabaya
18. Universitas Katholik Indonesia Atmajaya (Unika Atmajaya)
19. Universitas Kertanegara
20. Universitas Kristen Indonesia (UKI)
21. Universitas Kristen Krida Wacana (UKRIDA)
22. Universitas Mercu Buana
23. Universitas Mpu Tantular
24. Universitas Muhammadiyah Jakarta
25. Universitas Muhammadiyah Prof. Dr. Hamka
26. Universitas Nasional (UNAS)
27. Universitas Pancasila
28. Universitas Pelita Harapan
29. Universitas Pembangunan Nasional Veteran Jakarta
30. Universitas Persada Indonesia "YAI"
31. Universitas Prof. Dr. Moestopo (Beragama)
32. Universitas Respati Indonesia
33. Universitas Satyagama Jakarta
34. Universitas Setyanegara Indonesia (USNI)
35. Universitas Surapati
36. Universitas Suryadarma
37. Universitas Tarumanegara
38. Universitas Trisakti
39. Universitas Yarsi

Attachment 6

Table 9

List of Nuclear Related Training organized by BATAN

Training Topics	Number Of Training	Number of Participants
Nuclear Material and Fuel	17	293
Information Technology	54	567
Instrumentation and Installation	44	646
Managerial	369	4892
Nuclear Safety	111	2015
Radioisotopes and Radiation	165	2199
Nuclear Reactor and Energy	34	533
Material Sciences	10	129
Total	**804**	**11274**

Table 11

List of Country Destination for Nuclear Related Training Participated by BATAN Employees break down into the training topic (1977 - Now)

	Country										
Topic	**Asia**	**Australia**	**Canada**	**Europe**	**France**	**Germany**	**Italy**	**Japan**	**Other**	**U.S.A.**	**TOTAL**
Accelerator	6	-	11	3	-	1	2	11	1	-	35
Nuclear Material and Nuclear Fuel	7	19	2	6	16	13	3	29	12	23	130
Basic Sciences	21	-	5	3	3	14	10	36	3	3	98
Nuclear Technology Application	32	3	-	-	-	4	11	16	1	1	68
Information Science	9	-	5	2	4	1	4	20	8	2	55
Nuclear Instrumentation	43	9	23	7	16	13	8	69	8	11	207
Nuclear Medicine and Health Science	31	12	1	8	2	1	2	16	3	4	80
Management	36	10	15	7	13	4	7	75	24	13	204
Management of Technology	1	1	-	-	3	1	2	4	2	3	17
Food Science, Agricultural and	11	3	1	5	-	4	-	14	11	6	55
Waste Management	16	1	-	15	8	6	-	37	4	5	92
Energy and Mining	45	1	1	9	11	7	2	28	13	24	141
Radiation Protection and Radiation Safety	26	21	6	11	8	15	2	74	18	22	203
Material Science	3	-	7	3	1	9	7	9	-	-	39
Reactor Technology and Reactor Safety	23	2	3	19	8	38	15	71	10	33	222
Radiation Process and Radiation Technology	51	20	7	17	1	16	4	93	17	7	233
TOTAL	**361**	**102**	**87**	**115**	**94**	**147**	**79**	**602**	**135**	**157**	**1.879**

Attachment 7

Table 10

List of BATAN / BAPETEN participation in overseas training

(1977 - Now)

Country	Total Participants
Asia	361
Australia	102
Canada	87
Europe	115
France	94
Germany	147
Italy	79
Japan	602
Other	135
U S A.	157
TOTAL	**1879**

Table 12

Technical Manpower in BATAN

	Age Group								
Level of Education	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60+**	**Total**
HS	68	269	335	341	222	74	26	6	**1341**
D − I		1	3	5					**9**
D − II		1	4	7					**12**
D − III	19	67	69	40	15	2			**212**
D − IV			1	3		1			**5**
< Bach		4	8	29	36	16	13	7	**113**
Bachelors	25	97	236	277	165	84	38	54	**976**
Masters	7	26	67	93	61	27	9	8	**298**
Doctors		3	15	40	27	16	13	14	**128**
Total	**119**	**468**	**738**	**835**	**526**	**220**	**99**	**89**	**3094**

Table 13

Distribution of Age vs. Level of Education of Research Reactor Manpower In Serpong (30 MW), Bandung (2 MW), and Yogyakarta (1 MW)

	Level of Education						
Age Group	**HS**	**Dipl**	**< Bs**	**Bs**	**Ms**	**Ph.D**	
20 − 24		3					**3**
25 − 29		2		2	1		**5**
30 − 34	14	3		3	2		**22**
35 − 39	29	5		8	4	1	**47**
40 − 44	22	10	1	8	5	1	**47**
45 − 49	21	1	3	15	6		**46**
50 − 54	5		1	4	1		**11**
55 − 59				2	1	1	**4**
TOTAL	**91**	**24**	**5**	**42**	**20**	**3**	**185**

Note: HS:high school, Dipl(I,II,III,IV):1,2, 3 or 4 year college, Bs:Bachelor Degree, Ms:Master

The 4th Workshop on Human Resources Development in the Nuclear Field, FNCA
October 2002

Country Report of Indonesia

Status and Needs on Human Resource Development in Nuclear Field in Indonesia

Guritno Lokollo
Education and Training Center

National Nuclear Energy Agency

2002/10/15 1

Organization

1. Training on Radiation Protection in Indonesia

2. Investigation of Basic Data on HRD Program
2.1. Survey of Administrative Agency
2.2. Survey of National Education
2.3. Survey of Radiation and Radioisotopes Application
2.4. Survey of Nuclear Training Courses
2.5. Survey of Licensees of National Examination Related to Nuclear Energy
2.6. Survey of BATAN Manpower

3. Present State of AINST
1. The Objective
2. The Organization of AINST
3. The Activities

2002/10/15 2

Training on Radiation Protection in Indonesia

Instructional materials

Current topics of specialization in Radiation Protection Training

- Radiotherapy
- Radio diagnostic
- Nuclear Medicine
- Dental
- Industry
- Research

2002/10/15 3

The qualification of trainers

Manpower development through:

- Train the trainer courses;
- Domestic and international training participation;
- individual coaching and mentoring.
- Provide an adequate source of literatures

2002/10/15 4

Media of training

ETC of BATAN equipped with experimental laboratories adequate to conduct comprehensive training on radiation protection.

- 6 in class training and
- 4 in-house training for public
- 2 training for BATAN personnel annually.

2002/10/15 5

Investigation of Basic Data on HRD Program

Survey of Administrative Agency

Table 1
List of National Administrative Agency

Agency / Institutes	Role	Total Manpower
Nuclear Energy Control Board (BAPETEN)	regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials	180
National Nuclear Energy Agency (BATAN)	to execute, and to promote the research and the use of nuclear energy	3818

2002/10/15 6

Overview of National Education and Training

The path of development in Indonesia has been disturbed by the economic crisis since mid-1996.

The impacts seen among others are:
the declining pattern of investment in human capital,
the increasing drop out rate at primary to tertiary level and
the reduction of quality of education

2002/10/15 7

Higher Education Institutes

Three main risks that threatened the human resource development in the present condition:

•Declining of enrolment at the basic education level, especially in the lower income group,
•Deterioration of school quality at all levels of education,
•Compounding resource wastage due to existing inefficiencies.

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Survey of Radiation and Radioisotopes Application

Table 3.
List of Nuclear Application Distribution in Indonesia

SECTORS	NUMBER OF INSTITUTION	NUMBER OF PERMIT	RADIO ACTIVE SOURCES	RADIATION SOURCES
Medical	1451	1896	794	3490
Industrial	107	335	4013	249
Research	6	23	46	2
Total	2108	2999	4843	3741

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.Survey of Nuclear Training Courses

Attachment 6 - Table 9
List of Nuclear Related Training organized by BATAN

Training Topics	Number Of Training	Number of Participants
Nuclear Material and Fuel	17	293
Information Technology	54	567
Instrumentation and Installation	44	646
Managerial	369	4892
Nuclear Safety	111	2015
Radioisotopes and Radiation	165	2199
Nuclear Reactor and Energy	34	533
Material Sciences	10	129
Total	**804**	**11274**

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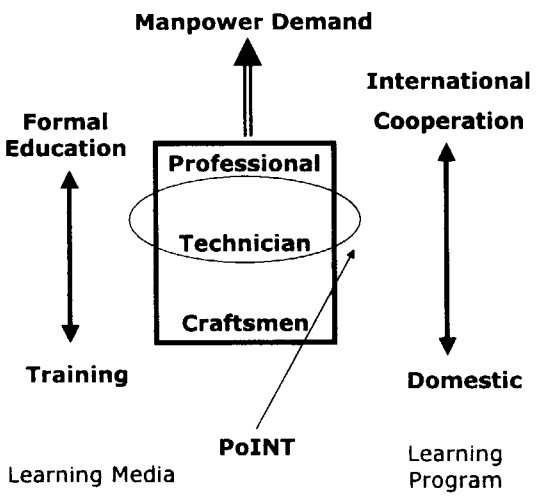
Present State of AINST

The Objective

The objective can be described as the following:

- To develop qualified nuclear human resources for nuclear energy program, industrial and medical purposes in technical level within the framework of peaceful utilization of nuclear science and technology in Asia,
- To ensure better public acceptance and public appreciation toward nuclear science and technology application in the region.
- To ensure sustainable nuclear human resource development in the region, especially in technical level.

2002/10/15 11



2002/10/15 12

The Organization of AINST

Asian Institute of Nuclear Science and Technology (AINST) is a joint research institute located in the Polytechnic Institute of Nuclear Technology (PoINT).

The following lists are tentative study centers within AINST to be established and operated with the PoINT:

- Center for Reactor Science and Technology (CRST)
- Center for Non Destructive Test (CNDT)
- Center for Industrial and Environmental Nuclear Safety (CIENS)
- Center for Nuclear Instrumentation (CNI),
- Center for Applied Nuclear Science and Technology (CANST)

2002/10/15 13

The Activities

- ❑ **Media for Asia Pacific and International Cooperation**
- ❑ **Student Research and Academic Development**
- ❑ **Nuclear Science and Technology Implementation in Medical and Industries**

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1.5.3 Korea

Nuclear Human Resources Development and Planned Development of Nuclear Education and Training in Korea

* Eui-Jin Lee, Young-Taek Kim, Kyoung-Won Han, Young-Mi Nam
Nuclear Training Center
Korea Atomic Energy Research Institute

1. Development of Training Materials in Radiation Protection Areas

There are many education and training courses on radiation protection and the safe use of radiation resources provided around the world. These education and training courses have a long history due to the fact that every government should ensure that an adequate legislative framework is established which requires appropriate training for all personnel engaged in activities relating to radiation, radioactive waste and transport safety. The NuTEC of JAERI has provided various training courses and education programs on radiation protection areas for neighboring countries under the MEXT Scientist Exchange Program since the middle of 1980s. The International Atomic Energy Agency also has a long history of providing training courses on radiation protection and the safe use of radiation resources for Member States. There was a technical meeting on the implementation of strategies for education and training in radiation and waste safety in Vienna on March 2002 for the purpose of review of its education and training program for next 10 years. The following are recommendations suggested by the meeting participants:

- Development and use of modular training materials for post-graduate course on radiation protection for 18 weeks (under updating the existing training material).
- Development of standardized training materials for practice-specific training
  - Personnel monitoring
  - Occupational radiation protection
  - Regulatory infrastructure
  - Patient protection
  - Source safety and Security
  - Transport safety
  - Emergency preparedness and response
  - Radioactive waste
- Development of training materials for distance learning in radiation protection (Ongoing IAEA/RCA project under review for the finalization of training materials. The participating countries are Australia, Korea, Indonesia, Mongolia, Thailand, The Philippines and New Zealand. The course is aimed at participants with secondary education level.)
- Establishment of an Inter-Center Network for the purpose of dissemination of lecture

materials through Web-Sites, promotion of distance learning programs, access to all relevant IAEA documents.

- Designation of regional training centers for post-graduate course on radiation protection

Figure 1 shows key milestones of the Agency's strategy for the implementation of education and training in radiation and waste safety. The final goal of the Agency's strategy is to encourage the Member States to achieve a self-reliance on the implementation of training capability of radiation protection and waste safety.

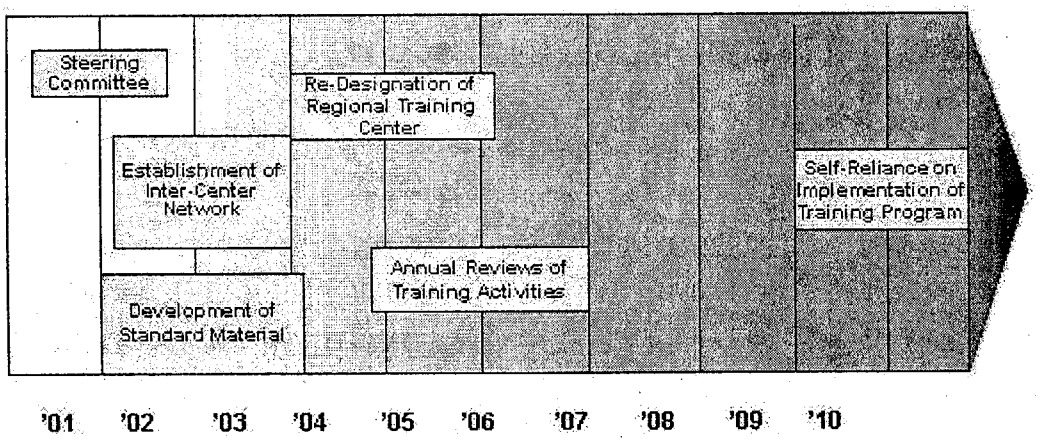


Figure 1. Key Milestones of the Agency's Strategy of Training in Radiation Protection

The following technical documents related with education and training courses in radiation protection have been published recently by the Agency;

- Evaluation report of IAEA education and training activities for radiation protection (December 2001)
- Training in radiation protection and the safe use of radiation sources (October 2001)
- Postgraduate educational course in radiation protection and safe use of radiation sources, volume 1: standard syllabus (November 2000)
- Several kinds of film and video in radiation protection areas. The list of these materials is available at the IAEA Web-site.

The Nuclear Training Center of KAERI had a project on the development of an education model and its evaluation methods for radiation safety in 2001 due to the fact that the government reinforced its training requirements for radiation workers. The project consisted of the improvement of training courses curricula, upgrading of evaluation skills for training organizations and its training courses, and the development of training materials. Through the project, NTC/KAERI published two new kinds of textbooks for radiation workers in 2002.

Concerning the need of training materials in radiation protection area to be used commonly in each

country, NuTEC/JAERI has provided several radiation protection courses for Vietnam. Thailand, Indonesia already with training materials in English. So, it is believed that these materials would also be very useful for other FNCA member countries if NuTEC/JAERI could develop them in textbook format.

2. Development of E-Learning Systems

With the rapid development of information technology and its application on education and training as well as environmental changes in those fields, NTC/KAERI has invested budgets for the establishment of E-Learning systems since 2000 as an ongoing project. The Center setup Web-based Cyber Learning and Training Systems in 2000 in the first phase with the domain name of www.kntc.re.kr. As the second phase, the Center conducted e-learning training courses on radiation safety and radiation emergency preparedness with a real time base for the domestic nuclear personnel in 2001. From the feedback of the second phase, the Center will upgrade the e-learning system and its Web-based homepage not only for integrating administration works of on-line and off-line training but also for construction of a data base in training materials by the end of 2002. The improved Web-based homepage and its e-learning system will be an integrated knowledge management system for education and training in the nuclear field for the future.

For the effective implementation of the e-learning project, the Center has developed several multi-media training materials and these training materials have been loaded into the system. The Center has developed 18 kinds of multi-media training materials in Korean and 7 kinds of multi-media training materials in English since 2000. The following are the list of multi-media training materials developed in English:

- Nuclear power project: policy and Korean experience
- Nuclear power reactor technology
- Nuclear power planning and project
- Decontamination and decommissioning of research reactors and other small facilities
- Data base for equipment qualification
- Use of the IAEA's methodologies and tools in greenhouse gas abatement studies
- Gas flow Radiation Model.

At present, the most important issue in the development of an e-learning system is how to operate and manage its system effectively. It requires a lot of time and effort to develop training materials and also needs qualified manpower for its operation and management.

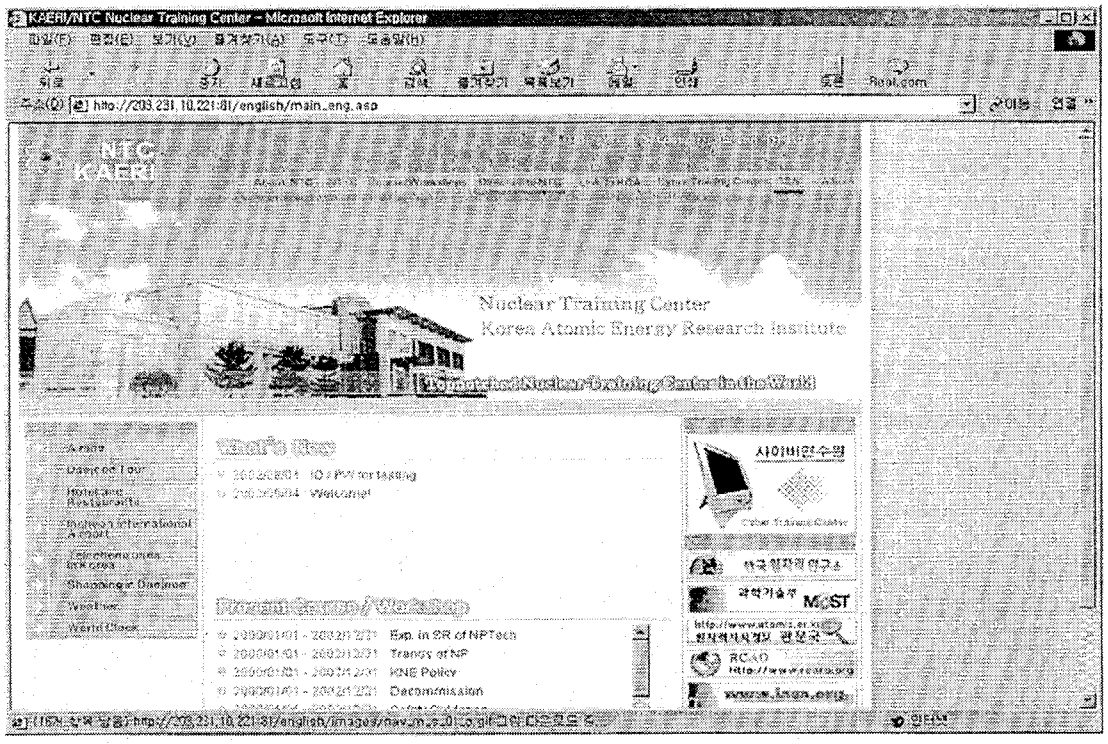


Figure 2. Improved Web-Based Homepage and E-Learning System at NTC/KAERI

In connection with the minutes on action item for linkage member countries' homepage with NuTEC/JAERI homepage in 2002, it is requested for further discussions on this matter. It is believed that linkage NuTEC/JAERI homepage with member countries' nuclear training center homepages would be a valuable framework for exchange of information and training materials among the member countries.

3. Investigation of Basic Data on Human Resources and Human Resources Development in Nuclear Field

According to the scheduled plan for survey of the basic data on human resources development in nuclear field in FNCA member countries, the results gained from the survey were attached herein as an attachment of this paper. These basic data was collected based on the nuclear white book and statistics on radiation practices in Korea, which were published by the Ministry of Science and Technology in 2002 respectively.

In Korea, there are 1,612 experts engaged in the administrative agencies and national nuclear research and development institutes as of September 2002. About 25,000 persons are engaged as radiation workers in various nuclear and radiation related organizations in Korea as of September 2002. Figure 4 shows that 1,822 organizations have achieved a license for using radioisotopes and radiation generators from the Ministry of Science and Technology as of June 2002. Figure 5 shows that 6,682 persons has achieved a license of radiation handling, reactor operation, nuclear material treatment from the Ministry of Science and Technology as of December 2001.

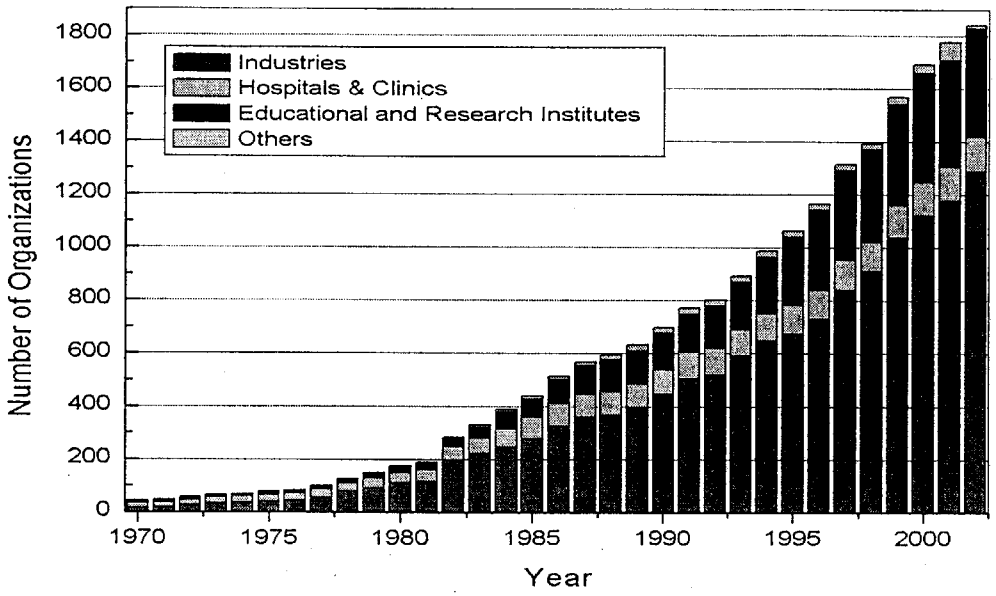


Figure 4. Annual Change in Number of Radiation Application Organizations in Korea

Even though the utilization of radiation and radioisotope has increased gradually, their industries are faced with many difficulties in securing qualified manpower, so-called qualified radiation workers, due to the size of company, working environmental, low salary, and lack of right understanding of radiation. University students have less interest in the radiation and radioisotope utilization field than the nuclear power engineering. These phenomena make it difficult to secure qualified experts to be responsible workers such as a safety supervisor in industries, and an engineer in research and development organizations.

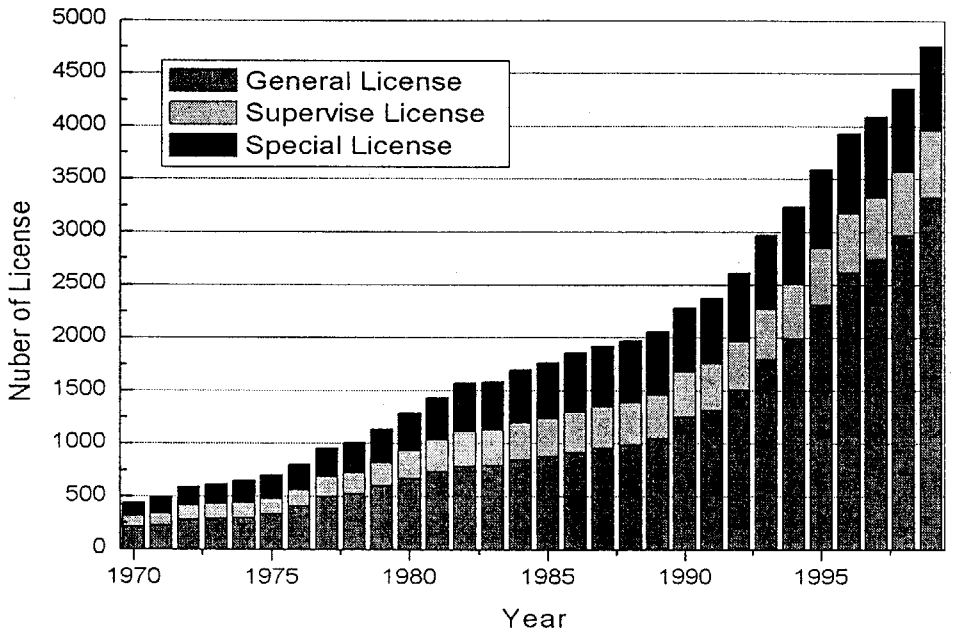


Figure 5. Annual Change in Number of Licensees in Radiation Handing

There are three activities in the Korean national promotion plan with respect to human resources development in the nuclear field.

Firstly, the government will support nuclear education programs at universities by providing students with more fellowship programs and intern job opportunities at research institutes and industries, as well as providing research funds for updating curricular and linkage of curricular with advanced technology.

Secondly, the government will support nuclear industries' activities to provide radiation workers with fringe benefits, to enhance retraining programs for employees, to activate exchange programs among industries, and research institutes and universities to maintain qualified nuclear personnel.

Lastly, the government will encourage global competitiveness of nuclear personnel by providing young researchers and students with international career, fostering joint research projects with international organizations and advanced countries. The government will also provide a budget for the utilization of outstanding experts from overseas in the implementation of national nuclear R&D program.

According to the Korean national promotion plan for the utilization of radiation and radioisotope, the advanced institute of radiation science and technology,; the second research institute of KAERI will be under construction within the year.

4. Current Topics Related Human Resources Development in Korea

With regard to the above mentioned Korean nuclear promotion plan for human resources development in the nuclear field, the Ministry of Science and Technology has included the promotion of projects for nuclear human resources development at universities and industries into the national mid and long-term nuclear R&D program in 2002. The purpose of the projects is to support the infrastructure of nuclear human resources development at universities and industries for the sustainable development of nuclear science and technology. The projects consist of the following;

- Dispatch of university students, who are majoring in nuclear engineering and radiation science at master or Ph. D. courses, to advanced countries for 1-2 years under the research agreement between universities in Korea and educational institutes in advanced countries.
- Dispatch of university/college students, who are majoring in nuclear engineering department, to educational institutes/universities in advanced countries for 6 months-1 year under the agreement both parties.
- Dispatch experts to research institutes or organizations in advanced countries for 1 year for upgrading their research career.
- Financial support for university students, who are majoring in nuclear engineering department, to study their thesis focused on upgrading their research capabilities.

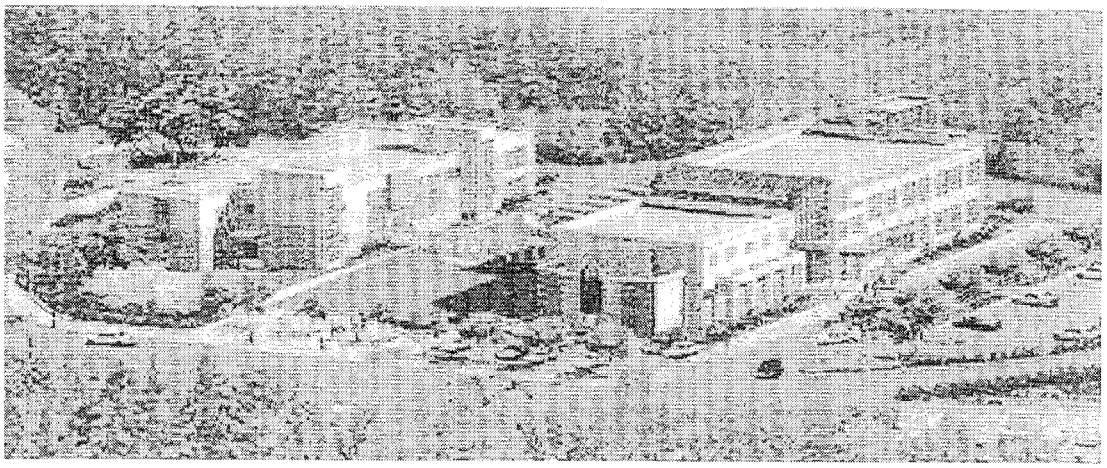


Figure 6. View of the International Nuclear Training and Education Center (INTEC)

To expand international cooperation for human resources development as well as international education and training with IAEA and other countries, the International Nuclear Training and Education Center, so-called INTEC, was established under the NTC/KAERI. The INTEC was inaugurated in March 2002 with the construction of two new buildings (see Figure 6). The INTEC consisted of two buildings. One is a 2 stories building for international training (1,980 square meters) that has an auditorium, conference rooms, seminar room, large and small lecture rooms. The other is a 2 stories guesthouse building for foreign trainees (1,300 square meters) equipped with self-cooking facilities. There are eight condominium type units in the guesthouse, 1 unit has 3 rooms (twin beds in each room) with a living room. Total 24 rooms with 48 beds are installed in the guesthouse. The INTEC buildings which were constructed in terms of upgrading training capabilities are being used for international events such as meeting, workshop that are conducted by other departments of KAERI. We are using NTC or INTEC buildings for the purpose of international training events.

The NTC/KAERI is scheduled to conduct 10 kinds of IAEA regional training events in 2002 as follows. The NTC/KAERI is planning to participate in the Agency's outsourcing program for regional training events from the end of this year.

- IAEA/RCA regional training course on non-destructive in-service inspection in petroleum industries (21-25 January, 1 week)
- IAEA/RCA regional workshop for dissemination of information on use of isotopes in dam safety and sustainability (15-19 April, 1 week)
- IAEA /RCA workshop on accident management and emergency response for research reactor (29 April-3 May, 1 week)
- IAEA/RCA workshop on core management for improved utilization of research reactor (13-24 May, 2 weeks)
- IAEA/RCA regional workshop on process optimization using tracers in petrochemical industries (2-11 July, 2 weeks)

- IAEA workshop on upgrading training capabilities to response to emerging needs (2-6 September, 1 week)
- Workshop on IAEA safeguards (2-9 October, 2 weeks)
- IAEA/RCA regional workshop on safety of radiation sources and security of radioactive materials (7-11 October, 1 week)
- IAEA regional training course on advance instrument and control systems for nuclear power plant (4-15 November, 2 weeks)
- IAEA/KOICA regional training course on nuclear power planning and project management (14 November-4 December, 3 weeks).

In April 2000, 17 RCA Member States agreed to establish an RCA regional office to strengthen its ownership. To this end, the Korean government decided to host the regional office in Korea, and the office opened at KAERI in March 2002. The regional office has developed two kinds of manpower development projects for Member States. One is the Post-Doctoral Fellowship program at research institutes such as KAERI, KINS, Korea Cancer Center Hospital, KEPRI, etc. for 6 months-1 year. This program already started in October this year. The other is a RCA master's degree course on nuclear energy policy and nuclear quantum engineering for 1 year at the Korea Advanced Institute of Science and Technology (KAIST) under the support of KAERI, KINS, MOST as well as IAEA. This RCA master course will start in the spring semester of 2003. These RCA manpower projects will be regarded as a demonstration in the concept of the International Nuclear University, which Korea proposed to the Agency in 2001.

5. Status of the International Nuclear University proposed to the IAEA

The IAEA has a regular project on *Preservation of Knowledge in Nuclear Science and Technology in 2002-2003 for Member States (D.4).* The project consisted of three sub-projects as follows:

- D.4.1. Assessing policy and requirements for nuclear science R&D and training.
- D.4.2. Facilitating education, training and research in nuclear science and related field through the establishment of international school of nuclear science and technology.
- D.4.3. Preservation of knowledge in nuclear science and technology.

With regard to the D.4.2 project, the IAEA has requested KAERI to make a proposal for the project's initiation. Upon the request of the IAEA, KAERI has submitted the Korean proposal for the feasibility study on the establishment of the Agency's sponsored International Nuclear University. KAERI has presented the INU proposal several times at the IAEA Meetings in 2001-2002. KAERI also presented the concept of INU at the 3rd FNCA HRD Workshop at KAERI in October last year.

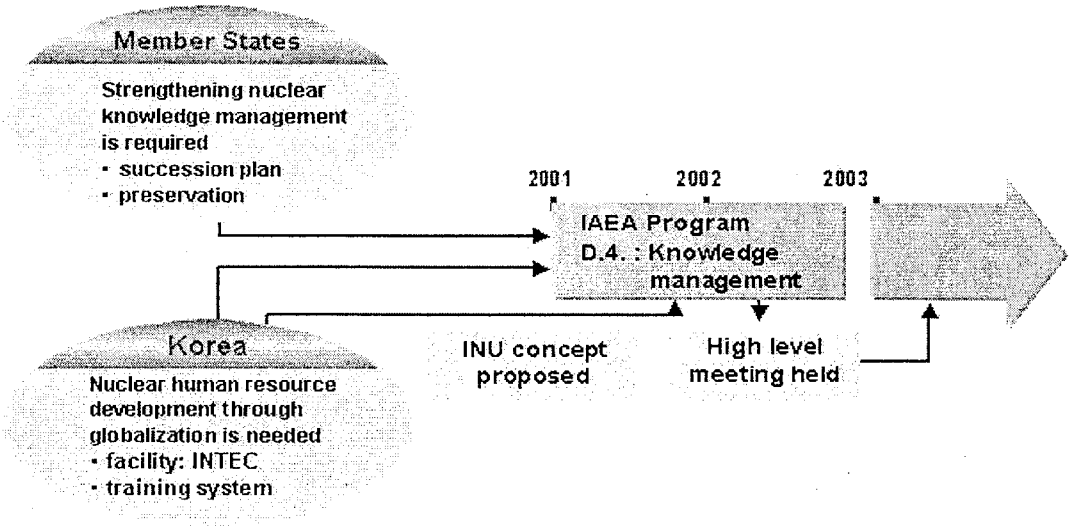


Figure 6. IAEA Program on Nuclear Knowledge Management

There was the IAEA Meeting of Senior Officials on Managing Nuclear Knowledge at Vienna in June 2002. The participants of the meeting have recommended some possible activities for the Agency, which consisted of six top priority activities and another 12 additional activities, which were ranked by the participants. Among these activities, recommendations numbers 2 and 6 for priority activities and number 7 for additional activities fall into the area to be considered by the Agency as a possible project for further development:

- Promote networking of institutions for nuclear education and training in Member States in coordination with existing activities
- Facilitate the development of curricula for internationally accepted high university degrees on nuclear technology, e.g., by networking universities
- Provide support for the establishment of an International Nuclear University.

Considering these three activities together, some important features can be derived to formulate an Agency coordinated project.

- First, the project will give priority on the networking of existing facilities rather than the establishment of new facilities.
- Second, the project would focus on the establishment of a mutually recognized education and training system for a higher degree in nuclear technology.
- Third, the project would be planned on a regional basis in advance, and possible for the Asian region. For example the European Union has already started to construct a network system named European Nuclear Engineering Network (ENEN).

Therefore, a project encompassing such features could be named as "an Asian Network of Higher Education and Training for Nuclear Technology". Once such a regional network is established and operated, it could serve as a good basis for moving to the next step, which would be the establishment of an

International Nuclear University. It is expected that a meeting on this project proposal for drawing consensus within the region be initiated by the IAEA soon.

[References]

1. Postgraduate Educational Course in Radiation Protection and the Safe Use of Radiation Sources, Volume 1: Standard Syllabus, November 2000, IAEA
2. Final Report on Strategic Approach to Education and Training in Radiation and Waste Safety, April 2001, IAEA
3. IAEA Safety Report Series No. 20, Training in Radiation Protection and the Safe Use of Radiation Sources, October 2001, IAEA
4. Final Draft Report, Technical Meeting on the Implementation of the Strategy on Education and Training in Radiation Protection and Waste Safety, March 2002, IAEA
5. Nuclear white book 2002, Ministry of Science and Technology, ROK
6. Statistics on Radiation Practices in Korea, 2002, Ministry of Science and Technology
7. Jin-Kyoung Kim, The Role of RCA Regional Office for International Cooperation, August 2002, ROK
8. Jong-Kyun Park, Eui-Jin Lee, Korean Proposal for a Feasibility Study on the Establishment of the Agency Sponsored International School in Nuclear Science and Technology, August 2001, NTC/KAERI

Answer Sheet for 'The Plan for Survey of the Basic Data on Human Resources Development in the Nuclear Field in FNCA Member Countries'

Korea

A−1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

A−1−1 Total number of administrative and technical officials in each agency and institutes

Agency / Institutes	Role	Total	Notes
Ministry of Science & Technology(MOST)	Administrative Agency: Planning, deliberation, and decision of nuclear policy in general	51	
Korea Atomic Energy Research Institute (KAERI)	R&D Institute: Research for promoting the peaceful application of nuclear energy	1,045	
Korea Institute of Nuclear Safety (KINS)	R&D Institute: Performs regulatory functions such as safety reviews, inspections, and development of regulatory technical standards	326	
Total		1,422	

Remarks

① Target agency and institutes
- National agency and institutes

② The number of staff members:
- Count only regular employees.
- Indirect category (driver, guard, and staff in dinning hall and clinic, etc.) should not be included. Explanatory note should be needed if your data has been included these staff members.

Your notes

① As to Research institutes we listed those that is engaged in only nuclear energy.
② Source : Atomic Energy Almanac in Korea 2001

A−1−2 The Number of Personnel Classified by Field in each Agency and Institutes (Breakdown table of A−1−1)

Agency / Institutes	Nuclear Administration				R&D		Total	Notes
	Promoting		Regulatory					
	R&D / Radiation Application	Nuclear power generation	R&D / Radiation Application	Nuclear power generation	Radiation Application	Nuclear power generation		
Ministry of Science & Technology(MOST)	51		—	—	—	—	51	Promoting includes Regulatory
Korea Atomic Energy Research Institute (KAERI)	—	—	—	—	1,045		1,045	
Korea Institute of Nuclear Safety (KINS)	—	—	326		—	—	326	
Total							1,420	

Remarks

① This table is a breakdown of A-1-1 and is to be filled in as much as you know.
② Write in the middle if the classification is not clear.
③ Attach the detailed data of each institution if available. The detailed table is acceptable as the substitution of this table.

Your notes

① MOST : The number of personnel for promoting is the Nuclear energy committee, and that for regulatory is that of the Atomic Safety Committee and their secretaries.

A−2. Survey of University Education Institutions

A−2−1 University Course

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
Seoul National U.	National	168	15	1959	26	(15)	1963	30	(15)	1966	
Kyung Hee U.	Private	150	13	1979	17	(13)	1984	8	(13)	1991	
Korea Advanced Institute of Science and Technology (KAIST)	National	22	10	1981	32	(10)	1982	90	(10)	1994	
Hanyang U.	Private	117	10	1958	23	(10)	1963	27	(10)	1973	
Chosun U.	Private	206	8	1985	6	(8)	1984	—	(8)	2000	
Cheju National U.	National	219	7	1984	8	(7)	1992	2	(7)	1999	
Total											

Remarks

① Target: University to educate nuclear energy (School of Engineering and Sciences).

② Fill in the applicable space for University, Graduate School (Master), and Graduate School (Doctor), respectively.

③ The number of student: Registered student or quota (Registered student is preferable for Graduate School.). (Specify which number of personnel is shown in the table in Notes)

④ The number of staff: Staff for education (Sample in Japan: Total of Professor, Assistant professor, Lecturer and Assistant). Write total number and classify if staff holds the both posts of school and graduate school.

Your notes

① The staffs of University are usually charge with the education of Graduate School in Korea
So the staff of Graduate School is same staff of University.

② Source : Atomic Energy Almanac in Korea 2001

A−2−2 Specialized School for Development of Technical Engineer

A−2−2−1 Medical Radiation Technical Engineers Training School

Number of School	Annual Trainee	Breakdown of School		Notes
22	1, 504	University	4	Notes 1
		Health Sciences College	8	
		Junior College	10	

A−2−2−2 Other Field (if there is any)

Field	Number of School	Annual Trainee	Breakdown of School	Total	Notes
None					

Remarks

① Target: Specialized School for Development of Technical Engineers

② Japan only has the Medical Radiation Technical Development School. However, write more in A-2-2-2 if there is something else in your country.

Your notes

① Notes 1: School term − for 4 years in University, for 3 years in Health Sciences College, for 3 years in Junior College (Annual Trainee: Results in FY2001)

A−3. Survey of Radiation and Radioisotopes Application

A−3−1 Agricultural Application

A−3−1−1 Plant Mutation Breeding

Number of the institutions implemented	Number of the scientists engaged	Notes
10	19	

A−3−1−2 Sterile Insect Technique

Number of the institutions implemented	Number of the scientists engaged	Notes
1	3	

A−3−1−3 Food Irradiation

Number of the institutions implemented	Number of the scientists engaged	Notes
2	44	

A−3−2 Medical Application − Radiation diagnosis

Number of the institutions implemented	Number of the radiation oncologists	Number of the therapeutic technicians	Notes
52	126	261	

A−3−3 Other field (if any)

Field	Number of implemented institution	Number of engaged scientist	Notes

Remarks

① Target: Quantitative data is needed. Write in A-3-3 if data is not available.

② Plant Mutation Breeding: Refer to attachment 8, database of FNCA Radiation Breeding Project, and correct it if needed.

③ Medical Application − Refer to attachment 7.

Your notes

A－4. Survey of Nuclear Training Courses

Field	Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Notes 1						

Remarks

① Target: Write the training course implemented by nation or private within the range of understanding.

② Field: a) Basic / general nuclear energy b) Radiation / Radioisotopes Application Technique
c) Nuclear power generation technique d) Safety (including Radiation Hazard Prevention)
e) Others (Including protection against nuclear materials and International cooperation)

③ Classify according to the table as mach as possible.

④ Cumulative Trainee is acceptable within the range of understanding.

Your notes

① Notes1 : A-4, Refer to attachment 1

A−5. Survey of Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Annual Licensee	Cumulative Licensee	Authorize Institution	Notes
General License	Radiation Application	110	3,427	MOST	Notes 1
Supervisory License	Radiation Application	43	646	"	
Special (oncologist) License	Radiation Application in medical use	8	797	"	
Reactor Operator	Research Reactor / Generation Reactor	67	702	"	
Reactor Senior Operator	"	60	847	"	
Nuclear Materials Treatment License	Nuclear material treatment	0	6	"	
Supervisory License for Nuclear Materials Treatment	Nuclear material treatment	13	31	"	

Remarks

① Target: The number of licensees of national certifying examinations in the nuclear field.

② Write other national certifying qualifications if data is available. Write the institutions to certify the qualifications in Notes.

③ Write cumulative licensee if data is available.

Your notes

① Notes 1 : A-5, Quoted from Statistics on Radiation Practices in Korea 2002, Atomic Energy Almanac 2001: Annual Licensee: Results in FY2000

A−6. Survey of Background Data for Analysis

A−6−1 The number of users of radiation application

Total number of users	Breakdown					Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	
FY2000 15,925 (100%)	216 (11.8%)	129 (7.19%)	196 (10.7%)	887 (48.7%)	424 (21.7%)(	Total :1822

A−6−2 Data of Radiation Diagnosis

A−6−2−1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt machines total
8	76	81

A−6−2−2 Total Number of Brachytherapy Machine

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
3	10	3	18	21

A−6−2−3 Annual new cancer patients in both sexes

83,846

A−6−3 Others (if any)

- The total number of registered crop varieties through mutation.
- Economic scale of nuclear application (Radiation application, Nuclear power generation)
- Scope of Nuclear power generation (The number of operating units, Generating capacity)

Remarks

① Target: These survey data could be useful for further analysis. Write in A-6-3 if you have any other suggestions.

② A-6-2: Refer to attachment 7.

③ Population and GDP will be made a list from national data collectively.

Your notes

① Notes 1 A-6-1
- Results in FY2001 treatment
- Cancer and diagnosis is included.
- Accelerator Contains Cyclotron and Linear Accelerator in the Hospitals and Clinics.
- Activities of Cs-137 and Co-60 in treatment are above 200 Ci.

② A-6-2-3 - Results in FY2000

③ A-6-3 - Refer to attachment 2,3,4

A−7. Comments on the Survey

This survey should be updated periodically to review the current strategies on human resources development in the nuclear field. It is requested that all corrected data should be analyzed appropriately not only for further development of HRD strategy in FNCA member countries but also for the cooperation in HRD strategy among member countries.

Remarks

① Target of the Survey: Write your opinions and comments;

a) Comprehensive opinion and comment b) Plan for future survey

c) Items for survey d) Others

Reference 1 **Survey of Nuclear Training Courses in Korea**

(1)KAERI Nuclear Training Center

(Unit: Person)

	Course	Duration	Time in Fy 2001(/year)	Max. Trainee 2001	Total Trainee from Fy 1960 to FY2001
1.International Training Courses	1.IAEA Regional Training Courses/Workshops in Nuclear Science and Technology	1Wk-5Wks	9	158	703
	2.Advanced Training Course by invitation of Foreign Experts	1 Wk	1	40	1966
	Sub Total			158	2,669
2.Training Course on Nuclear Power & Nuclear Fuel Technology	1.Basic Course on Nuclear Power Generation				1,709
	2.Basic Course of Design on Nuclear Power Plant				127
	3.Basic Course on Nuclear Power for Manufacturing Equipment and Components				173
	4.Nuclear Quality Assurance	2 Wks	1	13	295
	5.Safety of Nuclear Power Plant	7days	1	10	308
	6.Seminar on Nuclear Power Generation				62
	7.Planning & Preparedness to Radiological Emergency	7days	1	45	616
	8.Supervisory Course on Nuclear Materials Treatment	2 Wks	1	16	204
	9.Basic Course on Nuclear Materials Treatment				36
	10.Workshop on Severe Accidents Assessment Code				31
	11.Basic Course on CANDU System				56

	31.Risk Informed optimization of NPPS	7days	1	38	38
	32.Advanced Nuclear Fuel Technology	7days	1	17	17
	Sub Total			175	4,892
3.Training Courses of Radioisotopes Utilization And Radiation Protection	1.Basic Application of Radioisotopes	4 Wks	2	52	3,354
	2.Radiation Protection	6 Wks	1	45	1,459
	3.Medical Applications of Radioisotopes				1,198
	4.Agricultural Applications of Radioisotope				532
	5.Operation and Repair of Radiation Measuring Instrument				90
	6.Radioisotope Experiment				1,296
	7.Radiation Safety Management				15
	8.Safety Manager for Radiation Protection				1,027
	Sub Total			97	8,971
4.Non-Destructive Testing	1.General Techniques on NDT				993
	2.Specialized Course on Radiographic Testing Technology	1 Wks	1	13	121
	3.Specialized Course on Ultrasonic Testing Technology	1 Wks	1	9	82
	4.In Service Inspection for NPPS				592
	5.S/G ECT Testing Technology				24
	6.NDI Inspector of KEPIC				147
	7.NDE Technique of Construction Structure	4days	1	8	8
	Sub Total			30	1,967

5.Re-training for Nuclear-related License Holders and Qualified Engineers	1.Research Reactor	5days	1	14	76
	2.Power Reactor	5days			943
	3.Licensese for Radioisotope Treatment	1days	4	200	1,456
	4.License for RI Handing in Medical use	1days	2	18	330
	5.License for Radiation Handing Supervisor	1days	1	48	512
	6.Safety Manger for Radiation				4,144
	7.Supervisor for Nuclear Materials Treatment				18
	8.Nuclear Materials Treatment				1
	9.For Nuclear Material Treatment Safety Manager				9
	10.NDT Engineer (Level Ⅰ, Ⅱ)				652
	11.NDT Technician (Level Ⅰ)				902
	12.Nuclear Engineer (Level Ⅰ)				446
	Sub Total			280	9,489
6.Training Courses for HANARO Research Reactor Utilization	1.Neutron Beam	2days	1	37	120
	2.Nuclear fuel and Material Irradiation	1days	1	24	49
	3.Neutron Activation Analysis	1days	1	30	43
	4.Radioisotope Production	1days	1	7	34
	Sub Total			98	246
7.Education Programs for University Students	1.Research Reactor Experiment	1 Wks	9	206	2,568
	2.Laboratory Experiment	4 Wks	2	12	418
	Sub Total			218	2,986

8.PA and others	1.Radiation Measurement for School Teachers				80
	2.Radiation Measurement for WIIN				323
	3.Seminar on Venture Business				30
	4.NDT Course for Unemployed Persons				26
	5.Course for KAERI Family	2 Wks	4	106	553
	6.PC Course for Residents	2 Wks	2	228	327
	7.Workshop on SAT				17
	8.PC Course for 2002 Worldcup				80
	Sub Total			334	1,436
	Total				31,220

(2) Korea Association of RI

	Course	Duration	Time in Fy 2001 (/2001)	Max. Trainee 2000	Total Trainee from Fy 1987 to FY2000
1.Training Courses for RI Utilization and Radiation Workers	1.RI Distance Learing	9 months	1	163	3,007
	2.Radiation Worker	New : 20 hours/year	4	2,091	15,159
		Exist : 6 hours/year	19	1,057	
	3.Retraining Course for Radiation Licensee	6 hour/three years	5	102	102
	4.Short-term Course on RI License Preparation	General : 3 days	1	65	1,418
		Supervisory : 5 days	1	29	441
	5.Training for RI Handling Licensee				1,124
	Total			3,057	21,252

	12.ASME Codes Coures				183
	13.Instrumentation &Control Technology Codes Course				25
	14.Electrial Technology & Codes Course				14
	15.Concrete Technology & Codes Course				35
	16.Welding Technology Course				143
	17.Nuclear Safeguards Course				144
	18.Introductory Course on Equipment Companies for Small and Medium Enterprise				23
	19.Environmental Radioactivity Measurement Course				339
	20.Wolsung HPWR Course				30
	21.Safety Evaluation technique of PSA				40
	22.Safety and the Human Error				26
	23.Radioactive Waste Technology				16
	24.Inspection of Nuclear Facilities	5days	1	10	58
	25.Measurement Technique of Environmental Radioactivity				13
	26.Measurement Technology of Gamma-Ray Spectroscopic Analysis	7days	1	6	28
	27.Technology of KSNP				32
	28.Reliability Improvement of Disel-Generator				32
	29.Decontamination & Decommissioning of Nuclear Facilities				19
	30.Nuclear Control & Nuclear Safeguards	5days	1	20	20

Reference 2 **Nuclear Industry (2000)**

Classification	2000
Population	46,136 Thousand
GDP	442,338 Million dollars
Capacity of Nuclear Reactor Facilities (MW)	13,720 (16 Unit)
Share of Installed Nuclear Power Capacity	28.0%
Share of Nuclear Power Generation Capacity	40.9%
Gross Sales of Nuclear Industry (GDP Share)	7,077 Million dollars (1.6%)
Sales of Nuclear Supply Industry (GDP Share)	1,769 Million dollars (0.4%)
Volume of Radioisotopes Utilization	140 Million dollars
Export Amount of Nuclear Industy	203 Million dollars
Investment of Nuclear R&D	153 Million dollars
Nuclear Manpower (Persons)	20,700

Reference 3 Operation Status of Nuclear Power Plant

Classification	ST	Power Plant Name		Rx Type	Capacity (MW)	Construction Starting	Operation Start	Remark
Operation (16)	1	Kori	1 Unit	PWR	587	'72. 5	'78. 4	Total 13,716 MW
	2		2 Unit	〃	650	'78. 11	'83. 7	
	3		3 Unit	〃	950	'79. 12	'85. 9	
	4		4 Unit	〃	950	'79. 12	'86. 4	
	5	Wolsung	1 Unit	PHWR	679	'78. 2	'83. 4	
	6	Young-gwang	1 Unit	WR	950	'81. 12	'86. 8	
	7		2 Unit	〃	950	'81. 12	'87. 6	
	8	Uljin	1 Unit	〃	950	'83. 1	'88. 9	
	9		2 Unit	〃	950	'83. 1	'89. 9	
	10	Young-gwang	3 Unit	〃	1,000	'89. 12	'95. 3	
	11		4 Unit	〃	1,000	'89. 12	'96. 1	
	12	Wolsung	2 Unit	PHWR	700	'92. 8	'97. 7	
	13	Uljin	3 Unit	PWR	1,000	'93. 7	'98. 8	
	14	Wolsung	3 Unit	PHWR	700	'94. 2	'98. 7	
	15	Uljin	4 Unit	PWR	1,000	'93. 7	'99. 12	
	16	Wolsung	4 Unit	PWR	700	'94. 2	'99. 10	
Construction (4)	17	Young-gwang	5 Unit	PWR	1,000	'97. 6	2002. 4	Total 4,000 MW
	18		6 Unit	〃	1,000	'97. 6	2002. 12	
	19	Uljin	5 Unit	〃	1,000	'99. 5	2004. 6	
	20		6 Unit	〃	1,000	'99. 4	2005. 6	
Planning (8)	21	New Kori	1 Unit	PWR 〃	1,000		2008. 9	Total 9,600 MW
	22		2 Unit	〃	1,000		2009. 9	
	23		3 Unit	〃	1,000		2009. 9	
	24		4 Unit		1,000		2010. 9	
	25	APR-1400	1 Unit	APWR	1,400		2010. 9	
	26		2 Unit		1,400		2011. 9	
	27		3 Unit		1,400		2013. 6	
	28		4 Unit		1,400		2014. 6	

Reference 4 General Status of Nuclear Power Plant

Power Plant Name		Location	Capacity (MWe)	Rx Type	Reactor Supply Company	Turbine Generator Supply	A/E
Kori Site	1Unit	Kori	587	PWR	W	GEC	GAI
	2Unit		650	PWR	W	GEC	GAI
	3Unit		950	PWR	W	GEC	Bechtel
	4Unit		950	PWR	W	GEC	Bechtel
Wolsung Site	1Unit	Wolsung	679	PHWR	AECL	Parsons	Canatom
	2Unit		700	PHWR	AECL	Dasoon/GE	AECL
	3Unit		700	PHWR	AECL	〃	AECL
	4Unit		700	PHWR	AECL	〃	AECL
Young-gwang Site	1Unit	Yeong-gwang	950	PWR	W	W	Bechtel
	2Unit		950	PWR	W		Bechtel
	3Unit		1,000	PWR	DSH/G.E	Dajuy.E	KOPEC/S&L
	4Unit		1,000	PWR	〃	〃	〃
	5&6Unit		1,000	PWR	DSH	〃	〃
Uljin Site	1Unit	Uljin	950	PWR	FRA	Alsthom	FRA/Alsthom
	2Unit		950	PWR	FRA	Alsthom	〃
	3Unit		1,000	PWR	DSH	DSH	KOPEC/S&L
	4Unit		1,000	PWR	DSH	DSH	〃
	5&6Unit		1,000	PWR	DSH	DSH	〃

PWR: Pressurized Water Reactor

PHWR: Pressurized Heavey Water Reactor

C.E: Cambustion Engineering Co.

G.E: General Electric

S&L: Sargent & Lundy Engineering

W: Westinghouse

GEC: General Electric Co.

AECL: Atomic Energy of Canada Ltd.

FRA: Framatom

DSH: Doo San Heavy Industry

The 4th Workshop on Human Resources Development in the Nuclear Field
under the FNCA, 8-10 October 2002, Batangas in the Philippines

Nuclear Human Resources Development, Planned Development of Nuclear Education and Training in Korea

8 October 2002

Eui-Jin Lee, Young-Taek Kim
Nuclear Training Center
Korea Atomic Energy Research Institute

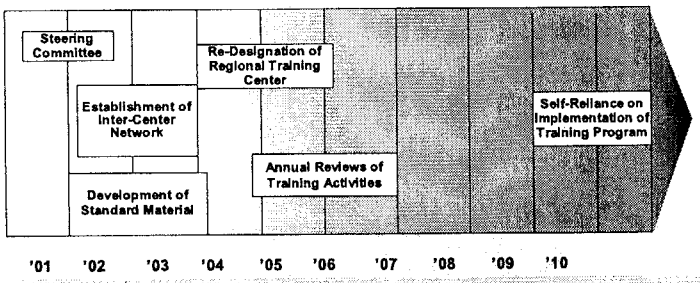
Contents

1. **Development of Training Materials in Radiation Protection Areas**
2. **Development of E-Learning Systems**
3. **Investigation of Basic Data on Human Resources and Human Resources Development in Nuclear Field**
4. **Current Topics Related Human Resources Development in Korea**
5. **Status of the International Nuclear University Proposed to the IAEA**

1. Development of Training Materials in Radiation Protection Areas

❑ IAEA Implementation Strategies for Education and Training in Radiation Protection and Waste Safety for Next 10 Years

- Development of modular training materials for postgraduate course on radiation protection
- Development of standardized training materials for practice-specific training
- Development of training materials for distance learning in radiation protection
- Establishment of Inter-Center Network
- Designation of regional training centers for post-graduate course on radiation protection



2 Korea Atomic Energy Research Institute

1. Development of Training Materials in Radiation Protection Areas

❑ IAEA Training Materials on Radiation Protection Areas

- Basic Professional Training on Radiation Protection (Postgraduate, 18 Wks, Standard Syllabus)
- Specialized Training Courses (Training Materials in CD)
  - Personnel Monitoring
  - Occupational Radiation Protection
  - regulatory Infrastructure
  - Patient Protection
  - Source Safety and Security
  - Transport Safety
  - Emergency Preparedness and Response
  - Radioactive Waste
- Radiation Protection Distance Learning, Modules & Workbooks, Draft, Dec. 1999
- Films and Video Tapes in Radiation Protection Areas (IAEA Homepage)
- Technical Documents
  - Training in Radiation Protection and the Safe Use of Radiation Protection, Safety Series-20 Oct. 2001
  - Evaluation Report of IAEA Education and Training Activities for Radiation Protection, Dec. '01
  - Postgraduate Education Course in Radiation Protection and Safe Use of Radiation Sources, Volume 1: Standard Syllabus, Nov. 2000

3 Korea Atomic Energy Research Institute

1. Development of Training Materials in Radiation Protection Areas

❑ Development of education model and its evaluation methods for radiation safety according to revision of Korean Atomic Energy Laws (2001):

- Improved training courses curricula for radiation workers
- Upgraded evaluation skill for training organizations and its training courses
- Developed training materials in 2002.



❑ NuTEC/JAERI training materials on radiation protection, which were provided for Vietnam, Thailand, Indonesia, would also be very useful for other FNCA Member Countries.

4 *Korea Atomic Energy Research Institute*

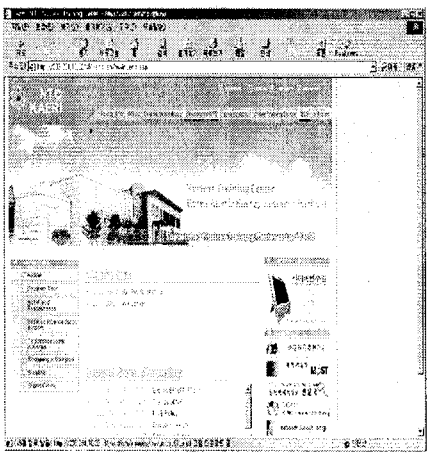
2. Development of E-Learning Systems

❑ Development of E-Learning Systems at NTC/KAERI Since 2000

• The First Step (2000)
- Establishment of Web-Based Homepage and E-Learning Systems

• The Second Step (2001)
- Development of multi-media training materials
- Implementation of e-learning training courses on radiation safety and radiation emergency preparedness with a real time base

• The Third Step (2002)
- Improvement of Web-Based Homepage not only for integration of administration works of on-line and off-line training but also for construction of dada base in training materials



Improved Homepage and E-Learning System, Domain name : www.kntc.re.kr

5 *Korea Atomic Energy Research Institute*

2. Development of E-Learning Systems

❑ Development of Multi-media Training Materials for E-Learning at NTC/KAERI

- Developed 18 kind of multi-media training materials in Korean
- Developed 7 kind of training materials in English
  - Nuclear power project: policy and Korean experience
  - Nuclear power reactor technology
  - Nuclear power planning and project
  - Decontamination and decommissioning of research reactors and other small facilities
  - Dada base for equipment qualification
  - Use of the methodologies and tools in greenhouse gas abatement studies
  - Gas flow radiation model

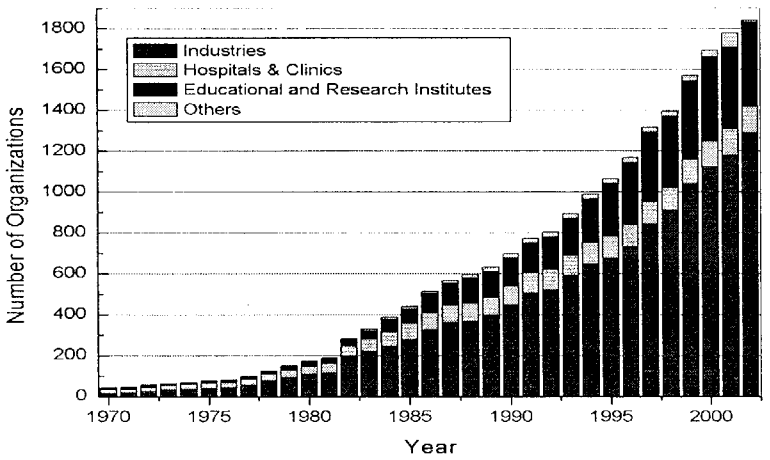
❑ Lessons learned from the project : the most important issues is how to operate and manage the e-learning system effectively, its requires a lot of time and effort to develop training materials and needs qualified manpower for its operation and management.

❑ Linkage NuTEC/JAERI homepage with member countries' nuclear training center homepages would be a valuable framework for exchange of information and training materials among member countries.

6 *Korea Atomic Energy Research Institute*

3. Investigation of Basic Data on Human Resources Development

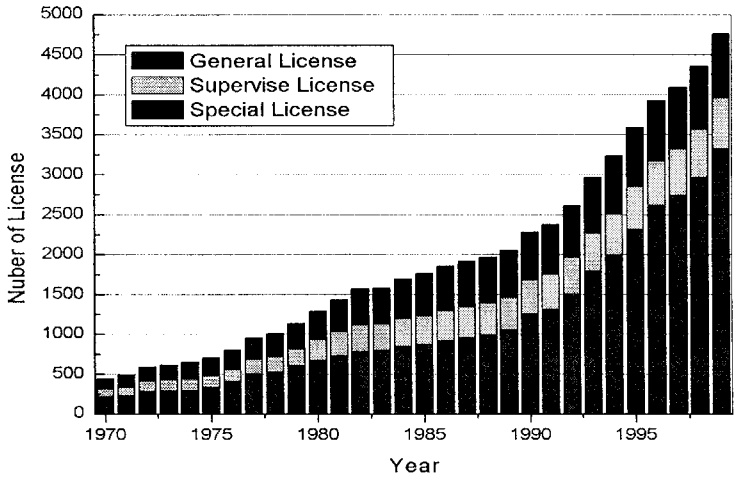
❑ Annual Change in Number of Organizations for RI Utilization



7 *Korea Atomic Energy Research Institute*

3. Investigation of Basic Data on Human Resources Development

❑ Annual Change in Number of License Issued for Radiation Workers



3. Investigation of Basic Data on Human Resources Development

❑ General comments from basic data on HRD

- Gradual increase in utilization of radiation & radioisotopes
- Industries have difficulties in maintaining qualified experts in the field of radiation & radioisotopes
- No merits or interests for students in the field of radiation & radioisotope utilization
- Need to promote manpower development in the field of radiation & radioisotopes utilization

❑ KAERI has started to construct the Advanced Institute of radiation Science and Technology as the second institute at site in 2002

4. Current Topics Related Human Resources Development

❑ National Promotion Plan for Nuclear Human Resources Development

■ Support for Nuclear Education Program at Universities
- Enlargement of fellowship program for students
- Providing intern job opportunities at research institutes and industries
- Support for updating curricula, linkage with the advanced technology

■ Maintaining Qualified Nuclear Personnel at Industries
- Providing fringe benefits for radiation workers
- Enhancement of training organizations and its training programs
- Activation of exchange programs among industries, research institutes and universities

■ Encouraging Global Competitiveness of Nuclear Manpower
- Providing international career for young researchers and students
- Fostering joint research projects with international organizations & advanced countries
- Utilization of outstanding experts from overseas

10 Korea Atomic Energy Research Institute

4. Current Topics Related Human Resources Development

❑ New promotion projects for HRD at universities and industries in 2002

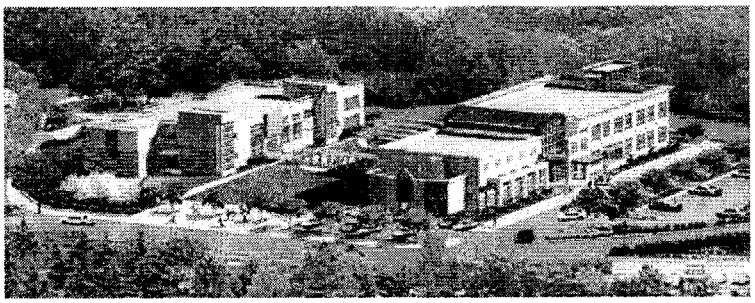
- Dispatch of university student majoring in nuclear engineering and radiation science at master or Ph. D. courses to educational institute in advanced countries for 1-2 years.
- Dispatch of university students majoring in nuclear engineering department to university in advanced countries for 6months-1 year.
- Dispatch of young professionals to research institutes in advanced countries for 1 year for upgrading their research career.
- Fellowship supports for university students majoring nuclear engineering to study their thesis focused on upgrading their research capabilities.

11 Korea Atomic Energy Research Institute

4. Current Topics Related Human Resources Development

❑ International Nuclear Training & Education Center (INTEC), under NTC/KAERI

- Inauguration in March 2002
- International training building (1,980 m²) : Auditorium, round-table seminar rooms, lecture rooms, cyber training system, others
- Guest house (1,300 m²) : 24 twin bed rooms (maximum 48 persons)



12 *Korea Atomic Energy Research Institute*

4. Current Topics Related Human Resources Development

❑ International Training Courses at NTC/KAERI in 2002

	Title of Course	Date	Target Country	Trainees
1.	IAEA/RCA Regional Training Course on "Non-Destructive(NDT) In-Service Inspection in Petroleum Industries"	Jan. 21- Jan. 25	Asia and Pacific	15
2.	IAEA/RCA Regional Workshop for Dissemination of Information on Use of Isotopes in Dam Safety and Sustainability	Apr. 15 – Apr. 19	"	15
3.	IAEA Workshop on Accident Management and Emergency Response for Research Reactor	Apr. 29 - May 3	"	15
4.	IAEA/RCA Workshop on Core Management for Improved Utilization of Research Reactors	May 13- May 24	"	15
5.	IAEA/RCA Regional Workshop on Process Optimization Using Tracers in Petrochemical Industries	July 2 – July 11	"	15
6.	IAEA Workshop on Upgrading of Training Facilities/Capabilities	Sep. 2 – Sep. 6	"	15
7.	IAEA Technical Workshop on Therapeutic Pharmaceuticals and Sources	Sep. 9 – Sep. 14	"	15
8.	Workshop on IAEA Safeguards	Oct. 2 – Oct. 9	"	15
9.	IAEA Regional Training Course on Advanced Instrument and Control Systems for Nuclear Power Plant	Nov. 4 – Nov. 15	"	15
10.	KOICA/IAEA Training Course on Nuclear Power Planning and Project Management	Nov. 14 – Dec. 4	"	15

13 *Korea Atomic Energy Research Institute*

4. Current Topics Related Human Resources Development

❑ IAEA RCA Regional Office and Its HRD Projects for Member States

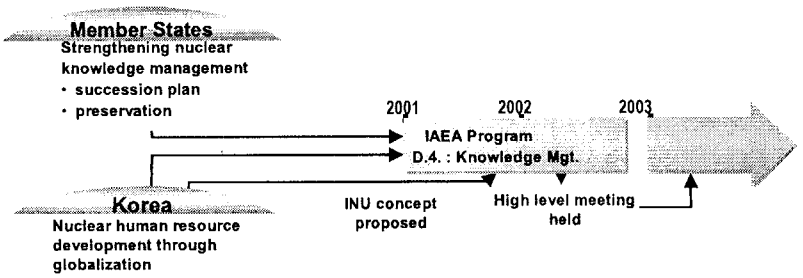
- Opened at KAERI site in March 2002
- Has developed two kinds of HRD projects for Member States
  - Post-Doctoral Fellowship program for 6 months-1 year from October 2002 at KAERI, KINS, KCCH, etc., 19 personnel from Member States
  - RCA Master's Degree Course on Nuclear Energy Policy and Nuclear Quantum Engineering at KAIST for 1 year under the support of KAERI, KINS, MOST, as well as IAEA for Member Countries
    - The course is planning to start in the spring semester 2003
- These projects could be regarded as a demonstration in the concept of the INU proposed to the Agency in 2001

14 *Korea Atomic Energy Research Institute*

5. Status of the International Nuclear university Proposed to the IAEA

❑ IAEA Program on Preservation of Knowledge in Nuclear Science & Technology for MS

- D.4.1 Assessing policy and requirements for nuclear science R&D and training
- D.4.2 Facilitating education, training and research through the establishment of international school of nuclear science and technology
- D.4.3 Preservation of knowledge in nuclear science and technology

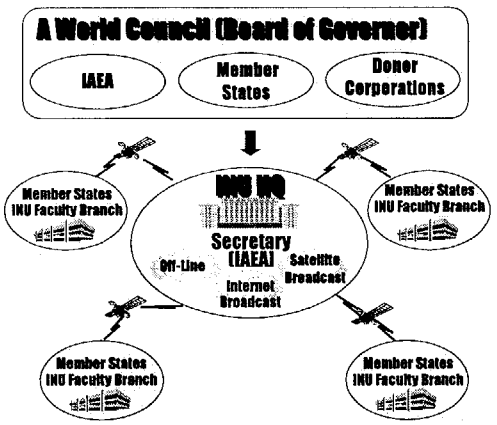


15 *Korea Atomic Energy Research Institute*

5. Status of the International Nuclear university Proposed to the IAEA

❑ Concept of International Nuclear University Proposed and Presented

- IAEA acts as a "Secretariat"
- 5 or 6 Regional INU Branches
- 2 Year Master's Degree Program
  - Introductory courses at home
  - Classes at a regional INU branch
  - Field education for thesis
- Branch National Degree with IAEA Certification
- Worldwide Nuclear Human Resources Pool



16 Korea Atomic Energy Research Institute

5. Status of the International Nuclear University Proposed to the IAEA

❑ IAEA Meeting of Senior Officials on Managing Nuclear Knowledge in June 2002

- Recommendations ranked for 6 priority activities and 12 additional activities related to the INU

  ② Promote networking of institutions for nuclear education and training in Member States in coordination with existing activities

  ⑥ Facilitate the development of curricula for internationally accepted high university degrees on nuclear technology, e.g., by networking universities

  ⑦ Provide support for the establishment of an International Nuclear University.

