THE 2000 ACTIVITIES AND THE 2nd WORKSHOP ON HUMAN RESOURCES DEVELOPMENT IN THE NUCLEAR FIELD AS PART OF ASIAN REGIONAL COOPERATION

June 2001

Nuclear Technology and Education Center

日本原子力研究所
Japan Atomic Energy Research Institute
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The 2000 Activities and the 2nd Workshop on
Human Resources Development in the Nuclear Field
as Part of Asian Regional Cooperation

Nuclear Technology and Education Center
(Tokai Site)
Japan Atomic Energy Research Institute
Tokai-mura, Naka-gun, Ibaraki-ken

(Received April 17, 2001)

In 1999, the Project for Human Resources Development (HRD) 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 kind of activities; in-workshop activities and outside-of-workshop
activities.

As in-workshop activities, the 2nd Workshop on Human Resources Development in the Nuclear
Field was held on November 27 and 28, 2000, at the Tokai Research Institute of JAERI. As outside-of-
workshop activities, "The presentation of the present state of international training and education in the
nuclear field in Japan" was held on November 29, 2000 after the workshop. Participating countries
were China, Indonesia, South Korea, Japan, Malaysia, the Philippines, Thailand, and Vietnam. The
secretariat for the Human Resources Development Projects is provided by the Nuclear Technology and
Education Center of the Japan Atomic Energy Research Institute.

This report consists of presentation papers and materials at the Workshop, presentation
documents of "The present state of international training and education in the nuclear field in Japan", a
letter of proposal from the Project Leader of Japan to the project leaders of the participating countries
after the Workshop and a presentation paper on Human Resources Development at the 3rd

Keywords: Human Resources Development, Nuclear Field, International Cooperation, Asian Countries,
Workshop, Training, Education, FNCA
アジア地域原子力協力における人材養成分野における
2000年度活動及び第2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

(2001年4月17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2回アジア地域原子力人材養成ワークショップ」が2000年
11月27・28日の2日間、東海研究所で開催された。WS外活動として本ワークシ
ョップに引き続き、11月29日に「日本における国際研修の現状」の報告会を実施した。
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、ベト
ナムである。なお、人材養成プロジェクトの事務局は、日本原子力研究所国際原子力
総合技術センターで実施している。

本報告書は、第2回ワークショップでの発表論文等、並びに「日本における国際研
修の現状」報告会の発表資料、ワークショップ後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に送付した活動提案レターと各国からのコメント等、及び
第3回FNCAコーディネーター会合（東京、2001年3月）での人材養成に関する発
表資料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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I. In-workshop Activities

1 The 2\textsuperscript{nd} Workshop on Human Resources Development in the Nuclear Field

1.2 Agenda
1.2.1 Program of "The 2nd Workshop on Human Resources Development in the Nuclear Field"

-FNCA-

November 27 – 28, 2000, Tokai Research Establishment, JAERI, Japan

Nov.27 / Monday  WORKSHOP (1st day)

Large Conference Room in the Advanced Science Research Center
Tokai Research Establishment, JAERI

Opening Session

11:00-11:10  Opening Address
Saichi NAKAZAWA, Director General
Atomic Energy Bureau,
Science and Technology Agency (STA)

11:10-11:20  Greetings by the Host
Yukio SATO, Executive Director
Japan Atomic Energy Research Institute (JAERI)

11:20-11:40  "Documents of the First Forum for Nuclear Cooperation in Asia (FNCA)"
Sueo MACHI, Coordinator of Japan, FNCA
Senior Managing Director
Japan Atomic Industrial Forum, Inc. (JAIF)

11:40-12:00  "Review and Scope of the Workshop on the Human Resources Development"
Yasushi SEKI, Project Leader of Japan
Director
Nuclear Technology and Education Center (NuTEC),
Japan Atomic Energy Research Institute (JAERI)

12:00-12:10  Commemorative Photograph

12:10-13:00  < Lunch >
Presentation Session (Country Report) – 1

"Specification of Needs on Human Resources Development (HRD)"
(15min. Presentation+10min. Q&A) / each country

Chairperson: VU Dang Ninh (VIETNAM)
Director, Administrative and Personnel Department,
Vietnam Atomic Energy Commission (VAEC)

13:10-13:35 CHINA
• YANG Lin and YANG Ying-Huang
  China National Nuclear Corporation (CNNC)

13:35-14:00 INDONESIA
• R.H.Jeni RUSLAN and SUDARMADI
  National Nuclear Energy Agency (BATAN)

14:00-14:25 KOREA
• Young-Myung CHOI and Eui-Jin LEE
  Korea Atomic Energy Research Institute (KAERI)

14:25-14:55 < Coffee Break >

Presentation Session – 2

Chairperson: YANG Lin (CHINA)
Deputy Director, Division of International Cooperation,
China National Nuclear Corporation (CNNC)

14:55-15:20 MALAYSIA
• Rapieh AMINUDDIN
  Malaysian Institute for Nuclear Technology Research (MINT)
• Ramli Bin MOHD.NOOR
  Ministry of Science, Technology & Environment Malaysia

15:20-15:45 THE PHILIPPINES
• Carol YOROBE
Department of Science and Technology
• Corazon Casenas BERNIDO
  Philippine Nuclear Research Institute (PNRI)

15:45-16:10  THAILAND
  • Warapon WANITSUKSOMBUT
    Office of Atomic Energy for Peace (OAEP)
  • Somyot SRISATIT
    Chulalongkorn University

Presentation Session – 3

Chairperson:  Warapon WANITSUKSOMBUT (THAILAND)
  Senior Radiation Physicist, Radiation Measurement Division,
  Office of Atomic Energy for Peace (OAEP)

16:10-16:35  VIETNAM
  • VU Dang Ninh
    Vietnam Atomic Energy Commission (VAEC)
  • PHAM Van Huynh
    Ministry of Science, Technology and Environment (MOSTE)

16:35-17:00  JAPAN
  • Yasushi SEKI
    Japan Atomic Energy Research Institute (JAERI)

17:30-19:30  Reception hosted by JAERI

Nov.28 / Tuesday  WORKSHOP (2nd day)

Discussion Session – 1

Chairperson:  Yoshio MURAO (Japan)
  Technical Consultant
  Japan Atomic Energy Research Institute (JAERI)
09:40-12:00  "Clarification and Classification of Needs of Each Country"
            "Japanese Proposal for Enhancement of the FNCA Program
            Activities"

12:00-13:00  < Lunch >

Discussion Session – 2

Chairperson: Young-Myung CHOI (KOREA)
            Director, Nuclear Training Center,
            Korea Atomic Energy Research Institute (KAERI)

13:00-15:00  "Discussions on Mutual Support Procedures for the Needs and the
            Annual Action Plan (FY2000)"

15:00-15:15  < Coffee Break >

Conclusion Session

Chairperson: Yasushi SEKI (JAPAN)
            Project Leader of Japan
            Director, Nuclear Technology and Education Center (NuTEC)
            Japan Atomic Energy Research Institute (JAERI)
            ①Conclusion of the Annual Action Plan for FY2000
            ②Proposal on Future Activities for Human Resources Development

Closing Session

15:50-16:00  Closing Address
            Yasushi SEKI (JAPAN)
            Project Leader of Japan
            Director, Nuclear Technology and Education Center (NuTEC)
            Japan Atomic Energy Research Institute (JAERI)
1.2.2 PARTICIPANTS’ LIST
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November 27 – 28, 2000, Tokai, Japan

November 27, 2000

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November 27 – 28, 2000, Tokai, Japan  

November 27, 2000

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Researcher
STA Research Program,
Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)

<Secretariat for the Workshop>
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<tr>
<th>Name</th>
<th>Position / Department</th>
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<tr>
<td>Mr. Kiyoshi KATO</td>
<td>Senior Staff</td>
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<td>Tokai Education Center</td>
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<td>Nuclear Technology and Education Center (NuTEC), Japan Atomic Energy Research Institute (JAERI)</td>
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<td>International Technology Transfer Division, Nuclear Technology and Education Center (NuTEC), Japan Atomic Energy Research Institute (JAERI)</td>
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<td>Nuclear Technology and Education Center (NuTEC), Japan Atomic Energy Research Institute (JAERI)</td>
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1.2.4 Participants
Opening Address by STA of Japan, Mr. Manabu Hamasak (deputy)

Greeting by the HoS Dr. Yukio Satō, Executive Director, JAERI

FNCA Coordinator of Japan, Dr. Saeo Machi
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Project Leaders
1.3 Opening Session
1.3.1 Opening Address by STA of Japan

The 2nd Workshop on Human Resources Development in the Nuclear Field

Mr. Saichi Nakazawa
Director General Atomic Energy Bureau
Science and Technology Agency, Japan

November 27, 2000

As all of you are fully aware, Japan has strong ties with the countries in Asia geographically, economically and historically. In the nuclear field, there are many areas of common issue including the use of radiation, the use of research reactors, and the introduction of nuclear power generation and so on. When Japan engages in a program of mutual cooperation in Asia, we recognize it is important that technology and experience accumulated in Japan be but to their best use.

Under such circumstances, the Atomic Energy Commission of Japan held the International Conference for Nuclear Cooperation in Asia every year since 1990 for then years. The 10th Conference was held on March 1999 in Tokyo. There, it was agreed that the conference would be renamed as “Forum for Nuclear Cooperation in Asia” and the various cooperative activities would restart under this new framework. The first Forum for Nuclear Cooperation in Asia was held this month in Bangkok, Thailand.

Recently, in Japan, our “Long-Term Program for Research, Development and Utilization of Nuclear Energy” has been revised. In the program, it is said that the general situation and the stage of nuclear development are quite different from country to country in Asia, and it is important to promote close cooperation considering those differences. I believe it is the real task which the new framework FNCA has to face, to make best effort to draw tangible results for the common issues with those situation in mind.

At the First FNCA, it was repeatedly addressed that the human resources development is extremely important both in promotion of nuclear energy and in securing nuclear safety. It means that this workshop should be recognized as of special significance.
Talking over the heritage of the cooperative activities so far, we are aiming at further reinforcement of international nuclear cooperation in the Asian region. We sincerely expect the further cooperation of each country to the Forum for Nuclear Cooperation in Asia.

I would like to expect that all of the distinguished participants positively join the discussions, and this workshop will be a good opportunity for the enhancement of understanding on the importance of nuclear development and utilization.
1.3.2 Greeting by the Host of Japan

Opening Address of Workshop

November 27, 2000
By Dr. Yukio Sato
Executive Director
JAERI

Good morning, ladies and gentlemen, on behalf of the Japan Atomic Energy Research Institute (JAERI), I would like to welcome all of you to the Second Workshop on Human Resources Development in Nuclear Field. In particular, I would like to express my sincere gratitude to participants from abroad who have come a long way.

It is a great pleasure for JAERI, as an organization responsible for the arrangement of this workshop, that the second workshop is held in the Tokai Research Establishment of JAERI. This is to respond to the proposal given by the Korean delegates at the First Workshop held in Tokyo last year to have mutual visits to the training facilities of Member Countries. The Tokai Research Establishment started operation in 1957, just one year after the establishment of JAERI. It is a comprehensive nuclear research institute with many research reactors, safety test facilities, and various accelerators carrying out a wide range of basic and applied research and development. The training of scientists and engineers for the use of nuclear power and radiation is carried out in the Nuclear Technology and Education Center located in the Tokai Research Establishment.

Two weeks ago, the First Forum on Nuclear Cooperation in Asia was held in Bangkok, where the importance of human resources development to secure the safety of nuclear power and radiation was emphasized. This workshop under the framework of the new Forum is expected to propose how human resources development in Asia could be promoted.

The purpose of this Workshop is to develop a policy of cooperation for promoting human resources development in order to contribute to the development of nuclear technologies and the enhancement of nuclear safety in Asian region. This workshop aims to identify issues and needs on human resources development in the Member Countries in order to enhance some visible ways of mutual understanding on these matters and possibly to obtain some visible ways of mutual support in this region.

I hope all of the participants from 8 Member Countries will enjoy fruitful results from this twoday workshop through the presentation of the country reports and lively discussions on human resources development. After the workshop, the third day will be devoted to a comprehensive presentation
of training courses in the nuclear field held provided in Japan for the Asian countries. On the fourth day, technical tour of the nuclear facilities in Tokai-mura will be organized. Through these activities and events, I hope you will have a better understanding of present status of the nuclear development in Japan.

Thank you very much for your attention.
1.3.3 Documents of the First Forum for Nuclear Cooperation in Asia (FNCA)

November 27, Tokai, Japan

SUEO MACHI

FNCA Coordinator of Japan
Senior Managing Director of JAIF

Forum for Nuclear Cooperation in Asia(FNCA)
Strategic Plan

Attachment

Program of the 1st FNCA

Joint Communiqué of the First Meeting of the FNCA
Forum for Nuclear Cooperation in Asia (FNCA) Strategic Plan

1. **Introduction**
The Forum for Nuclear Cooperation in Asia (FNCA) has evolved from the International Conference for Nuclear Cooperation in Asia (ICNCA) which was established 10 years ago with the aim of promoting the application of nuclear technology through collaboration among Asian countries. During this period the sharing of information, exchange of scientific personnel and active cooperative research have been pursued in several fields.

2. **Vision Statement**
"The FNCA is to be recognized as an effective mechanism for enhancing socio-economic development through active regional partnership in the peaceful and safe utilization of nuclear technology"

3. **Goals**
- To achieve socio-economic development by safe utilization of nuclear technology
- To utilize nuclear technology in those fields where it has a distinct advantage
- To respond to the needs of the FNCA countries

4. **Operational Strategies**

Framework of Operation
The FNCA Framework includes meetings and coordinated projects in agreed fields of activity as represented in Attachment 1.

**Strengthening National Effort**
- Each participating country of the FNCA will establish a national mechanism to promote and support the FNCA activities. Each country is also encouraged to contribute to the funding of the FNCA activities within its country.
- The FNCA Coordinators are requested to monitor the effectiveness of project implementation in their respective countries.

**Strengthening Planning and Review of Projects**
- A proposal for a new project, significant change to, or cessation of, an existing project will be discussed at the Coordinators Meeting. If the proposal is judged appropriate it will be submitted to the next Forum Meeting where proposals will be officially adopted. Alternatively, proposals coming forward and endorsed at the Forum Meeting will be considered in detail at the next Coordinators Meeting. This will ensure adequate consideration within the participating countries.

- For a new project the following information is required:
  - objectives of the project
  - a lead/host country(ies) and a lead/host organization(s)
  - outline of the project including duration, budget size, milestones and expected outputs
  - requirements for participating countries
  - available resources and facilities

- A new project may be introduced even if not supported by all countries provided that the resources necessary are made available by the supporting countries.

5. **CURRENT STATUS:**
Activities are currently pursued in the following seven fields:
- Utilization of Research Reactors
- Application of Radioisotopes and Radiation for Agriculture
Application of Radioisotopes and Radiation for Medical Use
Public Information on Nuclear Energy
Radioactive Waste Management
Nuclear Safety Culture
Human Resource Development

It has been agreed that more focus can be achieved in the projects under these respective fields and a greater degree of linkage between the activities is desirable. Participating countries are urged to consider possible options for the future. Some initiatives (Attachment 2) have been made and these are to be considered at workshops, as appropriate, and subsequently supported at the next Coordinators Meeting. The Forum welcomes these initiatives.

The provisional venues of Workshops in FY2001 are:
- Utilization of Research Reactor: (China/Vietnam)
- Application of Radioisotopes and Radiation for Agriculture: Thailand
- Application of Radioisotopes and Radiation for Medical Use: Malaysia
- Public Information on Nuclear Energy: The Philippines
- Radioactive Waste Management: (Vietnam/Korea)
- Nuclear Safety Culture: Japan
- Human Resources Development: (Japan/Korea)
Forum for Nuclear Cooperation in Asia

Forum Meeting

The Coordinators Meeting

In March

Regional Nuclear Cooperation Activities

Coordinator *
(One from each country)

In Autumn

Ministerial

Senior Official

Reporting a Paper for Strategy

* Communication and coordination among the Project Leaders of his/her

Reporting on the Activities by Field

Project Leaders
CURRENT STATUS – SUGGESTED INITIATIVES

1. Utilization of Research Reactor
   Efficient Tc-99m generator production system using new JAERI technology from Mo-99 produced by n-γ reaction. Applications of NAA (neutron activation analysis) for environment monitoring and mineral resources exploration are to be pursued.

2. Application of Radioisotopes and Radiation for Agriculture
   For mutation breeding, specific crops which need improving yield and/or disease resistance to be identified before the Coordinator Meeting in March 2001. A possible new project on biofertilizer technology to increase yield of grain legume and rice avoiding environmental pollution is proposed.

3. Application of Radioisotopes and Radiation for Medical Use
   For treatment of uterine cervical cancer (highest incidence in developing countries), expansion of application of established radiation treatment protocol and establishment of new protocol aiming at more efficient treatment to be scheduled.

4. Public Information on Nuclear Energy
   Emphasis to be on the support of national public information activities in each country.

5. Radioactive Waste Management
   The immediate cooperation on good management practice of spent radioisotope source is proposed with the establishment of regulation and management systems for radioisotope utilization in terms of registration, reporting, collection and storage of spent sources. Concrete measures tackling this problem are to be discussed in the workshop which will take place in Australia this coming December.

6. Nuclear Safety Culture
   The 10 year vision is “That safety culture programs should be implemented and effective at a comparable level in all nuclear facilities in FNCA countries”.

   Over the next three years, the workshops will focus on sharing information from countries with established programs and providing support to countries which intend to adopt nuclear power or where assistance in implementing safety culture programs has been requested. Other activities will include reporting against the agreed safety culture indicators and Nuclear Safety Convention articles

7. Human Resources Development
   Human Resources Development strategy for national nuclear program to be formulated by high level officials through a workshop with a focus on enhancement of safety in radioisotope and research reactor application.
Advanced Program of
the First Forum for Nuclear Cooperation in Asia (1st FNCA)

<as of November 13, 2000>

1. Date: November 10-15, 2000
2. Place: The Sukhothai Hotel, Bangkok
3. Sponsored by: Ministry of Science, Technology and Environment (MOSTE) of Thailand, and Atomic Energy Commission (AEC) of Japan
4. Supported by: Office of Atomic Energy for Peace (OAEP) of Thailand Science and Technology Agency (STA) of Japan Department of Public Relations of the Prime Minister's Office Kasetsart University Electricity Generating Authority of Thailand (EGAT) and National Science Museum (NSM)
5. In Cooperation with: Japan Atomic Energy Research Institute (JAERI) Japan Nuclear Cycle Development Institute (JNC) and Japan Atomic Industrial Forum, Inc. (JAIF)
6. Preparation Work: Office of Atomic Energy for Peace (OAEP) and Japan Atomic Industrial Forum, Inc. (JAIF)
7. Working Language: English

Friday, November 10, 2000 (SOM-1: Preparatory Meeting to MM)
* SOM: Senior Official Level Meeting MM: Ministerial Level Meeting

08:30-09:00 Registration

09:00-09:40 [Opening Session]
- Welcome Address:
  Mr. Kriengkom Bejrputra, Secretary General of the Office of Atomic Energy for Peace of Thailand (10 min.).
- Self-introduction of Participants (20 min.).
- Adoption of Agenda for the SOM-1 and SOM-2
  * Chaired by Mr. Kriengkom Bejrputra, Secretary General, the Office of Atomic Energy for Peace of Thailand (10 min.)

09:40-10:00 <Break>

10:00-11:00 [Session 1] Special Report
Chair: Mr. Kriengkom Bejrputra,
Secretary General, the Office of Atomic Energy for Peace of Thailand

"Japan's New Long-Term Program for Research, Development and Utilization of Nuclear Energy"
Mr. Tetsuya Endo, Commissioner of the Atomic Energy Agency (AEC) of
Japan
(30 Min.)
- Q & A (30 min.)

11:00-12:00 [Session 2] The FNCA Framework
Co-Chairs:
Dr. Manoon Aramrattana, Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand
Mr. Toru Nakahara, Director, International Affairs and Safeguards Division, Atomic Energy Bureau, the Science and Technology Agency of Japan
- Regional Nuclear Cooperation Activities (RNCA) under FNCA Framework
  Dr. Sueo Machi, FNCA Coordinator of Japan (20 Min.)
- Presentation of the Discussion Paper for Strategy at the First Coordinators Meeting
  Dr. Manoon Aramrattana, Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand (20 Min.)
- Q & A (20 min.)

12:00-13:00 <Lunch>

13:00-14:30 [Session 3] (Round Table Discussion: FNCA Strategic Plan and New Projects)
Chair: Dr. Manoon Aramrattana
  Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand
- New Projects
- FNCA Strategic Plan
- Discussion

14:30-15:00 <Break>

15:00-16:00 [Session 4] Drafting and Adoption of the FNCA Strategic Plan
Chair: Dr. Manoon Aramrattana
  Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand

16:00-18:00 [Session 5] Confirmation on the Draft Joint Communiqué
Chair: Dr. Manoon Aramrattana
  Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand

Saturday, November 11, 2000
Day reserved for possible discussion after the SOM-1
Sunday, November 12, 2000
Free day
19:00-21:00 Dinner hosted by H.E. Dr. Arthit, Minister for Science, Technology and Environment of Thailand at Celadon Thai Restaurant

Monday, November 13, 2000 (Ministerial Level Meeting: MM)

Basic Theme: "Future Nuclear Energy and Its Safety in Asia"

08:30-09:00 Registration

09:00-10:05 [Opening Session]
Master of Ceremonies (Thailand)

- Welcome Address:
  H.E. Dr. Arthit Ourairat, Minister for Science, Technology and Environment (10 min.)

- Opening Address:
  H.E. Dr. Trairong Suwankhiri, Chairman of Thai Atomic Energy Commission and Deputy Prime Minister (15 Min.)

- Address:
  H.E. Mr. Tadamori Ohshima, Chairman of the Atomic Energy Commission of Japan and Minister of State for Science and Technology (10 Min.)

09:35-10:00 <Taking Memorial Photo and Break>

10:00-10:05 Adoption of Agenda for the Ministerial Level Meeting (MM)
  * Chaired by H.E. Dr. Arthit Ourairat, Minister for Science, Technology and Environment of Thailand

10:05-11:35 [Session 1] Country Paper Presentation
Co-Chairs:
H.E. Dr. Arthit Ourairat, Minister for Science, Technology and Environment of Thailand
H.E. Mr. Tadamori Ohshima, Chairman of the Atomic Energy Commission, and Minister of State for Science and Technology of Japan

10:05-10:15 (Australia)
Prof. Helen Garnett, Chief Executive, Australian Nuclear Science and Technology Organization

10:15-10:25 (China)
H.E. Mr. Zhang Huazhu, Chairman, China Atomic Energy Authority
10:25-10:35  (Indonesia)
"Some Thoughts Towards A More Sustainable Global Development"
H.E. Dr. Muhammad A. S. Hikam, State Minister for Research and Technology

10:35-10:45  (Japan)
"Future Nuclear Energy and Its Safety in Asia"
H.E. Mr. Tadamori Ohshima, Chairman of the Atomic Energy Commission, and Minister of State for Science and Technology

10:45-10:55  (Republic of Korea)
Mr. Han, Jung-Kil, Vice Minister, Ministry of Science and Technology

10:55-11:05  (Malaysia)
H.E. Dato Law Hieng Ding, Minister of Science, Technology and the Environment

11:05-11:15  (The Philippines)
H.E. Dr. Filemon A. Uriarte, Jr., Secretary, Department of Science and Technology

11:15-11:25  (Thailand)
"Peaceful Utilization of Nuclear Energy in Thailand"
H.E. Dr. Arthit Ourairat, Minister for Science, Technology and Environment

11:25-11:35  (Vietnam)
"Peaceful Application of Nuclear Energy in Vietnam and the Role of Regional Cooperation for Its Promotion"
The Hon. Prof. Dr. Hoang Van Huay, Vice Minister, Ministry of Science, Technology and the Environment
*Absent, and Dr. Vuong Huu Tan presented on behalf of H.E.

11:35-12:10  [Session 2]  The FNCA Framework
Co-Chairs:
H.E. Dr. Arthit Ourairat, Minister for Science, Technology and Environment of Thailand
H.E. Mr. Tadamori Ohshima, Chairman of the Atomic Energy Commission, and Minister of State for Science and Technology of Japan

1) Special Report
"The Regional Nuclear Cooperation Activities (RNCA) under the FNCA Framework"
Mr. Saichi Nakazawa, Director General, Atomic Energy Bureau, the Science and Technology Agency of Japan (10 min.)

2) Introduction of the FNCA Strategic Plan
Dr. Manoon Aramrattana
Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand (10 min.)

3) Presentation
   “The IAEA in Asia”
   Mr. Qian Jihui, Deputy Director General for Technical Co-Operation
   the International Atomic Energy Agency (15 Min.)

12:10-14:00 Welcome Luncheon hosted by H.E. Dr.Arthit Ourairat, Minister for Science, Technology and Environment of Thailand
   at Room Chulalux
   * Another Buffet Lunch for the other delegation members is held at Celadon Thai Restaurant.

14:00-17:15 [Session 3] (Round Table Discussion)

   Basic Theme: “Future Nuclear Energy and Its Safety in Asia”

   Discussion Topics (one hour per topic):
   1) Promotion of Nuclear Energy Application
      - Moderator:
        Mr. Tetsuya Endo, Commissioner of Atomic Energy Commission of Japan.
      - Introductory Speaker:
        Mr. Zhang Jing, Director, Division of Inter-Governments and International Organizations, China Atomic Energy Authority

   2) Nuclear Safety
      - Moderator:
        Prof. Helen M. Garnett, Chief Executive, the Australian Nuclear Science and Technology Organisation
      - Introductory Speaker:
        Mr. Kim, Chang-Woio, Director, Radiation Safety Division, Nuclear Energy Bureau, the Ministry of Science and Technology of the Republic of Korea

      < 15 minutes break >

   3) How to Promote Cooperation among the FNCA Countries
      - Moderator:
        Ms. Pomphimol Chaichawanakul, Senior Research Scientist, Office of Senior Experts, Department of Agriculture, Ministry of Agriculture and Cooperatives of Thailand
      - Introductory Speaker:
        Dr. Sueo Machi, FNCA Coordinator of Japan

17:15-18:00 Drafting of the Joint Communiqué and Confirmation of the FNCA Strategic Plan
   * Joint work of Senior Officials in another room by nominating one Senior
Official from each FNCA country.

18:00-18:30  [Session 4]  Closing Session
Chair: H.E. Dr. Arthit Ourairat, Minister for Science, Technology and Environment of Thailand

- Adoption of the Joint Communiqué of the Ministerial Level Meeting of the First FNCA
  Introduction of Draft by Mr. Toru Nakahara, Director, International Affairs and Safeguards Division, Atomic Energy Bureau, the Science and Technology Agency of Japan

- Adoption of the FNCA Strategic Plan
  Introduction of Draft by Dr. Manoon Arammattana, Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand

- Closing Remarks by Thailand:
  Mr. Sunthut Somshiwin, Permanent Secretary for H.E. Dr. Arthit Ourairat, Minister for Science, Technology and Environment

- Remarks by Japan:
  H.E. Mr. Tadamori Ohshima, Chairman of the Atomic Energy Commission, and Minister of State for Science and Technology

18:30-19:00  Press Conference

19:00-21:00  Buffet Dinner hosted by H.E. Mr. Tadamori Ohshima, Chairman of the Atomic Energy Commission of Japan
  Courtyard of the Sukhothai Hotel
  * On rainy day, this will be held at Room Chulalux

Tuesday, November 14, 2000 (SOM-2: Follow-up Meeting to MM)

09:00-12:00  [Session 1]  Discussion on What was Suggested in the MM
Chair: Dr. Manoon Arammattana, Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand

[Session 2]
Discussion on Draft Summary Report of the First FNCA (SOM-1, MM, and SOM-2)
Co-Chairs:
  Dr. Manoon Arammattana, Deputy Secretary General, the Office of Atomic Energy for Peace of Thailand
  Mr. Toru Nakahara, Director of International Affairs and Safeguards Division, Atomic Energy Bureau, the Science and Technology Agency of Japan

12:00-13:30  <Lunch>
13:30-15:00  [Session 2]  
Discussion of Draft Summary Report of the First FNCA (SOM-1, MM, and SOM-2) (Continued)  
- Adoption of Summary of the First FNCA (SOM-1, MM, and SOM-2)  

15:00  Closing  

**Wednesday, November 15, 2000 (Technical Visit)**  
**Technical Visit:**  
10:00-12:00 - The Technopolis:  
The Thai Irradiation Center (TIC) and the National Science Museum (NSM)  
13:30-15:30 - (Optional in the afternoon)  
A. Ongkharak - Site for the New Nuclear Research Center  
B. Gamma Irradiation Service and Nuclear Technology Research Center, Kasetsart University  

**Thursday, November 16, 2000**  
Leave for home  

**Exhibition**  
October 30-November 3: Srinakarinwirot University Prasammit Campus, Mahidol University, and Thammsat University  
November 1: National Science Museum  
November 6-10: Kasetsart University and Chulalongkorn University  
November 6-17: Ministry of Science, Technology and Environment (MOSTE)  
November 13: Sukhothai Hotel and the Public Relations Department
Joint Communiqué
of
The First Meeting of Forum for Nuclear Cooperation in Asia (FNCA)

November 13, 2000

Introduction

1. The First Meeting of the Forum for Nuclear Cooperation in Asia (FNCA) was held in Bangkok, on 10th and 13th of November, 2000. Ministers and Senior Officials from nine Asian countries comprising the Commonwealth of Australia, People’s Republic of China, Republic of Indonesia, Japan, Republic of Korea, Malaysia, Republic of the Philippines, Kingdom of Thailand, and Socialist Republic of Vietnam responsible for the peaceful nuclear research, development and utilization met here. The Meeting also welcomed the participation of the International Atomic Energy Agency (IAEA) as an observer. The Meeting was co-hosted by the Ministry of Science, Technology and Environment (MOSTE) of the Kingdom of Thailand and the Atomic Energy Commission (AEC) of Japan.

2. The Forum assumed the activities of the former International Conference for Nuclear Cooperation in Asia (ICNCA), which had been led by Japan for the last ten years. At the Tenth Meeting of the ICNCA, the participating countries agreed that the ICNCA should be transformed into the Forum for Nuclear Cooperation in Asia (FNCA) with the first Forum Meeting to be held in Thailand.

3. The vision statement was developed at the First FNCA Coordinators Meeting and adopted at the Forum Meeting as follows: “The FNCA is to be recognized as an effective mechanism for enhancing socio-economic development through active regional partnership in the peaceful and safe utilization of nuclear technology.”

4. The Meeting discussed the activity under the FNCA Framework and the Regional Nuclear Cooperation Activities (RNCA) under the FNCA framework, and agreed on the following points.

Rationale for the FNCA

5. The Asian region is one of the regions which enjoys highest economic growth rates in the world. To sustain such growth in the face of limited resources and the need to protect and preserve the environment, the region can benefit from effective utilization of nuclear technology. According to the projections for expansion of nuclear power generation, the region is expected to be one of the three major nuclear-generation centers along with the United States and Europe early in the 21st Century. In addition to nuclear power generation, nuclear applications in fields, such as food and agriculture, human health care, improvement of industrial technology, and environmental protection, are of equal importance in people’s daily life.

6. In recognition of the above situation, regional cooperation to further the safe and peaceful use of nuclear technology will be significantly advanced by carrying out the Regional Nuclear Cooperation Activities (RNCA) currently in seven fields,

- Utilization of Research Reactors,
- Application of Radioisotopes and Radiation for Agriculture,
- Application of Radioisotopes and Radiation for Medical Uses,
- Public Information on Nuclear Energy,
- Radioactive Waste Management,
- Nuclear Safety Culture, and
- Human Resources Development.

7. These activities to date have led to the establishment of effective infrastructure for development and utilization of nuclear technology in the participating countries. It is also expected that these activities
would bring the FNCA countries many socio-economic benefits and enhance public awareness of the role, contribution and safety of nuclear technology and the way it is benefiting national development.

8. Development and utilization of nuclear technology through the FNCA can, in addition, help solve major issues which mankind faces in the 21st Century, the so-called "Trilemma Issues" of economic growth; security of resources, energy and food; and preservation of the global environment. Therefore, it is beneficial to promote the further development of the RNCA which can contribute to sustainable development through nuclear technology applications.

Direction of Future Activities
9. The Meeting adopted the FNCA Strategic Plan. Officials from FNCA countries will further cooperate to introduce and implement appropriate projects in those fields where socio-economic benefits can be clearly expected, and to make FNCA activities more efficient through better linkages with the IAEA and other appropriate international organizations. In this regard the initiatives listed in the Strategic Plan are welcomed.

10. The FNCA countries recognize that their contributions of manpower and finance are important to strengthen and expand the FNCA activities. Each country will try to establish a domestic system to support FNCA activities.

11. The nuclear accidents of the past two years such as the criticality accident at the JCO nuclear fuel facility in Japan and the radiological accident involving the spent Cobalt-60 source in Thailand should never occur again. To achieve this goal, development and utilization of nuclear technology in each country should be carried out with full attention to the safety aspect. It is also important to use the experiences of these unfortunate accidents as lessons in implementing the FNCA activities in the future.

12. The Meeting approved the following provisional venues of Workshops in FY2001:
   - Utilization of Research Reactor: (China/Vietnam)
   - Application of Radioisotopes and Radiation for Agriculture: Thailand
   - Application of Radioisotopes and Radiation for Medical Use: Malaysia
   - Public Information on Nuclear Energy: The Philippines
   - Radioactive Waste Management: (Vietnam/Korea)
   - Nuclear Safety Culture: Japan
   - Human Resources Development: (Japan/Korea)

Next Meetings
13. The Meeting agreed that the Second and the Third Meetings of the FNCA would be held in Japan and Republic of Korea in 2001 and 2002, respectively.

References
(1) OECD/NEA-IAEA "Uranium"
(2) IEA "World Energy Outlook"
1.3.4 Review and Scope of the Workshop on the Human Resources Development

Yashushi SEKI
Project Leader of Japan
Director
Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)
Activities to Date and Next Three-Year Plan
for Human Resources Development in the Nuclear Field
as Part of Asian Regional Cooperation

Yoshio Murao
Project Leader in the Area of Human Resources Development
Japan Atomic Energy Research Institute
Nuclear Technology and Education Center

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 the Atomic Energy Bureau of the Science and Technology Agency (STA) and is administered by the Nuclear Technology and Education Center (NuTEC) of the Japan Atomic Energy Research Institute.

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 kind of activities: in-workshop activities and outside-of-workshop activities, as the time of the workshops themselves is too short to achieve the objectives.

1.1. In-workshop activities

1st Seminar on Human Resources Development in the Nuclear Field

This Seminar was held on November 25 and 26, 1999, at the Tokyo International Forum. Participating countries were China, Indonesia, South Korea, Japan, Malaysia, the Philippines, Thailand, and Vietnam, with Australia submitting a study report only. Fifty people participated: 36 from Japan and 14 from the other seven countries. The participant list is Attachment 1 and the Seminar program is Attachment 2. The tasks of the Project had been left for determination at the first Seminar; tasks were proposed at the Seminar, and were refined and clarified after the Seminar, as follows:

1) to identify the HRD needs of each Asian country for consideration in planning international HRD programs hosted by the various countries, in order to have the needs of all countries more fully incorporated.
2) to mutually support the HRD activities of each country by exchanging resources on HRD (information on experiences, technologies and materials for training and so on).

Results of the Seminar

The Seminar succeeded in identifying the needs of each country in developing human resources in the nuclear field. Participating countries made presentations on their present situations and needs, which had been anticipated from preparatory reports submitted in advance. In the actual program, therefore, time was set aside to allow participants and Japanese committee members to discuss and identify the needs, which they reported in a rearranged form later in the Seminar. The Roundtable session then discussed how mutual support should be extended to meet those individual needs. While the Seminar's main objective was merely to identify and compile the needs, the participants also reached a basic agreement on actively promoting exchanges of information on their experiences in the development of human resources and training materials. The proposal, however, to limit such
cooperation to areas of minimal cost failed to obtain sufficient understanding, and thus needs to be discussed further in the future.

This Seminar was the first gathering of human resources development officers in Asia, and was a significant occasion from the perspective of international exchanges. Overall, it yielded the following results:
1) The current state of human resources development in each participating country was identified.
2) The HRD needs in each participating country were identified through discussions as shown in Table 1.
3) Mutual support for the needs of each country in the future was confirmed.
4) The following medium-to-long term target for cooperative activities was decided:
   "In order to promote the nuclear human resources development in each country, the problems and needs on the development are extracted and classified and the effective procedures of mutual support are discussed." (That is, the original sentence was revised by deleting the words "at the seminar to be held every year," since our activities are not only in-workshop activities during the HRD Seminars, but also outside-of-workshop activities.)
5) The three-year plan for FY2000 to 2002 was decided.

As for the annual action plan in the area of human resources development, the following items were agreed to:
1) Based on the Seminar results, each country must engage in discussions, under the leadership of its Project Leader, and submit a proposal on guidelines to the Japanese Project Leader (Murai) by the end of December 1999.
2) The materials used in the Seminar will be compiled in JAERI-Report. Materials requiring modifications must be revised and sent to the Japanese Project Leader by electronic media, such as floppy disks. The report should also cover past progress and the current status of human resources development in Japan.
3) The Seminar successfully identified the needs of each participating country. Reference data and supplementary materials should be provided for attachment to JAERI-Report.
4) In developing training materials, each country must provide its available materials and information via its Project Leader to the Japanese counterpart.
5) Any urgent or priority needs should be forwarded for examination.
6) Project Leaders from participating countries must maintain close contact, so as to share information within the group.

1.2. Outside-of-workshop activities

Guidelines for mutual support and the annual action plan for FY 2000 were not determined at the last Seminar, and Project Leaders were asked to propose them by the end of December 1999. There were, however, no comments by the end of January 2000, other than from Malaysia. JAERI then newly proposed guidelines for mutual support and an annual action plan for FY 2000 as outside-of-workshop activities, asking that they be adopted in our Project if no comments were received by the end of February 2000. We are now waiting for answers from Project Leaders from the participating countries.

The proposal is:
1) Publication in JAERI-Report of our activities in HRD

The country reports presented by the member countries at the first Seminar will be published in JAERI-Report in order to explain our activities in FY 1999 (April 1, 1999 to March 31, 2000). From the next fiscal year, the report will cover all of our activities related to the Project. The needs presented by the member countries are summarized in Attachment and Table. JAERI-Report is distributed worldwide; thus, many people will read the reports in the various countries, and the project planners for international programs will be able to refer to those needs when planning their programs. If the member countries desire any additions and/or revisions of the contents, they can be accepted until the end of March 2000.
2) Proposal of guidelines on mutual support among member countries

-Mutual support shall be carried out in conformity with the requests of the receiving countries; however, proposals are welcome from any country.
-In the support activities, duplication of those conducted by the IAEA and other organization should be avoided.
-Practically achievable mutual support should be carried out positively in the Project, while more costly support can be proposed as items of need.
-The activities and the results of mutual support should be reported at the Seminars.
(Comments should be sent by the end of February 2000.)

3) Specification of HRD needs
In order to specify HRD needs more precisely, it is necessary to describe the details of the needs as shown in Attachment 1 and Table 1. The Project Leaders of the member countries are requested to specify their needs with indications of priority by the end of June 2000. Additional detailed information will be requested by the end of September 2000 for discussion at the next Seminar. Attachment of related information is appreciated, to assist planners in incorporating the needs into international programs.

4) Proposal on in-workshop activities for FY 2000
In-workshop activities for FY 2000 will be proposed by the end of July 2000.

2. Three-year plan (FY2000 to 2002) for HRD Project
The three-year plan for FY2000 to 2002 was decided at the Seminar and the original contents have been rearranged as shown in Table 2, since our activities are not only in-workshop activities during the Seminars, but also outside-of-workshop activities.
[PROPOSAL] Needs in Each Country

1. CHINA
Need for senior managers for NPPs (Nuclear Power Plants)
   ① Training opportunities to provide basic technical background
      (design, operation, maintenance)
   ② Nations with advanced technology in nuclear power share expertise with other Asian countries
   ③ Establishment of manpower training plans, systems, and programs
   ④ Establishment of manpower training policies / regulation by government organizations
   ⑤ Exchanges of personnel, experience, and information about NPPs

2. KOREA
   General Needs:
   ① Exchanges of information concerning experiences in developing specialized nuclear training equipment
   ② Exchanges of training materials such as textbooks, handouts
   ③ Exchanges of experts involved in human resources development in the nuclear field
   ④ Visitation programs to training facilities
   ⑤ Mutual cooperation projects on new training methodologies, such as cyber learning systems, including multi-media. A yearly seminar is desirable.
   Specific Needs:
   ⑥ Group visitation programs to nuclear facilities for the purpose of training technical personnel and leaders
   ⑦ Creation of common textbooks according to levels of ability and experience

3. INDONESIA
   ① Development of technical infrastructure for operation & maintenance
   ② Human resources development
      (Training of leaders, training of trainers)
      (Scientific education for young people)
   ③ Raising motivation levels in present human resources
      (Increase knowledge and technical skills)
   ④ Program for training project leaders, trainers, and troubleshooters

4. MALAYSIA
   ① Gap analysis of human resources (HR) for nuclear power program (NPP)
   ② Information management
      1. Through Internet:
         - Gathering information and data
         - Hardware for NPP, implementation of virtual forum on regulations and licensing, technology transfer and application of present information on mutual education
         - Responding to problems in each country as learned through news on accidents, breakthroughs on the technology and training programs
      2. Development of training materials through Internet
3. Training of trainers
   1. Technical content and experimental set-ups may be learned from advanced countries
   2. Non-technical aspects
      - Curriculum design
      - Lesson planning
      - Implementation
         (Use of audio-visuals, dynamic presentations)
   3. Training readily available in Malaysia is limited to non-technical aspects

5. THE PHILIPPINES
   ① Nuclear education for high school science teachers: exchange program for high school teachers
      - These teachers will later on become trainers, not only in the Philippines, but also in other Asian countries.
      - Selected Japanese high school teachers will visit the Philippines to demonstrate the teaching of nuclear science and technology (for example, how to make and demonstrate the use of a cloud chamber).
   ② Development of training courses
      - A training course on the application of radioisotopes to agriculture, biotechnology and research will be conducted jointly by the Philippines and Japan. Japanese experts will be invited to the Philippines to lecture on radioisotope applications.
      - Philippine trainers and researchers will also visit Japan for training.
   ③ Development of training materials
      For example, cloud chambers, videos, visual aids, etc.
   ④ Obtaining M.S. degree in Nuclear Engineering
      - One or two Philippine students will be invited for graduate studies in Japan or other Asian countries.

6. THAILAND
   ① Development of training courses on research reactor utilization
      - Development of course content
      - Requests for Japanese lecturers
      - Requests for equipment related to the training courses
   ② Radiation protection officer qualification system
      - Exchanges of information with other countries
      - Requests for Japanese experts
   ③ Development of training courses for school teachers
      - Teaching materials concerning the social and economic aspects of nuclear utilization
   ④ Training of trainers
      - University lectures in social sciences, economics and political science

7. VIETNAM
   ① Training of leaders:
      Governmental administrative officers involved in safety evaluations,
      Project Leaders
   ② Training of trainers for the center in Dalat
   ③ Development of training courses:
      Nuclear applications in various fields (agriculture, medicine, etc.)
4 Development of teaching materials and techniques
5 Increasing knowledge of current researchers, professors, etc.
6 Training staff to participate in development of laws, regulations
7 Dealing with the brain drain
<table>
<thead>
<tr>
<th>Country</th>
<th>Training type</th>
<th>Training techniques development issues</th>
<th>Infrastructure development issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Leader training (Enhancing the capabilities of high-level managers)</td>
<td>Development of training techniques (Providing and exchanging experiences and information)</td>
<td>Establishment of the educational training system for the education, policies, and regulations of basic NPP technologies.</td>
</tr>
<tr>
<td>South Korea</td>
<td>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 experts) Development of computer-based training techniques (Multi-media)</td>
<td>Establishment of a long-term energy program. Development of nuclear fuel technologies. Development of nuclear safety systems. Development of the technological foundation for operating and maintaining research reactors and other facilities.</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>Leader training Researcher and expert training (Training young engineers and trouble-shooters) Instructor training</td>
<td>Development of training materials (visual materials and CAI) Development of computer-based training techniques (Gathering information on the Internet, holding virtual forums, providing technological knowledge, and providing training materials)</td>
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<td>Malaysia</td>
<td>Instructor training</td>
<td>Development of training materials (visual materials and CAI) Development of computer-based training techniques (Gathering information on the Internet, holding virtual forums, providing technological knowledge, and providing training materials)</td>
<td>PA of nuclear energy. Analysis of human resources needed for NPP. Development of educational infrastructure using the Internet. Countermeasures for the outflow of talents.</td>
</tr>
<tr>
<td>The Philippines</td>
<td>Researcher and expert training (nurturing MS and PhD holders, if introducing NPP) School teacher training (Nuclear energy education, and exchanges of high school teachers)</td>
<td>Development of training courses (RI use in agricultural, biological, and medical fields, and training in Japan) Development of training materials (Cloud chamber, videos, visual materials, and CAI)</td>
<td>Development of training courses (Using research reactors, creating curriculums, dispatching Japanese lecturers, providing materials and equipment) License system for radioactive protection managers (Exchanging information, and dispatching Japanese experts)</td>
</tr>
<tr>
<td>Thailand</td>
<td>Instructor training (Social, economic, and political lectures at universities) School teacher training (Materials on the social and economic aspects of nuclear energy utilization)</td>
<td>Development of training courses (Using research reactors, creating curriculums, dispatching Japanese lecturers, providing materials and equipment)</td>
<td>Countermeasures for the outflow of computer experts</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Leader training (administrative officers, project leaders, etc.) Researcher and professor training Instructor training Training of legislative and bureaucratic officials</td>
<td>Development of training courses (Reactor engineering, and RI use in agricultural and medical fields) Development of training materials and techniques</td>
<td>Development of training courses (Reactor engineering, and RI use in agricultural and medical fields) Development of training materials and techniques</td>
</tr>
<tr>
<td>Australia</td>
<td>-</td>
<td>-</td>
<td>Development of training courses (Reactor engineering, and RI use in agricultural and medical fields) Development of training materials and techniques</td>
</tr>
<tr>
<td>Country</td>
<td>Training type</td>
<td>Training techniques development issues</td>
<td>Infrastructure development issues</td>
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<tr>
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<td>-------------------------------------------------------------------------------</td>
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</tr>
</tbody>
</table>
| China       | Senior management people, researcher, expert, engineer training.               | 1. Development of training techniques on NPP operation management  
2. Development of training techniques on NPP project design and management  
3. Development of training techniques on NPP automatic design and management information system  
4. Development of training techniques on NPP digital I&G system design  
5. Training NPP senior operators  
6. Training NPP maintenance engineers  
7. Training NPP safety and technology advisor  
8. Development of training techniques on NPP waste treatment technology  
9. Development of training techniques reactor design and operation technology for radioisotope product  
10. Training NPP full-scale simulator teacher |                                                                                                                                                                                                                                          |                                                                                                  |
| South 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 experts)  
Development of computer-based training techniques (Multi-media) |                                                                                                                                                                                                                                          |                                                                                                  |
| Indonesia   | Leader training  
Researcher and expert training (Training young engineers and trouble-shooters)  
Instructor training | Establishment of a long-term energy program.  
Development of nuclear fuel technologies.  
Development of nuclear safety systems.  
Development of the technological foundation for operating and maintaining research reactors and other facilities. |                                                                                                                                                                                                                                          |                                                                                                  |
| Malaysia    | Instructor training                                                             | Development of training materials (visual materials and CAI)  
Development of computer-based training techniques (Gathering information on the Internet, holding virtual forums, providing technological knowledge, and providing training materials) | PA of nuclear energy.  
Analysis of human resources needed for NPP.  
Development of educational infrastructure using the Internet.  
Countermeasures for the outflow of talents.                                                                                                                                       |                                                                                                  |
| The Philippines | Researcher and expert training (nurturing MS and PhD holders, if introducing NPP)  
School teacher training (Nuclear energy education, and exchanges of high school teachers) | Development of training courses (Re-use in agricultural, biological, and medical fields, and training in Japan)  
Development of training materials (Cloud chamber, videos, visual materials, and CAI) |                                                                                                                                                                                                                                          |                                                                                                  |
| Thailand    | Instructor training (Social, economic, and political lectures at universities)  
School teacher training | Development of training courses (Using research reactors, creating curriculums, dispatching Japanese lecturers, providing materials and equipment) | License system for radioactive protection managers (Exchanging information, and dispatching Japanese experts)                                                                                                                                  |                                                                                                  |
<table>
<thead>
<tr>
<th>Vietnam</th>
<th>Development of training courses (Reactor engineering, and RI use in agricultural and medical fields)</th>
<th>Countermeasures for the outflow of trained people (brain drain)</th>
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</thead>
<tbody>
<tr>
<td>Leader training (administrative officers, project leaders, etc.)</td>
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<tr>
<td>Researcher and professor training</td>
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<td>Instructor training</td>
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<tr>
<td>Training of legislative and bureaucratic officials</td>
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<td>Australia</td>
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</table>

(Materials on the social and economic aspects of nuclear energy utilization)
<table>
<thead>
<tr>
<th>Master schedule of FNCA</th>
<th>FY1999</th>
<th>FY2000</th>
<th>FY2001</th>
<th>FY2002</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st CRD</td>
<td>1st Forum (Nov.) (Thailand)</td>
<td>2nd Forum (Japan)</td>
<td>3rd Forum (Place: to be determined)</td>
<td>4th CRD</td>
<td></td>
</tr>
<tr>
<td>Promotion of mutual recognition on the present status, problems and needs in each country</td>
<td>2nd CRD</td>
<td>3rd CRD</td>
<td>3rd Forum (Place: to be determined)</td>
<td>4th CRD</td>
<td></td>
</tr>
<tr>
<td>Development of medium-long term target and 3-year schedule for FY2000–2002</td>
<td>-Clarification of mutual recognition on the present status and needs in each country</td>
<td>-Development of basic policy of mutual support procedures</td>
<td>-Evaluation for the achievements in 3 years, revision of the medium-long term targets</td>
<td>-Development of 3-year schedule for FY2003–2005</td>
<td></td>
</tr>
<tr>
<td>Annual target</td>
<td>-Report of present status, problems and needs in Member Countries (MCs)</td>
<td>-Information exchange and proposal for problems and needs in MCs</td>
<td>-Report of present status, additional problems and needs</td>
<td>-Information exchange and proposal for problems and needs in MCs</td>
<td></td>
</tr>
<tr>
<td>On-workshop activities</td>
<td>1st Seminar (Japan)</td>
<td>2nd Seminar (Japan)</td>
<td>3rd Seminar (Place: to be determined)</td>
<td>4th Seminar (Place: to be determined)</td>
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<tr>
<td>General Presentation</td>
<td>-Report of present status, problems and needs in MCs</td>
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<td></td>
</tr>
<tr>
<td>Round Table Discussion</td>
<td>-Information exchange and proposal for problems and needs in MCs</td>
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</tr>
<tr>
<td>-Guideline on mutual support*</td>
<td>-Medium-long term targets</td>
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<tr>
<td>-3-year plan</td>
<td>-Annual action plan</td>
<td>-Annual action plan</td>
<td>-Annual action plan</td>
<td>-Annual action plan</td>
<td></td>
</tr>
<tr>
<td>-Annual action plan* (unresolved items)</td>
<td>-Promotion of mutual recognition for needs and discussion for mutual support procedures</td>
<td>-Promotion of mutual support activities and adjustment of mutual support procedures for needs</td>
<td>-Promotion of mutual support activities and adjustment of mutual support procedures for needs</td>
<td>-Promotion of mutual support activities and adjustment of mutual support procedures for needs</td>
<td></td>
</tr>
<tr>
<td>Off-workshop activities</td>
<td>-Execution of annual action plan</td>
<td>-Execution of annual action plan</td>
<td>-Execution of annual action plan</td>
<td>-Execution of annual action plan</td>
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<tr>
<td>Seminar style will be kept.</td>
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<tr>
<td>Future sub.: Network, etc</td>
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</table>

Table 2 Three-Year Plan (FY2000–2002) of the Project on Human Resource Development

Decided on November 26, 1999 and rearranged on February 10, 2000
Review and Scope of the Workshop on Human Resources Development in the Nuclear Field

Yasushi Seki
Nuclear Technology and Education Center
Japan Atomic Energy Research Institute

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
Activities to Date in the Project for Human Resources Development (HRD)

First Seminar on HRD in Nuclear Field (Tokyo, November, 1999)

1) Status of HRD in each country presented
2) HRD Needs identified and summarized (Table 1)
3) Confirmed mutual support in the future to meet HRD needs
4) Determined medium to long term target and 2000-2002 three year plan
5) FY1999 activities published as JAERI-Conf 2000-014

Table 1 Needs on HRD in Participating Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Training type</th>
<th>Training techniques development issues</th>
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<td>1. Development of training techniques on NPP operation management</td>
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<td></td>
<td>technology for radioisotope product</td>
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<td></td>
<td></td>
<td>Training NPP full-scale simulator teacher</td>
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</tr>
<tr>
<td>South</td>
<td>Development of training materials (Exchanging</td>
<td>(Exchanging materials and creating common textbooks)</td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>materials and creating common text books)</td>
<td>Development of training techniques (Exchanging information on training</td>
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<td>courses, mutually visiting training facilities, organizing seminars,</td>
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<td></td>
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<td>and exchanging experts)</td>
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<td></td>
<td></td>
<td>Development of computer-based training techniques (Multi-media)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 1 Needs on HRD in Participating Countries (cont’d)

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<thead>
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<td><strong>Leader training</strong>&lt;br&gt;Researcher and&lt;br&gt;expert training&lt;br&gt;(Training young&lt;br&gt;engineers and&lt;br&gt;trouble-shooters)&lt;br&gt;Instructor training</td>
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<tr>
<td>Malaysia</td>
<td><strong>Instructor training</strong></td>
<td>Development of training materials (visual materials and CAI)&lt;br&gt;Development of computer-based training techniques (Gathering information on the Internet, holding virtual forums, providing technological knowledge, and providing training materials)</td>
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<td>Thailand</td>
<td><strong>Instructor training</strong>&lt;br&gt;(Social, economic, and political lectures at universities)&lt;br&gt;School teacher training (Materials on the social and economic aspects of nuclear energy utilization)</td>
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</tr>
<tr>
<td>Vietnam</td>
<td><strong>Leader training</strong>&lt;br&gt;(administrative officers, project leaders, etc.)&lt;br&gt;Researcher and professor training&lt;br&gt;Instructor training&lt;br&gt;Training of legislative and bureaucratic officials</td>
<td>Development of training courses (Reactor engineering, and RI use in agricultural and medical fields)&lt;br&gt;Development of training materials and techniques</td>
<td>Countermeasures for the outflow of trained people (brain drain)</td>
</tr>
</tbody>
</table>
Guidelines on HRD mutual support

-Carry out mutual support in conformity with requests of receiving countries; Proposals from any country welcomed.

-Avoid duplication of support activities with those by the IAEA and other organizations

-Carry out practically achievable mutual support in the Project, while more costly support be proposed as items of need

-Report activities and results of mutual support at the Seminars/Workshop.

Medium-to-Long Term Target for Cooperative activities

Extract and classify problems and needs on the human resources development

Discuss effective procedures of mutual support
### 2000-2002 Three Year Plan

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>10 th ICNCA</td>
<td>1 st CRD</td>
<td>Nov. 1 st Forum (Thailand)</td>
<td>2 nd Forum (Japan)</td>
<td>3 rd Forum (Japan)</td>
<td>4 th CRD</td>
<td></td>
</tr>
</tbody>
</table>

#### SEMINAR ON H.R.D. Target
- Promoting mutual recognition on the present status, problems and needs in each country
- Developing medium-long term target and 3-year schedule for Y2000-2002

#### General Presentation
- Report of present status, problems and needs in Member Countries
- Extraction and classification of needs

#### Round Table Discussion
- Guideline on regional mutual support
- Annual action plan
- Medium-long term targets and 3-year schedule
- Report of present status, problems and needs in Member Countries
- Information exchange & proposal for problems & needs in Member Countries
- Promotion of mutual recognition for needs and discussion for mutual support procedures
- Annual action plan
- Report of mutual support activities and adjustment of mutual support procedures for needs
- Annual action plan

#### FUTURE SUBJECTS
Network, etc.

---

**Scope of this workshop**

1) Present HRD status and needs in each country
2) Revise and prioritize HRD Needs Table
3) Agree on mutual support to meet HRD needs
4) Discuss Japanese proposal at FNCA

FY2000 activities to be published as JAERI-Review Report
1.4 Presentation Session (Country Report)
"Specification of Needs on Human Development in the Nuclear Field"
1.4.1 The Needs of Human Resources on Nuclear Power and Nuclear Technology Application in China

YANG Yinghuang and YANG Lin
China National Nuclear Corporation
The 2nd HRD Workshop
November 27, 2000
Tokai, JAPAN

The proposals for mapping out the 10th Five-Year Plan were approved on October 11, 2000 in China. It is said that the following 5 to 10 years is an important period for the economic and social development of China, and is also an important period for the opening-up policy. As the economic and social development sets a large training needs of professionals on various subjects, developing human resources and educational undertakings becomes one of the top ten assignments during the 10th Five-Year Plan.

The construction of nuclear power of China, which started in early 1980s, has stepped into a small-batch production period. The basic policy of China electricity power construction is moderately developing nuclear power. To develop nuclear power, we should carry on the policy of “mainly relying on our own while pursuing foreign cooperation”, focusing on the promotion of nuclear power localization. Human resources is a basic element to reach this target, which enforce us to put emphasis on the development and training of professionals and senior management personnel in the field of nuclear power.

As a country with a large population, the application of nuclear technology has a promising future in China, especially in learning advanced technologies and experiences from foreign countries, developing and promoting the application of nuclear technology in industry, agriculture, medical science, etc. We should attach importance to the development of professionals, which is a key to the success of our nuclear cause.

The 1st Asia Nuclear Human Resources Development Conference held in Tokyo on November of 1999 was a good beginning to accelerate the peaceful uses of nuclear energy in Asia, which was also a good chance for the exchange and cooperation between Asian countries. Follows are brief introduction to the needs of nuclear professionals in China, and expectations of China nuclear power development in the 21st century.

Four chapters are as follows:

I. China’s Nuclear Power Development in the 21st Century
II. The Needs of Human Resources in Nuclear Fields
III. Giving Precedence to the Needs of Human Resources
IV. The Infrastructure for Personnel Training in China
I. China’s Nuclear Power Development in the 21st Century

1. Nuclear Power Strategies and Technical Route of China

"Moderately developing nuclear power" has always been the basic principle for electric power construction in China.

Subject to the centralized leadership and overall planning, “safety first and quality first” is consistently adhered to in nuclear power construction. The policy of “mainly relying on our own while pursuing foreign cooperation” is strongly upheld to promote localization and standardization.

Recently, 1000 MW-grade PWR unit with 300MW capacity for each of the three loops has been chosen as the main reactor type to be developed in China, aiming at raising the level of standardization, serialization and localization. Advanced reactor technology characterized by passive safety will be actively followed and developed.

2. Construction of 1000 MW-grade PWR unit in China

The main business of CNNC involves in developing nuclear power and nuclear fuel industry. CNNC is capable for R&D, design and operation of nuclear power, and production of nuclear fuels. In August 1999, the thought of “unification of reactor types and promotion of localization” was put forward, and CNP 1000 design scheme was formally recommended to the state and owners.

3. Active R&D on new techniques for nuclear power

While actively promoting nuclear power localization, CNNC also devotes its efforts to R&D of new techniques for nuclear power, following the tracks of world latest development of nuclear power techniques for the purpose of laying a sound foundation for future development of nuclear power in China.

China has a fairly complete system of reactor research facilities, research institutes and engineering design institutes. Focusing on nuclear power and its sustained development, nuclear power engineering research, design, testing and operation of reactors.

4. Developing nuclear fuel industry to guarantee nuclear power development

In recent years, China has achieved great progress in nuclear fuel industry, following the policy “self-reliance in nuclear fuel supply”. With localization and serialization achieved in the manufacture of nuclear fuel assemblies, China can independently produce fuel assemblies to support 300, 600 and 900 MW PWRs. The quality of fuel assemblies produced for Qinshan and Daya Bay NPPs meets the level of the like-kind products available from the world market. A production line of nuclear fuel assemblies for heavy water NPP is now under construction. In the meantime, it is planned to construct a complete fuel production plant for Tianwan NPP.
5. Major problems to be tackled with during the nuclear power development in China

☐ Safety and economics are the decisive factors in future development of nuclear power.
☐ National long-term planning is of great importance to nuclear power development
☐ Dissemination of public information on nuclear power shall be enhanced to create a favorable environment for nuclear power development.
☐ Correct understanding of competitiveness of the nuclear power
☐ Expectation of foreign involvement in the localization of nuclear power in China

II. The Needs of Human Resources in Nuclear Fields

1. Design of NPP

1.1 The design of all-digital I&C system of NPP
☐ Man-factor engineering design, and operator supporting system in the main control room (intelligence alarm system, development and application of computerized operation regulations)

Form: training and on-job training
Entities: Beijing Institute of Nuclear Engineering, and Mitsubishi Corp., Ltd.

1.2 Seismic calculation for nuclear island
☐ Seismic analysis method for primary system piping and components
☐ Research and application of earthquake resistance and isolation techniques

Form: on-job training, and technical exchange
Entities: Beijing Institute of Nuclear Engineering, and Mitsubishi Corp., Ltd.