17 Korea Atomic Energy Research Institute

5. Status of the International Nuclear University Proposed to the IAEA

❑ Step by step approach to the establishment of the INU suggested by the IAEA

- First, priority on the networking of existing facilities
- Second, focus on the establishment of a mutually recognized education and training system for a higher degree in nuclear technology
- Third, regional basis in advance, for example ENEN

❑ Suggested project title by the Agency :
"An Asian Network of Higher Education and Training for Nuclear Technology"

❑ Once such regional network is operated, it could serve as a good basis for moving to the establishment of an INU

18 *Korea Atomic Energy Research Institute*

Thank You !

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19 *Korea Atomic Energy Research Institute*

1.5.4 Malaysia

Rapieh Aminuddin
Malaysian Institute for Nuclear Technology Research (MINT)

1. Introduction

This report will present and discuss mostly the survey of basic data on human resource development (HRD) in the nuclear field. A brief mention will be made about the sub-project on training materials in radiation protection, sub-project on e-learning and scientist exchange programme.

2. Survey on basic data on HRD

A−1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

There are only 2 organizations in Malaysia dealing mainly with nuclear matters. The Malaysian Institute for Nuclear Technology Research is involved mainly with research and development and the Atomic Energy Licensing Board deals with the regulatory and licensing aspects.

A−1−1 Total number of administrative and technical officials in each agency and institutes

Agency / Institutes	Role	Total	Notes
Malaysia Institute for Nuc. Technology Research [MINT]	R&D, technical services and administrative services and national agency for planning & advisory on nuclear matters	535	
Atomic Energy Licensing Board [AELB]	Regulatory and Licensing	50	
Total		585	

A−1−2 The Number of Personnel Classified by Field in each Agency and Institutes (Breakdown table of A-1-1)

Agency / Institutes	Nuclear Administration				R&D		Total	Notes
	Promoting		Regulatory					
	R&D / Radiation Application	Nuclear power generation	R&D / Radiation Application	Nuclear power generation	Radiation Application	Nuclear power generation		
MINT	337	-	-	-	198	-	535	1
AELB	15-	-	35	-	-	-	50	
Total	352	-	35	-	198	-	585	

A−2. Survey of University Education Institutions

University course covered here are those pertaining mainly to nuclear. Other courses such as chemistry and physics teach some nuclear content but they are not covered here.

A−2−1 University Course

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
National University of Malaysia - Nuclear Science Dept.	National	46	12	1978	3	12	1981	1	12	1981	1,2
National University of Malaysia – Diagnostic Imaging and Radiotherapy	National	27	5	2000	-	-	-	-	-	-	
University of Malaya – Medical Physics	National	-	-	-	5	10	1998	2	10	1998	
Science University of Malaysia – Medical Radiation	National	26	10	2001	~10	10	1994	3	10	1994	
Science University of Malaysia – Medical Physic	National	25	10	2002	-	-	-	-	-	-	
UTM – Health Physic	National	40	6	1998	-	-	-	-	-	-	
Total		164	43		18	32		6	32		

A−2−2−1 Medical Radiation Technical Engineers Training School

Number of School	Annual Trainee	Breakdown of School		Notes
2	175	College of Radiography and Radiotherapy	125	1
		College of Radiography Sultanah Aminah Hospital	50	

The above colleges are under the Ministry of Health Malaysia. The courses lead to diploma and most of the students are employed by the ministry after graduation.

A−3. Survey of Radiation and Radioisotopes Application

A−3−1 Agricultural Application

A−3−1−1 Plant Mutation Breeding

Number of the institutions implemented	Number of the scientists engaged	Notes
4	18	

A−3−1−2 Sterile Insect Technique

Number of the institutions implemented	Number of the scientists engaged	Notes
1	1	

A−3−1−3 Food Irradiation

Number of the institutions implemented	Number of the scientists engaged	Notes
17	15	1

A−3−2 Medical Application − Radiation diagnosis

Number of the institutions implemented	Number of the radiation oncologists	Number of the therapeutic technicians	Notes
11 nuclear medicine 20 radiotherapy	32	60	

A−4. Survey of Nuclear Training Courses

Field	Course	Objectives	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Radiation Safety and Health	1. Radiation Safety and Health **2. Radiation Safety Awareness** 3. Workshop on Good Radiation Safety Practice **4. Radiation Protection for Worker** **5. Radiation Protection for Officer** **6. Chemical Safety and Health**	• **To understand the philosophy and principles of radiation protection;** • To understand the radiation safety aspects and practices at work place in accordance with safety standard and procedures; • **Giving exposure on the safe working procedures with ionizing radiation;** • **Learning the right and proper procedures in controlling the radiation exposure to the radiation workers;** • **Creating Awareness on biological effects and the risks of ionizing radiation.**	MINT	Maximum 45 per session	**3 days** **1 day** **1 day** **5 days** **7 days** **3 days**	**896(2001) 404 (up to 30 Jun 2002)**

Medical X-ray	1. Training Course for Medical X-ray Operator 2. Awareness Course On Radiological Safety for General Practitioner **3. Training Course on X-ray for General Practitioner** **4. Good Operational Practice** 6. Quality Assurance in Medical Radiography **7. Interpretation of Radiographic Image**	• To provide understanding of the philosophy and principles of radiation protection for medical application; • Creating awareness on the radiation hazard, biological effects and risks of ionizing; • To familiarize with the component, function, operation and control of x-ray and other associated equipment; • **To familiarize with the radiographic techniques and interpretation of radiograph for simple radiography;** • **To generate the importance of right working procedure being practiced when dealing with x-ray equipment.**	MINT		**8 days**	**129(2001) 89(up to 30 Jun 2002)**

Non-Destructive Evaluation	**1. Basic Course on NDT**	• To meet the syllabus requirement of MLVK (National Vocational Training Council) where applicable; • **To provide the participants with the necessary knowledge in both theory and practices of related technologies.**	**MINT**		**3 days**	**201(2001) 229 (up to 30 Jun 2002)**
	2. Basic Metallurgy in NDT				**5 days**	
	3. Concrete Inspection Using NDT Technique				**5 days**	
	4.Eddy Current Basic Grade				**6 days**	
	5. Eddy Current Intermediate Grade				**12 days**	
	6. Keselamatan Radiografi Untuk Pembantu Pengendali				**2 days**	
	7. Industrial Radiography Basic Grade				**12 days**	
	8. Industrial Radiography Intermediate Grade				**12 days**	
	9. Interpretation and Evaluation of Radiograph				**5 days**	
	10. Advanced Industrial Radiography				**12 days**	
	11. Surface Method Basic Grade				**11 days**	
	12. Surface Method Intermediate Grade				**11 days**	

A−5. Survey of Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Annual Licensee	Cumulative Licensee	Authorize Institution	Notes
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	Gaugas	+63	326	AELB	1
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	Sales	46	91	AELB	
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	NDT	7	14	AELB	
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	TENORM	9	18	AELB	

A−6. Survey of Background Data for Analysis

A−6−1 The number of users of radiation application

Total number of users	Breakdown					Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	
10,000	500	4400	100	5000	-	1

A−6−2 Data of Radiation Diagnosis

A−6−2−1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt machines total
7	19	26

A−6−2−2 Total Number of Brachytherapy Machine

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
15	2	1	6	9

A−6−2−3 Annual new cancer patients in both sexes

21670

3. Sub-project Training Materials in Radiation Protection

MINT has published a textbook, Radiation Protection which is used in most of the course in radiation protection conducted in MINT

4. Sub-project e-learning

MINT is in the process of setting up e learning facilities. It is taking longer than planned. Initially the system will be used in the learning of soft skills using ready made courseware. Certain learning policies will be put in place to ensure learning takes place. This will also inculcate e-learning culture. Later on MINT will develop its own courseware.

For the e-learning project to take of the ground, adequate facilities and competency in both subject matter and content and instructional design are necessary. Demand for e-learning must also be there. Some promotion work has been done. One of the first project is to work in collaboration with universities to develop common lectures to enhance teaching of nuclear science and technology the Malaysian government has made a decision that mathematics and science will be taught in English soon. This is seen as an opportunity to offer nuclear science e-leaning content as teaching materials in English has to be established from scratch.

As for e-learning as a sub-project under the FNCA HRD project , the subject matter must meet learning needs and motivate the specified target group, for the output of the project to be well utilized and worthwhile. Some of the factors that may motivate learners are:

- The learning leads to diploma or degree or some qualification recognised by government and good for career advancement. Certain HRD policies must be in place to support this.
- The learning can bridge competency gap
- The learning is perceived to lead to improvement of work performance

5. Scientist Exchange Programme

Malaysia is very much interested in the programme particularly on the following topics:-

- A. Operation, Design and Utilisation of Research and Test Reactor
- B. Production and Utilisation of Radioisotope
- E. Reactor Chemistry
- G. Physics
- H. Radiation Chemistry and Processing
- I. Radiation Control and Safety
- J. Treatment and Disposal of Radioactive Waste
- M. Medical and Biological Application of Radiation and Radioisotopes

6. Conclusion

The survey provides a good start for HRD project leaders to maintain a data base of information related to Human Resource Development in the field of Nuclear Science and Technology.
Data can be enriched by keeping a registry of persons or institutions counted.
For each category of application a more detailed study can be carried out regarding the different roles that exist and competencies required for each role. Competency gaps and training needs identified and training plan or design developed. In the process of doing the survey it is realized that there have been wastage in training in the sense that people that have been trained are doing other jobs or other projects. So the number of scientists in specific application is less that the number that have been trained. May be the extent of the wastage needs to be determined and measures taken to reduce it. However, the survey needs to provide guidance to the formulation of HRD strategy. We still need to answer the question − what is the common training or HRD need of member countries so that programs can be designed, developed and implemented.

Answer Sheet for 'The Plan for Survey of the Basic Data on Human Resources Development in the Nuclear Field in FNCA Member Countries'

Malaysia

A－1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

A－1－1 Total number of administrative and technical officials in each agency and institutes

Agency / Institutes	Role	Total	Notes
Malaysia Institute for Nuc. Technology Research [MINT]	R&D, technical services and administrative services and national agency for planning & advisory on nuclear matters	535	
Atomic Energy Licensing Board [AELB]	Regulatory and Licensing	50	
Total		585	

Remarks

① Target agency and institutes
- National agency and institutes

② The number of staff members:
- Count only regular employees.
- Indirect category (driver, guard, and staff in dinning hall and clinic, etc.) should not be included. Explanatory note should be needed if your data has been included these staff members.

Your notes

A－1－2　The Number of Personnel Classified by Field in each Agency and Institutes (Breakdown table of A－1－1)

Agency / Institutes	Nuclear Administration				R&D		Total	Notes
	Promoting		Regulatory					
	R&D / Radiation Application	Nuclear power generation	R&D / Radiation Application	Nuclear power generation	Radiation Application	Nuclear power generation		
MINT	337	-	-	-	198	-	535	1
AELB	15-	-	35	-	-	-	50	
Total	352	-	35	-	198	-	585	

Remarks

① This table is a breakdown of A-1-1 and is to be filled in as much as you know.

② Write in the middle if the classification is not clear.

③ Attach the detailed data of each institution if available.　The detailed table is acceptable as the substitution of this table.

Your notes

1. Personnel doing planning, external relations, HRD. Public retation and the normal administration are included under promoting.

A−2. Survey of University Education Institutions

A−2−1 University Course

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
National University of Malaysia - Nuclear Science Dept.	National	46	12	1978	3	12	1981	1	12	1981	1,2
National University of Malaysia – Diagnostic Imaging and Radiotherapy	National	27	5	2000	-	-	-	-	-	-	
University of Malaya – Medical Physics	National	-	-	-	5	10	1998	2	10	1998	
Science University of Malaysia – Medical Radiation	National	26	10	2001	~10	10	1994	3	10	1994	
Science University of Malaysia – Medical Physic	National	25	10	2002	-	-	-	-	-	-	
UTM – Health Physic	National	40	6	1998	-	-	-	-	-	-	
Total		164	43		18	32		6	32		

Remarks

① Target: University to educate nuclear energy (School of Engineering and Sciences).

② Fill in the applicable space for University, Graduate School (Master), and Graduate School (Doctor), respectively.

③ The number of student: Registered student or quota (Registered student is preferable for Graduate School.). (Specify which number of personnel is shown in the table in Notes)

④ The number of staff: Staff for education (Sample in Japan: Total of Professor, Assistant professor, Lecturer and Assistant). Write total number and classify if staff holds the both posts of school and graduate school.

Your notes

1. The same staff member are involved in teaching undergraduate, MSc and PhD students at times.
2. The number shown is annual average. The actual number fluctuate from year to year

A−2−2 Specialized School for Development of Technical Engineer

A−2−2−1 Medical Radiation Technical Engineers Training School

Number of School	Annual Trainee	Breakdown of School		Notes
2	175	College of Radiography and Radiotherapy	125	1
		College of Radiography Sultanah Aminah Hospital	50	

A−2−2−2 Other Field (if there is any)

Field	Number of School	Annual Trainee	Breakdown of School	Total	Notes

Remarks

① Target: Specialized School for Development of Technical Engineers

② Japan only has the Medical Radiation Technical Development School. However, write more in A-2-2-2 if there is something else in your country.

Your notes

1. This is a 3 years course leading to a Diploma. All qualified students are employed by government hospitals as medical radiographers

A−3. Survey of Radiation and Radioisotopes Application

A−3−1 Agricultural Application

A−3−1−1 Plant Mutation Breeding

Number of the institutions implemented	Number of the scientists engaged	Notes
4	18	

A−3−1−2 Sterile Insect Technique

Number of the institutions implemented	Number of the scientists engaged	Notes
1	1	

A−3−1−3 Food Irradiation

Number of the institutions implemented	Number of the scientists engaged	Notes
17	15	1

A−3−2 Medical Application − Radiation diagnosis

Number of the institutions implemented	Number of the radiation oncologists	Number of the therapeutic technicians	Notes
11 nuclear medicine 20 radiotherapy	32	60	

A−3−3 Other field (if any)

Field	Number of implemented institution	Number of engaged scientist	Notes

Remarks

① Target: Quantitative data is needed. Write in A-3-3 if data is not available.

② Plant Mutation Breeding: Refer to attachment 8, database of FNCA Radiation Breeding Project, and correct it if needed.

③ Medical Application − Refer to attachment 7.

Your notes

1. The institutions counted are members of the National Committee on Food Irradiation. Not all are involved in food irradiation research. Some are involved in regulation, public education, marketing while

A−4. Survey of Nuclear Training Courses

Field	Course	Objectives	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Radiation Safety and Health	1. Radiation Safety and Health 2. Radiation Safety Awareness 3. Workshop on Good Radiation Safety Practice 4. Radiation Protection for Worker 5. Radiation Protection for Officer 6. Chemical Safety and Health	• To understand the philosophy and principles of radiation protection; • To understand the radiation safety aspects and practices at work place in accordance with safety standard and procedures; • Giving exposure on the safe working procedures with ionizing radiation; • Learning the right and proper procedures in controlling the radiation exposure to the radiation workers; • Creating Awareness on biological effects and the risks of ionizing radiation.	MINT	Maximum 45 per session	3 days 1 day 1 day 5 days 7 days 3 days	896(2001) 404(up to 30 Jun., 2002)

Field	Course	Objectives	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Medical X-ray	1. Training Course for Medical X-ray Operator 2. Awareness Course on Radiological Safety for General Practitioner 3. Training Course on X-ray for General Practitioner 4. Good Operational Practice 5. Quality Assurance in Medical Radiography 6. Interpretation of Radiographic Image	• To provide understanding of the philosophy and principles of radiation protection for medical application; • Creating awareness on the radiation hazard, biological effects and risks of ionizing; • To familiarize with the component, function, operation and control of x-ray and other associated equipment; • To familiarize with the radiographic techniques and interpretation of radiograph for simple radiography; • To generate the importance of right working procedure being practiced when dealing with x-ray equipment.	MINT		8 days	129(2001) 89(up to 30 Jun., 2002)

Field	Course	Objectives	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Non-Destructive Evaluation	1. Basic Course on NDT	• To meet the syllabus requirement of MLVK (National Vocational Training Council) where applicable; • To provide the participants with the necessary knowledge in both theory and practices of related technologies.	MINT		3 days	201(2001) 229(up to 30 Jun., 2002)
	2. Basic Metallurgy in NDT				5 days	
	3. Concrete Inspection Using NDT Technique				5 days	
	4. Eddy Current Basic Grade				6 days	
	5. Eddy Current Intermediate Grade				12 days	
	6. Keselamatan Radiografi Untuk Pembantu Pengendali				2 days	
	7. Industrial Radiography Basic Grade				12 days	
	8. Industrial Radiography Intermediate Grade				12 days	
	9. Interpretation and Evaluation of Radiograph				5 days	
	10. Advanced Industrial Radiography				12 days	
	11. Surface Method Basic Grade				11 days	
	12. Surface Method Intermediate Grade				11 days	

Remarks

① Target: Write the training course implemented by nation or private within the range of understanding.

② Field: a) Basic / general nuclear energy b) Radiation / Radioisotopes Application Technique

c) Nuclear power generation technique d) Safety (including Radiation Hazard Prevention)

e) Others (Including protection against nuclear materials and International cooperation)

③ Classify according to the table as mach as possible.

④ Cumulative Trainee is acceptable within the range of understanding.

Your notes

Cumulative data of number of trainees is unavailable.

A−5. Survey of Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Annual Licensee	Cumulative Licensee	Authorize Institution	Notes
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	Gaugas	+63	326	AELB	1
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	Sales	46	91	AELB	
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	NDT	7	14	AELB	
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	TENORM	9	18	AELB	

Remarks

① Target: The number of licensees of national certifying examinations in the nuclear field.
② Write other national certifying qualifications if data is available. Write the institutions to certify the qualifications in Notes.
③ Write cumulative licensee if data is available.

Your notes

1. National examination and certification of RPO started in 2000.

A−6. Survey of Background Data for Analysis

A−6−1 The number of users of radiation application

Total number of users	Breakdown					Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	
10,000	500	4400	100	5000	-	1

A−6−2 Data of Radiation Diagnosis

A−6−2−1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt machines total
7	19	26

A−6−2−2 Total Number of Brachytherapy Machine

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
15	2	1	6	9

A−6−2−3 Annual new cancer patients in both sexes

21670

A−6−3 Others (if any)

- The total number of registered crop varieties through mutation.
- Economic scale of nuclear application (Radiation application, Nuclear power generation)
- Scope of Nuclear power generation (The number of operating units, Generating capacity)

Remarks

① Target: These survey data could be useful for further analysis. Write in A-6-3 if you have any other suggestions.

② A-6-2: Refer to attachment 7.

③ Population and GDP will be made a list from national data collectively.

Your notes

The fiq. Is based on

A−7. Comments on the Survey

1. The survey provides a good start for HRD project leaders to maintain a data base of information related to Human Resource Development in the field of Nuclear Science and Technology.
2. Data can be enriched by keeping a registry of persons counted.
3. For each category of application a more detail study can be carried out regarding the different roles that exist and competencies required for each role. Competency gaps and training needs identified and training plan or design developed
4. It is realized that there have been wastage in training in the sense that people that have been trained are doing other jobs or other projects. May be the extent of the wastage needs to be determined and measures taken to reduce.

Remarks

① Target of the Survey: Write your opinions and comments;

a) Comprehensive opinion and comment b) Plan for future survey

c) Items for survey d) Others

COUNTRY REPORT FROM MALAYSIA

4TH HRD WORKSHOP

TRAINING MATERIALS IN RADIATION PROTECTION

- TEXT BOOK : RADIATION SAFETY

E LEARNING

- MINT is in the process of setting up e learning facilities
- One of the first project is to work in collaboration with universities to develop common lectures to enhance teaching of nuclear science and technology
- Malaysian government has made a decision that mathematics and science will be taught in English − an opportunity to offer nuclear science e-leaning content
- E-learning as a sub-project under the FNCA project must meet learning needs and motivate target group

MOTIVATION FOR E-LEARNING

- Leads to diploma or degree recognised by government and good for career advancement
- Bridge competency gap
- Improve work performance

TOTAL NUMBER OF ADMINISTRATIVE AND TECHNICAL OFFICIALS IN EACH AGENCY AND INSTITUTES

Agency / Institutes	Role	Total	Notes
Malaysia Institute for Nuc. Technology Research [MINT]	R&D, technical services and administrative services and national agency for planning & advisory on nuclear matters	535	
Atomic Energy Licensing Board [AELB]	Regulatory and Licensing	50	
Total		585	

THE NUMBER OF PERSONNEL CLASSIFIED BY FIELD IN EACH AGENCY AND INSTITUTES

Agency / Institutes	Nuclear Administration				R&D		Total	Notes
	Promoting		Regulatory					
	R&D / Radiation Application	Nuclear power generation	R&D / Radiation Application	Nuclear power generation	Radiation Application	Nuclear power generation		
MINT	337	-	-	-	198	-	535	1
AELB	15-	-	35	-	-	-	50	
Total	352	-	35	-	198	-	585	

1.Personnel doing planning, external relations, HRD. Public retation and the normal administration are included under promoting.

SURVEY OF UNIVERSITY EDUCATION INSTITUTIONS
UNIVERSITY COURSE

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
National University of Malaysia - Nuclear Science Dept.	National	46	12	1978	3	12	1981	1	12	1981	1,2
National University of Malaysia - Diagnostic Imaging and Radiotherapy	National	27	5	2000	-	-	-	-	-	-	
University of Malaya - Medical Physics	National	-	-	-	5	10	1998	2	10	1998	
Science University of Malaysia - Medical Radiation	National	26	10	2001	~10	10	1994	3	10	1994	
Science University of Malaysia - Medical Physic	National	25	10	2002	-	-	-	-	-	-	
UTM - Health Physic	National	40	6	1998	-	-	-	-	-	-	
Total		164	43		18	32		6	32		

1 The same staff member are involved in teaching undergraduate, MSc and PhD students at times.
2 The number shown is annual average. The actual number fluctuate from year to year

MEDICAL RADIATION TECHNICAL ENGINEERS TRAINING SCHOOL

Number of School	Annual Trainee	Breakdown of School		Notes
2	175	College of Radiography and Radiotherapy	125	1
		College of Radiography Sultanah Aminah Hospital	50	

1. This is a 3 years course leading to a Diploma. All qualified students are employed by government hospitals as medical radiographers

A PLANT MUTATION BREEDING

Number of the institutions implemented	Number of the scientists engaged	Notes
4	18	

A STERILE INSECT TECHNIQUE

Number of the institutions implemented	Number of the scientists engaged	Notes
1	1	

FOOD IRRADIATION

Number of the institutions implemented	Number of the scientists engaged	Notes
17	15	1

1 The institutions counted are members of the National Committee on Food Irradiation. Not all are involved in food irradiation research. Some are involved in regulation, public education, marketing while others are beneficiaries.

MEDICAL APPLICATION
− RADIATION DIAGNOSIS

Number of the institutions implemented	Number of the radiation oncologists	Number of the therapeutic technicians	Notes
11 nuclear medicine 20 radiotherapy	32	60	

Field	Course	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Radiation Safety and Health	1.Radiation Safety and Health *(6 sessions a year)*	MINT	Maximum 45 per session	3 days	896 [2001] 400 [up to 30 Jun 2002]
	2.Radiation Safety Awareness *(2 sessions a year)*			1 day	
	3.Workshop on Good Radiation Safety Practice *(2 sessions a year)*			1 day	
	4.Radiation Protection for Worker *(2 sessions a year)*				
	5.Radiation Protection for Officer *(8 sessions a year)*			5 days	
	6.Chemical Safety and Health *(8 sessions a year)*			7 days	
				3 days	

Objectives

- To understand the philosophy and principles of radiation protection;
- To understand the radiation safety aspects and practices at work place in accordance with safety standard and procedures;
- Giving exposure on the safe working procedures with ionizing radiation;
- Learning the right and proper procedures in controlling the radiation exposure to the radiation workers;
- Creating Awareness on biological effects and the risks of ionizing radiation.

Medical X-ray	1.Training Course for Medical X-ray Operator *(7 sessions a year)*	MINT	Maximum 25 per session	8 days	129(2001) 89(up to 30 Jun 2002)
	2.Awareness Course On Radiological Safety for General Practitioner *(9 sessions a year)*			1 day	
	3.Training Course on X-ray for General Practitioner *(4 sessions a year)*			6 days	
	4. Good Operational Practice *(7 sessions a year)*			1 day	
	6. Quality Assurance in Medical Radiography *(1 session a year)*			3 days	
	7. Interpretation of Radiographic Image *(3 sessions a year)*			3 days	

Objectives

To provide understanding of the philosophy and principles of radiation protection for medical application;

- Creating awareness on the radiation hazard, biological effects and risks of ionizing;
- To familiarize with the component, function, operation and control of x-ray and other associated equipment;
- To familiarize with the radiographic techniques and interpretation of radiograph for simple radiography;
-
- To generate the importance of right working procedure being practiced when dealing with x-ray equipment.

Non-Destructive Evaluation	1. Basic Course on NDT *(2 sessions a year)*	MINT	Maximum 25 per session	3 days		201 (2001) ~~229~~ (up to 30 Jun 2002)
	2. Basic Metallurgy in NDT *(1 session a year)*			5 days		
	3. Concrete Inspection Using NDT Technique *(1 session a year)*			5 days		
	4.Eddy Current Basic Grade *(1 session a year)*			6 days		
	5. Eddy Current Intermediate Grade *(1 session a year)*			12 days		
	6. Keselamatan Radiografi Untuk Pembantu Pengendali *(5 sessions a year)*			2 days		
	7. Industrial Radiography Basic Grade *(3 sessions a year)*			12 days		
	8. Industrial Radiography Intermediate Grade *(5 sessions a year)*			12 days		
	9. Interpretation and Evaluation of Radiograph *(2 sessions a year)*			5 days		
	10. Advanced Industrial Radiography *(1 session a year)*			12 days		
	11. Surface Method Basic Grade *(1 session a year)*			11 days		
	12. Surface Method Intermediate Grade *(1 session a year)*			11 days		

Objectives

- To meet the syllabus requirement of MLVK (National Vocational Training Council) where applicable;
- To provide the participants with the necessary knowledge in both theory and practices of related technologies.

A SURVEY OF LICENSEES OF NATIONAL EXAMINATIONS RELATED TO NUCLEAR ENERGY

Qualification	Target	Annual Licensee	Cumulative Licensee	Authorize Institution	Notes
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	Gaugas	63	326	AELB	1
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	Sales	46	91	AELB	
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	NDT	7	14	AELB	
Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	TENORM	9	18	AELB	

1. National examination and certification of RPO started in 2000.

SURVEY OF BACKGROUND DATA FOR ANALYSIS
THE NUMBER OF USERS OF RADIATION APPLICATION

Total number of users	Breakdown					Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	
10,000	500	4400	100	5000	--	1

DATA OF RADIATION DIAGNOSIS

Cobalt	Accelerator	Megavolt machines total
7	19	26

A

A TOTAL NUMBER OF MEGAVOLTAGE TTELETHERAPY MACHINES

TOTAL NUMBER OF BRACHYTHERAPY MACHINE

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
15	2	1	6	9

RECENT TOPICS

- New remuneration scheme
  - Competency based
  - Several levels of competencies
  - Assessment through examination and training courses
- Reactor interest group
  - Neutron beam application
  - Isotope and tracer application
  - Neutron activation analysis
  - Engineering
  - Training and education

SCIENTIST EXCHANGE PROGRAMME

- A. Operation, Design and Utilisation of Research and Test Reactor
- B. Production and Utilisation of Radioisotope
- E. Reactor Chemistry
- G. Physics
- H. Radiation Chemistry and Processing
- I. Radiation Control and Safety
- J. Treatment and Disposal of Radioactive Waste
- M. Medical and Biological Application of Radiation and Radioisotopes

THANK YOU

1.5.5 The Philippines

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Philippine Nuclear Research Institute

1. Training Materials in Radiation Protection

The HRD Workshop under the FNCA is a good venue for exchange of information regarding available training materials in radiation protection. Some of these could be used in common by member countries, especially if these materials are available in English. The survey of available training materials which was conducted earlier, in preparation for this 4th HRD Workshop is a good start towards this end. In the Philippines, we have some available lecture notes in English which we are using for our local training courses. Some of these are shown in Table 1 below.

Table 1. Available Training Materials in English

Lectures	1. Basic Nuclear Physics
	2. Nuclear Reactions
	3. Radiation and Radioactivity
	4. Some Radiation Quantities and Units
	5. Interaction of Radiation with Matter
	6. Statistics of Counting
	7. Detection of Radiation
	8. Radiation Protection Instruments
	9. Biological Effects of Radiation
	10. Basic Safety Standards for Radiation Protection
	11. Radiation Dosimetry: An Overview
	12. Radiation Monitoring
	13. Maintenance and Calibration of Monitoring Instruments
	14. Dose Calculations
	15. Radiation Shielding
	16. Radiation Facility Design and Safety
	17. Decontamination
	18. Emergency Planning
	19. Radiological Health and Safety Officer: Qualifications, Duties and Responsibilities
	20. Transport of Radioactive Materials
	21. Radioactive Waste Management
Laboratory	1. Characteristics of Geiger-Muller Detectors
Exercises	2. Statistics of Counting
	3. Determination of Half-Life
	4. Gamma-Ray Spectrometry
	5. Absorption of Gamma Radiation
	6. Decontamination
	7. Calibration of Monitoring Instruments

In addition to the materials listed in Table 1, in the Philippines we have been using the Distance Learning Modules in Radiation Protection, developed at the Australian Nuclear Science and Technology Organisation (ANSTO), under an IAEA/RCA Project. We had participated in trialing these modules over the past few years. Once finalized, these will be published by the IAEA and will be free for use by any country as it sees fit. These modules in radiation protection are also excellent as handout materials in face to face training courses.

2. Introduction of E-Learning System

As a step towards the use of E-learning systems in training high school students in the area of nuclear science and technology, in the Philippines we have been developing an interactive, multimedia CD-ROM in English. The availability of this CD-ROM was reported during the 3rd HRD Workshop. However, its completion has been delayed, from July this year to the end of September. This training material in CD-ROM may be previewed by workshop participants during the technical tour to the Philippine Nuclear Research Institute. Table 2 outlines some of the contents of this CD-ROM.

Table 2. Contents of Multimedia CD-ROM for High School Students

Outline/Guide for Teachers
The Atom (Different concepts of the atom, What is an isotope, Definition of terms)
Radiation and Radioactivity (Types of ionizing radiation, Half-Life, Interaction with matter, Units used to measure radioactivity)
Biological Effects of Radiation (Effects of radiation on living cells, Health effects of radiation)
Radiation Safety (Instruments used to measure radiation, Effect of Time, Distance and Shielding, Justification Principle, Optimization Principle, Dose Limits)
Radioactive Waste Management (Categories of radioactive waste, Concepts of radioactive waste management)
Beneficial Uses of Radioisotopes (Uses in Food and Agriculture, Food Preservation, Insect/Pest Control, Animal Productivity, Uses in Medicine, Uses In Industry,
Nuclear Energy for Power Generation (Fission Process, Fission Chain Reaction, The Nuclear Reactor)

3. Investigation of Basic Data on Human Resources

The different data gathered in response to the survey prepared by Japan and sent out to the FNCA member countries are outlined in the following tables. The data on human resources include only those personnel involved with nuclear science and technology matters.

A-1. Survey of the Administrative Agencies and National R&D Institutes

A-1-1 Total number of administrative and technical officials.

Agency/ Institute	Role	Total
Philippine Nuclear Research Institute (PNRI)	The sole agency of government mandated to advance and regulate the applications of nuclear science and technology in the Philippines	262
Department of Science and Technology (DOST)	Cabinet level administrative agency; provides central direction, leadership and coordination of all S&T activities in the country. Formulates S&T policies, programs and projects in support of national development priorities.	20 (Only those concerned with nuclear S&T)

A-1-2 The Number of Personnel Classified by Field in each Agency/Institute (Breakdown of Table A-1-1)

Agency/ Institute	Nuclear Administration				R & D		TOTAL
	Promoting		Regulatory				
	R&D/ Radiation Application	Nuclear Power Generation	R&D/ Radiation Application	Nuclear Power Generation	Radiation Application	Nuclear Power Gen.	
PNRI	147		32		83		262
DOST	20 (only those concerned with nuclear S&T)						20
TOTAL	167		32		83		282

A-2 Survey of University Education Institutions

A-2-1 University Course

Target Univ.	National/ Private	University			Graduate School (Master)			Graduate School (Doc.)	Notes
		No. of Students	No. of Staff	Estab. Year	No. of Students	No. of Staff	Estab. Year		
UST	Private				12	6	1981	None	M.S. Medical Physics

Remarks:

1. UST is the University of Santo Tomas, in Manila.
2. Target: University offering nuclear science education
3. The number of students: registered students
4. The number of staff: this is the number of lecturers/faculty

A-2-2 Specialized School for Development of Technical Engineer

Number of Schools	Annual Trainees	Breakdown of Schools	Notes
None in Nuclear field			

A-3 Survey of Radiation and Radioisotopes Application

A-3-1 Agricultural Application

A-3-1-1 Plant Mutation Breeding

Number of Institutions Implementing	Number of Scientists Engaged	Notes
9	40	15 Crops, Plants 10 Varieties 107 Mutant Lines

A-3-1-2 Sterile Insect Technique

Number of Institutions Implementing	Number of Scientists Engaged	Notes
2	7	PNRI; Dept. of Agriculture (National Mango Research Institute)

A-3-1-3 Food Irradiation

Number of Institutions Implementing	Number of Scientists Engaged	Notes
7	26	PNRI; Food Dev. Center; Dole Phils.; UP-Diliman; UP-Los Banos; Bureau of Plant Industry; National Food Authority

A-3-2 Medical Application − Radiation Diagnosis

Number of Institutions Implementing	Number of Radiation Oncologists	Number of Therapeutic Technicians	Notes
13	36	44	Additional 16 Physicists

A-3-3 Non-Destructive Testing (Radiographic Testing)

Number of Companies Implementing	Number of Engineers/Technicians Engaged	Notes
29	700	Graduates of Radiographic Testing Levels 1,2,3 Training Courses

A-4 Survey of Nuclear Training Courses

Field	Course	Objective	Implement-ing Institution	Annual Quota of Trainees	Duration	Cumulative Number of Trainees
Radiation/ Radio-isotope Applica-tion Tech-niques	RTTC	RI applications in medicine, research, agriculture	PNRI	60	4 weeks	1,822
	IURC	RI applications in industry	PNRI	30	4 weeks	704
	NTUCF	Training of university/ college faculty	PNRI	30	5 weeks	252
	SNS-HSST	Training of high school teachers	PNRI	30	5 weeks	432
	RIA	Training in Radioimmuno-Assay	PNRI	30	1 week	127
	Radiation Cyto-Genetics	Training in radiation cytogenetics	PNRI	30	5 weeks	50
	Introduc-tory Course in Nuclear Science	Basic training for high school and elementa-ry school teachers	PNRI	60	1 week	119
Safety	RHSC	Training for Radiation Safety Officers	PNRI	30	4 weeks	508
	Radiation Safety Course	Radiation safety for radioisotope users	PNRI	60	3 days to 1 week	461
	Safe Transport of RAM	Safe transport of radioactive materials	PNRI	20	3 days	35
Safety	Emer-gency Planning and Pre-pared-ness	Training in emergency planning and preparedness	PNRI	30	1 week	45

Remarks:

1. RTTC − Radioisotope Techniques Training Course
2. IURC − Industrial Uses of Radioisotopes Course
3. NTUCF − Nuclear Technology for University/College Faculty
4. SNSHSST − Seminar in Nuclear Science for High School Science Teachers
5. RIA − Training Course in Radioimmunoassay
6. RHSC − Radiological Health and Safety Course

A-5 Survey of Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Annual Licensees	Cumulative Licensees	Authorizing Institution	Notes
Certification as Radiographic Testing Practitioner		5	29	National Certifying Body	Those who did not renew their certifica-tion, not counted. Recertification exams every 2 yrs.

Remark:

Target: The number of licensees of national certifying examinations in the nuclear field.

A-6 Survey of Background Data for Analysis

A-6-1 The number of users of radiation application

Total Number of Users	Breakdown				
	Research Institutions	Medical Institutions	Educational Institutions	Industrial Firms	Commercial Companies
313	13 (4%)	75 (24%)	11 (3%)	174 (56%)	40 (13%)

Remark:

Number of medical institutions do not include users of X-ray

A-6-2 Data of Radiation Diagnosis

A-6-2-1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt Machines Total
14	4	4

A-6-2-2 Total Number of Brachytherapy Machines

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
			5	5

A-6-2-3 Annual new cancer patients in both sexes

65,361

4. Other Information Exchange

There is a need in the Philippines to upgrade nuclear science education in the high school level. One important way to address this need is the training of high school teachers and educators, or training the trainors. A welcome development is the "Course on Dissemination of Nuclear Knowledge," one of the courses under the International Seminars on Nuclear Safety for 2002. This is organized by the International Nuclear Technology Cooperation Center/Radiation Application Development Association, and sponsored by the MEXT.

In the event that the Philippines will embark on a nuclear power program, and in order to have adequate human resources in support of a research reactor, there is a need for graduate degree holders in Nuclear Engineering. It will be a welcome development if the MEXT Scientist Exchange Program of Japan will include an academic program leading to M.S. Nuclear Engineering.

Country Report: PHILIPPINES

Corazon C. Bernido
Philippine Nuclear Research Institute

Training Materials in Radiation Protection (In English)

- Lecture Handouts:
  - Basic Nuclear Physics
  - Nuclear Reactions
  - Radiation and Radioactivity
  - Some Radiation Quantities and Units
  - Interaction of Radiation with Matter
  - Statistics of Counting
  - Detection of Radiation
  - Radiation Protection Instruments
  - Biological Effects of Radiation
  - Basic Safety Standards for Radiation Protection



Training Materials in Radiation Protection (In English)

- Lecture Handouts:
  - Radiation Dosimetry: An Overview
  - Radiation Monitoring
  - Maintenance and Calibration of Monitoring Instruments
  - Dose Calculations
  - Radiation Shielding
  - Radiation Facility Design and Safety
  - Decontamination
  - Emergency Planning
  - Radiological Health and Safety Officer: Qualifications, Duties and Responsibilities



Training Materials in Radiation Protection (In English)

- Lecture Handouts:
  - Transport of Radioactive Materials
  - Radioactive Waste Management
- Laboratory Exercises:
  - Characteristics of GM Detectors
  - Statistics of Counting
  - Determination of Half-Life
  - Gamma-Ray Spectrometry
  - Absorption of Gamma Radiation
  - Decontamination
  - Calibration of Monitoring Instruments

Introduction of E-Learning System

- Contents of Multimedia CD-ROM for High School Students:

Outline/Guide for Teachers
The Atom (Different concepts of the atom, What is an isotope, Definition of terms)
Radiation and Radioactivity (Types of ionizing radiation, Half-Life, Interaction with matter, Units used to measure radioactivity)
Biological Effects of Radiation (Effects of radiation on living cells, Health effects of radiation)

Introduction of E-Learning System

- Contents of Multimedia CD-ROM for High School Students:

Radiation Safety (Instruments used to measure radiation, Effect of Time, Distance and Shielding, Justification Principle, Optimization Principle, Dose Limits)
Radioactive Waste Management (Categories of radioactive waste, Concepts of radioactive waste management)
Beneficial Uses of Radioisotopes (Uses in Food and Agriculture, Food Preservation, Insect/Pest Control, Animal Productivity, Uses in Medicine, Uses In Industry,
Nuclear Energy for Power Generation (Fission Process, Fission Chain Reaction, The Nuclear Reactor)

Basic Data on Human Resources

A-1. Survey of the Administrative Agencies and National R&D Institutes

A-1-1 Total number of administrative and technical officials.

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Basic Data on Human Resources

A-1-2 The Number of Personnel Classified by Field in each Agency/Institute

Agency/ Institute	Nuclear Administration				R & D		TOTAL
	Promoting		Regulatory				
	R&D/ Radiation Applica-tion	Nuclear Power Genera-tion	R&D/ Radiation Applica-tion	Nuclear Power Genera-tion	Radiation Applica-tion	Nuclear Power Gen.	
PNRI	147		32		83		262
DOST	20 (only those concerned with nuclear S&T)						20
TOTAL	167		32		83		282

Basic Data on Human Resources
A-2 Survey of University Education Institutions

A-2-1 University Course

Target Univ.	National/ Private	University			Graduate School (Master)			Grad-uate School (Doc.)	Notes
		No. of Stud-ents	No. of Staff	Estab. Year	No. of Stud-ents	No. of Staff	Estab. Year		
UST	Private				12	6	1981	None	M.S. Medical Physics

Remarks:
1. UST is the University of Santo Tomas, in Manila.
2. Target: University offering nuclear science education
3. The number of students: registered students
4. The number of staff: this is the number of lecturers/faculty

Basic Data on Human Resources
A-3 Survey of Radiation and Radioisotopes Application

- **A-3-1 Agricultural Application**

A-3-1-1 Plant Mutation Breeding

Number of Institutions Implementing	Number of Scientists Engaged	Notes
9	40	15 Crops, Plants 10 Varieties 107 Mutant Lines

A-3-1-2 Sterile Insect Technique

Number of Institutions Implementing	Number of Scientists Engaged	Notes
2	7	PNRI; Dept. of Agriculture (National Mango Research Institute)

Basic Data on Human Resources
A-3 Survey of Radiation and Radioisotopes Application

- **A-3-1 Agricultural Application**

A-3-1-3 Food Irradiation

Number of Institutions Implementing	Number of Scientists Engaged	Notes
7	26	PNRI; Food Dev. Center; Dole Phils.; UP-Diliman; UP-Los Banos; Bureau of Plant Industry; National Food Authority

Basic Data on Human Resources
A-3 Survey of Radiation and Radioisotopes Application

- **A-3-2 Medical Application - Radiation Diagnosis**

Number of Institutions Implementing	Number of Radiation Oncologists	Number of Therapeutic Technicians	Notes
13	36	44	Additional 16 Physicists

Basic Data on Human Resources
A-3 Survey of Radiation and Radioisotopes Application

- **A-3-3 Non-Destructive Testing (Radiographic Testing)**

Number of Companies Implementing	Number of Engineers/Technicians Engaged	Notes
29	700	Graduates of Radiographic Testing Levels 1,2,3 Training Courses

Basic Data on Human Resources
A-3 Survey of Nuclear Training Courses

Field	Course	Objective	Implem-enting Institution	Annual Quota of Trainees	Duration	Cumulative Number of Trainees
Radiation/ Radio-isotope Application Tech-niques	RTTC	RI applications in medicine, research, agriculture	PNRI	60	4 weeks	1,822
	IURC	RI applications In industry	PNRI	30	4 weeks	704
	NTUCF	Training of university/ college faculty	PNRI	30	5 weeks	252
	SNS-HSST	Training of high school teachers	PNRI	30	5 weeks	432

Basic Data on Human Resources
A-3 Survey of Nuclear Training Courses

Field	Course	Objective	Implementing Institution	Annual Quota of Trainees	Duration	Cumulative Number of Trainees
Radiation/ Radio-Isotope Application Technique	RIA	Training in Radioimmuno-Assay	PNRI	30	1 week	127
	Radiation Cyto-Genetics	Training in radiation cytogenetics	PNRI	30	5 weeks	50
	Introductory Course in Nuclear Science	Basic training for high school and elementary school teachers	PNRI	60	1 week	119

Basic Data on Human Resources
A-3 Survey of Nuclear Training Courses

Field	Course	Objective	Implementing Institution	Annual Quota of Trainees	Duration	Cumulative Number of Trainees
Safety	RHSC	Training for Radiation Safety Officers	PNRI	30	4 weeks	508
	Radiation Safety Course	Radiation safety for radioisotope users	PNRI	60	3 days to 1 week	461
	Safe Transport of RAM	Safe transport of radioactive materials	PNRI	20	3 days	35

Basic Data on Human Resources
A-3 Survey of Nuclear Training Courses

Field	Course	Objective	Implement-ing Agency	Annual Quota of Trainees	Duration	Cumulative Number of Trainees
Safety	Emer-gency Planning and Pre-pared-ness	Training in emergency planning and preparedness	PNRI	30	1 week	45

Remarks:
1. RTTC – Radioisotope Techniques Training Course
2. IURC – Industrial Uses of Radioisotopes Course
3. NTUCF – Nuclear Technology for University/College Faculty
4. SNSHSST – Seminar in Nuclear Science for High School Science Teachers
5. RIA – Training Course in Radioimmunoassay
6. RHSC – Radiological Health and Safety Course

Basic Data on Human Resources
A-5 Survey of Licensees of National Examinations Related to Nuclear Energy

Qualifica-tion	Target	Annual Licensees	Cumulative Licensees	Authorizing Institution	Notes
Certification as Radio-graphic Testing Practitioner		5	29	National Certifying Body	Those who did not renew their certification, not counted. Recertification exams every 2 yrs.

Remark:
Target: The number of licensees of national certifying examinations in the nuclear field.

Basic Data on Human Resources
A-6 Survey of Background Data for Analysis

A-6 Survey of Background Data for Analysis

A-6-1 The number of users of radiation application

Total Number of Users	Breakdown				
	Research Institutions	Medical Institutions	Educational Institutions	Industrial Firms	Commercial Companies
313	13 (4%)	75 (24%)	11 (3%)	174 (56%)	40 (13%)

Remark:
Number of medical institutions do not include users of X-ray

Basic Data on Human Resources
A-6-2 Data of Radiagion Diagnosis

A-6-2-1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt Machines Total
14	4	4

A-6-2-2 Total Number of Brachytherapy Machines

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
			5	5

A-6-2-3 Annual new cancer patients in both sexes

65,361

Other Information Exchange

- Need to train high school teachers
  - A welcome development is the "Course on Dissemination of Nuclear Knowledge," one of the courses under the International Seminars on Nuclear Safety for 2002. This is organized by the International Nuclear Technology Cooperation Center/Radiation Application Development Association, and sponsored by the MEXT.
- Need for graduate degree holders in Nuclear Engineering
  - We would like to suggest that the MEXT Scientist Exchange Program of Japan include an academic program leading to M.S. Nuclear Engineering.

THE PROMOTION OF HUMAN RESOURCE DEVELOPMENT IN THE NUCLEAR FIELD BETWEEN JAPAN AND THE PHILIPPINES

P.C. Roceles, Phil. Nuclear Research Institute
Quezon City, Philippines

Presented during the 4th FNCA Workshop on Human Resources Development in the Nuclear Field, Nasugbu, Batangas, Philippines, 8−10 Oct. 2002

HISTORY OF STA

- Visit of Japanese officials in 1985
- Discussion of the proposed exchange program
- Implementation

Host Institutes for the Exchange Program

- JAERI
- JNC
- NIRS
- JCAC

Experts' Dispatch

- An expert on Research Reactor Safety (1995)
- An expert on High Dose Dosimetry (1999)

Philippine Participation in Other Japanese-Sponsored Seminars

- STA/RADA Seminars
  - ** Nuclear Administration
  - ** Nuclear Safety
  - ** Management of Radioactive Waste and Spent Fuel

PHILIPPINE PARTICIPATION IN STA/MEXT SCIENTIST EXCHANGE PROGRAM

YEAR	NUMBER	AREA OF RESEARCH
1985	3	1. Recovery of uranium from seawater and phosphoric acid 2. Environmental radiation protection 3. Radiation control
1986	1	1. Uranium exploration, tests and analysis
1988	3	1. Environmental radiation and radioactivity 2. Uranium exploration 3. Radiation effects on microorganisms
1989	6	1. Operation and management technology for research reactors 2. Maintenance, control and calibration of radiation measuring instruments 3. Radiation control and safety administration 4. Exploration, geology & mineralogy of uranium 5. Safeguards techniques of uranium related facilities 6. Determination of low level radionuclides & related elements

1990	3	1. Safeguards techniques 2. Radiation control in working environment 3. Personnel training techniques in the nuclear field
1991	5	1. Radiation processing with polymers 2. Environmental monitoring 3. Mineralogical tests & uranium rare earths occurrence 4. Personnel training in nuclear field 5. Nuclear criticality assessment using computer codes
1993	3	1. Personnel dosimetry 2. Personnel training in the nuclear field 3. Neutronics & thermohydraulic calculations of test reactors
1994	4	1. Trace element analysis 2. Uranium ore deposit formation study & application to uranium exploration 3. INIS 4. Environmental gamma ray measurement & monitoring technique

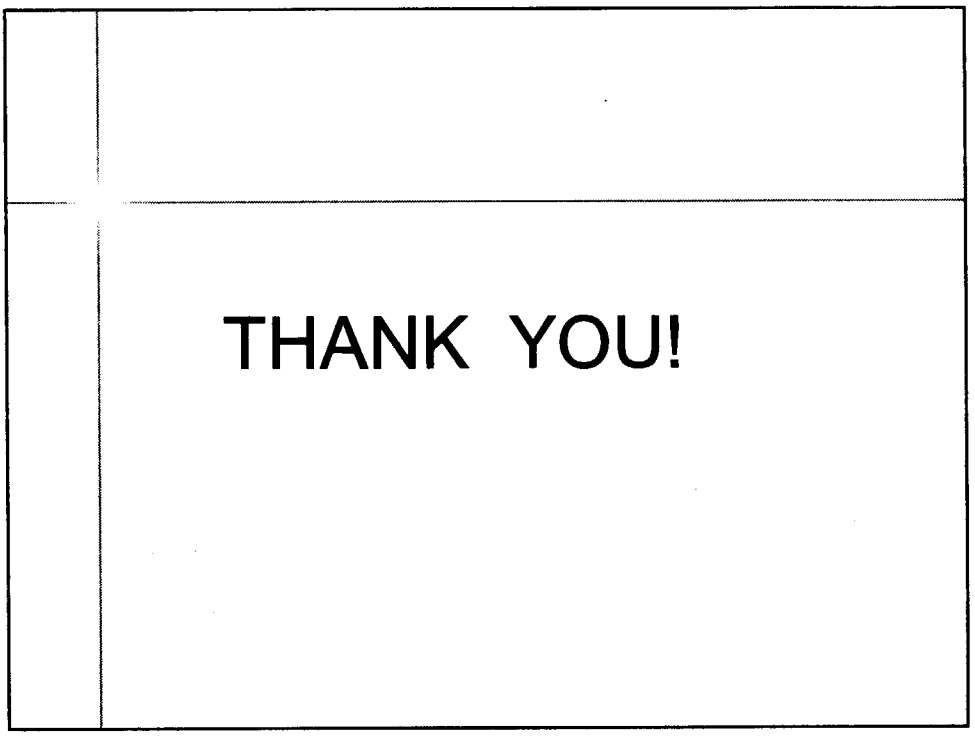
1995	1	1. Personnel training methods & techniques
1996	1	1. Radiation control in working environment
1998	1	1. Mossbauer spectroscopy of ion & lanthanide compounds
1999	1	1. Mutation breeding
2000	1	1. Chromosome aberration of human lymphocytes
2001	1	1. Development of dosimetry techniques
2002	1	1. Radiation processing of environmentally friendly polymers

PHILIPPINE PARTICIPATION IN STA/RADA/MEXT SEMINARS

ACTIVITY	*SPONSOR*	*NO. OF PARTICIPANTS*	*YEAR*
Seminar on Nuclear Safety	STA	1	1992
	STA	1	1993
	STA	2	1995
	STA	2	1996
	STA	2	1997
	STA	2	1999
	RADA	2	1998
Seminar on Nuclear Administration	STA	1	1989
	STA	1	1990
	STA	1	1991
	STA	1	1992
	STA	1	1993
	STA	1	1995
	STA	1	1996
	STA	1	1997
	STA	1	1998
	STA	1	2000
	MEXT	1	2001
	MEXT	1	2002
Seminar on Management of Radioactive Waste and Spent Fuel	RADA	1	1999
	RADA	1	2000

Major Concerns/Issues

- Age limit
- Deadline set by the sponsor
- Channels of communication


THANK YOU!

THE PROMOTION OF HUMAN RESOURCE DEVELOPMENT IN THE NUCLEAR FIELD BETWEEN JAPAN AND THE HPILIPPINES[1]

Pilar C. Roceles
Head, Technical Assistance Unit
Philippine Nuclear Research Institute

The year 1895 marked the beginning of research cooperation in the nuclear filed between Japan and her neighboring countries, when the Scientist Exchange Program, spearheaded by the Science and Technology Agency (STA) of Japan, went on full implementation.

The Philippines, since that time to the present, has sent 35 scientists/researchers under the said Program to conduct research and to exchange information and experiences in fields such as **Radiation Protection and Control of Nuclear Facilities, Personnel Training Methods and Techniques, Chromosome Aberration in Human Lymphocytes, Uranium Exploration, Safeguards Techniques,** and **Environmental Monitoring**. The range of research subjects have come from both the Philippine Nuclear Research Institute (PNRI) and other sectors, such as the academe.

When the Government of Japan imitated the dispatch of her experts under the STA Exchange Program, the Philippines was also privileged to avail of such technical assistance receiving Japanese experts in fields as determined necessary by the country.

The pursuit of Manpower Development in the Nuclear Field is realized also by our participation in other Japanese-sponsored activities such as the Radiation Application Development Association (RADA) – administered Seminars on Nuclear Administration, and on Nuclear Safety for Asia. Many of our senior – and middle-management staff have attended these seminars, which have been gainful in terms of widening perspectives and broadening the understanding of our managerial/technical staff on issues pertaining to nuclear administration and the promotion of nuclear safety culture. The expansion of the seminar to accommodate training on the Dissemination of Nuclear Knowledge, Management of Nuclear Facilities, and Radiation Applications is a welcome move that would facilitate gaining of further knowledge and exchange of experiences in these areas.

A major concern of the Institute, however, and which we have presented to the seminar administrators already, is the present age limit for participation in the said activities. Most of our young generation staff are either only recently-hired or occupy entry level positions in the organization and,

therefore, in terms of responsibilities and experience still cannot comply with the participation requirements of the seminar. Those who hold middle-level management and seminar management positions, on the other hand, are "over-aged" to participate, particularly in the valuable seminars on Nuclear Administration. A look into this issue may well be deserved.

Another human resource development activity where we have benefited from, and which should be highlighted in the future as also an important opportunity for recipient countries, is the STA Fellowship Program.

In 1999, we were introduced to this mode of technical assistance which has essential differences compared to the STA Exchange Program. Applications for the fellowship are made through designated Responsible Organizations or the potential Host Research Institutes in Japan. Management of the program is undertaken by the Japan Science and Technology Corporation (JST), in cooperation with the Japan International Science and Technology Exchange Center (JISTEC).

There are other activities where we are able to avail of training, courtesy of the Government of Japan, and there include JICA-sponsored (Japan International Cooperation Agency) courses, and even MOMBUKAGAKUSHO fellowships.

The build up of our nuclear human resource pool by way of technical cooperation with Japan can still go a long way, and improvement in certain areas of implementation can still be achieved through meaningful partnership between the Government of Japan and the other stakeholders in this cooperation.

PHILIPPINE PARTICIPATION IN STA/MEXT SCIENTIST EXCHANGE PROGRAM

YEAR	NUMBER	AREA OF RESEARCH
1985	3	1. Recovery of uranium from seawater and phosphoric acid 2. Environmental radiation protection 3. Radiation control
1986	1	1. Uranium exploration, tests and analysis
1988	3	1. Environmental radiation and radioactivity 2. Uranium exploration 3. Radiation effects on microorganisms
1989	6	1. Operation and management technology for research reactors 2. Maintenance, control and calibration of radiation measuring instruments 3. Radiation control and safety administration 4. Exploration, geology & mineralogy of uranium 5. Safeguards techniques of uranium related facilities 6. Determination of low level radionuclides & related elements
1990	3	1. Safeguards techniques 2. Radiation control in working environment 3. Personnel training techniques in the nuclear field
1991	5	1. Radiation processing with polymers 2. Environmental monitoring 3. Mineralogical tests & uranium rare earths occurrence 4. Personnel training in nuclear field 5. Nuclear criticality assessment using computer codes
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1994	4	1. Trace element analysis 2. Uranium ore deposit formation study & application to uranium exploration 3. INIS 4. Environmental gamma ray measurement & monitoring technique
1995	1	1. Personnel training methods & techniques
1996	1	1. Radiation control in working environment
1998	1	1. Mossbauer spectroscopy of ion & lanthanide compounds
1999	1	1. Radiation protection & control of nuclear facilities
2000	1	1. Chromosome aberration of human lymphocytes
2001	1	1. Development of dosimetry techniques
2002	1	1. Radiation processing of environmentally friendly polymers

PHILIPPINE PARTICIPATION IN STA/RADA/MEXT SEMINARS

ACTIVITY	*SPONSOR*	*NO. OF PARTICIPANTS*	*YEAR*
Seminar on Nuclear Safety	STA	1	1992
	STA	1	1993
	STA	2	1995
	STA	2	1996
	STA	2	1997
	STA	2	1999
	RADA	2	1998
Seminar on Nuclear Administration	STA	1	1989
	STA	1	1990
	STA	1	1991
	STA	1	1992
	STA	1	1993
	STA	1	1995
	STA	1	1996
	STA	1	1997
	STA	1	1998
	STA	1	2000
	MEXT	2	2001
	MEXT	0	2002
Seminar on Management of Radioactive Waste and Spent Fuel	RADA	1	1999
	RADA	1	2000

1.5.6 Thailand

RADIATION PROTECTION, A KEY TO NUCLEAR TECHNOLOGY DEVELOPMENT

Ms. Warapon WANITSUKSOMBUT
Office of Atomic Energy for Peace, THAILAND

INTRODUCTION

It is realized that the draw back in nuclear technology development causing from public understanding and radiation safety issue. Although nuclear technology is the answer to many useful applications, the reputation is easily destroyed in an incident of fault operation. The law and regulation concerning radiation protection is one important part that IAEA put emphasize on to each member country. The other equally important part is the personnel involved in the radiation protection. There are three groups of persons involving in nuclear applications, the legal person, the regulatory authority, and qualified experts. The legal person is one who has authority to use nuclear application. The regulatory authority is the organization and person who conduct the authorization, inspection and enforcement of the law and regulations. The qualified experts are including the radiation control officers, medical physicists, nuclear medical practitioners, radiography technicians, nuclear reactor operators, irradiator operators, etc. who carry the task of protecting relevant personnel from radiation hazard. Persons involved in each group should have appropriate knowledge on radiation protection to ensure that all the applications are carried out with safety.

RADIATION PROTECTION IN THAILAND

Nuclear technology application had been introduced to Thailand in the very beginning of nuclear age. The Atomic Energy for Peace Act was enacted in 1961, with establishment of the Office of Atomic Energy for Peace (OAEP), to carry out the regulatory function and to promote the nuclear technology application through the operation of a research reactor. From the beginning until now, medical applications are the most extensive among the other fields. Industrial application is the second numbers of nuclear technology utilization. There are a number of medical schools providing courses on medical radiation technology, medical physics, and radiography technician. Universities and collages provide some courses in nuclear technology, but neither of them gives in the full extent of radiation protection. The detail is shown in the HRD questionnaire.

In reviewing Thai's regulation on radiation protection, the inadequacy of information on radiation protection is found. Items of radiation protection regulations and standards are needed to implement. Among these items, the radiation safety officer is one of the most important keys needed to establish. The regulation concerning qualification and duty of such radiation safety officer is being laid, and system of qualifying the personnel to be the radiation safety office is considered.

OAEP has established two levels of radiation protection training courses since 1980. The level 1 Radiation Protection Training Course is aimed at workers and supervisors in the use of sealed radioactive sources and radiation generators. The level 2 Radiation Protection Training Course is for the use of unsealed radioisotopes. The two courses have been reviewed many times since the beginning of conduct. Because participants succeeded in the training examination can get permission to be the radiation safety officer in the nuclear applications authorization, the content should be adequate to produce qualified personnel. There is an effort to accomplish the IAEA standard syllabus for radiation protection training into the courses. Models of the training courses in other countries are also considered. There is the IAEA distance learning material on radiation protection, which is found useful for the beginner. The model of Japanese system for Radiation Protection Supervisor qualifying program is quite intensive and is a good enhancing program to acquire competent personnel. Both models are able to use as a guide for constructing the training courses and the radiation safety officer qualifying system for Thailand.

TRAINING MATERIALS FOR RADIATION PROTECTION

Concerning the radiation protection training materials to be commonly used in member country, practical exercises on radiation protection should be considered as a main part of the qualifying scheme. It is very important to ensure that participants achieve through the exercise, experience in radiation measurement, contamination detection and radiation control. Therefore the training materials should specify in detail the necessary information on the mentioned practical exercises. Language barrier is another problem that should be raised for consideration. Thailand has its own language that totally different from others. Local workers will have severe trouble to use English text to study radiation protection. Therefore the materials should be allowed to translate into each member country's language.

INFORMATION EXCHANGE AND TECHNICAL ASSISTANCE

Since nuclear technology applications have grown rapidly in Thailand. Continuing support from developed countries in radiation protection manpower development and in other nuclear technology training is needed to gain safely management of them. The information exchange as well as technical assistance in FNCA program has given opportunity to Thailand to develop its manpower through the program.

Answer Sheet for 'The Plan for Survey of the Basic Data on Human Resources Development in the Nuclear Field in FNCA Member Countries'

Thailand

A−1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

A−1−1 Total number of administrative and technical officials in each agency and institutes

Agency / Institutes	Role	Total	Notes
Thai Atomic Energy Commission for Peace (Thai A.E.C.) and its 14 sub-committees	Setting-up policies, deliberations in promoting and regulating the peaceful application of atomic energy for various purposes	214	
Office of Atomic Energy for Peace (OAEP)	Implementing the regulating and promoting performances for the use of atomic energy for the benefit of the country's development; serving as the focal point coordinating both national and international authorities in exercising the peaceful applications of atomic energy	393	Only regular officials, including scientists, engineers, technicians and administrative staffs are counted.
Total		607	

Remarks

① Target agency and institutes
- National agency and institutes

② The number of staff members:
- Count only regular employees.
- Indirect category (driver, guard, and staff in dinning hall and clinic, etc.) should not be included. Explanatory note should be needed if your data has been included these staff members.

Your notes

A－1－2　The Number of Personnel Classified by Field in each Agency and Institutes (Breakdown table of A－1－1)

Agency / Institutes	Nuclear Administration		R&D	Total	Notes
	Promoting	Regulatory			
1. Thai A.E.C.	16			16	
1.1 Sub-Committee on Atomic Energy Application in Agriculture	17			17	
1.2 Sub-Committee on Atomic Energy Application in Medicine	19			19	
1.3 Sub-Committee on Atomic Energy Application in Industry	17			17	
1.4 Sub-Committee on Issuing Nuclear Material and Its By-product Related Licenses	10			10	
1.5 Nuclear Law Sub-Committee	11			11	
1.6 Nuclear Facility Safety Sub-Committee	17			17	
1.7 Sub-Committee on Implementation in Accordance with IAEA Obligations	12			12	
1.8 Nuclear Fuel Protection and Inspection Sub-Committee	13			13	
1.9 Sub-Committee on Development of Structure and Management, Regulation and Control for Radiation Safety	13			13	
1.10 Sub-Committee on Implantation in Accordance with the Comprehensive Nuclear Test-Ban Treaty: CTBT	12			12	
1.11 CTBT Translation Correction Ad-hoc Sub-Committee	14			16	
1.12 Ad-hoc Sub-Committee on Legislation for CTBT Implementation	16			16	
1.13 Sub-Committee on Atomic Energy Application in Food and Nutrition	15			15	
1.14 Sub-Committee on Issuing Licenses for Radiation Sources	12			12	
2. Office of Atomic Energy for Peace	125	49	219	393	As of Sept'02
Total	388		219	607	

Remarks

① This table is a breakdown of A-1-1 and is to be filled in as much as you know.

② Write in the middle if the classification is not clear.

③ Attach the detailed data of each institution if available. The detailed table is acceptable as the substitution of this table.

Your notes

So far Thailand has not had any projects of generating power from nuclear, the "nuclear power generation" columns are therefore omitted.

A−2. Survey of University Education Institutions

A−2−1 University Course

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
Chulalongkorn	***National***										
Faculty of Engineering		-	-	-	62	10	1972	4	3	1996	-
Faculty of Medicine		176	37	checking	-	-	-	-	-	-	-
School of Radiological Technology		38	179	checking	-	-	-	-	-	-	-
Kasetsart	***National***										
Faculty of Science		86	16	1981	6	16	2002	-	-	-	-
Khonkaen	***National***										
Faculty of Medicine		30	9	1972	-	10	2004 (plan)	-	26	2009 (plan)	6 years program
Faculty of Agriculture		120	20	1962	-	40	1964	10	40	1985	4 years program
Faculty of Science		120	9	1964	-	60	1963	10	60	1999	4 years program
Naresuan	***National***										
Faculty of Science		44	2	1978	-	-	-	-	-	-	-
Faculty of Allied Health Science		160	5	1998	-	-	-	-	-	-	-
Prince of Songkla	***National***										
Faculty of Science		20	4	1975	5	2	1992	-	-	-	-
Chiang Mai	***National***	checking	checking	checking	checking	checking	checking	checking	checking	checking	

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
Mahidol	***National***										
Faculty of Science		50	26	1967	-	-	-	-	-	-	-
Faculty of Medicine (Ramathibodi Hospital)		-	-	-	11	28	1972	-	-	-	-
Faculty of Medicine (Siriraj Hospital)		-	-	-	72	45	1990	-	-	-	-
Thammasat	***National***	checking	checking	checking	checking	checking	checking	checking	checking	checking	
Ramkamheang	***National***	checking	checking	checking	checking	checking	checking	checking	checking	checking	
Total		844	307		156	211		24	129		

Remarks

① Target: University to educate nuclear energy (School of Engineering and Sciences).

② Fill in the applicable space for University, Graduate School (Master), and Graduate School (Doctor), respectively.

③ The number of student: Registered student or quota (Registered student is preferable for Graduate School.). (Specify which number of personnel is shown in the table in Notes)

④ The number of staff: Staff for education (Sample in Japan: Total of Professor, Assistant professor, Lecturer and Assistant). Write total number and classify if staff holds the both posts of school and graduate school.

Your notes

No information for Chiang Mai University, Thammasat University and Ramkamheang University.

A−2−2 Specialized School for Development of Technical Engineer

A−2−2−1 Medical Radiation Technical Engineers Training School

Number of School	Annual Trainee	Breakdown of School		Notes
7	196	National Uni	7	Number of school are including Chiang Mai University, but Annual trainee are excluding Chiang Mai University.

A−2−2−2 Other Field (if there is any)

Field	Number of School	Annual Trainee	Breakdown of School	Total	Notes
-	-	-	-	-	-

Remarks

① Target: Specialized School for Development of Technical Engineers

② Japan only has the Medical Radiation Technical Development School. However, write more in A-2-2-2 if there is something else in your country.

Your notes

A−3. Survey of Radiation and Radioisotopes Application

A−3−1 Agricultural Application

A−3−1−1 Plant Mutation Breeding

Number of the institutions implemented	Number of the scientists engaged	Notes
60	111	FNCA Database

A−3−1−2 Sterile Insect Technique

Number of the institutions implemented	Number of the scientists engaged	Notes
2	45	

A−3−1−3 Food Irradiation

Number of the institutions implemented	Number of the scientists engaged	Notes
9	77	

A−3−2 Medical Application

A−3−2−1 Radiation diagnosis

Number of the institutions implemented	Number of the radiologists and diagnostic technicians	Notes
2235	7305	

A−3−2−2 Radiation Therapy

Number of the institutions implemented	Number of the radiation oncologists and therapeutic technicians	Notes
26	569	

A−3−3 Other field (if any)

Field	Number of implemented institution	Number of engaged scientist	Notes

Remarks

① Target: Quantitative data is needed. Write in A-3-3 if data is not available.

② Plant Mutation Breeding: Refer to attachment 8, database of FNCA Radiation Breeding Project, and correct it if needed.

③ Medical Application − Refer to attachment 7.

Your notes

A−4. Survey of Nuclear Training Courses

1. Office of Atomic Energy for Peace

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Basic/general Nuclear Energy	Nuclear Science Youth Club	60	3 days	259 (1998)
	Nuclear Chemistry and Application		10 days	24 (1996)
	Nuclear Energy and Application	50	5 days	463 (1988)
	Introduction to Radiation and Application	60	2 days	363 (1997)
Radiation/Radioisotopes Application Technique	Radiographic Testing Level 1	30	5 days	235 (1989)
	Radiographic Testing Level 2	20	12 days	83 (1989)
	Foods and Agricultural Products Irradiation	30	5 days	89 (1997)
	OAEP/JAERI Training Course on Nuclear Technology and Its Diverse Applications	20	10 days	59 (1999)
	Applications of Radiotracer Techniques in the Petroleum and Petrochemical Industries	25	5 days	25 (1991)
	Pest Control Using Radiation	40	5 days	123 (1999)
Safety (including Radiation Hazard Prevention)	OAEP/JAERI Training Course on Radiation Protection for Radiation Safety Supervisors	30	10 days	63 (1999)
	Distance Learning on Radiation Protection			10 (1998)
	Emergency Preparedness	30	10 days	50 (1994)
	Introduction to Radiation Protection	50	2 days	235 (1992)
	Irradiator Operator	10	35 days	40 (1992)
	Reactor Operator	15	45 days	52 (1988)
	Radiation Protection Level 1	60	5 days	1668 (1990)
	Radiation Protection Level 2	60	10 days	1110 (1990)
Others (Including protection against nuclear materials and international cooperation)	Radiation Protection for Lighting Preventor	150	2 days	672 (1991)
	Seminar on Nuclear Technology and Science		2 days	1348 (1984)
	Seminar on Nuclear Technology and Advantage for Peace		1 days	96 (1998)

2. Gamma Irradiation Service and Nuclear Technology Research Center (GISC), Kasetsart University

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Radiation/Radioisotopes Application Techniques	Induced Mutation Technique for Crop Improvement	20	5 days	16 (1998)
	Project Formulation Meeting on Mutational Enhancement for Genetic Diversity in Rice	20	5 days	15 (1999)
	Use of Induced Mutation Technique for Genetic Diversity and Economic Crop Improvement	40	5 days	35 (1999)
	Ornamental Improvement through Gamma Rays Induced Mutation	45	1 day	90 (1999)
	Production of Exotic Ornamentals through Gamma Rays Induced Mutation	40	1 day	260 (2000)
	In vitro Mutagenesis and Molecular Marker Analysis of Ornamental Plants	25	5 days	25 (2000)
	The Use of Gamma Rays for Crop Improvement	20	3 days	20 (2001)
	Production of Exotic Ornamentals through Gamma Rays Induced Mutation	240	1 day	240 (2001)
	Induced Mutation Technique for Genetic Diversity and Economic Crop Improvement-II	20	4 days	16 (2002)

3. Sukhothai Thammathirat Open University

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (year)
Safety	Radiation Protection	120 − 135	5 days	900

Remarks

① Target: Write the training course implemented by nation or private within the range of understanding.

② Field: a) Basic / general nuclear energy
b) Radiation / Radioisotopes Application Technique
c) Nuclear power generation technique
d) Safety (including Radiation Hazard Prevention)
e) Others (Including protection against nuclear materials and International cooperation)

③ Classify according to the table as mach as possible.

④ Cumulative Trainee is acceptable within the range of understanding.

Your notes

A−5. Survey of Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Annual Licensee	Cumulative Licensee	Authorize Institution	Notes
Technician for Radiation Protection	Radiation Protection for Sealed Source		1542 (1990-2002)	OAEP	
Technician for Radiation Protection	Radiation Protection for Sealed Source		283 (1998-2002)	Sukhothai Thammathirat Open University	
Radiation Protection Officer	Radiation Protection for Unsealed Source		1055 (1990-2002)	OAEP	
Engineer for radiographic testing	Radiographic Testing level 1		121 (1989-2002)	OAEP	
Engineer for radiographic testing	Radiographic Testing level 2		52 (1989-2002)	OAEP	
Reactor Operator	Operation of Nuclear Research Reactor		41 (1988-2002)	OAEP	
Irradiation Operator	Operation of Irradiation Plant		25 (1992-2002)	OAEP	

Remarks

① Target: The number of licensees of national certifying examinations in the nuclear field.
② Write other national certifying qualifications if data is available. Write the institutions to certify the qualifications in Notes.
③ Write cumulative licensee if data is available.

Your notes

A−6. Survey of Background Data for Analysis

A−6−1 The number of users of radiation application

Total number of users	Breakdown				Notes
	Research Institution	Medical Institution	Industrial Firms	Others	
FY2002 662 (100%)	143 (21.6%)	114 (17.22%)	278 (41.99%)	127 (19.18%)	As from Oct '01 - Aug'02

Note: The number of users that is approved by the Thai A.E.C. 's Sub-Committee for Issuing Nuclear Material and Its By-product Related Licenses for producing/possessing/using nuclear material and its by-products.

A−6−2 Data of Radiation Diagnosis

A−6−2−1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt machines total
25	26	51

A−6−2−2 Total Number of Brachytherapy Machine

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
-	11	7	8	15

A−6−2−3 Annual new cancer patients in both sexes

63,741

A−6−3 Others (if any)

- The total number of registered crop varieties through mutation.
- Economic scale of nuclear application (Radiation application, Nuclear power generation)
- Scope of Nuclear power generation (The number of operating units, Generating capacity)

Remarks

① Target: These survey data could be useful for further analysis. Write in A-6-3 if you have any other suggestions.

② A-6-2: Refer to attachment 7.

③ Population and GDP will be made a list from national data collectively.

Your notes

A-6-2-3 is based on the latest data in 1993 of National Cancer Institute of Thailand.

A−7. Comments on the Survey

Remarks

① Target of the Survey: Write your opinions and comments;

a) Comprehensive opinion and comment b) Plan for future survey

c) Items for survey d) Others

RADIATION PROTECTION, A KEY TO NUCLEAR TECHNOLOGY DEVELOPMENT

Ms. Warapon WANITSUKSOMBUT
Office of Atomic Energy for Peace,
THAILAND



Introduction

It is realized that the draw back in nuclear technology development causing from public understanding and radiation safety issue. Although nuclear technology is the answer to many useful applications, the reputation is easily destroyed in an incident of fault operation.



Elements needed for radiation protection

- The law and regulation concerning radiation protection
- The personnel involved in the radiation protection.



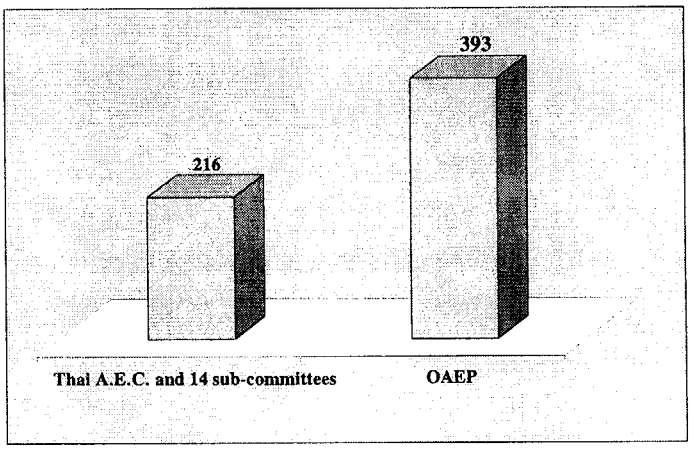
The qualified experts

- radiation control officers,
- medical physicists,
- nuclear medical practitioners,
- radiography technicians,
- nuclear reactor operators,
- irradiator operators, etc.

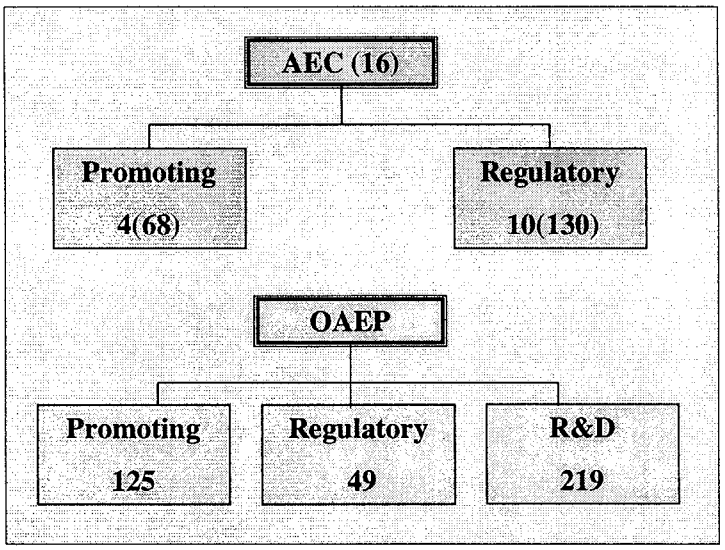


The Basic Data on Human Resources Development in the Nuclear Field in THAILAND

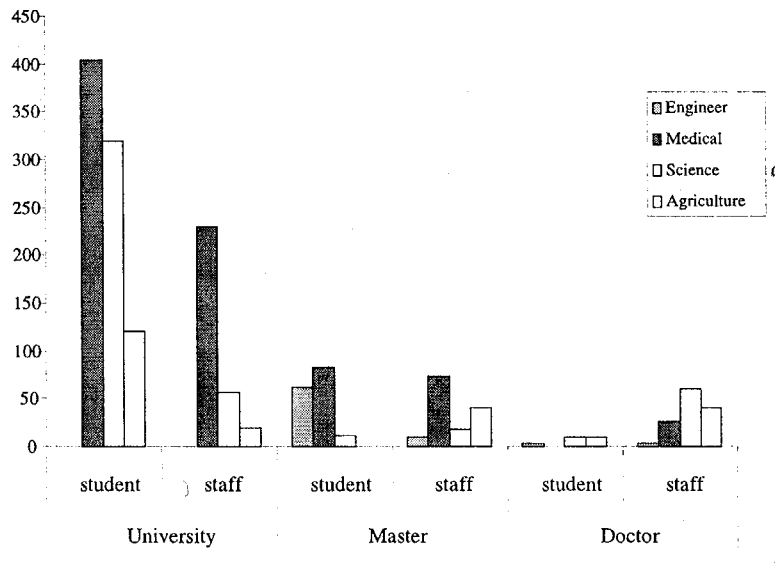
Total number of administrative and technical officials in each agency and institutes



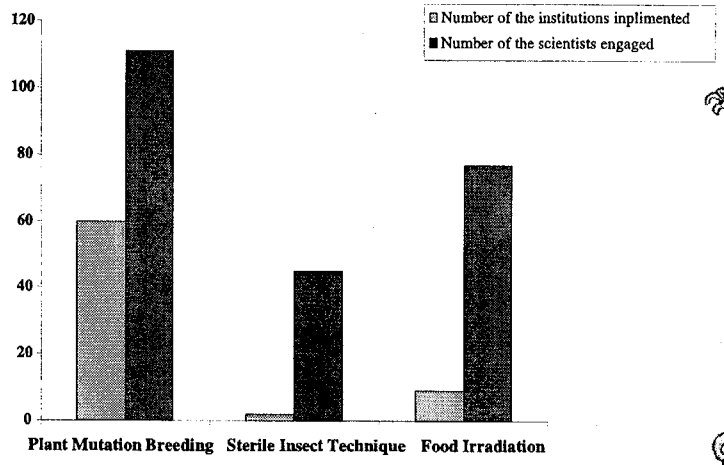
The Number of Personnel Classified by Field in each Agency and Institutes



Survey of University Education Institutions



Survey of Radioisotopes Application
Agricultural Application



Survey of Radioisotopes Application
Medical Application

	Number of the institutions implemented	Number of the radiologists, Oncologists and Medical physicists
Radiation diagnosis	**2235**	**7305**
Radiation Therapy	**26**	**569**

Survey of Nuclear Training Courses
OAEP

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Basic/ general Nuclear Energy	Nuclear Science Youth Club	60	3 days	259 (1998)
	Nuclear Chemistry and Application		10 days	24 (1996)
	Nuclear Energy and Application	50	5 days	463 (1988)
	Introduction to Radiation and Application	60	2 days	363 (1997)

Survey of Nuclear Training Courses
OAEP

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Radiation/ Radioisotopes Application Technique	Radiographic Testing Level 1	30	5 days	235 (1989)
	Radiographic Testing Level 2	20	12 days	83 (1989)
	Foods and Agricultural Products Irradiation	30	5 days	89 (1997)
	OAEP/JAERI Training Course on Nuclear Technology and Its Diverse Applications	20	10 days	59 (1999)
	Applications of Radiotracer Techniques in the Petroleum and Petrochemical Industries	25	5 days	25 (1991)
	Pest Control Using Radiation	40	5 days	123 (1999)

Survey of Nuclear Training Courses
OAEP

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Radiation Protection and specific qualification courses	OAEP/JAERI Training Course on Radiation Protection for Radiation Safety Supervisors	30	10 days	63 (1999)
	Distance Learning on Radiation Protection			10 (1998)
	Emergency Preparedness	30	10 days	50 (1994)
	Introduction to Radiation Protection	50	2 days	235 (1992)
	Irradiator Operator	10	35 days	40 (1992)
	Reactor Operator	15	45 days	52 (1988)
	Radiation Protection Level 1	60	5 days	1668 (1990)
	Radiation Protection Level 2	60	10 days	1110 (1990)



Survey of Nuclear Training Courses
OAEP

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Others (Including protection against nuclear materials and international cooperation)	Radiation Protection for Lighting Preventor	150	2 days	672 (1991)
	Seminar on Nuclear Technology and Science		2 days	1348 (1984)
	Seminar on Nuclear Technology and Advantage for Peace		1 day	96 (1998)



Survey of Nuclear Training Courses

Kasetsart University

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Radiation/Radioisotopes Application Techniques	Induced Mutation Technique for Crop Improvement	20	5 days	16 (1998)
	Project Formulation Meeting on Mutational Enhancement for Genetic Diversity in Rice	20	5 days	15 (1999)
	Use of Induced Mutation Technique for Genetic Diversity and Economic Crop Improvement	40	5 days	35 (1999)
	Ornamental Improvement through Gamma Rays Induced Mutation	45	2 day	90 (1999)



Survey of Nuclear Training Courses

Kasetsart University

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Radiation/Radioisotopes Application Techniques	Production of Exotic Ornamentals through Gamma Rays Induced Mutation	40	1 day	260 (2000)
	In vitro Mutagenesis and Molecular Marker Analysis of Ornamental Plants	25	5 days	25 (2000)
	The Use of Gamma Rays for Crop Improvement	20	3 days	20 (2001)
	Production of Exotic Ornamentals through Gamma Rays Induced Mutation	240	1 day	240 (2001)
	Induced Mutation Technique for Genetic Diversity and Economic Crop Improvement-II	20	4 days	16 (2002)



Survey of Nuclear Training Courses

Sukhothai Thammathirat Open University

Field	Course	Annual Quota of Trainee	Duration	Cumulative Trainee (from year)
Safety (including Radiation Hazard Prevention)	Radiation Protection	120 − 135	5 days	900



Survey of Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Cumulative License	Authorize Institution
Technician for Radiation Protection	Radiation Protection for Sealed Source	1542 (1990-2002)	OAEP
Technician for Radiation Protection	Radiation Protection for Sealed Source	283 (1998-2002)	Sukhothai Thammathirat Open University
Radiation Protection Officer	Radiation Protection for Unsealed Source	1055 (1990-2002)	OAEP
Engineer for radiographic testing	Radiographic Testing level 1	121 (1989-2002)	OAEP
Engineer for radiographic testing	Radiographic Testing level 2	52 (1989-2002)	OAEP
Reactor Operator Operation of	Nuclear Research Reactor	41 (1988-2002)	OAEP
Irradiation Operator	Operation of Irradiation Plant	25 (1992-2002)	OAEP



Survey of Background Data for Analysis
The number of users of radiation application

Total number of users	Breakdown				Notes
	Research Institution	Medical Institution	Industrial Firms	Others	
Fy2002 662 (100%)	143 (21.6%)	114 (17.22%)	278 (41.99%)	127 (19.18%)	As from Oct'01 – Aug'02

Data of Radiation Diagnosis
Total number of Megavoltage Teletherapy Machines

Cobalt	Accelerator	Megavolt machines total
25	26	51

Total number of Brachytherapy Machines

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
-	11	7	8	15

Annual new cancer patients in both sexes 63,741

Training Materials

- the material should include exercise, experience in radiation measurement, contamination detection and radiation control.
- the materials should be allowed to translate into each member country's language.



Information Exchange and Technical Assistance

The information exchange as well as technical assistance in FNCA program has given opportunity to Thailand to develop its manpower through the program.



Thank you



1.5.7 Vietnam

Vu Dang Ninh
Vietnam Atomic Energy Commission (VAEC)

I. ON SUBJECTS FOR DEVELOPMENT OF NUCLEAR TRAINING TECHNOLOGY

1. Training materials in radiation protection area to be used in member countries

It was reported by the Vietnamese delegation last year on the 3-rd Workshop on Human Resources Development in the Nuclear Field in Korea, that NuTEC/JAERI helped VAEC to carry out the Joint Training Courses on "Radiation Protection" and "Radiation Measurement". (The similar projects have been started before in Indonesia and Thailand). Materials used for the courses are highly appreciated by specialists in Vietnam and we would like to recommend them to be used in all FNCA member countries.

They are 9 lectures and 9 experiments for the "Radiation Protection" course, and 12/9 accordingly for the "Radiation Measurement" course as the followings

"Radiation Protection" - lectures

- Interaction of Radiation with Matter
- Dosimetric Quantities and Units
- Biological Effects of Radiation
- International Radiation Protection and Safety Standards
- Safe Handling of Radiation and Radioisotopes
- Radiation Measurement
- Operational Radiation Monitoring
- Decontamination and Waste Management
- Radiological Accident Management

"Radiation Protection" - experiments

- Radiation Type and Survey Meters
- Gas Monitoring
- Dosimetry of γ-ray Field and Environmental γ-ray Measurement
- γ-Ray Spectrometry
- Measurement of γ-ray Attenuation in Matter
- Shielding Design
- Surface Monitoring and Decontamination
- Measurement of Radioactivity in Aerial Particulates
- Personal Dosimetry Techniques (TLD)

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- Interaction of Radiation with Matter
- Radiation Measurement
- Introduction to Radiation Protection
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- Introduction to Liquid Scintillation Counting
- Analysis Techniques of Environmental Radioactivity
- Radiochemistry
- Neutron Activation Analysis

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- Preparation of Chemical Experiments
- X-ray Fluorescence Analysis
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- Compton Scattering
- Determination of Maximum Energy of β-Ray
- γ-Ray Spectrometry (NaI)
- Neutron Activation Analysis
- α-Ray Spectrometry
- Liquid Scintillation Counting

2. Introduction of e-learning system

VAEC is actively preparing for e-learning on nuclear technology in our country, and we would like to support an idea on e-learning system for all member countries. From our experience we learned that e-learning needs great efforts and huge preparation works. Therefore, it could be more reasonable to cooperate for achieving common aims. However, there exist different understanding of e-learning in the member countries. For instance, Korea imagines it as a very modern environment with up-to-date telecommunication equipment; meanwhile, Vietnam tries to make something like digital lectures. Our colleagues made Web pages for self-training where participants can read text, see picture and video, do exercises and test themselves.

II. INVESTIGATION OF BASIC DATA ON HUMAN RESOURCE AND HUMAN RESOURCE DEVELOPMENT IN NUCLEAR FIELD

Highly appreciated the proposal at the 3-rd FNCA Coordinators Meeting last March, but due to technical difficulties (there are too many related institutions and organizations belonged to different ministries and

located far along the country) at present, VAEC only has investigation data of itself. The final data of all country will be received some months later. Following are data on staff of VAEC

As of August 15, 2002

No	Sub-institution	Total	Academic degrees			Titles		Fields of research			
			University Degree	Master	PhD	Prof	Prof Assistants	Physicists	Chemists	Biologists	Others
1	Headquarters	36	21	1	7	2	0	9	6	0	14
2	INST	100	51	9	19	0	3	62	6	3	8
3	ITRRE	149	99	6	14	0	3	7	101	0	11
4	NRI	150	70	19	6	0	3	49	33	11	2
5	CNT	39	23	1	9	0	2	19	4	8	2
6	CRT	18	12	1	2	0	0	6	3	2	4
	Total *)	492	276	37	57	2	11	152	153	24.	41

*) Except 95 young contracted researchers.

Abbreviations: INST = Institute for Nuclear Science and Technique; ITRRE = Institute for Technology of Radiation and Rare Elements; NRI = Nuclear Research Institute; CNT = Center for Nuclear Techniques in Ho Chi Minh City; CRT = R&D Center for Radiation Technology

III. INFORMATION EXCHANGE

1. Studies on nuclear power development in Vietnam

May 2001, the Primary Minister issued order on pre-feasibility study project for the first nuclear power plant in Vietnam.

March 2002, the Primary Minister issued order on establishment a Steering Committee for P/F study project headed by the Minister of Industry and Sub-headed by the Deputy Minister of Science and Technology.

July 2002, the Primary Minister requested VAEC to carry out studies on seven major objectives advising the Government on the final decision. They are the followings

- Planning on Introduction of the first NPP into Vietnam
- NPP Technology
- Radiation Protection
- Radiation Waste Processing and Management
- Human Resource Development
- Research on Fuel Processing and Radiation Deposit
- Policy and necessary measures guaranteeing success of the National Nuclear Power Program

Human Resource Development Objective is one of them.

2. Long-term program for HRD in nuclear and related fields

In the coming period of 2002-2003, VAEC has to prepare a long-term program for HRD in the nuclear and related fields.

Subjects of the long-term program for HRD is proposed to include the followings

- Investigation of basic data on Human Resource and Human Resource Development in nuclear and related fields in Vietnam;
- Study on need of Human Resource and Human Resource Development for the National Nuclear Power Development Program including regulatory, R&D, education and training, project implementation and industrial utilities up to years 2010, 2015, 2020 and 2030;
- Planning for education and training; coordinating and sharing responsibilities of all related organizations and institutions to guarantee human resource for success of the National Nuclear Power Development Program; recommending necessary approaches and policies to the Government.

3. *Training courses*

There were three training courses in the field of radiation protection carried out at VAEC

- TC on "Radiation Measurement" in cooperation with NuTEC/JAERI, 2 weeks, 20 participants, December 2001
- TC on "Radiation Protection" in cooperation with NuTEC/JAERI, 2 weeks, 20 participants, January 2002
- TC on "Inspection and Permission of X-ray activities" in cooperation with the Vietnam Radiation Protection and Nuclear Safety Authority (VRPA), 1 week, 90 participants from provinces and cities, August 2002

4. *On MEXT Scientist Exchange Program*

In 2001, 9 Vietnamese researchers (87 months totally) have been accepted for MEXT study in Japan and 5 Japanese Scientists paid visit to Vietnam. In 2002, according numbers are 5 and 2.

The Program is very useful for Vietnam and using this opportunity we would like to express our sincere thanks to the Government and People of Japan for highly appreciated help.

In addition to the mentioned we would like to ask MEXT Scientist Exchange Program to pay attention on University Education for the member countries. In case of Vietnam: we would like to emphasize that personnel rejuvenation is urgent duty at VAEC, because our average personnel age reaches

47, and we will be lacking of leading experts after very few years. Therefore, at present, long-term education and training (master's degree / doctor's degree) is the most important for Vietnam. We suggest that MEXT could support Vietnam with 5 fellows for master degree study and 2 - for doctor degree research per year.

IV. CONCLUSION

At the end, we would like to have the following conclusions

- Self-reliance is the most important point in design and implementation of a long-term program for Human Resource Development;
- Support and cooperation of nuclear-developed countries and IAEA is an extremely important factor;
- And strong intention of Government to go on nuclear is indispensable and decisive engine for success of the National Nuclear Power Development Program in general and HRD particularly.

Answer Sheet for 'The Plan for Survey of the Basic Data on Human Resources Development in the Nuclear Field in FNCA Member Countries'

Vietnam

A-1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

Country	The number of personnel in Nuclear Administration							The number of Personnel in R&D			Total	Notes
	Promoting			Regulatory			Total	Radiation Application	Nuclear Power Generation	Total		
	R&D Radiation Application	Nuclear Power Generation	Total	R&D Radiation Application	Nuclear Power Generation	Total						
Vietnam				8		8	8	492		492	500	

A-2-1. Survey of University Education Institutions

Country	University			Graduate School (Master)			Graduate School (Doctor)			Number of Univ.	Total		Notes
	Number	Number of Student	Number of Staff	Number	Number of Student	Number of Staff	Number	Number of Student	Number of Staff		Number of Student	Number of Staff	
Vietnam	4	1,900	150	3	34	122	4	20	136	4	1,954	-	

A-2-2. Specialized School for Development of Technical Engineer

Country	Medical Radiation Technical Engineers Training School		Other Field (if there is any)		Notes
	Number of School	Number of Students	Number of School	Number of Students	
Vietnam	None	None	None	None	

A-3. Survey of Radiation and Radioisotopes Application
A-3-1. Agricultural Application

Country	Plant Mutation Breeding		Sterile Insect Technique		Food Irradiation		Notes
	Number of the institutions implemented	Number of the scientists engaged	Number of the institutions implemented	Number of the scientists engaged	Number of the institutions implemented	Number of the scientists engaged	
Vietnam	Checking	Checking	Checking	Checking	Checking	Checking	

A-3-2. Medical Application A-3-3. Other field

Country	Medical Application-Radiation Oncology			Other field		Notes
	Number of the implemented institutions	Number of the radiation oncologists	Number of the therapeutic technicians	Number of the implemented institutions	Number of engaged scientist	
Vietnam	739	2,010	50	65	494	

A-4. Survey of Nuclear Training Courses-----a) Summery

Country	The number of courses	The number of implement Institutions	Total number of Annual quota of Trainee	Total number of Cumulative Trainee	Notes
Vietnam	36	2	230	1,188	VAEC, MOST (5 years)

A-4. Survey of Nuclear Training Courses-----b) The number of Courses

Country	The number of Nuclear Training Courses						Notes
	A Basic/General Nuclear Energy	B Radiation/Radioisotopes Application Technique	C Nuclear Power Generation Technique	D Safety (including Radiation Hazard Prevention)	E Others (including protection against nuclear materials and International cooperation	Total	
Vietnam		4		30	2	36	1996-2001

A-4. Survey of Nuclear Training Courses--- c) The number of Trainee

Country	The number of Trainee (Annual quota of trainee/cumulative trainee)						Notes
	Basic/General Nuclear Energy	Radiation/Radioisotopes Application Technique	Nuclear Power Generation Technique	Safety (including Radiation Hazard Prevention)	Others (including protection against nuclear materials and International cooperation	Total	
Vietnam		-/108		200/2,010	-/59		1996-2001

A-5. Survey of Licensees of National Examinations Related to Nuclear Technology

Country	The number of Qualification			The number of Annual Licensees			Cumulative Licensees			Notes
	National	Other	Total	National	Other	Total	National	Other	Total	
Vietnam				33			406		406	1990-9/2002

A-6. Survey of Background Data for Analysis
A-6-1. The number of users of radiation application

Country	Breakdown						Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	Total	
Vietnam	492 (17%)	2,010 (68%)	150(5%)	257 (8%)	65 (2%)	2,974	

A-6-2. Radiation Therapy

Country	Total number of megavoltage teletherapy machine			Total number of brachytherapy machine						Number of annual new cancer patients in both sexes
	Cobalt	Accelerator	Total	Manual LDR	Auto Remote LDR	HDR			Total number of the potentially treatable capacity: brtx-cap (note)	
						CoHDR	IrHDR	HDR Total		
Vietnam	7	1	8	7		1	2	3	2,000	

A-6. Survey of Background Data for Analysis
A-6-3. Others

Country	Population (Thousand)	GDP (UD$ Million)	GDP per capital (US$)	Scope of Nuclear Power Generation (The number of operating units, Generating capacity)	Economic Scale of Nuclear Application (Radiation application, Nuclear power generation)	Notes
Vietnam	79,175	134,800	373			

A-1. The Administrative Agencies and National Research and Development (R&D) Institutes

Country	Agency/Institutes		Role	Total	Notes
Vietnam	1	Vietnam Radiation Protection and Nuclear Safety Authority (VRPA)	Regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials, Inspection and Licensing for Radiation Protection.	8	
	2	Vietnam Atomic Energy Commission (VAEC)	R&D Institute	492	

A-4. Survey of Nuclear Training Courses

Country	Field	Course	Objective	Implement Institute	Annual quota of Trainee	Duration	Cumulative Trainee
Vietnam	Radiation Safety			VAEC	200	5 days	2010 (5 years)
		RTC on the use of Immunoassay Technologies for studies on Diagnosis & Control of Foot and Mouth Disease in south Asia,		VAEC	23		23 (1996)
		National TC on Concepts and Principals of RIA/Data Processing, Internal Quality Control & External quality assessment Scheme		VAEC	42		42 (1997)
		Regional Training Course on Standard Software for Tracer Applications and Nucleonic Gauge Design and Calibration"		VAEC	15		15 (2000)
		RTC Web Site Construction and Management		VAEC	17		17 (2000)
		RTC on "SPECT Techniques in Cardiology and Oncology"		VAEC	26		26 (2000)
		TC on Radiation Treatment for Natural Polysaccharides		VAEC	24		24 (2000)

COUNTRY REPORT

On the 4-th Workshop on Human Resources Development in the Nuclear Field

8-10 October 2002, the Philippines

By **Vu Dang Ninh**

Vietnam Atomic Energy Commission (VAEC)

1

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- Surface Monitoring and Decontamination
- Measurement of Radioactivity in Aerial Particulates
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- **Research on Fuel Processing and Radiation Deposit**
- **Policy and necessary measures guaranteeing success of the National Nuclear Power Program**

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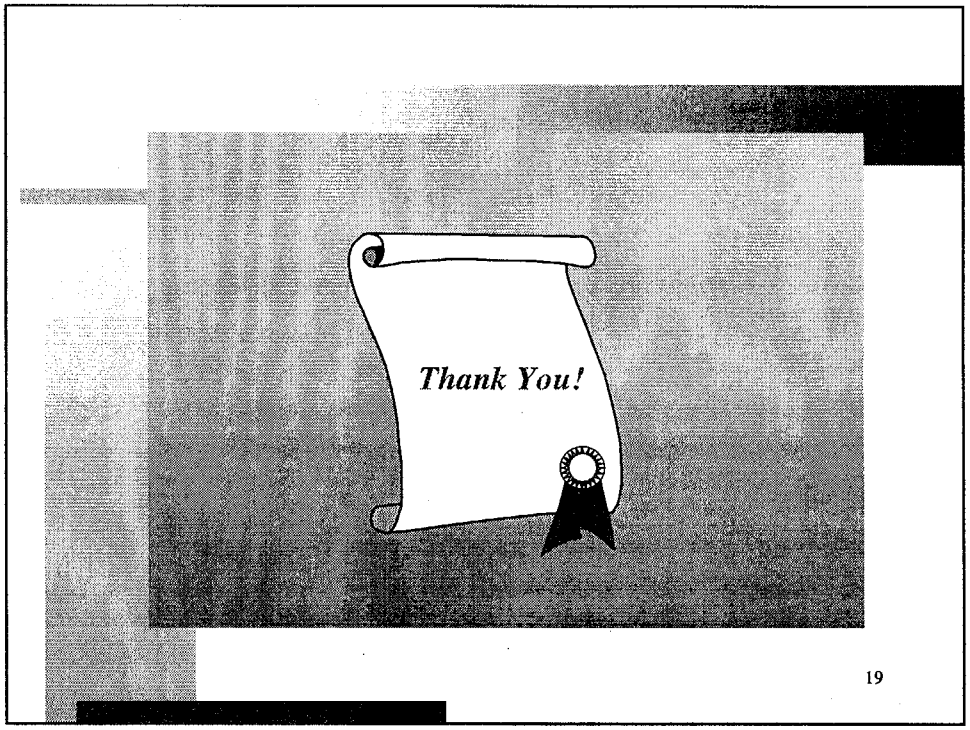
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Thank You!
19

1.5.8 Japan

Yasushi Seki and Kiyoshi Kato
Nuclear Technology and Education Center
Japan Atomic Energy Research Institute
http://nutec.tokai.jaeri.go.jp/panfu/english.htm

In this report, the recent topics in the nuclear field and related human resources development (HRD) in Japan and the comments on the items proposed for discussion in the 4th FNCA HRD Workshop are presented.

1. Recent topics in the nuclear field and related Human Resources Development (HRD)

In November 2001, a pipe rupture incident occurred in the pipe of the residual Heat Removal System in Hamaoka-1 BWR NPP in central part of Japan. The incident was evaluated to be caused by the combustion of non condensable gases (NCGs), hydrogen and oxygen gases accumulated in the top of the piping. In addition, a coolant leakage through a crack in the control rod casing was discovered.

In August 2002, when the largest electric power company in Japan, the Tokyo Electric Power Company was about to obtain consent from the local government to use the mixed U-Pu oxide (MOX) fuel in NPPs, falsified self-inspection data of BWR reactor components such as core shroud were disclosed. The disclosure lead to the resignation of the top of the company and indefinite delay of the consent by the local government regarding the use of MOX fuel. This incident is another huge setback for the promotion of nuclear power in Japan.

The Japan Atomic Energy Research Institute (JAERI) and the Japan Nuclear Fuel Cycle Cooperation (JNC) are scheduled to be unified to form an Independent Administrative Corporation in 2005. The Fundamental Report of the Unification was opened to the public on August 5. In the report, the Human Resources Development (HRD) in Nuclear Field is considered to be one of the important missions of the new unified Independent Administrative Corporation. The report urges the new Corporation to have closer cooperation with the universities and industries in the HRD mission. Preceding the unification in 2005, the unification of training courses on Nuclear Emergency conducted by JAERI and JNC will start next year based on the Support and Training Center of the Off-Site Center in Hitachinaka city.

2. Development of training material in radiation protection area to be used commonly in member countries.

In the minutes on the 2001 FNCA Workshop on Human Resources Development, one of the action items for FY 2002 is to develop training material in radiation protection area to be used commonly in member countries. Although we have investigated the training material in radiation protection area, it is still not clear which level and what specific area is missing and needed. Based on the result of the investigations of such material in each country and those provided by the IAEA, more discussion is needed

to clarify the specification and the need.

3. Introduction of e-learning system as the development subject of nuclear training technology.

The subject / needs has been proposed by Malaysia and Korea. It is newly proposed to be examined in the Workshop in connection with "Asian Institute of Nuclear Science and Technology (AINST)" proposed by Indonesia, "International Nuclear University (INU)" proposed by Korea, and "Asian Nuclear Safety Network (ANSN)" recently proposed by the IAEA. In this age of internet, the possibility of introducing e-learning system to promote HRD in nuclear field should be considered.

4. Investigation of basic data on Human Resources and Human Resources Development in nuclear field in member countries

It has been proposed at the Third FNCA Coordinators Meeting last March that the Human Resources Development Project should investigate the basic data on HRD in nuclear field in member countries. The request has been sent to the FNCA Coordinators and the HRD Project Leaders of member states and the result of the investigation are presented at this meeting. In the 4th HRD Workshop, it should be discussed how the collected basic data could be utilized for the formulation of HRD strategy.

Some of the results of the basic data investigation for Japan are shown in Table 1(1) and (2). The government administrative institutions in nuclear field have been restructured in January 2001 and the number of personnel in the respective institutions are shown in Table 1(1). The Cabinet Office is in charge of planning, deliberation and decision of general nuclear policy. The Ministry of Economy, Trade and Industry (METI) is in charge of nuclear power administration. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) is in charge of administration of all nuclear science and technology other than nuclear power. The number of persons engaged in promotion is 114 while the number engaged in regulatory and control is 541.

The number of personnel in three major national and semi-national research and development (R&D) institutions in the field of nuclear science and technology are shown in Table 1(2). They are the Japan Atomic Energy Research Institute (JAERI), the Japan Nuclear Fuel Cycle Corporation (JNC) and the National Institute of Radiological Sciences (NIRS). There are other R&D institutions in nuclear field besides the three but are not given in the table.

5. International Training Courses in Japan for FY2002

Review of the International HRD program for Nuclear Science and Technology under the sponsorship of MEXT, i.e. MEXT Nuclear Researchers Exchange Program, Seminar for Nuclear Administrators, International Seminar on Nuclear Safety, International Training Program for Atomic Energy Safety Technology and Nuclear Safety Expert Dispatching Program are being carried out. The MEXT Nuclear Researchers Exchange Program has been conducted for 17 years since it was started in FY1985. The program is presently being reexamined to adjust to the changing needs. The Table 2 on the International Training Courses in Japan in FY2002 is attached.

Table 1 Government Administrative Institution and Research and Development Institution

(1) Government Administrative Institution in Nuclear Filed in Japan

(Unit: Person)

		Planning, Deliberation, and Decision on General Nuclear Policy	Nuclear Administration of Nuclear and Technology	Nuclear Administration of Energy	Total
		Cabinet Office	Ministry of Education, Culture, Sports, Science and Technology (MEXT)	Ministry of Economy, Trade and Industry (METI)	
Promotion of Nuclear Energy		Atomic Energy Commission	Research Promotion Bureau (10 person) Research and Development Bureau (25 person)	Agency of Natural Resources and Energy	
Subtotal	committee	5	35	55	114
	secretary	19			
	Technical Counselor				
Nuclear Regulation		Nuclear Safety Commission	Science and Technology Policy Bureau	Nuclear and Industrial Safety Agency	
Subtotal	committee	5	90	346	541
	secretary	59			
	Technical Counselor	41			
Total		129	125	401	655

(2) Research and Development Institution

(Unit: Person)

	Staff (approved in FY2002)				Total
	Researcher	Engineer	Teacher	Clerk	
Japan Atomic Energy Research Institute	**1,108**	**590**	**164**	**401**	**2,263**
Headquarters	107	60	52	196	415
Tokai Research Establishment	429	358	72	96	955
Naka Fusion Research Establishment	244	34	11	25	314
Takasaki Radiation Chemistry Research Establishment	85	25	7	23	140
Kansai Research Establishment	94	8	0	16	118
Oarai Research Establishment	147	97	10	35	289
Mutsu Establishment	2	8	12	10	32
Japan Nuclear Cycle Development Corporation	**715**	**1,272**	−	**358**	**2,345**
Head Office	21	125	−	126	272
Tsuruga Head Office	26	37	−	51	114
Fugen Nuclear Power Station	6	118	−	8	132
Monju Construction Office	0	163	−	10	173
Tokai Works	337	630	−	74	1,041
O−aria Engineering Center	246	126	−	39	411
Ningyo−toge Environmental Engineering Center	27	54	−	17	98
Tono Geoscience Center	46	14	−	14	74
Tokyo Office	0	2	−	10	12
Horonobe Underground Research Center	6	3	−	9	18
National Institute of Radiological Sciences (NIRS)	**187**	**73**			**376**

Table 2 International Training Courses in Japan for Asian Countries

Sponsor	Training Course	Host	Purpose	Duration & Participants	Total number of participants up to 2001
MEXT	A. Intl. Seminar of Nuclear Safety	RADA			522 (239 from Asian countries)
	(1) Course on Safety Analysis (1998~)		To provide technologies of safety design and analysis for various kinds of nuclear facilities.	2 weeks, 10	56
	(2) Course on Facility Management (2002~)		To provide nuclear safety administration and regulation, operation and maintenance of nuclear facilities, emergency preparedness and safety training of employees.	2 weeks, 10	
	(3) Course on Radiation Application (2002~)		To provide administration and regulation in radiation applications as well as their application technologies	2 weeks, 10	
	(4) Course on Nuclear Administration (2002~)		To provide wide knowledge for nuclear administration such as reactor R&D project, safety concepts in design, construction and operation, radioactive waste management, radiation application and public acceptance.	1 week, 10	
	(5) Course on Dissemination of Nuclear Knowledge (2002~)		To provide effective methods for dissemination of nuclear and radiation knowledge, concentrating in tools, practices and lectures for school education.	1 week, 5	

Sponsor	Training Course	Host	Purpose	Duration & Participants	Total number of participants up to 2001
	B. Intl. Atomic Energy Safety Technology Training Project	NuTEC, JAERI			
	(1) Bilateral Joint Training Course (JTC)		To enhance technical skills and safety culture by independence of nuclear training administration		
	1)JTC at BATAN			2 weeks, 20/course	
	• Radiation Protection Course (1997~)				91
	• Radiation Measurement and Nuclear Spectroscopy Course (1997~)				97
	2)JTC at OAEP			2 weeks, 20/course	
	• Radiation Protection Course (1998~)				78
	• Nuclear Technology and Application Course (1998~)				77
	3)JTC at VAEC			2weeks, 20/course	
	• Radiation Protection Course (2001~)				20
	• Radiation Measurement and Nuclear Spectroscopy Course (2001~)				20
	(2) Instructor Training Program (ITP)		To enhance technical skills and safety culture by independence of nuclear training administration	2 months, 1~2/country	22
	(3) Safeguards Training Course (1996~)		To provide IAEA safeguards & particular techniques	3 weeks, 16/course	88
	C. Seminar for Nuclear Administrators (1987~)	JAIF	To introduce Japanese experience and to exchange their experience and opinion among the participating countries in nuclear energy development and utilization for middle-level or high-level administrators	About 10 days, About 10 persons	130

Sponsor	Training Course	Host	Purpose	Duration & Participants	Total number of participants up to 2001
MEXT	D. Nuclear Safety Experts Dispatching Program (in Asian region) (1995~)	NSRA			
	(1) Long-term program		To improve nuclear safety systems through exchange of technical knowledge	1.2~4 months/ person/ country	8
	(2) Short-term program		To discuss on the specified topics with experts from various organizations	1 week, 1~6	34
	E. The Nuclear Researchers Exchange Program Between Neighboring Countries (1985~)	JAERI JNC NIRS NIMS JCAC AIST	To invite foreign researchers at national nuclear institutes in Japan and to dispatch Japanese researchers to foreign countries for joint study on related subjects	Invitation: 2 months~ 1 year, Maximum dispatch: 2 months	Invitation : 1,166 Dispatch: 577
METI	F. Intl. Invitation Program for Safety Management at NPPs (1992~2001)*1	JEPIC	To enhance nuclear safety of NPPs	15 courses/y 16~30 days/ course, 6~12/course	
	(1) Administrators Course				
	(2) Managers and Supervisors Course				
	(3) Maintenance Personnel Course				
	(4) Seismic Designers Course				
	G. Long-term Training Course on Safety Regulation and Safety Analysis/Inspection (1996~)*2	Nuclear Power Engi-neering Corpora-tion	To learn various requirements for the establishment of safety regulations, standards, criteria, etc. from lectures about general safety regulations for nuclear power generation in Japan and OJT for safety analysis/inspection for the staffs of nuclear regulatory authority of Chinese and Indonesian government.	2~3 months, 4~8	41
	(1) Safety Regulation and Safety Analysis Course				
	(2) Safety Regulation and Inspection Course				

*1 1,000-personel-training course is concluded in FY2001 (Total participants: 1,042). New training course (5-year-plan) is for Russia, Eastern European and Asian countries.

*2 There is a plan for changing Participating countries from FY2003.

Sponsor	Training Course	Host	Purpose	Duration & Participants	Total number of participants up to 2001
JICA	H. Training Courses in the Nuclear Field				
	(1) Nuclear Technology (1985~)*3	NuTEC Tokyo	To acquire Radioisotope and Radiation handling skill	1.5 months, 6~10	149
	1) A Group				
	2) B Group	NuTEC Tokai	To Acquirer Nuclear Reactor engineering skill		
	(2) Nuclear Power Generation Basic (1985~)	JEPIC JAPC	To improve planning, design, construction, operation and safety measures of NPP	2 months, 5~7	95
	(3) Seminar on Nuclear Safety and Regulation (1987~)	JAIF	To enhance nuclear safety and regulation in general for safety control of radiation	1 month, 5~10	102
	(4) Environmental Radioactivity analysis and Measurement (1990~)	JCAC	To acquire practical knowledge of environmental radioactivity analysis and measurement	1 month, 4~6	61
	(5) Human-Radiation Interface; Application and Safety of Radiation in Medical, Biological, and Environmental Sciences.	NIRS	To acquire knowledge on Human- Radiation relationship in view of medical, biological and environmental sciences	1 month, 8~9/2years (in 2002, Nuclear medicine course is planned for 1 month for 8 students)	23

Sponsor	Training Course	Host	Purpose	Duration & Participants	Total number of participants up to 2001
IAEA / RCA	I. Enhancement and Harmonization of Radiation Protection RAS/9/018 (1992~)	NIRS JAERI Tokai JNC	To acquire knowledge and techniques required in the radiation protection	In FY2002, 1 week, 25 participants (by JAERI and JNC)	
	J-1.Nuclear Medicine Application (RCA) (RAS/6/028) (1997~)	NIRS	To acquire knowledge and techniques in nuclear medicine	FY 2002, 1 week, 20 participants	
	J-2.LDR and HRDR Brachytherapy in Treating Cervical Cancer (RAS/6/035) (2001~)	Gunma Uni. and NIRS	To acquire knowledge and techniques in radiotherapy of uterine cervical cancer	In FY2002, 1 week, 18 participants (RCA trainings in medicine J1 and J2 are not planned every year.)	20
	K. On the Job Training on Radiation Processing (1978~)	TRCRE	To acquire knowledge and techniques required in the radiation processing	MEXT: 6~12 months, 10~15 Bilateral:1~12 months, 3~5 RCA/IAEA: 1~2 weeks, 2~5	
MEXT	L. Graduate Course in Dept. of Nuclear Engineering (1) General Graduate Course (2) Intl. Graduate Course	Tokyo Institute of Technology	To acquire fundamental knowledge of Nuclear Engineering and to master professional ability		

*3 It is discontinued from FY2002.

Sponsor	Training Course	Host	Purpose	Duration & Participants	Total number of participants up to 2001
Japan Society for the Promotion of Science	M. Graduate School Educations (1) Invitation Fellowships for Research in Japan (Requirement: To hold a doctorate degree, which must have been received within six years) (2) Post Doctoral Fellowships for Foreign Researchers (Requirement: To hold a doctorate degree, which must have been received within six years) (3) Ronpaku (Dissertation Ph.D) Program (Requirement: To have excellent research activities)	Tokyo Institute of Technology	Short-term: To exchange scientific and technical information Long-term: To develop excellent professors and researchers through cooperative research To develop young excellent professors and researchers through cooperative research To get a doctoral degree through the dissertation research Period Up to five years	14~60 days 6~10 months 12~24 months Up to five years The Rnpaku fellow makes one visit of up to 90 days per year	

ETL: Electrochemical Laboratory

JAERI: Japan Atomic Energy Research Institute

JAIF: Japan Atomic Industrial Forum, Inc.

JAPC: The Japan Atomic Power Company

JCAC: Japan Chemical Analysis Center

JEPIC: Japan Electric Power Information Center, Inc.

JICA: The Japan International Cooperation Agency

JNC: Japan Nuclear Cycle Development Corporation

MEXT: Ministry of Education, Culture, Sports, Science and Technology

MITI: Ministry of International Trade and Industry

NIRS: National Institute of Radiological Sciences

NRIM: National Research Institute for Metals

NSRA: Nuclear Safety Research Association

NuTEC: Nuclear Technology and Education Center

RADA: Radiation Application Development Association

TRCRE: Takasaki Radiation Chemistry Research Establishment

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Attachment

Survey of the Basic Data on Human Resources Development in the Nuclear Field in Japan

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A−1. The Administrative Agencies and National Research and Development (R&D) Institutes

A−1−1 Total number of administrative and technical officials in each agency and institutes

Agency / Institutes	Role	Total	Notes
Cabinet Office	Administrative Agency: Planning, deliberation, and decision of nuclear policy in general	129	
Ministry of Education, Culture, Sports, Science and Technology (MEXT)	Administrative Agency: Nuclear administration of scientific technique	125	
Ministry of Economy, Trade and Industry (METI)	Administrative Agency: Nuclear administration of energy	401	
Japan Atomic Energy Research Institute (JAERI)	R&D Institute: Synthetic research and training for engineer	2,263	
Japan Nuclear Fuel Cycle Development Institute (JNC)	R&D Institute: Research development of nuclear cycle development	2,345	
National Institute of Radiological Sciences (NIRS)	R&D Institute: Research on radiation effects on human body and prevention, medical application of radioisotopes and radiation, effects on living environment, and human resources development	376	

Remarks

① Target agency and institutes
- National agency and institutes

② The number of staff members:
- Count only regular employees.
- Indirect category (driver, guard, and staff in dinning hall and clinic, etc.) should not be included. Explanatory note should be needed if your data has been included these staff members.

Your notes

① We have the Ministry of Land, Infrastructure and Transport in Japan as an administrative agency in charge of radioactive material transportation. However, it is omitted in this Japanese data.

② As to Research institutes we listed those that is engaged in only principal institutes.

A－1－2　The Number of Personnel Classified by Field in each Agency and Institutes (Breakdown table of A－1－1)

Agency / Institutes	Nuclear Administration				R&D		Total	Notes
	Promoting		Regulatory					
	R&D / Radiation Application	Nuclear power generation	R&D / Radiation Application	Nuclear power generation	Radiation Application	Nuclear power generation		
Cabinet Office	24		105		–	–	129	
MEXT	35		90		–	–	125	
METI	–	55	–	346	–	–	401	
Subtotal	114		541				655	
JAERI	–	–	–	–	2,263		2,263	
JNC	–	–	–	–	–	2,345	2,345	
NIRS	–	–	–	–	376	–	376	
Subtotal	0		0		4,984		4,984	

Remarks

① This table is a breakdown of A-1-1 and is to be filled in as much as you know.
② Write in the middle if the classification is not clear.
③ Attach the detailed data of each institution if available.　The detailed table is acceptable as the substitution of this table.

Your notes

① Cabinet Office: The number of personnel for promoting is the Nuclear energy committee, and that for regulatory is that of the Atomic Safety Committee and their secretaries.
② Refer to Reference A-1　Administrative Government and Government Research Development Institution.

A－2. University Education Institutions

A－2－1 University Course

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
Hokkaido Uni.	National	119	–	1967	61	–	1996	12	30	1996	Faculty belong to graduate school
Tohoku Uni.	National	98	–	1996	75	–	1996	38	24	1996	Faculty belong to graduate school
The Uni. of Tokyo	National	370	–	2000	96	–	1993	38	23	1993	Faculty belong to graduate school
Tokyo Institute of Technology	National	–	–	–	48	–	1957	43	20	1957	Faculty belong to graduate school
Nagoya Uni.	National	844	2	1987	41	–	1966	12	12	1966	Faculty belong to graduate school
Kyoto Uni.	National	476	–	1994	42	–	1957	14	15	1957	Faculty belong to graduate school
Osaka Uni.	National	144	–	1996	45	–	1957	24	14	1957	Faculty belong to graduate school
Kyushu Uni.	National	413	–	1998	55	–	1998	34	33	1998	Faculty belong to graduate school
Kinki Uni.	Private	276	11	1961	–	–	–	–	–	–	Faculty belong to graduate school
Tokai Uni.	Private	231	10	1971	33	–	1963	6	13	1963	Faculty belong to graduate school
Musashi Institute of Technology	Private	–	–	–	46	17	1981	–	–	–	
Kobe Uni. Of Mercantile Marine	National	147	–	1990	29	11	1994	–	–	–	Faculty belong to graduate school
Total		3,118	23	–	571	28	–	221	184	–	

Remarks

① Target: University to educate nuclear energy (School of Engineering).

② Fill in the applicable space for University, Graduate School (Master), and Graduate School (Doctor), respectively.

③ The number of student: Registered student or quota (Registered student is preferable for Graduate School.). (Specify which number of personnel is shown in the table in Notes)

④ The number of staff: Staff for education (Sample in Japan: Total of Professor, Assistant professor, Lecturer and Assistant). Write total number and classify if staff holds the both posts of school and graduate school.

Your notes

① Notes 1: The number of staff indicates masters and doctors of graduate school in all.
② Established Year: The year indicates the year of establishment of the original faculty. (Recently universities and schools of engineering of national universities are changed their names from nuclear engineering due to reorganization.)
③ Refer to Reference A-2 University Education Institutions (1) and (2)

A−2−2 Specialized School for Development of Technical Engineer

A−2−2−1 Medical Radiation Technical Engineers Training School

Number of School	Annual Trainee	Breakdown of School		Notes
39	2,122	National Uni.	5	Notes 1
		Prefectural Uni.	8	
		National Junior College	6	
		Prefectural Junior College	1	
		Private Junior College	4	
		Private Vocational College	15	

A−2−2−2 Other Field (if there is any)

Field	Number of School	Annual Trainee	Breakdown of School	Total	Notes
None					

Remarks

① Target: Specialized School for Development of Technical Engineers

② Japan only has the Medical Radiation Technical Development School. However, write more in A-2-2-2 if there is something else in your country.

Your notes

① Notes 1: School term − for 4 years in University, for 2 years in Junior College, for 3 years in Vocational College.

A−3. Radiation and Radioisotopes Application

A−3−1 Agricultural Application

A−3−1−1 Plant Mutation Breeding

Number of the institutions implemented	Number of the scientists engaged	Notes
115	324	Depends on FNCA data base

A−3−1−2 Sterile Insect Technique

Number of the institutions implemented	Number of the scientists engaged	Notes
1	18	

A−3−1−3 Food Irradiation

Number of the institutions implemented	Number of the scientists engaged	Notes
1	5	

A−3−2 Medical Application − Radiation diagnosis

Number of the institutions implemented	Number of the radiation oncologists	Number of the therapeutic technicians	Notes
611	540	1,062	

A−3−3 Other field (if any)

Field	Number of implemented institution	Number of engaged scientist	Notes
None			

Remarks

① Target: Quantitative data is needed. Write in A-3-3 if data is not available.

② Plant Mutation Breeding: Refer to database of FNCA Radiation Breeding Project, and correct it if needed.

③ Medical Application − Refer to attachment 7.

Your notes

① A-3-2: Quoted from paper of 'Quantitative status of resources for radiation therapy in Asia and Pacific region', refer to attachment 7.

A－4. Nuclear Training Courses

Field	Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
	Notes 1					

Remarks

① Target: Write the training course implemented by nation or private within the range of understanding.

② Field: a) Basic / general nuclear energy b) Radiation / Radioisotopes Application Technique
c) Nuclear power generation technique d) Safety (including Radiation Hazard Prevention)
e) Others (Including protection against nuclear materials and International cooperation)

③ Classify according to the table as mach as possible.

④ Cumulative Trainee is acceptable within the range of understanding.

Your notes

① Notes 1: Refer to Reference A-4 Nuclear Training Courses

A−5. Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Average Annual Licensee	Cumulative Licensee	Authorize Institution	Notes
First Class Supervisor of Radiation Protection	Radiation Application / Unsealed Radioisotopes	463	19,924 (1958~2000)	MEXT	
Second Class Supervisor of Radiation Protection (General)	Radiation Application / Sealed Radioisotopes	644	26,407 (1960~2000)	The same as above	
Second Class Supervisor of Radiation Protection (ECD)	Radiation Application / Sealed Radioisotopes	215	3,224 (1968~1999)	The same as above	
Chief Engineer of Reactors	Research Reactor / Generation Reactor	27	1,120 (1957~2000)	The same as above	
Chief Engineer of Nuclear Fuel	Fuel Processing / Uranium Enrichment / Reprocessing / Reactor	26	883 (1968~1999)	The same as above	
Clinical Radiation Technician	Radioactive Handling in Medical Treatment	1992	33,247	Ministry of health, labor and welfare	
Medical Physicist	None	10	131	Medical physics society	Notes 1

Remarks

① Target: The number of licensees of national certifying examinations in the nuclear field.
② Write other national certifying qualifications if data is available. Write the institution to certify the qualifications in Notes.
③ Write cumulative licensee if data is available.

Your notes

① Notes 1: Medical Physics Society certifying qualification started from 1987
Annual Licensee: Results in FY2001

A−6. Background Data for Analysis

A−6−1 The number of users of radiation application

Total number of users	Breakdown					Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	
FY2001 4,387 (100%)	793 (16.4%)	485 (10.0%)	713 (14.7%)	1,927 (39.8%)	919 (19.0%)	

Notes: The number of users that is approved of using radioisotope and radiation generator according to the rule of Radiation Hazard Prevention, by Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the number of users that is approved of using sealed radioisotopes under 3.7GBq in total by MEXT.

A−6−2 Data of Radiation Diagnosis

A−6−2−1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt machines total
213	603	816

A−6−2−2 Total Number of Brachytherapy Machine

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
2	8	187	74	198

A−6−2−3 Annual new cancer patients in both sexes

386,783

A−6−3 Others (if any)

- The total number of registered crop varieties through mutation.
- Economic scale of nuclear application (Radiation application, Nuclear power generation)
- Scope of Nuclear power generation (The number of operating units, Generating capacity)

Remarks

① Target: These survey data could be useful for further analysis. Write in A-6-4 if you have any other suggestions.

② A-6-3: Data is in the paper of A-3-3③.

③ Population and GDP will be made a list from national data collectively.

Your notes

① A-6-2-1: Quoted from paper of A-3-3③

A−7. Comments on the Survey

Remarks

① Target of the Survey: Write your opinions and comments;

a) Comprehensive opinion and comment b) Plan for future survey

c) Items for survey d) Others

Human Resources Development in Nuclear Field in Japan

Yasushi Seki and Kiyoshi Kato

Nuclear Technology and Education Center
Japan Atomic Energy Research Institute
http://nutec.tokai.jaeri.go.jp/fnca/fnca.htm

JAERI/NuTEC

Contents of Talk

- Recent topics in the nuclear field and related HRD
- Development of training material in radiation protection area
- Introduction of e-learning system, AINST, INU, ANSN
- Investigation of basic data on HRD Formulation of HRD strategy
- International Training Courses in Japan for FY2002

2

JAERI/NuTEC

Mutual Support Activities

- Homepage of FNCA-HRD Project (http://nutec.tokai.jaeri.go.jp/fnca/fnca.htm) :
- Summary of 1st –3rd HRD Workshop
- List of Training Materials and Curricula of training courses on Radiation Protection in MS
- Links to nuclear training centers

3

Recent Topics in Nuclear Field

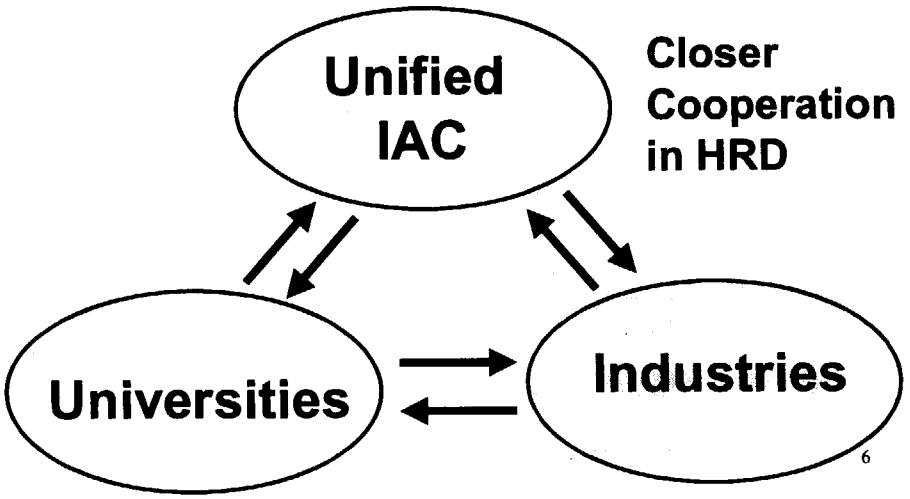
- Pipe rupture and coolant leakage incident in Hamaoka-1 BWR NPP (Nov. 2001)
- Disclosure of falsified self-inspection data of BWR by Tokyo Electric Power Company (August 2002)
- Unification of JAERI and JNC (Japan Nuclear Cycle Development Institute) planned for 2005

4

The Fundamental Report of the Unification of JAERI and JNC (August 5, 2002)

- Unification of training courses on Nuclear Emergency conducted by JAERI and JNC in "Support and Training Center" of the Off-Site Center in Hitachinaka city
- The Unified Independent Administrative Corporation (IUC) to have closer cooperation with Universities and Industries in HRD 5

The Fundamental Report of the Unification of JAERI and JNC (August 5, 2002)



Development of training material in radiation protection area

- Training material in radiation protection area in MS and IAEA have been investigated
- Which specific area is missing and needed?
- More discussion is needed to clarify the specification and the need

7

Introduction of e-learning system as a new subject of nuclear training technique

- The subject / needs has been proposed by Malaysia and Korea
- Should be discussed in connection with "Asian Institute of Nuclear Science and Technology (AINST)" proposed by Indonesia, "International Nuclear University (INU)" proposed by Korea, and "Asian Nuclear Safety Network (ANSN)" by IAEA

8

Investigation of basic data on HRD in nuclear field

- HRD Project should investigate the basic data on HRD in nuclear field in member countries (Coordinators Meeting, March 2002)
- We should discuss how the collected basic data could be utilized for the formulation of HRD strategy (Discussion Session 2)

9

Table 1 Government Administrative Institution and Research and Development Institution

(1) Government Administrative Institution in Nuclear Filed in Japan

(Unit: Person)

		Planning, Deliberation, and Decision on General Nuclear Policy	Nuclear Administration of Nuclear and Technology	Nuclear Administration of Energy	Total
		Cabinet Office	Ministry of Education, Culture, Sports, Science and Technology (MEXT)	Ministry of Economy, Trade and Industry (METI)	
Promotion of Nuclear Energy		Atomic Energy Commission	Research Promotion Bureau (10 person) Research and Development Bureau (25 person)	Agency of Natural Resources and Energy	
Subtotal	committee	5	35	95	114
	secretary	14			
	Technical Counselor				
Nuclear Regulation		Nuclear Safety Commission	Science and Technology Policy Bureau	Nuclear and Industrial Safety Agency	
Subtotal	committee	5	90	346	541
	secretary	59			
	Technical Counselor	41			
Total		123	125	441	655

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Result(1) of the basic data investigation for Japan

- The Cabinet Office is in charge of planning, deliberation and decision of general nuclear policy
- The Ministry of Economy, Trade and Industry (METI) is in charge of nuclear power administration
- The Ministry of Education, Culture, Sports, Science and Technology (MEXT) is in charge of administration of all nuclear science and technology other than nuclear power.

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Result(2) of the basic data investigation for Japan

- The number of persons engaged in promotion of nuclear is 114 while the number engaged in regulatory and control is 541

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Result(3) of the basic data investigation for Japan

- The number of persons in the Japan Atomic Energy Research Institute (JAERI) is 2263
- The Japan Nuclear Cycle Development Institute (JNC) is 2345
- The National Institute of Radiological Sciences (NIRS) is 376

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JAERI/NuTEC

International Training Courses in Japan for FY2002

- International HRD programs for Nuclear Science and Technology under the sponsorship of MEXT are being reviewed
- The MEXT Nuclear Researchers Exchange Program has been conducted for 17 years since it was started in FY1985. The program is presently being reexamined to adjust to the changing needs
- Table 2 on the International Training Courses in Japan in FY2002 is attached

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Requests on the Nuclear Research Exchange Programs and other programs

- Study Group organized by MEXT to review and to improve the effectiveness by modification and enhanced coordination among the five exchange programs in the nuclear field is in the second year of review
- FNCA HRD Workshop is the main occasion for presenting the requests and changes based on the needs of each country on the exchange programs

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It is hoped this workshop will find a mechanism of mutual support to cooperate in the human resources development in nuclear field in the Asia and Pacific region

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Action Items for FY2002

1. Training Materials in Radiation Protection

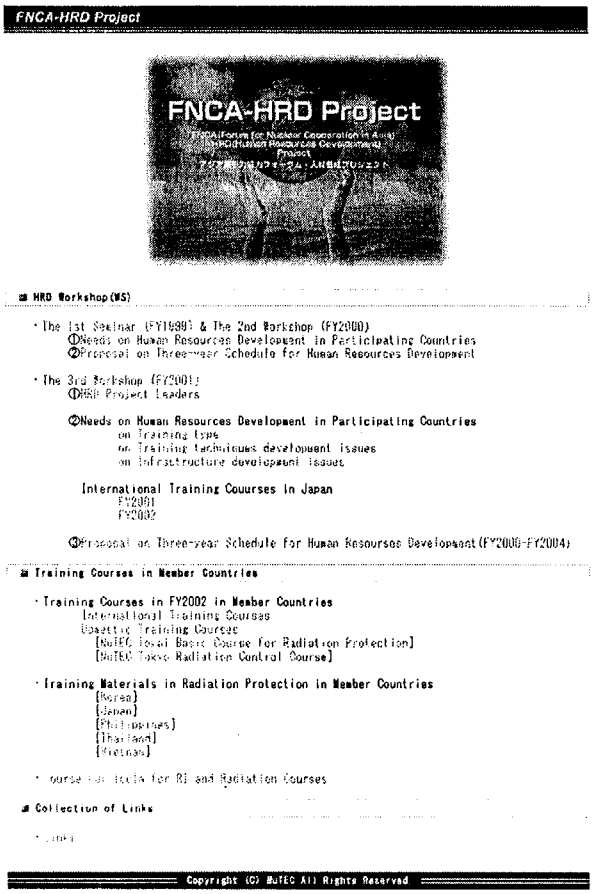
Worksheet for "Material"

To make a common training textbook in radiation protection area in FY2003, member countries provide the lists of existing training materials. KAERI will review the complete list to check duplications with IAEA training materials. The plan for the textbook will be discussed based on those lists during the 4th Workshop.

2. Interlink of homepage *http://nutec.tokai.jaeri.go.jp/fnca/fnca.htm*

Worksheet for "Homepage"

To exchange information about HRD mutually, member countries inform English HP addresses to interlink with the site of "FNCA HRD Project" NuTEC, JAERI.



3. Training Course to be held in 2002

Worksheet for "Course for International" and "Course for Domestic"

To exchange information about training courses, each country should provide the list of training courses to be held in 2002.