1.3 Heavy water reactor core fuel management
☐ Calculation software system
☐ Design technique for natural uranium fuel cycle
☐ Design technique for slightly enriched uranium fuel cycle
☐ Design technique for DUPIC fuel cycle
☐ Safety margin for routine operation

Form: technical exchange and cooperation, on-job training, lecture, introduction of software
Entities: Shanghai Nuclear Energy Research and Design Institute, and Korean Atomic Energy Research Institute

2. Nuclear facility Decommissioning, and Radioactive Wastes Treatment Technology

2.1 Nuclear facility decommissioning
☐ Clean and decontamination
☐ Cut-off and removal
☐ Waste recovery

Form: experience exchange, cooperation, on-job training, and lecture
Entities: Beijing Institute of Nuclear Engineering, JNC, and JAERI
2.2 Conditioning of LL and ML Radioactive Wastes
  □ Cementation
  □ Asphalt-based solidification
Form: on-job training, lecture
Entities: Beijing Institute of Nuclear Engineering, JNC, JAERI, and KAERI

3. Radioisotope Production and Nuclear Technology Application
3.1 Production technique of medical radioisotope and radioactive medicines
  □ Production technique of medical radioisotope and radioactive medicines
  □ Production technique of I-125 circle
Form: training
Entities: China Nuclear Power Research Institute, ANSTO, and BATAN

3.2 RIA and Laboratory Management
  □ The extraction and purification techniques for raw materials and preparations during RIA analysis, esp. the preparation technique for monoclonal antibody
  □ Advanced management for RIA center
Form: short-term training
Entities: China Nuclear Power Research Institute, China Isotope Corporation
Thailand National RIA Center

3.3 Assessment of Soil Erosion and Sediment Production in various agricultural Landscape using Environmental Radionuclides
  □ Standardizing the procedures of $^{137}$Cs field sampling in soils and sediments and measurement;
  □ Calibrating the relationships between $^{137}$Cs data and soil erosion rates and identifying the sediment sources;
  □ Obtaining reliable information on spatial patterns of soil erosion and sediment delivery in various agricultural landscapes;
  □ Determining the effective strategies and measures for reducing soil erosion and sediment production with the aim of increasing agricultural productivity and environment protection.
  □ Establishing a fast technique for monitoring soil erosion due to overland flow and wind and related models for assessing restoration of soil fertility in agricultural landscapes.
Entities: Institute for Application of Atomic Energy, CAAS
Japan, Korea

3.4 Using Nuclear Techniques to Study Effective Circle Model of Trace elements in Pasture Ecosystem and Economic Utilization
  □ Establishing the effective circle model of nutrient elements in pasture ecosystem through studying chemical behavior and bio-availability of trace elements in soil-forage-animal system and effect of isotope tracers on livestock weight and quality;
  □ Determining the transfer rates of nutrient elements in soil-forage-animal system for adjusting optimum methods of sustainable utilization of pastures
Entities: Institute for application of Atomic Energy, CAAS
3.5 Study on behaviors and fate of sulfonylurea herbicides in agroecosystem

- By establishing available methods to determine persistence, residues and degradation of sulfonylurea.
- To study the persistence, fate or behaviors of sulfonylurea on ecosystem, quantify the interactions between sulfonylurea and application of other chemicals or other farming practices.
- To study the impacts of sulfonylurea residues on crop growth and yield, the contribution of sulfonylurea leaching to pollution of ground and water and surface water.

Entities: Institute for application of Atomic Energy, CAAS
Thailand, Japan, Korea

III. Giving Precedence to the Needs of Human Resources

The principle of "self-design, -construction, -manufacture, and -operation" shall be adhered to for nuclear power development during the 10th Five-Year Plan and hereafter. In order to meet the above-mentioned requirements, self-design shall prevail over the other three. China has to learn advanced management methods and experience from foreign countries and carry out international cooperation in order to improve the safety, reliability and economics of China's NPP. All-digital I&C system design, decommissioning technology of nuclear facilities, disposal technology of radioactive wastes, radioisotope production and nuclear technology application are the first priorities to be taken into account.

IV. The Infrastructure for Personnel Training in China

- The training center in Qinshan Nuclear Power Base
  The training center is located in Haiyan County of Zhejiang Province. The center includes a training building and three simulators for basic training, re-training for the operators from Qinshan I, II, III nuclear plants.
  - A full-scale simulator for the Qinshan I 300 MW PWR plant in operation
  - A full-scale simulator for the Qinshan II 600 MW PWR plant in installing
  - A full-scale simulator for the Qinshan III 700 MW CANDU plant in construction
- Nuclear Training Center
  It is located in Beijing suburb, with a comprehensive building (include a library), computer laboratory, language teaching room, multimedia teaching room, dormitory and dining hall. A lecture hall is under construction at present.
- The Graduate School of Nuclear Industry
  Founded in 1985, the school is equipped with a teaching building, language teaching room, computer-aided teaching system, a multi-channel radio broadcasting station, compute center, dormitory and dinning hall. Elementary training course was run for 12 times, English training course 14 times. A total of 934 domestic persons were trained in the past years.

China takes part in international cooperation and training programs, such as STA of Japan, IAEA and
other bilateral science and technology exchange programs. Young people in the nuclear field are growing by the international programs. We believe the workshop will produce impart to the development of human resources in Asia. China shall spare no chances to advance the peaceful utilization of nuclear technologies in the world.
THE 2\textsuperscript{ND} SEMINAR ON HRD IN NUCLEAR FIELD
THE FORUM FOR NUCLEAR COOPERATION
IN ASIA (FNCA)

November  27 – 30, Tokai, Japan

1.4.2  HUMAN RESOURCE DEVELOPMENT IN NUCLEAR FIELD
SPECIFICATION OF NEEDS

By

JENI RUSLAN
SUDARMADI

NATIONAL NUCLEAR ENERGY AGENCY
OF INDONESIA
(BATAN)
Human Resource Development  
Specification of Needs  

Presented by  
Jeni Ruslan\textsuperscript{1} and Sudarmadi\textsuperscript{2}  

I. Introduction  

Manpower development for Nuclear Science and Technology Program need to be taken carefully due to the unique safety and reliability requirements as well as the national responsibilities. Endeavor to increase this manpower development, one of BATAN's Vision is: To lay down a strong foundation of a nuclear safety philosophy, and to implement this philosophy in applying nuclear science and technology.  

In order to do this BATAN believes that R and D on nuclear science and technology is a must and human resources in this respect must be increase. These resources must be highly qualified, properly motivated and essential to a comprehensive manpower development program. As we understand the development of manpower, especially highly qualified manpower for nuclear science and technology program is a long-term activity.  

We welcome the first seminar held last year as a forum for exchange of information, discussed and identified several very important topics concern with Human Resource Development (HRD), \textit{i.e.}: Leader Training, Researcher and Expert Training. In this presentation I would like to differentiate this topic much further, in the hope that a concrete program for training HRD in nuclear fields could be implemented and benefited by all participants needing such training.  

\textsuperscript{1} Director Bureau for Manpower  
\textsuperscript{2} Head of Training and Education Centre
II. Training Type

As mention in the introduction we will try to elaborate the various training that much concern all of us.

1. Leader Training

As the application of nuclear science and technology is to emphasize the direct application in the industry especially those which contribute mainly to the basic human need, the empowerment of senior research manager should be given priority to gain the knowledge and experience on how an industrial country sets her strategy in bringing the nuclear science into market friendly technology. The demand that a senior manager or research manager be able to translate the organization's goals into reality while at the same time fostering research cooperation domestically and internationally and developing subordinates into effective and efficient staff is an urgent matter. They have to be able to function the human resource management system in their research area in such a way that it gives added value to the organization. Benefit received from the program are the improvement of effective communication skills to deal with public interests in nuclear technology and its application and to be acquainted with a number of exemplary systems and procedures supporting the implementation of the human resources management function.

There are several things to be considered in leader training:

1. Leader training should be able to accommodate the diverse activities of the research; therefore it should be able to accommodate a large number of participants.

2. Discussions should be stressed on the strategic of technology transfer implementation in which participants diagnose current
problems and future challenges to be met through the training and development.

2. Participants should learn the Japanese experience in fostering research cooperation between research institutes and the industry.

Table 1. shows several training related to infrastructure development conducted in the past.

**Figure 1. Diagram of Training Co-ordination**

![Diagram of Training Co-ordination]

**2. Instructor Training**

While research and development experts training are focused on individual enrichment in the expertise area, instructor training is
focused on the knowledge and experimental enrichment of the trainer in delivering their knowledge in class or during experiments. Training has to be conducted in order to design and employ a solid foundation capable to develop and maintain continuous growth in providing qualified manpower. To do so, Instructor Training should also result in presenting related material to be delivered in research and development expert training.

The instructor training content is shaped by training needs assessment conducted during leader training. The objective of the instructor training is to teach the participant specific skills and knowledge.

3. Research and Development Expert Training

Domestic and overseas training is the major effort to fulfill the need of professional level manpower. The limiting opportunity to gain knowledge and experience overseas requires the nuclear program to provide a better training program domestically. The area of training should cover research and development that have more direct impact to the community will become a priority in the coming years.

The area of training mainly should cover the following issues:

1. Development of the Technological for Operation and Maintenance Research Reactor.
2. Development of Nuclear Safety System
3. Development of a Long Term Energy Program
4. Development of Nuclear Fuel Technologies

Title, curricula and syllabi of training to support the above issues will be diagnosed during the leader meeting.
Table 1. Tentative Training for Research and Development Expert

<table>
<thead>
<tr>
<th>No</th>
<th>Infrastructure Development Issues</th>
<th>Tentative Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Technological for Operation and Maintenance Research Reactor</td>
<td>Training for Reactor Supervisor and Operator (Safeguard)</td>
</tr>
<tr>
<td>2</td>
<td>Nuclear Safety System</td>
<td>Radiation Protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Probabilistic Safety Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nuclear Emergency and Preparedness</td>
</tr>
<tr>
<td>3</td>
<td>Long Term Energy Program</td>
<td>Introduction to Energy Planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power Reactor Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nuclear Power Plant Siting</td>
</tr>
<tr>
<td>4</td>
<td>Nuclear Fuel Technologies</td>
<td>Research Reactor Fuel Element Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fuel Element Cycle</td>
</tr>
</tbody>
</table>

III. Training Techniques Development Issues

In selecting training techniques, we propose:

1. "On-the-job" Techniques
Trainee receives job instruction directly on the job. Then the trainer demonstrates the job to give the trainee a model to copy. After that the trainee is allowed to imitate the trainer's example. Demonstration by the trainer and practice by the trainee are repeated until the job is mastered.

2. "Off-the-job" Techniques
Lecture and other Off-the-job techniques tend to rely more heavily on communications than on modeling. Participation, feedback, transference and repetition expected from the participants are often low. Therefore, we encourage the use of satellite communication to bring courses into the work site, particularly in engineering and other technical fields.
The 2nd Seminar on HRD in Nuclear Field
# Specification of needs #

By:
Jeni Ruslan & Sudarmadi
National Nuclear Energy Agency of Indonesia

Introduction

• Endeavor to increase manpower development, one of Batan’s Vision:
• To lay down a strong foundation of a nuclear safety philosophy, and to implement this philosophy in applying nuclear science and technology
Batan believes that R and D on nuclear science and technology is a must and human resources in this respect must be increased.

As we understand the development of manpower, especially highly qualified manpower for nuclear science and technology program is a long term activity.

**Training Type**

1. Leader Training, the empowerment of senior research manager should be given priority.

2. Instructor Training, to design and employ a solid foundation capable to develop & maintain continuous growth in providing qualified manpower.

Figure 1. Diagram of Training Co-ordination

Table 1. Tentative Training for Research and Development Expert

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<td>Technological for Operation and Maintenance Research Reactor</td>
<td>Training for Reactor Supervisor and Operator (Safeguard)</td>
</tr>
<tr>
<td>3</td>
<td>Long Term Energy Program</td>
<td>Introduction to Energy Planning, Power Reactor Technology, Nuclear Power Plant Siting</td>
</tr>
<tr>
<td>4</td>
<td>Nuclear Fuel Technologies</td>
<td>Research Reactor Fuel Element Technology, Fuel Element Cycle</td>
</tr>
</tbody>
</table>
The area of training mainly should cover the following issues:

- Development of the technological for O/M Research Reactor
- Dev. Of Nuclear Safety System
- Dev. Of a long term Energy Program
- Dev. Of Nuclear Fuel Technologies

Training Techniques Dev. Issues

- "On the job" techniques
- "Off the job" techniques
- Visiting training facilities
Table 2. Training Techniques Development Issues

<table>
<thead>
<tr>
<th>Training Type</th>
<th>Training Techniques</th>
<th>Estimated No. of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leader Training</td>
<td>Off the job</td>
<td>30</td>
</tr>
<tr>
<td>Instructors Training</td>
<td>On the job</td>
<td>10</td>
</tr>
<tr>
<td>Research and Development Expert Training</td>
<td>Off the job</td>
<td>120</td>
</tr>
</tbody>
</table>

Infrastructure Development Issues

- Establishment of HRD Program, will ensure an efficient & Effective ETA
- Establishment of facilities, to be upgraded to fit the training
- Establishment of ETA Program, Quality of trainers & facilities are the most important
Exchange of Information

- Providing & exchanging experiences for the development of training material such as;
- Textbooks & handout, Films, Slides and Computer aided instructions
1.4.3 Specification of Needs for Human Resources Development in the Nuclear Field in Korea

Young-Myung Choi, Eui-Jin Lee
Nuclear Training Center
Korea Atomic Energy Research Institute

The 2nd Workshop on Human Resources Development in the Nuclear Field
27-30 November 2000, Tokai, Japan

1. Introduction

In order to contribute to the improvement of the public's living standard and the growth of social welfare, and to strive for the prevention of disaster from radiation, as well as the safety of the public, the Korean Atomic Energy Act was put into force in 1958. In the mean time, the government established the Office of Atomic Energy as the administrative agency and the Atomic Energy Research Institute for research and development in 1959. With the promulgation of the Atomic Energy Act and the establishment of the government organization on research and development, the government policy focused on education and training programs for obtaining the qualified nuclear personnel who would play an important role in the development of nuclear energy utilization in the future. During the period of 1958-1962, the government sent about 200 scientists and engineers abroad for nuclear education and training. However, these trained scientists and engineers were unable to work on research and development activities after their return home due to poor research environments and lack of nuclear-related projects. Therefore, many nuclear personnel trained abroad were forced to move to advanced countries, the phenomenon of 'brain drain'. This 'brain drain' phenomenon continued until the mid 1970's.

When the government started construction of the first nuclear power plant in the 1970's, the training of nuclear personnel became issue of utmost important so that the Nuclear Training Center of the Korea Atomic Energy Research Institute was charged with the training of field engineers and managerial staff. During the late 1970's and early 1980's, a number of trained scientists and engineers who had moved to advanced countries due to brain drain began to return home. In the mid 1980's, Korea was able to start a self-reliance program on nuclear power development because there were qualified nuclear personnel. In the mean time, all of the domestic nuclear energy related organizations such as the utility, the regulatory body, the research institute, the A/E company, the manufacturers, the nuclear fuel company, and others were mainly focused on the acquisition of technology and human resource development under the support of government policy. In view of results so far achieved, it is believed that nuclear human resource development is desirable for discussion with direct involvement in the national nuclear energy development project.
Through many revisions in Korean Atomic Energy Laws and Regulations since the 1960’s, the technical qualifications of radiation workers and licensees in the field of radioisotope utilization, nuclear fuel material handling, and reactor operation were described in laws and regulations connected with requirements of education and training. Figure 1 shows that 23,025 persons are engaged as radiation workers in various nuclear related organizations in Korea as of August 2000\(^1\). Figure 2 shows that 1,571 organizations have achieved a license for using radioisotopes and radiation generators from the Ministry of Science and Technology as of August 2000\(^1\). Figure 3 also shows the number of licensees in the field of reactor operator/senior reactor operator, nuclear fuel material handler/senior nuclear fuel material handler, and radiation handler/radiation handling supervisor/radiation handler in medical use as of August 2000.

2. Specification of Needs

According to Figure 4, which shows the annual change in the number of users of radioisotopes and radiation generators, it is expected that such users will increase gradually with the development of national infrastructure and economic growth\(^1\). 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.

The Nuclear Training Center of KAERI, which is a corporate body sponsored by the government, annually offers specialized nuclear training courses for the national nuclear continuous training and retraining programs to about 1,000-1,200 engineers and technicians from nuclear industries, utility, regulatory body, and other organizations. The Center also offers annually not only internal training programs such as new technology courses, computer courses, language courses, and management courses to about 1,000 R & D staff, but also international training programs to about 100 participants from IAEA/RCA member countries in Asia and the Pacific. The Center is closely related to the research reactor experiment courses of six universities. The Center annually offers the research reactor experiment courses to about 150 students from six universities under the financial support of the government. The Nuclear Power Education Center of KEPCO has been operated as an in-house training center for reactor operators, maintenance crew and construction management staff since 1978. The Center annually offers initial and continuous training programs to about 3,500 of their technological and managerial staff.

These education and training organizations have contributed significantly to upgrading the capability of technical manpower in the nuclear sector. As nuclear power projects and nuclear R & D projects as well as the number of radioisotope users gradually increase, it is anticipated that nuclear personnel including radiation workers will increase upon the industries’ demand. In order to maintain the acquired nuclear technologies and to absorb the new technologies, the existing nuclear training programs should be

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\(^1\) : Statistics on Radiation Practices in Korea, September 2000, Ministry of Science and Technology, Korea radiation Association
continually revised according to the training needs occurring from environmental changes such as the application of new technologies, revision of laws and regulations, introduction of new projects, and others.

The following are the specification of needs for human resources development in the nuclear field.

1) Exchange of training course curricula in the field of radioisotope utilization courses, nuclear power and safety related training courses:
   - In order to update the existing training program, activities on improvement and development of specialized training courses should continue according to technology changes.

2) Exchange of training content and equipment descriptions in the field of research reactor experiment training courses for university students:
   - It is believed that every FNCA member country has a training program in the field of research reactor experiment for university students. The advanced training programs will be very useful for member countries to update their training programs.

3) Exchange of experts who have experience in human resources development, and exchange of lecturers upon the request of member countries:
   - Techniques concerning manpower planning, planning of educational infrastructure development, adoption of systematic approaches to training, planning and implementation of training program development will be very useful in promoting national human resource development.

4) Exchange of group training course visits to nuclear facilities for young nuclear executives:
   - Providing group training program visits for young nuclear executives who will be high-level nuclear decision-makers in the national nuclear organizations will contribute to the planning and implementation of future nuclear energy development programs in member countries.

5) Mutual cooperation projects such as establishment of cyber-learning system and development of multi-media training materials:
   - It is suggested to create an FNCA electric network of human resource development, e.g. connection of the FNCA human resource development homepage with the nuclear training center homepages of every member country. Furthermore, it is expected that a cyber system using information and communication technology will make it possible to introduce learning programs as a supplement to the existing nuclear training programs of member countries.

3. Exchange of Information

In order to promote the exchange of technical information and to share their experience among the IAEA/RCA member countries, the Nuclear Training Center of KAERI has hosted 7 IAEA/RCA training courses/workshops this year. About 100 participants from 13 member countries have attended the following IAEA/RCA training courses/workshops;

- IAEA/RCA Workshop for National Coordinators in Energy & Planning(6-10 March)
- IAEA/RCA Training Course on Digital Industrial Radiography (22 May-2 June)
- IAEA/RCA Workshop on the Role of Nuclear Power as a possible CDM (Clean Development
Mechanism) (26 June-7 July)
- 2000 Workshop on IAEA Safeguards (9-15 August)
- IAEA/RCA Workshop on Radio Tracers for Efficiency Testing of Water Treatment Plants (18-29 September)
- IAEA/RCA Training Course on Thermal Hydraulic Analyses of Research Reactor (16-27 October)
- IAEA/KOICA Training Course on Nuclear Power Reactor Technology (2-22 November)

As a result of the joint project between KAERI and IAEA to develop training course curricula which was implemented from August 1999 to October 2000, the Nuclear Training Center of KAERI has developed two kinds of curricula with different levels and duration. One is a one-week training workshop for high level decision-makers. The other is a two-week training course for nuclear policy decision-makers and planners who will severely consider introducing a first or new nuclear power project. The English version of textbook that was prepared by Korean experts will be printed by the beginning of next year.

This year the Nuclear Training Center of KAERI has proposed to the IAEA the development of cyber learning and training programs in nuclear technology in Asia and the Pacific Region. For project formulation an IAEA-organized small group meeting will be held at the Center in the coming December.

The Center started to construct an International Nuclear Training Center Building with a dormitory for foreign participants in October this year. The Building is scheduled to be completed by the end of October 2001.

Following training course curricula and textbooks (English version) conducted at the NuTEC and RI school of JAERI, and other training organizations in Japan could be useful for us to improve and develop our existing training programs.

- PA training curricula and textbooks for publics, middle-school teachers, primary and middle-school students
- Safety culture training curricula and textbooks for nuclear power plant personnel and radioisotope users
- Training curricula and textbooks for the training course on decommissioning and decontamination of nuclear facilities
- Training curricula and textbooks for research reactor experiment courses for university students
- Training curricula and textbooks for radiation protection and radioisotope utilization.
- Training curricula and textbooks for nuclear power and safety related technology.

4. Others

According to the national long-term nuclear power development program, the national power utility, KEPCO (Korea Electric Power Corporation), decided on two new nuclear power plants on August 2000. Two new units (to be known as new Kori-1 and Kori-2) will be the 7th and 8th to be constructed using the Korean Standard Nuclear Power Plant design (1,000 MW each). New Kori-1 and Kori-2 will be the 21st
and 22nd Korean Nuclear Power Units respectively, and construction will be completed by the year 2009. There are currently 16 nuclear power plants in operation in Korea; four each at the Yonggwang, Kori, Ulsan and Wolsong sites. Four more are under construction; Yonggwang-5 and Yonggwang-6 scheduled for completion in 2002, and Ulsan-5 and Ulsan-6 due to start up in 2004 and 2005 respectively. Table 1 shows status of nuclear power plant in operation and under construction in Korea.

References

1) Statistics on Radiation Practices in Korea, September 2000, Ministry of Science and Technology, Korea Radioisotope Association
2) The Nuclear Yearbook 2000 in Korea, Korea Atomic Industrial Forum, Inc.
Figure 1. The Number of Radiation Workers Engaged in Organizations as of August 2000.

Figure 2. The Number of Licensed Organizations of Using Radioisotopes and Radiation Generators
Figure 3. The Number of Licensees Who are Responsible Persons in Nuclear Related Organizations as of August 2000.
Figure 4. Annual Change in the Number of Users in Radiation Radioisotopes and Radiation
Table 1. Status of Nuclear Power Plant in Operation and under Construction in Korea

<table>
<thead>
<tr>
<th>No</th>
<th>Unit No.</th>
<th>Reactor Type</th>
<th>Gross Cap. (MWe)</th>
<th>Supplier</th>
<th>Date of Synchro.</th>
<th>Contract Form</th>
</tr>
</thead>
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<tr>
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<td>NSSS</td>
<td>T/G</td>
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<tr>
<td>1</td>
<td>Kori #1</td>
<td>PWR</td>
<td>587</td>
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Specification of Needs for Human Resources Development in the Nuclear Field in Korea

26-29 Nov. 2000, Tokai, Japan

Young-Myung Choi, Eui-Jin Lee

Nuclear Training Center
Korea Atomic Energy Research Institute
P.O. Box 105, Yusong, Taejon, ROK

Contents

☐ Introduction
☐ Specification of needs
☐ Exchange of Information
☐ Others
1. Introduction

- **Korean Atomic Energy Act was put into force in 1958**
  - In order to contribute to the improvement of the public’s living standard and the growth of social welfare and
  - to strive for the prevention of disaster from radiation, as well as the safety of the public.

- **Government organization was established in 1959**
  - Office of Atomic Energy as the administrative agency.
    - Now a day, it was changed to Atomic Energy Bureau of MOST.
  - Korea Atomic Energy Research Institute for R & D

- **‘Brain drain’ phenomenon continued until the mid 1970s**
  - During 1958-1962, about 200 scientists and engineers were sent to abroad for nuclear education and training.
  - Because of poor research environments and lack of nuclear R&D project, they are forced to move to advanced countries.

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- **Construction of the nuclear power plant was started in the 1970s**
  - Nuclear Training Center of the KAERI was charged with the training of field engineers and managerial staff.
  - A number of trained scientists and engineers who had moved to advanced countries due to brain drain began to return home.

- **In the mid 1980s, Korea could start a self-reliance program on nuclear power development**
  - Because there were qualified nuclear personnel
  - The technical qualifications were reinforced in the laws and regulations in connection with education and training for radiation workers and licensees.

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Nuclear human resource development is desirable for discussion with direct involvement in the national nuclear energy development project.

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NTC/KAERI
The Number of Radiation Workers as of Aug. 2000

Sales Firms (249) 1%
Research Institutes (1,907) 8%
Hospitals and Clinics (2,133) 9%
Educational Organizations (2,350) 10%
NDT Firms (2,930) 13%
Public Organizations (160) 1%
Utility (8,396) 37%
Industrial Firms (4,900) 22%

Total: 23,025 Persons

The Number of Licensed Organizations (Aug. 2000)

Sales Firms (29) 2%
NDT Firms (36) 2%
Hospitals & Clinics (120) 8%
Educational Organizations (181) 12%
Research Institutions (201) 13%
Public Organizations (218) 14%
Others (11) 1%
Industrial Firms (775) 48%

Total: 1,571 Organizations
2. Specification of Needs

- Annual change in the number of RI users:
  - Users of radioisotopes and radiation generators will increase gradually with the development of national infrastructure and economic growth.
These education and training organizations have contributed significantly to upgrading the capability of technical manpower in the nuclear sector.

As nuclear power projects and nuclear R & D projects as well as the number of radioisotope users gradually increase, it is anticipated that nuclear personnel including radiation workers will increase upon the industries' demand.

In order to maintain the acquired nuclear technologies and to absorb the new technologies, the existing nuclear training programs should be continually revised according to the training needs occurring from environmental changes such as the application of new technologies, revision of laws and regulations, introduction of new projects, and others.
1. Exchange of training course curricula in the field of radioisotope utilization courses, nuclear power and safety related training courses:
   - In order to update the existing training program, activities on improvement and development of specialized training courses should continue according to technology changes.

2. Exchange of training content and equipment descriptions in the field of research reactor experiment training courses for university students:
   - Every FNCA member country has a training program in the field of research reactor experiment for university students.
   - The advanced training programs will be useful for member countries to update their training programs.

3. Exchange of experts who have experience in human resources development, and exchange of lecturers upon the request of member countries:
   - Techniques concerning manpower planning, planning of educational infrastructure development, adoption of systematic approaches to training, planning and implementation of training program development will be useful in promoting national human resource development.

4. Exchange of group training course visits to nuclear facilities for young nuclear executives:
   - Providing group training program visits for young nuclear executives who will be high-level nuclear decision-makers in the national nuclear organizations will contribute to the planning and implementation of future nuclear energy development programs in member countries.

5. Mutual cooperation projects such as establishment of cyber-learning system and development of multi-media training materials:
   - It is suggested to create an FNCA electric network of human resource development, e.g. connection of the FNCA human resource development homepage with the nuclear training center homepages of every member country.
   - Furthermore, it is expected that a cyber system using information and communication technology will make it possible to introduce learning programs as a supplement to the existing nuclear training programs of member countries.
NTC of KAERI has hosted 7 IAEA/RCA training courses/workshops this year

About 100 participants from 13 member countries have attended

<table>
<thead>
<tr>
<th>Date</th>
<th>IAEA/RCA training courses/workshops this year</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 - 10 Mar.</td>
<td>• IAEA/RCA Workshop for National Coordinators in Energy &amp; Planning</td>
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<tr>
<td>22 May - 2 Jun.</td>
<td>• IAEA/RCA Training Course on Digital Industrial Radiography</td>
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<tr>
<td>26 Jun. - 7 Jul.</td>
<td>• IAEA/RCA Workshop on the Role of Nuclear Power as a possible CDM (Clean Development Mechanism)</td>
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<td>9 - 15 Aug.</td>
<td>• 2000 Workshop on IAEA Safeguards</td>
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<td>• IAEA/RCA Workshop on Radio Tracers for Efficiency Testing of Water Treatment Plants</td>
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<td>• IAEA/RCA Training Course on Thermal Hydraulic Analyses of Research Reactor</td>
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<tr>
<td>2 - 22 Nov.</td>
<td>• IAEA/KOICA Training Course on Nuclear Power Reactor Technology</td>
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</table>

As a result of the joint project between KAERI and IAEA to develop training course curricula on nuclear policy and project management, NTC/KAERI has developed two kinds of curricula with different levels and duration.

- These courses will be implemented at NTC/KAERI in 2001.

NTC of KAERI has proposed to the IAEA the development of cyber learning and training programs in nuclear technology in Asia and the Pacific Region:

- For project formulation an IAEA-organized small group meeting will be held at the Center in the coming December.

NTC started to construct an International Nuclear Training Center Building with a dormitory for foreign participants in October this year.
3. Exchange of Information (Continued)

- Following training course curricula and textbooks (English version) conducted at the NuTEC and RI school of JAERI, and other training organizations in Japan could be useful for us to improve and develop our existing training programs.
  - PA training curricula and textbooks for publics, middle-school teachers, primary and middle-school students
  - Safety culture training curricula and textbooks for nuclear power plant personnel and radioisotope users
  - Training curricula and textbooks for the training course on decommissioning and decontamination of nuclear facilities
  - Training curricula and textbooks for research reactor experiment courses for university students
  - Training curricula and textbooks for radiation protection and radioisotope utilization
  - Training curricula and textbooks for nuclear power and safety related technology

4. Others

- According to the national long-term nuclear power development program, the national power utility, KEPCO decided on two new nuclear power plants on August 2000.

- Two new units (to be known as new Kori-1 and Kori-2) will be the 7th and 8th to be constructed using the Korean Standard Nuclear Power Plant design (1,000 MW each).

- New Kori-1 and Kori-2 will be the 21st and 22nd Korean Nuclear Power Units respectively, and construction will be completed by the year 2009.

- There are currently 16 nuclear power plants in operation in Korea; four each at the Yonggwang, Kori, Ulchin and Wolsong sites.

- Four more are under construction; Yonggwang-5 and Yonggwang-6 scheduled for completion in 2002, and Ulchin-5 and Ulchin-6 due to start up in 2004 and 2005 respectively.
### Status of Nuclear Power Plant in Korea

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NTC/KAERI
1.4.4 SPECIFICATION OF NEEDS ON HUMAN RESOURCE DEVELOPMENT IN NUCLEAR TECHNOLOGY IN MALAYSIA

Rapieh Aminuddin, Malaysian Institute for Nuclear Technology Research (MINT)
Ramli Mohd Noor, Science & Technology Division, Ministry of Science Technology & the Environment (MOSTE)

1. Background

Malaysia presented its HRD needs and issues in the first workshop held on 25-26 November 1999. Among these the following were picked up:-

- Public acceptance (PA) of nuclear energy
- Analysis of human resources needed for nuclear power program (NPP)
- Development of educational infrastructure using internet
- Development of computer-based training techniques and computer-aided instruction (CAI) training materials
- Instructor training
- Counter measures for outflow of talents

In the course of the year we reviewed and clarified these needs and issues and made some progress in resolving some of them. We also had the pleasure of receiving an FNCA mission who came to investigate the present status of human resource in the nuclear field in Malaysia.

2. Review of Issues Raised in the 1st Workshop

2.1 PA of nuclear energy

This issue is actually covered under the PA project of FNCA. As Malaysia participates actively in that project it is not necessary to include this issue in this HRD project.