◆ ***All lists mentioned-above will be sent to the member countries after completion.***

Action Items

1. List of Training Materials in Radiation Protection

Country	*Course Name*		*Title of Materials*	*Page*	*Language*	*Training Place*
Korea	Radiation Protection Supervisor	Lectures	1. Introduction to Nuclear Power	454	*Korean*	
			– Nuclear Physics	– 90		
			– Radio Chemistry	– 126		
			– Radiation Biology	– 109		
			– RI Production & Application	– 62		
			– Interaction between Radiation and Matter	– 66		
			2. Radiation Protection	388		
			– Principle of Radiation Protection	– 194		
			– Radiation Safety Management	– 194		
			3. Atomic Energy Laws & Regulations	626		
		Experiment	1. Radiation Handling Techniques	434		
			– Radiation Measurement	– 148		
			– Radiation Handling	– 212		
			– Radioactive Waste Management	– 74		
	Basic Course in Application of Radioisotope	Lectures	1. Introduction to Nuclear Physics	275		
			– Nuclear Physics	– 75		
			– Radio-chemistry	– 108		
			– Radiation Biology	– 92		
			2. Radiation Protection	315		
			– Principle of Radiation Protection	– 94		
			– Radiation Safety Management	– 221		
			3. Radiation Treatment Technology	247		
			– Radiation Measurement	– 116		
			– Treatment Technology	– 131		
			4. Atomic Energy Laws & Regulations	626		
		Experiment	1. Radioisotope Experiment Practice	131		
			– GM Counter and Proportional Counter			
			– Scintillation Counter			
			– Liquid Scintillation Counter			
			– Radiation Detector			
			– Loss of Radiation Source and Countermeasures			
			– Contamination Accident & Countermeasures			
	Medical Applications of Radioisotopes	Lectures Experiment	1. Radiation Handling and Management			
			2. Radiation Control and System			
			3. RI Application Techniques in Medical Use			

Country	Course Name		Title of Materials	Page	Language	Training Place
Korea	Training & Preparedness to Radiological Emergency	Lectures Experiment	1. Radiological Emergency Countermeasure Planning	134	Korean	
			2. Overview of Radiological Accidents	34		
			3. Radiation Exposure and Protection Countermeasure	49		
			4. Radiation Emergency Management	108		
	Technical Education for Gamma-ray Spectroscopic Analysis	Lectures Experiment	1. Principle of Radiation Measurement	28	Korean	
			2. Theory of Gamma-Ray Energy Spectrum Analysis	11		
			3. Using Method to Gamma-ray Detector	27		
			4. Non-destructive Assay and Nuclide Analysis	58		
	New Employee of Radiation Working Area	Lectures Experiment	1. Basic Theory of Radiation Safety Management	180		
			- Radioactive	- 39		
			- Principles of Radiation Protection	- 53		
			- Radiation Treatment, Storage and Transfer	- 51		
			- Radioactive Waste Management	- 37		
			2. Measurement of Radioactivity	75		
			3. Safety Control Codes and Related Regulations	50		
			4. Countermeasures Against Radiation Accidents	25		
	Radiation Worker	Lectures Experiment	1. Effects of Radiation	40		
			2. Radiation Protection	34		
			3. Safety Handling of Radioactive Material	21		
			4. Radioactive Waste Management	25		
			5. Regulation and Process	47		
	Supervisory License for Radioisotope Treatment	Lectures	1. Radioisotope Treatment and Management	65		
			2. Technical Information	25		
			3. Regulations and Duty	5		
	Basic Radioisotope Treatment License	Lectures	1. Radioisotope Treatment and Technology	23		
			2. Regulation and Duty	40		
	Special Radioisotope Treatment (Medical) License	Lectures	1. Special Radioisotope Treatment and Technology	131		
			2. Technical Information	25		
			3. Regulations and Duty	5		

Country	Course Name		Title of Materials	Page	Language	Training Place
Japan	Basic Course for Radiation Protection	Lectures	1. Radiation		Japanese	Tokai NuTEC
			-Atom and Nucleus	28		
			-Basic Radiochemistry	83		
			-Radiation Physics	42		
			-Introduction to Radiations (CAI)	21		
			-Radiation Shielding	34		
			2. Effects of Radiation			
			-Cell and DNA	8		
			-Radiological Effects on Human	33		
			-Radiological Epidemiology Survey	12		
			3. Health Physics			
			-Introduction to Health Physics	9		
			-Recommendation of ICRP and Safety Standards	21		
			-Safety Handling of Radiation	19		
			-Basis of Dose Estimation	28		
			4. Measurement Techniques for Radiation Control			
			-Radiation Dosimetry	24		
			-Radiation Measurement	29		
			-Calibration of Dosimeter	12		
			5. Monitoring of Workplace			
			-Introduction to Monitoring of Workplace	12		
			-Monitoring for External Radiation	15		
			-Monitoring for Surface Contamination	15		
			-Monitoring for Air Contamination	35		
			-Monitoring for Radioactive Effluents	15		
			6. Individual Monitoring			
			-Monitoring of External Exposure	38		
			-Monitoring of Internal Exposure	40		

Country	Course Name		Title of Materials	Page	Language	Training Place
Japan	Basic Course for Radiation Protection	Lectures	7. Environmental Monitoring		Japanese	Tokai NuTEC
			-Introduction to Environmental Monitoring	27		
			-Monitoring of Environmental Radiation	44		
			-Monitoring of Environmental Samples	11		
			8. Radioactive Waste Management			
			-Processings of Radioactive Waste	55		
			-Decontamination	20		
			9. Nuclear Emergency Preparedness			
			-Introduction to Reactors	56		
			-Safety Measures of Nuclear Reactors	21		
			-Radiation Protection under Accidents	47		
			10. Laws and Regulations			
			-Law for Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors	14		
			-Law Concerning Prevention of Radiation Hazards	25		
			11. Special Tasks			
			-Behavior of Tritium and Exposure Dose	13		
			-Behavior of Radio-Iodine under Accidents	13		
			-Emergency Preparedness Arrangement: Example of USA	19		
		Exercises	1. Physics of Radiation	36		
			2. Units of Radiation	45		
			3. Biological Effects of Radiation	38		
			4. Control for Radiation Works	14		
			5. Estimation of Exposure Dose	22		
			6. Estimation of Environment Dose	19		
		Laboratory Exercises	1. Emergency Arrangement in JAERI, Tokai		Japanese	Tokai Establishment
			- Handling of Radiation Protection Equipments	10		
			2. Dosimetry for Beta-ray, Gamma-ray and Neutrons	7		
			3. Measurement of Gamma-ray Energy (1)	54		
			4. Measurement of Gamma-ray Energy (2)	19		
			5. Radiation Shielding Experiment	51		
			6. Measurement of Beta-ray by GM Counter	24		
			7. Neutron Experiment	23		
			8. Observation of Radiation Track by Cloud Chamber	60		
			9. Measurement of Concentration of Radioactive Dust in Air	10		
			10. Measurement of Surface Density of Radioactivity	18		
			11. Measurement of Concentration of Radioactivity in Water	7		
			12. Dosimetry by Ionization Chamber	60		
			13. Dosimetry by Personal Dosimeter	14		
			14. Measurement of Internal Radioactivity	18		

Country	Course Name		Title of Materials	Page	Language	Training Place
Japan	Radiation Control Course	Lectures	1. Dose Limits and Radiation Hazards	32	Japanese	Tokyo NuTEC
			2. Methods of Radiation Measurement	56		
			3. Dosimetry	24		
			4. Control of External Exposure	38		
			5. Control of Internal Exposure	23		
			6. Radiation Facilities	16		
			7. Control of Radiation in Facilities	26		
			8. Measuring Techniques for Radiation Control	145		
			9. Methods for Sampling and Activity Evaluation	22		
			10. Control of Unsealed Radioisotopes	36		
			11. Calibration of Radiation Monitors	20		
			12. Radioactive Waste Management	17		
			13. Decontamination of Radioactivity	22		
			14. Examples of Radiological Accidents and Countermeasures	32		
			15. Laboratory Guidance for Handling of Unsealed Radioisotope	8		
		Exercises	1. Application Procedures for Permission of Using Radioisotopes	33		
		Laboratory Exercises	1. Dosimetry	12		
			2. Liquid Scintillation Measurement	32		
			3. Measurement of Surface Contamination Density	12		
			4. Measurement of Concentration of Radioactive Dust in Air	17		
			5. Measurement of Concentration of Radioactive Gas	15		
	Radiation Protection Course VAEC/JAERI Joint Training Course	Lectures	1. Interaction of Radiation with Matter	24	English	VAEC
			2. Dosimetric Quantities and Units	22		
			3. Biological Effects of Radiation	21		
			4. International Radiation Protection and Safety Standards	25		
			5. Japanese Experience on Radiation Protection and Safety Management	24		
			6. Viet Nam National Regulations of Radiation Safety and Control	21		
			7. Radiation Measurement	33		
			8. Operational Radiation Survey	51		
			9. Safe Handling	16		
			10. Decontamination Techniques	13		
			11. Emergency Preparedness and Planning	23		
		Exercises	1. Radiation Type and Survey Meters	6		
			2. Gas Monitoring	12		
			3. Calibration of Survey Meters and Environmental Gamma-Ray Measurement	15		
			4. Gamma-Ray Spectrometry	37		
			5. Shielding Design	15		
			6. Measurement of Gamma-Ray Attenuation in Matter	8		
			7. Surface Monitoring and Decontamination	10		
			8. Natural Radioactivity in Atmospheric Dust	14		
			9. Personal Dosimetry Techniques (TLD)	12		

Country	Course Name		Title of Materials	Page	Language	Training Place
Japan	Radiation Protection Safety Supervisor OAEP/JAERI Joint Training Course	Lectures	1. Recent Development of Radiation Protection	13	English	OAEP
			2. Biological Effects of Ionizing Radiation	15		
			3. Radiation Detection and Measurement	71		
			4. Radiation Protection Programme	60		
			5. Basic Concepts for Radiation Shielding	40		
			6. Basic Concept for Monte Carlo Calculation in shielding Design	19		
			7. Record Keeping	21		
			8. Risk Assessment	22		
			9. Safe Handling of Radiation and Radioisotopes	14		
			10. Assessment of Occupational Exposure due to Intakes of Radionuclides	36		
			11. Radiological Emergency and Preparedness	25		
		Exercises	1. Alpha and Beta Measurement	12		
			2. Radioactive Substances in Environmental Samples	9		
			3. Radiation Contamination Monitoring and Decontamination Method	21		
			4. Radiation Detection by Various Types of Survey Meters	6		
			5. Determination of Personal Dose Equivalent for External Exposure by TLD	9		
			6. Measurement of Radioactive Gas	14		
			7. Measurement of Radioactive Dust Concentration in Air	12		
			8. Analysis of ^{3}H and ^{32}P using LSC	54		
	Radiation Protection Course BATAN/JAERI Joint Training Course	Lectures	1. Interaction of Radiation with Matter	17	English	BATAN
			2. Dosimetric Quantities and Units	21		
			3. Radiation Effects on Human Body	20		
			4. Regulation on Radiation Protection in the Republic of Indonesia	28		
			5. Radiation Protection	21		
			6. Radiation Survey	49		
			7. Safe Handling	18		
			8. Radiation Measuring Instruments	35		
			9. Radiochemistry	43		
		Exercises	1. Leakage Test	13		
			2. High Performance Liquid Chromatography (HPLC)	7		
			3. Survey Meter Calibration	13		
			4. Gamma-Ray Spectrometry	7		
			5. Thermoluminiscence Dosimeter (TLD) Reading	15		
			6. Shielding Design	13		
			7. Radioactivity in Dust	10		
			8. Liquid Scintillation Counting (LSC)	49		
	Technologies for Facility Radiation Control IAEA Regional Training Course	Lectures	1. Safe Handling of Radiation and Radioactive Materials	7	English	Tokyo NuTEC & Tokai NuTEC
			2. Treatment and Disposal of Radioactive Waste	10		
			3. Individual Monitoring	10		
			4. Radioactivity and Decay Chain	7		
			5. Interaction of Radiation with Matter	29		
			6. Workplace Monitoring for Surface Contamination	10		
			7. Workplace Monitoring for External Radiation	14		
			8. Workplace Monitoring for Air Contamination	12		
			9. Planning, Design, Maintenance and Control of Radiation Facilities	5		
			10. Biological and Health Effects of Ionizing Radiation	13		

Country	Course Name		Title of Materials	Page	Language	Training Place
Japan	Technologies for Facility Radiation Control IAEA Regional Training Course	Lectures	11. Transport and Storage of Radioactive Materials	13	English	Tokyo NuTEC & Tokai NuTEC
			12. Gamma-Ray Spectrometry	23		
			13. Management of Overexposed Workers	20		
			14. Monitoring for Effluent in Air	8		
			15. Radiation Shielding for Gamma-Rays and Neutrons	9		
			16. Principles of Radiation Protection	11		
			17. IAEA's Safety Standard Programme	9		
		Exercises	1. Handling of GM, Ionization Chamber and Scintillation Survey Meters	10		
			2. Measurement of Radioactive Gas in Air	12		
			3. Measurement of Surface Contamination	9		
			4. Measurement of Radioactivity Concentration in Discharge Water by Liquid Scintillation Counting	16		
			5. Measurement of Radioactive Dust in Working Environment	13		
			6. Measurement of Radioactivity Concentration in Discharge Water by Gamma-Ray Spectrometry	11		
			7. Beta, Gamma and Neutron Dose Measurements	16		
			8. Handling of Protective Clothes and Respiratory Protection Equipments	8		
Philippines	Radiation Protection	Lectures	1. Basic Nuclear Physics		English	PNRI
			2. Nuclear Reactions			
			3. Radiation and Radioactivity			
			4. Some Radiation Quantities and Units			
			5. Interaction of Radiation with Matter			
			6. Statistics of Counting			
			7. Detection of Radiation			
			8. Radiation Protection Instruments			
			9. Biological Effects of Radiation			
			10. Basic Safety Standards for Radiation Protection			
			11. Radiation Dosimetry: An Overview			
			12. Radiation Monitoring			
			13. Maintenance and Calibration of Monitoring Instruments			
			14. Dose Calculations			
			15. Radiation Shielding			
			16. Radiation Facility Design and Safety			
			17. Decontamination			
			18. Emergency Planning			
			19. Radiological Health and Safety Officer: Qualifications, Duties and Responsibilities			
			20. Transport of Radioactive Materials			
			21. Radioactive Waste Management			
		Exercises	1. Characteristics of Geiger-Muller Detectors			
			2. Statistics of Counting			
			3. Determination of Half-Life			
			4. Gamma-Ray Spectrometry			
			5. Absorption of Gamma Radiation			
			6. Decontamination			
			7. Calibration of Monitoring Instruments			

Country	Course Name		Title of Materials	Page	Language	Training Place
Thailand	Radiation Protection course level I	Lectures	1. Introduction to Radiation and Radioactivity 2. Environmental Radiation and Radioactivity 3. Radiation Quantities and Units 4. Introduction to Radiation Protection 5. Radiation Detection and Measurement 6. Radiation Protection Instruments 7. Calculation Relating to Radiation Protection Works 8. Biological Effect of Radiation 9. Radioactive Waste Management 10. Legislation and Regulation on Radiation and Radioactivity, Transport of Radioactive Substance, Thailand Atomic Energy for Peace Act 11. Emergency Planning and Preparedness 12. Nuclear Technology Applications in Thailand 13. Introduction to Nuclear Power Plant	166	*Thai*	OAEP
		Exercises	1. Radiation Protection Survey Instruments 2. Personal Monitoring and Calibration of Radiation Protection Instruments 3. Radiation Shielding			
	Radiation Protection course level II	Lectures	1. Introduction to Radiation and Radioactivity 2. Nuclear Technology Applications in Thailand 3. Radiation Quantities and Units 4. Radiation Detection and Measurement 5. Radiation Protection Instruments 6. Biological Effect of Radiation 7. Introduction to Radiation Protection 8. Calculation Relating to Radiation Protection Works 9. Legislation and Regulation on Radiation and Radioactivity, Thailand Atomic Energy for Peace Act 10. Transport of Radioactive Substance 11. Radiation Protection Management 12. Internal Radiation Dose Assessment 13. Environmental Radiation Monitoring 14. Basic Radioactive Laboratory Design 15. Radiation Protection in Hospital 16. Radioactive Decontamination 17. Radioactive Waste Management 18. Emergency Planning and Preparedness 19. Introduction to Nuclear Power Plant 20. Radiation Protection in Industrial Irradiator	411		
		Exercises	1. Radiation Detection and Counting Statistics 2. Gamma Spectrometry 3. Personal Monitoring and Calibration of Radiation Protection Instruments 4. Radiation Shielding			

Country	Course Name		Title of Materials	Page	Language	Training Place
Thailand	Radiation Protection in working place (part of undergraduate course in Industrial Hygiene Sampling and Analysis I, Burapa University)	Lectures	1. Radiation and Unit of Measurement 2. Nuclear Technology Applications in Thailand 3. Legislation and Regulation on Radiation and Radioactivity, Transport of Radioactive Substance, Radioactive Waste Management, Thailand Atomic Energy for Peace Act 4. Radiation Detection and Measurement	15	*Thai*	OAEP
		Exercises	1. Demonstration on Radiation Detection and Measurement			
	Introduction to Radiation Protection in working place	Lectures	1. Radiation and Unit of Measurement 2. Nuclear Technology Applications in Thailand 3. Legislation and Regulation on Radiation and Radioactivity, Transport of Radioactive Substance, Radioactive Waste Management, Thailand Atomic Energy for Peace Act 4. Radiation Detection and Measurement	15		
		Exercises	1. Demonstration on Radiation Detection and Measurement			
Vietnam	Radiation Protection Course VAEC/JAERI Joint Training Course	Lectures	1. Interaction of Radiation with Matter	24	*English*	VAEC
			2. Dosimetric Quantities and Units	22		
			3. Biological Effects of Radiation	21		
			4. International Radiation Protection and Safety Standards	25		
			5. Japanese Experience on Radiation Protection and Safety Management	24		
			6. Viet Nam National Regulations of Radiation Safety and Control	21		
			7. Radiation Measurement	33		
			8. Operational Radiation Survey	51		
			9. Safe Handling	16		
			10. Decontamination Techniques	13		
			11. Emergency Preparedness and Planning	23		

Action Items
3. Training Courses to be held in 2002

For International

Country	*Course Name*	*Duration*	*Date*	*Place*
Korea NTC, KAERI	IAEA/RCA Regional Training Course on "Non-Destructive In-Service Inspection in Petroleum	1Wk	Jan. 21–25	NTC, KAERI
	WS on Photon Accelerator	2Days	Feb. 21–22	
	IAEA/RCA Regional WS for Dissemination of Information on Use of Isotopes in Dam Safety and Sustainability	1Wk	Apr. 14–19	
	IAEA WS on Accident Management and Emergency Response for Research Reactor	1Wk	Apr. 29–May 3	
	IAEA Regional WS on Process Optimization Using Tracers in Petrochemical Industries	2Wks	July 2–11	
	WS on IAEA Safeguards	1Wk	July or Aug.	
	IAEA WS on GMP and QC of Therapeutic Pharmaceuticals	1Wk	Sep.	
	IAEA WS on Upgrading of Training Facilities/Capabilities	1Wk	Sep. 2–6	
	IAEA/RCA Regional Training Course on Advanced Instruments and Control Systems for NPP	2Wks	Nov.4–15	
	KOICA/IAEA Training Course on Nuclear Power Planning and Project Management	3Wks	Nov. 14–Dec. 4	
Japan NuTEC, JAERI	BATAN/JAERI Instructor Training Program	30Days	Jul. 23–Sep. 20	BATAN
	BATAN/JAERI Follow-up Training Course	1Wk	Jun. 3–14, Oct. 7–18	BATAN
	new Training Course on "Maintenance of Research Reactor"	2Wks	Oct. 21–Nov. 1	BATAN
	OAEP/JAERI Instructor Training Program	30Days	Jul. 23–Sep. 20	OAEP
	OAEP/JAERI Follow-up Training Course	1Wk	Jun. 10–21, Oct. 28–Nov. 8	OAEP
	new Training Course on "Radiological Emergency Preparedness and Response"	2Wks	Jun. 17–28	OAEP
	VAEC/JAERI Instructor Training Program	60Days	Jul. 23–Sep. 20	VAEC
	VAEC/JAERI Joint Training Course on "Radiation Measurement"	2Wks	Sep. 30–Oct. 11	VAEC
	VAEC/JAERI Joint Training Course on "Radiation Protection"	2Wks	Nov. 25–Dec. 6	VAEC
	Safeguards Training Course	3Wks	Feb. 21–Mar. 12	Tokai NuTEC
	IAEA, Radiation Control Training Course	2Wks	Mar. 4–15	NuTEC, JAERI
Malaysia MINT	Electrical Safety	2Days	May 21–22	
	Maintenance of Electronic Instruments	3Days	Jun. 25–27	
	Interfacing Techniques and Computer Control	3Days	Aug. 14–16	
	In-situ Soil Compaction Measurement Using Nuclear Techniques	3Days	Oct. 2–4	
	Basic Non-ionization Radiation Safety	3Days	May 21–23 Oct. 8–10	
	Industrial Safety	5Days	Jun. 25–29 Oct. 8–12	

Country	Course Name	Duration	Date	Place
Malaysia MINT	Chemical Safety and Health	3Days	Apr. 24–26 May 8–10 Jun. 26–28 Jul. 23–25 Sep. 4–6 Oct. 23–25	Kota Kinabalu Kuala Lumpur Prai, Penang Kemaman Kuala Lumpur Johor Bahru, Johro
	Chemical Pollution in Water Resources	3Days	Jul. 9–11	
	Membina Warga Cemerlang	1–2Days	Apr. 23–24 Aug. 6 Oct. 29–30	
	Techno-marketing	3Days	Jun. 26–28	
	Techno-marketing for Technological Products	3Days	Oct. 23–25	
	Mesra Pelanggan	3Days	Jun. 19–21 Sep. 25–27	Pulau Pinang
	Team Development	4Days	May 28–31	Langkawi
	Workshop on Skill Enhancement of Trainer	3Days	Jun. 19–21	
	Training Course for Medical X-ray Operator	1Wk	May 13–20 Jun. 25–Jul. 2 Jul. 1–8 Aug. 5–12 Oct. 14–21 Sep. 23–30	Kuala Lumpur Kota Kinabalu Kuala Lumpur Pulau Pinang Kuala Lumpur
	Awareness Course on Radiological Safety for General Practitioner	1Day	May 13 May 15 Aug. 5 Aug. 19 Sep. 11 Sep. 23 Oct. 14	Kuala Lumpur Melaka Penanag Kuala Lumpur Kuching, Sarawak Kuala Lumpur Penang
	Training Course on X-ray for General Practitioner	5Days	Jul. 1–5 Aug. 20–25 Oct. 14–18	Pulau Pinang Kuala Lumpur Pulau Pinang
	Good Operational Practice in Medical X-ray	1Day	Jun. 28 Jul. 31 Sep. 30 Oct. 21 Oct. 31 Nov. 3	Penang Kuala Lumpur Penang Johor Bahru Kota Kinabalu Penang

Country	Course Name	Duration	Date	Place
Malaysia MINT	Quality Assurance in Medical Radiography	3Days	Oct. 1-3	
	Interpretation of Radiographic Image	3Days	Jul. 17-19 Oct. 30-Nov. 1	Penang
	Seminar on Medical X-ray	2Days	May 27-28 Oct. 15-16	Penang Kuala Lumpur
	Basic Course on Non-destructive Testing [NDT]	5Days	Sep. 9-13	
	NDT for Supervisory Works	3Days	Jun. 10-12	Kemaman
	Radiation Safety and Health	3Days	May 14-16 Jun. 25-27 Jul. 16-18 Aug. 9-11 Aug. 27-29 Oct. 15-17 Oct. 22-24	Kuala Lumpur Johor Bahru, Johor Kemaman Bandar Sri Begawan, Negara Brunei Darussalam Penang Kuala Lumpur Kota Kinabalu, Sabah
	Radiation Safety Awareness	1Day	Sep. 24	
	Good Radiation Safety Practices	1Day	Sep. 11	Kuching, Sarawak
	Radiation Gauges	3Days	Jul. 2-4	
	Radiation Protection for Worker	5Days	May 13-17 Aug. 5-9	
	Radiation Protection for Officer	8Days	Jun. 11-20 Aug. 13-22 Oct. 22-31	
	Perlindungan Sinaran Untuk Pegawai (RPO)	10Days	Jul. 9-18 Sep. 17-26	
	5th National RPO Conference and Workshop 2002	4Days	Sep. 10-13	Kuching, Sarawak
Philippines PNRI	IAEA/RCA Regional Training Workshop on the Assessment of Soil Erosion Using Cs-137 and Related T	5 Days	May 27-31	PNRI
	IAEA/RCA Regional Workshop on Radiation Protection, Waste Management and QA in Nuclear Medicine	5 Days	July	PNRI
	IAEA/RCA Regional Training Course on Nuclear Oncology	5 Days	Aug. 5-9	PNRI
	FNCA 4th Workshop on HRD in the Nuclear Field	3 Days	Oct. 8-11	PNRI
Thailand OAEP	Radiation Processing of Natural Polymer for Agro-chemical Industry (RCA)	1 wk	Nov. 2001	OAEP
	Quality Assurance and GMP of Radiophamaceutical (RCA)	1 wk	Jun. 2002	OAEP
Vietnam VAEC	VAEC/JAERI Joint Training Course on "Radiation Measurement"	2Wks	Sep. 30-Oct. 11	VAEC
	VAEC/JAERI Joint Training Course on "Radiation Protection"	2Wks	Nov. 25-Dec. 6	VAEC

For Domestic Nuclear Personnel

Country	Field	Course Name	Duration	Date	Place
Korea NTC, KAERI	Nuclear Power and Nuclear Fuel Technology	1. Nuclear Power Safety	1Wk	Apr. 22-26	NTC, KAERI
		2. Enhancement of Safety and Economics of Nuclear Power	1Wk	Sep. or Oct.	NTC, KAERI
		3. Quality Assurance	2Wks	July 1-12	NTC, KAERI
		4. Bamma Spectroscope	1Wk	-	NTC, KAERI
		5. Probabilistic Safety Assessment of NPP	1Wk	Sep. 9-13	NTC, KAERI
		6. Safeguards for Inspector	1Wk	June	NTC, KAERI
		7. Safeguards for Utilities	1Wk	June	NTC, KAERI
		8. Management of Nuclear Fuel Materials	2Wks	-	NTC, KAERI
		9. Radiological Emergency Planning and Response	1Wk	-	NTC, KAERI
		10. Nuclear Fuel Material Handling	4Wks	May 6-31	NTC, KAERI
		11. Compact Nuclear Simulator Operation I	1Wk	Feb.	NTC, KAERI
		12. Compact Nuclear Simulator Operation II	1Wk	Aug.	NTC, KAERI
	Radioisotopes Application	1. Basic Application of Radioisotopes	4Wks	Jan. 28-Feb. 22 Oct. 21-Nov. 15	NTC, KAERI
		2. Radiation Protection	6Wks	May 20-June 28	NTC, KAERI
		3. Medical Uses of RI	4Wks	Aug. 26-Sep. 19	NTC, KAERI
	Non-Destructive Testing Technology	1. Non-Destructive Testing	4Wks	Mar. 4-29	NTC, KAERI
		2. Radiographic Examination	1Wk	Nov. 18-22	NTC, KAERI
		3. Ultrasonic Testing	1Wk	Nov.	NTC, KAERI
		4. NDT Diagnostic Techniques	1Wk	Feb. 25-28	NTC, KAERI
	Retraining for Nuclear-Related Licensee	1. Retraining for Research Reactor Operation Licensee	1Wk	Oct.	NTC, KAERI
		2. Retraining for Radiation Treatment Licensee			
		a) Sealed Source	1Day	Feb. Oct. Nov.	NTC, KAERI
		b) Non-Sealed Source	1Day	Apr. Aug.	NTC, KAERI
		c) Supervisor	1Day	July	NTC, KAERI
		3. Retraining for Nuclear Material Treatment Licensee	1Day	July	NTC, KAERI
	Education Programs for University Students	1. Research Reactor Experiment for Students Majoring in Nuclear Engineering	1Wk	Jan.-Oct.	NTC, KAERI
		2. Nuclear Experiment for Students in Science and Engineering	1Wk	Mar.-Sep.	NTC, KAERI
		3. Laboratory Experiment	4Wks	Jan. Aug.	NTC, KAERI
	Special Training Courses Using Hanaro Research Reactor	1. Neutron Activation Analysis	1Day	Mar.	NTC, KAERI
		2. Fuel and Material irradiation	1Day	Apr.	NTC, KAERI
		3. RI Production	1Day	May	NTC, KAERI
		4. Neutron Beam Application	1Day	May	NTC, KAERI
	Public Acceptance and Others	1. Internet and Nuclear Information for Resident People	3Wks	Mar.-Oct.	NTC, KAERI
		2. PC and Nuclear Information for Woman living in near location	2Wks	Aug. Dec.	NTC, KAERI
		3. Internet for Environmental Associations	1Wk	Jun.	NTC, KAERI
		4. Internet and PC for KAERI Family	1Wk	Feb.	NTC, KAERI

Country	Field	Course Name	Duration	Date	Place
Japan NuTEC, JAERI	Radioisotopes & Radiation Workers	1. Primary Basic Course	10Days	Apr. 15-26	Tokyo NuTEC
		2. Basic Course	17Days	May 8-30	Tokyo NuTEC
		3. Radioisotope Course	12Days	Sep. 10-27	Tokyo NuTEC
		4. Liquid Scintillation Measurement Course	5Days	Jun. 24-28	Tokyo NuTEC
		5. Radiation Control Course	10Days	Jun. 3-14	Tokyo NuTEC
		6. Environmental Radioactivity Measurement Course	9Days	Jul. 23-Aug. 2	Tokyo NuTEC
		7. Qualification Courses Class 1 Working Environment Measurement Expert Class 1 Radiation Protection Supervisor	 2Days 5Days	 Jun. 19-20 Apr.-Sep. (7)	 Tokyo NuTEC Tokyo NuTEC
	Nuclear Engineers	1. Reactor Engineering Course	21Wks	Apr. 16-Sep. 6	Tokai NuTEC
		2. Basic Reactor Engineering Course	10Wks	Apr. 16-Jun. 21	Tokai NuTEC
		3. Reactor Engineering Short Course	10Days	(2/year)	Tokyo, Osaka
		4. Introductory Nuclear Technology Course	4Wks	Jan. 14-Feb. 7, 2003	Tokai NuTEC
		5. Nuclear Supervisor Training Course	6Wks		Tokai NuTEC
		6. Radiation Protection Basic Course	6Wks	May 13-Jun. 21 Sep. 2-Oc. 11	Tokai NuTEC
		7. Nuclear Fuel Engineering Course	3Wks	Oct. 21-Nov.8	Tokai NuTEC
		8. Radioactive Waste Management Course	2Wks	Jul. 1-12	Tokai NuTEC
		9. Introductory Neutron Utilization Experiment Course	2Days	Jul. 22-Aug. 2	
	Personnel in Local Governments	1. Introductory Nuclear Emergency Preparedness Course	2Days	(14)	14 districts
		2. Nuclear Emergency Preparedness Course	1Wk	Sep. 9-13 Feb. 17-21, 2003	Tokai NuTEC
		3. Special Nuclear Emergency Preparedness Course	2Days	(4/year)	Tokai NuTEC
Philippines PNRI	Nuclear Science Education	1. Nuclear Science for University/College Faculty	5 Wks	Apr. 22-May 24	PNRI
		2. Seminar in Nuclear Science for High School Science Teachers	5 Wks	Apr. 22-May 24	PNRI
		3. Introductory Seminar in Nuclear Science for University/ High School Science Teachers	1 Wk	Upon request	PNRI
	Radioisotope Applications	1. Radioisotope Techniques Training Course (Medical)	4 Wks	July 22-Aug. 16	PNRI
		2. Industrial Uses of Radioisotopes Course	4 Wks	Oct. 21-Nov. 15	PNRI
		3. National Training Course in Radioimmunoassay	1 Wk	Nov. 11-15	PNRI
	Radiation Protection	1. Radiological Health and Safety Course (for Radiation Safety Officers)	4 Wks	May 27-June 21	PNRI
		2. Radiation Safety Course	3-5 Days	Upon request	On-site
		3. Emergency Preparedness	3-5 Days	Upon request	PNRI
		4. Seminar on Safe Transport of Radioactive Materials	3 Days	Upon request	PNRI
		5. Radiation Safety Seminar for Scrap Metal Dealers	3 Days	Upon request	PNRI
	Non-Destructive Testing Technology in cooperation with the Philippine Society for Non-Destructive Testing	1. Surface Methods, Levels 2 & 3	2 Wks	Jan. 14-29	PNRI
		2. Radiographic Testing, Levels 2 & 3	2 Wks	Feb. 18-Mar. 5	PNRI
		3. Ultrasonic Testing, Levels 2 & 3	2 Wks	May 13-28	PNRI
		4. Radiographic Interpretation	3 Days	May 29-31	PNRI
		5. Radiographic Testing, Levels 2 & 3	2 Wks	June 17-July 2	PNRI
		6. Surface Methods, Levels 2 & 3	2 Wks	Aug. 5-20	PNRI
		7. Ultrasonic Testing, Levels 2 & 3	2 Wks	Sept. 2-17	PNRI
		8. Radiographic Testing, Levels 2 & 3	2 Wks	Oct. 7-22	PNRI
		9. Radiographic Interpretation	3 Days	Nov. 19-21	PNRI

Country	*Field*	*Course Name*	*Duration*	*Date*	*Place*
Thailand OAEP	Radiation Protection	1. Radiation Protection Level I	1 wk	Jan, May, Jul	OAEP
		2. Radiation Protection Level II	2 wks	Jan, Aug	OAEP
		3. Radiation Protection for Radiation Safety Supervisor	2 wks	Jun	OAEP
		4. Introduction to Radiation Protection	1 day	May, Aug	OAEP
	Non-Destructive Testing Technology	1. Ultrasonic testing level I	1 wk	Nov	OAEP
		2. Ultrasonic testing level II	12 days	Jan	OAEP
		3. NDT Level I	1 wk	Mar	OAEP
		4. NDT Level II	12 days	May	OAEP
	Radioisotope Application	1. Sterile Insect Technique	1 wk	Jul	OAEP
		2. Nuclear Technology and Its Diverse Application	2 wks	Oct	OAEP
		3. Application of Radiotracer Techniques	1 wk	Mar	OAEP
		4. Isotope Methodologies on Water Management	3 days	Apr	OAEP
		5. Application of Nuclear Techniques in Bioreceptor Assay of Marine Biotoxin	1 wk	Apr	OAEP&Burapa University
		6. QA&QC for Nuclear Analytical Laboratory	1 wk	Mar	OAEP
	Radiophamaceutical	1. Good Practice in Radiophamaceutical Production	2 days	Apr	OAEP
	Others	1. Stable Isotope Technique in Pesticides Analysis	1 wk	Apr	OAEP&KU

1.6 Discussion Session
Special Presentation
1.6.1 Study on Human Resources Development in Nuclear Industry in Japan

Takashi YORI
The Japan Atomic Power Company

I would like to thank chairwoman for introducing me, and I would like to express my hearty thanks to all of you for giving me an opportunity today to explain "Study on Human Resources Development in Nuclear Industry in Japan " as a special presentation.

The development of nuclear power in Japan began with the introduction of technology from abroad in the 1950s. At first, our efforts were expended in learning and improving the technology we acquired from abroad, but eventually we were able to do our own independent work on nuclear technology. As a result, nuclear power now generates about 35% of Japan's total electric power and makes a significant contribution to the stable supply of energy. In order to promote further development and greater utilization of nuclear power, while at the same time maintaining a high level of nuclear safety, we believe that the development of human resources is an urgent issue. Indeed, it is foundational for the promotion of nuclear power.

With this in mind, Japan Atomic Power Industrial Forum, Inc.(hereinafter I call it JAIF) has been conducting a "Study on Human Resources Development for Engineers in Japan's Nuclear Power Industry". I have been participating in this study as one of its core members. Last autumn, we presented an interim report which states "In order to maintain and enhance the quality of engineers, it is important for the nuclear power industry to build a new transversal education system with the cooperation of the industrial world, the government, and the academic world."

I would like to introduce "Study on Human Resources Development in Nuclear Industry in Japan "

My presentation will cover the following five points.

1. Current Situation of Nuclear Power in Japan

First, with regard to the current situation of nuclear power in Japan, I would like to say a few words about deregulation trends in the electric power industry in Japan. Since March 2000, Japan has begun to partially deregulate the retail selling of electric power. Since November last year, a government panel has resumed its investigation on expanding the scope of deregulation. In the current atmosphere of deregulation, the Nuclear power industry is required to be able to meet market demands for cost

competitiveness, just like other electric power sources. From the perspective of recovering a short-term investment, there is concern that the incentive to construct new nuclear power plants may be declining.

Second, as a result of the sodium leak accident in the prototype fast breeder reactor Monju and JCO's criticality accident, the Japanese public's confidence in nuclear power has significantly diminished. Effort to regain that confidence is a high priority for the Japanese nuclear power industry.

Third, since the terrorist attacks against America on September 11 last year, Japan's nuclear power plants have been on the rigorous alert.

Fourth, I would like to mention global environmental problems. Since no carbon dioxide is produced in the process of nuclear power generation, nuclear power is able to play an important role in reducing global warming.

Investigation of Inspection and Maintenance Problems at TEPCO's NPPs

Fifth, I would like to talk about Investigation of Inspection and Maintenance Problems at Tokyo Electric Power Company's NPPs as a hot topic.

Concerning the inspection and maintenance of TEPCO's nuclear power plants conducted by GE from the late 1980's to the 1990's, GE pointed out to TEPCO that there was a possibility for some problems to have been treated inadequately as shown below.

- Some cracks or signs of cracks were not reported.
- There were some falsified maintenance records.

After then, TEPCO's Internal Investigative Committee conducted an investigation into the problems and submitted its report on September 17, 2002 to the Nuclear and Industrial Safety Agency of METI, and also to local governments of the regions where TEPCO's nuclear power plants are located.

(1) Summary of TEPCO's Investigation Report Results of Investigation

Of a total of 29 cases pointed out by GE, 16 cases were judged to have been handled inappropriately. They included items such as, "Cracks on equipment not reported," and "Falsified reports of records in order to conceal the existence of cracks on equipment."

・Safety Evaluation of Equipment in Use

Top priority was given to a safety evaluation of the equipment now in use such as core shroud. It was confirmed that there is no safety problem with the equipment. It was also confirmed by the Nuclear and Industrial Safety Agency of METI that there would be no immediate effect on the safety of reactors.

・Measures to Prevent Recurrence of Similar Incidents

- Ensure disclosure of information to the public and Improve transparency

Disclosure of information to the public should be thoroughly ensured, and power plant operation should be managed with a high degree of transparency, taking into account the perspective of people outside of the Company.

- Create environment for conducting appropriate business activities

  Strengthen the functioning of supports for company employees and organizations to conduct business activities appropriately.

- Strengthen internal audits of nuclear power sections and reform corporate culture.

  The narrow and closed society of nuclear power sections should be broken down to build a frank and open corporate culture.

- Thoroughly comply with corporate ethics.

  To construct an infrastructure that promotes the above-mentioned policies, all personnel should "thoroughly comply with corporate ethics."

(2) Trends in Enforcement of Regulations

The Subcommittee for Examination of the Nuclear Safety Regulation Law, under the Advisory Committee on Energy and Natural Resources, submitted an interim report proposal on October 1, 2002. The interim report proposal to prevent the recurrence of similar incidents consists of the following three items;

- Introduction of "Defect Evaluation Criteria (code for maintaining operation)" which can approve continuous operation of a reactor if a defect is thought not to cause any safety problem
- Legalization of self-imposed inspection
- More stringent penal regulations

2. Current Status of Securing Human Resources in Nuclear Power Industry

Japan's nuclear power industry must secure and nurture human resources in order to promote further development and utilization of nuclear power. In particular, fields like nuclear power generation and nuclear fuel cycle need human resources to secure development without the loss of safety.

JAIF conducted a survey among industrial producers of nuclear energy. The greatest response was obtained for the statement: "With regard to human resources, although there is a sufficient quantity, there is a problem acquiring superior quality people".

Another matter to be noted is the fact that Japan's population of nuclear engineers is aging. Engineers who labored long years since the beginning of Japan's nuclear power industry and obtained advanced expertise, knowledge, and rich experience are now retiring.

At the same time, in the universities, there has been a trend toward a decreasing number of students majoring in nuclear engineering. A number of universities have changed the name of the "Department of Nuclear Engineering" with the result that the level of fundamental nuclear engineering education has significantly lowered. In the case of the University of Tokyo, for instance, the Department of Nuclear Engineering was changed to Department of Quantum Energy Engineering in April 1993, and then further changed to Department of Systems Innovation in April 2000. As the names of the departments change, the programs also change, resulting in less time being devoted to the fundamentals of nuclear engineering.

In addition, Japan now has the lowest birth rate in the world. As we enter an era of fewer children, it is expected that securing talented human resources will become more and more difficult.

3. JAIF's Study on Human Resources Development

Since February 2001 "The Human Resources Problem Subcommittee" of JAIF has been conducting a study on human resources development. The subcommittee consists of the Chairman, Mr. Sumi, President of the Japan Atomic Power Company, and members representing electric power companies, research institutes, universities, manufacturing companies, and construction and engineering companies.
This committee is now just going to produce a report. I would like to introduce an outline of the report to you.

4. An Outline of Study on Human Resources Development

In order to promote further development and utilization of nuclear power, it is necessary to secure highly talented nuclear engineers, skilled technicians and competent workers. For this purpose, we must develop "Measures for Securing Human Resources". Now, educational organizations in universities, research institutes, and the industrial world including electric power companies, manufacturing companies, and construction and engineering companies are conducting studies together on this subject with view to develop broad ranging links.

4-1. Current Problems

A questionnaire concerning securing human resources was sent out to the nuclear power industrial world, research institutes and educational organizations. The results show an imbalance in the supply of and demand for human resources and a mismatch in respect to quality. Also, concerning education in universities and industries, certain problems became clear.

The first problem is the existence of an "Imbalance in Demand in connection with Employment" between universities and the industrial world.

On the demand side in the industrial world, there are the following problems.

- In the last five years, there has been a gradual trend to decrease the number of new engineers to be

employed.

- The number of nuclear engineering majors to be employed has leveled off at 40 to 50 a year. The ratio of nuclear engineers employed to the total number of engineers employed is about 15%. (The number of students majoring in electrical and mechanical engineering is greater than the number of students majoring in nuclear engineering.

Universities on the supply side have the following problems,

- The industrial demand for nuclear engineering graduates is small so nuclear engineering draws very few students.
- The number of nuclear engineering graduates employed has leveled off at 125 a year on average. The percentage of nuclear engineering students who seek employment in nuclear related industries is about 75%, but the actual percentage employed in nuclear related industries is only about 40%. The description above is the actual situation.

The second problem is "A Mismatch of Quality in connection with Employment" between universities and the industrial world.

The industrial world has the following problems.

- Industry demands highly professional personnel, but the number of personnel needed for nuclear power is small.
- Industry has great need for personnel with a good educational foundation, logical thinking skills, intellectual flexibility and the ability to solve problems.

But the actual situation on the side of universities is as follows.

- Top class personnel tend to go into industries other than nuclear power.
- Many students with general knowledge of radiation graduate from universities.

Next there are educational problems which exist both in universities and the industrial world.

"Situation in University Education" is as follows.

- Many national universities have changed the name of their nuclear engineering departments in order to maintain the number of students.

- Nuclear research facilities in the universities have become old, and the budget for their maintenance has been reduced.

"Situation in Corporate Education" is as follows.

- Although education in electric utilities, research institutes and manufacturing companies differs, there are common problems such as;
  a) The basic educational level of new employees is lower.

b) Due to the aging of engineers, there is a problem in transmitting technology to younger generations.

4-2. Main Problems and Solutions

The above-mentioned problems are summarized as three main issues.

First of all, it is necessary for all related organizations to cooperate to build a solid system for human resources development. As I explained before, economic competitiveness is required in the industrial world, and a high degree of specialization is required for research institutes. But the position of nuclear engineering education has become lower in universities. On the basis of these facts and also the results of an opinion poll of students on employment, it has become clear that there is an expanding mismatch in the expectations of these organizations. As I previously mentioned, we have proposed "a concept of Nuclear Educational System Network" to deal with this problem. I will explain its idea later.

Secondly, the nuclear industrial world must revitalize nuclear technology by contributing to society. This includes, for example, utilizing accompanying technology such as radiation technology in the fields of medicine, manufacturing and agriculture. Through such activities the industrial world can demonstrate to society the attractiveness of nuclear energy.

Thirdly, it is necessary to build a system to foster a sense of security among the Japanese people. For this purpose, it is necessary to make clear the role that nuclear power plays in solving energy problems and to provide correct information in school education from elementary schools to universities and in social education systems.

4-3. Concept of Nuclear Educational System Network

The concept of "Nuclear Educational System Network" which I mentioned before is a new transversal educational system — a system established by linking the industrial world, the government and the academic world in order to maintain and enhance the quality of nuclear engineers.

Nuclear Educational System Network consists of 'Training course for key researchers', 'Education and Training Information Center' and 'Maintenance Skill Training Center'.

1) Training course for key researchers

In order to provide education and training primarily for doctor course students (mainly students in doctor course) who will become leaders of nuclear power development, we proceed with preparation for opening "Key Researchers Course". The main body of this course will be established considering the current trend that combined university graduate courses be upgraded and that two nuclear corporate bodies (JAERI and JNC) are united.

In this course, nurturing of researchers and engineers for creation of attractive industry, such as enhancement of the existing technology and challenges to new technology, are mainly promoted. "Innovation, incubation" which is an original duty of universities and research organizations will be an idea of the establishment of the course.

In addition, practical business affairs education for engineers (business school) based on needs of the industrial world, the government and local governments will be performed for a consideration.

2) Education and Training Information Center

Now in the industrial world, education systems and facilities of companies are managed mainly by these companies independently from the beginning to the end of the education. This will be changed so that education systems and facilities will be used mutually freely. For this purpose, it must be arranged such that information of education systems and facilities are unified and publicized on Web-site so that guidance to users, access to suppliers, examination, acceptance, registration of users, and claim of expenses can be dealt with smoothly.

When the system is determined to be on a track, an Information Center's unique Web base training course will be opened as a second step. Development that meets customers needs be further promoted.

3) Maintenance Skill Training Center

Maintenance skill training center will be established utilizing each company's training center. In this center, an education system that can be commonly utilized for realization of maintenance alliance in the future will be pursued. The following are considered for this.

-Education of new workers which is common to each company's NPPs will be performed efficiently.
-Education menu for practical skill training for workers, OJT instructors, foremen at work places, and work controllers should be made.

The purpose of this training center in the future is to set up conditions for maintenance alliance and to introduce a qualification system. For this purpose, it is necessary to conduct investigation in a medium and long term base regarding such items as selection of items of technology required for this purpose, setting up contents of education and determining curriculum for each kind of job.

To implement this Nuclear Education System Network, corporations engaged in nuclear power, research institutes and universities should cooperate. Lecturers and educational facilities will be shared.

At present this concept is at the stage of "Conceptual Design". It is necessary now to design a concrete plan.

5. Current Conclusions

Finally, let me briefly state our current conclusions.

In the long run, the further development of nuclear power in Japan depends upon the mutual cooperation of the industrial world, the government and the academic world to secure and foster engineers who possess the following qualities.

"The Ideal Nuclear Engineer" has the following characteristics.

- He possesses advanced knowledge of nuclear engineering.
- He possesses knowledge of hardware matters such as systems and equipment, and also has a good background as a field engineer.
- He is sociable and ethically sensitive.
- He exercises leadership and has potential to help reform the current situation.

This is the kind of engineer needed at the present time.

Japanese educators and nuclear industry professionals face many and great challenges in the future, but we are planning now to meet these difficulties. We are confident that cooperation between government, industry, and academic institutions will secure for Japan the kind of bright young nuclear engineers that we need to continue to contribute not only to the progress of nuclear energy in Japan, but in all the world. Not only for the good of our people, but for the progress of prosperity and safe energy for all mankind.

This brings my presentation to an end.
I want thank you all for giving me your kind attention.

Study on Human Resources Development in Nuclear Industry in Japan

Takashi Yori

The Japan Atomic Power Company

FNCA-HRD WS October 9, 2002

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1. Current Situation on Nuclear Power in Japan
2. Current Status of Securing Human Resources in Nuclear Power Industry
3. JAIF's Study on Human Resources Development
4. An Outline of Study on Human Resources Development
5. Current Conclusions

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1.Current Situation on Nuclear Power in Japan

- Deregulation of Electric Power Industry
- Public Trust in Nuclear Power Industry
- The Effect of Sep. 11 Attacks in USA
- Global Environmental Problems
- Inspection & Maintenance Problems at TEPCO's NPPS

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Hot topics

Inspection and Maintenance Problems at TEPCO's NPPs

(1) Summary of Investigation Report

- Investigation by Internal Investigative Committee
- Results
  - — 16 cases of 29 cases were found to have been inappropriately handled
- Locus of Responsibility

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- Safety Evaluation of Equipment in Use
  - — There is no safety problem
- Measures to Prevent Recurrence
  - — Transparency and disclosure of public information
  - — Environment for appropriate business activities
  - — Internal audits and corporate culture
  - — Corporate ethics

(2) Trends in Enforcement of Regulations

- Proposed preventative measures by METI's advisory panel
  - — Introduction of Defect Evaluation Criteria

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2. Current Status of Securing Human Resources in Nuclear Power Industry

- **Industry**
  - — "With regard to human resources, although there is a sufficient quantity, there is a problem acquiring superior quality people."
  - — Aging of engineers with advanced expertise, knowledge,and rich experience
- **Universities**
  - — Decreasing number of students major in nuclear engineering
  - — Changing names of university departments lowers level of nuclear fundamental education
- **Low birthrate**

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3. JAIF's Study on HRD

- **JAIF subcommittee currently studying**

  − Members: **Chairman Mr. Sumi**
  (President of JAPC)
  Utilities, Research institutes, Manufactures, Construction and Engineering companies, Universities

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4. An Outline of Study on HRD

4-1. Current Problems

- **Imbalance of supply & demand**

  −Industry (Demand side)
  - Acceptance for engineers is on the decrease
  - Average acceptance rate of nuclear engineers to the total is about 15%

  −Universities (Supply side)
  - Jobs for nuclear engineering majors decrease
  - Employment rate to the nuclear industry is about 40%

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● Mismatch of quality

−Industry (Demand side)

- Highly professional
- Basic scholarship, Logical thinking skills Intellectual Flexibility

−Universities (Supply side)

- Some top-class personnel tend to go to other industries
- Many graduates with general knowledge of radiation

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● Situation in university education

- − Many Universities changed name of nuclear engineering department
- − University Nuclear research facilities old and budget for maintenance reduced

● Situation in corporate education

- − Basic educational level of new employees is lower
- − Aging of the engineers and problems transmitting technology to next generation

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4-2. Main Problems and Solutions

- **To build solid HRD systems with cooperation among related organizations**

⇨ **Concept of Nuclear Educational System Network(NES NET)**

- **To contribute to society to revitalize nuclear power industry**
- **To build system to foster a sense of security among public**

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4-3.Concept of NES NET

Effective utilization of existing education facilities and lecturers

Universities/Research Institute

Industry

- **Training course for key researchers**
  - — Nurturing of researchers and engineers for creation of attractive industry
  - — Practical business affairs education for engineers
- **Education and Training Information Center**
  - — Education systems and facilities will be used mutually freely Information is published on a Web-site
  - — Web based training course
- **Maintenance Skill Training Center**
  - — Rationalize new employees' education
  - — Education menu for practical skill training for workers
  - — Introduce a qualification system

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5. Current Conclusions

- For further development of nuclear power, it is essential for the nuclear power industry to secure and foster engineers with the following characteristics.

<Ideal Nuclear Engineer >

- **Advanced knowledge on nuclear engineering**
- **Knowledge of systems and equipment and background as a field engineer**
- **Sociability and ethical sensitivity**
- **Leader and potential reformer**

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1.7 Survey of the Basic Data on HRD

1.7.1 Letter and Plan for request of "Survey of the Basic Data on Human Resources Development in the Nuclear Field"

Dear Ms. / Mr. FNCA Coordinators and FNCA Project Leaders of HRD

In the Third FNCA Coordinators Meeting, it was proposed to carry out a survey of the basic data on Human Resources Development (HRD) in the Nuclear Field. A tentative plan for the survey and draft questionnaires were mailed to HRD Project Leaders by Dr. Seki, the HRD Project Leader for Japan, on June 18 2002. Consequently, we prepared "The Plan for Survey of the basic data on Human Resources Development in Nuclear Field in Member Countries", as attached, based on your comments.

As we discussed the objective of the survey in the 3rd Coordinators Meeting, it aims to collect quantitative data on HRD in the nuclear field to support formulation of HRD strategy in FNCA member countries. The results of the survey could be used: 1) to recognize the actual situation in each countries by mutual comparison, which will be useful in drafting HRD plans, 2) to formulate the scope of the HRD project of common interest for the FNCA countries, 3) to review programs of the nuclear researchers exchange program and international nuclear training courses implemented by Japan.

This survey is the first step for developing the HRD strategy. The follow-up survey will be needed based on the result.

Moreover, further survey focused on specific purpose may also be needed in accordance with the conclusions of the coming HRD Workshop and Coordinators Meeting. For example, separate survey on the items of university education which is the basis of HRD might be needed. As regard the HRD strategies for specific fields such as medical and agriculture applications, the cooperation of other Project Leaders in respective field will be needed.

We would highly appreciate if you could cooperate with the HRD Project Leader of your country to carry out the survey. We would like you to have the result of the survey by September 20 and send it to the Japanese secretariat, Mr. Kato or Ms. Ouchi, listed below. Each Project Leader is requested to report the result of the survey in the country report in the Workshop in the Philippines from October 8 to 10, for discussion and planning. The result of the Workshop will be reported in the 4th Coordinators Meeting, and some of the key issues on the result will also be reported in the 3rd FNCA Ministerial Level Meeting in Seoul in October, 2002.

We would be very obliged to have your cooperation in this matter.

Sincerely yours,

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The Plan for Survey of the Basic Data on Human Resources Development in Nuclear Field in FNCA Member Countries

1. Outline of Survey

The 3rd FNCA Coordinator Meeting was held from 6 to 8 of March 2002, in Tokyo. It was proposed that the FNCA HRD activities and its coordination with those of other projects under the FNCA framework should be strengthened. The proposal of supporting the development of HRD strategy was also widely discussed. It was decided to carry out as soon as possible, a survey of the Basic Data on Human Resources Development (HRD) in FNCA member countries. The minutes and the discussion documents are herein attached (Attachment 1, 2, 3).

2. Purpose of the Survey

The survey aims to produce quantitative data on HRD in nuclear field, which could be used to develop HRD plans in FNCA member countries. To be concrete, the examples of items of survey are as follows; 1) the number of government administrative and technical officials and researchers in the nuclear field, 2) the number of faculties and students in the nuclear field in university, 3) the number of licensees of national certifying examinations in the nuclear field as well as 4) the number of nuclear training courses and trainees in the nuclear field. It may be, for instance, helpful to evaluate the HRD status of each country by comparing with other member countries, the number of HRD data divided by total population or Gross Domestic Product (GDP). Based on the result of the survey, it could be helpful for the member country to make the draft HRD plans by knowing the lack of personnel in particular nuclear field.

The result will be reported and discussed during the Fourth HRD Workshop, and it will be also reported at the FNCA Coordinators Meeting.

This is the first step for developing the HRD strategy, and further plan including the follow-up survey will be discussed in the coming HRD Workshop and Coordinators Meeting.

3. Schedule and plan for Survey

(1) Send the plan for Survey ——— August 9

- A draft was sent to Project Leaders from Dr. Seki on June 18 to obtain their comments.

(2) Deadline for submission ——— by September 20

(3) Answers from each country will be collected by Japan, and will be reported at the Fourth

HRD Workshop for discussion ——— October 8-10

① Project Leaders will report the result of the survey with final report in the presentation of country reports.

② Analyze the results and discuss further procedures.

(4) Summary report at the Third FNCA Meeting ——— October 30-31

(5) Detailed report at the Fourth Coordinators Meeting ——— March, 2003

4. Items for Survey

A − 1 Survey of Administrative Agencies, and National Research and Development Institutes

A − 1 − 1 The number of administrative and technical personnel

① Target

- Proposed list of agency and Institute is in the Attachment 4. This is from the book of 'Organizations and Who's Who in Nuclear Energy' contributed by JAIF.
- Other important agencies and institutes related to nuclear energy should be added to the list, if there is any.

② Method of counting data

- Total number of personnel in each agencies and institutes.
- The number of personnel of every department of every agency and institute, if possible.

A − 1 − 2 The break down number of A-1-1 by classification

- The number of personnel, mentioned above, should be added up by the classification of a) Promoting side, b) Regulatory side, and c) Research and Development side.

A − 2 Survey of University Education Institutions

① Target

a) Graduate universities and universities with school of nuclear engineering and science

b) School with specific field, such as medical, to educate technical expert (Medical radiation technical engineers training school)

② Survey items

a) Graduate universities with school of engineering and science, and its established year.

b) Quota of students (Bachelor, Master, Doctor, respectively)

c) The number of faculties (Professor, Assistant professor, Lecturer, Assistant, respectively)

*) For Medical radiation technical engineers training schools, write in only b).

A－3 Survey of Radiation and Radioisotopes Application

A－3－1 Agricultural Application

a) The number of the institutions implemented, the scientists engaged in Plant Mutation Breeding.

b) The number of the institutions implemented, the scientists engaged in Sterile Insect Technique.

c) The number of the institutions implemented, the scientists engaged in Food Irradiation.

A－3－2 Medical Application

a) The number of the institutions implemented, the radiation oncologists and the therapeutic technicians.

A－4 Survey of Nuclear Training Courses (Special training for personnel engaged in the nuclear field)

(1) The list of training institutions

(2) Field, Course name, Function, Duration, and Cumulative number of trainees

A－5 Survey of Licensees of National Examinations Related to Nuclear Energy

The number of licensees of national certifying examinations

Example of qualifications for national examinations in Japan;

(1) First Class Supervisor of Radiation Protection (Radiation Application / Unsealed Radioisotopes)

(2) Second Class Supervisor of Radiation Protection (General) (Radiation Application / Sealed Radioisotopes)

(3) Second Class Supervisor of Radiation Protection (ECD) (Radiation Application / Sealed Radioisotopes)

(4) Chief Engineer of Reactors (Research Reactor / Nuclear Power Plant)

(5) Chief Engineer of Nuclear Fuel (Fuel Processing, Uranium Enrichment,

Reprocessing, Nuclear Reactor)

(6) Clinical Radiation Technician (Radioactive Handling in Medical Treatment)

(7) Medical Physicist (Public License) (the same as above)

A－6 Survey of Background Data for Analysis

A－6－1 The number of Radiation Application Users

Survey of the number of Radiation Generators and Radioisotope Sources to know the development of Radiation Application.

Example of Japan: Total number of users of use Radioisotope or Radiation Generators permitted by the Minister of MEXT based on the regulation of The law for Radiation Hazard Prevention, and the total number of users of sealed Radioisotope under 3.7GBq in total.

(1) Hospital & Clinics (2) Educational Organizations

(3) Research Institutions (4) Industrial Firms (5) Other Organizations

A－6－2 Data of Radiation Diagnosis

A－6－3 Population and GDP, others

A－7 Comments on the Survey

5. Answer Sheet

Follow the Attachment 5 to answer. Attachment 6, a sample data of Japan, is herein attached for your reference. However, Japanese sample data is a draft, and it will be revised for the HRD Workshop.

6. Submission and Terms

◆ Submit to: Secretariat of the Workshop on HRD

Yasushi Seki, Japanese Project Leader
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E-mail: k-kato@popsvr.tokai.jaeri.go.jp

◆ **The terms for submission: by September 20, 2002, by e-mail or Fax.**

List of Attachments

1. Survey of Basic Data for Human Resources Development
   —— Japanese proposal in The Third Coordinators Meeting

2. Record of mutual agreement on The Third Coordinators Meeting
   —— Strategy for Human Resources Development (HRD)

3. Record of The Third Coordinators Meeting (CM)

4. Proposal List of Target Agencies and Institutes for the Personnel Survey in Administrative Agencies and National Research and Development Institutes

5. Answer Sheet for 'The Plan for Survey of the Basic Data on Human Resources Development in the Nuclear Field in FNCA Member Countries'

6. Sample Answer Sheet of Japan

7. Summary Data of Medical Application

8. Number of Persons Involved in the Mutation Breeding

9. Survey of Nuclear Training Courses in Japan

Attachment 1

Survey of Basic Data for Human Resources Development

1. Objective

As the basic data for studying on strategy for Human Resources Development (HRD), the numbers of personnel related to nuclear technology development and utilization will be surveyed.

For this purpose, items are listed as follows, to survey the number of personnel in different sectors. Questionnaire will be sent to each country around May, after being reviewed at the Third Coordinators Meeting. Opinions of HRD PLs should also be taken into consideration:

2. Example of survey items

2-1. Survey of number of personnel engaged in different businesses related to nuclear technology utilization

(1) Number of personnel of governmental organizations and national institutes

① Administration personnel

- Application of radiation − Number of personnel for promotion and regulation
- Nuclear power − Number of personnel for promotion and regulation

② Research personnel

- Number of personnel of national research and development organizations in the field of nuclear science and technology

(2) Number of personnel in industries

- We will study the measures for classification of personnel in manufacturers and electric utilities.

2-2. Survey on education on nuclear technology

(1) Education in universities

① List of universities with courses for education of nuclear technology in Engineering, Physics or Medical Faculty (National and private)

② Number of courses

③ Number of educational personnel (Professors, Assistant Professors, Assistants and Technical Officers)

④ Quota of students (Undergraduate, Graduate and Doctor course,

respectively)

⑤ Record to date (Graduates of Undergraduate, Graduate and Doctor course)

(2) Organization for HRD

① List of organizations

② Roles

③ Contents of courses and quota

④ Record of development to date (Number of persons who finished the courses)

2-3. Number of persons who have obtained certificates related to nuclear technology

For example, the list of certificate given after national examination in Japan is as follows:

① Supervisor of Radiation Protection and Users, First Class:
Radiation utilization facilities

② Supervisor of Radiation Protection and Users, Second Class:
Radiation utilization facilities

③ Chief Engineer of Reactors:
Research reactors and power reactors

④ Chief Engineer of Nuclear Fuel:
Nuclear fuel facilities for research reactor and power reactor

⑤ Medical Radiation Technologist:
Medical utilization facilities

⑥ Medical Physicist (approved by the Academy):
Medical utilization facilities

3. Case study survey for the HRD strategy

As a case study for the discussion of future HRD strategy, the followings are surveyed:

① Strategy for developing human resources in the long term

② Necessary number of personnel for a specific priority project and human resources development program for it

Attachment 2

Session 4-2

Strategy for Human Resources Development(HRD)

Sueo Machi, Japan

Strategic Plan for HRD

In some FNCA countries young generation including university students are losing interest and enthusiasm in "nuclear science and applications" because of limited job opportunity and poor public acceptance of nuclear power. The challenge is to improve the situation by innovative ways and means and to preserve knowledge of nuclear science and technology.

1. The strategy of the HRD should be formulated taking into account the following points:
   i. Coordination and cooperation with other projects of the FNCA;
   ii. New systems and cooperation activities to be proposed to promote human resources development.

2. Medium and long term strategies of the national HRD should be formulated in accordance with nuclear program by each country.

3. Cooperation and synergy between national HRD activities of each FNCA country and ongoing HRD program of Japan with FNCA countries should be explored and implemented.

4. International and regional concepts such as AINST and INU for education and training in nuclear science and technology may facilitate HRD.

Roles of Coordinators and Project Leaders

The Coordinators Meeting and the HRD Project Group and Workshop will share responsibilities, and cooperate in the formulation of a strategy for HRD under the FNCA framework.

The Coordinators Meeting should discuss the policy for HRD strategy.
At HRD Project Leaders Meeting and Workshop, specific implementation plan will be discussed and studied in accordance with the policy which has been decided at the Coordinators Meeting.

The Project Leaders are responsible for implementation of the strategy and its action plan.

For actions in 2002 and 2003 the followings are proposed:

1) HRD Project Leaders will collect the basic data on "Human Resources Development" by sending questionnaire to each country after the discussion at the Third Coordinators Meeting.

2) For the strategy of HDR mentioned above, each Coordinator should submit comments and/or proposals before June 15, 2002.

3) The comments and proposals should be circulated immediately to the FNCA Coordinators for comments which will be received by the Coordinator of Japan before July 31, 2002 for compilation. The FNCA Coordinator of Japan will prepare draft paper "Strategy of HDR".

4) After agreement of the Coordinator of each country, proposal on HRD strategy will be submitted to the FNCA meetings.

5) The work plan for 2003 and 2004 will be formulated following the conclusion of the Third FNCA Meeting.

Attachment 3

Record of The Third Coordinators Meeting (CM)

March 6-8, 2002, Tokyo, Japan

1. The Third CM was held from 6 through 8 March 2002 in Tokyo hosted by the Cabinet Office (CO) and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan.

2. At the Opening Session the opening speech was presented by Mr. S. Machi, FNCA Coordinator of Japan and Mr. T. Endo, Vice Chairman of Atomic Energy Commission (AEC) of Japan, gave the welcome remarks.

3. The agenda of the meeting was adopted after one item regarding project proposal on "Nuclear Instrumentation Maintenance Network" was added.

4. Chairs for sessions were adopted as proposed.
   Three rapporteurs, Mr. A. Manoon, Ms. A. de la Rosa and Mr. S. Machi were appointed to draft the record of the meeting.

5. In Session-1, the FNCA Coordinator of Japan reported the outcome of the Second FNCA Meeting (MM and SOM). The meeting noted the report.

6. In Session 2 the representative of each country presented the country report. The statements which need following up are as follows:

   (1) The representative of Australia pointed out the importance of "ownership" as motivating factor to the successful outcome of the project. He also underscored that the FNCA program should be constantly reviewed in order not to be duplicated with those being carried out by the IAEA-TC and RCA.
   The FNCA Coordinator of China mentioned that Chinese Government has promised to host workshops or seminars at least in one technical field each year and try its best to do more contribution to the cooperation.

   (2) The FNCA Coordinators of Indonesia and Vietnam proposed

"Nuclear Instrumentation Maintenance Network" and "Marine Environmental Pollution Research and Monitoring using Nuclear and Nuclear-related Analytical Techniques and FNCA Database," respectively which were discussed in Session 6.

(3) The representative of Korea mentioned the need of establishment of a Nuclear Liability Scheme in the FNCA countries. The FNCA Coordinator of Thailand mentioned that liability scheme for radiation safety is equally important.

(4) The FNCA Coordinator of Malaysia mentioned that his government would consider to be a volunteer country for spent radiation source management in the future.

(5) The FNCA Coordinator of the Philippines offered to host the Workshop (WS) on Application of Radioisotopes and Radiation for Agriculture in 2003 and the WS on Nuclear Safety Culture in 2003. She proposed that the Government of the Philippines would host the Seventh FNCA Meeting in 2006.

(6) The FNCA Coordinator of Thailand offered to host the WS on HRD in 2003.

7. In Session 3 a review of the on-going projects in the eight fields of cooperative activities was undertaken, and future work plan was approved. The meeting agreed the tentative schedule for WS/Meeting under the FNCA Framework together with venues in Attachment 1

8. With the significant shift in project management from a meeting-oriented approach to a problem-solving approach, the FNCA projects have gained specific focus. Consequently these are now aligned more closely with the technological and socio-economic needs of the FNCA countries. The work plans were approved as shown in Attachment 2.

9. Important subjects discussed are listed in Attachment 3.

10. In Session 4 key issues raised by the Project Leaders on Public Information of Nuclear Energy (PI) and on HRD were discussed.
    (1) For the issue on PI, the linkage between the joint survey and national information dissemination scheme was extensively discussed. The meeting agreed that the linkage should be reflected in the current draft document by adding "the analysis of the result of the joint survey should be used to formulate and adjust to national public information scheme" to proposed plan for the joint survey. Furthermore, the meeting also suggested the linkage between regional speakers bureau and national public information activities should be coordinated. The strategic plan for public information was agreed to be submitted to the Third FNCA Meeting for endorsement. The revised text of the proposal is shown in Attachment 4.

    (2) For issue on HRD, the proposal on strategic plan was discussed extensively. The meeting endorsed that the survey of basic data on HRD in each FNCA country be conducted at the earliest possible time. The meeting agreed that the overall strategic plan should be revised to reflect the discussion and be submitted to the Third FNCA Meeting for endorsement. The revised text is shown in Attachment 4.

11. In Session 5 the CM agreed to recommend to the Third FNCA Meeting for adoption of a project on "Sustainable Development and Nuclear Energy in Asia". The FNCA Coordinators of China, Indonesia, Japan, Korea, Malaysia, the Philippines, Thailand, and Vietnam supported the project. A seminar on CDM of the Kyoto Protocol should be added as an activity of the project.

12. The proposal for the "Asian Institute of Nuclear Science and Technology (AINST)" was discussed. The meeting agreed to consider the proposal under the framework of the strategic plan on HRD.

13. In Session 6, two new proposals were discussed, i.e. "Marine

Environmental Pollution Research and Monitoring using Nuclear and Nuclear-related Analytical Techniques and FNCA Database" by Vietnam and "Nuclear Instrumentation Maintenance Network" by Indonesia. The meeting agreed that the FNCA Coordinator of Japan should consult with the IAEA to avoid duplication and to enhance complementarity, and to report the result for possible initiation to the FNCA Coordinators for comments and suggestions.

14. In Session 7 the FNCA Coordinator of Japan presented issues on operation of the FNCA activities carried forward from the Second FNCA Meeting, particularly the role of a lead country, duration of a project, and the proposal and selection process for a project. The meeting had extensive discussions and agreed to revise the document on the issue as shown in Attachment 5.

15. The Korean delegation reported on the preparation of the Third FNCA Meeting to be held in Seoul, Korea tentatively on October 30 − 31, 2002, with optional technical visit on October 29. The theme of the Meeting will be "Atoms for the Next Generation". The tentative venue of the meeting is ASEM Hall, COEX Building, Seoul.

16. The meeting adjourned with a closing remarks by MEXT.

Attachment 4

Proposal List of Target Agencies and Institutes for the Personnel Survey in Administrative Agencies and National Research and Development Institutes*

1. CHINA
   (1) China Atomic Energy Authority (CAEA)
   (2) National Nuclear Safety Administration (NNSA)
   (3) China National Nuclear Corporation (CNNC)
   (4) China Institute of Atomic Energy (CIAE)
   (5) Nuclear Power Institute of China (NPIC)
   (6) China Institute for Radiation Protection (CIRP)

2. INDONESIA
   (1) Badan Tenaga Nuklir Nasional (BATAN)
   (2) National Nuclear Energy Control Board (BAPETEN)

3. JAPAN
   (1) Cabinet Office (CO)
   (2) Ministry of Education, Culture, Sports, Science and Technology (MEXT)
   (3) Ministry of Economy, Trade, and Industry (METI)
   (4) Japan Atomic Energy Research Institute (JAERI)
   (5) Japan Nuclear Cycle Development Institute (JNC)
   (6) National Institute of Radiological Sciences (NIRS)

4. KOREA
   (1) Ministry of Science & Technology (MOST)
   (2) Korea Atomic Energy Research Institute (KAERI)
   (3) Korean Institute of Nuclear Safety (KINS)

5. MALAYSIA
   (1) Malaysia Institute for Nuclear Technology Research (MINT)
   (2) Atomic Energy Licensing Board (AELB)

6. THE PHILIPPINES
   (1) Department of Science and Technology (DOST)
   (2) Philippine Nuclear Research Institute (PNRI)

7. THAILAND
   (1) Ministry of Science, Technology and Environment (MOSTE)
   (2) Office of Atomic Energy for Peace (OAEP)

*) Quoted from 'Organizations and Who's Who in Nuclear Energy, 2000' issued by JAIF

8. VIETNAM

(1) Vietnam Atomic Energy Commission (VAEC)

(2) Vietnam Radiation Protection & Nuclear Safety Authority

Attachment 5

Answer Sheet for 'The Plan for Survey of the Basic Data on Human Resources Development in the Nuclear Field in FNCA Member Countries'

1. How to answer

   (1) Fill in the blanks of the Answer Sheet with as much data as possible.

   (2) Write "None", "Unknown" or "Checking" if data is unavailable or under survey.

   (3) Write approximate number if its precise number is unknown. (with explanatory notes)

   (4) Attach the detail data if it is available.

   (5) Refer to Sample Data in Japan for your Answer Sheet.

2. Submission Date and Address

   (1) Send your data to the secretariat of JAERI, by September 20 by email or fax.

   (E-mail: k-kato@popsvr.tokai.jaeri.go.jp Fax: +81-29-282-6543)

   (2) Result of the further survey should be added to the country report for HRD Workshop to be held in October.

3. List of Answer Sheet

   A−1. Survey of Administrative Agencies and National Research Development Institutes

   A−2. Survey of University Education Institutions

   A−3. Survey of Radiation Application

   A−4. Survey of Nuclear Training Courses

   A−5. Survey of Licensees of a National Examination Related to Nuclear Energy

   A−6. Survey of Background Data for Analysis

   A−7. Comments on the Survey

A−1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

A−1−1 Total number of administrative and technical officials in each agency and institutes

Agency / Institutes	Role	Total	Notes
Total			

Remarks

① Target agency and institutes
- National agency and institutes

② The number of staff members:
- Count only regular employees.
- Indirect category (driver, guard, and staff in dinning hall and clinic, etc.) should not be included. Explanatory note should be needed if your data has been included these staff members.

Your notes

A−1−2 The Number of Personnel Classified by Field in each Agency and Institutes (Breakdown table of A−1−1)

Agency / Institutes	Nuclear Administration				R&D		Total	Notes
	Promoting		Regulatory					
	R&D / Radiation Application	Nuclear power generation	R&D / Radiation Application	Nuclear power generation	Radiation Application	Nuclear power generation		
Total								

Remarks

① This table is a breakdown of A-1-1 and is to be filled in as much as you know.

② Write in the middle if the classification is not clear.

③ Attach the detailed data of each institution if available. The detailed table is acceptable as the substitution of this table.

Your notes

A－2. Survey of University Education Institutions

A－2－1 University Course

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
Total											

Remarks

① Target: University to educate nuclear energy (School of Engineering and Sciences).

② Fill in the applicable space for University, Graduate School (Master), and Graduate School (Doctor), respectively.

③ The number of student: Registered student or quota (Registered student is preferable for Graduate School.). (Specify which number of personnel is shown in the table in Notes)

④ The number of staff: Staff for education (Sample in Japan: Total of Professor, Assistant professor, Lecturer and Assistant). Write total number and classify if staff holds the both posts of school and graduate school.

Your notes

A−2−2 Specialized School for Development of Technical Engineer

A−2−2−1 Medical Radiation Technical Engineers Training School

Number of School	Annual Trainee	Breakdown of School		Notes

A−2−2−2 Other Field (if there is any)

Field	Number of School	Annual Trainee	Breakdown of School	Total	Notes

Remarks

① Target: Specialized School for Development of Technical Engineers

② Japan only has the Medical Radiation Technical Development School.
However, write more in A-2-2-2 if there is something else in your country.

Your notes

A−3. Survey of Radiation and Radioisotopes Application

A−3−1 Agricultural Application

A−3−1−1 Plant Mutation Breeding

Number of the institutions implemented	Number of the scientists engaged	Notes

A−3−1−2 Sterile Insect Technique

Number of the institutions implemented	Number of the scientists engaged	Notes

A−3−1−3 Food Irradiation

Number of the institutions implemented	Number of the scientists engaged	Notes

A−3−2 Medical Application − Radiation diagnosis

Number of the institutions implemented	Number of the radiation oncologists	Number of the therapeutic technicians	Notes

A−3−3 Other field (if any)

Field	Number of implemented institution	Number of engaged scientist	Notes

Remarks

① Target: Quantitative data is needed. Write in A-3-3 if data is not available.

② Plant Mutation Breeding: Refer to attachment 8, database of FNCA Radiation Breeding Project, and correct it if needed.

③ Medical Application − Refer to attachment 7.

Your notes

A−4. Survey of Nuclear Training Courses

Field	Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee

Remarks

① Target: Write the training course implemented by nation or private within the range of understanding.

② Field: a) Basic / general nuclear energy b) Radiation / Radioisotopes Application Technique
c) Nuclear power generation technique d) Safety (including Radiation Hazard Prevention)
e) Others (Including protection against nuclear materials and International cooperation)

③ Classify according to the table as mach as possible.

④ Cumulative Trainee is acceptable within the range of understanding.

Your notes

A−5. Survey of Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Annual Licensee	Cumulative Licensee	Authorize Institution	Notes

Remarks

① Target: The number of licensees of national certifying examinations in the nuclear field.

② Write other national certifying qualifications if data is available. Write the institutions to certify the qualifications in Notes.

③ Write cumulative licensee if data is available.

Your notes

A−6. Survey of Background Data for Analysis

A−6−1 The number of users of radiation application

Total number of users	Breakdown					Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	

A−6−2 Data of Radiation Diagnosis

A−6−2−1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt machines total

A−6−2−2 Total Number of Brachytherapy Machine

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total

A−6−2−3 Annual new cancer patients in both sexes

A−6−3 Others (if any)

- The total number of registered crop varieties through mutation.
- Economic scale of nuclear application (Radiation application, Nuclear power generation)
- Scope of Nuclear power generation (The number of operating units, Generating capacity)

Remarks

① Target: These survey data could be useful for further analysis. Write in A-6-3 if you have any other suggestions.

② A-6-2: Refer to attachment 7.

③ Population and GDP will be made a list from national data collectively.

Your notes

A−7. Comments on the Survey

Remarks

① Target of the Survey: Write your opinions and comments;

a) Comprehensive opinion and comment b) Plan for future survey

c) Items for survey d) Others

Attachment 6 Sample Answer Sheet of Japan

Answer Sheet for 'The Plan for Survey of the Basic Data on
Human Resources Development in the Nuclear Field in FNCA Member Countries'

1. How to answer

   (1) Fill in the blanks of the Answer Sheet with as much data as possible.

   (2) Write "None", "Unknown" or "Checking" if data is unavailable or under survey.

   (3) Write approximate number if its precise number is unknown. (with explanatory notes)

   (4) Attach the detail data if it is available.

   (5) Refer to Sample Data in Japan for your Answer Sheet.

2. Submission Date and Address

   (1) Send your data to the secretariat of JAERI, by September 20 by e-mail or fax.

   (E-mail: k-kato@popsvr.tokai.jaeri.go.jp Fax: +81-29-282-6543)

   (2) Result of the further survey should be added to the country report for HRD Workshop to be held in October.

3. List of Answer Sheet

   A−1. Survey of Administrative Agencies and National Research Development Institutes

   A−2. Survey of University Education Institutions

   A−3. Survey of Radiation Application

   A−4. Survey of Nuclear Training Courses

   A−5. Survey of Licensees of a National Examination Related to Nuclear Energy

   A−6. Survey of Background Data for Analysis

   A−7. Comments on the Survey

A−1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

A−1−1 Total number of administrative and technical officials in each agency and institutes

Agency / Institutes	Role	Total	Notes
Cabinet Office	Administrative Agency: Planning, deliberation, and decision of nuclear policy in general	129	
Ministry of Education, Culture, Sports, Science and Technology (MEXT)	Administrative Agency: Nuclear administration of scientific technique	125	
Ministry of Economy, Trade and Industry (METI)	Administrative Agency: Nuclear administration of energy	491	
Japan Atomic Energy Research Institute (JAERI)	R&D Institute: Synthetic research and training for engineer	2,263	
Japan Nuclear Fuel Cycle Development Institute (JNC)	R&D Institute: Research development of nuclear cycle development	2,345	
National Institute of Radiological Sciences (NIRS)	R&D Institute: Research on radiation effects on human body and prevention, medical application of radioisotopes and radiation, effects on living environment, and human resources development	376	
Total		5,710	

Remarks

① Target agency and institutes
- National agency and institutes

② The number of staff members:
- Count only regular employees.
- Indirect category (driver, guard, and staff in dinning hall and clinic, etc.) should not be included. Explanatory note should be needed if your data has been included these staff members.

Your notes

① We have the Ministry of Land, Infrastructure and Transport in Japan as an administrative agency in charge of radioactive material transportation. However, it is omitted in this Japanese data.

② As to Research institutes we listed those that is engaged in only nuclear energy.

A−1−2 The Number of Personnel Classified by Field in each Agency and Institutes (Breakdown table of A−1−1)

Agency / Institutes	Nuclear Administration				R&D		Total	Notes
	Promoting		Regulatory					
	R&D / Radiation Application	Nuclear power generation	R&D / Radiation Application	Nuclear power generation	Radiation Application	Nuclear power generation		
Cabinet Office	21		105		-	-	129	
MEXT	35		90		-	-	125	
METI	-	55	-	-	-	-	491	
JAERI	-	-	-	-	2,263		2,263	
JNC	-	-	-	-	2,345		2,345	
NIRS	-	-	-	-	376	-	376	
Total	114		631		4,984		5,710	

Remarks

① This table is a breakdown of A-1-1 and is to be filled in as much as you know.
② Write in the middle if the classification is not clear.
③ Attach the detailed data of each institution if available. The detailed table is acceptable as the substitution of this table.

Your notes

① Cabinet Office: The number of personnel for promoting is the Nuclear energy committee, and that for regulatory is that of the Atomic Safety Committee and their secretaries.

A−2. Survey of University Education Institutions

A−2−1 University Course

Target University		University			Graduate School (Master)			Graduate School (Doctor)			Notes
University	National / Private	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	Number of Student	Number of Staff	Established Year	
Hokkaido Uni.	National	Checking	Checking	1967	Checking	38	Checking	Checking	Notes 1	Checking	
Tohoku Uni.	National	Checking	Checking	Checking	Checking	24	Checking	Checking	Notes 1	Checking	
The Uni. of Tokyo	National	Checking	Checking	Checking	Checking	26	Checking	Checking	Notes 1	Checking	
Nagoya Uni.	National	Checking	Checking	Checking	Checking	Checking	Checking	Checking	Checking	Checking	
Kyoto Uni.	National	Checking	Checking	1960	Checking	Checking	Checking	Checking	Checking	Checking	
Osaka Uni.	National	Checking	Checking	Checking	Checking	16	Checking	Checking	Notes 1	Checking	
Kyushu Uni.	National	Checking	Checking	Checking	Checking	34	Checking	Checking	Notes 1	Checking	
Kinki Uni.	Private	Checking	11	1961	Checking	Checking	Checking	Checking	Checking	Checking	
Tokai Uni.	Private	Checking	19	1971	Checking	Checking	Checking	Checking	Checking	Checking	
Kobe Uni. Of Mercantile Marine	National	Checking	Checking	Checking	Checking	12	Checking	Checking	Notes 1	Checking	
Tokyo Institute of Technology	National	Checking	Checking	Checking	Checking	21	Checking	Checking	Notes 1	Checking	
Tokyo Uni. Of Mercantile Marine	National	Checking	Checking	Checking	Checking	2	Checking	Checking	Notes 1	Checking	
Total											

Remarks

① Target: University to educate nuclear energy (School of Engineering and Sciences).
② Fill in the applicable space for University, Graduate School (Master), and Graduate School (Doctor), respectively.
③ The number of student: Registered student or quota (Registered student is preferable for Graduate School.). (Specify which number of personnel is shown in the table in Notes)
④ The number of staff: Staff for education (Sample in Japan: Total of Professor, Assistant professor, Lecturer and Assistant). Write total number and classify if staff holds the both posts of school and graduate school.

Your notes

① Notes 1: The number of staff indicates masters and doctors of graduate school in all.
② Established Year: The year indicates the year of establishment of the original faculty. (Recently universities and schools of engineering of national universities are changed their names from nuclear engineering due to reorganization.)

A−2−2 Specialized School for Development of Technical Engineer

A−2−2−1 Medical Radiation Technical Engineers Training School

Number of School	Annual Trainee	Breakdown of School		Notes
39	2,122	National Uni.	5	Notes 1
		Prefectural Uni.	8	
		National Junior College	6	
		Prefectural Junior College	1	
		Private Junior College	4	
		Private Vocational College	15	

A−2−2−2 Other Field (if there is any)

Field	Number of School	Annual Trainee	Breakdown of School	Total	Notes
None					

Remarks

① Target: Specialized School for Development of Technical Engineers

② Japan only has the Medical Radiation Technical Development School. However, write more in A-2-2-2 if there is something else in your country.

Your notes

① Notes 1: School term − for 4 years in University, for 3 years in Junior College, for 3 ears in Vocational College.

A−3. Survey of Radiation and Radioisotopes Application

A−3−1 Agricultural Application

A−3−1−1 Plant Mutation Breeding

Number of the institutions implemented	Number of the scientists engaged	Notes
115	324	Depends on FNCA data base

A−3−1−2 Sterile Insect Technique

Number of the institutions implemented	Number of the scientists engaged	Notes
Checking	Checking	

A−3−1−3 Food Irradiation

Number of the institutions implemented	Number of the scientists engaged	Notes
Checking	Checking	

A−3−2 Medical Application − Radiation diagnosis

Number of the institutions implemented	Number of the radiation oncologists	Number of the therapeutic technicians	Notes
611	540	1,062	

A−3−3 Other field (if any)

Field	Number of implemented institution	Number of engaged scientist	Notes
None			

Remarks

① Target: Quantitative data is needed. Write in A-3-3 if data is not available.

② Plant Mutation Breeding: Refer to database of FNCA Radiation Breeding Project, and correct it if needed.

③ Medical Application − Refer to attachment 7.

Your notes

① A-3-2: Quoted from paper of 'Quantitative status of resources for radiation therapy in Asia and Pacific region', refer to attachment 7.

A－4. Survey of Nuclear Training Courses

Field	Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
	Notes 1					

Remarks

① Target: Write the training course implemented by nation or private within the range of understanding.

② Field: a) Basic / general nuclear energy b) Radiation / Radioisotopes Application Technique
c) Nuclear power generation technique d) Safety (including Radiation Hazard Prevention)
e) Others (Including protection against nuclear materials and International cooperation)

③ Classify according to the table as mach as possible.

④ Cumulative Trainee is acceptable within the range of understanding.

Your notes

① Notes 1: Refer to Attachment 9

A−5. Survey of Licensees of National Examinations Related to Nuclear Energy

Qualification	Target	Average Annual Licensee	Cumulative Licensee	Authorize Institution	Notes
First Class Supervisor of Radiation Protection	Radiation Application / Unsealed Radioisotopes	463	19,924 (1958~2000)	MEXT	
Second Class Supervisor of Radiation Protection	Radiation Application / Sealed Radioisotopes	727	29,631 (1960~2000)	The same as above	
Chief Engineer of Reactors	Research Reactor / Generation Reactor	627	1,120 (1957~2000)	The same as above	
Chief Engineer of Nuclear Fuel	Fuel Processing / Uranium Enrichment / Reprocessing / Reactor	26	883 (1968~1999)	The same as above	
Clinical Radiation Technician	Radioactive Handling in Medical Treatment	Checking	Checking	Ministry of health, labor and welfare	
Medical Physicist	None	10	131	Medical physics society	Notes 1

Remarks

① Target: The number of licensees of national certifying examinations in the nuclear field.
② Write other national certifying qualifications if data is available. Write the institution to certify the qualifications in Notes.
③ Write cumulative licensee if data is available.

Your notes

① Notes 1: Medical Physics Society certifying qualification started from 1987
Annual Licensee: Results in FY2001

A−6. Survey of Background Data for Analysis

A−6−1 The number of users of radiation application

Total number of users	Breakdown					Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	
FY2001 4,387 (100%)	793 (16.4%)	485 (10.0%)	713 (14.7%)	1,927 (39.8%)	919 (19.0%)	

Notes: The number of users that is approved of using radioisotope and radiation generator according to the rule of Radiation Hazard Prevention, by Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the number of users that is approved of using sealed radioisotopes under 3.7GBq in total by MEXT.

A−6−2 Data of Radiation Diagnosis

A−6−2−1 Total number of megavoltage teletherapy machines

Cobalt	Accelerator	Megavolt machines total
213	603	816

A−6−2−2 Total Number of Brachytherapy Machine

Manual LDR	Auto Remote LDR	HDR		
		CoHDR	IrHDR	HDR Total
2	8	187	74	198

A−6−2−3 Annual new cancer patients in both sexes

386,783

A−6−3 Others (if any)

- The total number of registered crop varieties through mutation.
- Economic scale of nuclear application (Radiation application, Nuclear power generation)
- Scope of Nuclear power generation (The number of operating units, Generating capacity)

Remarks

① Target: These survey data could be useful for further analysis. Write in A-6-4 if you have any other suggestions.
② A-6-3: Data is in the paper of A-3-3③.
③ Population and GDP will be made a list from national data collectively.

Your notes

① A-6-2-1: Quoted from paper of A-3-3③

A−7. Comments on the Survey

Remarks

① Target of the Survey: Write your opinions and comments;

a) Comprehensive opinion and comment b) Plan for future survey

c) Items for survey d) Others

Summary Data of Medical Application

Country	Estimated number of annual new cancer patients in both sexes	Departments	Teletherapy machines			Brachytherapy machines					No. of Radiation Oncologist	No. of Radiation technician
								HDR				
			Cobalt	Accelerator	Megavolt machines total	Manual LDR	Auto remote LDR	Co HDR	Ir HDR	HDR total		
Australia	60,070	42	4	86	90	3	11	na	12	12	119	603
China	1,394,552	453	381	286	667	171	na	na	30	302	3,440	2,245
Indonesia	129,071	16	15	9	24	2	6	3	2	5	34	30
Japan	386,783	611	213	603	816	2	8	187	74	198	540	1,062
Korea	70,109	42	10	59	69	3	10	3	4	30	130	207
Malaysia	21,670	16	7	19	26	15	2	1	6	9	42	60
Philippines	65,361	13	13	4	17	1	0	na	na	2	25	50
Thailand	54,043	25	24	26	50	1	13	2	8	10	57	120
Viet Nam	52,721	6	11	0	11	5	8	1	0	1	61	39

Source: "Quantitative status of resources for radiation therapy in Asia and Pacific Region", Hideo Tatsuzaki, Cecil Victor Levia, Radiotherapy and Oncology 60 (2001) 81-89 <http://www.elsvier.com/locate/radonline>

Attachment 8

Number of Persons Involved in the Mutation Breeding
(Source: the latest FNCA MB Database)

Country	Institution	Scientists	Crops, Plants	Varieties	Mutant lines
China	23	102	62	62	0
Indonesia	1	14	7	11	68
Japan	115	324	297	99	206
Korea	10	37	24	10	34
Malaysia	11	26	8	7	16
Philippines	4	18	11	8	36
Thailand	60	111	96	30	31
Vietnam	11	36	22	52	20
Total	235	668	527	279	411

Attachment 9

Survey of Nuclear Training Courses in Japan

(1) Japan Atomic Energy Research Institute
Nuclear Technology and Education Center

1) Tokyo Education Center

(Unit: Person)

Course		Duration	Time in FY2001 (/year)	Max. Trainee	Total Trainee from FY 1958 to FY2001
Basic Course		17days	2	32	8,084(209*)
Primary Basic Course		10days	2	16	54
Expert Course	Radioisotope and Radiation Technology Course	5days	1	16	0
	Radioisotope Course	12days	1	16	229
	Liquid Scintillation Measurement Course	5days	1	16	492
	Radiation Control Course	10days	1	16	623
	Autoradiography Course	9days	1	16	564(1*)
	Environmental Radioactivity Measurement Course	9days	1	16	130
Qualification Course	Working Environment Measurement Expert	2days	1	16	497
	Radiation Protection Supervisor	5days	7	32	3,612
International Training	JICA/JAERI Joint Nuclear Technology Course	5weeks	1		137*
	IAEA/JAERI Joint Training Course	4weeks	1		170*
	Instructors Training Program for Asian Countries	2months	1		30*
	Bilateral Joint Training Course for Asian Countries	2weeks	6		383*
Special Course					37(34*)
Expert Course	Sealed Radioisotopes				394
	Soft-Bata Radioisotopes				135(2*)
	Activation Analysis				87
	Application of Radioisotopes for Industry				36
	Application of Radioisotopes for Chemistry				36
	Health Physics				119
	Applied Measurement of Radioisotopes				66
	Chemical Application of Radioisotopes				24
	Nuclear Experiment Seminar				580
	Radiation Chemistry				426(3*)
	Application of Radioisotopes to Biological Science Course				489(9*)
	Radiation Processing of Polymers Course				45
Seminar on Nuclear Education for Teachers					2,345
Seminar on Nuclear Education for Teachers (Introductory Course)					151
General	Seminar on Nuclear Experiment for Teachers (Tokyo Course)				145
Introductory nuclear Technology Course		4weeks	1		56
Advanced Course					230(4*)
Course for New Employees					996
EPTA					20(15*)
Total					21,431 (997*)

The asterisk(*) indicates the number of Foreigners

2) Tokyo Education Center (Unit: Person)

	Course	Duration	Time in FY2001 (/year)	Max. Trainee	Total Trainee from FY 1958 to FY2001
Reactor Engineering	Reactor Engineering Course	21weeks	1	16	1,693
	Basic Rector Engineering Course	10weeks	1	16	21
	Reactor Engineering Short Course	10weeks	2	40	1,633
	Introductory Nuclear Technology Course	4weeks	1	24	1,048
Specialized	Radiation Protection Basic Course	6weeks	2	24	111
	Nuclear Fuel Engineering Course	3weeks	1	24	1,092
	Radioactive Waste Management Course	2weeks	1	24	626
Radiological Emergency Preparedness	Introductory Nuclear Emergency Preparedness Course	2days	4	50	13,554
	Nuclear Emergency Preparedness Course	5days	2	32	1,444
	Special Nuclear Emergency Preparedness Course	2days		32	98
	Nuclear Supervisor Training Course	6weeks			69
	Inspector Training Course for Safety Management of Nuclear Installations				124
International Training	JICA/JAERI Joint Nuclear Technology Course	5weeks	1		116*
	Safeguards Training Course	4weeks	1		88*
	IAEA/EBP Training Course	2months	1		50*
Reactor Engineering	Advanced Course				66
	Reactor Engineering Short Course				359
	Reactor Engineering				111
Specialized	Health Physics Course				687
	Radiation Protection Course				503
General	Seminars on Nuclear for Teachers (Local)				638
	Seminars on Nuclear (Tokai, Takasaki)				1,083
Radiological Emergency Preparedness Training	Fundamental Course for Emergency Environmental Monitoring	2days	5		737
	Emergency Environmental Monitoring Course	5days	2		163
	Radiological Emergency Preparedness Course for Emergency Manager	2days	2		306
	Radiological Emergency Preparedness Course (for Fire-men) (for Police-men)	2days	4 1		934
Others	Reactor Operator Training Basic Course				749
	JRR-1 Operation Training Course				258
	Short-term Course on Reactor Physics				
	Short-term Course on Nuclear Measurement				
	Nuclear Education Course				
	Short-term Course on Reactor Engineering Safety				
International Training	Analysis Technology Training Course				
	Seminars on Nuclear Safety				
Total					29,524 (504*)

The asterisk(*) indicates the number of Foreigners

(2) National Institute of Radiological Sciences (NIRS) (Unit: Person)

Course	Duration	Time in FY2001 (/year)	Max. Trainee	Total Trainee from FY 1958 to FY2001
Basic Radiation Knowledge for Nursing	5days	5	24	767
Radiation Protection and Safety	15days	1	24	3,051
Radioisotope Techniques and Radiation Protection in Life Sciences	15days	1	16	1,434
Emergency Preparedness	5days	3	24	1,112
Medical Aspects of Radiation Accidents	3days	3	20	138
Environmental Monitoring	8days 5days	1	16	470
Radiation Protection for Maritime Safety	5days	1	24	About 200

(3) Japan Chemical Analysis Center (JCAC) (Unit: Person)

Course	Duration	Time in FY2001 (/year)	Max. Trainee	Total Trainee from FY 1958 to FY2001
Fundamental of Environmental Radioactivity Analysis and Measurement	8days	2	10	209
Gamma−Ray Spectrometry of Environmental Samples	8days	2	10	196
Methods of Sampling and Pretreatment of Environmental Samples	4days	1	10	89
Alpha−Ray Spectrometry of Environmental Samples	7days	1	5	33
Methods of Analysis and Measurement of Radioactive Strontium in Environmental Samples	10days	1	6	64
Methods of Environmental Gamma−Ray Dose Measurement	5days	1	10	80
Methods of Analysis and Measurement of Tritium	4days	1	8	66
Methods of Environmental Gamma−Ray Dose Measurement with Thermoluminescence Dosimeter System	4days	1	8	59
Methods of Estimation and Evaluation of Environmental Radiation Dose	2days	1	8	17
Fundamental Usage of Environmental Radiation Network	5days	1	13	122
Methods of Measurement of Radioactive Iodine in Environmental Samples for Emergency	3days	1	8	8
Monitoring Methods of Measurement of Cumulative Dose for Emergency Monitoring	3days	1	8	4
Gamma−Ray Spectrometry of Environmental Samples for Emergency Monitoring	4days	1	8	11
Methods of Analysis of Uranium and Plutonium in Environmental Samples for Emergency Monitoring	4days	1	8	5

(4) Japan Radiation Association (JRIA)

(5) Nuclear Safety Technology Center (Emergency Preparedness Training)

(6) Others

1.7.2 Tentative Summary of the Answers from FNCA Countries on "Survey of the Basic Data on Human Resources Development"

Secretariat
Japan Atomic Energy Research Institute
Japan Atomic Industrial Forum Inc.

1. Distribution of the questionnaire and the answer from each country

(1) Distribution of the questionnaire

On August 9, 2002, Survey was requested in the names of Dr. S. Machi, FNCA Japan Project Leader and Dr. Y. Seki, FNCA Japan Project Leader on Human Resources Development to the FNCA Coordinators and Project Leaders of the eight member countries including Australia.

(2) Answers from each country

As of September 30, 2002, seven countries, i.e. China, Indonesia, Japan, Korea, Malaysia, the Philippines and Thailand returned the answers, those from China and Indonesia were of partial ones. Vietnam answered only the number of personnel in VAEC pending the answer in a couple of months. Australia contacted Coordinator Machi, saying that since they are interested in this survey, they hoped to learn about the result of the WS, although they cannot participate in it.

2. Summary of the data from each country

The summary of the data from each country is shown in Attachment (1).

3. Summary of the answers on individual survey items and comments

For the answers obtained from each country, summary by survey items has been made and comments on noted points have been added.

A-1. Survey of the Administrative Agencies and Nuclear Research and Development (R&D) Institutes

(1) For the Governmental Agencies of each country involved in Nuclear Administration and Nuclear Research & Development, Name, Role and Total Number the Officials have been summarized in Attachment (2).

(2) Comments or notes

a) In the answer from Korea, a private organization, Korea Electric Power Institute (KEPRI) is included.

Our survey plan, the subject was limited to the governmental agencies. The reason is that in case the framework is expanded to include private organization, especially in Japan, it would be

difficult to determine up to where the subject would be included. Taking nuclear power generation for example, the frame would be expanded from electric utilities, manufacturers to architect engineers studying aseismic design. To mention in addition, only the national research institutes specified in nuclear research have been included as Japanese research institutes.

It may be necessary to consider how to specify the subject agencies in the future including the review on it, in rearranging the way of utilization of the survey data.

b) From Indonesia, the education level and age constitution of BATAN were shown. Such data are considered of reference in the future analysis. Though it would be difficult for each country to survey on all the agencies, it would be necessary to study the way to tackle with this issue.

A-2. Survey of University Education Institutions

(1) The result of the survey on Universities is summarized in A-2-1 of Attachment (1).

(2) The result of the survey on Medical Radiation Technical Engineers Training school is summarized in A-2-2 of Attachment (2).

(3) Comments or notes

a) In the answers of Malaysia and The Philippines, the predominant part is taken by the data on medical universities, while in those of Japan, medical universities are not included.

When the survey plan was considered in Japan, medical universities were out of the consideration. At present, it is considered necessary that medical field be included in the survey. It is considered that summing up, however, should be made on medical field and on engineering/scientific field, separately.

b) The number of university students in Japan is significantly overestimated. This is based on the result of the answers from universities. The reason of the overestimate is national universities with Nuclear Engineering Department turning into graduate universities because of university reorganization in recent years. In other words, the number of students summed up this time is the summation of those of several specialties. For example, in the case of Kyoto University, 200 students are admitted in the Physical Engineering Department every year. Thus the data this time shows more than 400 students for two years. This number includes those of Mechanical Engineering students and Aeronautical Engineering students, except for Nuclear Engineering Department students. After two years, the students entering Physical Engineering Department are divided into sub-courses. Nuclear Engineering Sub-course receives 20 students. Since this ratio differs by universities, it is considered necessary to sum-up the number once again.

A-3 Survey of Radiation and Radioisotopes Application

(1) The result of summation for Plant Mutation Breeding, Sterile Insect Technique and Food Irradiation is shown in A-3-1 of Attachment (1), the summing up of the total, and that for Radiation Therapy in A-3-2.

(2) As the other field, The Philippines answered on the numbers of institutions and engineers of Non-Destructive Testing. Thailand answered on the numbers of institutions and engineers of Radiation Diagnosis.

A-4 Survey of Nuclear Training Course

(1) The training courses in Indonesia, Malaysia, The Philippines and Thailand are summarized in the Attachment (3). Japan and Korea are excluded from this table since the numbers of training courses are large and those courses related to nuclear power generation also are included. Refer to the country reports of each country.

(2) Comments or notes

a) Through this survey of the basic data we got a lot of information about training courses especially in Japan and Korea. These information will be very useful in practicing and planning of future training courses in member countries.

b) From Indonesia, the number of participants in the overseas training is shown. It would be necessary to study how to consider the training in the overseas.

c) In our survey plan, it was considered to categorize the training courses into the following five types:

i) Basic/general Nuclear Energy

ii) Radiation/Radioisotopes Application Technique

iii) Nuclear Power Generation Technique

iv) Safety (Including Radiation Hazard Prevention)

v) Others (Including Protection against Nuclear Materials and International Cooperation)

The answers from each country show that this categorization does not seem to be sufficient. In other words, the number of training courses and the ratio of each category significantly differ between the cases whether nuclear power generation is implemented or not. Therefore, it is considered if it would have been better to divide it into i) General, ii) Other than nuclear power generation and iii) Nuclear power generation, and then sub-divide them into necessary categories.

A-5 Survey of Licenses of National Examinations Related to Nuclear Technology

(1) A list of the Name, Role, Number of persons that obtained the qualification, Total number of persons that obtained the qualification of Nuclear Technology and Certification organization is shown in Attachment (4)

(2) Comments or notes.

a) Through this survey we got good results to put in order the information of National Examinations of each country. Hereafter the system of each country will get better by mutual information exchange.

A-6 Survey of Background Data for Analysis

(1) The number of users of radiation applications is shown in A-6-1 of the Attachment (1), the number of radiotherapy facilities in A-6-2 and the data on population, GDP and GPD per capita in A-6-3.

(2) Comment or notes

a) It is necessary to study what kind of item other than those surveyed this time to consider as the data for analysis in the future, e.g. the number of units of nuclear power generation and outputs. If there were such data as economical productivity by use of radiation it would be possible to have more interesting analysis.

A-7 Comments on the Survey

(1) Comments only from Malaysia is as follows:

a) The survey provides a good start for HRD project leaders to maintain a data, base of information related to Human Resource Development in the field of Nuclear Science and Technology.

b) Data can be enriched by keeping a registry of persons counted.

c) For each category of application a more detail study can be carried out regarding the different roles that exist and competencies required for each role. Competency gaps and training needs identified and, training plan or design developed

d) It is realized that there have been wastage in training in the sense that people that have been trained are doing other jobs or other projects. May be the extent of the wastage needs to be determined and measures taken to reduce.

4. Summary of survey from now on

(1) The summary of the HDR Survey this time will be studied in accordance with the purpose of utilizing it for the study of human resources strategy of each country in the future. More specifically, the study result is to be summarized and reported to the Fourth Coordinators Meeting to be held in Tokyo in March 2003.

(2) The survey this time is positioned to be the first step of the study of the human resources strategy and it is the basic approach to collect available numerical values. In other words, those data selected as survey items were not those from the viewpoint of if they are essentially necessary data, but from that of if they are available or not. In addition, the secretariat considered the possibility of Japan providing the data.

(3) Therefore, it is not necessarily considered that the survey this time would immediately turn out to be the direct data for the study of human resources strategy. However, it is significant to collect

and put in order information and data of member countries concerning human resources development. So, we would like to continue to collect numerical data as the first step. Needless to mention, the data is limited in principle to what each country can provide.

If improvement or addition to the items and contents of the survey this time is suggested, Japanese secretariat would appreciate to be contacted.

(4) We would like to proceed with the analysis/evaluation of data in parallel with the work mentioned in the above (3). The approach on the way of proceeding with it is summarized in the followings:

a) Since the human resources strategy is the task, in principle, for each country to consider in accordance with its own nuclear development program, there is not standard pattern to be referred to.

Therefore, it is considered that there would be no other way but to tackle the task reflecting the opinions of those of member countries in the manner of try and error, and in some cases challengingly. It is expected that ideas and opinions from those of as many countries as possible be obtained.

b) We would start with the comparison by each country, by dividing the survey data by the population (and/or GDP) as the analysis for the time being.

c) The attached figure, the number of radiation oncologist, is one of the image of our analysis. This graph is made of the data from the paper, Quantitative status of resources for radiation therapy in Asia and Pacific region, wrote by Dr. H. Tatsuzaki and Dr. C. V. Lein, which is collected by the activities of IAEA/RCA. (This paper is accessible to www.elsevier./com/locate/radonline.) As to individual field like medical and agriculture utilization, it is comparatively easy to make these analyses, but they may not be applicable to all the other survey items.

d) However, it is considered there would be fundamental difference in all numerical values such as the number of officials of governmental agencies, that of university students and that of training courses differ between the cases whether power generations is implemented or not.

It is difficult task how to evaluate it. It is not considered enough simply to divide it by the numbers of nuclear power plants or the output of plants. In some cases it would be necessary to include trend by ageing into consideration.

Since the common base of FNCA member countries is in the radiation utilization, it is another task for consideration how far to study this task.

(5) Because all the data is not yet complete, and since it is necessary to study the way of arrangement and summarization in a course of time, this survey is considered to be the theme to be implemented in two years, i.e. this and next year.

(6) Since the survey on universities is considered to be an important theme for FNCA member

countries, it is considered to be studied separately.

5. Contact Persons

As to any opinion, comment question concerning this HRD survey and sending answers, please contact following Japanese Secretariat.

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Attachment

Summary of the Data from Each Country

of

"Survey of the Basic Data on Human Resources Development (HRD)"

(Draft)

Attachment (1) : Summary of the Data of Each Item of the Survey

Attachment (2) : A− 1 The Administrative Agencies and National Research and Development (R&D) Institutes

Attachment (3) : A−4. Survey of Nuclear Training Courses

Attachment (4) : A−5. Survey of Licensees of National Examinations Related to Nuclear Technology

Attachment (1)

Summary of the Data from Each Country of the Survey

A−1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

Country	The Number of Personnel in Nuclear Administration							The Number of Personnel in R&D			Total	Notes
	Promoting			Regulatory			Total					
	R&D/ Radiation Application	Nuclear Power Generation	Total	R&D/ Radiation Application	Nuclear Power Generation	Total		Radiation Application	Nuclear Power Generation	Total		
China			300 −350			200 −250	500 −600				500 −600	
Indonesia											3,818	
Japan			114			541	655			4,984	5,639	
Korea	51		51	326		326	377	1,045		1,045	1,422	Promoting includes Regulatory
Malaysia	352	−	352	35	−	35	387	198	−	198	585	
Philippines	167		167	32		32	199	83	−	83	282	
Thailand	209		209	179		179	388			219	607	
Vietnam				8		8	8	492		492	500	Only VAEC data
Total												

A－2－1 Survey of University Education Institutions

Country	University			Graduate School (Master)			Graduate School (Doctor)			Number of Univ.	Total		Notes
	Number	Number of Student	Number of Staff	Number	Number of Student	Number of Staff	Number	Number of Student	Number of Staff		Number of Student	Number of Staff	
China	13												
Indonesia	2			3									Faculty of Nuclear Technology of Gadjah Mada University (graduate/master) was abolished 2000.
Japan	10	3,118	23	11	571	28	11	221	184	12	3,910	235	
Korea	6	882	63	6	112	(63)	5	157	(63)	6	1,151	63	
Malaysia	5	164	43	3	18	32	3	6	32	6	185	107 (note)	Note: The same staff member are included in undergraduate, M.S. and Ph.D.
Philippines	—	—	—	1	12	6	None			1	12	6	Only: medical physics
Thailand	6	844	307	4	156	211	2	24	129	12	1,024	647	No information for Chiang Mai Univ., Thammasat Univ. a nd Ramkamheang Univ.
Vietnam	4	1,900	150	3	34	122	4	20	136	4	1,954	—	
Total													

A−2−2 Specialized School for Development of Technical Engineer

Country	Medical Radiation Technical Engineers Training School		Other Field (if there is any)		Notes
	Number of School	Number of Student	Number of School	Number of Student	
China					
Indonesia	1	checking			School for X-ray operator
Korea	22	1,504	None	None	University - 4year: 4 Vocational School -3years: 18
Japan	39	2,122	None	None	
Malaysia	2	175	None	None	
Philippines	None	None	None	None	
Thailand	7	196			
Vietnam	None	None	None	None	
Total					

A−3 Survey of Radiation and Radioisotopes Application

A−3−1 Agricultural Application

Country	Plant Mutation Breeding		Sterile Insect Technique		Food Irradiation		Notes
	Number of the institutions implemented	Number of the scientists engaged	Number of the institutions implemented	Number of the scientists engaged	Number of the institutions implemented	Number of the scientists engaged	
China		(500)					Total number of Agricultural Application
Indonesia							
Korea	10	19	1	3	2	44	
Japan	115	324	1	18	1	5	
Malaysia	4	18	1	1	17	15 (note)	note : Not all are involved in research
Philippines	9	40	2	7	7	26	
Thailand	60	111	2	45	9	77	
Vietnam	Checking	Checking	Checking	Checking	Checking	Checking	
Total							

A－3　Survey of Radiation and Radioisotopes Application

A－3－2　Medical Application／A－3－3　Other field

Country	Medical Application-Radiation Oncology			Other field		Notes
	Number of the implemented institutions	Number of the radiation oncologists	Number of the therapeutic technicians	Number of the implemented institutions	Number of engaged scientist	
China		5,000	470		2,500－3,000	Other : Industrial Application(cardinal number of Co-60, accelerators,etc.)
Indonesia	24					
Korea	52	126	261	None	None	
Japan	611	540	1,062	None	None	
Malaysia	20	32	60	None	None	
Philippines	13	36	44 (Note 1)	29 (Note 2)	700 (Note 2)	Note1: Additional 16 physicists Note2: Non-destructive Testing
Thailand	26	569		2,235 (Note)	7,305 (Note)	Note: Radiation Diagnosis
Vietnam	739	2,010	50	65	494	
Total						

A—4 Survey of Nuclear Training Courses --- a)Summary

	The Number of Courses	The Number of Implement Institutions	Total Number of Annual quota of Trainee	Total Number of Cumulative Trainee	Notes
China					
Indonesia	(8)	1		11,274	BATAN
Korea	80	2	4,452	52,472	KAERI, KARI
Japan	176	12			JAERI, NIRS, JCAC, JNC, JAIF, JAPCO, others
Malaysia	25	1		6	
Philippines	11	1	410	4,555	
Thailand	31	3	1,345	8,684	
Vietnam	36	2	230	1,188	VAEC, MOST (5years)
Total					

A—4 Survey of Nuclear Training Courses --- b)the Number of Courses

Country	The Number of Nuclear Training Courses						Notes
	A Basic/General Nuclear Energy	B Radiation/Radioisotopes Application Technique	C Nuclear Power Generation Technique	D Safety (including Radiation Hazard Prevention)	E Others(including protection against nuclear materials and International cooperation)	Total	
China	Nuclear Graduate School, Beijing (not a single course)		Training Centres in NPPs (no information of the number of course)		Business Administration Institute for Nuclear Industry		
Indonesia						8	
Korea	(22)	(24)	(32)	(Note)	(2)	80	Note: Included in B.C
Japan	(35)	(43)	(48)	(24)	(26)	176	
Malaysia		19		6		25	
Philippines		7		4		11	
Thailand	4	15 (Note)		9	1	29	Note : 9 out of 15 are: agricultural application training courses (Kasetsart Univ.)
Vietnam		4		30	2	36	1996-2001
Total							

A－4 Survey of Nuclear Training Courses --- c)the Number of Trainee

Country	The Number of Trainee (Annual quote of trainee / Cumulative trainee)						Notes
	Basic/General Nuclear Energy	Radiation/Radioisotopes Application Technique	Nuclear Power Generation Technique	Safety (including Radiation Hazard Prevention)	Others(including protection against nuclear materials and International cooperation)	Total	
China							
Indonesia						-/11,274	
Korea							See Korea's Attachment
Japan							See Japan's Attachment
Malaysia							
Philippines		270/3,506		140/1,049		410/4,555	
Thailand	170/1,109	635/1,331 (470/717:note)		390/4,128	150/2,116	1,345/8,684	Note : Agricultural application (Kasetsart Univ.)
Vietnam		- /108		200/2,010	- /59		1996-2001
Total							

A−5. Survey of Licensees of National Examinations Related to Nuclear Technology

Country	The Number of Qualification			The Number of Annual Licensees			Cumulative Licensees			Notes
	National	Other	Total	National	Other	Total	National	Other	Total	
China	2		2	560 −600		560 −600	(560 −600)		(560 −600)	Annual or Cumulative (not defined)
Indonesia										
Korea	7	—	7	301	—	301	6,456	—	6,456	
Japan	6	1	7	(3,275)	10	(3,285)	(51,508 + α)	137	(51,639 + α)	
Malaysia	4	—	4	125	—	125	449	—	449	
Philippines	1	—	1	5	—	5	29	—	29	Radiographic testing practitioner
Thailand	7		7				3,119		3,119	
Vietnam				33			406		406	1990-9/2002
Total										

A−6 Survey of Background Data for Analysis

A−6−1 The number of users of radiation application

Country	Breakdown (%)						Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	Total	
China							
Indonesia							
Korea	216 (11.8%)	129 (7.19%)	196 (10.7%)	887 (48.7%)	424 (21.7%)	1,821	
Japan	793 (16.4%)	485(10.0%)	713(14.3%)	1,927(39.2%)	919 (19%)	4,837	
Malaysia	500(5%)	4,400(44%)	100(1%)	5,000(50%)	—	10,000	
Philippines	13(4%)	75(24%)	11(3%)	174(56%)	40(13%)	313	
Thailand	143(21.6%)	114(17.22%)	—	278(41.99%)	127(19.18%)	662	
Vietnam	492(17%)	2,010(68%)	150(5%)	257(8%)	65(2%)	2,974	
Total							

A－6　Survey of Background Data for Analysis

A－6－2　Radiation Therapy

Country	Total number of megavoltage teletherapy machines			Total number of brachytherapy machine						Numbe of annual new cancer patients in both sexes
	Cobalt	Accelerator	Total	Manual LDR	Auto Remote LDR	HDR			Total number of the potentially treatable capacity: brtx-cap (note)	
						CoHDR	IrHDR	HDR Total		
China										
Indonesia										
Korea	8	76	84	3	10	3	18	21	11,450	83,846
Japan	213	603	816	2	8	187	74	198	99,740	386,783
Malaysia	7	19	26	15	2	1	6	9	4,725	21,670
Philippines	14	4	18						2,500	65,361
Thailand	25	26	51		11	7	8	15	8,380	63,741
Vietnam	7	1	8	7		1	2	3	2,000	
Total										

note : brtx-cap=number of manual load brachytherapy kits × 50

+number of automatic after loading LDR machines × 80, (^{60}Co and ^{192}Ir) ×500

<Source: Quantitative status of resources for radiation therapy in Asia and Pacific region, Hideo Tatsuzaki and Cecil Victor Levin, Radiotherapy and Oncology 60 (2001) 81-89<www.elsevier.com/locate/radonline>

A－6　Survey of Background Data for Analysis

A－6－3　Others

Country	Population (thousand)	GDP (US$ Million)	GDP per Capita (US$)		Scope of Nuclear Power Generation (The number of operating units, Generating capacity)		Economic Scale of Nuclear Application (Radiation application, Nuclear Power generation)	Notes
China	1,284,971	1,079,954	798					
Indonesia	214,840	153,255	674					
Japan	127,334	4,764,020	34,276					
Korea	47,069	457,220	8,871					
Malaysia	22,633	89,321	3,613					
Philippines	77,131	74,733	1,032					
Thailand	63,584	122,165	2,000					
Vietnam	79,175	134,800	373					
US	285,926	9,963,100	32,778					
India	1,025,096	454,535	453					
Bangladesh	140,369	36,408	291					
Pakistan	144,971	60,092	487					

Attachment (2)

A — 1 The Administrative Agencies and National Research and Development (R&D) Institutes (1/2)

	Agency / Institutes		Role	Total	Notes
China					
Indonesia	1	Nuclear Energy Control Board (BAPETEN)	Regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials		Nuclear Energy Control Board (BAPETEN)
	2	National Nuclear Energy Agency (BATAN)	To execute, and to promote the research and the use of nuclear energy	3818	National Nuclear Energy Agency (BATAN)
Korea	1	Ministry of Science & Technology (MOST)	Administrative Agency: Planning, deliberation, and decision of nuclear policy in general	51	
	2	Korea Atomic Energy Research Institute (KAERI)	R&D Institute: Research for promoting the peaceful application of nuclear energy	1,045	
	3	Korea Institute of Nuclear Safety (KINS)	R&D Institute: Performs regulatory functions such as safety reviews, inspections, and development of regulatory technical standards	326	
Japan	1	Cabinet Office	Administrative Agency: Planning, deliberation, and decision of nuclear policy in general	129	
	2	Ministry of Education, Culture, Sports, Science and Technology (MEXT)	Administrative Agency: Nuclear administration of scientific technique	125	
	3	Ministry of Economy, Trade and Industry (METI)	Administrative Agency: Nuclear administration of energy	401	
	4	Japan Atomic Energy Research Institute (JAERI)	R&D Institute: Synthetic research and training for engineer	2,263	
	5	Japan Nuclear Fuel Cycle Development Institute (JNC)	R&D Institute: Research development of nuclear cycle development	2,345	
	6	National Institute of Radiological Sciences (NIRS)	R&D Institute: Research on radiation effects on human body and prevention, medical application of radioisotopes and radiation, effects on living environment, and human resources development	376	

A−1 The Administrative Agencies and National Research and Development (R&D) Institutes (2/2)

	Agency / Institutes		Role	Total	Notes
Malaysia	1	Malaysia Institute for Nuclear Technology Research [MINT]	R&D, technical services and administrative services and national agency for planning & advisory on nuclear matters	535	
	2	Atomic Energy Licensing Board [AELB]	Regulatory and Licensing	50	
Philippines	1	Philippine Nuclear Research Institute (PNRI)	The sole agency of government mandated to advance and regulate the applications of nuclear science and technology in the Philippines	262	
	2	Department of Science and Technology (DOST)	Cabinet level administrative agency; provides central direction, leadership and coordination of all S&T activities in the country. Formulates S&T policies, programs and projects in support of national development priorities.	20	(Only those concerned with nuclear S&T)
Thailand	1	Thai Atomic Energy Commission for Peace (Thai A.E.C.) and its 14 sub-committees	Setting-up policies, deliberations in promoting and regulating the peaceful application of atomic energy for various purposes	214	
	2	Office of Atomic Energy for Peace (OAEP)	Implementing the regulating and promoting performances for the use of atomic energy for the benefit of the country's development; serving as the focal point coordinating both national and international authorities in exercising the peaceful applications of atomic energy	393	Only regular officials, including scientists, engineers, technicians and administrative staffs are counted.
Vietnam	1	Vietnam Radiation Protection and Nuclear Safety Authority (VRPA)	Regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials, Inspection and Licensing for Radiation Protection	8	
	2	Vietnam Atomic Energy Commission (VAEC)	R&D Institute	492	

Attachment (3)

A—4. Survey of Nuclear Training Courses

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Indonesia			Nuclear Material and Fuel		BATAN			293
			Information Technology		BATAN			567
			Instrumentation and Installation		BATAN			646
			Managerial		BATAN			4892
			Nuclear Safety		BATAN			2015
			Radioisotopes and Radiation		BATAN			2199
			Nuclear Reactor and Energy		BATAN			533
			Material Sciences		BATAN			129

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Malaysia	1	Radiation Safety and Health	1.Radiation Safety and Health	To understand the philosophy and principles of radiation protection;	MINT		3 days	896(2001) 404 (up to 30 Jun 2002)
			2.Radiation Safety Awareness	To understand the radiation safety aspects and practices at work place in accordance with safety standard and procedures;	MINT		1 day	
			3.Workshop on Good Radiation Safety Practice	Giving exposure on the safe working procedures with ionizing radiation;	MINT		1 day	
			4.Radiation Protection for Worker	Learning the right and proper procedures in controlling the radiation exposure to the radiation workers;	MINT		5 days	
			5.Radiation Protection for Officer	Creating Awareness on biological effects and the risks of ionizing radiation.	MINT		7 days	
			6.Chemical Safety and Health		MINT		3 days	

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Malaysia	2	Medical X-ray	1. Training Course for Medical X-ray Operator	To provide understanding of the philosophy and principles of radiation protection for medical application;	MINT		8 days	129 (2001) 89(up to 30 Jun 2002)
			2. Awareness Course On Radiological Safety for General Practitioner	Creating awareness on the radiation hazard, biological effects and risks of ionizing;	MINT			
			3.Training Course on X-ray for General Practitioner	To familiarize with the component, function, operation and control of x-ray and other associated equipment;	MINT			
			4. Good Operational Practice	To familiarize with the radiographic techniques and interpretation of radiograph for simple radiography;	MINT			
			5. Quality Assurance in Medical Radiography	To generate the importance of right working procedure being practiced when dealing with x-ray equipment.	MINT			
			6. Interpretation of Radiographic Image		MINT			

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Malaysia	3	Non-Destructive Evaluation	1. Basic Course on NDT		MINT		3 days	201(2001) 229 (up to 30 Jun 2002)
			2. Basic Metallurgy in NDT		MINT		5 days	
			3. Concrete Inspection Using NDT Technique		MINT		5 days	
			4. Eddy Current Basic Grade		MINT		6 days	
			5. Eddy Current Intermediate Grade		MINT		12 days	
			6. Keselamatan Radiografi Untuk Pembantu Pengendali	To meet the syllabus requirement of MLVK (National Vocational Training Council) where applicable;	MINT		2 days	
			7. Industrial Radiography Basic Grade		MINT		12 days	
			8. Industrial Radiography Intermediate Grade	To provide the participants with the necessary knowledge in both theory and practices of related technologies.	MINT		12 days	
			9. Interpretation and Evaluation of Radiograph		MINT		5 days	
			10. Advanced Industrial Radiography		MINT		12 days	
			11. Surface Method Basic Grade		MINT		11 days	
			12. Surface Method Intermediate Grade		MINT		11 days	

	Field		Course	Objective	Implement Institution	Annual Quota of Trainees	Duration	Cumulative Number of Trainees
Philippines	1	Radiation/ Radioisotope Application Techniques	RTTC	RI applications in medicine, research, agriculture	PNRI	60	4weeks	1,822
			IURC	RI applications in industry	PNRI	30	4weeks	704
			NTUCF	Training of university/college faculty	PNRI	30	5weeks	252
			SNS-HSST	Training of high school teachers	PNRI	30	5weeks	432
			RIA	Training in Radioimmuno-Assay	PNRI	30	1week	127
			Radiation Cyto-Genetics	Training in radiation cytogenetics	PNRI	30	5weeks	50
			Introductory Course in Nuclear Science	Basic training for high school and elementary school teachers	PNRI	60	1week	119
	2	Safety	RHSC	Training for Radiation Safety Officers	PNRI	30	4weeks	508
			Radiation Safety Course	Radiation safety for radioisotope users	PNRI	60	3 days to 1week	461
			Safe Transport of RAM	Safe transport of radioactive materials	PNRI	20	3 days	35
	3	Safety	Emergency Planning and Preparedness	Training in emergency planning and preparedness	PNRI	30	1 week	45

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Number of Trainees
Thailand	1	Basic/general Nuclear Energy	Nuclear Science Youth Club		OAEP	60	3 days	259 (1998)
			Nuclear Chemistry and Application		OAEP		10 days	24 (1996)
			Nuclear Energy and Application		OAEP	50	5 days	463 (1988)
			Introduction to Radiation and Application		OAEP	60	2 days	363 (1997)
	2	Radiation/Radioisotopes Application Technique	Radiographic Testing Level 1		OAEP	30	5 days	235 (1989)
			Radiographic Testing Level 2		OAEP	20	12 days	83 (1989)
			Foods and Agricultural Products Irradiation		OAEP	30	5 days	89 (1997)
			OAEP/JAERI Training Course on Nuclear Technology and Its Diverse Applications		OAEP	20	10 days	59 (1999)
			Applications of Radiotracer Techniques in the Petroleum and Petrochemical Industries		OAEP	25	5 days	25 (1991)
			Pest Control Using Radiation		OAEP	40	5 days	123 (1999)
	3	Safety (including Radiation Hazard Prevention)	OAEP/JAERI Training Course on Radiation Protection for Radiation Safety Supervisors		OAEP	30	10 days	63 (1999)
			Distance Learning on Radiation Protection		OAEP			10 (1998)
			Emergency Preparedness		OAEP	30	10 days	50 (1994)
			Introduction to Radiation Protection		OAEP	50	2 days	235 (1992)
			Irradiator Operator		OAEP	10	35 days	40 (1992)
			Reactor Operator		OAEP	15	45 days	52 (1988)
			Radiation Protection Level 1		OAEP	60	5 days	1668 (1990)
			Radiation Protection Level 2		OAEP	60	10 days	1110 (1990)
	4	Others (Including protection against nuclear materials and international cooperation)	Radiation Protection for Lighting Preventor		OAEP	150	2 days	672 (1991)
			Seminar on Nuclear Technology and Science		OAEP		2 days	1348 (1984)
			Seminar on Nuclear Technology and Advantage for Peace		OAEP		1 days	96 (1998)

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Number of Trainees
Thailand	5	Radiation/ Radioisotopes Application Techniques	Induced Mutation Technique for Crop Improvement		GISC	20	5 days	16 (1998)
			Project Formulation Meeting on Mutational Enhancement for Genetic Diversity in Rice		GISC	20	5 days	15 (1999)
			Use of Induced Mutation Technique for Genetic Diversity and Economic Crop Improvement		GISC	40	5 days	35 (1999)
			Ornamental Improvement through Gamma Rays Induced Mutation		GISC	45	1 day	90 (1999)
			Production of Exotic Ornamentals through Gamma Rays Induced Mutation		GISC	40	1 day	260 (2000)
			In vitro Mutagenesis and Molecular Marker Analysis of Ornamental Plants		GISC	25	5 days	25 (2000)
			The Use of Gamma Rays for Crop Improvement		GISC	20	3 days	20 (2001)
			Production of Exotic Ornamentals through Gamma Rays Induced Mutation		GISC	240	1 day	240 (2001)
			Induced Mutation Technique for Genetic Diversity and Economic Crop Improvement-II		GISC	20	4 days	16 (2002)
			Induced Mutation Technique for Crop Improvement		GISC	20	5 days	16 (1998)
	6	Safety	Radiation Protection		note	120 – 135	5 days	900

GISC: Gamma Irradiation Service and Nuclear Technology Research Center, Kasetsart University

note: Sukhotai Tammathirat Open University

	Field	Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Number of Trainees
Vietnam	Radiation Safety			VAEC	200	5 days	2010 (5years)
		RTC on the use of Immunoassay Technologies for studies on Diagnosis & Control of Foot and Mouth Disease in south Asia		VAEC	23		23 (1996)
		National TC on Concepts and Principals of RIA/Data Processing, Internal Quality Control & External quality assessment Scheme		VAEC	42		42 (1997)
		Regional Training Course on Standard Software for Tracer Applications and Nucleonic Gauge Design and Calibration		VAEC	15		15 (2000)
		RTC Web Site Construction and Management		VAEC	17		17 (2000)
		RTC on "SPECT Techniques in Cardiology and Oncology"		VAEC	26		26 (2000)
		TC on Radiation Treatment for Natural Polysaccharides		VAEC	24		24 (2000)

Attachment (4)

A−5. Survey of Licensees of National Examinations Related to Nuclear Technology (1/2)

		Qualification	Target	Average Annual Licenses	Cumulative Licenses	Authorize Institution	Notes
China	1	Second class Supervisor of Radiation Protection	Radiation Application/Sealed sources				
	2	First class Supervisor of Radiation Protection	Radiation Application/Sealed Sources				
	3	Chief Engineer	Reactors / Nuclear Fuel				
	4	Chief Engineer of Nuclear Fuel	Fuel Processing, Uranium Enrichment, Reprocessing, Reactor				
	5	Clinical Radiation Technician	Medical Application				
	6	Medical Physicist (Public License)	the same as above				
Indonesia							
Korea	1	General License	Radiation Application	110	3,427	MOST	
	2	Supervisory License	Radiation Application	43	646	"	
	3	Special (oncologist) License	Radiation Application in medical use	8	797	"	
	4	Reactor Operator	Research Reactor/Generation Reactor	67	702	"	
	5	Reactor Senior Operator	"	60	847	"	
	6	Nuclear Materials Treatment License	Nuclear material treatment	0	6	"	
	7	Supervisory License For Nuclear Materials Treatment	Nuclear material treatment	13	31	"	
Japan	1	First Class Supervisor of Radiation Protection	Radiation Application / Unsealed Radioisotopes	463	19,924 (1958~2000)	MEXT	
	2	Second Class Supervisor of Radiation Protection (General)	Radiation Application / Sealed Radioisotopes	644	26,407 (1960~2000)	MEXT	
	3	Second Class Supervisor of Radiation Protection (ECD)	Radiation Application / Sealed Radioisotopes	215	3,224 (1968~1999)	MEXT	
	4	Chief Engineer of Reactors	Research Reactor / Generation Reactor	27	1,120 (1957~2000)	MEXT	
	5	Chief Engineer of Nuclear Fuel	Fuel Processing / Uranium Enrichment / Reprocessing / Reactor	26	883 (1968~1999)	MEXT	
	6	Clinical Radiation Technician	Radioactive Handling in Medical Treatment	Checking	Checking	Ministry of health, labor and welfare	
	7	Medical Physicist	None	10	131	Medical physics society	

A—5. Survey of Licensees of National Examinations Related to Nuclear Technology (2/2)

		Qualification	Target	Average Annual License	Cumulative License	Authorize Institution	Notes
Malaysia	1	Radiation Protection Officer[RPO] Radiation Protection Supervisor [RPS]	Gaugas	+63	326	AELB	
	2	Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	Sales	46	91	AELB	
	3	Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	NDT	7	14	AELB	
	4	Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	TENORM	9	18	AELB	
Philippines		Certification as Radio-graphic Testing Practitioner		5	29	National Certifying Body	Those who did not renew their certification, not counted. Recertification exams every 2 yrs.
Thailand	1	Technician for Radiation Protection	Radiation Protection for Sealed Source		1542 (1990-2002)	OAEP	
	2	Technician for Radiation Protection	Radiation Protection for Sealed Source		283 (1998-2002)	Sukhothai Thammathirat Open University	
	3	Radiation Protection Officer	Radiation Protection for Unsealed Source		1055 (1990-2002)	OAEP	
	4	Engineer for radiographic testing	Radiographic Testing level 1		121 (1989-2002)	OAEP	
	5	Engineer for radiographic testing	Radiographic Testing level 2		52 (1989-2002)	OAEP	
	6	Reactor Operator	Operation of Nuclear Research Reactor		41 (1988-2002)	OAEP	
	7	Irradiation Operator	Operation of Irradiation Plant		25 (1992-2002)	OAEP	
Vietnam							

1.7.3 Research on Education Systems Related to Nuclear Human Resource Development

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ABSTRACT

It is discussed first that the evaluation of fruits gained from FNCA program related to human resource development and its modification, on the basis of the results are necessary to be continued. Next, a research on education systems related to human resource development in nuclear and its related fields is proposed. Subsequently, the research subjects, research terms and methods are also discussed. Finally, the method to utilize the results obtained through the proposed research is discussed.

1. BACKGROUND

The needs for human resource development in nuclear and its related fields among different countries are not in harmony, due to their actual circumstances. For instance, nuclear power plants (NPPs) are in operation in Korea, China and Japan. On the other hand, Indonesia and Vietnam have been considering to introduce the NPPs in the future. Thailand is researching the feasibility whether NPPs can be introduced in the future or not. Finally, Malaysia and the Philippines have decided not to introduce the NPPs in the future, but are utilizing radioactive ray facilities in various fields.

FNCA program related to human resource development in nuclear and its related fields has been carried out in the last four years. It is required that the FNCA program should be efficiently administered by evaluating the results in the past and by modifying the ineligible parts in order to continue the program in the future. The purpose of FNCA program of human resource development is to support the development of the human resource in the membership countries by themselves. It is important to promote the persons with the required ability to achieve this purpose.

Universities and professional schools play the important roles to endorse the talented persons not only in nuclear but also various fields. It is, therefore, proposed that the education systems of human resource development in nuclear and its related fields will be surveyed in the membership countries. The purpose of this study is to grasp the needs for human resource development related to nuclear power reactors, research reactors and utilization of radioactive ray including accelerators once more. For this purpose, the education systems in universities, professional schools and so on will be studied. The results will be applied to the database for assessment of Asian Nuclear University concepts such as AINST.

2. RESEARCH SUBJECTS

In the field of the qualified persons, which are promoted by the FNCA program related to human resource development, it can be classified into the followings:

(1) Governmental sectors
- Decision makers in nuclear and energy development policy
- Administrators under the policy
- Practical workers such as inspectors

(2) Educational sectors
- Excellent researchers in the universities and research laboratories to perform research activities and promote the successors
- Professors in universities to educate skilled engineers, designers, scientists and so on
- Professors and teachers in universities and professional schools to produce professional workers

In the proposed research, the following subjects will be surveyed in order to study the requirements for FNCA program related to human resource development in each membership country, that is, to grasp the fields for the insufficiency in human resource development carried out in each membership country;

(1) existing academic related societies and associations and the number of their members
(2) the fields, the number of professors and teachers, and curriculum of related lectures in the existing related universities and professional schools
(3) future plans such as nuclear power plants, research reactors, accelerators and radioactive rays utilized for inspection, agriculture, medical and so on to attain the related fields and human resources required for each membership country in the future
(4) the results of FNCA program performed in the past: how they satisfy the requirements and contribute to the human resource development in each country

Since some of the above-mentioned databases have been presented as the country reports and surveyed as questionnaires, these results can be employed for this study.

3. RESEARCH TERM AND METHODS

In order to achieve the purposes of the proposed research, the following research terms and methods are considered:

(1) From October, 2002 to September 1, 2003:
FNCA coordinator and project leader in each country are assigned to research the above-mentioned subjects. The research subjects, which have never been agreed upon in the past FNCA coordinator meetings, will be figured out after the meeting in the year 2003.

(2) FNCA 2003 Workshop of human resource development
The results obtained from the proposed research will be presented and discussed.

(3) From October, 2003 to September 1, 2004
Another dispatch program sponsored by the MEXT will be introduced to research a short part of the program through research (1).

(4) FNCA 2004 Workshop of human resource development
Further results obtained from the proposed research will be presented and discussed once more.

(5) Beyond October, 2004
In the case where there will still remain a short subjects through researchs (1) and (3), the proposed research will be continued.

4. REFLECTION OF THE RESEARCH RESULTS IN FUTURE FNCA PROGRAM OF HUMAN RESOURCE DEVELOPMENT

FNCA Programs of human resource development will be modified continuously to satisfy the needs of human resource development in nuclear and related fields of each membership country after FY2004 on the basis of the results achieved from this research. FNCA will put the priority to the fields where the needs shall have been clarified.

RESEARCH ON EDUCATION SYSTEMS RELATED TO NUCLEAR HUMAN RESOURCE DEVELOPMENT

October 9, 2002

Masanori ARITOMI

Research Laboratory for Nuclear Reactors,
Tokyo Institute of Technology

PURPOSES OF PROPOSED RESEARCH

● Background

- ➢ Needs for human resource development in nuclear and related fields are not in harmony with other countries due to their actual circumstances.
  - Korea, China, Japan : NPPs in operation
  - Indonesia, Vietnam : Introduction of NPPs
  - Thailand : Study on introduction of NPPs
  - Malaysia, Philippines : Utilization of radioactive ray
- ➢ FNCA has been operated for four years.
  - → FNCA should be efficiently operated.
    - Limited budget

●Purposes

- ➢To grasp the needs for human resource development related to nuclear power reactors, research reactors and utilization of radioactive ray including accelerators
- ➢To investigate their education in universities, professional schools and so on.
- ➢The results will be applied as the database for assessment of Asian Nuclear University concept such as AINST.

RESEARCH SUBJECTS

1. Existing academic related societies and associations
2. Existing related universities and professional schools
   - ➢Fields, the number of professors, lectures
3. Future plans of nuclear power development and utilization of radioactive rays
   - ➢The database has been presented as the country reports.
     - Nuclear power plants
     - Research reactors
     - Accelerators
     - Radioactive rays utilized for inspection, agriculture, medical and so on

4. Requirements for FNCA human resource development
   - ➢ The fields for lack of human resource development in own country
   - ➢ Governmental sectors
     - · Decision makers of nuclear development policy
     - · Carriers of the policy
     - · Workers for inspection and so on
   - ➢ Educational sectors
     - · Excellent researchers in universities and research laboratories to raise research activities and bring up the successors
     - · Professors in universities to develop skilled engineers, designers and analyzers
     - · Professors and teachers in universities and professional schools to develop professional workers

5. The fruits of FNCA program performed in the past
   - ➢ How do the fruits meet the needs of human resource development in nuclear and related fields of each country?
   - ➢ How do the fruits contribute the human resource development of each country?

RESEARCH TERM AND METHODS

(1) October, 2002 to September 1, 2003
- ➢ To assign the coordinator in each country to research them.

(2) FNCA 2003
- ➢ To discuss the research results

(3) October, 2003 to September 1, 2004
- ➢ To utilize another dispatch program sponsored by the MEXT to research a short part of them through research (1).

(4) FNCA 2004
- ➢ To discuss the research results

(5) After October, 2004
- ➢ If necessary, this research will continue.

REFLECTION OF THE RESEARCH RESULTS IN FNCA FUTURE PROGRAM

●FNCA Programs after 2004 will be modified continuously to meet the needs of human resource development in nuclear and related fields of each country.
- ➢ To have priority to the fields where the needs have been clarified.

1.8 Conclusion Session

1.8.1 Minutes on the 4th Workshop on Human Resources Development

October 8 - 10, 2002
Batangas, the Philippines

The 4th FNCA Workshop on Human Resources Development (HRD) took place on October 8 − 10, 2002 in Batangas, the Philippines. This Workshop was sponsored by the Department of Science and Technology (DOST) of the Philippines and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan. The Philippine Nuclear Research Institute (PNRI) and the Japan Atomic Energy Research Institute (JAERI) acted as the hosts.

The number of participants in the Workshop totaled 19 people including 5 observers. The Opening Session and Presentations of country reports were conducted on the first day, and Round Table Discussions were conducted on the second day. The Concluding Session was held on the third day.

The participants of the Workshop were the Project Leaders, who are the persons responsible for human resources development − one from each of the eight member countries, i.e. China, Indonesia, Korea, Malaysia, Thailand, the Philippines, Vietnam and Japan. Besides the Project Leaders, one from Korea and the Philippines, respectively, and four participants from Japan were also attended the Workshop. As observers, three from the Philippines, and two from Japan attended.

Themes and contents of the country reports for the 4th Workshop were as follows, as agreed upon in the last Workshop and as proposed in the 3rd Coordinators Meeting held in March 2002:

(1) Subject for development of nuclear training technology

① Training materials in radiation protection area to be used commonly in member countries
② Introduction of e-learning system

(2) Survey of basic data on Human Resources Development in the nuclear field

(3) Other Information Exchange

① Requests on the MEXT Nuclear Researchers Exchange Program etc.
② Asian Institute of Nuclear Science and Technology (AINST) proposed by Indonesia

At the Round Table Discussions of the Workshop, the main points of the comments for future plans, and for the proposals and opinions agreed upon include the following:

(1) Subject for development of nuclear training technology

① Training materials in radiation protection area to be used commonly in member countries

- NuTEC/JAERI will initiate the process to provide the training materials from the joint training courses with Indonesia, Thailand and Vietnam, as the common training materials on radiation protection.

- The training materials will be provided in the HRD project website for review and

comments by the Project Leaders.

② Introduction of e-learning system

- Participants agreed on the usefulness of the e-learning system but the subject topics should be carefully selected.
- Real time e-learning has many technical difficulties, therefore e-learning contents in the form of CD-ROM should be considered as the starting point.

(2) Survey of basic data on Human Resources Development in the nuclear field

① The HRD needs and the HRD strategy that may be formulated as an outcome of the survey should be based on the nuclear development plan. Any comments for the comparison table containing the basic data should be added for clarification.

② In order for the collected data to be useful in the formulation of the HRD strategy, many factors/conditions need to be considered.

(3) Other Information Exchange

① The concept of the Asian Institute of Science and Technology was explained to be still evolving, in order to maximize the benefits to FNCA member countries.

② Items to be reported in next year's country report will include the following:

- Draft of HRD strategy in member states and how the strategy was formulated
- Any information or suggestions regarding seminars, workshops or training courses for nuclear managers/executives.
- Activities to promote the interest of the young generation in nuclear S&T
- Ways of using the basic data on HRD

(4) Action Items for FY2002

① Nuclear Training Materials and Methodology

- NuTEC/JAERI will initiate the process of providing the training materials from the joint training programs with Indonesia, Thailand and Vietnam, as the training materials on radiation protection to be used commonly.
- The training materials will be posted in the HRD project website for review and comments.
- Participants generally agreed on the usefulness of the e-learning system, with careful selection of subject topics and to proceed from off-line CD-ROMs. Information on the availability of multimedia CD-ROMs will be collected.
- Japan will distribute the textbook on fundamental reactor physics focused on Q & A.
- Japan shall dispatch trainers (speakers) to seminars/ workshops/training courses for

high school students, college students, and other young generation of member countries, upon request, in connection with the Public Information subproject of the FNCA.

② Basic Data on HRD

- Corrections and additions for the submitted data should be sent to the Secretariat by the end of December 2002 with the exception of China because of the difficulty to get national data.

③ Other Information Exchange

- Update and continue the inputs of member countries to the HRD project website regarding training courses in 2003, as well as training materials.

(5) The mid-term plans for HRD project as shown in Table 1 will focus on the following topics.

① Training support

- To improve the efficiency of human resources development in each country, mutual support activities such as exchange of information by way of the project website will be continued.
- To present requests for the MEXT nuclear researchers personnel exchange program etc. based on the actual needs in HRD of each country.
- Further investigation and discussions on the Asian Institute of Nuclear Science and Technology.
- Production and exchange of common training materials.

② Survey of basic data on HRD

- To formulate HRD strategy, survey, analysis, and result will be carried out in the three-year plan divided by general data and university data.
- Collecting the general survey data will be carried out by the end of the year, and analysis of the data will be carried out next year.

Remarks

Thailand tentatively offered to host the 2003 Workshop on HRD at the 3rd FNCA Coordinators Meeting. All participants appreciated the offer and agreed on Thailand as the venue for the Workshop in 2003.

The Workshop included a technical tour to Philippine Nuclear Research Institute. The participants expressed their sincere gratitude to the organizers and hosting institutions.

The Minutes were discussed and agreed upon by all participants in the Workshop. This will be reported at the 4th FNCA Coordinators Meeting to be held in March 2003 in Tokyo, Japan.

Table 1 The mid-term plans for Human Resources Development (HRD) Project

	FY2002	FY2003 (Plan)	FY2004 (Plan)	Notes
1. **General Schedule**	· 3rd FNCA Meeting (Oct. 30-31, Korea) · 4th CRD (March, Japan)	· 4th FNCA Meeting (Autumn, Japan) · 5th CRD (March, Japan)	· 5th FNCA Meeting (Vietnam) · 6th CRD (March, Japan)	
2. **HRD Workshop**	**4th Workshop (the Philippines) Oct. 8-10**	**5th Workshop (Thailand – pending)**	**6th Workshop (pending)**	
1) Training support • Training Materials & Technical Problems	• Examination of providing training materials in radiation protection • Examination of introducing e-learning system	• Production and exchange of training materials • Exchange of information on availability of multimedia CD's	→	Mutual support activity for problems and needs
• Information exchange & Needs	• AINST, INU • Intl. / Domestic Training Courses & Curricula & Materials	→	→	Put on HRD project web page
2) Survey of basic data on HRD • General	→	→		Report the result of the survey to CRD and FNCA
	Rough Survey	Analysis		
• University		→	→	
		Survey	Analysis	
• Result of Survey			→	
			• Report issues and improvements for HRD	

3. Outside Activities	**Workshop**	• Implementation of annual action plan • Issue of JAERI-Report on activities in FY2002 • Update of HRD web page	• Implementation of annual action plan • Issue of JAERI-Review on activities in FY2003 • Update of HRD web page	• Implementation of annual action plan • Issue of JAERI-Review on activities in FY2004 • Update of HRD web page

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2. Outside-Workshop Activity

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2.1 Document on Human Resources Development for the Forth Coordinators Meeting of FNCA (March 5-7, 2003, Japan)

2.1.1 Project Review on Human Resources Development in the Nuclear Field

Session 3
Document 3-HRD

Yasushi Seki
Project Leader of Human Resources Development
Director of Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)

Result of the 4th Workshop on Human Resources Development (HRD) in the Nuclear Filed in FY2002

1.1 Details and Objectives of the Workshop on HRD

In 1999, the Project for HRD was added to the existing fields of cooperation as defined in the framework of the Forum for Nuclear Cooperation in Asia, FNCA. The objective of the HRD Project is to solidify the foundation of technologies for nuclear development and utilization in Asia by promoting human resources development in Asian countries. Major cooperative activity of the Project is to hold a Workshop once a year.

The objective of workshops was to clarify the issues and needs in HRD of each country and to mutually support HRD activities of each country mainly through information exchange upon training materials and training techniques.

1.2 Summary of the 4th Workshop on HRD

(1) Date : October 8 − 10, 2002
(2) Venue : Batangas, the Philippines
(3) Sponsor by : MEXT, DOST
In cooperation with : JAERI, JAIF and PNRI
(4) Program : See Attachment 1
(5) Participant : 19 in total (See Attachment 2)
(One participant from China, Indonesia, Malaysia, Thailand, Vietnam, respectively, two from Korea, 5 from the Philippines, and 7 from Japan)

1.3 Summary of the Conference

The Opening Session and Presentations of country reports were conducted on

the first day, and Round Table Discussions were conducted on the second day. The Concluding Session and technical tours to the Philippine Nuclear Research Institution were conducted on the third day.