2.2 Analysis of human resources needed for NPP [Soft Infrastructure issue]

Although guidelines for human resource planning for NPP are well documented in the IAEA publications, we can learn much from comparing them with actual experience of countries like China, Korea and of course Japan who have already implemented the plan. However, this need is not urgent for Malaysia in the next 2 – 3 years.

2.3 Development of educational infrastructure using internet [Physical infrastructure development issue]

An education infrastructure using the internet would provide vast opportunity for distance and e-learning for participating countries. E-learning can provide training and education anywhere, anytime and at the learners pace. It eliminates repetitive delivery and the same program can be made available again and again with consistency in accuracy, detail and quality. It can be used to run short courses as well as 1st degree, Masters degree and Phd. programs. Twinning degree programs where two institutions collaborate in running a degree program, are now quite common in Malaysia although they do not necessarily run on virtual basis. Some countries may already have this infrastructure. Through
FNCA we can create an arrangement where training programs in a member country can be made accessible to other member countries. In this way countries can collaborate in fulfilling each other’s needs in the provision of training and education.

This issue was brought up during the FNCA mission to Malaysia. One University, the University Putra Malaysia (UPM) has the infrastructure for learning through the internet already in place and was willing to consider a proposal by FNCA to use its facility.

At MINT, some fund has been allocated in the 8th Malaysia Plan (2001-2005) for the development of infrastructure for e-learning. Probably by year 2002 we would have a training program available on the web.

The education infrastructure using the internet can also provide a platform for virtual forum and dissemination of news and information on training opportunities, training resources, etc. For this to be implemented, in addition to infrastructure provision, the management issue of the system have to be considered. Participating countries need to have facilities to access this system and be prepared to input the required data, information and news.

2.4 Development of computer-based training techniques and CAI training materials (Training technique development issue)

At MINT training materials for our regular courses are already available in the form of lecture notes, text books or power point slides. We would like to transform these course materials into multimedia or CAI for the advantages it provides such as consistency, reduction in manpower use and provision of training at participants’ choice of place, time and speed. Conversion of these materials into CAI requires not only skill but time. Skill for development of CAI is not yet adequate in MINT but training can be acquired locally. However, the process of developing the skill is taking longer than it should because personnel involved have other more important commitments. Another constraint is the time available to do the conversion and development. Consequently the number of CAI that can be produced is limited. Through FNCA it is hoped that some arrangements can be made to accelerate the development of CAI and sharing of CAI that has been developed.

2.5 Instructor Training (Training type issue)

What Malaysia requires here is training of instructors for CAI or multi media instruction. This has been mentioned in 2.4. Hopefully it is not inappropriate to mention here that Malaysia in aspiring to become another center of excellence for education has a variety of training offered in the market including instructor training. We can manage quite well as far as the general instructor training is concerned and gladly assist member countries to have access to this training.

2.6 Counter measures for outflow of talents (Soft infrastructure development issue)

There are many causes of outflow of talents. Two causes will be addressed here - the most common and unavoidable is one due to retirement and the other migration for greener pastures locally or overseas.

MINT will face the retirement of its highly experienced scientist in large batches from year 2006 onwards. The retirement age for Malaysian civil servants is 55 years. Our experience shows that it takes around 10 years to develop a scientist to become highly skilled and 15 to 20 years to become expert. With continuous expansion of activities we are also experiencing a significant shortage of scientist. To resolve the issue on time we have to take immediate action. Realising this we made a
concerted effort involving all levels of management to provide inputs and solutions to make sure that we can sustain our current activities as well as venture into new areas of research.

We started by formulating a 10 year strategic and manpower plan. We envisioned our future, described it and portrayed it graphically. We analyzed the present stock of scientists and presented a scenario of what would happen if nothing is done and proposed the desired scenario. We made a very detailed plan. Samples of these are shown in Figure 1 and Table 1. We held a 3 days workshop and several follow up sessions involving all our senior scientists to do this. The results were nicely compiled and presented to high level meetings and to central agencies. This efforts have begun to show positive results. There are indications that we may get about 90 new posts in year 2001.

Retirement of experienced scientist is a form brain drain. In Malaysia negotiations are under way between workers union and government [represented by the Public Service Department (PSD)] to increase the mandatory retirement age of government servants from 55 to 58 or 60. The government is yet to decide. While this is pending, there is provision to retain the present experts by re-employment of retirees on year-to-year contract basis.

On the issue of migration of our scientists for greener pastures, retention strategies have to be formulated. Apart from providing challenging and meaningful assignments opportunities for upward mobility [promotion] must to be in place. In MINT we have a flexible promotion scheme up to senior scientist level and we are putting up a proposal to extend this to principal scientist level and JUSA C. What this means is that promotion can be exercised whenever a scientist is eligible and does not depend on availability of post. A JUSA C post is the post held by our deputy director general. If this materialise it will be a very attractive career offer.

There is a significant number of excellent Malaysian scientists now working overseas. We regard this as brain drain and a loss to the country. The government is reviewing its policy on expert returnees by providing more attractive salaries, incentives, fringe benefits, seed grants, etc. for them to serve in R&D institutions in Malaysia.

3. NEW ISSUES

Several other issues were identified during the visit of the FNCA mission and during the course of executing of our HRD functions.

3.1 New Issue 1: Specialised Training and Expert (Training type issue)

As MINT progresses and expands its activities, we venture into new technologies and consequently, new training needs and expert services arise. The specification of training and expert services have been prepared but will be provided separately as there is insufficient space to include them here.

3.2 New Issue 2: Recognition of Nuclear Medicine Practitioners (Soft infrastructure issue)

Nuclear medicine practitioners in Malaysia are not considered to be specialists as radiologists, cardiologist, neurologists, etc. are. This, in a way, impedes further progress of nuclear medicine as there is no incentives for young doctors to choose nuclear medicine as their area of specialisation. Malaysia would like to seek the views of FNCA members on this issue.
4. National and Medium Term Strategy for HRM&D in Non Power Applications

Malaysian energy policy still does not include nuclear. As such only HRM&D in non power applications will be addressed.

Malaysia does not have a formalised national policy or strategy on HRM&D in non power application. We operate by using S&T policy, Malaysia Plan, Outline Perspective Plan (OPP), Industrial Master Plan and sectoral policies. So far these policies have been useful and adequate in guiding us in determining strategic directions and formulating strategies and policies. Lately MINT have been asked to take care of the national HRD in Nuclear field. With this added responsibility, it is pertinent that we have a National Nuclear Technology Development Policy and National HRD Policy in Nuclear. We shall be embarking on this very shortly.

5. Role of FNCA to enhance HRD in Member Countries Through Regional Cooperation

By the end of this 2nd workshop, each country would have identified, clarified and prioritised its issues and training needs. Part of the role of FNCA would be to facilitate the consolidation of these issues, identification of common issues and needs and formulation of vision and objectives. As the theme of this program is mutual collaboration, we need to lay down the terms of this collaboration.

We would like to share with this seminar the key elements of smart partnership as practiced by the Commonwealth Partnership for Technology Management (CPTM):

- Fair and equitable outcome for all partners
- Shared vision
- Complimentary of attributes of partners
- Ethical commitment

6. Conclusion

As space does not permit, there are a few more issues that has not been covered in this paper. These will be touched in the presentation. In conclusion, this paper has briefly reviewed and refines our HRD needs and issues explained how we have addressed and resolved some of these issues. We are confident that significant progress will be made in this workshop.
FIGURE 1: REDUCTION DUE TO RETIREMENT, NEW INTAKE AND RESULTANT NUMBER OF RESEARCH OFFICERS

- REDUCTION DUE TO RETIREMENT
- NEW INTAKE
- RESULTANT NUMBER OF RO
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| **TOTAL**       | **102**         | **66**          | **24**          | **25**          | **22**          | **14**          | **7**           | **5**           | **8**           | **52**          | **323**        |
## Training Needs Specification

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<tr>
<td>Medical imaging and technology of data acquisition, image reconstruction and image processing (DICOM)</td>
<td>1 WEEK</td>
<td>2000</td>
<td>HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determination of SR-90 using LSC</td>
<td>1 WEEK</td>
<td>2001</td>
<td>HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement of oil content in soil-water-oil mixture using neutron and microwave technique</td>
<td>1 WEEK</td>
<td>2001</td>
<td>HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gamma green house facility and horticulture</td>
<td>1 WEEK</td>
<td>2001</td>
<td>HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determination of Am, Pu, U and Th using alpha spectrometry system</td>
<td>1 WEEK</td>
<td>2001</td>
<td>HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formulation and design of research approach to isolate regulatory gene sequences for flower color and flower development</td>
<td>2 WEEKS</td>
<td>2001</td>
<td>HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upgrading of design and fabrication of nuclear reactor instrumentation and control system for MINT TRIGA Reactor.</td>
<td>1 WEEK</td>
<td>2001</td>
<td>HIGH</td>
<td></td>
<td></td>
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</table>
SPECIFICATION OF NEEDS ON HUMAN RESOURCE DEVELOPMENT IN NUCLEAR TECHNOLOGY IN MALAYSIA

RAPIEH AMINUDDIN,
MALAYSIAN INSTITUTE FOR NUCLEAR TECHNOLOGY RESEARCH (MINT)

RAMLI MOHD NOOR,
SCIENCE & TECHNOLOGY DIVISION,
MINISTRY OF SCIENCE TECHNOLOGY & THE ENVIRONMENT (MOSTE)

BACKGROUND

- 1ST WORKSHOP
- HRD PROJECT MISSION
- PROGRESS SINCE LAST WORKSHOP
PROPOSED NEED 1: PA OF NUCLEAR ENERGY

- SOFT INFRASTRUCTURE DEVELOPMENT ISSUE
- PERSPECTIVE OF PA PROJECT

PROPOSED NEED 2: HR PLANNING FOR NPP

- SOFT INFRASTRUCTURE DEVELOPMENT ISSUE
- WELL DOCUMENTED IN IAEA PUBLICATION
- IN ADDITION CHINA AND KOREA MAY LIKE TO SHARE THEIR EXPERIENCE AND PRESENT THEIR VERSION
- NOT URGENT IN MALAYSIAN CONTEXT
PROPOSED NEED 3: DEVELOPMENT OF EDUCATIONAL INFRASTRUCTURE USING INTERNET

- PHYSICAL INFRASTRUCTURE DEVELOPMENT ISSUE
- SHORT COURSE, 1ST DEGREE, MSC, PHD
- TWINNING DEGREE PROGRAMMES
- VIRTUAL FORUM, NEWS AND INFORMATION
- DISCUSSED DURING FNCA MISSION TO M'SIA
- MINT ALLOCATED FUND TO DEVELOP INFRASTRUCTURE FOR E-LEARNING FOR 8TH M'SIA PLAN (2001-2005)

PROPOSED NEED 4: DEVELOPMENT OF TRAINING MATERIAL IN THE FORM OF CAI

- TRAINING TECHNIQUE DEVELOPMENT ISSUE
- TRAINING MATERIALS ARE AVAILABLE IN NOTES, POWER POINT SLIDES
- CONVERSION TO CAI REQUIRES SKILL AND TIME
- TRAINING AVAILABLE LOCALLY
- EXCHANGE OR SHARING OF READY CAI BETWEEN MEMBER COUNTRIES
PROPOSED NEED 5: VIRTUAL FORUM, DATABASE, INFORMATION, NEWS, TRAINING MATERIALS THROUGH INTERNET/FNCA HOMEPAGE

♦ PHYSICAL INFRASTRUCTURE DEVELOPMENT ISSUE
♦ PERSPECTIVE OF PA PROJECT
♦ HRD PROJECT NEED TO PROVIDE INPUT
♦ MANAGEMENT AND UTILISATION OF DATABASE/INFORMATION/KNOWLEDGE

PROPOSED NEED 6: COUNTER MEASURES FOR OUTFLOW OF TALENTS

♦ Soft infrastructure development issue
♦ Due to retirement or greener pastures
♦ Retention
  ♦ Better scheme of service
  ♦ Flexible promotion
  ♦ Better environment
  ♦ Challenging assignment
  ♦ Extend to retirement age
♦ Replacement
  ♦ Create new post
  ♦ On contract service after retirement
  ♦ Attract Malaysian Scientist Overseas
  ♦ Succession plan
ADDITIONAL NEEDS 1: SPECIALISED TRAINING

- TRAINING TYPE ISSUE
- RADIATION TECHNOLOGY FOR ENGINEERS
- MUTAGENESIS USING NEW TECHNOLOGY: DOUBLE HAPLOID
- IRRADIATION OF PLANT MATERIAL: ION BEAM, CHRONIC IRRADIATION
- SLOW RELEASE TECHNOLOGY
- EXTRACTION OF BIOACTIVE COMPONENTS IN PLANTS
- DETECTION OF IRRADIATED FOOD
- RADIATION AS QUARANTINE TREATMENT FOR CUT PLANTS
- BORON NEUTRON CAPTURE THERAPY (BNCT)-MEDIUM TERM
- INCINERATION AND VITRIFICATION OF RADIOACTIVE WASTE

CONTINUATION

- CYCLOTRON- OPERATION, MAINTENANCE, UTILISATION, ISOTOPE PRODUCTION
- ONCOLOGY
- NUCLEAR MEDICINE
- PATTERN RECOGNITION AND ROBOTIC
- MASS SPECTROMETER OPERATION AND MAINTENANCE
- SANS
- C-14
- RLA
- THIN LAYER ACTIVATION
- DEVELOPMENT OF GAUGES
ADDITIONAL NEEDS: EXPERT

- **TRAINING TYPE ISSUE**
- **SPEAKER FOR M’SIAN ANNUAL RPO CONFERENCE**
- **CURRICULUM DEVELOPMENT FOR INSTRUMENTATION**
- **ENHANCEMENT OF REACTOR UTILISATION**
- **REVIEW OF DEGREE COURSE ON DIAGNOSTIC IMAGING AND RADIOTHERAPY**
- **PICTURE ARCHIVING AND COMMUNICATION SYSTEM [PACS]**
- **MEDICAL IMAGING, IMAGE RECONSTRUCTION AND PROCESSING [DICOM]**
- **DETERMINATION OF SR-90 USING LSC**

CONTINUATION

- **MEASUREMENT OF OIL CONTENT IN SOIL-WATER-OIL MIXTURE USING NEUTRON AND MICROWAVE TECHNIQUE**
- **GAMMA GREEN HOUSE FACILITY AND HORTICULTURE**
- **ALPHA SPECTROMETRY SYSTEM**
- **ISOLATION OF REGULATORY GENE SEQUENCES FOR FLOWER COLOUR AND DEVELOPMENT**
- **NUCLEAR REACTOR INTRUMENTATION AND CONTROL SYSTEM**
ADDITIONAL NEEDS:
RECOGNITION OF NUCLEAR MEDICINE PRACTIONERS

♦ SOFT INFRASTRUCTURE DEVELOPMENT ISSUES
♦ IN MALAYSIA MEDICAL DOCTORS SPECIALISING NUCLEAR MEDICINE NOT RECOGNISED AS SPECIALIST
♦ MEDICAL PHYSICIST NOT CONSIDERED PROFESSIONAL LIKE PHARMACIST
♦ THIS HINDERS PROGRESS OF NUCLEAR MEDICINE

ROLE OF FNCA TO ENHANCE HRD IN MEMBER COUNTRIES THROUGH REGIONAL COOPERATION

♦ CLARIFY VISION, OBJECTIVES AND TERMS OF COLLABORATION
♦ THE ROLE OF FNCA IS TO ENSURE THE AGREED VISION, OBJECTIVES AND TERMS ARE UPHELD AND ACHIEVED
SMART PARTNERSHIP PRACTICE — KEY ELEMENTS

- FAIR AND EQUITABLE OUTCOME FOR ALL PARTNERS
- SHARED VISION
- COMPLIMENTARY OF ATTRIBUTES OF PARTNERS
- ETHICAL COMMITMENT

CONCLUSION

- IDENTIFIED ISSUES AND NEEDS HAVE BEEN REVIEWED AND CLARIFIED
- ADDITIONAL ISSUES AND NEEDS HAVE BEEN IDENTIFIED
- SPECIFICATION AND PRIORITY OF NEEDS HAVE ALSO BEEN INDICATED
- THE PREMISE FOR THIS PROJECT IS MUTUAL COLLABORATION
- THE VISION, OBJECTIVES AND TERMS OF THIS COLLABORATION NEEDS TO BE SPELT OUT
- THE ROLE OF FNCA IS TO ENSURE THE AGREED VISION, OBJECTIVES AND TERMS ARE UPHeld AND ACHIEVED
Country statement on:

1.4.5

(1) Philippine Human Resources Development Policy in the Nuclear Field

I. National Medium-Term Strategy for Human Resources Development in the Field of Nuclear Applications

In its Medium-Term Development Plan 1999-2004, the Philippine government has emphasized the importance of the human resources development to upgrade the country’s capability and increase its productivity in the various sectors of economic and non-economic endeavors.

In consonance with the Medium-Term Philippine Development Plan, the Department of Science and Technology (DOST) has included in its Medium-Term Plan 1999-2004, programs that will contribute to the enhancement of the agriculture, industry, and services sectors, particularly the small and medium enterprises, through the implementation of an appropriate and gender-responsive S&T Human Resources Development Program.

In the Department's Medium-Term Plan, the Philippine Nuclear Research Institute (PNRI) has identified projects under the Department’s flagship programs covering various areas that will need the appropriate expertise of scientists in the nuclear field. These programs are on R&D packaging, metrology, biotechnology, R&D on cleaner production technologies, water resource management, waste management, among others.

II. Priority Areas of Human Resources Development in the Nuclear Field as per S&T Plan

Among the priority areas of S&T human resources development are those in the nuclear field in order for the DOST to support the government’s bid for increased productivity in the various sectors, particularly, industry, agriculture, health, and environment. Specifically, the development of expertise in the following areas is deemed necessary: nuclear research; nuclear technology development and applications; specialized nuclear and allied services; and nuclear safety and regulation (including standards development).

Furthermore, graduate programs in very selective areas like nuclear engineering, nuclear physics and chemistry, radiochemistry and radiation chemistry, radiobiology and medical physics, would be needed.

III. Brain Drain Issue

Over the past 25-30 years, we have lost quite a number of trained scientists in the nuclear field through brain drain, and some by retirement. Many Filipino nuclear researchers and scientists who trained and studied abroad did not return to the Philippines. It is, therefore, essential that we recruit and train young people to replenish the loss. Also, the Department of Science and Technology has strengthened its Balik Scientist Program to partly counteract the brain drain.
Likewise, it is important to provide appropriate incentives to prevent further brain drain. These incentives may include the following: monetary incentives – higher salaries, allowances, and other benefits; non-monetary incentives – world-class laboratories and equipment, and support to research work.

IV. Ways to Maintain and Stimulate Interest of Young Scientists in Nuclear Science

It is important that the science culture is imbibed in the young. The young scientists must have the appreciation for science and technology and its applications. For this reason, the Department of Science and Technology, together with the Department of Education, Culture and Sports and the Commission on Higher Education, has enhanced its science and technology education program for the primary, secondary and tertiary levels.

The enhancement of the science and technology education program is made by improving the academic curriculum, strengthening the science and mathematics programs; teacher training in science and mathematics; and upgrading of science-related facilities, including information and communications technology. Likewise, training techniques and training materials on nuclear science have to be developed.

Nuclear science would be a new area to consider in the primary and secondary levels. The tertiary level science education in the nuclear field would need some focusing and enhancement. Graduate programs in very selective areas mentioned earlier would be encouraged.

Different modes of learning will be adopted. These are the formal and non-formal training, including distance learning, scientist exchange program, research fellowship, among others.

V. Role of Forum for Nuclear Cooperation in Asia (FNCA) to Enhance HRD in Member Countries

The FNCA's continued support to member countries in the latter's participation in regional collaborative projects must be sustained. This strengthens the region's capability in the nuclear field, particularly for peaceful purposes such as, nuclear research and technology applications in the economic and non-economic sectors.

These collaborative projects in research must be accompanied by the conduct of scientist exchange (either for academic or laboratory/research purposes) and research fellowships (formal and non-formal training).

Sharing of available facilities/laboratories and equipment and/or making these and other nuclear-related services available to member countries should be encouraged.

Exchange of information on research results and technologies available for adoption, including S&T policies in nuclear field should be sustained.
Human Resources Development Policy in the Nuclear Field

PHILIPPINES

Medium-Term Strategy for HRD in Nuclear Applications

- Implement an appropriate and gender-responsive S&T Human Resources Development Program in nuclear field in these program areas:
  - R&D packaging
Medium-Term Strategy for HRD in Nuclear Applications

- Metrology
- Biotechnology
- R&D on Cleaner Production Technologies
- Water Resource Management
- Waste Management

Priority Areas of HRD in Nuclear Field

Sectors:
- Industry
- Agriculture
- Health
- Environment
Priority Areas of HRD in Nuclear Field

Areas of Expertise Required:
- Nuclear Research
- Nuclear Technology Development and Applications
- Specialized Nuclear and Allied Services
- Nuclear Safety and Regulation
  (including Standards Development)

Priority Areas of HRD in Nuclear Field

Graduate Programs Needed:
- Nuclear Engineering
- Nuclear Physics and Chemistry
- Radiochemistry & radiation chemistry
- Radiobiology
- Medical Physics
Prevention of Brain Drain

Train young people
Balik Scientist Program
Provide incentives
  monetary – higher salaries, allowances, benefits
  non-monetary – world-class laboratories and equipment, support to research work

Stimulating Interest of Young Scientists in Nuclear Science

Enhancement of S&T Education Program

  Improve academic curriculum in science and mathematics

  Develop training techniques and materials on nuclear science
Stimulating Interest of Young Scientists in Nuclear Science

Enhancement of S&T Education Program

- Train teachers in science and mathematics

- Upgrade science-related facilities, including information and communications technology

Stimulating Interest of Young Scientists in Nuclear Science

Adoption of Modes of Learning

- Formal and non-formal training
- Distance learning
- Scientist exchange program
- Research fellowship
FNCA Role

Continue to support regional collaborative projects among member countries for peaceful nuclear research and technology applications

Promote scientist exchange and research fellowships

FNCA Role

Encourage sharing of available facilities/laboratories and equipment; making nuclear-related services available to member countries

Sustain exchange of information on research results, technologies, and S&T policies
Thank You for Your Kind Attention
(2) SPECIFICATION OF NEEDS ON HUMAN RESOURCES DEVELOPMENT IN THE NUCLEAR FIELD

Corazon C. Bernido

Philippine Nuclear Research Institute, Commonwealth Avenue
Diliman, Quezon City 1101, Philippines

1. BACKGROUND

At the present time, the Philippines does not have a nuclear power program. However, in the country’s energy plan, there is a possibility for the introduction of nuclear power in the year 2020 or beyond. The country has one research reactor which operated for many years; it was converted to a 3 MW Triga type reactor, but at present it is undergoing repair and not operational.

There are around 278 companies and institutions licensed by the Philippine Nuclear Research Institute to use and possess radioactive materials. This includes medical, industrial, and commercial users as well as research institutions. The breakdown according to sector is shown in Figure 1, which shows that 55% of licensees are industrial users, 23% are medical users, 13% commercial users, and 9% are users from research institutions.

Figure 1.

A number of hospitals have nuclear medicine, and radiotherapy facilities. The regulations require a medical physicist in radiotherapy facilities; there is a growing demand for medical physicists. The first Positron Emission Tomography (PET) facility will be put up next year by one hospital. In the industrial applications of isotopes, in addition to nuclear gauges, there is widespread use of nondestructive testing techniques such as radiographic testing.

2. SPECIFICATION OF NEEDS ON HRD IN THE NUCLEAR FIELD

2.1 Activity Areas

The needs for human resources in the nuclear field arise from the following activity areas:
(a) Nuclear applications in industry, medicine, agriculture, research, and other areas.
(b) Manpower in support of a nuclear power program and in support of the Philippines’ research reactor.
(c) Science and technology education, specifically in the nuclear field.
In (a) there is a need for training users of radioisotopes, and for training radiation safety officers and medical physicists, as required by regulations. There is a need for M.S. and Ph.D. holders in Medical Physics. In (b) the need is more long-range in nature, but the more immediate need is in the area of public acceptance and public awareness of nuclear science and technology, as well as graduate degree (M.S. or Ph.D.) holders in Nuclear Engineering. Also, in support of the research reactor there is a need for personnel trained in the repair of research reactors, as well as in their utilization. In (c) there is a need to enhance and upgrade nuclear science and technology education in schools and universities in the secondary (high school) level and in the tertiary (university or college) level. This means training the teachers, and revising high school and college curricula to include nuclear science education. Addressing the need in activity area (c) will greatly contribute to the social and political climate necessary for a successful nuclear power program.

2.2 Specification of Needs According to Three Groups: Training Type, Training Techniques and Development Issues, and Infrastructure Development Issues

2.2.1 Needs According to Training Type

Academic Training

There is an urgent need for manpower with M.S. and Ph.D. in Nuclear Engineering. This will be in support of the Philippine Research Reactor, which is now undergoing repair, and in support of a future nuclear power program. This type of graduate degree program is not offered in the Philippines at present, although an M.S. in Nuclear Engineering was once offered by one university. There is also a growing need for M.S. Medical Physics graduates who will be employed in hospitals with radiotherapy 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. This M.S. program was started in the 1980's with support from the International Atomic Energy Agency. 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.

Exchange Programs

There is a need for some sort of exchange program wherein high school science teachers from the Philippines will go to another country in the region, such as Japan, for training in the teaching of nuclear science and technology to high school students. These trained teachers will later become trainors in the Philippines. Selected high school science teachers from another country such as Japan will also come to the Philippines to demonstrate the teaching of nuclear science and technology (including how to fabricate and demonstrate the use of radiation detectors such as the cloud chamber).

Faculty development in the field of Medical Physics will be enhanced by some arrangement such as visiting professors in Medical Physics from other countries coming over to the Philippines.

2.2.2 Needs According to Training Techniques Development

There is a need for the development of certain types of training courses such as a training course on the applications of radioisotopes in agriculture, biotechnology and research. There could be an exchange of information regarding syllabi, lecture materials, etc. Training of lecturers in this type of training course could be undertaken in Japan or other countries.

There is a need to develop training materials and visual aids such as videos, computer-aided instruction, simple equipment for detecting radioactivity such as cloud chambers. Development of distance learning modules on nuclear science and technology topics which could be made available through the internet would be of great help. Distance Learning modules in radiation protection in printed form, and distance learning modules in nuclear medicine in CD-ROM have been developed by the Australian Nuclear Science and Technology Organization (ANSTO) under an IAEA/RCA project.
2.2.3 Infrastructure Development Issues

The Philippines is following a certification scheme for qualifying nondestructive testing practitioners, including Radiographic Testing personnel, as set forth in the Philippine Standard PNS 146:1998. This scheme follows recommendations of the ISO Standard ISO/DIS 9712. However, the country does not have a scheme for the certification of Medical Physicists or Radiation Safety Officers. In the present practice the Philippine Nuclear Research Institute, the nuclear regulatory body, assesses and approves the qualifications of Radiation Safety Officers.

The curricula for high school and college education needs to be modified to include nuclear science topics. The agency responsible for secondary or high school education is the Department of Education, Culture and Sports (DECS) while that for tertiary education is the Commission on Higher Education (CHED).

The infrastructure for internet-based learning in the Philippines is growing rapidly. In addition, the interconnectivity of countries in the region is enhanced by an IAEA/RCA Project on Electronic Networking and Outreach. Therefore, development of internet-based teaching and learning modules on nuclear science and technology will be important in the near future.

The infrastructure for the offering of graduate academic programs in nuclear science and technology in the Philippines needs to be developed or enhanced. The possibility of forming a consortium or cooperation among three or four universities in the offering of M.S. Medical Physics is being explored.

3.0 EXCHANGE OF INFORMATION

Exchange of information regarding the availability of teaching aids such as videos, CD-ROMs, training manuals, science programs on television for the public, will be most helpful. Collaboration among countries in the region regarding the production of teaching materials is deemed important.

Exchange of information regarding syllabi in training courses is also necessary. In addition, exchange of information regarding the availability of distance learning modules is also needed.

4.0 PRIORITIZATION

In the order of prioritization of needs in the Philippines, academic training as outlined in Section 2.2.1 comes first. Second priority would be the development of training techniques and training materials as listed under Section 2.2.2. Third priority would be the enhancement of nuclear science education, and one of the means of achieving this would be the exchange program as discussed in Section 2.2.1, and through the modification of the curricula for high school and college education.
Speciation of Needs on Human Resources Development in the Nuclear Field

Corazon C. Bernido
Philippine Nuclear Research Institute

Background

- In the Philippines’ energy plan, there is a possibility for the introduction of nuclear power in the year 2020 or beyond.

- The country has one research reactor, 3 MW Triga type which at present is undergoing repair.

- There are around 278 companies and institutions licensed to use and possess radioactive materials.
Background

- A number of hospitals have nuclear medicine, and radiotherapy facilities. Regulations require a medical physicist in radiotherapy facilities.

- There is a growing demand for medical physicists.

- The first Positron Emission Tomography (PET) facility will be put up next year by one hospital.

- Nondestructive testing techniques such as Radiographic Testing is widely used in industry.

Activity Areas

The needs for human resources in the nuclear field arise from the following activity areas:

- Nuclear applications in industry, medicine, agriculture, research, and other areas

- Manpower in support of a nuclear power program and the Philippines’ research reactor

- S & T education, specifically in the nuclear field
Specification of Needs

Needs according to training type:

- **Academic Training**
  - M.S. and Ph.D. in Nuclear Engineering
    (In support of the Philippine Research Reactor, and a future Nuclear Power Program).

- M.S. and Ph.D. in Medical Physics
  (Who will be employed in hospitals with radiotherapy facilities, linear accelerators and baby cyclotrons; and who will act as faculty in graduate programs)

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Specification of Needs

Needs according to training type:

- **Exchange Programs**
  - For High School science teachers
    (For training in the teaching of nuclear S & T, including how to fabricate and use simple radiation detectors such as the cloud chamber, etc.)

- For Faculty of Medical Physics
  (Faculty development in the field of Medical Physics will be enhanced by some arrangement such as visiting Professors from other countries coming over to the Philippines)
Specification of Needs

Needs According to Training Techniques
Development

- Development of certain types of training courses
  (For example, training course on applications of radioisotopes in agriculture, biotechnology and research. Training of lecturers, exchange of information regarding syllabi & lecture materials)

- Development of visual aids and training materials
  (Videos, computer-aided instruction, distance learning modules, simple radiation detection equipment for demos)

Specification of Needs

Infrastructure Development Issues

- Curricula for high school and college education need to be modified to include nuclear science topics.

- Infrastructure for internet-based learning & internet-based teaching modules on nuclear S & T

- Infrastructure for offering graduate academic programs in nuclear science & technology (e.g., consortium among 3 universities)

- Scheme for qualification and certification of Medical Physicists and Radiation Safety Officers
Exchange of Information

- Availability of teaching aids such as videos, CD-ROMs, training manuals, science programs for television.

- Exchange of information/collaboration regarding the production of teaching materials.

- Exchange of information regarding syllabi.

- Availability of distance learning modules.