Themes and contents of the country reports for the 4th Workshop were as follows, as agreed upon in the last Workshop and as proposed in the 3rd Coordinators Meeting held in March 2002:

(1) Subject for development of nuclear training technology

① Training materials in radiation protection area to be used commonly in member countries
② Introduction of e-learning system

(2) Survey of basic data on Human Resources Development in the nuclear field

(3) Other Information Exchange

① Requests on the MEXT Nuclear Researchers Exchange Program etc.
② Asian Institute of Nuclear Science and Technology (AINST) proposed by Indonesia

At the Round Table Discussions on the second day of the Workshop, discussions were made on the themes mentioned above to further regional cooperation. The Medium-Term Plan of the project on HRD was formulated and agreed upon.

1.4 Results and Summary of the Conference

At the Round Table Discussions of the Workshop, the main points of the comments for future plans, and for the proposals and opinions agreed upon include the following:

(1) Subject for development of nuclear training technology

① Training materials in radiation protection area to be used commonly in member countries

- NuTEC/JAERI will initiate the process to provide the training materials from the joint training courses with Indonesia, Thailand and Vietnam, as

the common training materials on radiation protection.

- The training materials will be provided in the HRD project website for review and comments by the Project Leaders.

② Introduction of e-learning system

- Participants agreed on the usefulness of the e-learning system but the subject topics should be carefully selected.

- Real time e-learning has many technical difficulties, therefore e-learning contents in the form of CD-ROM should be considered as the starting point.

(2) Survey of basic data on Human Resources Development in the nuclear field

The HRD needs and the HRD strategy that may be formulated as an outcome of the survey should be based on the nuclear development plan. Any comments for the comparison table containing the basic data should be added for clarification.

(3) Action Items for FY2002

① Nuclear Training Materials and Methodology

- NuTEC/JAERI will initiate the process of providing the training materials from the joint training programs with Indonesia, Thailand and Vietnam, as the training materials on radiation protection to be used commonly.

- The training materials will be posted in the HRD project website for review and comments.

- Participants generally agreed on the usefulness of the e-learning system, with careful selection of subject topics and to proceed from off-line CD-ROMs. Information on the availability of multimedia CD-ROMs will be collected.

- Japan will distribute the textbook on "Exercises in reactor physics"

focused on Q & A.

- Japan shall dispatch trainers (speakers) to seminars/ workshops/training courses for high school students, college students, and other young generation of member countries, upon request, in connection with the Public Information subproject of the FNCA.

② Basic Data on HRD

- Corrections and additions for the submitted data should be sent to the Secretariat by the end of December 2002 with the exception of China because of the difficulty to get national data.

③ Other Information Exchange

- Update and continue the inputs of member countries to the HRD project website regarding International and Domestic training courses in 2003, as well as training materials.

(4) The mid-term plans for HRD project as shown in Table 1 will focus on the following topics.

① Training support

- To improve the efficiency of human resources development in each country, mutual support activities such as exchange of information by way of the project website will be continued.

- To present requests for the MEXT nuclear researchers personnel exchange program etc. based on the actual needs in HRD of each country.

- Further investigation and discussions on the Asian Institute of Nuclear Science and Technology.

- Production and exchange of common training materials.

② Survey of basic data on HRD

- To formulate HRD strategy, survey, analysis, and result will be carried out in the three-year plan divided by general data and university data.

- Collecting the general survey data will be carried out by the end of the year, and analysis of the data will be carried out next year.

Remarks

Thailand tentatively offered to host the 2003 Workshop on HRD at the 3rd FNCA Coordinators Meeting. All participants appreciated the offer and agreed on Thailand as the venue for the Workshop in 2003.

The Workshop included a technical tour to Philippine Nuclear Research Institute. The participants expressed their sincere gratitude to the organizers and hosting institutions.

The Project Review is written based on the Minutes on the 4th HRD Workshop.

The Minutes were discussed and agreed upon by all participants in the Workshop. This will be reported at the 4th FNCA Coordinators Meeting to be held in March 2003 in Japan.

Annex 1 Program of "The 4th FNCA Workshop on Human Resources Development in the Nuclear Field"

Annex 2 List of Participants

Annex 3 The Plan for Survey of the Basic Data on Human Resources Development in the Nuclear Field in FNCA Member Countries

Annex 4 Summary of the Data from Each Country of "Survey of the Basic Data on Human Resources Development (HRD)"

Annex 1

Program of "The 4th FNCA Workshop on Human Resources Development in the Nuclear Field"

October 8-10, 2002, The Philippines

Oct. 7 / Monday

Arrival in Metro Manila, The Philippines (overseas participants)
Reserved Hotel in Metro Manila

Oct. 8 / Tuesday **WORKSHOP (the 1st day)**

7:30 - 10:00 Leave Metro Manila for Batulao, Batangas
10:00-10:45 Check-In at Evercrest Golf Club Resort
Workshop Registration

[10:45-12:00 Opening Session]

10:45-10:50 **WELCOME ADDRESS**
Alumanda M. dela Rosa
Acting Director, Philippine Nuclear Research Institute (PNRI)

10:50-10:55 **OPENING ADDRESS**
Shinya Takeuchi
Director for International Nuclear Cooperation, Atomic Energy Division, Research and Development Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)

10:55-11:00 **INTRODUCTION OF GUEST SPEAKER**
Alumanda M. dela Rosa

11:00-11:05 **KEYNOTE ADDRESS**
Hon. Estrella U. Alabastro
Secretary, Department of Science and Technology (DOST)

11:05-11:30 Introduction of Participants
Commemorative Photograph

11:30-12:00 "Review and Scope of Workshop on the Human Resources Development and Procedure for the 4th Workshop"
Yasushi SEKI
Japanese Project Leader (PL)
Director, Nuclear Technology and Education Center (NuTEC), Japan Atomic Energy Research Institute (JAERI)

12:00-13:30 *<Lunch>*

[13:30-17:20 Presentation Session − Country Report]

Presentation Session − 1 Chairperson: VU Dang Ninh (Vietnam)
(Presentations: 25 min. each country including 10 min. Q&A)

13:30-13:55 **China, CHEN Gang**

13:55-14:20 **Indonesia, Guritno LOKOLLO**

14:20-14:45 **Korea, Eui-Jin LEE**

14:45-15:15 *<Coffee Break>*

Presentation Session − 2 Chairperson: CHEN Gang (China)

15:15-15:40 **Malaysia, Rapieh AMINUDDIN**

15:40-16:05 **The Philippines, Corazon C. BERNIDO**
The Philippines, Pilar C. ROCELES

16:05-16:30 **Thailand, Warapon WANITSUKSOMBUT**

Presentation Session − 3 Chairperson: Guritno LOKOLLO (Indonesia)

16:30-16:55 **Vietnam, VU Dang Ninh**

16:55-17:20 **Japan, Yasushi SEKI**

18:30-20:30 Reception hosted by DOST/PNRI and MEXT

Oct. 9 / Wednesday **WORKSHOP (the 2nd day)**

Discussion Session − 1

Co-Chairpersons: Warapon WANITSUKSOMBUT (Thailand)
Rapieh AMINUDDIN (Malaysia)

9:00-11:30 Theme of Country Report: Subject for Development of Nuclear Training Technique and Exchange of HRD information"

11:30-12:00 Special Presentation; "Study on Human Resources Development in Nuclear Industry in Japan"
Takashi YORI (JAPCO)

<Coffee Break for 20 min.>

12:00-13:30 *<Lunch>*

Discussion Session − 2 Chairperson: Eui-Jin LEE (Korea)

13:30-16:40 "Survey of the Basic Data on Human Resources Development"

16:40-17:00 *<Coffee Break for 20 min.>*

Discussion Session − 3 Chairpersons: Corazon C. BERNIDO (The Philippines)

17:00-18:00 Annual Action Plan for 2002
3-year action plan proposed by Japan (2003-2005)
Yasushi SEKI (Japan)

Oct. 10 / Thursday **WORKSHOP (the 3rd day)**

Conclusion Session

Co-Chairpersons: Corazon C. BERNIDO (The Philippines)
Yasushi SEKI (Japan)

8:30-10:00	Adoption of Minutes and Action Plans
10:00-10:15	*<Coffee Break>*
10:15-10:30	Check out from Evercrest Golf Club Resort
10:30-16:00	Leave for Metro Manila, and Technical Tour of the Philippine Nuclear Research Institute
	<Lunch in Metro Manila>
16:00-	**CLOSING ADDRESS** **Alumanda M. dela Rosa,** Acting Director, PNRI
	Reserved Hotel in Metro Manila

Oct. 11 / Friday

Leave for home (overseas participants)

Annex 2

List of Participants

[CHINA]

Mr. CHEN Gang
Deputy Manager
Management Training Center, Human Resources Department,
China Guangdong Nuclear Power Holding Co., LTD (CGNPC)

[INDONESIA]

Mr. (Dr.) Guritno LOKOLLO
Head of Planning Division
Education and Training Center
National Nuclear Energy Agency (BATAN)

[KOREA]

Mr. Eui-Jin LEE
Manager,
Education of Program Development,
Nuclear Training Center,
Korea Atomic Energy Research Institute (KAERI)

Mr. Young-Taek KIM
Principal Engineer,
Nuclear Training Center,
Korea Atomic Energy Research Institute (KAERI)

[MALAYSIA]

Ms. Rapieh AMINUDDIN
Director,
Human Resource,
Malaysian Institute for Nuclear Technology Research (MINT)

[THE PHILIPPINES]

Ms. (Dr.) Corazon Casenas BERNIDO
Head of Nuclear Training
Division of Nuclear Services and Training
Philippine Nuclear Research Institute (PNRI)

Ms. Pilar C. ROCELES
Supervising Science Research Specialist
Head, Technical Assistance Unit
Philippine Nuclear Research Institute (PNRI)

[THAILAND]

Ms. Warapon WANITSUKSOMBUT
Radiation Physicist
Division of Radiation Measurement
Office of Atomic Energy for Peace (OAEP)
Ministry of Science Technology and Environment

[VIETNAM]

Mr. VU Dang Ninh
Director
Department of Administration and Personnel Development
Vietnam Atomic Energy Commission (VAEC)

[JAPAN]

Mr. (Dr.) Yasushi SEKI
Director
Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)

Mr. (Prof.) Masanori ARITOMI
Professor
Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology

Mr. Takashi YORI
Senior General Manager & General Manager
Corporate Planning Department, The Japan Atomic Power Company

Mr. Shinya TAKEUCHI
Director for International Nuclear Cooperation
Research and Development Bureau, Atomic Energy Division
Ministry of Education, Culture, Sports, Science and Technology (MEXT)

Mr. Nobuyuki INOUE
Group Leader
Asia Cooperation Center, Japan Atomic Industrial Forum, Inc.

<Observer>

Ms. Victoria Fe O. MEDINA
FNCA Project Officer
Office of the Director
Philippine Nuclear Research Institute (PNRI)

Dr. Estrella D. RELUNIA
Senior Science Research Specialist
Nuclear Training, Division of Nuclear Services and Training
Philippine Nuclear Research Institute (PNRI)

Ms. Jocelyn L. DAVID
Science Research Specialist II
Nuclear Training, Division of Nuclear Services and Training
Philippine Nuclear Research Institute (PNRI)

<Secretariat>

Mr. Kiyoshi KATO
Senior Staff
Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)

Ms. Rei Ouchi
Secretariat
International Technology Transfer Division
Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)

Annex 3

The Plan for Survey of the Basic Data on Human Resources Development in Nuclear Field in FNCA Member Countries

1. Outline of Survey

The 3rd FNCA Coordinator Meeting was held from 6 to 8 of March 2002, in Tokyo. It was proposed that the FNCA HRD activities and its coordination with those of other projects under the FNCA framework should be strengthened. The proposal of supporting the development of HRD strategy was also widely discussed. It was decided to carry out as soon as possible, a survey of the Basic Data on Human Resources Development (HRD) in FNCA member countries. The minutes and the discussion documents are herein attached (Attachment 1, 2, 3).

2. Purpose of the Survey

The survey aims to produce quantitative data on HRD in nuclear field, which could be used to develop HRD plans in FNCA member countries. To be concrete, the examples of items of survey are as follows; 1) the number of government administrative and technical officials and researchers in the nuclear field, 2) the number of faculties and students in the nuclear field in university, 3) the number of licensees of national certifying examinations in the nuclear field as well as 4) the number of nuclear training courses and trainees in the nuclear field. It may be, for instance, helpful to evaluate the HRD status of each country by comparing with other member countries, the number of HRD data divided by total population or Gross Domestic Product (GDP). Based on the result of the survey, it could be helpful for the member country to make the draft HRD plans by knowing the lack of personnel in particular nuclear field.

The result will be reported and discussed during the Fourth HRD Workshop, and it will be also reported at the Fifth FNCA Coordinators Meeting.

This is the first step for developing the HRD strategy, and further plan including the follow-up survey will be discussed in the coming HRD Workshop and Coordinators Meeting.

3. Items for Survey

A − 1 Survey of Administrative Agencies, and National Research and Development Institutes

A − 1 − 1 The number of administrative and technical personnel

① Target

- Proposed list of agency and Institute is in the Attachment 4. This is from the book of 'Organizations and Who's Who in Nuclear Energy' contributed by JAIF.

- Other important agencies and institutes related to nuclear energy should be added to the list, if there is any.

② Method of counting data

- Total number of personnel in each agencies and institutes.
- The number of personnel of every department of every agency and institute, if possible.

A − 1 − 2 The break down number of A-1-1 by classification

- The number of personnel, mentioned above, should be added up by the classification of a) Promoting side, b) Regulatory side, and c) Research and Development side.

A − 2 Survey of University Education Institutions

① Target

a) Graduate universities and universities with school of nuclear engineering and science

b) School with specific field, such as medical, to educate technical expert (Medical radiation technical engineers training school)

② Survey items

a) Graduate universities with school of engineering and science, and its established year.

b) Quota of students (Bachelor, Master, Doctor, respectively)

c) The number of faculties (Professor, Assistant professor, Lecturer, Assistant, respectively)

*) For Medical radiation technical engineers training schools, write in only b).

A − 3 Survey of Radiation and Radioisotopes Application

A − 3 − 1 Agricultural Application

a) The number of the institutions implemented, the scientists engaged in Plant Mutation Breeding.

b) The number of the institutions implemented, the scientists engaged in Sterile Insect Technique.

c) The number of the institutions implemented, the scientists engaged in Food Irradiation.

A − 3 − 2 Medical Application

a) The number of the institutions implemented, the radiation oncologists and the therapeutic technicians.

A − 4 Survey of Nuclear Training Courses (Special training for personnel engaged in the nuclear field)

(1) The list of training institutions

(2) Field, Course name, Function, Duration, and Cumulative number of trainees

A − 5 Survey of Licensees of National Examinations Related to Nuclear Energy

The number of licensees of national certifying examinations

Example of qualifications for national examinations in Japan;

(1) First Class Supervisor of Radiation Protection (Radiation Application / Unsealed Radioisotopes)

(2) Second Class Supervisor of Radiation Protection (General) (Radiation Application / Sealed Radioisotopes)

(3) Second Class Supervisor of Radiation Protection (ECD) (Radiation Application / Sealed Radioisotopes)

(4) Chief Engineer of Reactors (Research Reactor / Nuclear Power Plant)

(5) Chief Engineer of Nuclear Fuel (Fuel Processing, Uranium Enrichment, Reprocessing, Nuclear Reactor)

(6) Clinical Radiation Technician (Radioactive Handling in Medical Treatment)

(7) Medical Physicist (Public License) (the same as above)

A − 6 Survey of Background Data for Analysis

A − 6 − 1 The number of Radiation Application Users

Survey of the number of Radiation Generators and Radioisotope Sources to know the development of Radiation Application.

Example of Japan: Total number of users of use Radioisotope or Radiation Generators permitted by the Minister of MEXT based on the regulation of The law for Radiation Hazard Prevention, and the total number of users of sealed Radioisotope under 3.7GBq in total.

(1) Hospital & Clinics (2) Educational Organizations

(3) Research Institutions (4) Industrial Firms (5) Other Organizations

A − 6 − 2 Data of Radiation Diagnosis

A − 6 − 3 Population and GDP, others

A − 7 Comments on the Survey

4. Tentative Summary of the Answers from FNCA Countries on "Survey of the Basic Data on Human Resources Development "

(1) Distribution of the questionnaire and the answer from each country

1) Distribution of the questionnaire

On August 9, 2002, the request for survey was sent in the names of Dr. S. Machi, FNCA Japan Project Leader and Dr. Y. Seki, FNCA Japan Project Leader on Human Resources Development to the FNCA Coordinators and Project Leaders of the eight member countries including Australia.

2) Answers from each country

Before the 4th HRD WS in 2002, eight countries returned the answers including partial answers from China, Indonesia and Vietnam. Vietnam, Korea and Thailand provided some additional answers after the WS.

(2) Summary of the data from each country

1) Although it was a new attempt, the data were provided from all participating country in a short term despite lacking of data accumulations. (China and Indonesia partially answered.)

2) There is little precedence in the world for the regional survey to develop HRD strategy to investigate the number of personnel for Administrative Agencies, National Research and Development Institutes, University student and the Faculty. The result is expected to be a useful reference for HRD strategy study in each country to compare and analyze these survey data in the future.

3) In the area of radiation application for the medical area, the numerical data of doctors, engineers and devices were collected. However, in the radiation application in agriculture and industrial areas, suitable items to denote the level of the application could not be identified. We need to ask the respective PL in these area for suitable items for quantification

4) Japan and Korea provided information of the training courses for the nuclear training, respectively. The information should be useful for planning and implementation of the

domestic training courses in other member countries. Indonesia showed the data of trainees who has taken oversea training courses in BATAN and BAPETEN. It will be needed to study how to take into consideration the oversea training courses in the future survey.

5) Acquisition of the data on the National Licensees in Nuclear Field in each country was one of the results of the survey. It can be utilized to improve the respective system by mutual information exchange in the future.

Annex 4-1

Summary of the Data from Each Country of "Survey of the Basic Data on Human Resources Development (HRD)"

Attachment (1) : Summary of the Data of Each Item of the Survey

Attachment (2) : A− 1 The Administrative Agencies and National Research and Development (R&D) Institutes

Attachment (3) : A−4. Survey of Nuclear Training Courses

Attachment (4) : A−5. Survey of Licensees of National Examinations Related to Nuclear Technology

Attachment (1)

Summary of the Data from Each Country of the Survey

A−1. Survey of the Administrative Agencies and National Research and Development (R&D) Institutes

Country	The Number of Personnel in Nuclear Administration							The Number of Personnel in R&D			Total	Notes
	Promoting			Regulatory			Total					
	R&D/ Radiation Application	Nuclear Power Generation	Total	R&D/ Radiation Application	Nuclear Power Generation	Total		Radiation Application	Nuclear Power Generation	Total		
China			300 −350			200 −250	500 −600				500 −600	
Indonesia	3,818										3,818	
Japan			114			541	655			4,984*	5,639	*JAERI, JNC, NIRS
Korea	51		51	326		326	377	1,045		1,045	1,422	Promoting includes Regulatory
Malaysia	352	−	352	35	−	35	387	198	−	198	585	
Philippines	167		167	32		32	199	83	−	83	282	
Thailand	209		209	179		179	388			219	607	
Vietnam				8		8	8	492		492	500	Only VAEC data
Total												

A－2－1 Survey of University Education Institutions

Country	University			Graduate School (Master)			Graduate School (Doctor)			Number of Univ.	Total		Notes
	Number	Number of Student	Number of Staff	Number	Number of Student	Number of Staff	Number	Number of Student	Number of Staff		Number of Student	Number of Staff	
China	13												
Indonesia	2			3									Faculty of Nuclear Technology of Gadjah Mada University (graduate/master) was abolished 2000.
Japan	10	1,447	23	11	583	28	9	214	204	12	3,915	255	
Korea	6	882	63	6	112	(63)	5	157	(63)	6	1,151	63	
Malaysia	5	164	43	3	18	32	3	6	32	6	185	107 (note)	Note: The same staff member are included in undergraduate, M.S. and Ph.D.
Philippines	—	—	—	1	12	6	0			1	12	6	Only: medical physics
Thailand	6	844	307	4	156	211	2	24	129	12	1,024	647	No information for Chiang Mai Univ., Thammasat Univ. a nd Ramkamheang Univ.
Vietnam	4	1,900	150	3	34	122	4	20	136	4	1,954	408	
Total													

A－2－2 Specialized School for Development of Technical Engineer

Country	Medical Radiation Technical Engineers Training School		Other Field (if there is any)		Notes
	Number of School	Number of Student	Number of School	Number of Student	
China					
Indonesia	1	checking			School for X-ray operator
Korea	22	1,504	None	None	University - 4year: 4 Vocational School -3years: 18
Japan	39	2,122	-	-	Number of Student is total of quota
Malaysia	2	175	None	None	
Philippines	None	None	None	None	
Thailand	7	196			
Vietnam	None	None	None	None	
Total					

A−3 Survey of Radiation and Radioisotopes Application

A−3−1 Agricultural Application

Country	Plant Mutation Breeding		Sterile Insect Technique		Food Irradiation		Notes
	Number of the institutions implemented	Number of the scientists engaged	Number of the institutions implemented	Number of the scientists engaged	Number of the institutions implemented	Number of the scientists engaged	
China		(500)					Total number of Agricultural Application
Indonesia							
Korea	10	19	1	3	2	44	
Japan	115	324	1	18	1	5	
Malaysia	4	18	1	1	17	15 (note)	note : Not all are involved in research
Philippines	9	40	2	7	7	26	
Thailand	60	111	2	45	9	77	
Vietnam	Checking	Checking	Checking	Checking	Checking	Checking	
Total							

A－3　Survey of Radiation and Radioisotopes Application

A－3－2　Medical Application／A－3－3　Other field

Country	Medical Application-Radiation Oncology			Other field		Notes
	Number of the implemented institutions	Number of the radiation oncologists	Number of the therapeutic technicians	Number of the implemented institutions	Number of engaged scientist	
China		5,000	470		2,500－3,000	Other : Industrial Application(cardinal number of Co-60, accelerators,etc.)
Indonesia	24					
Korea	52	126	261	None	None	
Japan	611	540	1,062	None	None	
Malaysia	20	32	60	None	None	
Philippines	13	36	44 (Note 1)	29 (Note 2)	700 (Note 2)	Note1: Additional 16 physicists Note2: Non-destructive Testing
Thailand	26	569		2,235 (Note)	7,305 (Note)	Note: Radiation Diagnosis
Vietnam	739	2,010	50	65	494	
Total						

A—4 Survey of Nuclear Training Courses --- a)Summary

	The Number of Courses	The Number of Implement Institutions	Total Number of Annual quota of Trainee	Total Number of Cumulative Trainee	Notes
China					
Indonesia	(8)	1		11,274	BATAN
Korea	80	2	4,452	52,472	KAERI, KARI
Japan	178	12	11,500	127,319	JAERI, NIRS, JCAC, JNC, JAIF, JAPCO, others
Malaysia	25	1		6	
Philippines	11	1	410	4,555	
Thailand	31	3	1,345	8,684	
Vietnam	36	2	230	1,188	VAEC, MOST (5years)
Total					

A－4 Survey of Nuclear Training Courses --- b)the Number of Courses

Country	The Number of Nuclear Training Courses						Notes
	A Basic/General Nuclear Energy	B Radiation/ Radioisotopes Application Technique	C Nuclear Power Generation Technique	D Safety (including Radiation Hazard Prevention)	E Others(including protection against nuclear materials and International cooperation)	Total	
China	Nuclear Graduate School, Beijing (not a single course)		Training Centers in NPPs (no information of the number of course)		Business Administration Institute for Nuclear Industry		
Indonesia						8	
Korea	(22)	(24)	(32)	(Note)	(2)	80	Note: Included in B.C
Japan	(35)	(45)	(48)	(24)	(26)	178	
Malaysia		19		6		25	
Philippines		7		4		11	
Thailand	4	15 (Note)		9	1	29	Note : 9 out of 15 are: agricultural application training courses (Kasetsart Univ.)
Vietnam		4		30	2	36	1996-2001
Total							

A－4 Survey of Nuclear Training Courses --- c)the Number of Trainee

Country	The Number of Trainee (Annual quote of trainee / Cumulative trainee)						Notes
	Basic/General Nuclear Energy	Radiation/Radioisotopes Application Technique	Nuclear Power Generation Technique	Safety (including Radiation Hazard Prevention)	Others(including protection against nuclear materials and International cooperation)	Total	
China							
Indonesia						-/11,274	
Korea							See Korea's Attachment
Japan							See Japan's Attachment
Malaysia							
Philippines		270/3,506		140/1,049		410/4,555	
Thailand	170/1,109	635/1,331 (470/717:note)		390/4,128	150/2,116	1,345/8,684	Note : Agricultural application (Kasetsart Univ.)
Vietnam		- /108		200/2,010	- /59		1996-2001
Total							

A−5. Survey of Licensees of National Examinations Related to Nuclear Technology

Country	The Number of Qualification			The Number of Annual Licensees			Cumulative Licensees			Notes
	National	Other	Total	National	Other	Total	National	Other	Total	
China	2		2	560 −600		560 −600	(560 −600)		(560 −600)	Annual or Cumulative (not defined)
Indonesia										
Korea	7	—	7	301	—	301	6,456	—	6,456	
Japan	6	1	7	(3,367)	10	(3,377)	(84,755)	131	(84,886)	
Malaysia	4	—	4	125	—	125	449	—	449	
Philippines	1	—	1	5	—	5	29	—	29	Radiographic testing practitioner
Thailand	7		7				3,119		3,119	
Vietnam				33			406		406	1990- 9/2002
Total										

A−6 Survey of Background Data for Analysis

A−6−1 The number of users of radiation application

Country	Breakdown (%)						Notes
	Research Institution	Medical Institution	Educational Institution	Industrial Firms	Others	Total	
China							
Indonesia							
Korea	216 (11.8%)	129 (7.19%)	196 (10.7%)	887 (48.7%)	424 (21.7%)	1,821	
Japan	793 (16.4%)	485(10.0%)	713(14.7%)	1,927(39.8%)	919 (19%)	4,837	
Malaysia	500(5%)	4,400(44%)	100(1%)	5,000(50%)	—	10,000	
Philippines	13(4%)	75(24%)	11(3%)	174(56%)	40(13%)	313	
Thailand	143(21.6%)	114(17.22%)	—	278(41.99%)	127(19.18%)	662	
Vietnam	492(17%)	2,010(68%)	150(5%)	257(8%)	65(2%)	2,974	
Total							

A−6 Survey of Background Data for Analysis

A−6−2 Radiation Therapy

Country	Total number of megavoltage teletherapy machines			Total number of brachytherapy machine						Number of annual new cancer patients in both sexes
	Cobalt	Accelerator	Total	Manual LDR	Auto Remote LDR	HDR			Total number of the potentially treatable capacity: brtx-cap (note)	
						CoHDR	IrHDR	HDR Total		
China										
Indonesia										
Korea	8	76	84	3	10	3	18	21	11,450	83,846
Japan	213	603	816	2	8	187	74	198	99,740	386,783
Malaysia	7	19	26	15	2	1	6	9	4,725	21,670
Philippines	14	4	18						2,500	65,361
Thailand	25	26	51		11	7	8	15	8,380	63,741
Vietnam	7	1	8	7		1	2	3	2,000	
Total										

note : brtx-cap=number of manual load brachytherapy kits × 50

+number of automatic after loading LDR machines × 80, (^{60}Co and ^{192}Ir) ×500

<Source: Quantitative status of resources for radiation therapy in Asia and Pacific region, Hideo Tatsuzaki and Cecil Victor Levin, Radiotherapy and Oncology 60 (2001) 81-89<www.elsevier.com/locate/radonline>

A－6　Survey of Background Data for Analysis

A－6－3　Others

Country	Population (thousand)	GDP (US$ Million)	GDP per Capita (US$)	Scope of Nuclear Power Generation (The number of operating units, Generating capacity)	Economic Scale of Nuclear Application (Radiation application, Nuclear Power generation)	Notes
China	1,284,971	1,079,954	798			
Indonesia	214,840	153,255	674			
Japan	127,334	4,764,020	34,276			
Korea	47,069	457,220	8,871			
Malaysia	22,633	89,321	3,613			
Philippines	77,131	74,733	1,032			
Thailand	63,584	122,165	2,000			
Vietnam	79,175	134,800	373			
US	285,926	9,963,100	32,778			
India	1,025,096	454,535	453			
Bangladesh	140,369	36,408	291			
Pakistan	144,971	60,092	487			

Attachment (2)

A — 1 The Administrative Agencies and National Research and Development (R&D) Institutes (1/2)

		Agency / Institutes	Role	Total	Notes
China					
Indonesia	1	Nuclear Energy Control Board (BAPETEN)	Regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials		Nuclear Energy Control Board (BAPETEN)
	2	National Nuclear Energy Agency (BATAN)	To execute, and to promote the research and the use of nuclear energy	3818	National Nuclear Energy Agency (BATAN)
Korea	1	Ministry of Science & Technology (MOST)	Administrative Agency: Planning, deliberation, and decision of nuclear policy in general	51	
	2	Korea Atomic Energy Research Institute (KAERI)	R&D Institute: Research for promoting the peaceful application of nuclear energy	1,045	
	3	Korea Institute of Nuclear Safety (KINS)	R&D Institute: Performs regulatory functions such as safety reviews, inspections, and development of regulatory technical standards	326	
Japan	1	Cabinet Office	Administrative Agency: Planning, deliberation, and decision of nuclear policy in general	129	
	2	Ministry of Education, Culture, Sports, Science and Technology (MEXT)	Administrative Agency: Nuclear administration of scientific technique	125	
	3	Ministry of Economy, Trade and Industry (METI)	Administrative Agency: Nuclear administration of energy	401	
	4	Japan Atomic Energy Research Institute (JAERI)	R&D Institute: Synthetic research and training for engineer	2,263	
	5	Japan Nuclear Fuel Cycle Development Institute (JNC)	R&D Institute: Research development of nuclear cycle development	2,345	
	6	National Institute of Radiological Sciences (NIRS)	R&D Institute: Research on radiation effects on human body and prevention, medical application of radioisotopes and radiation, effects on living environment, and human resources development	376	

A−1 The Administrative Agencies and National Research and Development (R&D) Institutes (2/2)

	Agency / Institutes		Role	Total	Notes
Malaysia	1	Malaysia Institute for Nuclear Technology Research [MINT]	R&D, technical services and administrative services and national agency for planning & advisory on nuclear matters	535	
	2	Atomic Energy Licensing Board [AELB]	Regulatory and Licensing	50	
Philippines	1	Philippine Nuclear Research Institute (PNRI)	The sole agency of government mandated to advance and regulate the applications of nuclear science and technology in the Philippines	262	
	2	Department of Science and Technology (DOST)	Cabinet level administrative agency; provides central direction, leadership and coordination of all S&T activities in the country. Formulates S&T policies, programs and projects in support of national development priorities.	20	(Only those concerned with nuclear S&T)
Thailand	1	Thai Atomic Energy Commission for Peace (Thai A.E.C.) and its 14 sub-committees	Setting-up policies, deliberations in promoting and regulating the peaceful application of atomic energy for various purposes	214	
	2	Office of Atomic Energy for Peace (OAEP)	Implementing the regulating and promoting performances for the use of atomic energy for the benefit of the country's development; serving as the focal point coordinating both national and international authorities in exercising the peaceful applications of atomic energy	393	Only regular officials, including scientists, engineers, technicians and administrative staffs are counted.
Vietnam	1	Vietnam Radiation Protection and Nuclear Safety Authority (VRPA)	Regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials, Inspection and Licensing for Radiation Protection	8	
	2	Vietnam Atomic Energy Commission (VAEC)	R&D Institute	492	

Attachment (3)

A—4. Survey of Nuclear Training Courses

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Indonesia			Nuclear Material and Fuel		BATAN			293
			Information Technology		BATAN			567
			Instrumentation and Installation		BATAN			646
			Managerial		BATAN			4892
			Nuclear Safety		BATAN			2015
			Radioisotopes and Radiation		BATAN			2199
			Nuclear Reactor and Energy		BATAN			533
			Material Sciences		BATAN			129

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Malaysia	1	Radiation Safety and Health	1.Radiation Safety and Health	To understand the philosophy and principles of radiation protection;	MINT		3 days	896(2001) 404 (up to 30 Jun 2002)
			2.Radiation Safety Awareness	To understand the radiation safety aspects and practices at work place in accordance with safety standard and procedures;	MINT		1 day	
			3.Workshop on Good Radiation Safety Practice	Giving exposure on the safe working procedures with ionizing radiation;	MINT		1 day	
			4.Radiation Protection for Worker	Learning the right and proper procedures in controlling the radiation exposure to the radiation workers;	MINT		5 days	
			5.Radiation Protection for Officer	Creating Awareness on biological effects and the risks of ionizing radiation.	MINT		7 days	
			6.Chemical Safety and Health		MINT		3 days	

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Malaysia	2	Medical X-ray	1. Training Course for Medical X-ray Operator	To provide understanding of the philosophy and principles of radiation protection for medical application;	MINT		8 days	129 (2001) 89(up to 30 Jun 2002)
			2. Awareness Course On Radiological Safety for General Practitioner	Creating awareness on the radiation hazard, biological effects and risks of ionizing;	MINT			
			3.Training Course on X-ray for General Practitioner	To familiarize with the component, function, operation and control of x-ray and other associated equipment;	MINT			
			4. Good Operational Practice	To familiarize with the radiographic techniques and interpretation of radiograph for simple radiography;	MINT			
			5. Quality Assurance in Medical Radiography	To generate the importance of right working procedure being practiced when dealing with x-ray equipment.	MINT			
			6. Interpretation of Radiographic Image		MINT			

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Trainee
Malaysia	3	Non-Destructive Evaluation	1. Basic Course on NDT		MINT		3 days	201(2001) 229 (up to 30 Jun 2002)
			2. Basic Metallurgy in NDT		MINT		5 days	
			3. Concrete Inspection Using NDT Technique		MINT		5 days	
			4. Eddy Current Basic Grade		MINT		6 days	
			5. Eddy Current Intermediate Grade		MINT		12 days	
			6. Keselamatan Radiografi Untuk Pembantu Pengendali	To meet the syllabus requirement of MLVK (National Vocational Training Council) where applicable;	MINT		2 days	
			7. Industrial Radiography Basic Grade		MINT		12 days	
			8. Industrial Radiography Intermediate Grade	To provide the participants with the necessary knowledge in both theory and practices of related technologies.	MINT		12 days	
			9. Interpretation and Evaluation of Radiograph		MINT		5 days	
			10. Advanced Industrial Radiography		MINT		12 days	
			11. Surface Method Basic Grade		MINT		11 days	
			12. Surface Method Intermediate Grade		MINT		11 days	

	Field		Course	Objective	Implement Institution	Annual Quota of Trainees	Duration	Cumulative Number of Trainees
Philippines	1	Radiation/ Radioisotope Application Techniques	RTTC	RI applications in medicine, research, agriculture	PNRI	60	4weeks	1,822
			IURC	RI applications in industry	PNRI	30	4weeks	704
			NTUCF	Training of university/college faculty	PNRI	30	5weeks	252
			SNS-HSST	Training of high school teachers	PNRI	30	5weeks	432
			RIA	Training in Radioimmuno-Assay	PNRI	30	1week	127
			Radiation Cyto-Genetics	Training in radiation cytogenetics	PNRI	30	5weeks	50
			Introductory Course in Nuclear Science	Basic training for high school and elementary school teachers	PNRI	60	1week	119
	2	Safety	RHSC	Training for Radiation Safety Officers	PNRI	30	4weeks	508
			Radiation Safety Course	Radiation safety for radioisotope users	PNRI	60	3 days to 1week	461
			Safe Transport of RAM	Safe transport of radioactive materials	PNRI	20	3 days	35
	3	Safety	Emergency Planning and Preparedness	Training in emergency planning and preparedness	PNRI	30	1 week	45

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Number of Trainees
Thailand	1	Basic/general Nuclear Energy	Nuclear Science Youth Club		OAEP	60	3 days	259 (1998)
			Nuclear Chemistry and Application		OAEP		10 days	24 (1996)
			Nuclear Energy and Application		OAEP	50	5 days	463 (1988)
			Introduction to Radiation and Application		OAEP	60	2 days	363 (1997)
	2	Radiation/Radioisotopes Application Technique	Radiographic Testing Level 1		OAEP	30	5 days	235 (1989)
			Radiographic Testing Level 2		OAEP	20	12 days	83 (1989)
			Foods and Agricultural Products Irradiation		OAEP	30	5 days	89 (1997)
			OAEP/JAERI Training Course on Nuclear Technology and Its Diverse Applications		OAEP	20	10 days	59 (1999)
			Applications of Radiotracer Techniques in the Petroleum and Petrochemical Industries		OAEP	25	5 days	25 (1991)
			Pest Control Using Radiation		OAEP	40	5 days	123 (1999)
	3	Safety (including Radiation Hazard Prevention)	OAEP/JAERI Training Course on Radiation Protection for Radiation Safety Supervisors		OAEP	30	10 days	63 (1999)
			Distance Learning on Radiation Protection		OAEP			10 (1998)
			Emergency Preparedness		OAEP	30	10 days	50 (1994)
			Introduction to Radiation Protection		OAEP	50	2 days	235 (1992)
			Irradiator Operator		OAEP	10	35 days	40 (1992)
			Reactor Operator		OAEP	15	45 days	52 (1988)
			Radiation Protection Level 1		OAEP	60	5 days	1668 (1990)
			Radiation Protection Level 2		OAEP	60	10 days	1110 (1990)
	4	Others (Including protection against nuclear materials and international cooperation)	Radiation Protection for Lighting Preventor		OAEP	150	2 days	672 (1991)
			Seminar on Nuclear Technology and Science		OAEP		2 days	1348 (1984)
			Seminar on Nuclear Technology and Advantage for Peace		OAEP		1 days	96 (1998)

	Field		Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Number of Trainees
Thailand	5	Radiation/ Radioisotopes Application Techniques	Induced Mutation Technique for Crop Improvement		GISC	20	5 days	16 (1998)
			Project Formulation Meeting on Mutational Enhancement for Genetic Diversity in Rice		GISC	20	5 days	15 (1999)
			Use of Induced Mutation Technique for Genetic Diversity and Economic Crop Improvement		GISC	40	5 days	35 (1999)
			Ornamental Improvement through Gamma Rays Induced Mutation		GISC	45	1 day	90 (1999)
			Production of Exotic Ornamentals through Gamma Rays Induced Mutation		GISC	40	1 day	260 (2000)
			In vitro Mutagenesis and Molecular Marker Analysis of Ornamental Plants		GISC	25	5 days	25 (2000)
			The Use of Gamma Rays for Crop Improvement		GISC	20	3 days	20 (2001)
			Production of Exotic Ornamentals through Gamma Rays Induced Mutation		GISC	240	1 day	240 (2001)
			Induced Mutation Technique for Genetic Diversity and Economic Crop Improvement-II		GISC	20	4 days	16 (2002)
			Induced Mutation Technique for Crop Improvement		GISC	20	5 days	16 (1998)
	6	Safety	Radiation Protection		note	120 – 135	5 days	900

GISC: Gamma Irradiation Service and Nuclear Technology Research Center, Kasetsart University

note: Sukhotai Tammathirat Open University

	Field	Course	Objective	Implement Institution	Annual quota of Trainee	Duration	Cumulative Number of Trainees
Vietnam	Radiation Safety			VAEC	200	5 days	2010 (5years)
		RTC on the use of Immunoassay Technologies for studies on Diagnosis & Control of Foot and Mouth Disease in south Asia		VAEC	23		23 (1996)
		National TC on Concepts and Principals of RIA/Data Processing, Internal Quality Control & External quality assessment Scheme		VAEC	42		42 (1997)
		Regional Training Course on Standard Software for Tracer Applications and Nucleonic Gauge Design and Calibration		VAEC	15		15 (2000)
		RTC Web Site Construction and Management		VAEC	17		17 (2000)
		RTC on "SPECT Techniques in Cardiology and Oncology"		VAEC	26		26 (2000)
		TC on Radiation Treatment for Natural Polysaccharides		VAEC	24		24 (2000)

A-4 Nuclear Training Courses

(1) Japan Atomic Energy Research Institute
Nuclear Technology and Education Center

1) Tokyo Education Center

(Unit: Person)

Course		Duration	Time in FY2001	Max. Trainee	Total Trainee from FY1958 to FY2001	Note
Basic Course		17days	2/year	32	8,084(209*)	
Primary Basic Course		10days	2/year	16	54	
Expert Course	Radioisotope and Radiation Technology Course	5days	1/year	16	0	
	Radioisotope Course	12days	1/year	16	229	
	Liquid Scintillation Measurement Course	5days	1/year	16	492	
	Radiation Control Course	10days	1/year	16	623	
	Autoradiography Course	9days	1/year	16	564(1*)	
	Environmental Radioactivity Measurement Course	9days	1/year	16	130	
Qualification Course	Working Environment Measurement Expert	2days	1/year	16	497	
	Radiation Protection Supervisor	5days	7/year	32	3,612	
International Training	JICA/JAERI Joint Nuclear Technology Course	5weeks	1/year		137*	
	IAEA/JAERI Joint Training Course	4weeks	1/year		170*	
	Instructors Training Program for Asian Countries	2months	1/year		30*	
	Bilateral Joint Training Course for Asian Countries	2weeks	6/year		383*	
Special Course					37(34*)	until 1995
Expert Course	Sealed Radioisotopes				394	until 1974
	Soft-Bata Radioisotopes				135(2*)	until 1972
	Activation Analysis				87	until 1972
	Application of Radioisotopes for Industry				36	until 1971
	Application of Radioisotopes for Chemistry				36	until 1972
	Health Physics				119	until 1975
	Applied Measurement of Radioisotopes				66	until 1974
	Chemical Application of Radioisotopes				24	until 1974
	Nuclear Experiment Seminar				580	until 1991
	Radiation Chemistry				426(3*)	until 1995
	Application of Radioisotopes to Biological Science Course				489(9*)	until 1999
	Radiation Processing of Polymers Course				45	until 1999
Seminar on Nuclear Education for Teachers					2,345	until 1995
Seminar on Nuclear Education for Teachers (Introductory Course)					151	until 1995
General	Seminar on Nuclear Experiment for Teachers (Tokyo Course)				145	until 1997
Introductory Nuclear Technology Course		4weeks	1/year		56	until1990
Advanced Course					230(4*)	until 1974
Course for New Employees					996	until 1974
EPTA					20(15*)	only 1964
Total					21,431 (997*)	

The asterisk (*) indicates the number of Foreigners

2) Tokai Education Center

(Unit: Person)

Course		Duration	Time in FY2001	Max. Trainee	Total Trainee from FY1958 to FY2001	Note
Reactor Engineering	Reactor Engineering Course	21weeks	1/year	16	1,693	former General Course on Nuclear Technology
	Basic Reactor Engineering Course	10weeks	1/year	16	21	New Course
	Reactor Engineering Short Course	10weeks	2/year	40	1,633	former Reactor Theory Course
	Introductory Nuclear Technology Course	4weeks	1/year	24	1,048	
Specialized	Radiation Protection Basic Course	6weeks	2/year	24	111	former Health Physics and Radiation Protection Course
	Nuclear Fuel Engineering Course	3weeks	1/year	24	1,092	former Short-term Course on Nuclear Fuel Engineering
	Radioactive Waste Management Course	2weeks	1/year	24	626	
Radiological Emergency Preparedness Training	Introductory Nuclear Emergency Preparedness Course	2days	4/year	50	13,554	
	Nuclear Emergency Preparedness Course	5days	2/year	32	1,444	
	Special Nuclear Emergency Preparedness Course	2days		32	98	New Course
	Nuclear Supervisor Training Course	6weeks			69	former Training Course for Senior Specialist for Nuclear Emergency Preparedness
	Inspector Training Course for Safety Management of Nuclear Installations				124	New Course
International Training	JICA/JAERI Joint Nuclear Technology Course	5weeks	1		116*	
	Safeguards Training Course	5weeks	1		88*	
	IAEA/EBP Training Course	2months	1		50*	
Reactor Engineering	Advanced Course				66	until 1982
	Reactor Engineering Short Course				359	until 1991
	Reactor Engineering				111	until 2000
Specialized	Health Physics Course				687	until 1997
	Radiation Protection Course				503	until 1007
General	Seminars on Nuclear for Teachers (Local)				638	until 1995
	Seminars on Nuclear (Tokai, Takasaki)				1,083	until1997
Radiological Emergency Preparedness Training	Fundamental Course for Emergency Environmental Monitoring	2dyas	5/year		737	until 1996
	Emergency Environmental Monitoring Course	5days	2/year		163	until 1996
	Radiological Emergency Preparedness Course for Emergency Manager	2days	2/year		306	until 1996
	Radiological Emergency Preparedness Course (for Fire-men) (for Police-men)	2days	4/year 1/year		934	until 1996
Others	Reactor Operator Training Basic Course				749	until 1975
	JRR-1 Operation Training Course				258	until 1963
	Short-term Course on Reactor Physics				29	until 1975
	Short-term Course on Nuclear Measurement				286	until 1982
	Nuclear Education Course				493	until 1984
	Short-term Course on Reactor Engineering Safety				105	until 1978
Intl. Training	Analysis Technology Training Course				16*	only 1987
	Seminars on Nuclear Safety				234*	until 1996
Total					29,524 (504*)	

The asterisk (*) indicates the number of Foreigners

(2) National Institute of Radiological Sciences (NIRS)

(Unit: Person)

Course	Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Basic Radiation Knowledge for Nursing	5days	5/year	24	767	
Radiation Protection and Safety	15days	1/year	24	3,051	
Radioisotope Techniques and Radiation Protection in Life Sciences	15days	1/year	16	1,434	
Emergency Preparedness	5days	3/year	24	1,112	
Medical Aspects of Radiation Accidents	3days	3/year	20	138	
Environmental Monitoring	8days 5days	1/year	16	470	
Radiation Protection for Maritime Safety	5days	1/year	24	about 200	
Total				7,172	

(3) Japan Chemical Analysis Center (JCAC)

(Unit: Person)

Course	Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Fundamental of Environmental Radioactivity Analysis and Measurement	8days	2/year	10	209	from 1990
Gamma−Ray Spectrometry of Environmental Samples	8days	2/year	10	196	from 1990
Methods of Sampling and Pretreatment of Environmental Samples	4days	1/year	10	89	from 1990
Alpha−Ray Spectrometry of Environmental Samples	7days	1/year	5	33	from 1990
Methods of Analysis and Measurement of Radioactive Strontium in Environmental Samples	10days	1/year	6	64	from 1990
Methods of Environmental Gamma−Ray Dose Measurement	5days	1/year	10	80	from 1994
Methods of Analysis and Measurement of Tritium	4days	1/year	8	66	from 1990
Methods of Environmental Gamma−Ray Dose Measurement with Thermoluminescence Dosimeter System	4days	1/year	8	59	from 1990
Methods of Estimation and Evaluation of Environmental Radiation Dose	2days	1/year	8	17	from 2000
Fundamental Usage of Environmental Radiation Network	5days	1/year	13	122	from 1992
Methods of Measurement of Radioactive Iodine in Environmental Samples for Emergency Monitoring	3days	1/year	8	8	from 2001
Methods of Measurement of Cumulative Dose for Emergency Monitoring	3days	1/year	8	4	from 2001
Gamma−Ray Spectrometry of Environmental Samples for Emergency Monitoring	4days	1/year	8	11	from 2001
Methods of Analysis of Uranium and Plutonium in Environmental Samples for Emergency Monitoring	4days	1/year	6	5	from 2001
Total				963	

(4) Japan Radioisotope Association (JRIA)

(Unit: Person)

Course	Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Designated course for first class Radiation Protection Supervisor	5days	12/year	32	411	
Designated course for first class Working Environment Measurement Expert	2days	2/year	36	64	
Basic Training course on Radioisotope handling	5days	2/year	32	41	
Radioisotope safety handling course	5days	1/year	100	71	
Sealed source safety handling course	4days	1/year	100	65	
Educational course for first class Radiation Protection Supervisor	3days	1/year	32	36	
Educational course for second class Radiation Protection Supervisor	2days	1/year	32	37	
Total				725	

(5) Institute of Radiation Measurements

(Unit: Person)

Course	Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Nuclear Education Course	5days	2/year	20	540	
Introductory Radiation Control Course	5days	2/year	20	625	
Radiation Control and Measurement Course	5days	3/year	20	1,399	
Total				2,564	

(6) Radiation Application Development Association (RADA)

(Unit: Person)

Course		Duration	Time in FY2002	Max. Trainee	Total Trainee to FY2001	Note
International Seminar on Nuclear Safety	Course for Asian Countries	3weeks	1/year	15−20	82	
	Course on Radioactive Waste and Spent Fuel Managements	3weeks	1/year	12−30	89	
	Course on Safety Analysis	3weeks	1/year	10−31	55	
	Course for CIS and CEEC	3weeks	1/year	10−20	53	until FY 2000
	Course for Ukraine	3weeks	1/year	10	9	until FY 1997
Subtotal					288	
Domestic Seminar for Nuclear Knowledge Dissemination	Advanced Course	3days	2/year	40	87	
	Science Teacher Course	3−4days	6/year	24−40	1,724	
	Basic Course	2days	3/year	40	114	
	Regional Course	1−2days	20/year	10−30	1,483	
	Non−Scientific Teacher Course	1−2days	11/year	50−150	474	
Subtotal					3,882	
Total					4,170	

(7) Japan Atomic Industrial Forum, Inc. (JAIF)

(Unit: Person)

	Course	Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Domestic Course	Short Course for Chief Engineer of Nuclear Fuel	5dyas	1/year		until FY1999	Short Course for Getting the Qualification of Chief Engineer of Nuclear Fuel
	Short Course for First−Class Supervisor of Radiation Protection	5dyas	1/year	50		Preparatory Short Course for National Examination of First−Class Supervisor of Radiation Protection
	Short Course for Second−Class Supervisor of Radiation Protection	5dyas	1/year	50		Preparatory Short Course for National Examination of Second−Class Supervisor of Radiation Protection
	Nuclear Seminar for Clerical Workers	4dyas	3−5/year	30	until FY1999	For Businessmen
	Management Seminar for Nuclear	4dyas	3/year	30	from FY2000	For Businessmen (Renamed from Clerical Workers)
	Short Course for Quality Assurance of Nuclear Power Plant	2days	2/year	80−100		For Businessmen
Intl.	Seminar on Nuclear Safety and Regulation	1month	1/year	6	102	
	Seminar for Nuclear Administrators	10days	1/year	about11	130	
Total					232	

(8−1) Nuclear Safety Technology Center (Emergency Preparedness Training)

(Unit: Person)

	Course	Duration	Time in FY2002	Max. Trainee	Total Trainee to FY2001	Note
Basic Course	General	3days	2/year	30	156	
	Radiation Survey Meter Handling	1day	4/year	30	25	
	Radiation Monitoring	3days	8/yer	30	1,272	
	Refuge Activities	3days	11/year	30	1,197	
	Firefighting/Rescue	3days	16/year	30	1,728	
	Community Fire Corps	2days	20/year	30	1,706	
	Police	3days	9/year	30	668	
	Maritime Safety	4days	4/year	30	25	
	Self−defense Forces	3days	4/year	30	95	
	Teachers	3days	2/year	30	−	New Course
Practical Course	Head−quarter (H.Q.) Staff	3days	2/year	16	129	
	H.Q. Radiation Evaluation Team	3days	1/year	16	6	
	Radiation Monitoring	2days	1/year	16	27	
	Refuge Activities	2days	1/year	30	62	
	Firefighting/Rescue	2days	1/year	30	77	
	Contaminated−injured Transportation	1day	2/year	16	31	
	Police	2days	1/year	30	68	
Expert Course	H.Q. Management	2days	2/year	30	505	
	Radiation Monitoring	3days	2/year	16	259	
	Emergency Dose Prediction System	3days	2/year	16	209	
	Firefighting/Rescue	3days	2/year	30	53	
Total					8,298	

(8−2) Nuclear Safety Technology Center (Training Center)

(Unit: Person)

Course	Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Training Course for 2nd−class Radiation Protection Supervisors	3days	13/year	36	9,396	
Practical Course for ECD Engineers	3days	1/year	36	431	
Total				9,827	

(9) Japan Nuclear Cycle Development Institute

(Unit: Person)

Course		Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Training Course of Nuclear Emergency Preparedness	Crises Management for Nuclear Emergency Preparedness	2days, twice/year			234	from FY2000
	Public Relations Activities at Nuclear Emergencies	2days, twice/year			106	from FY2000
	Planning of Nuclear Emergency Response Exercises	2days, twice/year			111	from FY2000
	Management of Offsite Center for Nuclear Emergencies (Advanced Course)	1day, 6times/year			178	from FY2001
	Management of Offsite Center for Nuclear Emergencies (Practical Course)	1day, 6times/year			254	from FY2001
	Exercise for Members of Functional Groups in Offsite Center for Nuclear Emergencies	2days, 6times/year			311	from FY2001
	Nuclear Emergency Response for Senior Specialists for Nuclear Emergency Preparedness	2days, 6times/year			36	from FY2001
Total					1,230	

(10) BWR Operator Training Center Corporation (BTC)

(Unit: Person)

Course		Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Training	Basic Theory	21weeks		16	1,862	
	Application	8weeks		8		
Re−Training	I	2weeks		4	3,526	
	II	2weeks		4		
	III	9days		4		
Senior Training		5days		8	973	
Re−Training Refresh		3days		4		
Senior Training Refresh		3dyas		4		
Family Training		1day		Unit: team	5,429(team)	
Special Training						
Nuclear Reactor Theory		5days		8		
Instructor Training		4days		4		
Special Training (Report/Introduction Training based on the Law for Nuclear Disaster)		2days		4 minimum2		
Special Training (Report/Continuation Training based on the Law for Nuclear Disaster)		1day		4 minimum2		
Training for Senior Staff		1day		4−8		
Training for Nuclear Engineers		4weeks		4		
Total						

(11) Nuclear Power Training Center, Ltd. (NTC: PWR Operator Training)

(Unit: Person)

Course		Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Primary Training Course	Training for Nuclear Reactor Operator	20weeks		−	(FY2000, 1,094)	
	I. Basic Lecture	6weeks				
	II. System Lecture	6weeks				
	III. Simulator Training	8weeks		8		Simulator Training: 144h
Re−Training Course	General Course			4	(2,580)	
	I	10days				
	II	7days				
	Senior Course			4	(3,293)	
	I	5days				
	II	5days				
	III	5days				
	Supervisors Course				(2,425)	
	I	5days				
	II	5days				
	III	5days				
	IV	5days				
	EOP−Re−training Course	2days		4	(695)	
Cooperation Training Course for Staffs				8	(2,441) (team)	
I		1day				
II		2days				
Special Training Course	METI Special Skill Training Course	3days			(922)	
	Simulator Training Course (Short)	10days				
	Introduction Course for Nuclear Engineers	3days				
	Nuclear PA Course	3days				
	Training Course for Technical Staffs	3days				
	Training Course for Instructors	5days				
Total						

(12) The Japan Atomic Power Company, Training Center

(Unit: Person)

Course	Duration	Time in FY2001	Max. Trainee	Total Trainee to FY2001	Note
Nuclear basic engineering course A	52days	1/year	15	933	from FY1968
Nuclear basic engineering course B	52days	1/year	15	467	from FY1968
Nuclear power generation course	32days	1/year	6−8	95	from FY1985
NUPEC inspection and maintenance course	5days	1/year	6	35	from FY1996
Health physics managerial person training course for radio active facility	2days	1/year	60	1,258	from FY1980
Radiation management staff training course	9days	1/year	10	73	from FY1994
Total				2,861	

Attachment (4)

A−5. Survey of Licensees of National Examinations Related to Nuclear Technology (1/2)

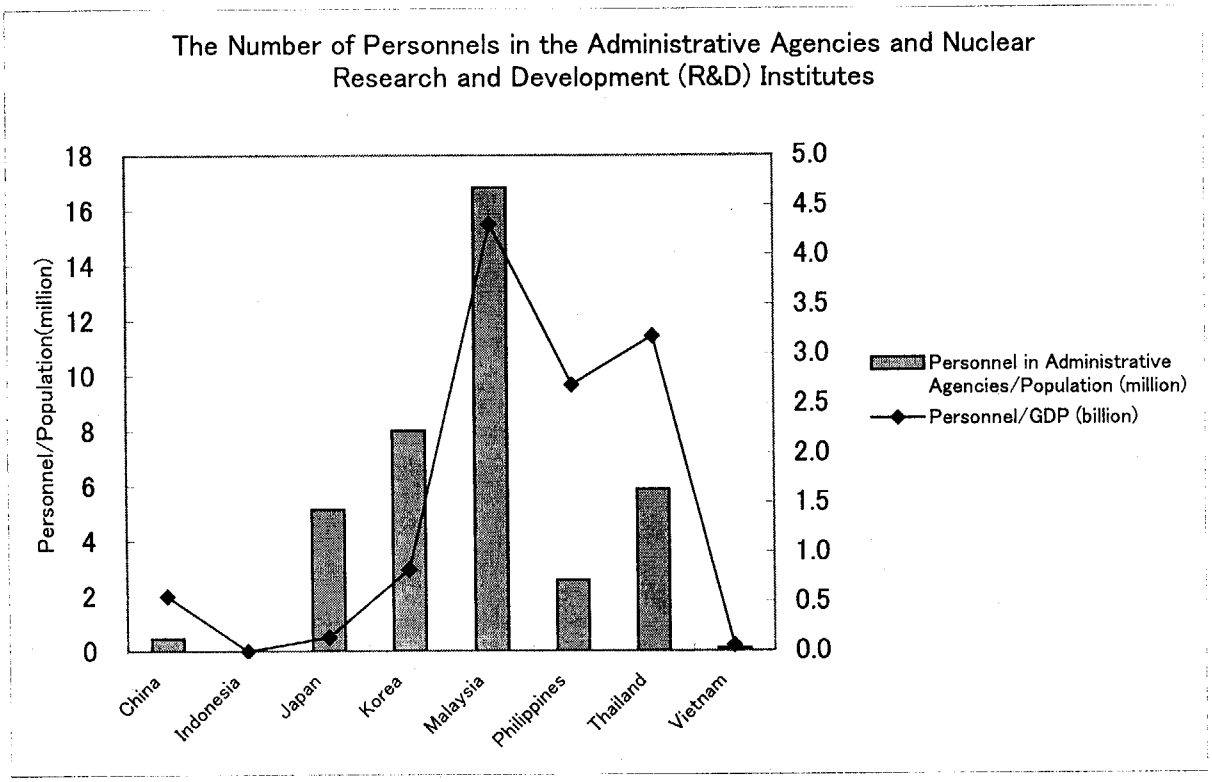
	Qualification		Target	Average Annual Licenses	Cumulative Licenses	Authorize Institution	Notes
China	1	Second class Supervisor of Radiation Protection	Radiation Application/Sealed sources				
	2	First class Supervisor of Radiation Protection	Radiation Application/Sealed Sources				
	3	Chief Engineer	Reactors / Nuclear Fuel				
	4	Chief Engineer of Nuclear Fuel	Fuel Processing, Uranium Enrichment, Reprocessing, Reactor				
	5	Clinical Radiation Technician	Medical Application				
	6	Medical Physicist (Public License)	the same as above				
Indonesia							
Korea	1	General License	Radiation Application	110	3,427	MOST	
	2	Supervisory License	Radiation Application	43	646	"	
	3	Special (oncologist) License	Radiation Application in medical use	8	797	"	
	4	Reactor Operator	Research Reactor/Generation Reactor	67	702	"	
	5	Reactor Senior Operator	"	60	847	"	
	6	Nuclear Materials Treatment License	Nuclear material treatment	0	6	"	
	7	Supervisory License For Nuclear Materials Treatment	Nuclear material treatment	13	31	"	
Japan	1	First Class Supervisor of Radiation Protection	Radiation Application / Unsealed Radioisotopes	463	19,924 (1958~2000)	MEXT	
	2	Second Class Supervisor of Radiation Protection (General)	Radiation Application / Sealed Radioisotopes	644	26,407 (1960~2000)	MEXT	
	3	Second Class Supervisor of Radiation Protection (ECD)	Radiation Application / Sealed Radioisotopes	215	3,224 (1968~1999)	MEXT	
	4	Chief Engineer of Reactors	Research Reactor / Generation Reactor	27	1,120 (1957~2000)	MEXT	
	5	Chief Engineer of Nuclear Fuel	Fuel Processing / Uranium Enrichment / Reprocessing / Reactor	26	833 (1968~1999)	MEXT	
	6	Clinical Radiation Technician	Radioactive Handling in Medical Treatment	1,992	33,247	Ministry of health, labor and welfare	
	7	Medical Physicist	None	10	131	Medical physics society	

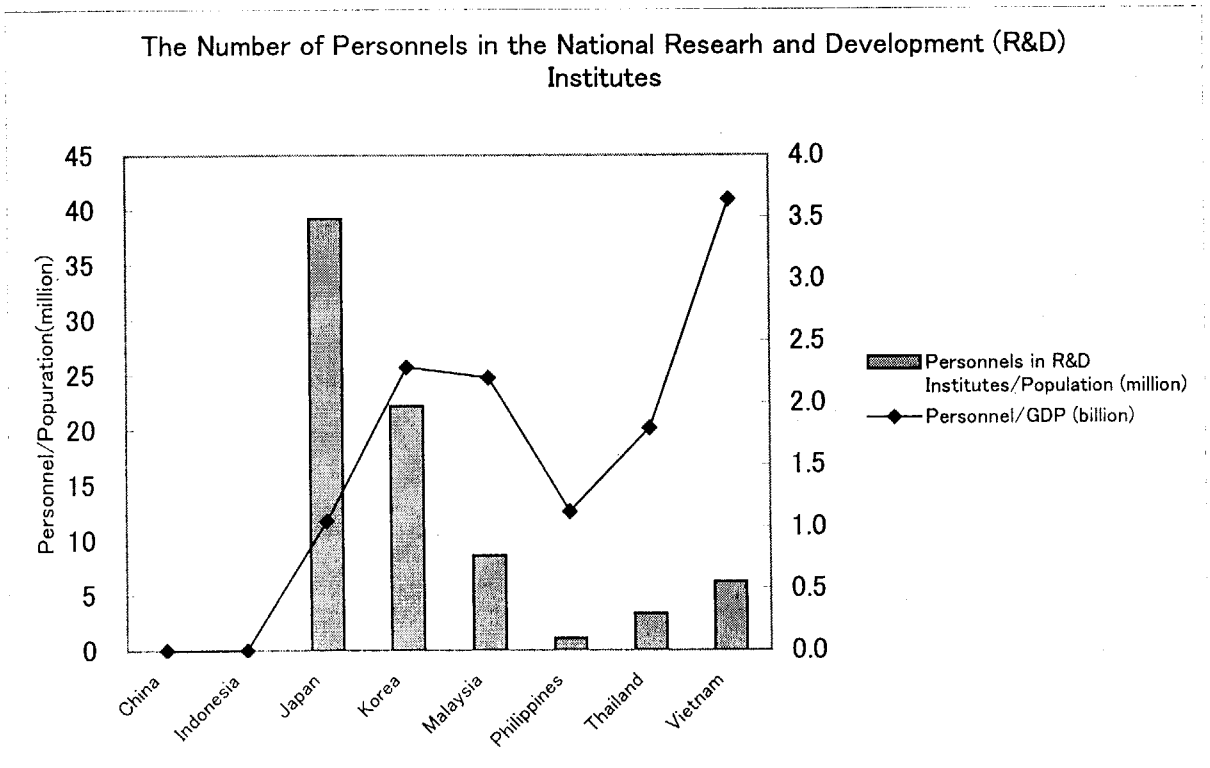
A−5. Survey of Licensees of National Examinations Related to Nuclear Technology ·(2/2)

		Qualification	Target	Average Annual License	Cumulative License	Authorize Institution	Notes
Malaysia	1	Radiation Protection Officer[RPO] Radiation Protection Supervisor [RPS]	Gaugas	+63	326	AELB	
	2	Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	Sales	46	91	AELB	
	3	Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	NDT	7	14	AELB	
	4	Radiation Protection Officer [RPO] Radiation Protection Supervisor [RPS]	TENORM	9	18	AELB	
Philippines		Certification as Radio-graphic Testing Practitioner		5	29	National Certifying Body	Those who did not renew their certification are not counted. Recertification exams every 2 yrs.
Thailand	1	Technician for Radiation Protection	Radiation Protection for Sealed Source		1542 (1990-2002)	OAEP	
	2	Technician for Radiation Protection	Radiation Protection for Sealed Source		283 (1998-2002)	Sukhothai Thammathirat Open University	
	3	Radiation Protection Officer	Radiation Protection for Unsealed Source		1055 (1990-2002)	OAEP	
	4	Engineer for radiographic testing	Radiographic Testing level 1		121 (1989-2002)	OAEP	
	5	Engineer for radiographic testing	Radiographic Testing level 2		52 (1989-2002)	OAEP	
	6	Reactor Operator	Operation of Nuclear Research Reactor		41 (1988-2002)	OAEP	
	7	Irradiation Operator	Operation of Irradiation Plant		25 (1992-2002)	OAEP	
Vietnam							

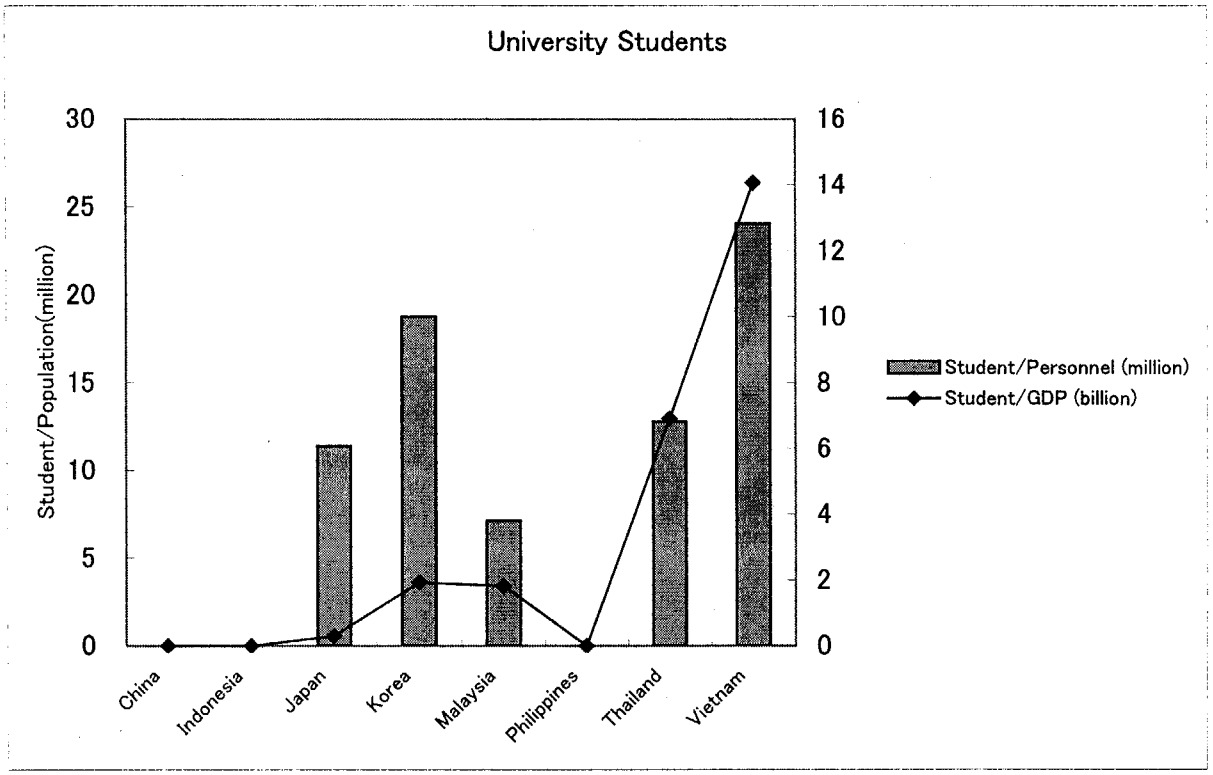
Annex 4-2

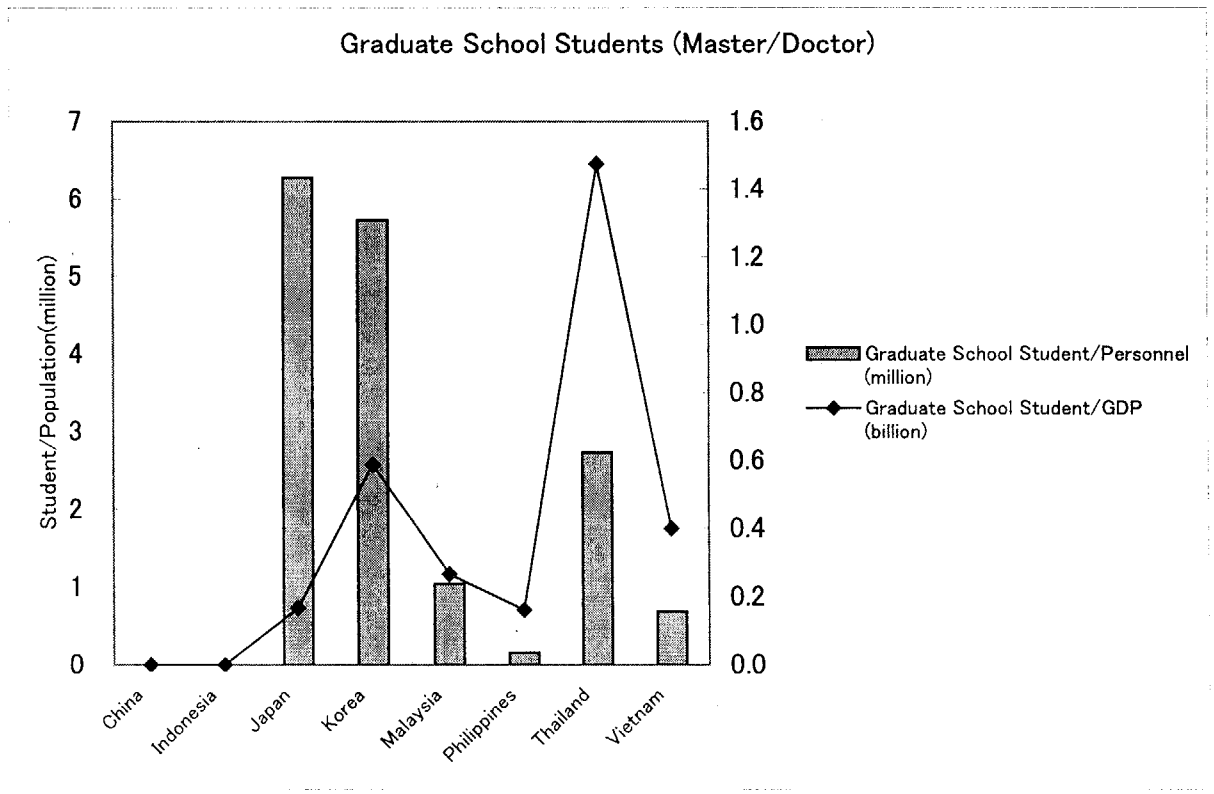
A-1 Survey of the Administrative Agencies and National R&D Institutes