Prioritization of Needs

- Academic training for M.S. and Ph.D. in Nuclear Engineering, as well as in Medical Physics

- Development of training techniques and training materials

- Enhancement of nuclear science education
Country Report

1.4.6 Specification of Needs on Human Resource Development (HRD) of Thailand

Warapon Wanitsuksombut
Office of Atomic Energy for Peace

1. Introduction

After the accident involving cobalt-60 teletherapy unit in February, the country was so alert and the information on the radiation and radioactivity was widely requested. The request for conducting training in related subjects is also tremendously dumping in. Two side effects have been achieved from this situation, one is the public awareness of the dangerous of radiation. The other side effect is awaken of many agents who could give their hands on helping the public understanding and on regulating and controlling the use of radiation and radioisotopes. Many organizations show their interest to create training include radiation protection and safety management in normal and abnormal situation. Except that, the intensive and effective radiation safety scheme must be implemented as soon as possible. Since radiation protection has been included in all nuclear technology application courses, it seems that the training is still inadequate. Emphasizing may be needed on the good practicing and management of every laboratory using radiation and radioisotopes. This may require both regulatory enforcement and initiation through seminars and workshops.

2. Infrastructure development issue

It is realized that the successful nuclear program depends on good radiation safety system. The accident that occurred revealed the inadequate safety scheme of the country. The urgent need is to develop a system of national accreditation for radiation protection officer. Academic as well as special training on radiation protection should be harmonized to a good agreement and effectiveness. The fundamental for radiation protection has been included in many courses offering. But in every course seems lacking the part in the regulatory control as well as management control of the radiation and radioactive material uses. Methods of radiation safety scheme in other nuclear technology developed countries may be used as examples for development of radiation safety scheme of the country. Another equally important subject is the building of competency in operational radiation protection. Specific course curriculum must be identified for specific handling of licenses.

3. Training techniques development issues

The Office of Atomic Energy for Peace has close cooperation with the academic institutes in Thailand. The summer training is regularly offered to the students as well as the opportunity to work in special project or research in the facilities. But the portion of offering is incomparable to the needs. The laboratory in each academic institute has limited equipment. The student could not have opportunity to familiarize to the experiment in nuclear science. Thus Nuclear physics is considered a tough subject for students everywhere. A computer-based training technique (suggested by Korea) could be a solution for helping student to better understand the subject. Through the multi-media training material, interest of young scientist to nuclear science could be stimulated.

4. Training type
Training in the management function for handling of radiation and radioactive material must be initiated. Since it has been shown in many cases of accidents that lack of radiation protection knowledge in the management level lead to the situations.

The curriculum for schoolteacher training on nuclear science should be formulated. The material, further than the subject of nuclear science, should include social and economic aspects of nuclear energy utilization as well as the legislative aspects.

5. Conclusion

The specific needs mentioned above may be common to most of the member countries. Mutual support plan may be discussed in the workshop to develop training and technology transfer.
Specific Needs on Human Resource Development of Thailand

Warapon WANTSUKSONGBUT
OFFICE OF ATOMIC ENERGY FOR PEACE

Infrastructure development issues

- To develop a more effective system including national accreditation for radiation protection officer.
- To develop national radiation safety scheme.
- To build competency in operational radiation protection personnel.

INTRODUCTION

The radiological accident resulted:
- the increased public awareness of the nature and hazard of radiation,
- the increased activities to educate public on regulating and controlling the use of radiation and radioisotopes.

Training technique development issues

A computer-based training technique (suggested by Korea) could be a solution for helping student to better understand the subject. Through the multi-media training material, interest of young scientist to nuclear science could be stimulated.
Training type

- The training on handling of radiation and radioactive material for management level must be initiated.
- The curriculum for schoolteacher training on nuclear science should be formulated, and the training material should accommodate social and economic aspects of nuclear energy utilization as well as the legislative aspects.

Conclusion

Mutual support plan may be discussed in the workshop to develop training and technology transfer.
COUNTRY REPORT

1.4.7 SPECIFICATION OF NEEDS ON HUMAN RESOURCES DEVELOPMENT IN NUCLEAR FIELD IN VIETNAM

At the Second Workshop on HRD in the Nuclear Field
Regional Nuclear Cooperation Activities (RNCA)
Tokai, Japan, November 27-30, 2000

by
Mr. VU DANG NINH
Director of Administrative and Personnel Department
Vietnam Atomic Energy Commission (VAEC)

and
Dr. PHAM VAN HUYNH
Deputy General Director of Department
Ministry of Science, Technology and Environment (MOSTE)
INTRODUCTION

Vietnam located in the South East Asia, covering an area of 333,688 km². The population of Vietnam is now about 76,8 million, of which around 80% live in the rural area and the remaining 20% in the urban area. As the result of National Family Planning Programme, currently, population growth rate reduced to 1.7% against 2.1% in early nineties.

At present, Vietnam Atomic Energy Commission (VAEC) and Vietnam Radiation Protection and Nuclear Safety Authority (VRPA) are the subsidiary bodies of the Ministry of Science, Technology and Environment (MOSTE).

Vietnam Atomic Energy Commission

The VAEC was established in April 1976 and up to April 1994 it was controlled under the Office of the Government. In April 1994, the VAEC was reorganized and belonged to the MOSTE. The main tasks and functions of the VAEC are the following:

- To formulate directions, strategies, planning and plans for research and development in the field of atomic energy in Vietnam;
- To conduct fundamental research; applied research on nuclear techniques, research on nuclear technology and nuclear fuel;
- To participate in the formulation of law projects and regulatory documents in relation with to atomic energy;
- To carry out research, develop technical matters on radiation protection and nuclear safety;
- To plan and train scientific and technical personnel in the field of atomic energy; and
- To undertake international Co-operation in the field of atomic energy.

Vietnam Radiation Protection and Nuclear Safety Authority

On July 30th, 1994, VRPA was established under the MOSTE in order to assist MOSTE performing the state management of radiation protection and nuclear safety. At present, VRPA, in collaboration with the VAEC, is conducting the preparation legislative framework concerning nuclear safety.

At present, Vietnam is still a non-nuclear power country. However, from the viewpoint of sustainability, nuclear power has been taken into consideration as a national electricity supply option after the year 2015. The MOSTE and Ministry of Industry (MOI) have submitted to the Government a final report that concluded the needs of nuclear power development in Vietnam. The Government is examining this conclusion.

I. NEEDS FOR HUMAN RESOURCE DEVELOPMENT IN NUCLEAR FIELD

1.1. Activities in the year 2000

As of the 1st October 2000, the regular staff of the VAEC is 526 people, in addition, other 67 people who are working under the labor contracts,

Statistics on distribution of personnel and qualification of the staff in the VAEC's subsidiary bodies is presented in the following table.
<table>
<thead>
<tr>
<th>Name of Subsidiary Bodies</th>
<th>Total</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Doctor</td>
</tr>
<tr>
<td>Dalat Nuclear Research Institute (NRI)</td>
<td>171</td>
<td>9</td>
</tr>
<tr>
<td>Center for Nuclear Techniques, HCM City (CTN)</td>
<td>44</td>
<td>8</td>
</tr>
<tr>
<td>Hanoi Institute for Nuclear Science and Techniques (INST)</td>
<td>108</td>
<td>23</td>
</tr>
<tr>
<td>Institute for Technology of Radioactive and Rare Elements (ITRRE)</td>
<td>151</td>
<td>16</td>
</tr>
<tr>
<td>Center for R &amp; D of Irradiation Technology (CRDIT)</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>VAEC Headquarter</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>526</td>
<td>65</td>
</tr>
</tbody>
</table>

In the year 2000, under the framework of the Master Plan 2000 signed on March of this year between the VAEC and Japan Atomic Industrial Forum (JAIF), VAEC has established Sub-Committee on Human Resource Development headed by the Chairman of the VAEC. This Sub-Committee is primarily responsible for formulating a plan on human resource development, based on which annual training plan will be elaborated. Training covers the fields as:

- Design, construction, operation, maintenance of the nuclear power plant;
- Research and development activities of nuclear science and technology;
- Application of radiological rays and radioisotopes in various socio-economic sectors;
- Licensing, inspection, administration and management at the governmental level;
- University education.

Besides, three high ranking official mission from the VAEC and the Government visited to nuclear installations of Japan according to the JAIF invitation. At the same time, in the year 2000, two JAIF group-training courses were held in Japan for 23 Vietnamese experts in the aspects related to the nuclear energy application on non-power and power, such as:

- Human Resource Development
- Site Survey for Nuclear Power Plant
- Nuclear Safety
- Fuel Cycle and Radwaste Management
- Operation and Maintenance of Nuclear Power Plant.
- Public Information
- Nuclear Regulatory
- Quality Control and Quality Assurance of Nuclear Equipment
- Accelerator application in medical treatment
Recently, a mission of 8 Vietnamese experts from VAEC, Hanoi National University and Hanoi University of Technology has visited the Nuclear Technology and Education Center (NuTEC) belonged to Japan Atomic Energy Research Institute (JAERI) to discuss a plant for establishing a Training Center on Radiation Protection and Nuclear Measurement Techniques.

It can say that the visits and training courses are of significant contribution to the formulating of plan for development of nuclear science and technology, especially nuclear power in Vietnam.

In the year 2000, VAEA has hosted the following workshops, seminars and training courses:

<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>Organizers</th>
<th>Date</th>
<th>Number of Participants</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>National Seminar on Nuclear Safety</td>
<td>IAEA-VAEC</td>
<td>03-07 March 2000</td>
<td>16</td>
<td>VAEC Hanoi</td>
</tr>
<tr>
<td>2</td>
<td>Mid-term Review Meeting (Maintenance and Repair of Nuclear Instruments)</td>
<td>IAEA - VAEC</td>
<td>03-07 April 2000</td>
<td>12</td>
<td>INST Hanoi</td>
</tr>
<tr>
<td>3</td>
<td>Regional Workshop on CDM</td>
<td>IAEA - VAEC</td>
<td>10-14 April 2000</td>
<td>56</td>
<td>VAEC Hanoi</td>
</tr>
<tr>
<td>4</td>
<td>Regional Training Course on Standard Software for Tracer Application and Nucleonic Gauges Design and Calibration</td>
<td>IAEA - VAEC</td>
<td>05-09 June 2000</td>
<td>16</td>
<td>NRI, Dalat</td>
</tr>
<tr>
<td>5</td>
<td>Reference Asian Man Project (Phase 2): Ingestion and Organ Content of Trace Elements of Importance in Radiological Protection</td>
<td>IAEA - VAEC</td>
<td>26-30 June 2000</td>
<td>12</td>
<td>NRI, Dalat</td>
</tr>
<tr>
<td>6</td>
<td>Regional Training Course on Radiation Processing of Natural Polysaccharides</td>
<td>IAEA - VAEC</td>
<td>03-07 July 2000</td>
<td>24</td>
<td>CRDIT, HCM City</td>
</tr>
<tr>
<td>7</td>
<td>Regional Training Course on Website Construction and Management</td>
<td>IAEA - VAEC</td>
<td>21-25 August 2000</td>
<td>14</td>
<td>INST, Hanoi</td>
</tr>
<tr>
<td>8</td>
<td>National Training Workshop on Radiation and Waste Safety in Industrial Practices</td>
<td>IAEA - VAEC</td>
<td>11-15 September 2000</td>
<td>60</td>
<td>VAEC, Hanoi</td>
</tr>
<tr>
<td>9</td>
<td>National Workshop on Safety and Regulatory Control for RRs</td>
<td>IAEA - VAEC</td>
<td>03 - 06 October 2000</td>
<td>30</td>
<td>VAEC, Hanoi</td>
</tr>
<tr>
<td>10</td>
<td>Regional Workshop on Methodology for Plant Mutation Breeding for Quality Effective Use of Physical/Chemical Mutagens</td>
<td>FNCA-VAEC</td>
<td>09 - 13 October 2000</td>
<td>18</td>
<td>Agriculture Genetics Institute (AGI) Hanoi</td>
</tr>
</tbody>
</table>
1.2. Plan for the year 2001

Based on the current situation of shortage of highly qualified experts in nuclear power field, VAEC has given special priority to personnel training in the aspects concerning nuclear power, including project management.

We are fully aware of that radiation protection and nuclear safety is of an extremely important role, at the same time, we consider it as a prerequisite condition in safe peaceful use of nuclear energy. Those who work in the nuclear field should be trained on basic knowledge in radiation protection and nuclear safety. At present, we are elaborating a training programme, in which training teachers and instructors is main task in the coming years. After that, they will be responsible for training in the wide scope. In order to successfully perform this task, VAEC would like to ask JAERI support a project on establishing a Center for Training on Radiation Protection Techniques and Nuclear Experiment under the bilateral cooperation between VAEC and JAERI.

In order to increase the quality of diagnostics and treatment by nuclear medicine techniques, as well as, to support to staff training in this field, this year, VAEC and JAIF are cooperating to formulate a project aimed to set-up a Center for Application of Nuclear Techniques in Medicine in Vietnam. Therefore, one of the major tasks is training staff on accelerator techniques, radiation protection and medical physics. We welcome the Japan assistance in this field.

In order to prepare manpower to nuclear power programme, VAEC is making every effort to upgrade Training Center at Dalat Nuclear Research Institute. The main task of the Center is training on reactor technology, radiation protection and nuclear safety, radwaste management.

II. EXCHANGE OF INFORMATION

In this year, The VAEC Website has been created. Now, it is available for use.

Research results of the VAEC have been presented in the preprint and Annual Report. We would like to exchange the publications with other nuclear organizations of the FNCA members.

Besides, the VAEC also would like to establish bilateral cooperation with all nuclear organization of the FNCA members in the peaceful use of nuclear energy.

III. LATEST TOPICAL NEWS ON NUCLEAR ENERGY

Along with enhancing the research and development activities in the non-power application of nuclear energy, in the year 2000, the VAEC has also conducted preparation works for introduction of nuclear power into Vietnam.

The VAEC, in collaboration with the JAIF, has conducted site survey for nuclear power plant, formulated a manpower development plan for the first nuclear power plant in Vietnam (Period 2015-2017). Besides, the VAEC planned to organize an Exhibition on Peaceful Use of Nuclear Energy in next April in Hanoi with the assistance of the JAIF.

*******************************
1.4.8 Specification of Needs for Human Resources Development in the 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/panfu/Enter.htm

1. Introduction

In Japan, the Long Term Plan for Nuclear Power Research, Development and Application is being revised this year. In this section, the portion of the plan related to the human resources development is introduced. In the final draft of the plan it is stated that for the research and steady development of nuclear power it is very important to develop and maintain competent human resources. However, the nuclear power industry in Japan is entering a mature state so that the number of researchers, engineers and technicians and the amount of expenditure on research are decreasing in recent years. It is anticipated that it will become more difficult to maintain at the present level the technological standard and human resources in the design and manufacturing area.

Under such circumstances, the universities which are the central institutions for the human resources development (HRD) should develop competent human resources in close cooperation with the research and development institutions, industries and also considering international cooperation. The education and training for the practical use of the most advanced technology using the advanced R&D facilities should also be effective.

The most effective way for industries to maintain, succeed and improve technological level and human resources, is to continue manufacturing products. The nuclear power industry is expected to continuously introduce the most advanced technologies, to improve education and training of personnel and to accumulate technologies for future generations.

The national institutions and industries should establish a system for enhancing mutual exchange of human resources and technologies with more joint researches and personnel exchanges so that the human resources and technological level of the country as the whole could be maintained.

It is important to make clear to the public the vital role of nuclear power for the nation and its contribution to the international framework for peace and stability. In addition it is also necessary to extend a new frontier of nuclear power by R&D activities which can give new dream and hope to the young generations.

2. Issues in Human Resources Development

Although the Long Term Plan has stated the plan for human resources development in a positive manner, there are some serious issues in the human resources development in nuclear field in Japan. The first one is an apparent decline of interest in the nuclear engineering among the university students. This is
partly due to the maturing of the nuclear technology compared with rapidly evolving area such as information technology and biotechnology, but more due to the anti-nuclear movements and criticism by mass media enhanced by a series of accidents typified by the JCO criticality accident in September 1999. As a result, the nuclear engineering departments in the universities are not recruiting as many good students as it used to thirty years ago. The second issue is that the research reactors which have played the central role in the human resources development are now having difficulty in continuing operation because of the more stringent regulatory control and the aging of qualified personnel. The third is the reduction of scientists and engineers working in the area of radioisotope and radiation utilization in research and development institutions. This is partly due to the diversification of research area toward more of nuclear science and advanced technology such as those utilizing high energy particle accelerators rather than conventional nuclear engineering based on research reactors and partly due again to the tighter regulatory control and aging of the qualified personnel.

In order to cope with the above issues, universities, research and development institutions and industries should establish a system for enhancing mutual exchange of human resources and technologies so that the human resources and technological level in the country as the whole could be maintained. Such a system for enhancing mutual exchange of human resources and technologies should be extended internationally so that the human resources and technological level in the world could be maintained.

However, the establishment of such a system is beyond the capability of the authors so that in the next section, the state of the Nuclear Technology and Education Center (NuTEC) of the Japan Atomic Energy Research Institute (JAERI) will be briefly described.

3. State of Nuclear Technology and Education Center

Since 1958, NuTEC has carried out “Training of researchers and engineers in the fields of utilization of radioisotopes and nuclear energy”, as one of the main JAERI project, through its training courses. The activities of NuTEC are manifold today, consisting of training courses for nuclear researchers and engineers, and introductory courses for the public. International training courses have also been offered annually for the last seventeen years in response to recent needs, especially, for participants from Asian countries.

More than 48,000 participants have completed the courses at NuTEC in the 43 years. We will continue to provide the education necessary for safe use of nuclear technology that enhance the quality of our lives.

We have two education centers, one in Tokyo and the other in Tokai. The following courses were held at the Tokyo Education Center: (1) Basic Course on Radioisotope and Radiation Handling; (2) Specialized Courses on “Application of Radioisotopes to Biological Sciences”, “Autoradiography”, “Radiation Processing of Polymers”, “Radiation Control”, “Liquid Scintillation Measurement”, “Radioisotopes”, and “Environmental Radioactivity Measurement”; (3) Qualification Courses for Class-1 Radiation Protection Supervisors and Class-1 Working Environment Measurement Experts; (4) International Course on Nuclear Technology in basic radioisotope fields in cooperation with the Japan International Cooperation Agency (JICA) and another International Course on specific subjects in radioisotope field (e.g., Determination of Radionuclides in Food and Environmental Samples) in
cooperation with the International Atomic Energy Agency (IAEA).

The following courses were held at the Tokai Education Center: (1) General Course on Reactor Engineering; (2) Specialized Courses on "Reactor Engineering" and "Radiation Protection"; (3) Short-term Courses in "Reactor Engineering", "Nuclear Fuel Engineering", "Radioactive Waste Management", Introductory Nuclear Energy, Emergency Preparedness and Planning, and Elementary Emergency Preparedness and Planning; (4) International Course on Nuclear Technology in the field of nuclear reactors in cooperation with JICA.

In relation to the JCO accident, the training course for Senior Specialist for Nuclear Emergency Preparedness and Inspector for Safety Management of Nuclear Installations has been started this year.

There is also a growing need for the instructors of NuTEC to provide appropriate information of nuclear power and radiation to the general public. The educational courses for school teachers have been transferred from NuTEC to the Radiation Application Development Association two years ago.

The international program on "Nuclear Safety" in Asian countries was started four years ago. The program consists of Joint Training Course held in certain Asian countries, Instructor Training, and Safeguards Training Course.

The change in the needs for training courses in NuTEC for researchers and engineers in fields of utilization of radioisotopes & radiation and reactor engineering are described in the next section.

4. Change of Needs in Nuclear Technology Education

Figure 1 shows a graph for the annual changes in the number of trainees having attended two representative NuTEC courses. It clearly shows the long-term change of needs in nuclear technology education in Japan. The number of trainees for the 18 days Basic Course on Radioisotope (RI) and Radiation Handling has decreased to about 1/6 of the peak value at around the year 1973. On the other hand, that for the 6 months General Course on Reactor Engineering has decreased to about 1/5 of the peak value at around 1970, but a certain level of needs seem to be remaining till now. This could be interpreted as the needs exist for this course because it is effective for acquiring the general knowledge in nuclear engineering which is required to become the government approved Nuclear Reactor Operation Supervisor.

Figure 2 shows the recent change in the number of trainees for the Basic Course on Radioisotope and Radiation Handling together with the number of institutions with the license to use radioisotope and radiation. Since the number of the institutions is almost constant at around 5000, the decrease in the number of trainees can be interpreted as the larger institutions are now capable of educating the personnel on their own.

Figure 3 shows the recent change in the number of trainees for the government designated courses for Class-1 Radiation Protection Supervisors and Class-1 Working Environment Measurement Experts. The completion of these courses with practical training is required to become the official Supervisors and Experts after passing the paper examination. Although the number of the trainees change somewhat in accordance with the change in the number of the applicants that pass the paper examination, the relatively steady number of trainees for the courses show that the needs for the supervisors and experts required for
the institution are about constant.

Figure 4 shows the recent change in the number of trainees for nuclear engineering courses. The 10 days Short Course is mainly for the applicants for the examination to become Nuclear Reactor Operation Supervisor. For the other longer courses, there seems to be a trend to prefer shorter courses at this time of economic difficulty. It should be noted that there are 51 nuclear power plants in operation and 4 plants under construction in Japan. There are a number of training centers operated by Electric Power Companies where practical aspects of nuclear power plants operation and maintenance are taught.

In summary, the basic education of RI & radiation handling are given more in larger institutions and the practical aspects of nuclear engineering are taught in the Electric Power Companies. There are needs in NuTEC for the training courses to prepare for the examination of Nuclear Reactor Operation Supervisor and for the qualification courses to become government approved Radiation Protection Supervisors and Working Environment Measurement Experts.

5. Specification of Needs

As described in the last section, the needs for basic and general training courses in NuTEC seem to be gradually decreasing because of the improved capability for education in private sectors in Japan. On the other hand, NuTEC is now requested to play more part in the training for nuclear accident prevention and emergency preparedness area.

At the same time, our capability and experience in training nuclear scientists and engineers in Japan can be of use to the Asian and Pacific nations that are planning to increase the use of radioisotopes, radiation and nuclear power. In order to contribute more effectively to the human resources development in these nations, there is a clear need to provide the information on training courses, teaching materials in English language. It should be noted that some technical issues such as the copy rights of texts and figures need to be solved. We hope the present workshop will find the mechanism of mutual support to cooperate in the exchange and production of materials useful for the human resources development in the nuclear field.

6. Summary

The long term plan for the human resources development and some issues in the human resources development in the nuclear field in Japan are summarized. The state of Nuclear Technology and Education Center of JAERI and the change in needs for the training courses in NuTEC are described. A need for teaching material in English language is presented.

Acknowledgement

The authors thank Drs. Masakatsu Saeki, Hirotsugu Shiraishi and Yuko Kikuchi-Ikuta of NuTEC, JAERI for the valuable comments on the paper.
Fig. 1 Long-term change in the number of trainees of basic training courses

Fig. 2 Recent change in the number of trainees of RI-Radiation Basic Course and Institutions with license to handle RI and radiation
Fig. 3 Recent change in the number of trainees for the qualification courses

Fig. 4 Recent change in the number of trainees for Nuclear Engineering Courses
Specification of Needs for Human Resources Development in the Nuclear Field in Japan

Yasushi Seki and Kiyoshi Kato

Nuclear Technology and Education Center
Japan Atomic Energy Research Institute

Content of Talk

- Introduction
- Issues in HRD in Japan
- State of NuTEC Training Courses
- Change of Needs in Nuclear HRD
- Specification of Needs
- Summary
Introduction (1)

HRD described in Long Term Plan for Nuclear Power R&D and Application

Nuclear Power in Japan entering mature state so that manpower and expenditure decreasing

51 NPP operating 4 under construction

Difficult to maintain HR and technological level

Introduction (2)

- Universities should develop HR in close cooperation with R&D institutions and industries, also considering international cooperation
- Education and training on advanced technologies should be effective
- To maintain HR, industries should keep on manufacturing products
**Introduction (3)**

Enhance mutual exchange of HR and technologies to maintain HR and technology level

**Introduction (4)**

- Make clear to the public the vital role of nuclear power for Japan and its contribution to the framework of peace and stability in the world
- Extend the frontier of nuclear technology and science to give new dream and hope to the young generations
Issues in HRD in Japan

- Decline of interest in Nuclear Engineering among students (Maturing of Nuclear Engineering, Anti-nuke movements, media)
- Decrease of research reactors (Tighter regulatory control, Aging of HR)
- Reduction of human resources in hot area in R&D institutions (Diversification, Move toward science)

How to enhance mutual exchange of HR and technologies

1. Universities
2. Industries
History of NuTEC

• 1957: JAERI established
• 1958: RI Training Center (Tokyo)
• 1959: Reactor Training C. (Tokai)
• 1975: RI-Reactor Training Center
• 1996: (International) Nuclear Technology and Education Center
• More than 48,000 trainees in 43 y

Objective of Training Courses

• Training of RI, Radiation Engineers
• Training of Nuclear Engineers
• Cooperate in training of Nuclear and Radiation Engineers in Asian countries
• Nuclear hazard prevention training
• Disseminate knowledge on nuclear and radiation to the general public
Training of Radiation Engineers

- Radiation Basic Courses
- Radiation Protection Course
- Courses for application of RI and radiation (Radioisotope, Liquid Scintillation Measurement, etc.)
- Qualification Courses (Radiation Protection Supervisor, Working Environment Measurement Expert)

Training of Nuclear Engineers

- Nuclear Engineering General Courses,
  Introductory Course,
  Short-Term Course
- Senior Specialist for Nuclear Emergency Preparedness,
  Inspector for Safety Management of Nuclear Installations,
  Radiation Protection Course,
  Introductory Nuclear Emergency Preparedness and Planning

Courses on Nuclear Fuel Engineering, Radioactive Waste Management
Long-term change in the number of trainees of basic training courses

Change in number of trainees of RI-Radiation Basic Course and Institutions handling RI and radiation
Recent change in the number of trainees for the qualification courses

Change in the number of trainees for Nuclear Engineering Courses
Change in Training Needs (1)

• More of basic and practical training of RI, Radiation and Nuclear Engineers done in private sectors

• Certain needs in training to prepare for Nuclear Reactor Supervisor, Radiation Protection Officer and Working Envir. Measurem. Expert

• More request for nuclear accident and emergency preparedness

Change in Training Needs (2)

• More of basic and practical training of RI·Radiation and Nuclear Engineers done in private sectors

• Capability and experience in training RI, Radiation and Nuclear Engineers can be of use in Asian countries

• A need for teaching materials in English
It is hoped this workshop will find a mechanism of mutual support to cooperate in the exchange and production of materials useful for the human resources development in nuclear field in Asian and Pacific region
1.5 Discussion Session

1.5.1 Clarification and Classification of Needs of Each Country (See Table 1)
<table>
<thead>
<tr>
<th>Country</th>
<th>Training Type</th>
<th>Training Techniques Development Issues</th>
<th>Infrastructure Development Issues</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Training of professionals and senior management personnel</td>
<td>On-the-job training</td>
<td>(following have been operated)</td>
<td>To learn advanced management methods and experience from foreign</td>
</tr>
<tr>
<td></td>
<td>- Design of NPPs</td>
<td>Technical/experience exchange</td>
<td>- The training center in Qinshan</td>
<td>countries and to carry out international cooperation are required.</td>
</tr>
<tr>
<td></td>
<td>- Decommissioning and radioactive waste treatment technology</td>
<td>Lecture</td>
<td>Nuclear Power Base</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- RI production and nuclear technology application</td>
<td>Introduction of software (short-term) Training</td>
<td>- Nuclear Training Center</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- The Graduate School of Nuclear Industry</td>
<td></td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>Exchange of training course curricula in the field of RI utilization courses and nuclear power/safety related courses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exchange of training content and equipment descriptions in the field of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RR experiment training courses for university students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exchange of experts who have experience in HRD and exchange of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>lecturers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exchange of group training course visits to nuclear facilities for young nuclear executives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mutual cooperation projects such as establishment of cyber-learning system and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>development of multi-media training materials</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 1  Summary Table of Needs on HRD in Participating Countries based on the Country Reports for the 2nd WS (cont’d.)

<table>
<thead>
<tr>
<th>Country</th>
<th>Training Type</th>
<th>Training Techniques Development Issues</th>
<th>Infrastructure Development Issues</th>
<th>Note</th>
</tr>
</thead>
</table>
| Indonesia | Leader training  
- should be able to accommodate the diverse activities of the research  
- should be stressed on the strategy of technology transfer implementation  
Instructor training  
- to teach specific skills and knowledge  
R&D expert training  
- should cover development of "technology for operation and maintenance of RR", "nuclear safety system", "long term energy program", "nuclear fuel technology" | On-the-job techniques  
Off-the-job techniques  
- use of satellite communication  
Mutual visiting to training facilities                                                                 | Establishment of HRD program  
Establishment of facilities for training  
Establishment of education and training program |                                                                  |
| Malaysia  | Instructor training (review)  
Specialized training and expert (new)                                                                 | Development of computer-based training techniques and CAI training materials (review)  
- transformation from lecture notes/text books/power point slides to multimedia or CAI knowledge, and providing training materials | (Soft)  
- Analysis of human resources needed for NPP (review)  
- Countermeasures for the outflow of talents (review)  
- Recognition of nuclear medicine practitioners (Physical)  
- Development of educational infrastructure using internet (review) |                                                                  |
<table>
<thead>
<tr>
<th>Country</th>
<th>Training Type</th>
<th>Training Techniques Development Issues</th>
<th>Infrastructure Development Issues</th>
<th>Note</th>
</tr>
</thead>
</table>
| The Philippines | Academic Training to M.S. and Ph.D. in Nuclear Engineering, and to M.S. Medical Physics  
Exchange Program (high school science teachers  
- to other countries for training in the teaching of nuclear Science and technology  
- from other countries for demonstration of the teaching  
- for Faculty development in Medical Physics  | Development of training courses  
- RI application in agriculture, biotechnology and research  
Development of training materials, visual aids and simple equipment for detecting radioactivity  
Development of distance learning modules  | Modification of the curricula for high school and college education to include nuclear science topics  
Development of internet-based teaching and learning modules on nuclear science and technology  
Development or enhancement of graduate academic programs in nuclear science and technology |                                                                      |
| Thailand   | Training in the management function for handling of radiation/radioactive material  
School-teacher training on nuclear science (Material should include social, economic and legislative aspects)  | Computer-based training technique (suggested by Korea) for university students  
Multi-media training material for young scientists  | Development of a system of national accreditation for radiation protection officer  
Development of radiation safety scheme (regulatory and management control for use the radiation and radioactive materials)  
Building of competency in operational radiation protection |                                                                      |
<table>
<thead>
<tr>
<th>Country</th>
<th>Training Type</th>
<th>Training Techniques Development Issues</th>
<th>Infrastructure Development Issues</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viet Nam</td>
<td>Personnel/manpower training in the aspects concerning nuclear power, including project management, Teachers and instructors training, Staff training in the field of diagnostic and treatment by nuclear medicine techniques</td>
<td>Training on basic knowledge in radiation protection and nuclear safety&lt;br&gt;Training on reactor technology, radiation protection, nuclear safety and radwaste management&lt;br&gt;Training on accelerators techniques, radiation protection and medical physics</td>
<td>Establishment of a Center for Training on Radiation Protection Techniques and Nuclear Experiment&lt;br&gt;Upgrade the Training Center at Dalat Nuclear Research Institute&lt;br&gt;Setting-up a Center for Application of Nuclear Techniques in Medicine</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>Education and training of practical use of the most advanced technology using the advanced R&amp;D facilities, Provision of information on training courses and teaching materials in English (the copyright of texts and figures is one of technical issues to be solved)</td>
<td>Establishment of a system for enhancing mutual exchange of the human resources and technologies among universities, R&amp;D institutions and industries</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.5.2 Japanese Proposal for Enhancement of the FNCA Program Activities

November 28, Tokai, Japan

SUEO MACHI

FNCA Coordinator of Japan
Senior Managing Director of JAIF
The First FNCA/SOM 1 /Session 3

Japanese Proposal for Enhancement of the FNCA Program Activities

1. Introduction

During past 10 years, the FNCA network for cooperation has been well established even at the level of ministers. Scientific information has been exchanged among scientists and experts of the FNCA in the seven fields of activities to share experience, to accelerate research & development and application of nuclear technology. At the first Coordinator Meeting in Tokyo in March 2000, it was agreed to periodically review achievement and work plan of activities. This paper describes the proposal of Japan to revise the work plan to enhance social and economic impact of cooperative program.