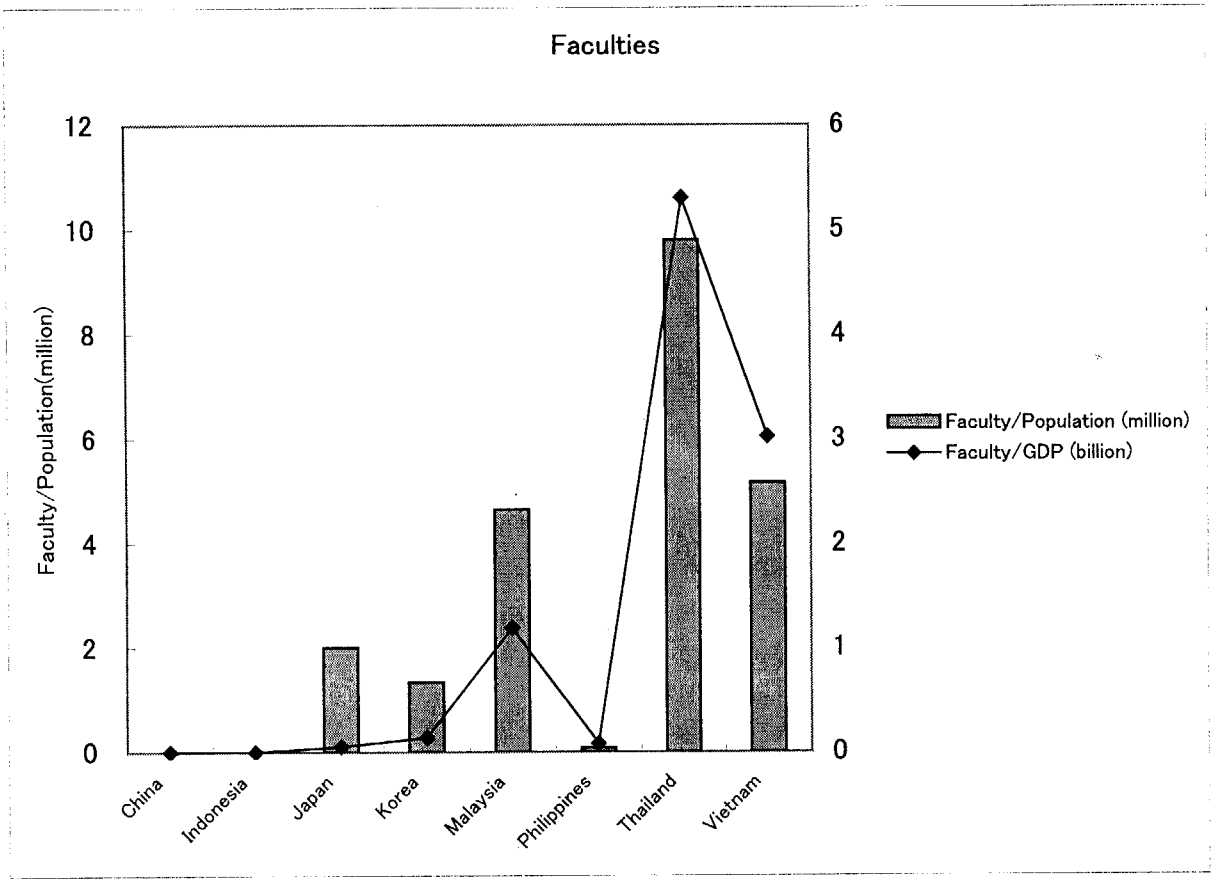


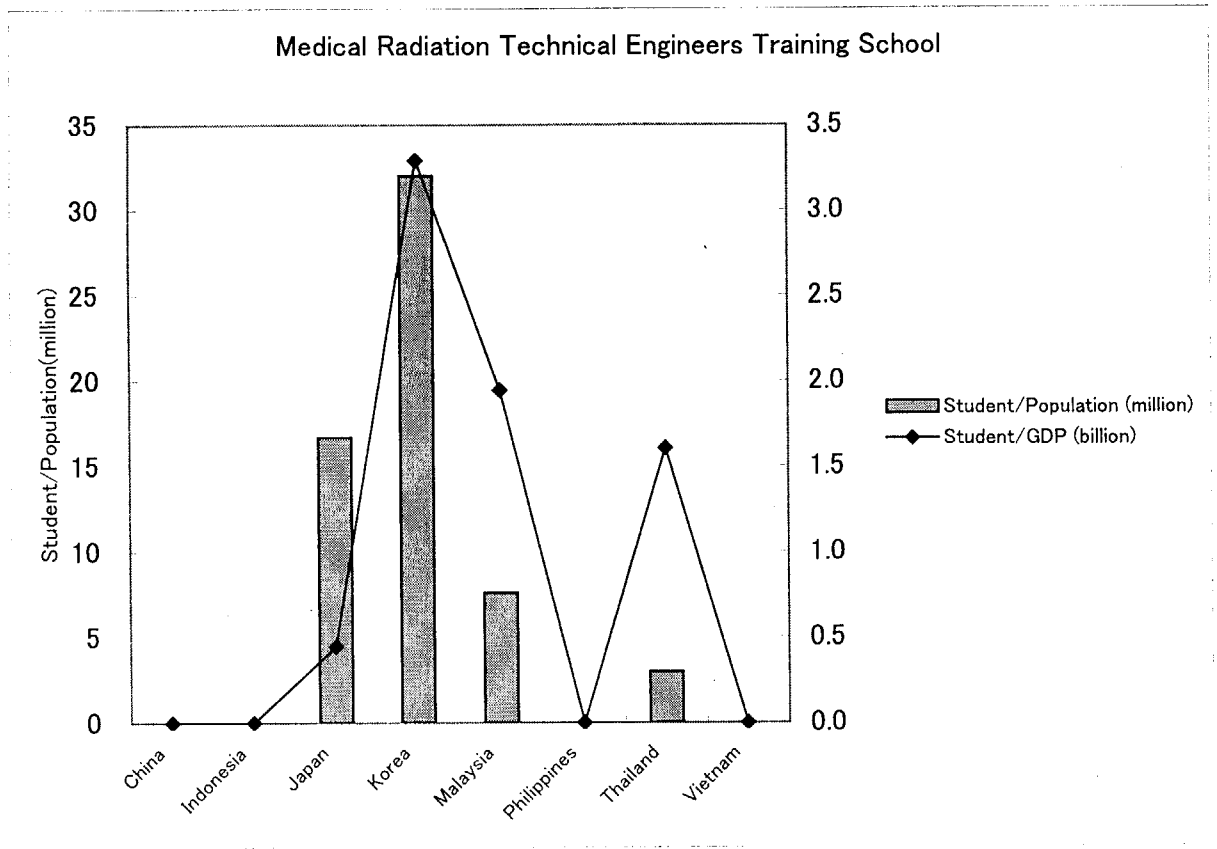


A-2 Survey of University Education Institutions

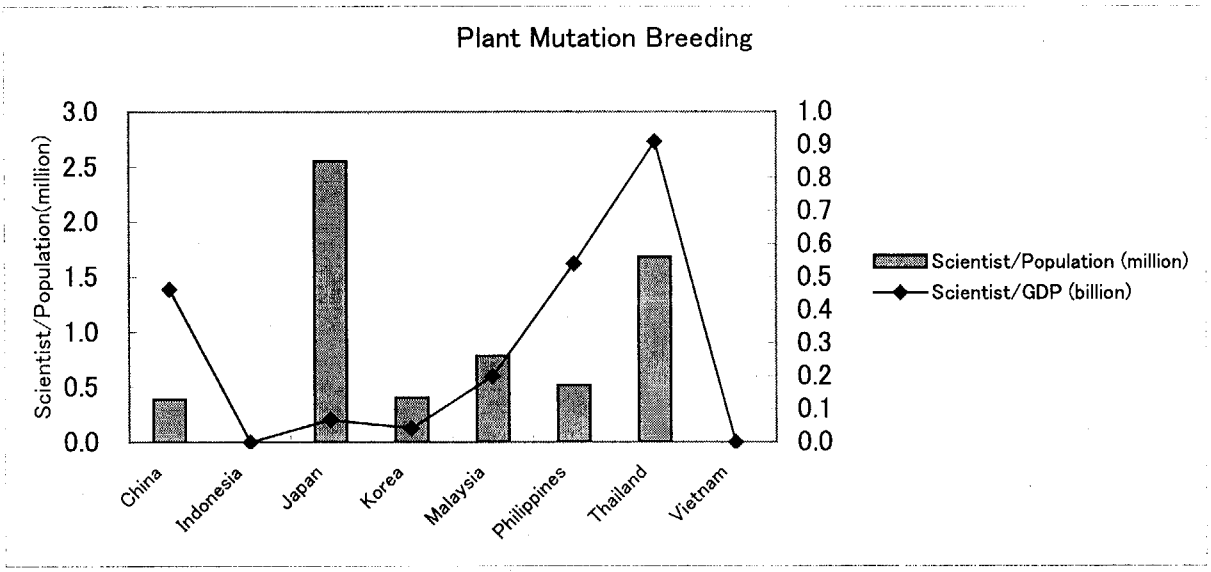


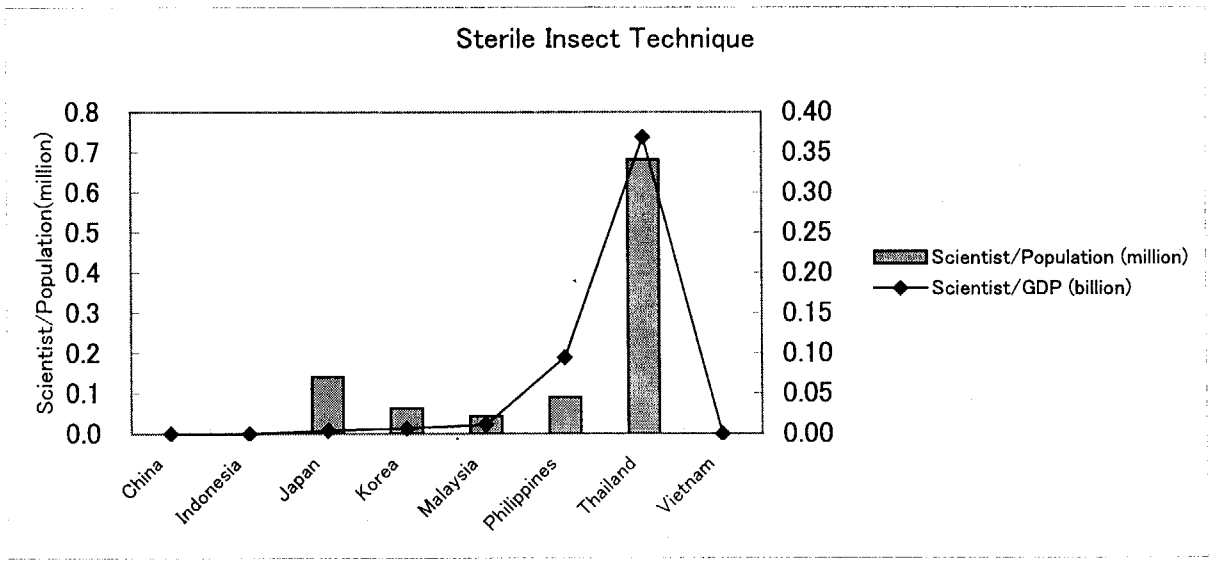


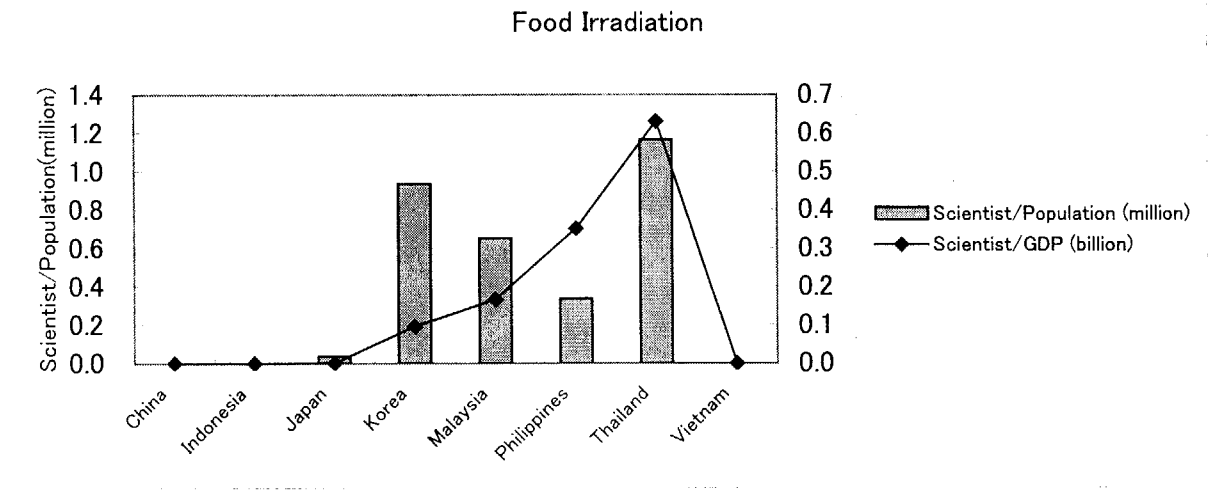

Faculties
Faculty/Population(million)
12
10
8
6
4
2
0
6
5
4
3
2
1
0
China
Indonesia
Japan
Korea
Malaysia
Philippines
Thailand
Vietnam
Faculty/Population (million)
Faculty/GDP (billion)

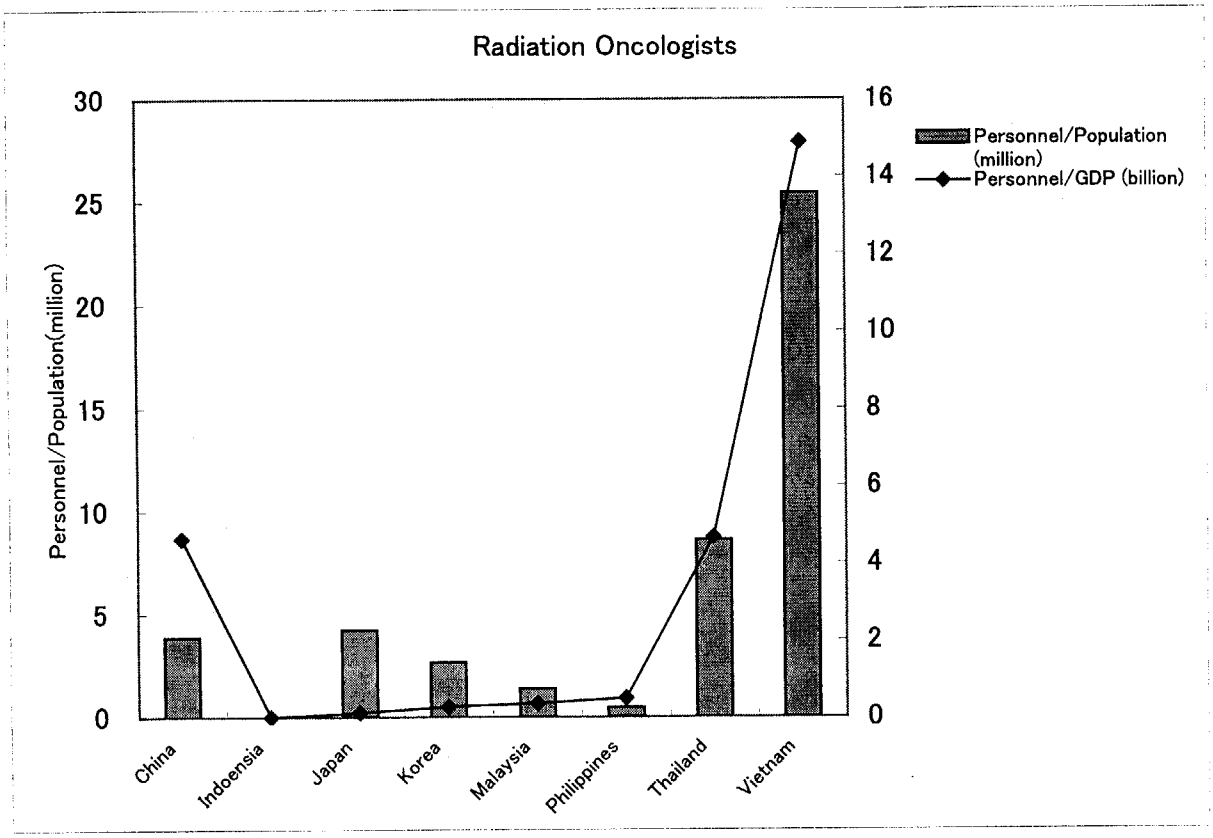

Medical Radiation Technical Engineers Training School
Student/Population(million)
35
30
25
20
15
10
5
0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
China
Indonesia
Japan
Korea
Malaysia
Philippines
Thailand
Vietnam
Student/Population (million)
Student/GDP (billion)

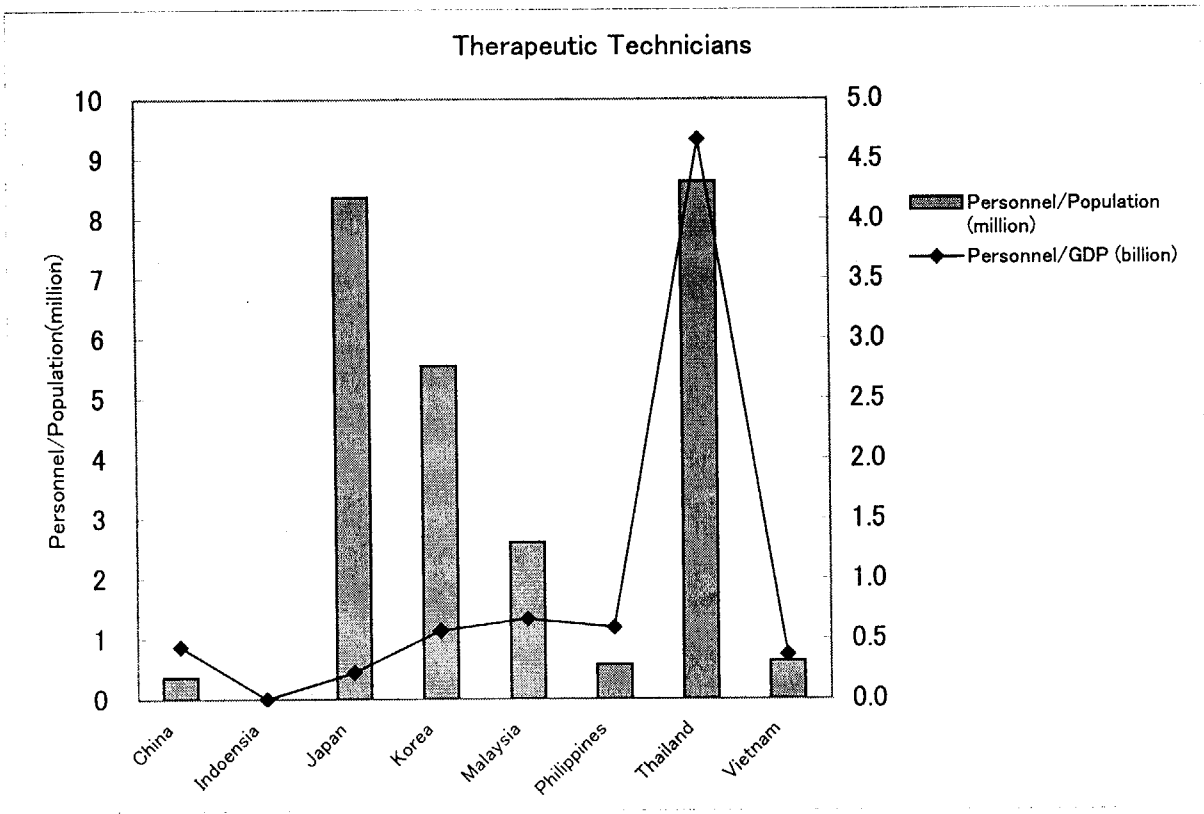
A-3 Survey of Radiation and Radioisotopes Application



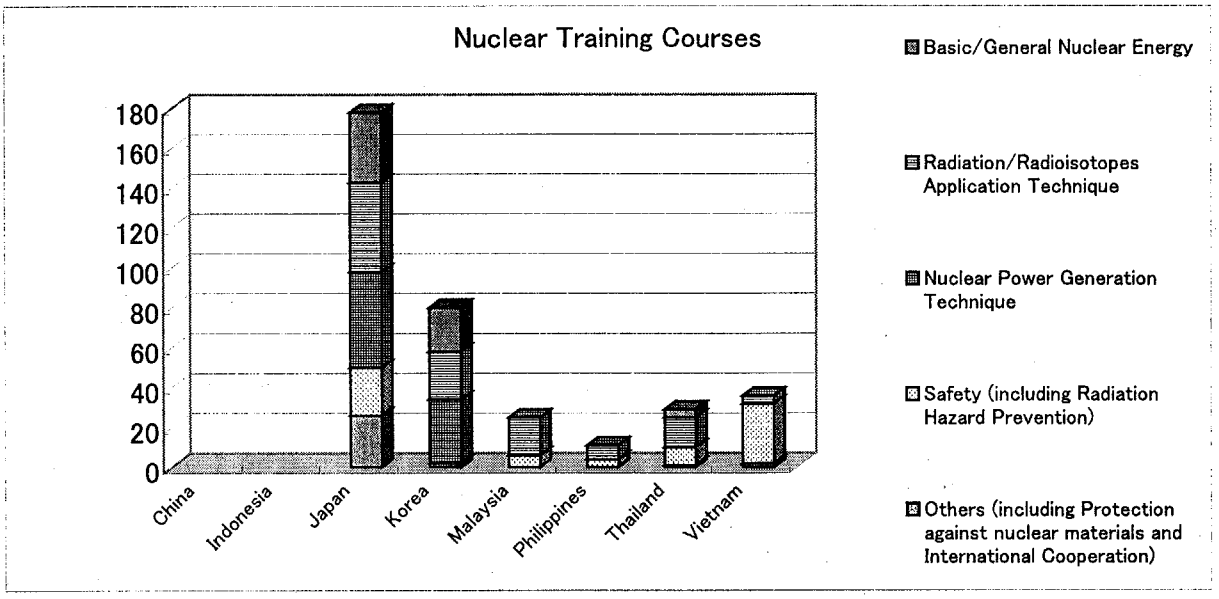


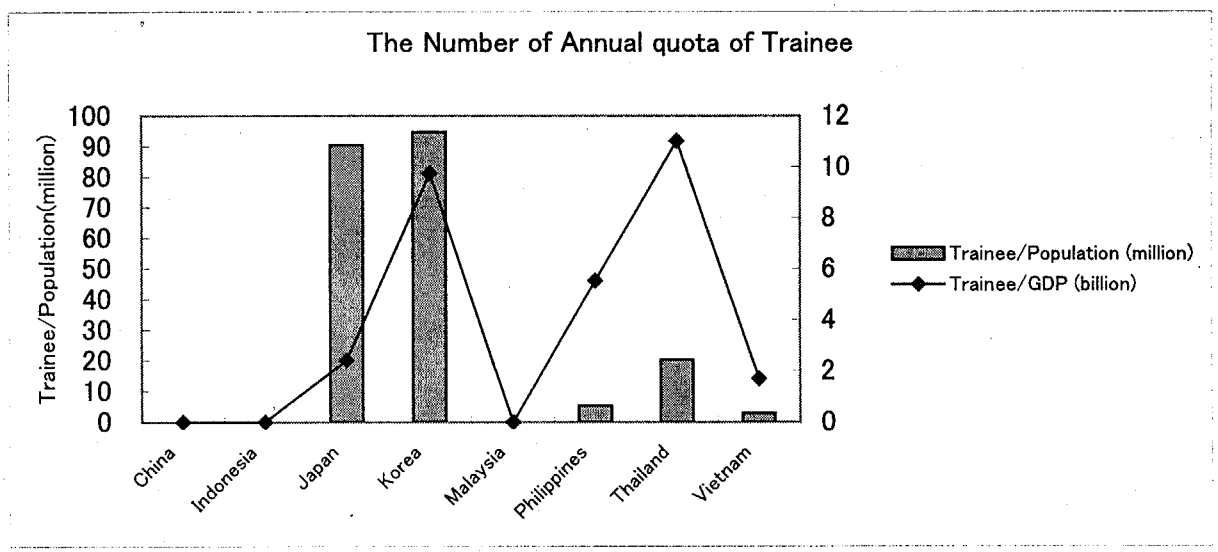


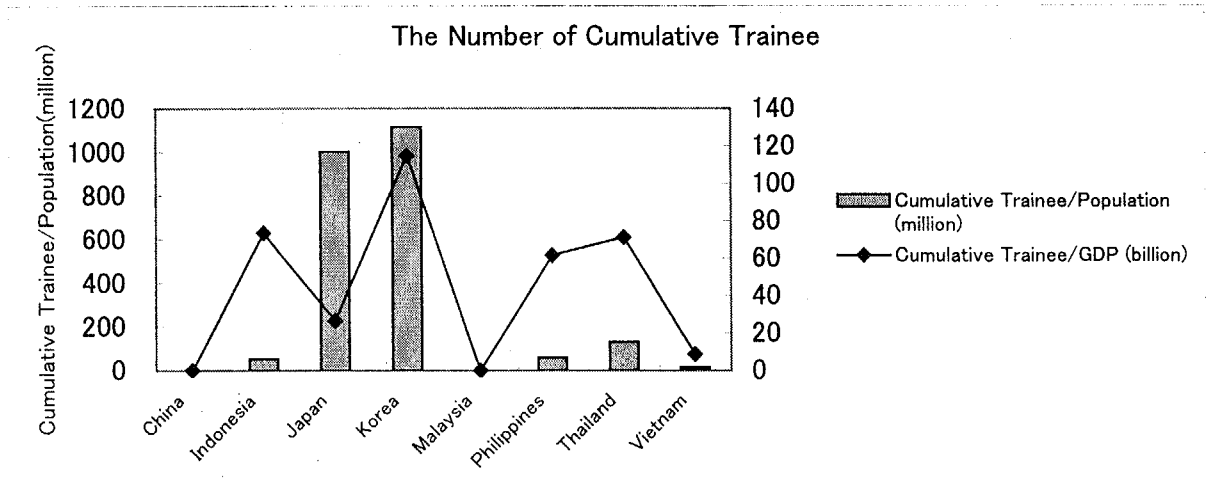

Radiation Oncologists
Personnel/Population(million)
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
China
Indoensia
Japan
Korea
Malaysia
Philippines
Thailand
Vietnam
Personnel/Population (million)
Personnel/GDP (billion)


Therapeutic Technicians
Personnel/Population(million)
10
9
8
7
6
5
4
3
2
1
0
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
China
Indoensia
Japan
Korea
Malaysia
Philippines
Thailand
Vietnam
Personnel/Population (million)
Personnel/GDP (billion)

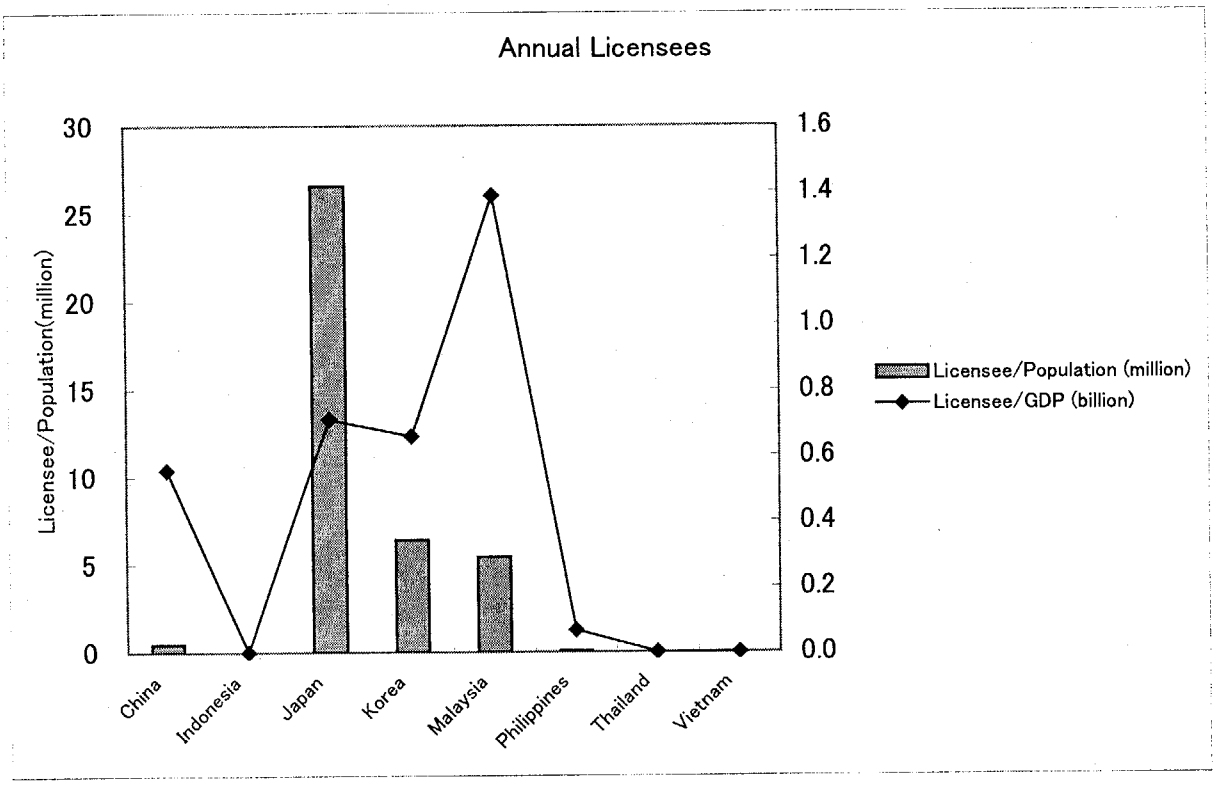
A-4 Survey of Nuclear Training Courses

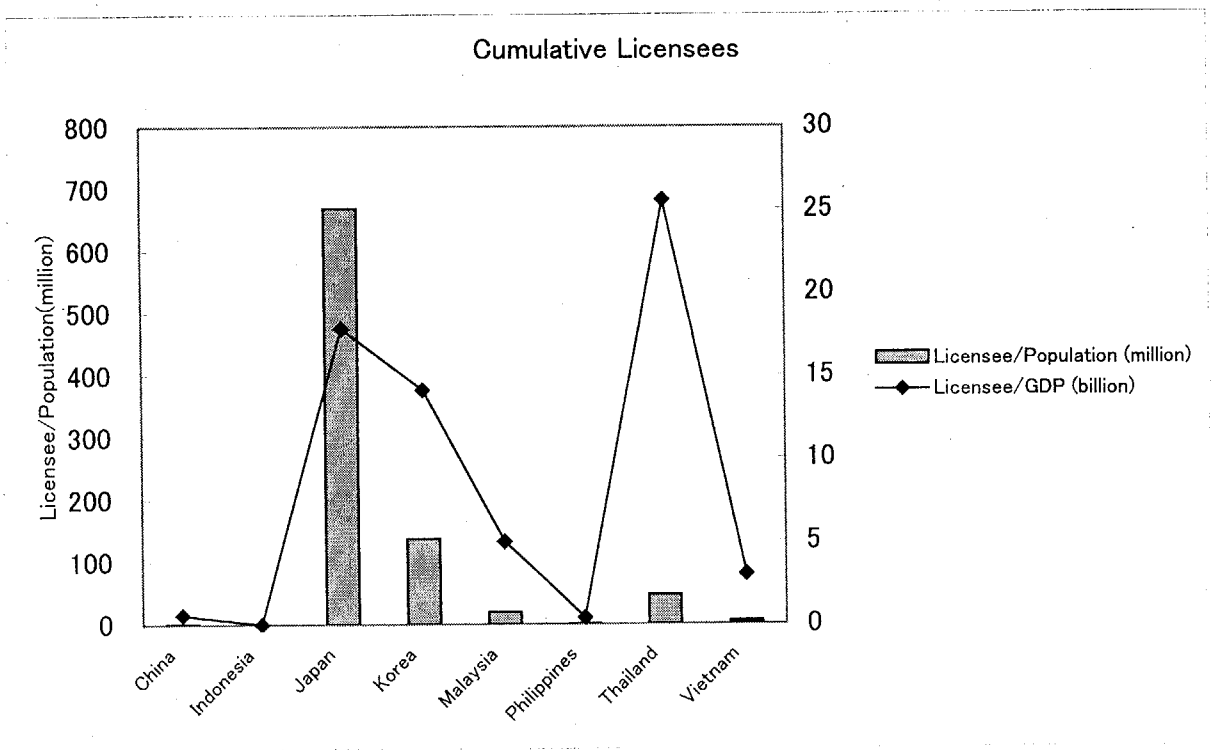




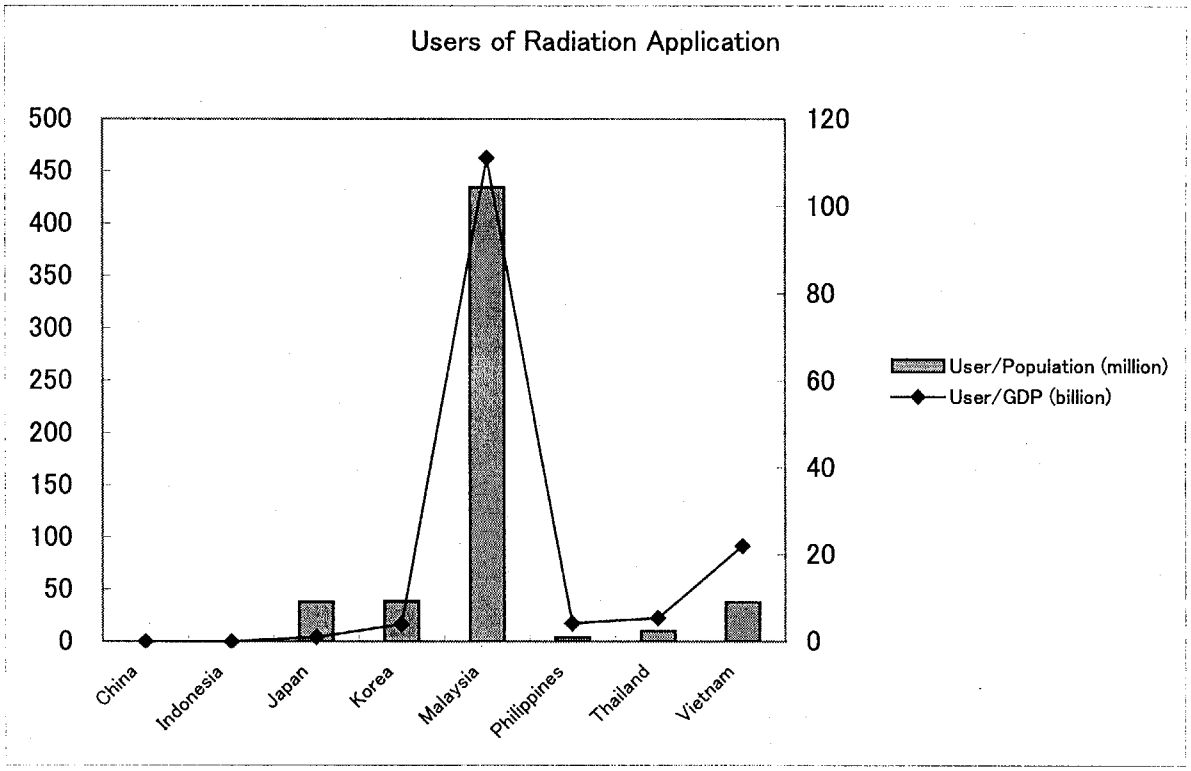


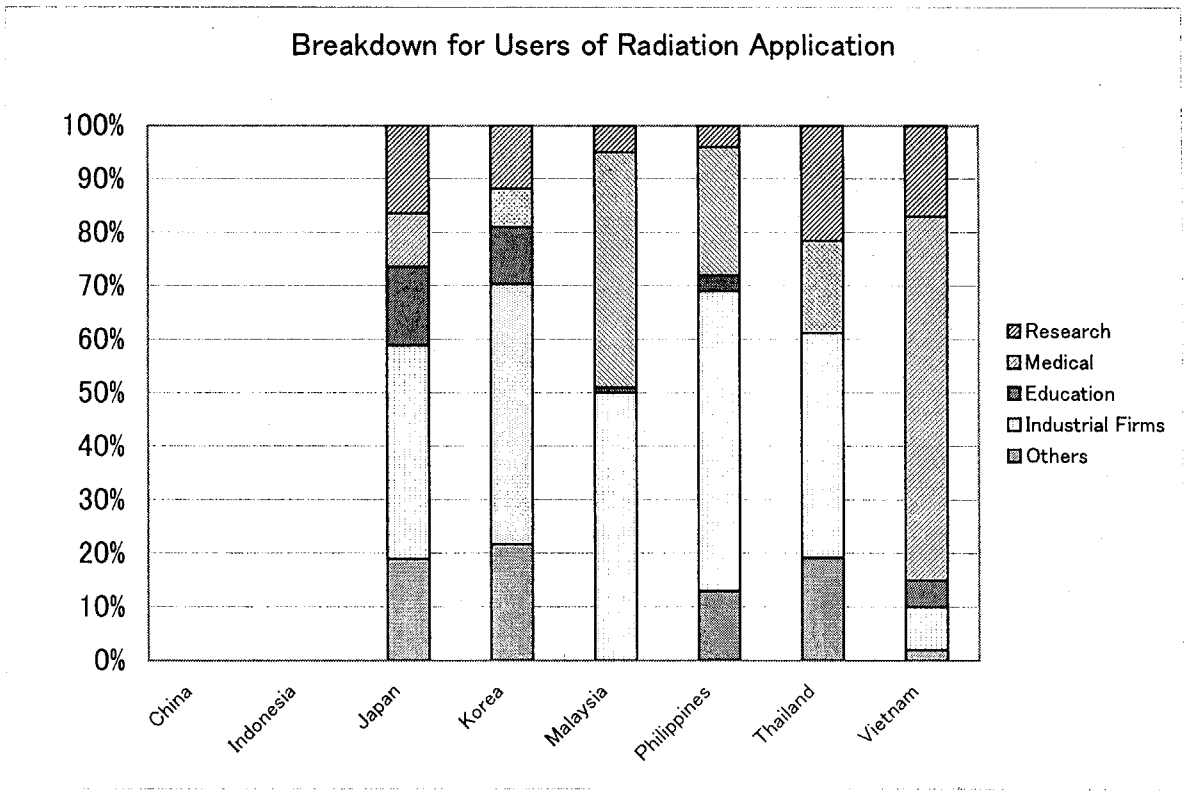
A-5 Survey of Licensees of National Examinations related to Nuclear Technology



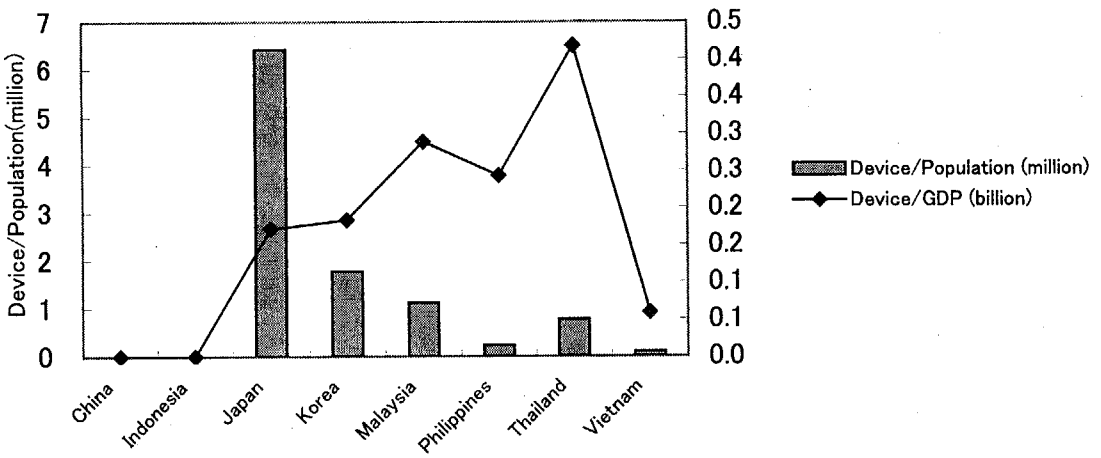


A-6 Survey of Background Data of Analysis

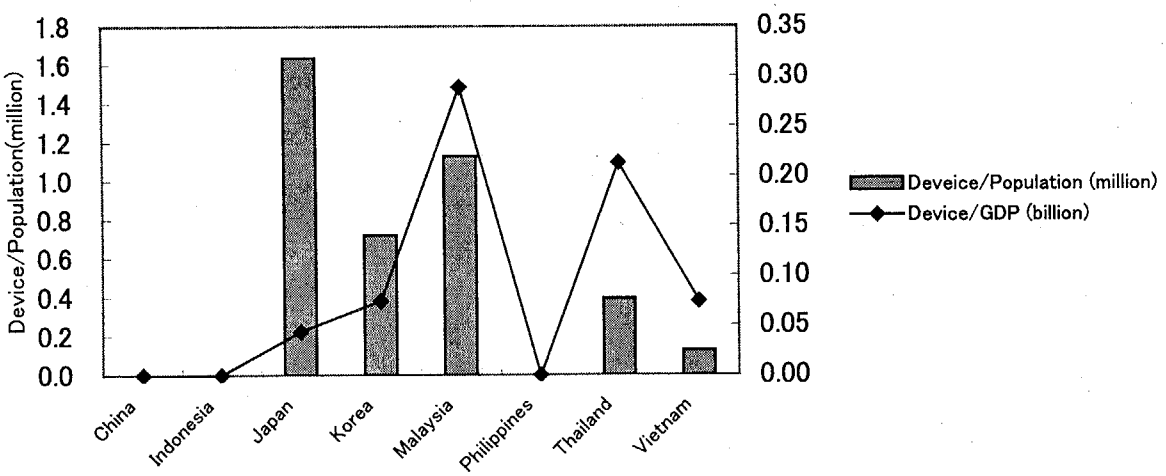




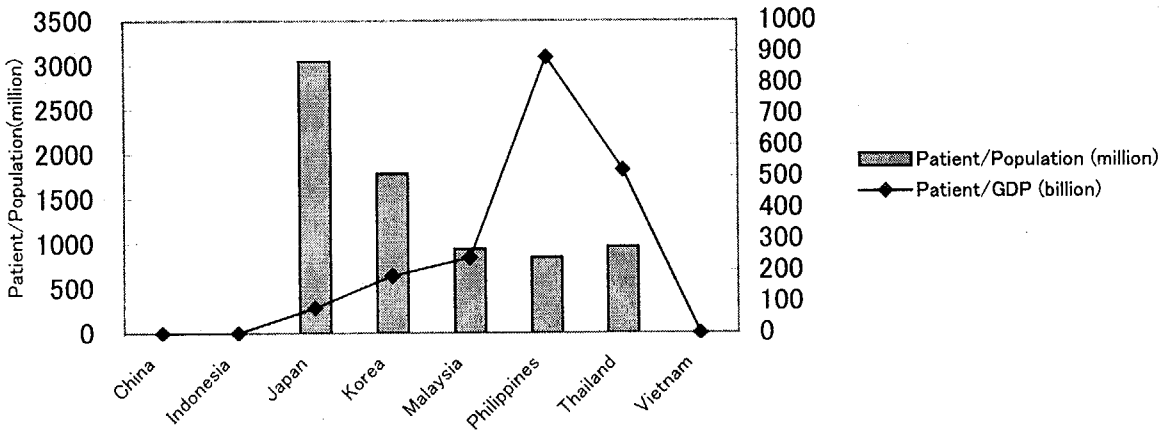
Megavoltage Teletherapy Machines



Brachytherapy Machines



Annual new Cancer Patients in both sexes



Human Resources Development Project Report

Yasushi Seki

Nuclear Technology and Education Center

Japan Atomic Energy Research Institute

(NuTEC, JAERI)

FNCA-Coordinator Meeting 2003

1

Content of Talk

- Activities to Date
- Achieved Results
- Future Plan
- Action Plan for 2003
- 3 year plan

2

Activities to Date

- Project of Human Resources Development (HRD), was approved in the FNCA framework and started in August 1999

- 1999 Workshop (November in Tokyo,Japan)
- 2000 Workshop (October in Tokai, Japan)
- 2001 Workshop (October in Daejon, Korea)
- 2002 Workshop (October in Batangas, the Philippines)

3

2002 Workshop

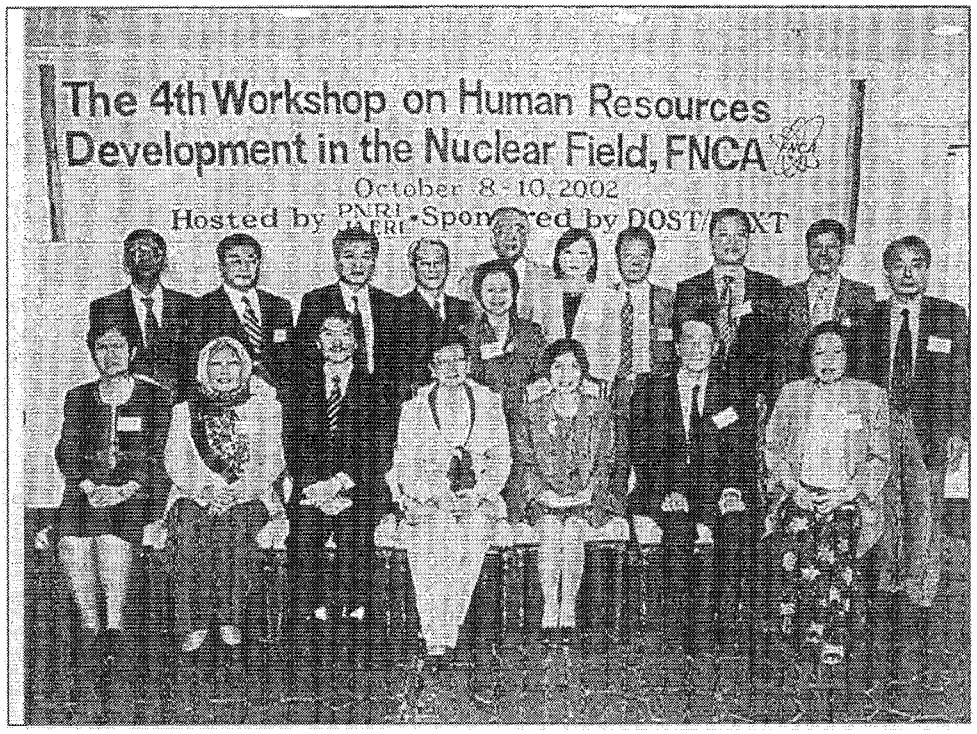
- October 8- October 10, 2002 in Batangas, the Philippines

- Sponsored by DOST of the Philippines, MEXT of Japan and hosted by PNRI, JAIF and JAERI

- 19 Participants from 8 member states

- The Philippines provided beautiful venue (Evercrest Golf Club Resort) and excellent arrangements of the WS

4



Development of Nuclear Training Techniques

- Common training material on Radiation Protection (in English) produced by Japan jointly with Indonesia, Thailand and Vietnam, for the Joint Training Courses will be uploaded on HRD Project Website for review and comments by HRD PLs
- Possibility of jointly producing e-learning material for nuclear training was discussed and decided to collect the information on the availability of multimedia CD-ROMs

6

Training materials exchange

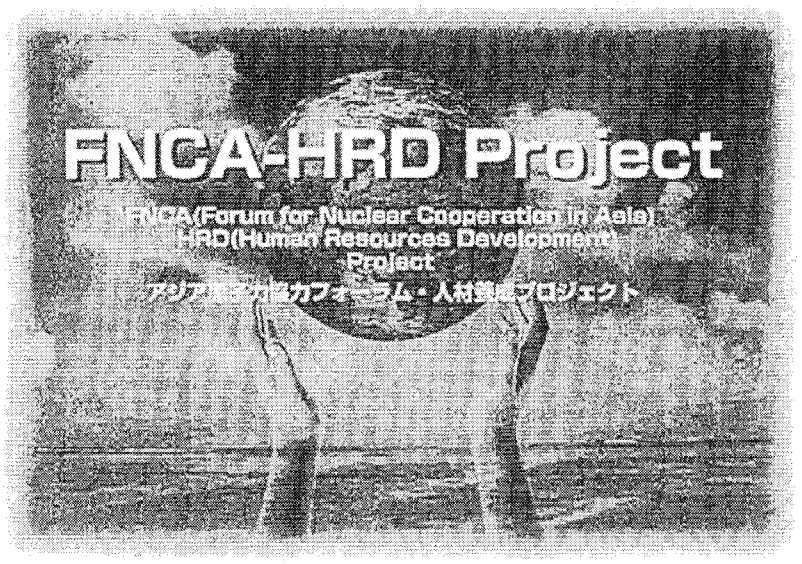
- "Radiation Safety" second edition (393 pages, written in English) was distributed to each country by Malaysia.
- "Exercises in Reactor Physics" (292 pages, written in English), recently published in Japan was distributed to member countries upon request.
- As a step towards the use of e-learning systems in training high school students in the area of nuclear science and technology, the Philippines is developing an interactive, multimedia CD-ROM in English, will be distributed after completion.

7

Information exchange

- To improve the efficiency of human resources development in each country, information of the nuclear training courses will be exchanged by way of the project website set up in FY2001. International and domestic training courses in each country will be updated and the courses in FY2003 will be provided in the website

8



Activities

Course Curricula for RI and Radiation Courses

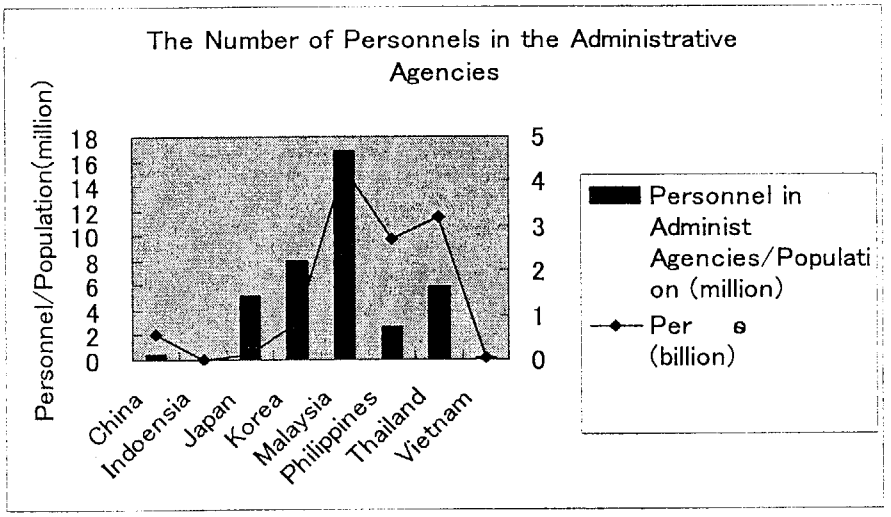
Copyright(C) 2002 Japan Atomic Energy Research Institute

9

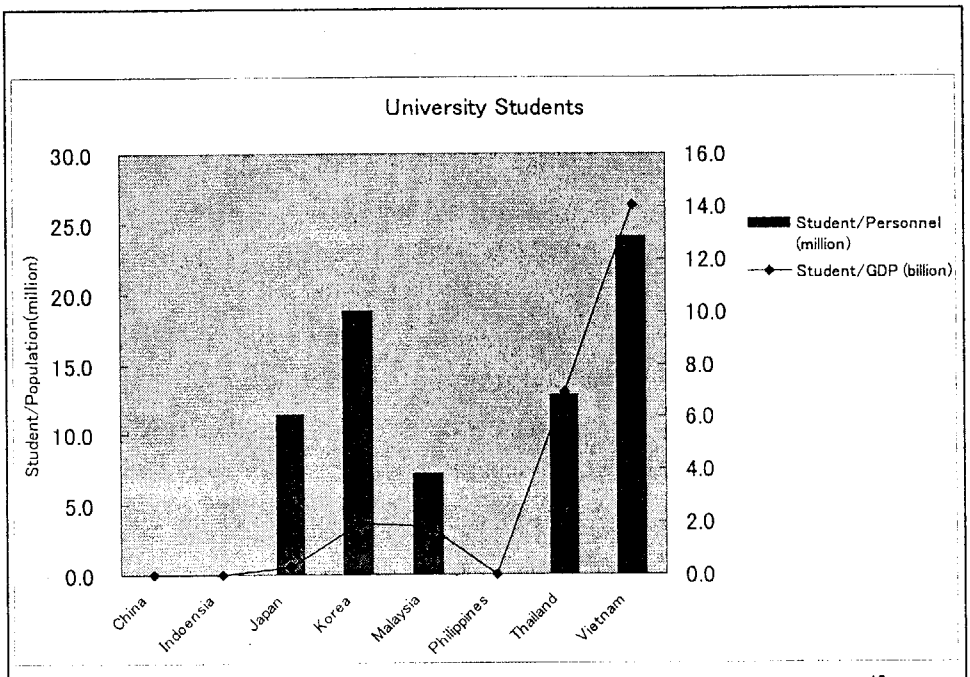
Survey of the Basic Data on HRD

- 3rd Coordinators Meeting in FY2001 decided to carry out the survey of the basic data on HRD at the FNCA in order that the data be used in the formulation of the HRD strategy
- General data of the Human Resources in Nuclear Field were collected and presented at the 4th HRD Workshop in FY2002
- Analysis and evaluation of the survey data and further survey of insufficient data, such as those in the nuclear education in Universities, will be carried out as shown in the three-year plan FY2002-FY2004

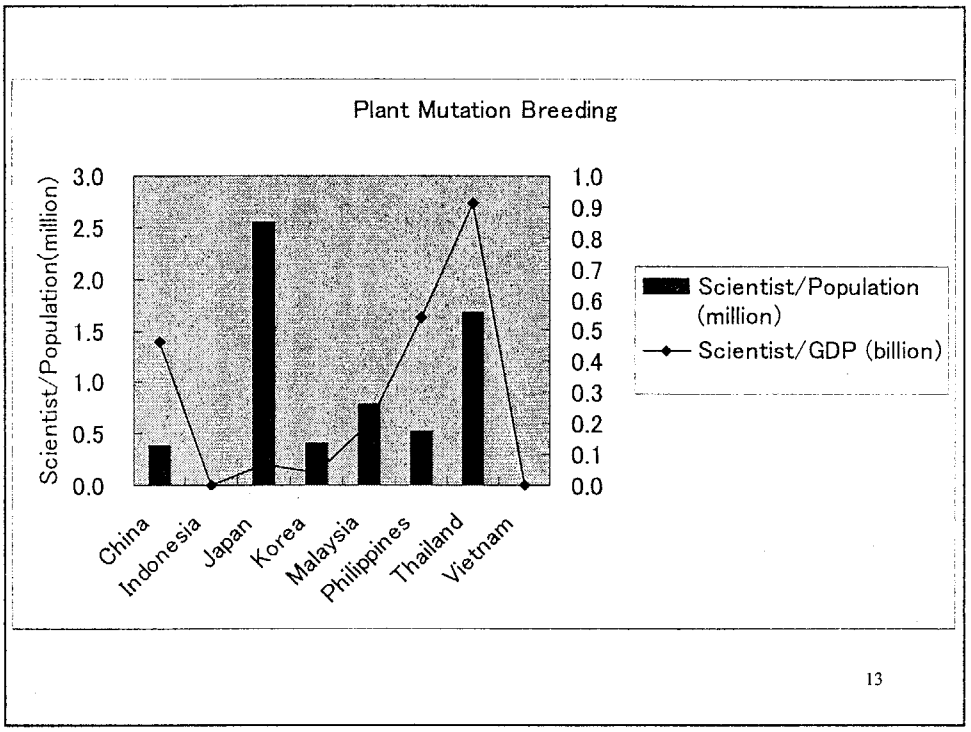
10

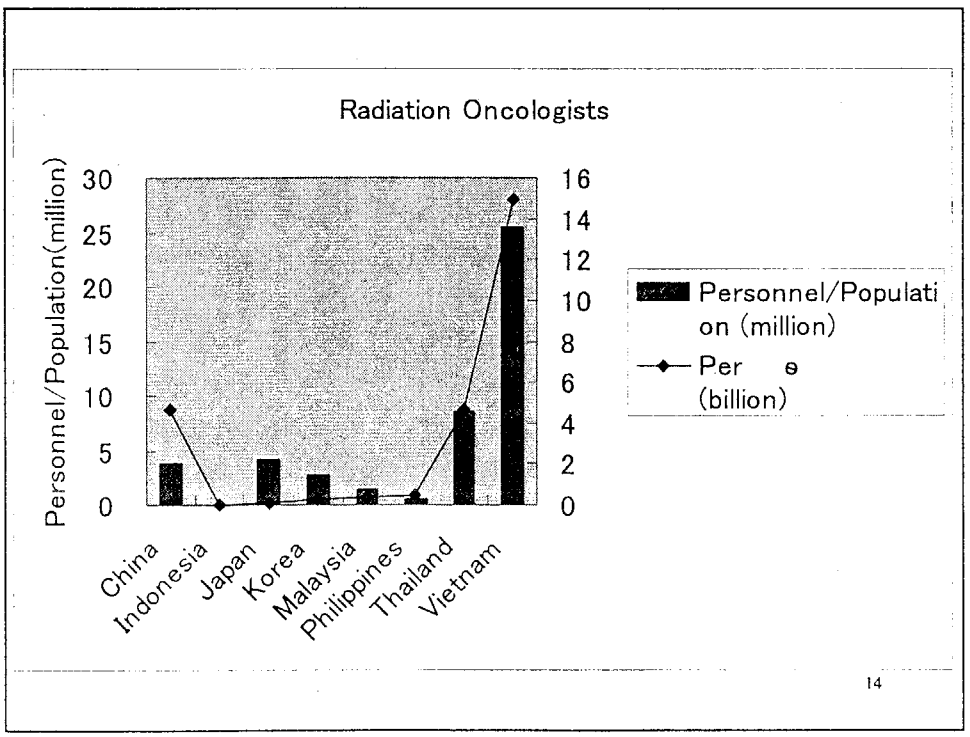

The Number of Personnels in the Administrative Agencies
Personnel/Population(million)
18
16
14
12
10
8
6
4
2
0
5
4
3
2
1
0
China
Indoensia
Japan
Korea
Malaysia
Philippines
Thailand
Vietnam
Personnel in Administ Agencies/Populati on (million)
Per e (billion)

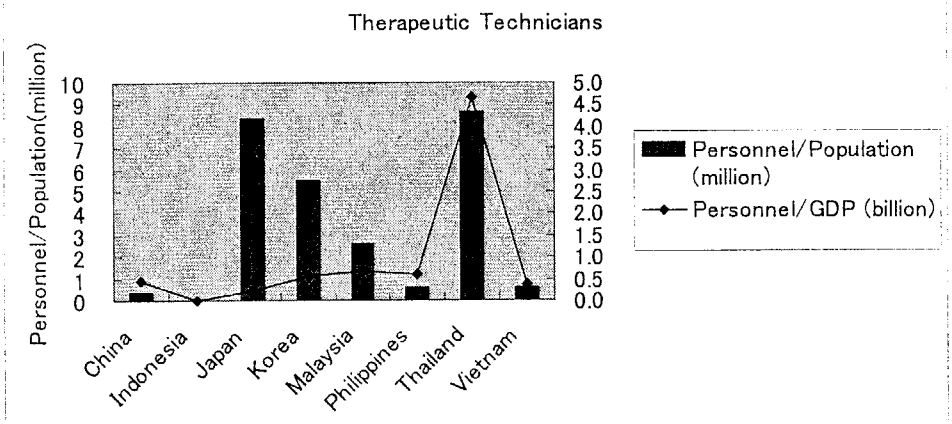
11


University Students
Student/Population(million)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
China
Indoensia
Japan
Korea
Malaysia
Philippines
Thailand
Vietnam
Student/Personnel (million)
Student/GDP (billion)

12


Plant Mutation Breeding
Scientist/Population(million)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
China
Indonesia
Japan
Korea
Malaysia
Philippines
Thailand
Vietnam
Scientist/Population (million)
Scientist/GDP (billion)
13


Radiation Oncologists
Personnel/Population(million)
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
China
Indonesia
Japan
Korea
Malaysia
Philippines
Thailand
Vietnam
Personnel/Populati on (million)
(billion)
14



15

Request for Nuclear Research Exchange Programs and other Programs

- Better utilization and improvement of Japan's HRD program for Nuclear Science and Technology, i.e. MEXT Nuclear Researchers Exchange Program, Seminar for Nuclear Administrators, International Seminar on Nuclear Safety, International Training Program for Atomic Energy Safety Technology and Nuclear Safety Expert Dispatching Program were discussed

16

Achieved Results

- Development of common training materials on Radiation Protection started
- Information exchanges on training courses, curriculums and teaching materials started
- Three year survey of basic data on HRD has started

17

Future Plan

- Three year plan to collect, analyze basic data on HRD to assist the development of HRD strategy
- Mutual support activities such as exchange of information by project home page and joint development of common training materials on Radiation Protection will be continued
- Present requests for personnel exchange program based on the actual needs in HRD of each country
- Further investigation on e-learning materials such as multimedia CD-ROMs

18

Action items for 2003

- Publish 2002 workshop proceedings
- Training materials in radiation protection used in the bilateral Joint Training Courses will be provided in the HRD Project website for review and comments
- Update the project homepage of the project and distribute available training materials in English (textbook, CD-ROM, etc.)
- Present requests for changes in the exchange programs based on needs of each country

19

The mid-term Plan (FY2002-2004) of the Project on Human Resources Development

FY2002	FY2003	FY2004
3rd Forum (Korea) 4th CRD	4th Forum (Japan) 5th CRD	5th Forum (Vietnam) 6th CRD
1) 4th Workshop (Philippines) 1) Training support Training Materials · -Provide common training materials on radiation protection Examination of introducing e-learning system	1) 5th Workshop (Thailand) -Report of present status, problems and needs -Information exchange and proposal for problems and needs	6th Workshop (Place: to be determined) -Report of present status, problems and needs -Information exchange and proposal for problems and needs
Survey of basic data on HRD · General Data · University Data	Survey of basic data on HRD · General Data University Data Analysis of Data	Survey of basic data on HRD · General Data University Data Summaroze Result of Survey

20

2.1.2 Strategy of Human Resources Development (HRD)

Session 4
Document 4-2
Sueo Machi, FNCA Coordinator of Japan

(1) Asian Nuclear Research, Education Training network

1) Indonesia proposed the AINST(Asian Institute Nuclear Science and Technology) for strengthening the newly established POINT of Indonesia in 2001. However, the proposal of AINST has been withdrawn in 2002 due to insufficient interest of other countries.
2) As a replacement of the AINST proposal, the concept of regional network for research, education, and training was discussed at the WS of HRD in 2001.
3) The Korean Government proposed for the IAEA to study the feasibility of the International Nuclear University (INU) at the GC in 2001. Accordingly, the Agency convened the meeting on "Nuclear Knowledge Management and Preservation" in June 2002.
4) In the lead-off comments on "Strategy for HRD" by Dr. Han of KAERI, the formulation of "Asian network of high education and training in nuclear technology" for preparation of the INU was suggested (Attachment-1) and its importance was recognized by the delegates (Attachment-2).
5) Recently the Agency announced the meeting in Korea on the regional networking for nuclear science education and training to be held in May 2003.

(2) The survey on available human resources in respective nuclear applications and future resources demand to meet the national nuclear programme is being conducted by the FNCA-HRD project. The results of survey should be useful for the strategy of HRD in each country and the regional cooperation. The results will be compiled and analyzed in 1 or 2 years.

(3) High level task group

1) At the 3rd FNCA meeting the formation of high level task group was agreed in order to further scope the potential activities on the HRD strategy.
2) Important issues raised at the 3rd FNCA meeting could be agenda items at the high level task force as follows:
   - Promotion of the exchange of information on human resources development strategies in connection with nuclear knowledge management,
   - Development of programs for attracting the young generation to nuclear science and technology,
   - Harmonization of different interests in technical areas,
   - Formulation of an Asian network of higher education and training in nuclear technology for the preparation of the establishment of the International Nuclear University in the future,

3) Planning of the meeting of high level task group has no been set due to the delay in identifying its clear objectives and terms of reference.

(4) For "The Asian Nuclear Research, Education and Training Network" (ANRETN) following issues should be fully made clear:

- Focal points of network in each country for all different fields and their capacity.
- Needs of the network in terms of numbers of students, research scientists, and technicians in different fields.
- Issue of Diploma.
- Funds – IAEA fellowship, fellowship given by countries of students, fellowship of host countries.
- Harmonization and linkage with other technical and scientific areas relevant to nuclear science.
- The roles of nuclear research institutes and universities in FNCA countries.

Attachment 2

Chairperson's Summary of the Third Meeting of the FNCA

1.3 Session 2: Round Table Discussion

1-3-1 Lead-Off Comments on 'Strategy for Human Resources Development'

by Dr. Kyong Won Han
Head of Nuclear Training Center
Korea Atomic Energy Research Institute

1. Introduction

Qualified manpower is an essential element for the successful implementation of national long-term nuclear programs as well as associated R&D programs. Such manpower could only be developed effectively under a well established national strategy, which addressed adequately the need of human resources in terms of technical areas, number of personnel and timing. In establishing such a strategy, account should be taken on the availability of infrastructure for education and training, and the feasibility of networking among institutions concerned at national as well as international levels. In this context, I would like to talk about the need of nuclear human resources in Asia and the effort made by FNCA in addressing the need. Then I will conclude my talk by suggesting some points for consideration in this discussion.

2. Needs of Nuclear Human Resources Development in Asia

Recently, many countries have expressed their concerns, in a number of international meetings, about aging of human workforce in the nuclear field an sharp decline in the number of new entrants to the education and training in nuclear science and technology. In order to better understand and discuss these worldwide phenomena, an IAEA meeting on nuclear knowledge management was held in Vienna in June 2002. The knowledge management was viewed in the aspect of knowledge preservation and succession planning of workforce, which are closely linked to human resources development. Participants of the meeting recommended IAEA to consider 18 activities including integration of existing nuclear data and information bases, networking of institutions for nuclear education and training., facilitating the development of curricula for internationally accepted higher university degrees on nuclear technology, establishment of an International Nuclear University, and attracting the new generation of students into the nuclear area. The knowledge management issue was further discussed in an IAEA Scientific Forum held in September 2002. Suggestions from the forum included formulation of clusters by nations with a similar economic and cultural situation, and networking for education and training on a regional bases.

It may be obvious that Asian countries share the view on the importance of nuclear manpower development in the same way as discussed above. However, they seem to have more particular reasons for having interests in the human resources development. It is in Asian countries where most of the current constructions of nuclear power plants in the world are taking place. While, a large number of Asian

countries seem to focus on non-power activities and consequently have their primary interest, for the time being, in the utilization of radioisotopes. Along this line, Asian countries could be categorized as the following groups:

- countries operating NPPs;
- countries planning construction of NPPs;
- countries conducting R&D on NPPs;
- countries focusing on non-power activities.

This regional specific situation could be interpreted as an indication that there is a high need of human resources to address the increasing activities in nuclear fields in Asian countries. It also indicates that diverse groups of human resources will be required to meet the different areas of interests from the groups mentioned above. In this context, cooperation among Asian countries is felt beneficial in the sense that it can solve common problems of human resource development, which are specific to the region. Also, the idea of regional approach is in line with the concept of cooperation brought about from the aforementioned IAEA meetings.

3. Efforts Made by FNCA on Human Resources Development

It is our recognitions that FNCA has made a great effort in promoting regional cooperation to meet the need of human resources for the sustainable development of nuclear industries in Asia. In general, all of the FNCA projects being carried out have contributed to the human resource development by dealing with important subjects, i.e. utilization of research reactors, application of radioisotopes and radiation for agriculture, application of radioisotopes and radiation for medical use, public information of nuclear energy, radioisotope waste management, and nuclear safety culture. Moreover, it is felt encouraging that FNCA deals with the issue of human resources development under a separate project. The project is promoting the following activities:

- Information of national strategies on human resources development has been exchanged through meetings;
- Investigation has been conducted to collect and analyze basic data about nuclear research institutions, universities, radiation and isotope applications, nuclear training courses, etc. From this year, further survey of basic data will be conducted for better creation of joint projects for member countries;
- Discussions have been initiated to deal with strategy issues on how to attract the young generation, and how to secure the safety of research reactors and in radioisotope utilization;
- Discussions have been conducted on the establishment of Asian Institute of Nuclear Science and Technology (proposed by Indonesia) and International Nuclear University (proposed to the IAEA by Korea). Also an activity of developing a textbook on radiation protection was launched in order to improve and harmonize training capabilities in member countries.

4. Suggestions for Future Cooperation for Human Resources Development

As discussed above, the importance of human resources development in the field of nuclear is recognized worldwide. Asian region is not an exception and in need of regional cooperation in order to solve common problems together in an effective way. FNCA has made a great contribution to the regional cooperation and its effort is expected to continue. In this context, it is felt essential to review the strategies of human resources development at national and regional levels in order to have the future regional cooperation more effective. Now I would like to bring the following items for consideration by the audience in discussing the strategy issue:

- Promotion of exchange of information on human resources development strategy in connection with nuclear knowledge management;
- Development of programs for attracting the young generation to nuclear science and technology;
- Harmonization of diverse interests in technical areas;
- Formulation of an Asian network of higher education and training in nuclear technology for the preparation of the preparation of the establishment of International Nuclear University in the future;
- Cooperation and interaction with other regions for human resources development.