2. Features of Project Activities

Basic features of the FNCA activities leading achievements with social and economic impact are:

- respond to needs of the FNCA countries
- significant economic and social impact for end users
- distinct advantages of nuclear technology over other methods
- firm commitment of participating governments

In order to expand social and economic impact of activities, sufficient linkage should be ensured with end users which could not be necessarily in nuclear industries.

Strengthening National Support

Each participating country of the FNCA is requested to establish a national mechanism to support the FNCA activities and also encouraged to prepare funds for FNCA cooperative activities in its country.

Coordinators should communicate more closely to evaluate the results, to review implementation, to discuss a work plan of the activities, and to coordinate basic issues among participating countries.

3. Focusing Project Activities

In order to achieve tangible results with social and economic impact, current project activities should be more focused to address specific needs. In this respect, following specific work plans are proposed for six fields of activities:

(1) Utilization of Research Reactor

Efficient Tc-99m generator production system using new JAERI technology from Mo-99 produced by n-γ reaction will be developed. The first small demonstration plant of Tc-99m generator column will be operated in 2001. Tc-99m generator is essential agent for nuclear
medicine and currently imported by Asian countries.

Applications of NAA (neutron activation analysis) for environment monitoring and mineral resources exploration will be also result-oriented activities.

(2) Application of Radioisotopes and Radiation for Agriculture

For mutation breeding, specific crops which need improving yield and/or disease resistance should be identified before the Coordinator Meeting in March 2001.

New activity on biofertilizer technology to increase yield of grain legume and rice avoiding environmental pollution is proposed to start in 2001.

(3) Application of Radioisotopes and Radiation for Medical Care

For treatment of uterine cancer (highest incidence in developing countries), expansion of application of established protocol and establishment of new protocol aiming more efficient treatment will be focused as scheduled.

(4) Public Information of Nuclear Energy

Emphasis shall be put to support national public information activities in each country.

(5) Radioactive Waste Management

Urgent cooperation on good management practice of spent radioisotope source is proposed. Regulation and management system for radioisotope utilization in terms of registration, reporting, collection and storage of spent radioisotope should be established. Concrete measures tackling this problem shall be discussed in the workshop which will take place in Australia in coming December.

(6) Human Resources Development

Human Resources Development strategy for national nuclear programme should be formulated by high level officials through workshop. Preparation of Human Resources Development scenario for enhancement of safety in radioisotope and research reactor application will be focused.

Japan will consider to support the human resource development of FNCA countries by its personnel exchange and training programs.
Appendix:

Proposal for the Future Plan of FNCA 's Activities in the Six Fields

1. Utilization of Research Reactor

2. Application of Radioisotopes and Radiation for Agriculture

3. Application of Radioisotopes and Radiation for Medical Uses

4. Public Information of Nuclear Energy

5. Radioactive Waste Management

6. Human Resources Development
1. Utilization of Research Reactors

Background

Cooperative activities on utilization of research reactors began in 1992. Up to now, workshops (WS) have been held with the main aim of exchanging scientific information on the following four themes: (1) neutron scattering; (2) radioisotope (RI) production; (3) neutron activation analysis (NAA); and (4) safe operation and maintenance of research reactors. In addition, at sub-workshops, efforts to transfer research techniques have been made through demonstrations and experiments.

Future Plan

A three-year program will focus on the most important activities according to the needs of the participating countries. The next WS will discuss this policy. The following activities will be proposed:

(1) Establishment and promotion of technology for Tc-99m generator production

Establishment and promotion of technology for Tc-99m generator production will be proposed as a new sub-project. Tc-99m generator is an essential agent for nuclear medicine and is currently imported by Asian countries. Significant social benefits can be expected, and the local production will give economic effects.

This sub-project will be implemented by the use of new JAERI technology, which produces Tc-99m efficiently by n-r reaction of Mo-99. Based on the first demonstration test of PZC (Poly-Zirconium Compound) column scheduled in 2001 in Japan, model tests will be started as one of the FNCA projects in 2002.

(2) Application of NAA.

Aiming to be more result-oriented activities, the purposes of NAA, which were defined in the present 3 year project, will be changed as follows:

i) Environmental samples from cities suffering from air pollution will be analyzed. Data will be used not only for comparisons among countries, but be made useful to solve the environmental problem.

ii) NAA will also serve as a means to probe and analyze mineral resources. Investigations using NAA on key mineral resources in each country will be implemented in coordination with organizations related to natural resources, and be used for resource development. Information on results will be exchanged to optimize development methodology.
2. Application of Radioisotopes and Radiation to Agriculture

Background

Following the implementation of the SIT project for three years from 1992, a project for plant mutation breeding has been carried out for seven years, since 1993. From 1993 to 1997, the focus was on information exchange, by which the situation in each country was better understood, and the need for improvements in the quantity and quality of commercial crops, and in resistance to disease, was found to be high. Since 1998, as Phase II, activities have been carried out focusing on workshops under the theme of basic methodology for “screening method for plant mutation breeding”.

Future Plan

Following the current Phase II ending in 2001, Phase III starting in 2002 will be reformulated with the following points to be taken into consideration: (i) cooperation activities should be based on concrete needs for improvement of plant varieties in each country, (ii) in addition to mutation breeding, other subjects will be considered to meet the needs of the FNCA countries.

(1) As for the improvement of plant varieties, crops for which there are high specific needs, and characteristics requiring improvement, will be identified at the next workshop and Coordinator Meeting, in order to prepare a plan (draft) for implementing joint research and achieving targets. Participate countries, work plans and sharing of responsibilities will be specified early in 2001.

(2) Efforts to improve the existing mutation breeding database and mutant stock repository (MSR) will be continued.

(3) As a new activity, the application of bio-fertilizers is proposed. Its purpose would be to increase crop yield, for example legume and rice, by the utilization of microorganisms (rhizobia) to improve the efficiency of nitrogen fixation. The bio-fertilizer has advantages over chemical fertilizers in terms of cost and environmental protection.
3. Application of Radioisotopes and Radiation for Medical Uses

Background

Establishment of a standardized protocol (treatment plan) for uterine cervix cancer (which frequently occurs in Asia, and is difficult to cure) has been conducted since 1993, being recognized that it would be of common benefit to the participating countries. In those countries, 210 patients have been treated by this protocol, resulting in a 60.3% three-year-survival rate and 83.7% local control rate, which is much better than old protocol. At workshop, open lectures on radiotherapy for radiotherapists, general practitioners and interns, plus visits to hospitals, has contributed to raising the level of regional health care.

Future Plan

Currently, activities are being carried out to accumulate 160 clinical cases under the new protocol in multi-fraction radiotherapy, which began last year. Hereafter, the following points will be considered in order to improve treatment efficiency and dissemination of new protocol.

Application of a standardized protocol for breast cancer, lung cancer, and head-and-neck cancer, and throat cancer, following uterine cervix cancer, will be promoted to improve therapy, efficiency in the future.

(1) Multi-fraction radiotherapy, which began last year, will be used to treat uterine cervix cancer for increased number of patients, with follow-up on survival ratio and local control ratio for the coming five years.

(2) Since better results are achieved under the above-mentioned standardized protocol, efforts will be made to expand its use. Through workshops and training courses in each participating country, and through strengthened cooperation with ministries and agencies responsible for medical care, the development of human resources for the therapy will be fostered and technology transfer will be enhanced. For this purpose, STA will consider to send Japanese experts/specialists and to accept oversea trainees under the FNCA framework.
4. Public Information of Nuclear Energy

Background

Cooperation in this area began as the Scientific Forum in 1991, and was later renamed PA seminars. At seminars (currently workshops), not only information on the methods of public information in each country, but the input of people from areas other than public information, including the mass media, education and government, has been shared. Contact Persons (currently Project Leader) were nominated to serve as PA contact points in each country, and AsiaNNet has been set up and improved. There is a facsimile network, PA materials are provided, the FNCA Newsletter is published, and an FNCA web-site has been opened on the Internet.

Future Plan

Emphasis will be shifted from the exchange of information/experiences among persons in charge of PA to public information activities. FNCA will support national public information activities in each country to obtain understanding of its own people on the utilization of nuclear technology.

(1) PI (PA) activities should be considered cross-sectional in all FNCA activities. Taking conclusion of workshop in Korea into consideration, strategy of PI (PA) project should be reviewed at the next Coordinators Meeting.

(2) In coordination with the IAEA and other organizations, experts and opinion leaders will be sent to symposiums and dialogues to be held by the FNCA countries on their own, in order to obtain public understanding on the peaceful use of nuclear energy.

(3) AsiaNNet information service and activities, including Newsletters and web-sites, will be enhanced. Each country will consider the publication of a Newsletter and the creation of a Web-site in its own language. Communications on accidents, which have been by facsimile and other media, will be continued with e-mail as well.

(4) The name will be changed from Public Acceptance (PA) to Public Information (PI).
5. Radioactive Waste Management

Background
Activities in the area of radioactive waste management have been carried out since 1995 mainly through workshop. Information exchange on the status of radioactive waste management in each country, the creation of a network among persons in charge, publication of a newsletter, and creation of an internet web-site have been achieved through these activities.

Future Plan
Recently, some troubles have occurred due to lack of good management of spent RI sources, such as radiation exposure accident in Thailand and import of metal scrap contaminated by radio isotopes from the Philippines to Japan. Considering this situation, we have reviewed the current three-year plan and propose the following activity plan with top priority in order to prevent similar accidents in any FNCA participating country. Synergy will be achieved through close coordination of the activities with the IAEA.

(1) Support to establish management system for sealed spent RI sources.
In order to prevent accidents due to inadequate management of sealed spent RI sources, a sub-project, which make support to establish management system, is proposed. The sub-project will be implemented in the order of: i) investigation of the current situation; ii) identification of appropriate methods for treatment/management and the necessary facilities; and iii) planning of possible cooperation programs.
Since this item is urgent, concrete plans will be formulated in Sydney workshop held in December this year.

(2) Completion of a Consolidated Report
Radioactive waste is divided into three categories: i) waste from nuclear power plants; ii) waste from research reactors; and iii) waste from medical and industrial uses.
Information on management policies, regulating systems, regulatory status, waste volumes, management including treatment, storage and disposal of these wastes in each country have been exchanged. Such information will be collected into a consolidated report by joint efforts among all countries using a common format. Completion of consolidated report is priority activities in the workshop as it will be the basis for cooperation on the management of radioactive waste and the prevention of accidents.
6. Human Resources Development

Background

At the tenth International Conference for Nuclear Cooperation in Asia (ICNCA) in March, 1999, the importance of the human resource development, which Japan proposed, was recognized. The first Seminar in November, 1999, in Tokyo, concluded that the needs of each country would be first clarified and FNCA countries cooperate to meet their needs.

Future Plan

This area covers extensive, diversified activities, ranging from education in schools, to seminars/training to foster young engineers and researchers (including qualification systems), to improvements in training methods, including development of educational materials, and to a national program to secure human resources. At workshop efforts will be made to tackle the issues, common in the region, as listed below, including identifying needs in each country and formulate scenarios to meet them. Because human resource development is closely related to the nuclear utilization program of each country, the common issues will be discussed at Coordinators' Meetings and FNCA meetings.

(1) Strategies will be discussed among high-level officials in charge, for fostering human resource development required to implement nuclear utilization programs in each country. Based on the needs of each country, cooperation will be useful in developing scenarios to foster/train human resources in each country, securing safety in RI and the utilization of research reactors.

(2) Cooperation will be made to foster the development of young human resources including students in nuclear research and technical development.

(3) As for the proposals made at workshop, Coordinators Meetings and FNCA meetings, Japan will make effort to reflect them, in the programs within the framework of existing personnel exchange and training programs (dispatch of experts, acceptance of trainee, various training seminars).
Some Suggestions for discussion

- Ph.D. Student exchange programme in nuclear science
- Youth conference on nuclear science and application
- Contribution of senior experts from developed countries staying in developing countries for longer period
- How to preserve expertise owned by senior experts to be retired
- Efficient utilization of STA scientist exchange programme and other ongoing training programme funded by Japan (Meeting needs of recipient country)
- Trained manpower for maintenance service of nuclear instruments

Human Resource Development (HRD)

1. Formulation of HRD strategy to meet national and regional needs
2. HRD scenario to ensure safety in RI and research reactor
3. Scenario for HRD in young generation
4. Coordination with personnel exchange and training programme sponsored by Japanese government
Workshop in 2001

- Presentation of national HRD strategy
- Presentation of scenario of HRD for nuclear safety (RI and RR)
- New proposals

**Strategy 1HRD**

○ Education in univ.
○ Training (OJT)
○ Preservation of expertise
  - Retirement
  - Brain drain to outside of country

○ New technique for education and training
○ Role of international cooperation
  - Exchange trainees
  - Exchange trainers
  - Student exchange programme
  - Joint development of training materials
1.6 Conclusion Session

Proposal on Future Activities
for Human Resources Development

On November 27 and 28, 2000, the Second Workshop on Human Resources Development (HRD) in Nuclear Field was held in Tokai Research Establishment of the Japan Atomic Energy Research Institute in the framework of the Forum for Nuclear Cooperation in Asia (FNCA). The status of HRD in each country was presented and through discussions, the needs were identified. A proposal to support the formulation of HRD strategy and scenario in member countries were made by Japan and discussed.

The action plan for the future cooperative activities for the HRD Project is to be communicated and agreed among the project leaders through the outside-the-workshop activities and presented to the Coordinators Meeting held on March 2001.

This proposal summarizes some thought on objectives and an action plan for the coming three years, i.e. from 2001 to 2003.

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 second workshop, an action plan based on the activities of the past year and a Japanese proposal for HRD presented at the first FNCA in Thailand was derived based on an extensive discussion among the countries.

1. Long term targets of cooperative activities

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 for mutual support will be included in the annual action plan and will be conducted as project activities. In addition, the need to mutually support the formulation of HRD strategy and scenario was identified.

2. The 3-year schedule for FY2001-2003

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 schedule 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 supporting 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 schedule of the Workshop for FY2001-2003 (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 STA SEP)
   - Develop annual action plan of the year
   - Develop 3 years plan (2002-2004)

(2) The Fourth Workshop (FY2002: to be discussed)
Target: Evaluate the achievements of 3 years, conduct mutual support activities, formulate HRD strategy and study HRD scenario
a. General presentation
   - Evaluate the achievements of mutual support of 3 years
   - Report HRD strategy and scenario
   - Information exchange on HRD in each country
b. Round table discussion
   - Review and revise medium-long term targets
   - Review HRD strategy and scenario
   - Develop annual action plan
   - Develop 3-year schedule for FY2003-2005

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

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

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

(1) Publication of JAERI-Review Report
The proceedings of the second workshop and the “Presentation on International Training and Education in Japan for Asian Countries” will be published as the “Annual Activities of FNCA HRD Project for FY 2000”.

(2) Mutual support for the needs in HRD
- Proposal from Japan, to start an internet homepage 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.

(3) Consideration of the following topics on HRD proposed at the Second Workshop by Dr. Machi, the FNCA Coordinator for Japan for discussion in the Third Workshop.
- Support the formulation of HRD strategy to meet national and regional needs
- Prepare HRD scenario to ensure safety in RI and research reactor
- Investigate HRD scenario in young generation
- Propose items for personnel exchange such as STA SEP.
<table>
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<th><strong>Table 1 Proposal on Three-year Schedule for Human Resources Development</strong></th>
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<td><strong>December 28, 2000</strong></td>
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<td><strong>MASTER SCHEDULE</strong></td>
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<td><strong>Annual Target</strong></td>
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<td><strong>Workshop on HRD General Presentation</strong></td>
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<td><strong>Round Table Discussion</strong></td>
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<td><strong>Outside-the Workshop activities</strong></td>
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II. Outside-workshop Activities
2. Program of “Presentations on International Training and Education in Japan for Asian Countries”
   November 29, 2000, Tokai Research Establishment, JAERI, Japan

Nov.29 / Wednesday  PRESENTATIONS

Large Conference Room in the Advanced Science Research Center
Tokai Research Establishment, JAERI

09:15-09:45  Visit to Tokai Education Center  (Overseas Participants)
             (Escort: Masakatsu Saeki, Deputy Director, Nuclear Technology and
             Education Center (NuTEC), JAERI)

09:45-15:15  Presentations
             Chairperson: Kenji Shimooka
             General Manager, Tokai Education Center,
             Nuclear Technology and Education Center (NuTEC),
             JAERI

09:45-10:15  Session-1
             “International Seminar on Nuclear Safety founded by STA”
             ① International seminar on nuclear safety for Asia
             ② International seminar on management of radwaste and spent
                fuel
             ③ International seminar on safety analysis
                Tsutomu Sakurai
                Director, International Nuclear Technology Cooperation
                Center, Radiation Application Development Association
                (RADA)

10:15-10:55  Session-2
             2-1 “International Seminar on Nuclear Safety Technology founded by
             STA”
             ① Joint Training Course
             ② Instructor Training Program
             ③ Safeguards Training Course
2-2 "IAEA Regional Training Workshop on Safety of Research Reactor"
Hajimu Shitomi
Head, International Technology Transfer Division
Nuclear Technology and Education Center (NuTEC), JAERI

10:55-11:05  < Coffee Break>

11:05-11:35  Session-3  Various Works Founded by STA
3-1 "The Seminar for Nuclear Administrators"
Nobuyuki Inoue
Deputy General Manager, Asia Cooperation Center
Japan Atomic Industrial Forum, Inc. (JAIF)

3-2 "Nuclear Safety Experts Dispatching Program"
Atsuko Takano
International Affairs and Research Department
Nuclear Safety Research Association

11:35-11:50  Session-4  Various Works Founded by MITI
4-1 "International Invitation Program for Safety Management at Nuclear Power Plants"
Haruo Matsumoto
Director, Japan Electric Power Information Center (JEPIC)

4-2 "Long Term Training on Safety Regulation for Nuclear Power"
Tsutomu Yokoyama
General Manager, Office of International Affairs
Nuclear Power Engineering Corporation

12:05-13:00  < Lunch (Akogigaura club) >  Transfer by bus

13:00-13:30  Session-5  "Outline of the STA Scientist Exchange Program in Nuclear Energy Research"
Akihiko Yamaguchi
Deputy Manager, Asia Cooperation Center
Japan Atomic Industrial Forum, Inc. (JAIF)
13:30-14:00 Session-6
Group training courses in the nuclear field founded by JICA and STA
6-1 “Seminar on Nuclear Safety and Regulation (JAIF)
   Group Training Course funded by JICA

6-2 “Nuclear Power Generation (JEPIC/JAPCO)

6-3 “Human Radiation Interface; Application in Medical Science
   —A Course of Radiation Therapy— (NIRS)
   Personal Training Course funded by JICA

6-4 “ Nuclear Technology (JAERI) ”

6-5 “Environmental Radioactivity analysis and Measurement”
   (Japan Chemical Analysis Center)
   Hikoyuki Ukai
   Deputy Director, First Training Division
   Tokyo International Center
   Japan International Cooperation Agency (JICA)

14:00-14:45 Session-7  Training Course coordinated by RCA Cooperation
7-1 “Overall Review”
   Hiroshi Abe
   Science and Nuclear Energy Division,
   Foreign Policy Bureau, Ministry of Foreign Affairs

7-2 “Enhancement and Harmonization of Radiation Protection
   RAS/9/018 (NIRS/JAERI Tokai/JNC) ”
   Kenzo Fujimoto
   National Project Coordinator of RAS/9/018
   Director, Human Radiation Environment,
   National Institute of Radiological Sciences

7-3 “RCA Program Activities in Medical Field (NIRS)
   Sadayoshi Kobayashi
   Senior Research Councilor
   National Institute of Radiological Sciences
7-4 “Regional Cooperation on Radiation Processing (JAERI)”
Tamikazu Kume
Head, Functional Materials Laboratory 1,
Takasaki Radiation Chemistry Research Establishment,
JAERI

14:45-15:15 Session-8 University Education on Nuclear Engineering for Foreign Students and Researchers
Masanori Antomi
Professor, Research Laboratory for Nuclear Reactors,
Tokyo Institute of Technology

15:15-15:30 <Coffee Break> 

15:30-16:00 Discussion
Chairperson: Yasushi Seki
Project Leader of Japan
Director, Nuclear Technology and Education center (NuTEC)

16:00-17:30 Technical Tour to Japan Atomic Power Company Training Center

Nov.30 / Thursday TECHNICAL TOUR * overseas participants only

09:15-15:50 Technical tour visit to Nuclear Facilities in Tokai-mura

• Japan Atomic Power Company—Tokai No.2 Power Station
• Tokai Research Establishment of JAERI —JRR-3, NSRR
• Japan Nuclear Cycle Development Institute—Tokai Works
2.1

I  Title of the seminar

International Seminars of Nuclear Safety

II  Sponsor
Science and Technology Agency

III  Implementing organization
Radiation Application Development Association

IV  Composition of the seminar
To enhance the knowledge and techniques of the persons concerned with nuclear safety in neighboring Asian countries and some others and also to improve the safety of nuclear facilities in our country, the seminar includes the three courses with the following subtitles:

International seminar on nuclear safety for Asia,
International seminar on management of radwaste and spent fuel,
International seminar on safety analysis.

Each of the three seminars consists of two parts:
(i) Presentation (lectures, and country reports)
(ii) Facility visit and technical tour

Outline of the three courses is described below.

IV-1. International Seminar on Nuclear Safety for Asia
1. Starting year
   1992
2. Purpose
   • To provide the participants with a panoramic scope on safety technology over various kinds of nuclear facilities.
   • To provide them with an opportunity of discussing the safety culture by visiting the facilities.
3. Qualification of the participant
   The participants should be engineers/administrators graduated from college/university in the faculty of science/technology and currently in the positions of
manager/supervisor class, or expected to be promoted to such positions in the near future. Their ages are to be 45 years old or less. All participants should be nominated by their government.

4. Place of the seminar
   Lecture building of Japan Atomic Energy Research Institute
   Shirakata-Shirane 2-4, Tokai-mura, Ibaraki-ken, Naka-gun, Japan

5. Duration of the seminar
   About 3 weeks/seminar (one seminar/year).

6. The number of the participants
   15 participants from 7 Asian countries (China, Korea, Indonesia, Malaysia, Philippines, Thailand and Vietnam).

7. Contents of the seminar
   The themes of the presentation are on nuclear safety administration and regulation in Japan, safety analysis of power reactors, reactor behavior at accident, etc. Facility visits/technical tour to relevant facilities have been planned (see Tables 1-1 and 2-1).
   During the period of the seminar, the participants are mainly expected to be able to exchange the following information:
   1) The system of nuclear safety administration and regulation in Japan.
   2) The present status of the operations of nuclear reactors and other nuclear facilities in Japan.
   3) The outline of the concepts of nuclear safety on design and constructions of nuclear facilities.
   4) The outline of the research and development activities of nuclear safety in Japan.

IV-2. International seminar on management of radwaste and spent fuel

1. Starting year
   1994

2. Purpose
   · To provide the participants with information of the current Japanese situation for management of radwaste and spent fuel and to enhance nuclear safety of the
facilities concerned.
   • To provide them with an opportunity of discussing the safety culture by visiting the facilities.

3. Qualification of the participant
   Participants should be administrative and technical experts of radwaste and spent fuel in the ages of forty-five years or less. All participants should be nominated by their government.

4. Place of the seminar Place of the seminar
   Lecture building of Japan Atomic Energy Research Institute
   Shirakata-Shirane 2-4, Tokai-mura, Ibaraki-ken, Naka-gun, Japan

5. Duration of the seminar
   About 3 weeks/seminar (one seminar/year).

6. The number of the participants
   19～20 participants from 15～16 Asian countries, Former Soviet Union and Central and East Europe (China, Indonesia, Korea, Malaysia, Philippine, Thailand, Vietnam, Bulgaria, Czech, Hungary, Lithuania, Romania, Russia, Slovakia, Ukraine, Poland).

7. Contents of the seminar
   The themes of the presentation are on nuclear safety administration and regulation of radwaste and spent fuel in Japan, decommissioning of nuclear facilities, storage and transport of spent fuel in Japan, etc. Facility visits/technical tour to relevant facilities are planned (see Tables 1-2and 2-2).
   During the period of the seminar, participants are mainly expected to be able to exchange the following information:
   1) Administration/regulation systems and guidelines relevant to radwaste and spent fuel in Japan.
   2) R&D activities of radwaste/spent fuel at JAERI and Japan Nuclear Cycle Development Institute (JNC).
   3) Present status of radwaste/spent fuel management at a nuclear power station.
   4) Radwaste/spent fuel technologies in Japan.
   5) Some related topics such as emergency preparedness.
IV-3. International seminar on safety analysis

1. Starting year
   1998

2. Purpose
   - To provide the participants with a scope on safety analysis technology over
     various fields of safety analysis for nuclear power plants.
   - To provide them with an opportunity of discussing a specified subject relevant
     to safety analysis by visiting the facilities.

3. Qualification of the participant
   Participants should be engineers/administrators who are in the position to
   choose methodologies software and modeling to be used in various fields regarding the
   safety analysis. They should be at their age of 45 years or less. All participants
   should be nominated by their government.

4. Place of the seminar
   Place of the seminar
   Lecture building of Japan Atomic Energy Research Institute
   Shirakata-Shirane 2-4, Tokai-mura, Ibaraki-ken, Naka-gun, Japan

5. Duration of the seminar
   About 3 weeks/seminar (one seminar/year).

6. The number of the participants
   13〜14 participants from 11〜12 Asian countries, Former Soviet Union and
   Central and East Europe (China, Indonesia, Korea, Philippines, Thailand, Vietnam,
   Bulgaria, Lithuania, Romania, Slovakia, Ukraine, Poland).

7. Contents of the seminar
   The themes of the presentation are on the latest data and technology on safety
   standard, safety design and safety analysis of nuclear facilities. Facility
   visits/technical tour to relevant facilities have been planned (see Tables 1-3 and 2-3).
   During the period of the seminar, the participants are mainly expected to be
   able to exchange the following information:
   1) Regulation system and guidelines relevant to safety analysis of nuclear
      facilities in Japan.
   2) Recent applications of safety analysis report for licensing.
   3) R&D activities for methodologies and software used for safety analysis.
   4) Outline of R&D activities on nuclear safety in Japan.
X. Attached papers
1) Recent Curricular---Table 1-1, Table 1-2, and Table 1-3.

2) The number of the participants---Table 2-1, Table 2-2, and Table 2-3.

XI. Reference
Radiation Application Development Association,
Tokai-mura, Naka-gun, Ibaraki-ken, 319-1106, Japan,

Tsutomu SAKURAI

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FAX: +81-29-282-6571
E-mail: sakurai@popx.tokai.jaeri.go.jp
Table 1-1
Curriculum for the 9th International Seminar on Nuclear Safety for Asia

August 24—September 12, 2000

International Nuclear Technology Cooperation Center
Radiation Application Development Association
### 1st Week

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October 4—October 27, 2000

International Nuclear Technology Cooperation Center
Radiation Application Development Association
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<td>Radioactive Waste Management System in JAERI</td>
<td>W-6-2</td>
<td>Radioactive Waste Management on Nuclear Power Station</td>
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<td>Radiation Monitoring in JAERI</td>
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<td>Volume Reduction and Solidification Technologies for Low Level Radioactive Waste in Japan</td>
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<td>Radionuclides during Nuclear</td>
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<td>19 Oct.</td>
<td>W-20 Engineering-Economic Analysis</td>
<td>W-21 Safeguards Techniques for a LWR</td>
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Table 1-3
Curriculum for the 3rd International Seminar on Safety Analysis

November 29—December 19, 2000

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Radiation Application Development Association
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<td>SA-1 Basic Concept of Nuclear Reactor Safety 2</td>
<td>SA-3 Japanese System of Safety Review and Legal Control</td>
<td>SA-4 Safety Design and Licensing Review of Light Water Reactors</td>
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<td>SA-9 Analysis of Severe Accident Phenomena</td>
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<td>SA-14 Neutronics Calculations for Safety Analysis</td>
<td>SA-15 Shielding Design and Analysis</td>
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<td>SA-16 Confirmation of Thermal-Hydraulic Design</td>
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<td>SA-17 Accident Analysis (Thermal-Hydraulic Analysis)</td>
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<td>SA-17-2-1 Transient Analysis</td>
<td>SA-17-2-2 LOCA</td>
<td>SA-17-2-3 Fuel Behavior in the NSRR Experiments Simulating Reactivity Initiated Accident and its Application</td>
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<td><strong>SA·18 Probabilistic Safety Assessment (PSA)</strong></td>
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<td>[K. Muramatsu]</td>
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| 14 Dec. (Thur) | | | **Ikata Nuclear Power Station, Shikoku Electric Power Co., Inc.**  
(Intl. Waste Process Plant) | |
| 15 Dec. (Fri) | | | **Matsuyama → Tadotsu**  
Tadotsu Engineering Laboratory, Nuclear Power Engineering Corporation  
Tadotsu → Kyoto | |
<p>| 16 Dec. (Sat.) | | | <strong>Report Work</strong> | |</p>
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- Kyoto → Yokohama
- Toshiba Corporation
  Yokohama → Tokyo
- Course Evaluation, Closing Ceremony & Farewell Party
- Departure from Narita
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Table 2-3  Number of Participants for the Int. Seminar on Safety Analysis

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2.2
2.2.1
I. International Atomic Energy Safety Technology Training Project

The Science and Technology Agency (STA) of Japan has entrusted the Japan Atomic Energy Research Institute (JAERI) to conduct the International Atomic Energy Safety Technology Training Project. The Project includes Bilateral Joint Training Courses, Instructor Training Program and Safeguards Training Course. The Radiation Application Development Association (RADA) has supported JAERI to execute the Project.

1. Bilateral Joint Training Course (JTC)

JTC is a training course on atomic energy safety for middle class scientists, engineers and technicians in intended Asian Countries. It is conducted in joint works with an education or training organization of the intended country. JAERI dispatches a course coordinator and several lecturers including specialists of RADA to JTC. The aims of JTC are to increase technical skills of the trainees and to make themselves familiar with safety culture. The curricula are very practical and are placed an importance on experiments. It is also aimed to improve and to reinforce the training system of the intended country in order to conduct higher level of training courses independently in future. At present, JAERI conducts JTC in joint works with the National Nuclear Energy Agency (BATAN) of the Republic of Indonesia and with the Office of Atomic Energy for Peace (OAEKP) of the Kingdom of Thailand. The activities necessary to conduct JTC in both countries above are based on the Bilateral Cooperation Arrangements.

(1) JTC at BATAN

BATAN takes 2 courses titled “Radiation Protection” and “Radiation Measurement and Nuclear Spectroscopy”. Every course is held for 2 weeks once a year with about 20 trainees at the Center for Education and Training (CET) of BATAN in Jakarta. The Radiation Protection Course is for development of radiation protection officers and of personnel who work in facilities concerned radiation and/or radioactive materials. The Radiation Measurement and Nuclear Spectroscopy Course is for personnel who are engaged in radiation measurement in various fields. The first JTC at BATAN titled “Radiation Protection” was held in December 1997. In November 2000, the 8th JTC titled “Radiation Measurement and Nuclear Spectroscopy” was completed. Table 1 shows the number of instructors concerned and trainees completed JTC. The details of the trainees are shown in Table 2. Through these 4 years joint works, CET has improved the training system enough
to conduct the above 2 training courses independently. As an example, the curriculum of the 8th JTC at BATAN is shown in Table 3.

(2) JTC at OAEP
OAEP has chosen 2 courses titled "Radiation Protection" and "Nuclear Technology and Application". Every course is held for 2 weeks once a year with about 20 trainees at the training center of OAEP in Bangkok. The Radiation Protection Course is for development of radiation protection officers. The Nuclear Technology and Application Course is for development of personnel who work in facilities concerned radiation and/or radioactive materials. The first JTC at OAEP titled "Radiation Protection" was held in November 1998. In October 2000, the 6th JTC titled "Nuclear Technology and Application" was completed. Table 4 shows the number of instructors concerned and trainees completed JTC. The details of the trainees are shown in Table 5. It is expected that the training center of OAEP will conduct the above 2 training courses independently from 2002.

2. Instructor Training Program (ITP)

ITP is a training course to develop instructors who will be engaged in JTC above. JAERI consults to develop instructors for the experiments planned in JTC with an adequate redundancy and accepts 1 or 2 trainees per year from the intended country for about 9 weeks to the Nuclear Technology and Education Center (NuTEC). In the curriculum of ITP, "Safety Instruction" and "Unsealed Radioisotope Handling" are compulsory subjects. Focusing the experiments, the trainees choose the other subjects at their own discretion depending on their roles and responsibilities in future JTC. After completed the training in NuTEC, the trainees work as co-instructors for the experiments of JTC together with JAERI instructors dispatched. Taking account of experiences and skills developed through the On-The-Job (OJT) at JTC, the co-instructors are promoted to instructors as one of the components indispensable for the training system of the intended country.

The 1st ITP for 2 BATAN personnel was held in November / December 1996. For the OAEP personnel, the 1st ITP was held in January / February 1997. In accordance with the curricula of JTC, JAERI accepted 9 persons from BATAN and also 9 persons from OAEP to NuTEC Tokyo and Tokai until the end of FY 2000. The subjects taken by BATAN and OAEP trainees are shown in Table 6 and Table 7 respectively. As an example, the latest curriculum for OAEP trainee is shown in Table 8.
Table 1  JTC AT BATAN
NUMBER OF INSTRUCTORS AND TRAINEES

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Table 2  JTC Trainees & Organization in Indonesia

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Table 3 BATAN-JAERI 8th JTC
ON RADIATION MEASUREMENT AND NUCLEAR SPECTROSCOPY
NOVEMBER 2000

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2nd week

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November 2000
# Table 4  JTC AT OAEP

NUMBER OF INSTRUCTORS AND TRAINEES

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Curriculum for Instructor Training Program
For OAEP

Duration: August 1 (Tue.) ~ September 29 (Fri.), 2000
Participant: Mr. Kun SUTTSURI

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*1: R&D Team for Earth Simulator

*2: Facility Radiation Control Division I
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**Participants in Safeguards Training Course**

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### Table 10
**Participants in IAEA Regional Training Workshop on Safety of Research Reactors**

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<td><strong>TOTAL</strong></td>
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</table>
1. Title: Safeguards Training Course

2. Organizer: STA, JAERI, IAEA

3. Executive Organization: NuTEC, JAERI

4. Contents of the training course

4.1. Initiated Year: FY 1996

4.2. Objectives of the training course

The training course is intended to provide the following information for the participants.

(1) Structure, procedure and activities of IAEA safeguards

(2) Particular techniques of Non Destructive Assay (NDA) and Containment/Surveillance (C/S)

(3) State System of Accounting for and Control of Nuclear Material (SSAC) in Japan

4.3. Qualification of applicant

(1) Qualification of applicant is expected to be administrative and technical experts of safeguards

(2) Nomination and endorsement of the government is necessary

4.4. Place of the training

Tokai Education Center, Nuclear Technology and Education Center

Japan Atomic Energy Research Institute

Tokai-mura, Naka-gun, Ibaraki-ken 319-1195, Japan,

Nuclear Power Station,

Fuel manufacturing factory, and

Safeguards analytical laboratory.

4.5. Duration: 3 weeks

4.6. The number limit: 16 persons
The Fourth Safeguards Training Course

CURRICULUM

February 24 ~ March 14, 2000

Nuclear Technology & Education Center
Japan Atomic Energy Research Institute

As of Feb. 28
<table>
<thead>
<tr>
<th>No.</th>
<th>TITLE</th>
<th>SESSION</th>
<th>LECTURER</th>
<th>ORGANIZATION</th>
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<tr>
<td>SG-1.1</td>
<td>IAEA Safeguards and the Peaceful Uses of Nuclear Energy</td>
<td>1</td>
<td>Kenji MURAKAMI</td>
<td>Director, Division of Operations C, IAEA</td>
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<td>-1.2</td>
<td>IAEA Safeguards Agreements</td>
<td>1</td>
<td>Jaime</td>
<td>Head, Section for Safeguards Training Division of Technical Services, IAEA</td>
</tr>
<tr>
<td>-1.3</td>
<td>IAEA Safeguards Approaches and Goals</td>
<td>1</td>
<td>VIDAURRE-HENRY</td>
<td>IAEA</td>
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<td>Introduction to IAEA Safeguards</td>
<td>1</td>
<td>Kenji MURAKAMI</td>
<td>IAEA</td>
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<td>Workshop on Design Information Questionnaire</td>
<td>2</td>
<td>Valerij BYTCHKOV</td>
<td>Head, Section OC2, Div. of Operations C, IAEA</td>
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<td>-3</td>
<td>Development of the Strengthened Safeguards System</td>
<td>1</td>
<td>Takeshi OSABE</td>
<td>NMCC</td>
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<td>IAEA Requirements to SSAC</td>
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<td>Valerij BYTCHKOV</td>
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<td>Basic Concepts of IAEA Nuclear Material Accounting</td>
<td>1</td>
<td>John OAKBERG</td>
<td>Senior Safeguards Information Officer, Sec. for Information Support Services, Div. of Safeguards Information Technology, IAEA</td>
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<td>Selected Nuclear Material Accounting Exercises</td>
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<td>IAEA</td>
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<td>Valerij BYTCHKOV</td>
<td>Head, Operations A, Tokyo Field Office, Div. of Operations A</td>
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<td>Dale QDEN</td>
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<td>NMCC</td>
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<td>Hideki YOSHIDA</td>
<td>Deputy Manager, Data Analysis Sec., Div. of Safeguards Information Treatment, NMCC</td>
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<td>-5.1</td>
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<td>Demonstration &amp; Workshop C/S Technology (1) Cobra Seal (2) Cerenkov Viewing Device</td>
<td>1</td>
<td>Yoichi YAMAMOTO</td>
<td>Nuclear Material Management Technology Lab., Dept. of Fuel Cycle Safety Research, JAERI</td>
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<td></td>
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<td>Makoto SAKAGUCHI</td>
<td>Non-destructive Assay Section, Safeguards Analytical Lab., NMCC</td>
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<td>-53</td>
<td>Japanese SSAC System and Its Application</td>
<td>1</td>
<td>Yukio NAKAMURA</td>
<td>Acting Inspector-General, International Affairs and Safeguards Div., STA</td>
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<td>SSAC Information Systems in Japan</td>
<td>1</td>
<td>Hiroshi OKASHITA</td>
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<td>Tadayoshi TAKEDA</td>
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<td>Takao SATO</td>
<td>Tokai Education Center, Nuclear Technology &amp; Education Center, JAERI</td>
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<td>-56</td>
<td>NDA Demonstration &amp; Workshop (1) Measurements of Enrichment of Uranium Samples (NaI) (2) Measurements of Enrichment of Uranium Samples (Ge) (3) Measurements of Enrichment of Uranium Samples using HM-4 (NaI)</td>
<td>4</td>
<td>Masao HASHIMOTO</td>
<td>NuTEC, JAERI</td>
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<td>Minoru AOKI</td>
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<td>Ryosuke KUROKAWA</td>
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<td>Hironobu OGAWA</td>
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<td>Demonstration on Recording and Reporting Systems</td>
<td>1</td>
<td>Hideo NISHIMURA</td>
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<td>The Application of Safeguards at Test and Research Reactors at JAERI</td>
<td>1</td>
<td>Fujio MIYAMOTO</td>
<td>Former Staff, JAERI</td>
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<td>Practice of SSAC in Japan 1) Light Water Reactors</td>
<td>1</td>
<td>Takeyoshi YAEGASHI</td>
<td>Manager, Engineering Sec., Onagawa Nuclear Power Station, Tohoku Electric Power Co., Inc.</td>
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<td>Practice of SSAC in Japan 2) Nuclear Material Control and Accounting in a Japanese Fuel Fabrication Facility</td>
<td>1</td>
<td>Tadatsugu ISHIKAWA</td>
<td>Group Manager, Nuclear Materials Management Group, Administration Dept., Japan Nuclear Fuel Co., Ltd.</td>
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<td>SSAC Activities other than for IAEA Safeguards</td>
<td>1</td>
<td>John HILL</td>
<td>Head, International Safeguards Section, ASNO</td>
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<td>Wan-Ki Yoon</td>
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<td>Safeguards Activities in Korea</td>
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<td>John HILL</td>
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<td>Establishing an SSAC at State and Facility Levels (Workshop)</td>
<td>2</td>
<td>Kenichi SHIMIZU</td>
<td>General Manager, Nuclear Materials Management Technology Lab., Dept. of Fuel Cycle Safety Research, JAERI</td>
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## II. FACILITY VISIT

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## III. TECHNICAL TOUR 5 DAYS

1. Mihama NPP, Kansai Electric Power Company
2. "Fugen (ATR)", JNC

## V. OTHERS

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<td>Course Evaluation and Closing Ceremony</td>
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The Fourth Safeguards Training Course

Timetable

February 24 ~ March 14, 2000

Nuclear Technology & Education Center
Japan Atomic Energy Research Institute
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<th>Date / Time</th>
<th>9:10 ~ 10:20</th>
<th>10:40 ~ 11:50</th>
<th>Lunch</th>
<th>13:30 ~ 14:40</th>
<th>15:00 ~ 16:10</th>
<th>Notes</th>
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<td>22 Feb. (Tue.)</td>
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<td>Arrival at Narita</td>
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<td>Narita → Mito</td>
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<td>24 Feb. (Thu.)</td>
<td>Registration, Opening Ceremony, Orientation and Safety Guide, etc.</td>
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<td>1.1 IAEA Safeguards and the Peaceful Uses of Nuclear Energy</td>
<td>1.2 IAEA Safeguards Agreements</td>
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<td>[Participants, NuTEC]</td>
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<td>(Video tape IAEA Safeguards)</td>
<td>[ IAEA – J. Vidaurre-Henry]</td>
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<td>[ IAEA – K. Murakami]</td>
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<td>16:00~16:10 Q &amp; A</td>
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<td>25 Feb. (Fri.)</td>
<td>1.3 IAEA Safeguards Approaches and Goals</td>
<td>2.1 Introduction to IAEA Safeguards</td>
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<td>2.2 Workshop on Design Information Questionnaire</td>
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<tr>
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<td>9:10 ~ 10:20</td>
<td>10:40 ~ 11:50</td>
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<td>28 Feb. (Mon.)</td>
<td>3 Development of the Strengthened Safeguards System</td>
<td>4.1 IAEA Requirements to SSAC</td>
<td>[IAEA - V. Bytchkov]</td>
<td>13:30 ~ 15:00</td>
<td>[IAEA - J. Oakberg]</td>
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<tr>
<td>29 Feb. (Tue.)</td>
<td>9:00 ~ 10:50</td>
<td>11:10 ~ 12:00</td>
<td>5.1 -1 Non-destructive Assay of Nuclear Material and Introduction to Containment and Surveillance Techniques</td>
<td>[IAEA - V. Bytchkov]</td>
<td>[IAEA - J. Oakberg]</td>
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<tr>
<td>1 Mar. (Wed.)</td>
<td>11:10 ~ 12:00</td>
<td>5.2 Demonstration &amp; Workshop C/S Technology</td>
<td>13:30 ~ 15:00</td>
<td>[IAEA - V. Bytchkov]</td>
<td>15:20 ~ 16:10</td>
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<td>2 Mar. (Thu.)</td>
<td>13:30 ~ 15:00</td>
<td>5.2 Demonstration &amp; Workshop C/S Technology</td>
<td>15:20 ~ 16:10</td>
<td>[IAEA - V. Bytchkov]</td>
<td>Non-destructive Assay of Nuclear Material</td>
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<tr>
<td>3 Mar. (Fri.)</td>
<td>15:20 ~ 16:10</td>
<td>5.1 -2 Non-destructive Assay of Nuclear Material</td>
<td>15:20 ~ 16:10</td>
<td>G1 ~ G4</td>
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<tr>
<td>5.5-1 NDA Demonstration &amp; Workshop</td>
<td>15:20 ~ 16:10</td>
<td>5.5-1 NDA Demonstration &amp; Workshop</td>
<td>15:20 ~ 16:10</td>
<td>G1 &amp; G2</td>
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<tr>
<td>5.5-2 NDA Demonstration &amp; Workshop</td>
<td>15:20 ~ 16:10</td>
<td>5.5-2 NDA Demonstration &amp; Workshop</td>
<td>15:20 ~ 16:10</td>
<td>G3 &amp; G4</td>
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<tr>
<td>5.6 NDA Demonstration &amp; Workshop</td>
<td>15:20 ~ 16:10</td>
<td>5.6 NDA Demonstration &amp; Workshop</td>
<td>15:20 ~ 16:10</td>
<td>(2) Measurement of Gamma-ray Spectrum using Ge Detector</td>
<td>NMCC - Aoki [JAERI - Hashimoto]</td>
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<tr>
<td>(1) Measurements of Enrichment of Uranium Samples (NaI)</td>
<td>15:20 ~ 16:10</td>
<td>(1) Measurements of Enrichment of Uranium Samples (NaI)</td>
<td>15:20 ~ 16:10</td>
<td>NMCC - Aoki [JAERI - Hashimoto]</td>
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<tr>
<td>(2) Measurements of Enrichment of Uranium Samples (Ge)</td>
<td>15:20 ~ 16:10</td>
<td>(2) Measurements of Enrichment of Uranium Samples (Ge)</td>
<td>15:20 ~ 16:10</td>
<td>NMCC - Kurokawa &amp; JAERI - Oda</td>
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<tr>
<td>(3) Measurements of Enrichment of Uranium Samples using HM-4 (NaI)</td>
<td>15:20 ~ 16:10</td>
<td>(3) Measurements of Enrichment of Uranium Samples using HM-4 (NaI)</td>
<td>15:20 ~ 16:10</td>
<td>JAERI - Ogawa</td>
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[STA - Nakamura] [NMCC - Okashita] [IAEI - Shinohara, Takeda, Sato] [JAERI - Hashimoto] [NMCC - Aoki] [JAERI - Ogawa]
<table>
<thead>
<tr>
<th>Date / Time</th>
<th>9:10 ~ 10:20</th>
<th>10:40 ~ 11:50</th>
<th>Lunch</th>
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<td></td>
<td>Demonstration on Recording and Reporting Systems</td>
<td>Practice of SSAC in Japan 1) Light Water Reactors</td>
<td>The Application of Safeguards at Test and Research Reactors at JAERI</td>
<td>Practice of SSAC in Japan 2) Nuclear Material Control and Accounting in a Japanese Fuel Fabrication Facility</td>
<td>JNF - Ishikawa</td>
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<td></td>
<td>[ JAERI - Nishimura ]</td>
<td>[ TEPCO - Yaegashi ]</td>
<td>[ JAERI - Miyamoto ]</td>
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<td>[ JNF - Ishikawa ]</td>
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<td>7 Mar. (Tue.)</td>
<td>9.1</td>
<td>9.2</td>
<td>Site Visit to NMCC (NMCC. Tokai Lab.)</td>
<td>Site Visit to JRR-3M</td>
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<td></td>
<td>SSAC Activities other than for IAEA Safeguards</td>
<td>SSAC Experience in Australia</td>
<td>[ NMCC ]</td>
<td>[ JAERI ]</td>
<td>[ JF ]</td>
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<td>[ ASO - J. HILL ]</td>
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<td>8 Mar. (Wed.)</td>
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<td>11</td>
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<tr>
<td></td>
<td>Korean Safeguards Activities and their Perspective</td>
<td>Establishing an SSAC at State and Facility Levels (Workshop)</td>
<td>[ JAERI - Shimizu &amp; NMCC - Osabe ]</td>
<td>[ JAERI - Shimizu &amp; NMCC - Osabe ]</td>
<td>[ JAERI ]</td>
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<td>Technical tour Mito → Tsuruga</td>
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<td>10 Mar. (Fri.)</td>
<td>Mihama NPP, Kansai Electric Power Company “Fugen (ATR)”, JNC</td>
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<td>9:10 ~ 10:20</td>
<td>10:40 ~ 11:50</td>
<td>Lunch</td>
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<td>Japan Nuclear Fuel Co., Ltd.</td>
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<td>14 Mar. (Tue.)</td>
<td>10:00~13:30 Course Evaluation, Closing Ceremony &amp; Farewell Party</td>
<td>[ STA, JAERI ]</td>
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<tr>
<td>20 countries</td>
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Number of persons participated in the Safeguards Training Course from 1996 to 1999

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<td>Total Countries</td>
<td>19</td>
<td>16</td>
<td>15</td>
<td>9</td>
<td>59 participants</td>
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</table>
2.2.2

1. Title: IAEA Regional Training Workshop on Safety of Research Reactors

2. Sponsor (Organizer): International Atomic Energy Agency (IAEA)

3. Host Organization: Japan Atomic Energy Research Institute (JAERI)

4. Substance:
   1) Commencement: Year of 1999
   2) Purpose: The workshop is designed to provide training on the safety of research reactors for personnel involved in safety regulation and operation.
   3) Participants: max. Twenty-four participants from China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam
   4) Place: Nuclear Technology Education Center (NuTEC), Tokai Research Establishment, JAERI
   5) Term: two weeks each for two years
   6) Note: The workshop is operated in the frame of the Extra-Budgetary Programme of Nuclear Installations in the South East Asia, Pacific and Far East Countries (EBP). In 1999, the workshop was focused on the role and contents of the safety analysis report, and in 2000, on the operational safety of research reactor.

5. Attachment: The time table of Y2K Training Workshop on the Safety of Research Reactors (draft)
# Timetable for the Regional Training Workshop on the Safety of Research Reactors (Operational Safety)

**Nov. 6 - 17, 2000, JAERI-Tokai, JAPAN**

**Draft: October 13, 2000**

<table>
<thead>
<tr>
<th>Date</th>
<th>1 9:30 - 10:40</th>
<th>2 10:50 - 12:00</th>
<th>3 13:10 - 14:20</th>
<th>4 14:30 - 15:40</th>
<th>5 15:50 - 17:00</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nov/06</strong></td>
<td>No. 1 Opening</td>
<td>No. 2 Status and Program of Research Reactor</td>
<td>No. 3 Status of Research Reactors in JAERI</td>
<td>No. 4 Country Report on Operational Safety Activity</td>
<td>No. 5 (IAEA, Kim)</td>
</tr>
<tr>
<td>Mon.</td>
<td>(IAEA/JAERI)</td>
<td>(IAEA, Kim)</td>
<td>(JAERI, Sakurai)</td>
<td>(IAEA, Kim)</td>
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<td><strong>Nov/07</strong></td>
<td>No. 6 Operational Safety in Research Reactor</td>
<td>No. 7 Safety Guideline For Operational Safety</td>
<td>No. 8 Test and Maintenance Program in Research Reactor</td>
<td>No. 9 Radiation Protection Program</td>
<td>No. 10 Radiation Protection Implementation in JAERI</td>
</tr>
<tr>
<td>Tue.</td>
<td>(IAE/Kim)</td>
<td>(JAERI, Ichikawa)</td>
<td>(Korea, We)</td>
<td>(Argentina, Mazzi)</td>
<td>(JAERI, Omura)</td>
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<td><strong>Nov/08</strong></td>
<td>No. 11 Rules for Operational Safety in JAERI</td>
<td>No. 12 Quality Assurance Program (1)</td>
<td>No. 13 Operational Limits and Condition for Research Reactor</td>
<td>No. 14 Risk Concerned Maintenance</td>
<td>No. 15 Discussion</td>
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<tr>
<td>Wed.</td>
<td>(JAERI, Ishima)</td>
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<td><strong>Nov/09</strong></td>
<td>No. 16 Quality Assurance Program (2)</td>
<td>No. 17 Environmental Impact Analysis for Research Reactor</td>
<td>No. 18 Radiological Consequence Analysis for Research Reactor</td>
<td>No. 19 INSARR Missions and Their Results</td>
<td>No. 20 Discussion</td>
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<td>Thu.</td>
<td>(Korea, Jung)</td>
<td>(Argentina, Mazzi)</td>
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<td><strong>Nov/10</strong></td>
<td>No. 21 Country Report on Emergency Operating Procedure and Emergency Planning</td>
<td>No. 22</td>
<td>No. 23 Core Management of Research Reactor</td>
<td>No. 24 Safety in Decommissioning</td>
<td>No. 25 Discussion</td>
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<tr>
<td>Fri.</td>
<td>(IAEA, Kim)</td>
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<td>(JAERI, Murayama)</td>
<td>(JAERI, Yanagihara)</td>
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**WEEKEND BREAK**

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<th>5 15:50 - 17:00</th>
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<tr>
<td><strong>Nov/13</strong></td>
<td>No. 26 Fundamental Reactor Theory</td>
<td>No. 27 Outline for Simulator Exercise</td>
<td>No. 28 Group A: JRR-1 Simulator Exercise</td>
<td>No. 29 Group B: Facility Visit 1 (JRR-3M and Naka Fusion Res. Inst.)</td>
<td>No. 30 Group C: Facility Visit 2 (NSRR, JMTR and HTTR)</td>
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<td>Mon.</td>
<td>(JAERI, Murayama)</td>
<td>(JAERI, Honko)</td>
<td>(JAERI, Murayama)</td>
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<td>No. 31 Preparation of Operation Procedure (1)</td>
<td>No. 32 Preparation of Operation Procedure (2)</td>
<td>No. 33 Group A: Facility Visit 2 (NSRR, JMTR and HTTR)</td>
<td>No. 34 Group B: JRR-1 Simulator Exercise</td>
<td>No. 35 Group C: Facility Visit 1 (JRR-3M and Naka Fusion Res. Inst.)</td>
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<td>Tue.</td>
<td>(France, Abuyeza)</td>
<td>(France, Abuyeza)</td>
<td>(JAERI, Shimooka)</td>
<td>(RADA, Katagiri)</td>
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<td>No. 36 Radioactive Waste Management</td>
<td>No. 37 Radiological Emergency Preparedness Arrangement</td>
<td>No. 38</td>
<td>No. 39</td>
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<td>No. 41 Operational Event Analysis (1)</td>
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<td>No. 43 Group C: JRR-1 Simulator Exercise</td>
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<td>Thu.</td>
<td>(France, Abuyeza)</td>
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<td>(France, Abuyeza)</td>
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<td>No. 46 Course Evaluation</td>
<td>No. 47 Closing</td>
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- 221 -
INTERNATIONAL TRAINING COURSES

NUCLEAR TECHNOLOGY AND EDUCATION CENTER
(NuTEC)

JAERI 1

INTRODUCTION

1. INTERNATIONAL ATOMIC ENERGY SAFETY TECHNOLOGY TRAINING PROJECT
2. IAEA REGIONAL TRAINING WORKSHOP ON SAFETY OF RESEARCH REACTORS
INTERNATIONAL ATOMIC ENERGY SAFETY TECHNOLOGY TRAINING PROJECT

- BILATERAL JOINT TRAINING COURSES (JTC)
- INSTRUCTOR TRAINING PROGRAM (ITP)
- SAFEGUARDS TRAINING COURSE

WHAT IS JTC?

- A TRAINING COURSE ON ATOMIC ENERGY SAFETY FOR SCIENTISTS, ENGINEERS AND TECHNICIANS.
- CONDUCTED IN JOINT WORKS WITH AN EDUCATION OR TRAINING ORGANIZATION
- JAERI DISPATCHES SOME LECTURERS AND A COURSE COORDINATOR.
- THE ACTIVITIES TO CONDUCT JTC ARE BASED ON A BILATERAL ARRANGEMENT.
AIMS OF JTC

- LEVEL-UP OF TECHNICAL SKILLS AND STIMULATION / INFILTRATION OF SAFETY CULTURE OF THE TRAINEES
- TO IMPROVE / TO REINFORCE THE TRAINING SYSTEM OF THE COUNTRY TO CONDUCT HIGHER GRADE TRAINING COURSES INDEPENDENTLY IN FUTURE

JTCs CURRENTLY CONDUCTED

- IN ACCORDANCE WITH THE NEEDS AND PREPARATION STATUS, JTC IS CONDUCTED; WITH BATAN: EVERY 2W/Y, 20 TRAINEES
  RADIATION PROTECTION
  RAD. MEASUREMENT & NUCLEAR SPECTROSCOPY
  WITH OAEP: EVERY 2W/Y, 20 TRAINEES
  RADIATION PROTECTION
  NUCLEAR TECHNOLOGY AND APPLICATION
INSTRUCTOR TRAINING
PROGRAM (ITP)

- TO DEVELOP INSTRUCTORS
  FOR JTC
- TO REINFORCE TRAINING
  SYSTEM

DEVELOPMENT OF INSTRUCTORS

- ACCEPTS 1 OR 2 TRAINEES FOR 2
  MONTHS IN NuTEC OF JAERI
- PLACE AN IMPORTANCE ON
  EXPERIMENTS.
- TRAINEES CHOOSE AND STUDY
  SUBJECTS TO BE RESPONSIBLE
  AT JTC IN FUTURE.
OJT IN JTC

- AFTER COMPLETED ITP, QUALIFIED AS CO-INSTRUCTOR FOR EXPERIMENTS IN JTC
- INSTRUCT JTC TRAINEES WITH JAERI INSTRUCTORS DISPATCHED
- QUALIFIED AS INSTRUCTOR

SAFEGUARDS TRAINING COURSE

TRAINING PROVIDES:
- STRUCTURE, PROCEDURE & ACTIVITIES OF IAEA SAFEGUARDS
- PARTICULAR TECHNIQUES OF NDA & C/S
- SSAC OF NUCLEAR MATERIAL IN JAPAN
QUALIFICATION OF APPLICANT

- EXPECTED TO BE ADMINISTRATIVE & TECHNICAL EXPERT OF SAFEGUARDS
- NOMINATION AND ENDORSEMENT OF GOVERNMENT

TRAINING IS HELD;

- UNDER COOPERATION OF IAEA
- AT NuTEC TOKAI OF JAERI
- FOR 3 WEEKS
- WITH MAX. 16 PARTICIPANTS
IAEA REGIONAL WORKSHOP ON SAFETY OF RESEARCH REACTORS

- ORGANIZED BY IAEA BASED ON THE EXTRA-BUDGETARY PROGRAM (EBP) SUPPORTED BY STA, JAPAN
- HOSTED BY NuTEC OF JAERI

WORK SHOP

- PROVIDES TRAINING ON SAFETY OF RESEARCH REACTORS FOR PERSONNEL INVOLVED IN SAFETY REGULATION AND OPERATION
- FOCUSED ON SAFETY ANALYSIS REPORT (SAR) AND OPERATIONAL SAFETY
WORKSHOP IS HELD;

- AT NuTEC TOKAI JAERI
- FOR 2 WEEKS
- WITH MAX. 24 PARTICIPANTS, from China, Indonesia, Malaysia, the Philippines, Thailand and Viet Nam
2.3 Various Works Founded by STA

2.3.1 The Seminar for Nuclear Administrators

1. Name of the Program: The Seminar for Nuclear Administrators

2. Sponsor: Science and Technology Agency (STA), the Government of Japan

3. Operating Organizations: Japan Atomic Industrial Forum, Inc. (JAIF)

4. Outline of the Seminar
   1) Start of the Seminar:
      from FY1985 (Every fiscal year)
   2) Purposes of the Seminar
      The seminar is organized for middle-level nuclear administrators
      from Asian countries to introduce Japanese experience in nuclear
      energy development and utilization.
   3) Countries covered
      China, Republic of Korea, Indonesia, Malaysia, Thailand, The
      Philippines, Bangladesh, Sri Lanka and Vietnam
   4) Places of the Seminar:
      Lectures: JAIF (Tokyo)
      Technical Visits: Research Institutes, Nuclear Power Station and
      related nuclear facilities
   5) Period of Seminar: 2 weeks
   6) Number of Participants

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</tbody>
</table>

5. Contact (Mailing Address):
   Asia Cooperation Center
   Japan Atomic Industrial Forum, Inc.
   1-7-6, Toranomon, Minato-ku, Tokyo 100-5001 Japan
   Mr. Akihiko Yamaguchi, Deputy Manager
   Telephone: +81 3-3508-7932 Facsimile: +81 3-3508-9021
   E-mail: yamaguch@jaif.or.jp (Mr. Akihiko Yamaguchi)
Table 2  Number of Participants for the Seminar for Nuclear Administrators

<table>
<thead>
<tr>
<th></th>
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( ) number of participants on their account, included in the TOTAL.
# Program of the 13th Seminar for Nuclear Administrators

**Basic Theme:** Development, Utilization and Safety of Nuclear Energy

<table>
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<th>Date</th>
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<tr>
<td>1/25 Tuesday</td>
<td>Opening</td>
<td>Lecture 1: Long-term Program for Nuclear R&amp;D in Japan (STA, Mr. Naka)</td>
<td>Lecture 2: Nuclear Energy Policy and Administrative Regime in Japan (STA, Mr. Oshima)</td>
<td>Lecture 3: Present Status of Nuclear Safety Administration in Japan (STA, Mr. Anegawa)</td>
<td>Lecture 4: The Outline of JCO Accident and measures to be taken (STA, Mr. Honda)</td>
<td>Briefing for the Seminar (JAIF)</td>
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<td>1/27 Thursday</td>
<td>Lecture 5: Operational Safety of Nuclear Power Plants in Japan (MITI, Mr. Kurotani)</td>
<td>Lecture 6: Actions to be taken in case of Incident or Accident in Japanese Nuclear Power Stations (Tokyo Electric Power Company, Mr. Igarashi)</td>
<td>Lecture 7: Safety Maintenance of Nuclear Fuel Producing Company (Mitsubishi Materials Co., Dr. Ishii)</td>
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<td>1/31 Monday</td>
<td>Technical Visit 3: SPring 8 (Japan Synchrotron Radiation Research Institute) Technical Visit 4: New Suburu (Himeji Institute of Technology)</td>
<td>Transportation (Himeji ⇒ Tsuruga)</td>
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<td>2/1 Tuesday</td>
<td>Technical Visit 5: Mihama Power Station (Kansai Electric Power Company Inc.) Technical Visit 6: Institute of Nuclear Safety System, Inc.</td>
<td>Transportation (Tsuruga ⇒ Tokyo)</td>
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<td>2/2 Wednesday</td>
<td>Lecture 8: Present Status of Radiation and RL Utilization in Japan (Japan Radioisotope Association, Dr. Umezawa)</td>
<td>Lecture 9: The Circumstances of PA Activities for Nuclear Energy in Japan (Federation of Electric Power Companies, Mr. Kimiyama)</td>
<td>Lecture 10: Nuclear Energy and Mass Media (Science Journalist, Mr. M. Nakamura)</td>
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<td>2/4 Friday</td>
<td>Lecture 13: Nuclear Cooperation in Asia (STA, Mr. Nakano) Evaluation Session for the Future Improvement (STA and JAIF)</td>
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2.3.2 Nuclear Safety Experts Dispatching Program

Atsuko Takano
International Affairs and Research Department
Nuclear Safety Research Association

1. Introduction

This program is one of the Science and Technology Agency (STA) projects and executed by Nuclear Safety Research Association (NSRA). The program in Asian region was started in 1994FY to dispatch Japanese experts to each country in Asia for the purpose of mutual improvement in nuclear safety systems through technical discussions and exchange of technical knowledge. The countries covered in this program are fundamentally China, Republic of Korea, Indonesia, Malaysia, Thailand, The Philippines and Vietnam.