Attachment 2

Chairperson's Summary of the Third Meeting of the FNCA

4. In the afternoon session, a representative from IAEA (Mr. M.N. Razley, Section Head, East Asia and the Pacific Section, Department of Technical Cooperation), who participated in their meeting as an observer, delivered a presentation on "Improving Human Welfare through Partnership and Integrated Technologies." Mr. Razely introduced some of the IAEA'S efforts to benefit the FNCA countries, particularly to the Asia-Pacific Region that the nuclear techniques could provide.

5. At the Round Table Discussion, the FNCA Countries expressed their views and made comments on two topics, namely: 'Strategy for Human Resources Development (HRD)', and 'Sustainable Development and Nuclear Energy.' The first roundtable discussion topic entitles 'Strategy for HRD' was introduced by Mr. K.W. Han (Head of the Nuclear Training Center at Korea Atomic Energy Research Institute). The leadoff speaker emphasized the necessity for nuclear knowledge preservation as a preparatory measure for inducing the second nuclear Renaissance. This view gained other delegates' consensus along with the additional comments that continuous effort should be made to develop human resources in keeping abreast with today's needs and modus operandi. In particular, the following issues were considered important:

- Promotion of the exchange of information on human resources development strategies in connection with nuclear knowledge management,
- Development of programs for attracting the young generation to nuclear science and technology;
- Harmonization of different interests in technical areas,
- Formulation of an Asian network of higher education and training in nuclear technology for the preparation of the establishment of the International Nuclear University in the future,
- Cooperation and interaction with other regions for human resources development.

Attachment 3

Tentative HRD Plan for Each Country

Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)

This document is excerpted from country reports of the past HRD Workshop. However, HRD Plans for Korea, Thailand and the Philippines are revised

CHINA

With regard to contingent construction, although great efforts have been made to continuously improve the contingent structure, and the main part of human resources has become keen-witted and capable, which guarantee and give impetus to the upgrade of construction and scientific research level of key nuclear projects, there are still a long way to go to prevent brain drains, and solve the problems of lacking human resources and increasing the proportion of professionals, etc. from the long-term point of view for further development of the CNNC in the future.

To achieve the development target of nuclear industry during the "Tenth Five-Year Plan", i.e. developing nuclear power, adjusting structure, giving prominence to benefits, strengthening management and rejuvenating nuclear industry by science and technology, the development and management of human resources must be strengthened and a well qualified contingent must be established to provide powerful assurance for the development of nuclear industry. To this end, the CNNC has launched a "111" Human Resources Project, i.e. by 2005, the CNNC will bring up about 100 senior management personnel for enterprises and institutions, 100 academic and technical foregoers, and 100 skillful specialists.

<Fostering of Younger Generation of Nuclear Human Resources>

In China, the demand and supply of human resources in nuclear field is greatly unbalanced. On one hand, with the development of nuclear power and the expansion of nuclear technical application, the demand for nuclear human resources is increasing all the time; on the other hand, subject to the influence of nuclear power market, the opportunities for students majoring in nuclear-related specialty to take up an occupation are very limited compared with other specialties. Hence is the reason of insufficiency of nuclear human resources.

To solve this problem, cultivation of younger generation must be strengthened on two aspects. More young talented people should be cultivated by universities and colleges on the one hand, some other

should be recruited, selected and trained by work units on the other to expand the contingent of nuclear human resources.

Presently, China's nuclear power plants are in great demand of young and middle-aged technical personnel.

Survey of Basic Data on Human Resources and Human Resources Development in Nuclear Field in CHINA

Investigation Field	Data
Administrative Government and Government Research Development Institution	
1. Personnel of Administration	300-350 (person)
• Nuclear Regulation Development	200-250 (person)
Agriculture Application (mainly for Research Development)	500 (person)
• The number of doctors using radiation diagnostic • The number of therapeutic / diagnostic equipments using radiation (Co-60, accelerators, etc.)	5,000 (person) 470 (person)
Industrial Application (Cardinal number of Co-60, accelerators, etc.)	2,500-3,000 (person)
• Personnel of Electric Power • Personnel except Electric Power	7,000 (person) 20,000 (person)

INDONESIA

In line with the statements of the World Bank, the decreasing of Indonesia economy will also impose some severe implication, especially in manpower development to support nuclear program. The reduction in the number of enrollment in higher education will also reduce the prospective manpower number to be involved in nuclear program. In the other hand, the decline in the economy will also imply decline of quality of manpower graduated from all level of education. Therefore, the national nuclear program will have quite heavy work to improve quality of the manpower.

It was learned that 278 out of 298 personnel with Master Degree and 109 out of 128 personnel with Doctor degree have participated in domestic training experiences. Table 1 lists the government administrative institutions in nuclear related area.

Table 1 List of National Administrative Agency

Agency / Institutes	Role	Total Manpower
Nuclear Energy Control Board (BAPETEN)	regulate and control the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials	
National Nuclear Energy Agency (BATAN)	to execute, and to promote the research and the use of nuclear energy	3818

There are at least 2999 RPO in Indonesia whom responsible for the safe operation of 4843 radioactive sources and 3741 radiation sources.

Survey of Radiation and Radioisotopes Application

Table 2 List of Nuclear Application Distribution in Indonesia

Sectors	Number of Institution	Number of Permit	Radioactive Sources	Radiation Sources
Medical	1451	1896	794	3490
Industrial	107	335	4013	249
Research	6	23	46	2
Total	2108	2999	4843	3741

The school of Polytechnic Institute of Nuclear Technology (PoINT) has graduated 531 students while currently conducts education for 234 students and prepares to start program for 87 new students. The school offers specialization program on (a) Nuclear Technophysics: Electromechanics, Electronics and Instrumentations, and (b) Technochemistry.

As an educational institute under BATAN organization, the school main objective is to provide educational and training facilities to support human resource development program, especially in enhancing manpower capabilities in dealing with nuclear science and technology.

KOREA

Cultivating nuclear manpower in terms of quality and quantity is an essential key for the successful implementation of a national nuclear energy development program. Therefore, human resources development in the nuclear field is an important item needed for the promotion until 2010. The following are issues and needs on human resources development, which were identified in the national promotion plan on nuclear technology:

1) Support for nuclear education program at universities
   - Providing fellowship programs and career opportunities
   - Updating curriculum and linkage of its curricula with the advanced technology such as information technology, biotechnology, and nano-technology for the innovation of technology
   - Providing a basic nuclear engineering education program for the mechanical engineering department, electrical engineering department, chemical engineering department, etc.
   - Enlargement of intern job opportunities at nuclear industries and research institutes for students of the nuclear engineering department
   - Enlargement of the specialized training course with collaboration of research institutes, and industries.
2) Maintain qualified nuclear personnel at nuclear industries
   - Providing fringe benefits such as house and education fees, good working environment, etc.
   - Enhancement of retraining programs such as in-house degree education courses, overseas training courses, cyber education courses using information and communication technology for the improvement of their specialty.
   - Development of a qualification system and preferential for a nuclear licensee.
   - Activation of exchange programs among industries, research institutes, and universities.
   - Fostering nuclear education and training centers for the training of industry personnel.
3) Encourage global competitiveness of nuclear manpower
   - Utilization of outstanding experts from overseas
   - Attracting students from developing countries
   - Supporting and fostering joint research projects with international organizations
   - Supporting overseas training programs for young researchers and young students in master and doctoral courses at universities

In Korea, there are 1,612 experts engaged in the administrative agencies and national nuclear research and development institutes as of September 2002. About 25,000 persons are engaged as radiation workers in various nuclear and radiation related organizations in Korea as of September 2002. Figure 1 shows that 1,822 organizations have achieved a license for using radioisotopes and radiation generators from the Ministry of Science and Technology as of June 2002. Figure 2 shows that 6,682 persons has achieved a license of radiation handling, reactor operation, nuclear material treatment from the Ministry of Science and Technology as of December 2001.

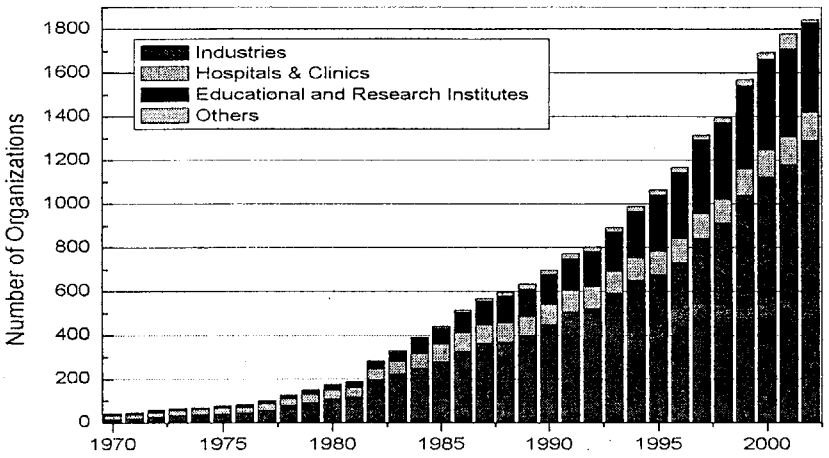


Figure 1. Annual Change in Number of Radiation Application Organizations in Korea

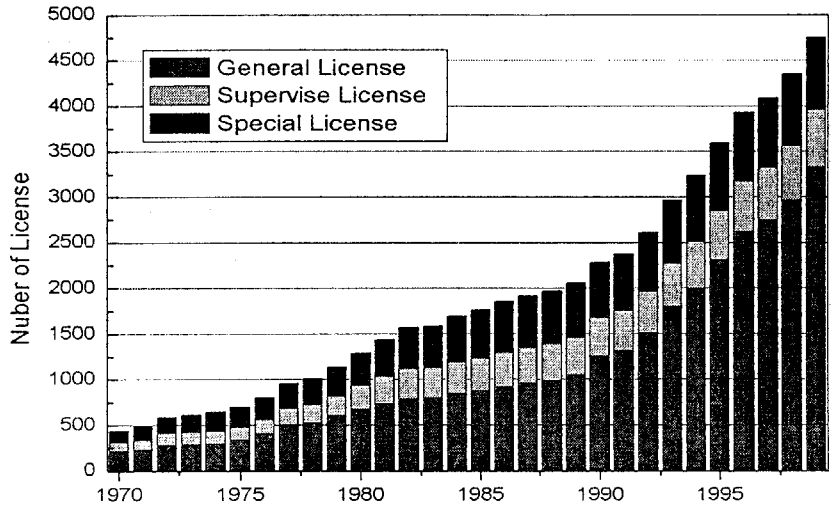


Figure 2. Annual Change in Number of Licensees in Radiation Handing

Korean nuclear promotion plan for human resources development in the nuclear field, the Ministry of Science and Technology has included the promotion of projects for nuclear human resources development at universities and industries into the national mid and long-term nuclear R&D program in 2002.

- Dispatch of university students, who are majoring in nuclear engineering and radiation science at master or Ph. D. courses, to advanced countries for 1-2 years under the research agreement between universities in Korea and educational institutes in advanced countries.
- Dispatch of university/college students, who are majoring in nuclear engineering department, to educational institutes/universities in advanced countries for 6 months-1 year under the agreement both parties.
- Dispatch experts to research institutes or organizations in advanced countries for 1 year for upgrading their research career.

- Financial support for university students, who are majoring in nuclear engineering department, to study their thesis focused on upgrading their research capabilities.

There are six universities that have a nuclear engineering department and two major nuclear training centers (NTC/KAERI and NPEC/KEPCO) in Korea, the supplying organizations for nuclear personnel education and training. Each year about 180-190 nuclear engineers graduate from these six universities with a bachelor's degree, while each year about 40-50 graduate with a master's degree and about 10-15 graduate with a doctor's degree.

There are six universities that have a nuclear engineering department and two major nuclear training centers (NTC/KAERI and NPEC/KEPCO) in Korea, the supplying organizations for nuclear personnel education and training. Each year about 180-190 nuclear engineers graduate from these six universities with a bachelor's degree, while each year about 40-50 graduate with a master's degree and about 10-15 graduate with a doctor's degree.

MALAYSIA

Malaysia embarks on the peaceful application of nuclear science and technology in four broad areas – medicine, industry, agriculture and the environment.

There are only 2 organizations in Malaysia dealing mainly with nuclear matters. The Malaysian Institute for Nuclear Technology Research is involved mainly with research and development and the Atomic Energy Licensing Board deals with the regulatory and licensing aspects.

The Number of Personnel Classified by Field in each Agency and Institutes

Agency / Institutes	Nuclear Administration				R&D		Total
	Promoting		Regulatory				
	R&D / Radiation Application	Nuclear power generation	R&D / Radiation Application	Nuclear power generation	Radiation Application	Nuclear power generation	
MINT	337	-	-	-	198	–	535
AELB	15-	-	35	-	-	–	50
Total	352	-	35	-	198	-	585

The PHILLIPINS

In the Philippines, a ten-year National Strategy for Human Resources Development in the Nuclear Field has been drawn up, envisaging an implementation level that would involve other ministries such as the Department of Education (DepEd) and the Commission on Higher Education.

A draft of a national HRD strategy for nuclear science and technology in the Philippines had been prepared and submitted to the Department of Science and Technology. It had been proposed that an interagency committee will oversee the implementation of this HRD strategy.

The national HRD strategy includes: (1) the conduct of local training initiated by the Philippine Nuclear Research Institute; (2) nuclear science and technology education in schools and universities; (3) the role of international cooperation, i.e. training abroad through linkages with relevant institutions and organizations in foreign countries; (4) new techniques for education and training; and (5) preservation of expertise − by addressing brain drain and retirement of personnel with expertise in nuclear S&T.

Item number (2) above includes the following activities: revising the school curricula and introducing topics in nuclear science and technology in secondary (high school) and tertiary (college) education; training and education of teachers and educators in the basics of radiation and nuclear technology; improving the infrastructure for the offering of graduate programs in nuclear S&T such as M.S. Medical Physics and M.S. Nuclear Engineering.

There is an imminent problem regarding the human resources in the nuclear field. Because of the government ban on hiring of employees which had been in effect the past number of years, in a few years time many personnel will be of retirement age, with no sufficiently trained and qualified middle-level staff to replace those in the higher positions who will be retiring. This is a very serious problem that needs to be addressed in the national HRD strategy.

HRD Scenario in the Young Generation

Addressing the need to train the teachers and educators, and to revise high school and college curricula to include nuclear S&T topics and subjects will greatly contribute to the social and political climate necessary for a successful future nuclear power program.

In the event that the Philippines will embark on a nuclear power program, and in order to have adequate human resources in support of a research reactor, there is a need for graduate degree holders (M.S. and Ph.D.) in Nuclear Engineering. At present, there is a need in the Philippines for qualified research reactor personnel, and those trained in the repair of the research reactor. It will be a welcome development

if the MEXT Scientist Exchange Program of Japan will include an academic program leading to M.S and Ph.D. in Nuclear Engineering.

There is a need for training Medical Physicists in the Philippines. There is a growing need for M.S. Medical Physics graduates who will be employed in hospitals with nuclear medicine, radiotherapy and diagnostic radiology facilities, linear accelerators, and baby cyclotrons for Positron Emission Tomography (PET) scanning. An M.S. Medical Physics program is being offered by one university in the Philippines. However, there is a need to augment the faculty in this program, and possibly thesis advisers outside the Philippines could be consulted through the internet or by e-mail. There is a need for faculty with doctorate degrees in Medical Physics, who will serve as faculty and thesis advisers.

THAILAND

Bilateral agreement has been established between OAEP of Thailand and JAERI of Japan since 1994. The agreement is including Instructor Training Program and Joint Training Courses.

The utilization of nuclear technology in Thailand is growing each year. Without considering of the energy demand, nuclear technology has its use in many fields; medicine, industry, agriculture, research and education.

Radiation Protection Training Courses for the radiation workers and radiation protection officers of the small sealed radioactive sources, the unsealed radioactive sources and that of the large sealed sources is regularly conducted.

Another important task related to radiation protection and safety is to develop Radiation Protection Officer Certification Scheme. It is stated in the new regulation that the Radiation Protection Officer Certification Scheme will be set out by the Thai Atomic Energy Commission.

Nuclear Technology and Applications

Arrangement for joint Training Courses will be continued for the next four years as the follow up program. In connection to the courses, promotion of research activities among research centers and universities are expected. To set up the program in Thailand, there are needs for advisers from the experience university staffs in Japan.

Assistance for developing computer- teaching aids is needed. Mutual support from Member States with high experience in this area should be organized to help the other states.

VIETNAM

In the coming period of 2002-2003, VAEC has to prepare a long-term program for HRD in the nuclear and related fields.

Subjects of the long-term program for HRD is proposed to include the followings

- Investigation of basic data on Human Resource and Human Resource Development in nuclear and related fields in Vietnam;
- Study on need of Human Resource and Human Resource Development for the National Nuclear Power Development Program including regulatory, R&D, education and training, project implementation and industrial utilities up to years 2010, 2015, 2020 and 2030;
- Planning for education and training; coordinating and sharing responsibilities of all related organizations and institutions to guarantee human resource for success of the National Nuclear Power Development Program; recommending necessary approaches and policies to the Government.
- By August 15, 2002, Vietnam Atomic Energy Commission (VAEC) has permanent staff of 492 persons and contract staff of 95 persons.

Following are data on staff of VAEC

As of August 15, 2002

No	Sub-institution	Total	Academic degrees			Titles		Fields of research			
			University Degree	Master	PhD	Prof	Prof Assistants	Physicists	Chemists	Biologists	Others
1	Headquarters	36	21	1	7	2	0	9	6	0	14
2	INST	100	51	9	19	0	3	62	6	3	8
3	ITRRE	149	99	6	14	0	3	7	101	0	11
4	NRI	150	70	19	6	0	3	49	33	11	2
5	CNT	39	23	1	9	0	2	19	4	8	2
6	CRT	18	12	1	2	0	0	6	3	2	4
	Total *)	492	276	37	57	2	11	152	153	24	41

*) Except 95 young contracted researchers.

- In May 2001, Primary Minister issued order on pre-feasibility study project for the first nuclear power plant in Vietnam. One of the first important duties is to develop human resource for project implementation. This duty should be done by VAEC in cooperation with relevant institutions of the Ministry of Industry.

To achieve those objectives, our policy on human resource development includes the following of

- Formulating advanced cadres, especially, leaders and project managers who are capable in formulating directions, strategies, plans and planning for research and development in major fields of atomic energy;
- Regularly training and re-training that response demands on individual knowledge, experience and quantity; special attention has been paid to young staff, number of young researchers should be increased up to 20-30 persons per year, our personnel should be rejuvenated;

We would like to emphasize that personnel rejuvenation is urgent duty at VAEC, because our averate personnel age reaches 47.

In cooperation with Hanoi National University, VAEC encourages young students for nuclear study, sponsors excellent ones. At present, Hanoi National University receives about 50 students per year in nuclear study. It is a good human resource for VAEC. Talent university graduates could have jobs and be sent abroad for advanced study.

On-job post-graduate training for master and PhD degree is well-operated system at VAEC. Every year, 5-8 young persons are selected for PhD study under the guidance of professors of VAEC; their theses have close connection with researches carried out at VAEC; ten persons are sent to universities for post-graduate training.

Nomination of young talent persons for leading duties is one of effective ways of personnel rejuvenation.

Main activities on our human resources development are as follows;

- Training to strengthen personnel up to high level both for nuclear power and non-power applications; formulation of 5-7 excellent groups with leaders who have competence to lead advanced researches;
- Human resource development for the planned center in nuclear technique application in medicine, especially, in the fields of accelerator technology, medicine physics and radiation protection;
- Improvement of training program and experimental instruments of the Training Center in Dalat aimed at training in the fields of nuclear reactor technology, radiation protection and radioactive waste management;
- Human resource development (HRD) is the most important factor for successful implementation of nuclear development program; however HRD should be based on the

long-term nuclear development program of the country;

- It is very important to coordinate all possibilities of the country for HRD; and it should be emphasized that personnel rejuvenation is the necessary and regular duty;
- Support and cooperation of IAEA and nuclear-developed countries are factors that guaranteed successful implementation of HRD in particular and encouraged nuclear development in the Region in general.

JAPAN

The Long-Term Program 2000 by the Atomic Energy Commission was published in November 2000. The following are included in the section on Development of Human Resources.

Research, development and utilization of nuclear energy, while securing safety, requires the nurturing and retention of the best people - the best human resources. But Japan's nuclear industry is entering a mature phase. Not only the numbers of researchers, engineers and technicians, but also nuclear energy research expenditures, have been declining in recent years. In the field of designing and manufacturing, it will be increasingly difficult to maintain the present levels of technology and human resources in the years ahead.

Japan's universities must therefore take the initiative in human resources development, in cooperation with organizations such as research and development institutes and private nuclear operators.

The nuclear power industry must make continual efforts to introduce the latest technology. At the same time, nuclear operators are expected to improve their own education and training, evolve their accumulated technology still further on their own, and pass that technology on steadily to future generations.

It is also important for national research institutes and private nuclear operators to establish methods to facilitate mutual exchanges of personnel and technology, such as joint research and assignments, and to work to strengthen the human-resources and technological positions of Japan as a whole.

In order, moreover, for nuclear energy to attract and inspire promising individuals, it is important to demonstrate to them the importance of nuclear energy to Japan and the role nuclear energy can play toward achieving international peace and stability. It is just as important that research and development activities cover a wide range of possibilities, be challenging, and fire hopes and dreams among the young.

RESEARCH ON EDUCATION SYSTEMS RELATED TO NUCLEAR HUMAN RESOURCE DEVELOPMENT

March 6, 2003

Masanori ARITOMI

Research Laboratory for Nuclear Reactors,
Tokyo Institute of Technology

PURPOSES OF PROPOSED RESEARCH

● Background

- FNCA project has been operated for four years.
  → It is required to evaluate the past results and to improve the project.
  = FNCA project should be efficiently managed.
- Needs for human resource development in nuclear engineering and related fields are not in harmony with other countries due to their actual circumstances.

● Purpose of human resource development
- to support the development of the human resource in the membership countries by themselves.

(1) Governmental sectors
- Decision makers of nuclear development policy
- Carriers of the policy
- Workers for inspection and so on

(2) Educational sectors
- Excellent researchers to promote research activities and bring up the successors
- Professors in universities to develop skilled engineers, designers and analysts
- Teachers in professional schools to produce professional workers

RESEARCH SUBJECTS

● Purpose of this research
- To grasp the needs for human resource development in nuclear engineering field through the research.
  = The fields for lack of human resource development in the individual country

● Research subjects
- Existing academic related societies and associations
- Existing related universities and professional schools

● Establishment of education and training system
- Utilization of radioactive rays will be promoted for hospital, agriculture, industry and so on.
→ Radiation protection and management of LLW
- Education and training systems should be established.
・ The skilled persons, who studied the subjects in the related seminar and training, will teach and train in their own countries.

PH.D PROGRAM BY DISSERTATION

● Needs to get Ph.D from Japanese universities.
- To apply his/her Doctor dissertation to Japanese university, to be reviewed by professors and to conduct his/her final examination.
× Scholarship systems for foreign graduate course students are out of the scope.

● JSPS Ronpaku Program
- To improve it and to establish its short-term program.

● In HRD program, scholarship system will be introduced in the future.

2.1.3 Record of the Fourth Coordinators Meeting (CM) March 5-7, 2003, Naha-Shi, Okinawa, Japan

1. The Fourth CM was held from March 5 through 7, 2003 in Naha-Shi, Okinawa, Japan, hosted by the Cabinet Office (CAO) and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan.
   Mr. Keiichi Inamine, the Governor of Okinawa Prefecture gave the welcome remarks, Mr. Hideaki Ohmura, Parliamentary Secretary, Cabinet Office (CAO), made an Opening Speech and Dr. Sueo Machi, the FNCA Coordinator of Japan gave the opening remarks.
   The Meeting was participated in by delegates from FNCA countries, and two observers from IAEA (Attachment 1). The program of the Meeting is shown in Attachment 2.

2. In Session 1, the FNCA Coordinator of Japan gave a summary report of activities in FY 2002 and the Third FNCA Meeting in Seoul (Ministerial Level Meeting {MM} and Senior Officials Meeting {SOM}) (Attachment 3). He stressed that the partnership and the linkage with end-users should be further strengthened for the FNCA activities.
   The Meeting noted the report.

3. In Session 2, during the presentation of country reports (Attachment 4), the statements which need follow-up actions are as follows:

(1) Dr. Easey, the representative of Australia, pointed out that due to the limits on financial and human resources a constantly expanding program is unlikely to provide an environment in which efficient and effective cooperation can be maintained.

(2) Mr. Li, Coordinator of China, reported that Chinese government has paid great attention to set up the domestic management system, to encourage more and more institutions to join the cooperation under the FNCA framework.

(3) Dr. Hastowo, FNCA Coordinator of Indonesia stated that Indonesia is expecting support from FNCA member countries having nuclear power plants on the public information materials. He also offered to host the workshop on radioactive waste in 15-19 October 3, 2003, and subworkshop on technetium generator as well as expert meeting on neutron scattering in Serpong, second week of January, 2004.

(4) Mr. Choi, the representative of Korea, offered to host the Workshop on Nuclear Safety Culture in early February 2004 in combination with the peer review of research reactor safety culture. He also supported Vietnam's

proposal on "Marine Environmental Pollution Research and Monitoring using Nuclear and Nuclear-related Analytical Techniques and FNCA Database".

(5) Mr. Adnan, the FNCA Coordinator of Malaysia, stated that his government was interested in participating in an additional project related to "Nuclear Medicine" in the future. Mr. Khairul of MINT pointed out the application of electron beams to cleaning waste water for recycling as industrial use water was an interesting subject of research. Malaysia will host the Workshop on Industrial Application of accelerators for thin films this year.

(6) Dr. Dela Rosa, the FNCA Coordinator of the Philippines, mentioned that her government would host the Workshop on Mutation Breeding. The PNRI would provide FNCA participant countries with a copy of the multi-media on CD-ROM titled "Atom, Radiation and Radioactivity".

(7) Ms. Jindarom, the representative of Thailand, proposed to host the FNCA Workshop on Human Resources Development (HRD) in October 2003, and requested speakers from Regional Speakers Bureau (RSB) of FNCA for the "National Symposium on Nuclear Science and Technology" to be held in June 2003. The support of an expert in Ko-NAA may be necessary for Thailand to conduct this work using local facilities.

(8) Dr. Tan, the FNCA Coordinator of Vietnam, said that the installation of an electron accelerator in Vietnam would be considered as a national project proposal. At this Meeting, Vietnam proposed a new FNCA project entitled: marine environmental pollution research and monitoring using nuclear and nuclear-related analytical techniques and FNCA database. Vietnam expressed its willingness to host other FNCA events planned in 2003, especially to host the 5 th FNCA Ministerial Level Meeting to be held in 2004.

(9) Mr. K. P. Kim, the representative of the IAEA presented the mandate and mission of the Agency, and RCA program. He expressed the desire to have further synergy between IAEA/RCA and FNCA in the future, with a focus on enhancement of collaboration and complementarity of the activities at a project level. It is also mentioned that all regional projects of RCA are truly having a trans-boundary effect and not only focusing on a national issue. In this regard, it is recommended that FNCA and IAEA work in the same direction.

4. In Session 3, the progress and the future directions of FNCA projects in the eight fields were introduced and reviewed. The Meeting approved the activities of on-going projects and their future plans. The Meeting agreed to the tentative schedule for Workshops/Meetings under the FNCA framework together with venues are shown in Attachment 5.
Major points discussed and/or agreed upon for each project were shown in Attachment 6. The three-year work plan of each project was also approved

as shown in Attachment 7.

5. In Session 4, a follow-up to the Third FNCA Meeting was made, and new project proposals were also reviewed as follows:

< Sustainable Development and Nuclear Energy in Asia >

(1) Dr. Jung, Vice President of Asia Pacific Energy Research Center, Institute of Energy Economics of Japan, presented an overview of the APEC energy demand and supply outlook up to 2020. He underscored the importance of nuclear power for energy security and for environmental protection. According to him, without a major crisis, the trend will be the same, business as usual (BAU) for the next 20 years which are fossil fuel based. He also stressed that without the nuclear power option, most Annex 1 countries would not meet the environmental targets required by the Kyoto Protocol. However, he observed the nuclear industry is facing the problem of public acceptance. He strongly urged that the nuclear power option be kept.
He said that the nuclear industry should needed to show the cost reductions like the natural gas utilization if it were to become a more competitive energy source.

(2) Dr. Machi, FNCA Coordinator of Japan presented the revised project proposal on "Sustainable Development and Nuclear Energy in Asia" (Attachment 8) .

(3) The representative of Australia stated that there were no plans for Australia to participate in the project at this stage.

(4) The FNCA Coordinator of the Philippines mentioned that recommendations during the Round Table Discussion of the Third FNCA Meeting had been taken into account in the revised proposal.

(5) Dr. Hastowo, FNCA Coordinator of Indonesia expressed his satisfaction that the proposal was finally approved.

(6) The Meeting approved the implementation of the project subject to availability of funds.

< Strategy for Human Resources Development >

(1) Dr. Machi, FNCA Coordinator of Japan presented a paper on this subject (Attachment 9).

(2) It was agreed that the survey on available human resources and the future demand in accordance with the national nuclear program should be completed. In relation with the survey, Prof. Aritomi of Tokyo Institute of Technology made a presentation on "Education Systems Related to Nuclear Human Resources Development".

(3) The Asian Network of Higher Education and Training in Nuclear Technology proposed by Korea will be reviewed based on the result of the survey.

(4) The Meeting noted the parallel initiatives of IAEA on this subject.

(5) The Coordinator of the Philippines stated the requirement of nuclear research institutions in the FNCA countries for post graduate academic training. As a strategy, the fellow can take the core subjects in the local university and conduct his/her thesis or dissertation in the appropriate FNCA country through the project ANRTEN.

(6) Mr. Adnan, Coordinator of Malaysia proposed another strategy which is the extension of the maximum period of stay of MEXT Nuclear Researchers Exchange Program from one year to 2 - 3 years to facilitate post-graduate study to get a MS/Ph. D. degree.

< Project Proposal on Marine Environmental Pollution Research and Monitoring using Nuclear and Nuclear-related Analytical Techniques>

(1) Dr. Le Van So of Vietnam presented the revised proposal on marine environmental pollution research and monitoring using nuclear and nuclear-related analytical techniques (Attachment10) which is focused on toxic heavy metals and the establishment of FNCA database.

(2) It was noted that the current related IAEA/RCA project deals with marine radioactivity.

(3) Dr. Easey of Australia suggested that it would not be efficient to establish a separate FNCA database. He suggested that the data on heavy metal concentrations in water, sediment and biota produced by the project should contribute to databases established by the International Maritime Organization (IMO).

(4) The Meeting recommended that the selection of sites for monitoring should be linked with specific environmental problem of each country.

(5) The Meeting noted that collaboration with marine research institutes is necessary in the planning and implementation of the project.

(6) It was noted that the proposal project can be implemented within the on-going project on "Neutron Activation Analysis".

< Maintenance Network of Nuclear Medical Instrumentation >

(1) The revised proposal on "Maintenance Network of Nuclear Medical Instrumentation" was presented by Dr. Hastowo of Indonesia (Attachment 11).

He stressed the importance of maintenance of gamma cameras in his country where two-thirds of these were out of order. Accordingly the Meeting noted the project focus on gamma cameras.

(2) The importance of a survey on the condition of gamma cameras in terms of operation and maintenance was recognized as a necessary prerequisite in order to formulate a work plan for the project.

(3) Mr. Li of China stated that the implementation of the survey in China is difficult because many hospitals are under the control of several departments, and located in different provinces.

(4) Dr. Easey of Australia pointed out that the IAEA had extensive information on the maintenance of gamma cameras which might be used instead of the survey.

(5) Finally, Dr. Machi, the FNCA Coordinator of Japan was requested to consult with IAEA experts on the current problems and condition of gamma cameras' maintenance in FNCA countries before the proposal will be approved.

6. In Session 5, Dr. Machi presented the points of discussion (Attachment 12) to promote FNCA activities more efficiently.

(1) Role of Leading Countries and Definition of Project

Following the definition of Projects and Leading Country approved at the Third CM and the Third FNCA Meeting and noting the comments of this meeting, the list of fields, projects, and activities was revised (Attachment 13).

(2) Strengthening Linkage with End-Users of Technologies to be Developed

FNCA Projects are to achieve socio-economic development and therefore must be demand-driven and not simply informational. The technology outcomes must reach the end-users. Dr. Easey suggested that project deliverables should be clearly indicated in a project proposal. FNCA Coordinators should support project leaders in their efforts to communicate and cooperate with end-users. It was suggested that open lectures be conducted in conjunction with the Workshops. This approach has been done in the Workshops on Radiation Oncology and Low Energy Electron Beam in Japan and in the Utilization of Research Reactors in Indonesia. Mr. Adnan stated that Malaysia had also organized Open Lectures for the public in many occasions.

(3) Strengthening the Partnership in FNCA Activities

Increased government support, such as funding for projects carried out by

scientists in each country, and the recognition of FNCA activities as part of the national programs is desirable. Governments are encouraged to fund FNCA projects. For some countries this might necessitate the establishment of a formal document for the Cooperation. This matter may be discussed in future meetings. It was recommended that at the national level, linkages between FNCA Coordinators and Project Leaders be enhanced.

(4) Synergy of FNCA Activities With Other Technical Cooperation Programs of Japan

Dr. Machi again pointed out the MEXT Nuclear Researchers Exchange Program operated by JAERI, JNC, NIRS and other institutions that provide good opportunities for scientists from FNCA countries to stay in Japan for one year and undertake cooperative research relevant to the FNCA project. Also Japanese experts can be invited by FNCA countries to enhance a particular FNCA project. He also drew attention to the seminars on nuclear safety funded by the MEXT.

7. Dr. Hans Holger Rogner, Head, Planning and Economic Studies Section, IAEA, presented his paper entitled, "Nuclear Power and Sustainable Development". He emphasized that in the chain of energy sources, seven compatibility criteria must be satisfied. Taking into consideration the global energy demand on one hand and the changing requirements for sustainable development on the other hand, the nuclear energy option remains a credible one. He strongly cautions against foreclosing the energy option since this runs counter to sustainable development. He urged active efforts to keep the nuclear option alive. It is not for the present generation to deprive future generations the choice to decide on the options they will take.

8. Plan of the Fourth FNCA Meeting, as the first or second week of December 2003, Okinawa, was introduced.

9. TECHNICAL TOUR
A technical tour to the Fruit Fly Eradication Facility was made on 5 th of March, 2003. The impressive accomplishments of the Japanese government in eradicating the melon fly and the oriental fruit fly in the Okinawa Islands were noted by the delegates. The facility has served as a training laboratory for SIT researchers from a number of FNCA countries through the IAEA fellowship program. Collaboration between the RCA and the FNCA for the training on SIT could be developed.

END

Tentative Schedule for FNCA-related Workshops/Meetings Revised on March 7, 2003 Attachment-1

Field	Meeting, WS, etc.	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
FNCA Meeting		3rd FNCA: Korea SOM: October 30 MM: October 31	4th FNCA Japan (First or second week of Dec.?)	5th FNCA Vietnam	6th FNCA Japan	7th FNCA
Coordinators Meeting		Japan (March 5-7)	Japan	Japan	Japan	Japan
1) Utilization of Research Reactor	**WS**	WS : Indonesia (Jan.13-17, 2002)	WS: Vietnam (* Safety Operation will be also discussed)			
	Tc-99m (Sub) Project	SWS : Indonesia (Jan.13-17, 2002)	SWS: Indonesia(2nd week of Jan.2004)			
	NAA (Sub) Project	SWS : Indonesia (Jan.13-17, 2002) N.B.	SWS: Vietnam			
	NS (Sub) Project		M: Indonesia(2nd week of Jan.2004)			
2) Application of Radioisotopes and Radiation for Agriculture	**MB Project**	WS : China (August 20-23)	WS: The Philippines (Aug.25-28)	WS: Malaysia		
	Multilateral Research Program	Project Formulation M on Insect Resistance : China (Aug.26-27)	Project Formulation M (on Disease Tolerance ?) The Philippines			
	Bio-Fertilizer Project	WS : China (August 19-23)	WS: Vietnam (Oct.?)			
3) Application of Radioisotopes and Radiation for Medical Use	**Radiation Oncology Project**	WS : Japan (Dec.17-20)	WS: China (Dec. 9-11)			
4) Public Information of Nuclear Energy	**PLM and Project**	PLM: Malaysia (Oct.15-17)	PLM: Vietnam (Oct.)			
	Support to PI Activities	to Malaysia, etc.	to Vietnam and Thailand			
	Others	Joint Survey on Radiation for High School Students				
5) Radioactive Waste Management	**WS and Project**	WS: Korea (Nov.18-22)	WS : Indonesia (Dec.15-19)			
	Task Group	SRS Management M : Korea (August 26-30) M : Indonesia (Aug.12-16)	TENORM Malaysia(Jul. or Aug.),and Vietnam (Jul. or Aug.) * Cooperation :Australia (Feb.2003) ,	TENORM China (Jul. or Aug.) and Thailand (Jul. or Aug.)		
6) Nuclear Safety Culture	**Nuclear Safety Culture Project**	WS : Vietnam (Jan.14-17,2003)	WS: Korea (Beginning of Feb.2004)	WS: Indonesia		
7) Human Resources Development	**Support to Each Country's Needs and Information Exchange**	WS : The Philippines (Oct. 8-10)	WS: Thailand (Oct. 8-10)			
8) Industrial Application	**Electron Beam Accelerator Project**	WS on Liquid : Japan (Dec.16-19))	WS on Thin Film: Malaysia (MINT or Kuala Lumpur, Aug. 11-15)	WS : China for Gas or Korea for Water	(Vietnam or Thailand if project is extended)	

WS: Workshop SWS: Sub-workshop including Experiments PLM: Project Leader Meeting M: Small-group Meeting or Expert Meeting

Attachment 2

Program of the Fourth FNCA Coordinators Meeting

March 5 - 7, 2003, Naha-Shi, Okinawa-Ken, Japan

as of March 5, 2003

1) Date: Wednesday, March 5 – Friday, March 7, 2003

2) Place: Hotel Nikko Naha Grand Castle
Shuri Yamakawa-Cho 1-132-1, Naha-Shi, Okinawa-Ken, 903-8601 Japan
TEL:+81-98-886-5454, FAX:+81-98-886-1277

3) Sponsored by: The Cabinet Office (CAO) and The Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan

4) Secretariat: Japan Atomic Industrial Forum Inc.

5) Working Language: English (Simultaneous interpretation to and from Japanese is arranged)

< at Room "Shuri A," 2F, Hotel Nikko Naha Grand Castle >

Wednesday, March 5

8:30 - 12:00 ○**Technical Tour to Fruit Fly Eradication Facility (Option)**

* Fruit Fly Eradication Project Office
Department of Agriculture, Forestry and Fisheries
Okinawa Prefectural Government
123 Maji, Naha-Shi, Okinawa-Ken, 902-0072 Japan
TEL: +81-98-886-3880 FAX: +81-98-884-9119

13:30 - 14:10 **Opening Session**

Master of Ceremonies: Mr. Genichi Suzuki,

- Welcome Remarks: Mr. Keiichi Inamine, Governor of Okinawa-Ken
- Opening Speech: Mr. Hideaki Ohmura, Parliamentary Secretary, Cabinet Office (CAO)
- Opening Remarks: Dr. Sueo Machi, FNCA Coordinator of Japan and Senior Managing Director, Japan Atomic Industrial Forum, Inc.(JAIF)
- Commemorative Group Picture

< Short Break >

- Self-Introduction of the Participants
- Adoption of the Agenda of the Fourth FNCA Coordinators Meeting
- Election of the Session Chairs/Co-Chairs and the Drafter of the Minutes

14:10 - 14:40 **Session 1: Summary Report of Activities of FY 2002 and the Third FNCA Meeting in Seoul**

Chair: (Australia)

Reporter: Dr. Sueo Machi, FNCA Coordinator of Japan

14:40 − 17:55 **Session 2: Country Report on FNCA Cooperation Activities and Nuclear Program and Policy**

Presentation by Representative of Each Country

(in accordance with alphabetic order of the countries, 20 min.× 9 countries)

14:40 − 16:00 : Session 2 - Part I

Chair: (Thailand)

- Australia

  Dr. John F. Easey, Senior Principal Research Scientist

  Australian Nuclear Science and Technology Organisation (ANSTO)
- China
- Indonesia
- Japan

  Dr. Sueo Machi, FNCA Coordinator of Japan

＜Coffee Break 16:00 − 16:15＞

16:15 − 17:55 : Session 2 - Part II

Chair: (China)

- Korea
- Malaysia
- The Philippines
- Thailand
- Vietnam

17:55 − 18:25 **Presentation on RCA Activities**

Chair: (China)

"Technical Co-operation Programme and Its Strategy"

Mr. Kyoung Pyo Kim

Programme Management Officer, RCA Office, East Asia and the Pacific Section, Division of Technical Co-operation, International Atomic Energy Agency (IAEA)

19:00- 20:30 **Welcome Reception** < Room "Shuri B," 2F, Hotel Nikko Naha Grand Castle >

Thursday, March 6

8:30 − 15:20 **Session 3: Progress and Future Direction of FNCA Projects**

8:30 − 11:40 : Session 3 - Part I

Chair: (Indonesia)

8:30-9:50 Utilization of Research Reactors

- 8:30-8:45 Utilization of Research Reactors
  Mr. Isao Takeshita, Deputy Director General, Tokai Research Establishment, Japan Atomic Energy Research Institute (JAERI)
- 8:45-9:05 Project on Tc-99m Generator
  Dr. Tsuguo Genka, Project Leader of Japan
  and Project Manager of Japan Atomic Industrial Forum, Inc. (JAIF)
  Dr. Le Van So, Project Leader of Vietnam
  and Head, radioisotope Department, Dalat Nuclear Research Institute, Vietnam Atomic Energy Commission (VAEC)
- 9:05-9:15 Project on Nuclear Activation Analysis
  Dr. Mitsuru Ebihara, Project Leader of Japan
  and Professor, Graduate School of Science, Tokyo Metropolitan University
- 9:15-9:25 Project on Neutron Scattering
  Dr. Yoshikazu Hamaguchi, Project Leader of Japan
  and Research Commissioner, Department of Research Reactor, JEARI
- 9:25-9:50Discussion on Utilization of Research Reactors

9:50-10:40 Application of Radioisotopes and Radiation for Agriculture

- 9:50-10:10 Project on Plant Mutation Breeding
  Dr. Shigemitsu Tano, Project Leader of Japan
  and Former Professor, Faculty of Agriculture, The University of Tokyo
  Dr.Siranut Lamseejan, Project Leader of Thailand
  and Senior Researcher, Gamma Irradiation Service and Nuclear Technology Research Center (GISC), Kasetsart University Research and Development Institute (KURDI)
- 10:10-10:20 Project on Bio-Fertilizer
  Dr. Takuji Ohyama, Project Leader of Japan
  and Professor, Faculty of Agriculture, Niigata University
- 10:20-10:40 Discussion on Application of Radioisotopes and Radiation for Agriculture

10:40-11:10 Application of Radioisotopes and Radiation for Medical Care

- 10:40-10:50 Project on Radiation Oncology
  Dr. Hirohiko Tsujii, Project Leader of Japan
  and Director, Hospital of Research Center for Charged Particle Therapy National Institute of Radiological Sciences (NIRS)
- 10:50-11:10 Discussion on Application of Radioisotopes and Radiation for Medical Use

11:10-11:40 Public Information of Nuclear Energy

- 11:10-11:20 Project on Public Information of Nuclear Energy

Dr. Yasumasa Tanaka, Project Leader of Japan
and Professor Emeritus, Gakushuin University

・11:20-11:40 Discussion on Public Information of Nuclear Energy

< Buffet Lunch 11:40 − 13:00 at Room "Shuri B" >

13:00 − 15:20 : Session 3 − Part II

Chair: (Korea)

13:00-13:30 Radioactive Waste Management

・13:00-13:10 Project on Radioactive Waste Management
Dr. Toshiso Kosako, Project Leader of Japan
and Associate Professor, Research Center for Nuclear Science and Technology, The University of Tokyo

・13:10-13:30 Discussion on Radioactive Waste Management

13:30-14:20 Nuclear Safety Culture

・13:30-14:00 Project on Nuclear Safety Culture
Dr. John Frederick Easey, Senior Principal Research Scientist
Australian Nuclear Science & Technology Organisation (ANSTO)
Prof. Michio Ishikawa, Project Leader of Japan
and Engineering Advisor, Nuclear Power Engineering Corporation (NUPEC)
Mr. Le Doan Phac, Deputy Director Department of International Relations and Planning, VAEC

・14:00-14:20 Discussion on Nuclear Safety Culture

14:20-14:50 Human Resources Development

・14:20-14:30 Project on Human Resources Development
Dr. Yasushi Seki, Project Leader of Japan
and Director, Nuclear Technology and Education Center, JAERI

・14:30-14:50 Discussion on Human Resources Development

14:50-15:20 Industrial Application

・14:50-15:00 Project on Low Energy Electron Accelerator
Dr. Tamikazu Kume, Project Leader of Japan
and Deputy Director, Department of Ion-Beam-Applied Biology, Takasaki Radiation Chemistry Research Establishment, JAERI

・15:00-15:20 Discussion on Low Energy Electron Accelerator

< Coffee Break 15:20 − 15:40 >

15:40 − 18:20 Session 4: Follow-up to the Third FNCA Meeting and Proposals of New Projects

Co-Chairs: Dr. Sueo Machi, FNCA Coordinator of Japan, and (Vietnam)

15:40-16:50 Sustainable Development and Nuclear Energy in Asia

・15:40-16:10 Keynote Speech "APEC Energy Demand and Supply Outlook focusing on Energy Security"

Mr. Yonghhun Jung, Vice President, Asia Pacific Energy Research Center, Institute of Energy Economics (IEE)

・16:10-16:25 Background of Discussion in FNCA and Summary of Round Table Discussion of Third FNCA Meeting, and Proposal of Project

Dr. Sueo Machi, FNCA Coordinator of Japan

・16:25-16:50 Discussion

16:50-17:20 Strategy for Human Resources Development

・16:50-17:00 Background of Discussion in FNCA and Summary of Round Table Discussion of Third FNCA Meeting

Dr. Sueo Machi, FNCA Coordinator of Japan

・17:00-17:20 Discussion

17:20-17:50 Monitoring Marine Environment by Nuclear Related Technologies

・17:20-17:30 Proposal of Project

by Vietnamese Speaker

・17:30-17:50 Discussion

17:50-18:20 Maintenance Network of Nuclear Medical Instrumentation

・17:50-18:00 Proposal of Project

by Indonesian Speaker

・18:00-18:20 Discussion

Friday, March 7

8:30 – 10:30 Session 5: Discussion to Promote FNCA Activities More Efficiently

Chair: (Malaysia)

・Strengthening linkage with end-users of technologies to be developed

・ Government commitment to FNCA projects and synergy between national program and FNCA activities

・ Others

10:30 – 14:30 Session 6: Finalizing Minutes

Chair: (The Philippines)

Drafters: ( ) ( ), and ( )

・10:30 - 12:00 Discussion

< Buffet Lunch 12:00 - 13:00 at Room "Shuri B" >

・13:00 - 14:30 Discussion (Continued)

14:30-15:00 Presentation on Sustainable Development and Nuclear Energy

Chair: Dr. Sueo Machi, FNCA Coordinator of Japan

"Nuclear Power and Sustainable Development"

Mr. Hans Holger Rogner

Head, Planning and Economic Studies Section, Department of Nuclear Energy, IAEA

15:00-15:20 Announcement: The Fourth FNCA Meeting

Introduction: Japan

< Coffee Break 15:20 − 15:50 >

15:50-16:50 Closing Session

Chair: (Australia)

- Adoption of the Minutes of the Fourth FNCA Coordinators Meeting
- Closing Remarks

Attachment 3

Major Points Reported to / Discussed at Session 3
- Progress Situation and Future Direction of FNCA Projects -

Utilization of Research Reactors

- Mr. Isao Takeshita, proposed a new project for the future in this field to enhance safety and performance of research reactors. Dr. Easey commented that his proposal was too general in its present form. The Meeting supported direction of this idea and asked him to collect comments of Project Leaders of FNCA countries, and submit a revised more detailed proposal to coming workshop in Vietnam, in order to prepare a project formulation meeting in FY 2004.

<Tc-99m Generator Production>

- Dr. Tsuguo Genka reported success in demonstrating of Mo-99 absorption, Tc-99m elution and low-Mo breakthrough with the PZC method. It was reported a Patent application has been jointly submitted in Indonesia and in Japan by BATAN and Kaken. Dr. Le Van So explained about the technical details of the device and inter-comparison results of conventional and the PZC methods. The importance of QA/QC of Tc-99m generator for medical use was also detailed.

<Nuclear Activation Analysis>

- Prof. Mitsuru Ebihara reported progress of the joint study of air particulate sampling and analysis work. Valuable data process software called Ko-method was discussed. The future direction of the work to combine Ko-method software from Europe, China and Vietnam in some way was supported by the Meeting. It was suggested that an experts meeting be held before the coming workshop in Vietnam.

< Neutron Scattering>

- Dr. Yoshikazu Hamaguchi reported on the polymers submitted by participant countries with possible ways of their application. A plan was proposed and approved to hold an expert meeting in conjunction with the Tc-99m generator workshop.

Application of Radioisotopes and Radiation for Agriculture

<Project on Mutation Breeding>

- Prof. Shigemitsu Tano reported following progress in FY 2002:
  - Multilateral Research Program(MRP)−2 "Insect Resistance in Orchids" will start from FY2003 by participation of Indonesia, Japan, Malaysia and Thailand.
  - "Mutation Breeding Database (MBDB)" was uploaded on FNCA Web

site using a semi-closed system.

- Seven rice seed samples from Japan was registered in the Mutant Stock Repository (MSR) in the Philippines and Thailand..

・ Prof.. Siranut Lamseejan of Thailand introduced MRP-2 with economical benefit for farmers, and also made a presentation of "Bringing Induced Mutation Technology from Our Laboratory to Thai Ornamental Growers" by showing the economic impact of a mutant variety of jasmine rice and successful attempt to transfer the induced mutation technology to Thai ornamental growers and the public as well.

<Project on Bio-Fertilizer>

・ Prof. Takuji Ohyama reported that the field demonstrations of the effect of bio-fertilizer had already started in each participant country.

・ The "Biofertilizer Group Newsletter" has been published regularly since April 2002 alternately by each country

・ "Who's Who in Biofertilizer" was project constructed and uploaded on the FNCA web-site.

・ "Biofertilizer Mailing List" is functioning and has over 100 participants and "BF-info" (Bio-fertilizer Information) has been distributed about 30 times.

Project on Radiation Oncology

・ Dr. Hirohiko Tsujii reported on new initiatives taken in the project during the last year in chemoradiotherapy trials of cervical cancer and nasopharyngeal cancer respectively, due to achievement and recommended guideline in the USA and the Europe. With the first standard protocol CERVIX-1, five year survival and local cotrol rates reached 52.5% and 81.6% respectively, and these are satisfactory figures.

・ A proposal to improve follow-up rates for CERVIX-1 and CERVEX-2 protocols was encouraged.

・ An open lecture on advanced radiation therapy was held for one day with 150 audience in conjunction with the Workshop.

Public Information of Nuclear Energy

・ Prof. Yasumasa Tanaka reported successful results of the joint survey on the understanding of radiation and its applications. The survey was carried out in October over 1,100 high school students per country. There is a trend that Philippino and Thai students seem to know more about radiation utilization in agriculture, than Japanese students. A proposal was supported by the Meeting to continue the statistical analysis and find explanations for cross-cultural differences as well as similarities.

Project on Radioactive Waste Management

・ Prof. Toshiso Kosako reported on progress of activities of the group as follows:

- RWM Consolidated Report
  Final draft copy was distributed to the participants. This report was designed to be model document for the annual report to IAEA of the member of the Joint Convention on Safe Management of Spent Fuel and Radioactive Waste (Joint Convention).
- Task Group activities of Spent Radiation Sources Management (SRSM) were completed with assistance of voluntary countries of the Philippines, Thailand, Indonesia, Korea, and Japan. This idea was proposed by H.E. Minister Tadamori Oshima at the First FNCA Meeting in Bangkok in November 2000 and carried out in 2001 and 2002. The result will be published on Japanese Journal of Health Physics.

・ Launch of TENORM Task Group activity for FY 2003 and FY 2004 was agreed upon, and China and Thailand were endorsed as possible voluntary countries in FY 2004.

Project on Nuclear Safety Culture

・ Activities in this field were reported by Dr. John Easey of Australia, Mr. Le Doan Phac of Vietnam, and Prof. Michio Ishikawa of Japan with emphasis on the FNCA 2002/2003 Workshop on Nuclear Safety Activities held in Vietnam in January 2003.

- Dr. Easey discussed technical aspects of the Workshop and mentioned that both smooth progress and substantial discussions took place. He emphasized the good cooperation of VAEC and overseas participants. He also pointed out effectiveness to apply the code of conducts being prepared by IAEA, and this direction was supported by the FNCA Coordinators.
- Mr. Phac reported on the results of the first Peer Review to Dalat Research Reactor which was very useful in ensuring safety and in deepening experiences.
- Prof. Ishikawa mentioned that the Workshop was the most successful so far, and there were positive contributions from all participants. He requested to FNCA Coordinators to give strong and effective support to their Project Leaders through good communications, and he also requested Australia to provide strong leadership in this field.

Human Resources Development

・ Dr. Yasushi Seki reported activities in this field including, exchange of training materials, survey of basic data on human resources development in the nuclear fields, and combined efforts with MEXT's Nuclear Researcher Exchange Program.

・ Dr. Easey indicated that they have prepared distance learning training materials for training in radiation protection, and IAEA wants to utilize them for e learning.

・ Dr. De la Rosa expressed that basic courses in nuclear science and technology should be considered to be very important topics in the nuclear

education and training, citing that there is no course of that topic in Philippines universities.

- Dr. Vuong Huu Tan of Vietnam suggested that it would be useful to provide both professors and text materials of nuclear engineering to countries where no nuclear engineering faculties are founded.

Project on Low Energy Electron Accelerator

- Dr. Tamikazu Kume reported progress of the project as follows:
  - At the FNCA 2002 Workshop, there was a demonstration test of EB system for liquids, a review of irradiation systems, and the design and cost analysis of EB irradiation system were made.
  - An Open Lecture was held during the Workshop, and Dr. Khairul Zaman mentioned that this will also be considered at the FNCA 2003 Workshop in Malaysia.

Summary of Session 2

Important news introduced in the country report were:

(Australia)
National low level radioactive waste repository plan is now awaiting the decision of Ministry for the Environment and Heritage.

(China)
More than 300 enterprises and institutes produce total annual output of 15 billion yuan RMB by nuclear technology application.

(Indonesia)
In 2002, comprehensive study on introduction of nuclear power plant (NPP) to Java Bali grid was completed in 2002 in cooperation with the IAEA, and expected time of the introduction will be around in 2015, and small NPP might be introduced to other grids. Action of BATAN to organize support of nuclear power from government offices is vigorously scheduled.

(Japan)
New law on the "Basic Energy Policy" was approved in the national congress in June 2002, and its major points are: 1) securing energy supply, 2) protection of environment, and 3) economic competitiveness. Nuclear power is the most feasible energy source to meet these points for Japan.

(Korea)
Both the Advanced Power Reactor 1400 (APR1400) and the System-integrated Modular Advanced Reactor (SMART) are selected as candidates of "Near Term Development" in GIF. For the national atomic energy R & D program of 2002, about M$ 164 was invested. KAERI is constructing new Research Center for Advanced Radiation Utilization by end of 2005. At end of February 2003, Korean AEC approved KHNP proposal to select candidate site for both a low and interim level liquid waste (LILW) repository and an away from reactor (AFR) storage for spent fuel, and announced four candidate sites.

(Malaysia)
To enhance the utilization of the reactor for R & D and education, Reactor Interest Group (RIG) was launched in June 2002 with more than 50 researchers from research institute and universities. PI activities through "editorial partnership program" with a TV station have been carried out successfully. MINT celebrate annually its Flora Day to launch and release new mutants to the end-users. It is expected to establish a new policy on radioactive waste management within one year.

(The Philippines)
In bio-fertilizer field, PNRI carried out field trial of Bio-N, a solid inoculant, on upland rice and corn in Malaybalay City in Bulidnon, and so far results are

successful.
In support of the national Clean Air Act, PNRI is using nuclear analytical techniques like XRF for air quality management. NAA analytical cooperation has been made with Prof. Ebihara of Japan.
PNRI is carrying out structural investigation of gamma irradiated Carrageenan and so on.
The first nuclear safety culture seminar-workshop was held in PNRI in November 19-20, 2002.

(Thailand)
Restructuring of former OAEP into the Office of Atoms for Peace (OAP) and the research and development organization has been delayed awaiting for new legislation for establishing a new agency.
Dissemination of mutation breeding technique and nuclear technology in agriculture to the public were conducted via workshops and media such as TV, radio, and newspapers.
Thai wants to invite specialist through the Regional Speakers Bureau (RSB) to the National Symposium on Nuclear Science and Technology in June 2003.

(Vietnam)

MOST/VAEC is preparing a draft "National Long-Term Strategy for Atomic Energy Development in Vietnam" to submit to the Government by the middle of 2003.

In March 2002, to give guidance for implementation of study works on nuclear power, the Government set up a National Steering Committee for Nuclear Power Development. The Committee has two main duties to submit to the Government by the end of 2003 are as follows:

a. Prepare a report on Pre-FS on the first NPP's construction

b. Study seven aspects in relation to the nuclear power development in Vietnam

In October 2002, VAEC dispatched a VTV's delegation to visit nuclear installations in Japan. After that, several thematic programs on nuclear power were broadcasting on the VTV and caused positive impression to the viewers.

(IAEA)

END

2.2 E-mail from the Project Leader of Japan to the Project Leaders of Participating Countries

2.2.1 Invitation of the 4th Workshop on HRD and Request for Country Report

E-mail on July 11, 2002

Dear Ms. & Mr. Project Leaders,

The 4th Workshop on Human Resources Development (HRD) in the Nuclear Field will be held from 8 to 10 of October 2002 in the Philippines sponsored by the Department of Science and Technology of the Philippines (DOST) and the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT), and hosted by the Philippine Nuclear Research Institute (PNRI) and the Japan Atomic Energy Research Institute (JAERI).

We are pleased to extend herewith a cordial invitation to all the member countries of the Forum for Nuclear Cooperation in Asia (FNCA) to participate in the Workshop. Please refer to the attached Tentative Program.

JAERI invites the Project Leader in the area of HRD from each country to participate in the Workshop.

We would like to welcome Mr. Eui-Jin LEE has become the new Korean Project Leader, and two new Project Leaders Mr. Chen Gang from China and Dr. Guritno Lokollo from Indonesia. Please find the attached 'List of Project Leaders'. Please inform us if you have any corrections on the list.

All participants are requested to submit country report on the theme given in 'Request for report' herein attached (See Attachment).

Due to the formalities, we would appreciate if you could fill in the attached 'Registration Form' with the participant's data and send it back to secretariat, mentioned below, by E-mail by the end of July 2002.

Thank you for your assistance and cooperation.

Sincerely yours,
Yasushi Seki, Japanese Project Leader
Nuclear Technology and Education Center (NuTEC)

Japan Atomic Energy Research Institute (JAERI)
TEL: +81-29-282-5444 FAX: +81-29-282-6041

[Secretariat of the Workshop on HRD]
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Japan Atomic Energy Research Institute (JAERI)
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Fax: +81-29-282-6543
E-mail: k-kato@popsvr.tokai.jaeri.go.jp

Attachment

Request for Country Report

All participants are requested to submit country report on the theme given in "Theme of the Country Report" to PNRI and JAERI Secretariat at the addresses below by **September 20, 2002**, by E-mail.

(1) Report should include the following items:

1. Title
2. Full name(s) of author(s)
3. Organization
4. Contents

(2) Contents

Refer to "Theme of the Country Report".

(3) Paper Length: Maximum 10 pages

Microsoft Word, Font size − 10.5 point, Font type − Times New Roman

(4) A presentation document file (Power Point) must arrive no later than September 27.

(5) All papers will be presented orally within 20 minutes.

(6) Papers will be published in the JAERI-Review report, and it will be distributed to the participants and the national & international organizations concerning HRD after the Workshop.

Send To:

Dr. Corazon C. BERNIDO
Head of Nuclear Training
Division of Nuclear Services and Training
Philippine Nuclear Research Institute (PNRI)
Address: P.O.Box 213 U.P., Quezon City, Metro Manila, 1101, The Philippines
E-mail: cber@info.com.ph or cber823@yahoo.com

CC:

Secretariat of the Workshop on HRD
Kiyoshi KATO / Rei OUCHI
Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)
Address: Tokai-mura, Naka-gun, Ibaraki-ken, 319-1195, Japan
E-mail: k-kato@popsvr.tokai.jaeri.go.jp

Theme of the Country Reports for the 4th HRD Workshop in FY 2002

1. Subject for development of nuclear training technology
   1) Training materials in radiation protection area to be used commonly in member countries.
      - It is one of the Action Items for FY 2003 stated in the Minutes on the 2001 FNCA Workshop on Human Resources Development.

   2) Introduction of e-learning system
      - The subject / needs has been proposed by Malaysia and Korea, and it should be examined on the Workshop in connection with "Asian Institute of Nuclear Science and Technology (AINST)" proposed by Indonesia, "International Nuclear University (INU)" proposed by Korea, and "Asian Nuclear Safety Network (ANSN)" recently proposed by IAEA.

2. Investigation of basic data on Human Resources and Human Resources Development in nuclear field in member countries
   - It has been proposed at the Third FNCA Coordinators Meeting last March and has been requested to you by previous mail (sent from Dr. Yasushi Seki on June 18, 2002) to provide the results as soon as possible. The results need to be reported.

3. Other Information Exchange
   1) Recent topics in the nuclear field and related Human Resources Development (HRD) in your country.

   2) Your requests on MEXT Scientist Exchange Program in Nuclear Energy Research, International Training Courses, and University Education (master's degree / doctor's degree)

   3) Indonesia: Present state of AINST
      Korea: Present state of INU

   4) Others

2.2.2 Request for Revision of Survey of the Basic Data

E-mail on December 27, 2002

Dear Ms. & Mr. Project Leaders,

Two months have already passed by since our HRD Workshop was held in the Philippines.

Regarding the Survey of the Basic Data on HRD, its revision was supposed to be collected by December 27, 2002.

We understand that it takes time for the detailed survey, but still we would like to encourage you to revise your survey data, which is herein attached.
Please correct and add some additional data. Also any explanatory notes for details will be appreciated. We would like to expect to receive the revised data from you by the end of January, 2003.

Also we attached the revised Tentative Summary of the Answers from FNCA Countries on "Survey of the Basic Data on HRD", which was provided for Discussion Session 2 during the Workshop. The data from Vietnam has been added on it.

All data from each country will be reported at the Coordinators Meeting to be held on March 2003.

We would truly appreciate your continuous cooperation and assistance in this.

Sincerely yours,
Yasushi Seki, Japanese Project Leader
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2.2.3 Distribution of the textbook on "Exercises in Reactor Physics"

E-mail on January 30, 2003

Dear Ms. & Mr. Project Leaders,

It is our pleasure to inform you that the textbook on "Exercises in Reactor Physics" focused on Q&A, which is composed by Mr. SUGI Teruo, NuTEC, has recently been completed. This textbook has 292 pages.

According to the Minutes on the 4th Workshop, we would like to distribute a copy to you upon your request.

Please contact the Workshop secretariat if you wish to have one.

Incidentally, we would like to request you to provide the list of International and domestic training courses in FY2003 to update our FNCA-HRD Project web page.

Thank you very much for your cooperation.

Sincerely yours,
Yasushi Seki, Japanese Project Leader
Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)
TEL: +81-29-282-5444 FAX: +81-29-282-6041

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: r-ouchi@popx.tokai.jaeri.go.jp

国際単位系 (SI) と換算表

表 1　SI基本単位および補助単位

量	名称	記号
長さ	メートル	m
質量	キログラム	kg
時間	秒	s
電流	アンペア	A
熱力学温度	ケルビン	K
物質量	モル	mol
光度	カンデラ	cd
平面角	ラジアン	rad
立体角	ステラジアン	sr

表 2　SIと併用される単位

名称	記号
分，時，日	min，h，d
度，分，秒	°，′，″
リットル	l，L
トン	t
電子ボルト	eV
原子質量単位	u

1 eV = 1.60218 × 10^{-19} J

1 u = 1.66054 × 10^{-27} kg

表 5　SI接頭語

倍数	接頭語	記号
10^{18}	エクサ	E
10^{15}	ペタ	P
10^{12}	テラ	T
10^{9}	ギガ	G
10^{6}	メガ	M
10^{3}	キロ	k
10^{2}	ヘクト	h
10^{1}	デカ	da
10^{-1}	デシ	d
10^{-2}	センチ	c
10^{-3}	ミリ	m
10^{-6}	マイクロ	μ
10^{-9}	ナノ	n
10^{-12}	ピコ	p
10^{-15}	フェムト	f
10^{-18}	アト	a

表 3　固有の名称をもつSI組立単位

量	名称	記号	他のSI単位による表現
周波数	ヘルツ	Hz	s^{-1}
力	ニュートン	N	$m \cdot kg/s^2$
圧力，応力	パスカル	Pa	N/m^2
エネルギー，仕事，熱量	ジュール	J	N·m
工率，放射束	ワット	W	J/s
電気量，電荷	クーロン	C	A·s
電位，電圧，起電力	ボルト	V	W/A
静電容量	ファラド	F	C/V
電気抵抗	オーム	Ω	V/A
コンダクタンス	ジーメンス	S	A/V
磁束	ウェーバ	Wb	V·s
磁束密度	テスラ	T	Wb/m^2
インダクタンス	ヘンリー	H	Wb/A
セルシウス温度	セルシウス度	℃	
光束	ルーメン	lm	cd·sr
照度	ルクス	lx	lm/m^2
放射能	ベクレル	Bq	s^{-1}
吸収線量	グレイ	Gy	J/kg
線量当量	シーベルト	Sv	J/kg

表 4　SIと共に暫定的に維持される単位

名称	記号
オングストローム	Å
バーン	b
バール	bar
ガル	Gal
キュリー	Ci
レントゲン	R
ラド	rad
レム	rem

1 Å = 0.1 nm = 10^{-10} m

1 b = 100 fm^2 = 10^{-28} m^2

1 bar = 0.1 MPa = 10^5 Pa

1 Gal = 1 cm/s^2 = 10^{-2} m/s^2

1 Ci = 3.7 × 10^{10} Bq

1 R = 2.58 × 10^{-4} C/kg

1 rad = 1 cGy = 10^{-2} Gy

1 rem = 1 cSv = 10^{-2} Sv

（注）

1. 表1－5は「国際単位系」第5版，国際度量衡局 1985年刊行による。ただし，1 eVおよび1 uの値はCODATAの1986年推奨値によった。
2. 表4には海里，ノット，アール，ヘクタールも含まれているが日常の単位なのでここでは省略した。
3. barは，JISでは流体の圧力を表わす場合に限り表2のカテゴリーに分類されている。
4. EC閣僚理事会指令ではbar，barnおよび「血圧の単位」mmHgを表2のカテゴリーに入れている。

換　算　表

力	N(=10^5 dyn)	kgf	lbf
	1	0.101972	0.224809
	9.80665	1	2.20462
	4.44822	0.453592	1

粘　度　1 Pa·s(N·s/m^2) = 10 P(ポアズ)(g/(cm·s))

動粘度　1 m^2/s = 10^4 St(ストークス)(cm^2/s)

圧力	MPa(=10 bar)	kgf/cm^2	atm	mmHg(Torr)	lbf/in^2(psi)
	1	10.1972	9.86923	7.50062 × 10^{-3}	145.038
	0.0980665	1	0.967841	735.559	14.2233
	0.101325	1.03323	1	760	14.6959
	1.33322 × 10^{-4}	1.35951 × 10^{-3}	1.31579 × 10^{-3}	1	1.93368 × 10^{-2}
	6.89476 × 10^{-3}	7.03070 × 10^{-2}	6.80460 × 10^{-2}	51.7149	1

エネルギー・仕事・熱量	J(=10^7 erg)	kgf·m	kW·h	cal(計量法)	Btu	ft·lbf	eV
	1	0.101972	2.77778 × 10^{-7}	0.238889	9.47813 × 10^{-4}	0.737562	6.24150 × 10^{18}
	9.80665	1	2.72407 × 10^{-6}	2.34270	9.29487 × 10^{-3}	7.23301	6.12082 × 10^{19}
	3.6 × 10^6	3.67098 × 10^5	1	8.59999 × 10^5	3412.13	2.65522 × 10^6	2.24694 × 10^{25}
	4.18605	0.426858	1.16279 × 10^{-6}	1	3.96759 × 10^{-3}	3.08747	2.61272 × 10^{19}
	1055.06	107.586	2.93072 × 10^{-4}	252.042	1	778.172	6.58515 × 10^{21}
	1.35582	0.138255	3.76616 × 10^{-7}	0.323890	1.28506 × 10^{-3}	1	8.46233 × 10^{18}
	1.60218 × 10^{-19}	1.63377 × 10^{-20}	4.45050 × 10^{-26}	3.82743 × 10^{-20}	1.51857 × 10^{-22}	1.18171 × 10^{-19}	1

1 cal = 4.18605 J(計量法)

= 4.184 J　(熱化学)

= 4.1855 J　(15 °C)

= 4.1868 J(国際蒸気表)

仕事率　1 PS(仏馬力)

= 75 kgf·m/s

= 735.499 W

放射能	Bq	Ci
	1	2.70270 × 10^{-11}
	3.7 × 10^{10}	1

吸収線量	Gy	rad
	1	100
	0.01	1

照射線量	C/kg	R
	1	3876
	2.58 × 10^{-4}	1

線量当量	Sv	rem
	1	100
	0.01	1

(86年12月26日現在)

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