2. Contents of the program

Our association has dispatched the experts to those countries for a short and/or long term under this program.

(1) Long-term program (2 to 6 months)

We dispatch one senior expert basically, who has much and wide knowledge of nuclear technology and nuclear safety, to each country in a fiscal year. Each expert discusses the technical issues and exchange opinions frankly about them with the executive officers, the experts in the related organizations (governmental organizations, institutes, etc.). In addition, special lectures are given to the students majored in nuclear engineering in the universities and/or technical colleges. In the technical discussion and exchange, each dispatched expert introduces much experience and present status in the nuclear development, technologies, and nuclear safety in Japan to be put to the best use in every country.

The expert in this program, on some occasions, also cooperates to the governmental organizations as a technical consultant.

(2) Short-term program (about 1 week)

If some specific and technical topics for discussions during the long-term program are come up, we dispatch several experts additionally for a short-term to hold the technical meetings. The short-term program consists of the experts from various organizations (governmental institutions, industries, universities, etc.), because these meetings aim for discussions on the specified topics.
3. Conclusion

For the peaceful utilization of nuclear power and for the operation of research reactors in Asian region, it is necessary and important to recognize the importance of establishment of nuclear safety systems, and to establish and enhance them actually.

This program is organized for the purpose of improving in nuclear safety systems and enhancing them through the exchange of technical knowledge, information, and opinion by dispatched experts. And its effect will be expected to lead to enhance mutual understanding and to establish the mutual support in Asian region.
Table 1: Schedule for Nuclear Safety Expert Dispatching Program in The Philippines

1) Dispatched Expert: one
2) Duration: January 6, 2000 to February 4, 2000
3) Place and Contact Organization: Philippine Nuclear Research Institute
4) Schedule:

<table>
<thead>
<tr>
<th>Date</th>
<th>Contents</th>
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<tbody>
<tr>
<td>January 6</td>
<td>Briefing on the schedule of the program</td>
</tr>
<tr>
<td>January 7</td>
<td>Hearing of development in nuclear fields in Philippines and repair of</td>
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<td></td>
<td>Philippine Research Reactor-1 (PRR-1)</td>
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<tr>
<td>January 10-11</td>
<td>Discussion about the repair of PRR-1</td>
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<tr>
<td>January 12</td>
<td>Discussion about the status of radiological emergency preparedness in</td>
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<td>January 13-14</td>
<td>Preparations for the special lectures</td>
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<tr>
<td>January 17</td>
<td>Special lecture and discussion about “Recent Nuclear Criticality Accident</td>
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<tr>
<td></td>
<td>at Tokaimura in Japan”</td>
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<tr>
<td>January 18</td>
<td>Preparations for the special lectures</td>
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<tr>
<td>January 19</td>
<td>Special lecture and discussion about “Safety Culture”</td>
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<tr>
<td>January 20</td>
<td>Preparations for the special lectures</td>
</tr>
<tr>
<td>January 21</td>
<td>Special lecture and discussion about “Nuclear Safety Regulations And</td>
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<tr>
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<td>licensing Procedures of Nuclear Facilities in Japan “</td>
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<td>January 24</td>
<td>Special lecture and discussion about “Safety in Nuclear Facilities”</td>
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<tr>
<td>January 25</td>
<td>Technical discussion at BNPP</td>
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<td>January 26</td>
<td>Meeting with IAEA delegations on research reactor repair</td>
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<tr>
<td>January 27-28</td>
<td>Summarizing of the contents of the program, effects, and issues</td>
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<td>February 1</td>
<td>Discussion about materials degradation, including Aluminum corrosion</td>
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<td>Discussion about nuclear regulations in Philippines</td>
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<td>February 3</td>
<td>Special lecture and discussion about “Radiation Protection and Radiation</td>
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<td>Emergency Program in Japan”</td>
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<td>February 4</td>
<td>Briefing on the effect of the program</td>
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<tr>
<td>Year</td>
<td>Country</td>
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<tr>
<td>------</td>
<td>---------</td>
</tr>
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<td>China</td>
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<td>1998</td>
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<td>2000</td>
<td>Indonesia</td>
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<td>The Philippines</td>
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<table>
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<th>FY1998 (Pre-meeting)</th>
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TOTAL 11 10 30
2.4 Various Works Founded by MITI

1. Name of the training program
   International Invitation Program for Safety Management at Nuclear Power Plants

2. Sponsor
   Ministry of International Trade and Industry

3. Acting organization
   Japan Electric Power Information Center (JEPIC)

4. Others
   - Starting year: Fiscal year 1992
   - Ending year: Fiscal year 2001
   - Purpose of the training: To enhance nuclear safety
   - Trainees: Personnel from nuclear related organizations in beneficiary countries (Russia, Ukraine, Bulgaria, Lithuania, Armenia, Hungary, Czech, Slovakia, Rumania, China)
   - Training venue: JEPIC, nuclear power plants and training centers of electric utilities, manufacturers, etc.
   - Training frequency and duration (FY 2000):
     15 courses/year, 17-20 days/course
   - Number of trainees to be accepted (FY 2000): 8-9 persons/course
Table: The schedule of “Managers and Supervisors Course”
(An example)

<table>
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<tr>
<th>Day</th>
<th>Activities/Subjects</th>
<th>Venues</th>
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<td>Arrival at Tokyo</td>
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<tr>
<td>2 (Thu.)</td>
<td>General description on nuclear power in Japan</td>
<td>JEPIC</td>
</tr>
<tr>
<td>3 (Fri.)</td>
<td>Safety regulation and administration</td>
<td>JEPIC</td>
</tr>
<tr>
<td>4 (Sat.)</td>
<td>(Free)</td>
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</tr>
<tr>
<td>5 (Sun.)</td>
<td>Trip</td>
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<tr>
<td>6 (Mon.)</td>
<td>Quality control/Organization for maintenance</td>
<td>Manufacturer</td>
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<td>7 (Tue.)</td>
<td>Trip</td>
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<td>8 (Wed.)</td>
<td>Operation management/Maintenance management</td>
<td>NPP (PWR)</td>
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<td>9 (Thu.)</td>
<td>Water chemistry control/Reactor core control·Fuel handling</td>
<td>NPP (PWR)</td>
</tr>
<tr>
<td>10 (Fri.)</td>
<td>Education for operators</td>
<td>NTC</td>
</tr>
<tr>
<td>11 (Sat.)</td>
<td>Trip</td>
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<tr>
<td>12 (Sun.)</td>
<td>(Free)</td>
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<tr>
<td>13 (Mon.)</td>
<td>Quality control/Radiation control/Measures to prevent human errors</td>
<td>NPP (BWR)</td>
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<tr>
<td>14 (Tue.)</td>
<td>Fire prevention/Education and training/Management of troubles</td>
<td>NPP (BWR)</td>
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<td>15 (Wed.)</td>
<td>Trip</td>
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<td>16 (Thu.)</td>
<td>Closing meeting</td>
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<td>17 (Fri.)</td>
<td>Departure from Narita Airport</td>
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[Abbreviation]

·JEPIC: Japan Electric Power Information Center
·NPP: Nuclear Power Plant
·NTC: Nuclear Power Training Center
·PWR: Pressurized Water Reactor
·BWR: Boiled Water Reactor
2.4.1

International Invitation Program for Safety Management Nuclear Power Plants

Purpose: To enhance nuclear safety

Trainees: Russia, Ukraine, Bulgaria, Lithuania, Armenia, Hungary, Czech, Slovakia, Rumania, China

1,000 Persons (10-years period)


Sponsor: Ministry of International Trade and Industry (MITI)

Acting organization: Japan Electric Power Information Center (JEPIC)
International Invitation Program for Safety Management Nuclear Power Plants

Training frequency (FY 2000) : 15 courses/year
  - Managers and Supervisors Course (6 courses)
  - Maintenance Personnel Course (8 courses)
  - Aseismic Designers Course (1 course)

Training duration (FY 2000) : 17 – 20 days/course

Number of trainees (FY 2000) : 8 – 9 persons/course
2.4.2 Long-term Training on Safety Regulation for Nuclear Power

Dr. YOKOYAMA, Tsutomu
Chief, Office of International Affairs
Nuclear Power Engineering Corporation

Purpose of Long-term Training

• To provide generic knowledge of safety regulation for nuclear power.

• To provide OJT (On the Job Training) on Safety Analysis or Inspection.

• To visit organizations and facilities for better understanding of safety regulation.
Results of Long-term Training

• Started in 1996. It is the 5th times in 2000.

• Trainees stayed for 3 months.

• 34 trainees are finished who are from Republic of China and Republic of Indonesia.

Program Structure of Long-term Training

1. General Lecture on Nuclear Power and Safety Regulation

2. Special Lecture on Specific Field

3. OJT on Safety Analysis, or Inspection
Program Summary of Long-term Training

- **General Lecture for 1 week**
  - Summary of Japanese Nuclear Power Generation
  - Japanese Safety Regulation on Nuclear Power

**2 Special Lecture for 7/6 weeks**
- Safety Regulation, Safety Analysis and Earthquake Analysis 1 week
- Permission for Construction Work Plan 1 week
- Maintenance and Inspection (except Inspection course) 1 week
- Operation Administration, Function of Plant 2 week
- Information on Operation Management 1 week
- Demonstration Test for Reliability 1 week

- Safety Analysis OJT 5 weeks
- Inspection OJT 6 weeks

**Yearly Results of Long-term Training**

<table>
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<th>Year</th>
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<td>1996</td>
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<td>Course on Safety Regulation and Safety Analysis</td>
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<td>Course on Safety Regulation and Safety Analysis/Inspection</td>
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<td>1998</td>
<td>NNSA and related organization, China 3 (2 for Inspection course), BPPT, Indonesia 3</td>
<td>Ditto</td>
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<td>1999</td>
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<td>Ditto</td>
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<tr>
<td>2000</td>
<td>NNSA and related organization, China 4 (2 for Inspection course), BAPETEN, Indonesia 4</td>
<td>Ditto</td>
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</table>
2.5 Outline of the STA Scientist Exchange Program in Nuclear Energy Research

1. Name of the Program: The Scientist Exchange Program in Nuclear Energy Research between Japan and Neighboring Countries

2. Sponsor: Science and Technology Agency, the Government of Japan

3. Japanese Institutes engaged in the Program:
   1) Japan Atomic Energy Research Institute (JAERI)
   2) Japan Nuclear Cycle Development Corporation (JNC)
   3) National Institute of Radiological Sciences (NIRS)
   4) National Research Institute for Metals (NRIM)
   5) Japan Chemical Analysis Center (JCAC)
   6) Electrochemical Laboratory (ETL)

Secretariat:
Asia Cooperation Center, Japan Atomic Industrial Forum, Inc.

4. Outline of the Program
   1) Start of the Program:
      from FY1985 (Every fiscal year)

2) Purposes of the Program
   Aiming to strengthen cooperation between Japan and the neighboring countries in the field of nuclear energy, to receive foreign scientists at national nuclear institutes in Japan and to dispatch Japanese scientists to foreign countries, for joint study on the related subjects.

3) Foreign Organizations Invited to the Program:
   Bangladesh Atomic Energy Commission (BAEC)
   China Atomic Energy Authority (CAEA)
   National Nuclear Energy Agency (BATAN, Indonesia)
   Ministry of Science and Technology (MOST, Korea)
   Malaysian Institute for Nuclear Technology Research (MINT)
   Philippine Nuclear Research Institute (PNRI)
Atomic Energy Authority (AEA, Sri Lanka)
Office of Atomic Energy for Peace (OAEP, Thailand)
Vietnam Atomic Energy Commission (VAEC)

4) Places to Implement the Program:
Assignment of Foreign Scientists to Japan: 6 Japanese Institutes
Assignment of Japanese Scientists to Abroad: Inst., lab., etc designated by the foreign organizations

5) Period of Assignment of Scientists
Foreign Scientists to Japan: three months to one year
Japanese Scientists to Abroad: two months at longest

6) Number of Assignment of Scientists*
Foreign Scientists to Japan: JAERI (60), JNC (19), NIRS (4),
NRIM (2), JCAC (2), ETL (5)
Japanese Scientists to Abroad: JAERI (25), JNC (7), NIRS (3),
NRIM (a few members), JCAC (a few members), ETL (5)

*The number shows the approximate number of scientists planned for FY 2001 program.

5. Attachments: 2 figures

6. Contact (Mailing Address):
Asia Cooperation Center
Japan Atomic Industrial Forum, Inc.
1-7-6, Toranomon, Minato-ku, Tokyo 1005-0001 Japan
Ms. Kaoru Sasaki or Mr. Akihiko Yamaguchi
Tel.: +81 3-3508-7932 Fax.: +81 3-3508-9021
E-mail: kaoru@jaif.or.jp (Ms. Kaoru Sasaki)
yamaguch@jaif.or.jp (Mr. Akihiko Yamaguchi)
Scientist Exchange Program

-Assignment of Japanese Scientists to Abroad-

(Number of Scientists)

- Number of Applications
- Number of Japanese Scientists Assigned to Abroad

(Fiscal Year) (Planned)
2.6 Group Training Courses in the Nuclear Field founded by JICA and STA

Address by Hikoyuki Ukai
Deputy Director, First Training Division
Tokyo International Centre
Japan International Cooperation Agency

The Japan International Cooperation Agency (JICA) was founded in 1974 to implement technical cooperation programmes and facilitate capital grant assistance to developing countries under Japan's Official Development Assistance (ODA) Programme.

JICA is organising five group training courses in the nuclear field. The Tokyo International Centre (TIC), which is one of ten international centres of the Agency, handles all the courses. Considering the number of courses, you may think that the Agency puts a particular priority on the field, however, I must confess that they are one of minorities among more than six hundred group training courses we have every year. JICA’s training courses cover every field and sector from a very basic and practical training such as ‘Handling and Primary Processing of Fishery Products’, to the cutting edge of technology such as ‘Human-Radiation Interface; Application in medical Science’, which will be introduced later.

Before introducing the outlines of five nuclear related courses, I would like to show you the basic process of group training course management.

1. Each recipient government puts the order of priorities on six hundred training courses within their votes allocated by the government of Japan. The results will also be reflected in the scrap and build assessments for a training course every five or ten year.

2. At the same time, each training institution puts the order of priorities on the inviting countries in consultation with the related Japanese authorities.

3. JICA coordinates the priorities of both parties with the related Japanese authorities.

4. Through the evaluation of each training course, invited countries will be reviewed every year.

As a result of the process, the participants for five nuclear related courses are chosen in favour of Asian countries, the percentage is shown as follows;

1. Nuclear Technology 76.2%
2. Nuclear Power Generation 77.1%
3. Seminar on Nuclear Safety and Regulation 76.8%
4. Environmental Radioactivity analysis and Measurement 85.5%
5. Human-Radiation Interface; Application in medical Science ~A Course of Radiation Therapy~ 96.0%

The propensity for Asian countries reflects the policy of the Japanese government, which should be introduced to you in previous sessions.
Followings are the outlines of five nuclear related courses.

2.6.1 Nuclear Technology
This training course, which consists of two fields of training, “Radioisotope and radiation experiments” and “Engineering of nuclear reactors” will provide training separately according to the field of study. The curriculum of each group consists of three parts: (1) lectures, (2) practices and (3) study tours.

- Target Group
- Course objectives
- Training institutions
  \[\text{See Appendix 1}\]
- Course Duration
  \[1.5\text{ months}\]

2.6.2 Nuclear Power Generation
The purpose of the course is to provide the participants with general introductory information on the administrative and technical aspects of Japan’s nuclear power industry, which includes experience gained through planning, design, construction and operation of nuclear power plants. Through the training, participants will be able to implement the future development plan of nuclear power in their countries.

- Target Group
- Course objectives
- Training institutions
  \[\text{See Appendix 2}\]
- Course Duration
  \[2\text{ months}\]

2.6.3 Seminar on Nuclear Safety and Regulation
The purpose of the seminar is to introduce Japanese situation of nuclear safety and regulations in general as well as work-site systems for safety control of radiation through lectures and observation trips. Exchanges of opinions and information on participants’ countries regarding their immediate problems will be encouraged.

- Target Group
- Course objectives
- Training institutions
  \[\text{See Appendix 3}\]
- Course Duration
  \[1\text{ month}\]

2.6.4 Environmental Radioactivity analysis and Measurement
The purpose of the seminar is to give the participants practical knowledge of environmental radioactivity analysis and measurement, and to give them an opportunity to learn the relevant techniques through lectures and practical exercises.
2.6.5 Human-Radiation Interface: Application in medical Science

~ A Course of Radiation Therapy ~

The purpose of this course is to give the participants knowledge on Human-Radiation Interface in view of medical, biological and environmental sciences and to transfer the latest techniques through lectures, practices of one's speciality and interest, study tours and seminars to promote of radiation in each developing country.

- Target Group
- Course objectives
- Training institutions
- Course Duration 1 month

Finally, I really hope that these five courses will contribute to the safe usage of nuclear, and the moderate steps of development in each invited country.
Appendix 1

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<thead>
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<th>Course No</th>
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<td>Target Group</td>
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Course objectives:

Through the training program, participants are expected to:

- **Group A** (Radiosotope and radiation experiments)
  1. reaffirm the basic concepts of radiation and radioisotopes and the basic techniques of radiation measurement.
  2. understand all concepts of utilization of radiation and radioisotopes in science and engineering.
  3. comprehend the importance of radiological protection at nuclear facilities, and acquire basic techniques of radiation monitoring.

- **Group B** (Engineering of nuclear reactors)
  1. obtain basic knowledge of nuclear reactor.
  2. obtain practical knowledge of reactor operation.
  3. obtain general knowledge of power reactors.

Training Institution 1

Tokyo Education Center, Nuclear Technology and Education Center, Japan Atomic Energy Research Institute (JAERI)
Training Institute for Group A

| Address | 2-28-49 Honkomagome, Bunkyo-ku, Tokyo 113-0021, Japan |
| TEL     | 81-3-3942-4221 |
| FAX     | 81-3-3944-4445 |

Training Institution 2

Tokai Education Center, Nuclear Technology and Education Center, Japan Atomic Energy Research Institute (JAERI)
Training Institute for Group B

| Address | Tokai-mura, Naka-gun, Ibaraki 319-1195, Japan |
| TEL     | 81-292-82-5309 |
| FAX     | 81-292-82-6041 |

Responsible JICA Centre

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### Nuclear Technology

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*P/D : Presentation & Discussion  **Obs./V : Observation & Visit  
There will, however, be minor changes in several subjects.

### A. Curriculum for Group A (Radioisotope and radiation experiments)

1. Lectures
   a. Basic subject such as Radiation Physics, Radiation Chemistry, Radiation Biology, etc.
   b. Radiological protection such as Principle of Radiological Protection, Radiation Monitoring, etc.
   c. Radiation and radioisotope application such as Application to Industry, Medical Application of Accelerators, etc.

2. Practice:
   a. Basic experiments such as Gamma-ray Spectrometry, Liquid Scintillation Measurements, etc.
Nuclear Technology

b. Radiation monitoring such as Gamma-ray Exposure Survey, Surface Contamination Measurement, etc.
c. Radiation and radioisotope application such as Autoradiography, Radioimmunoassay, Neutron Activation Analysis, Radiation Damage, Radiation Sterilization, etc.

(3) Study Tours
a. Takasaki Radiation Chemistry Research Establishment, Japan Atomic Energy Research Institute (Gunma Prefecture)
b. Genkai Nuclear Power Plant (PWR), Kyushu Electric Company (Fukuoka Prefecture)
c. Hamaoka Nuclear Power Plant (BWR), Chubu Electric Company (Shizuoka Prefecture)

B. Curriculum for Group B (Engineering of nuclear reactors)
(1) Lectures
a. Reactor Physics
b. Reactor Thermal Hydraulics
c. Reactor Kinetics
d. Reactor Instrumentation and Control
e. Reactor Engineering
f. Nuclear Fuel Cycle
g. Reactor Safety

(2) Practices
a. TCA Experiments (TCA: a critical assembly)
b. Reactor Simulator Practice

(3) Study Tours
a. Research and Test Reactors and other Research Laboratories in JAERI
b. Tokai Power Station, Japan Atomic Power Company (Ibaraki Prefecture)
c. Genkai Nuclear Power Plant (PWR), Kyushu Electric Company (Fukuoka Prefecture)
d. Hamaoka Nuclear Power Plant (BWR), Chubu Electric Company (Shizuoka Prefecture)
## Appendix 2

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<td>Course objectives</td>
<td>Through the course, participants are expected to become familiar with:</td>
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<td>(1) History of Japan’s nuclear power development</td>
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<td>(2) Japan’s governmental policy and regulations concerning the nuclear power industry</td>
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<td>(3) Technology adopted in the field of Japan’s nuclear power plants from the construction to operation and maintenance stage of the plants</td>
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<td>(4) Safety measures applied in Japan in nuclear power generation</td>
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### Training Institution 1
- **Agency of Natural Resources and Energy, Ministry of International Trade and Industry**
- **Address**: 3-1 Kasumigaseki 1-chome, Chiyoda-ku, Tokyo 100-8931, Japan
- **TEL**: 81-3-3501-1511 FAX

### Training Institution 2
- **Japan Electric Power Information Center, Inc. (JEPIC)**
- **Address**: 15-33, Shibaura 4-chome, Minato-ku, Tokyo 108-0023, Japan
- **TEL**: 81-3-5476-5060 FAX

### Training Institution 3
- **The Japan Atomic Power Company (JAPC)**
- **Address**: Otemachi Bldg., 1-6-1, Otemachi, Chiyoda-ku, Tokyo 100-0004, Japan
- **TEL**: 81-3-3201-6631 FAX

### Responsible JICA Centre
- **Tokyo International Centre (TIC)**

### Invited Countries

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Nuclear Power Generation

1. Introductory Programme at International Cooperation Center (ICC) of Japan Electric Power Information Center (JEPIC)
   Lectures:
   1) Japan's Electric Power Industry
   2) Power Demand and Electric Power Development Plan
   3) Outline of Nuclear Power Generation in Japan
   4) Safety Regulation and Administration for Commercial Nuclear Power Plants
   5) Nuclear Power PA (Public Acceptance) Activities of the Electric Power Industry

2. Programme at The Japan Atomic Power Company (JAPC)
   Lectures:
   1) General features of nuclear power plants
      - Major systems of boiling water reactor and pressurized water reactor
         - reactor core
         - primary/secondary cooling system
         - turbine/generator
         - instrumentation and control
         - engineered safety features system
         - radioactive waste treatment system
         - others
      - Safety design
      - Aseismatic design
      - Quality assurance
   2) Construction
      - Licensing
      - Site selection
      - Construction work
   3) Operation and maintenance
      - Operation
      - Core management
      - Maintenance
      - Radiation protection
      - Incidents and response system
Appendix 3

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| Course objectives | Through the seminar, participants are expected to:  
(1) acquire overall understanding regarding the administrative organizations and functions of the Japanese government for safety assurance and control or nuclear safety,  
(2) understand how safety is secured at facilities and reactor facilities using radioisotope,  
(3) have mutual understanding on the situation of nuclear safety control among participants’ countries, and  
(4) establish international solidarity regarding assurance of nuclear safety. |
| Training Institution | Japan Atomic Industrial Forum (JAIF) |
| Address | Masumoto Building 3F, 1-7-6, Toranomon, Minato-ku, Tokyo 105-0001, Japan |
| TEL | 81-3-3508-7932 |
| FAX | 81-3-3508-9021 |

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</table>
Environmental Radioactivity analysis and Measurement

<table>
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<tr>
<th>Objective</th>
<th>Programme / Details</th>
<th>Purpose and Method of Guidance</th>
<th>Schedule (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To obtain knowledge of nuclear safety regulations in Japan</td>
<td>1. Country Report Presentation</td>
<td>• Participants make presentation on the nuclear safety regulations in their respective countries to share the information</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>2. Lectures</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) Current status of nuclear safety administration in Japan</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) Safety regulations and administration on;</td>
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</tr>
<tr>
<td></td>
<td>a. The application of radiation and radioisotope</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Research &amp; demonstration reactors in Japan</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Nuclear fuel facilities in Japan</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Transport of nuclear materials in Japan</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. Management and disposal of radioactive waste</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f. Commercial NPP in Japan</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) Operational experience of NPP in Japan</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4) Safeguards of nuclear materials in Japan</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5) Off-site disaster preventive measures for NPP in Japan</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>To exchange opinions on problems for application to present status in each country</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To understand implementation of nuclear safety regulations</td>
<td>3. Round Table Discussion</td>
<td>• The operational experience of NPP in Japan is introduced.</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>Study Tour</td>
<td>• The outline of safeguards of nuclear materials in Japan is explained.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Preventive measures for NPP are explained.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants discuss problems of nuclear safety regulations in Japan and in other countries following questions and topics brought up by a course leader.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants observe JAERI Tokai establishment, PNC Tokai works, a research reactor, a nuclear power plant, a safety research facility, Hiroshima Peace Memorial Park, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participants also have a great opportunity to attend the 10th International Congress of the International Radiation Protection Association (IPRA-10) to be held in Hiroshima, from May 14 to May 19, 2000.</td>
<td></td>
</tr>
</tbody>
</table>

Total: 37 0 11 42

*P/D: Presentation & Discussion  **Obs./V: Observation & Visit
There will, however, be minor changes in several subjects.
Appendix 4

<table>
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<tr>
<th>Course No</th>
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<tr>
<td>Course Title</td>
<td>Environmental Radioactivity Analysis and Measurement</td>
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<td>Duration (JFY2000)</td>
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<tr>
<td>Target Group</td>
<td>Researchers who have been working in organizations or divisions concerned with environmental radioactivity analysis and measurement fields.</td>
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<td>Course objectives</td>
<td>Through the training, participants are expected to understand: (1) a basic concept of environmental radioactivity analysis and measurement, (2) the methods and techniques on collection and pretreatment of environmental samples, (3) the methods and techniques on radiochemical analysis and measurement of tritium, radioactive strontium and uranium in environmental samples, (4) Gamma ray spectrometry with germanium semiconductor detector, (5) the methods and techniques of Gamma ray dose measurement with thermoluminescence dosimeter system, and (6) some topics concerning the recent techniques on environmental problems.</td>
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<th>Training Institution</th>
<th>Japan Chemical Analysis Center (JCAC)</th>
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<tr>
<td>Address</td>
<td>295-3, Sanno-cho, Inage-ku, Chiba-shi, Chiba 263-0002, Japan</td>
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<tr>
<td>TEL</td>
<td>81-43-424-8663 FAX 81-43-423-4071</td>
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<th>Tokyo International Centre (TIC)</th>
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<tr>
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<td>Indonesia</td>
<td>1 1 1 1 1 1 1 7</td>
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<tr>
<td>Korea</td>
<td>2 1 1 1 1 1 5 6</td>
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<td>Malaysia</td>
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<td>Mongolia</td>
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<td>Philippines</td>
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<td>Sri Lanka</td>
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<td>Thailand</td>
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<td>Saudi Arabia</td>
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<td>Brazil</td>
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Seminar on Nuclear Safety and Regulation

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<th>Purpose and Method of Guidance</th>
<th>Schedule (Hours)</th>
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<tr>
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<td>Lecture</td>
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<td>To understand the concepts and methods of radioactive analysis</td>
<td>1. Basic Subjects</td>
<td>• Radioactivity and Radioisotopes</td>
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<tr>
<td></td>
<td></td>
<td>• Radiation in a Living Environment</td>
<td>3</td>
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<tr>
<td></td>
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<td>• Radiochemistry</td>
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<tr>
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<td></td>
<td>• Behaviors of Globally Dispersed Radionuclides</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2. Sampling and Pretreatment</td>
<td>• Sampling and Pretreatment of Precipitation, Water, Fish, Vegetables, etc.</td>
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<tr>
<td></td>
<td>3. Analysis and Measurements of Tritium, Radioactive Strontium, Radon and Uranium in Environmental Samples</td>
<td>• Tritium Beta Ray Measurement with Liquid Scintillation Counter</td>
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<tr>
<td></td>
<td></td>
<td>• Radioactive Strontium Beta Ray Measurement with GM Counter</td>
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<tr>
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<td></td>
<td>• Uranium Alpha Ray Measurement with Silicon Semiconductor Detector</td>
<td>3</td>
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<tr>
<td></td>
<td></td>
<td>• Radon Measurement</td>
<td>6</td>
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<tr>
<td></td>
<td></td>
<td>• Gamma Ray Spectrometry with Germanium Semiconductor Detector</td>
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<tr>
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<td>• Environmental Gamma Ray Dose Measurement with Thermoluminescence Dosimeter System</td>
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</tr>
<tr>
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<td>4. Gamma Ray Spectrometry</td>
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</tr>
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<td></td>
<td>5. Environmental Gamma Ray Dose Measurement</td>
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<tr>
<td></td>
<td>6. Others</td>
<td>• Radon in a Human Environment</td>
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<tr>
<td></td>
<td></td>
<td>• The Emergency Dosimeter for People -Application from Chernobyl Accident-</td>
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<td></td>
<td>7. Observation</td>
<td>• Environmental Radiation Monitoring Center</td>
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<td>• Nuclear Power Station</td>
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<td>• Radiation Effects Research Foundation</td>
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Total: 40 | 65 | 0 | 38

*P/D : Presentation & Discussion    **Obs./V : Observation & Visit

There will, however, be minor changes in several subjects.
Appendix 5

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<td>Course Title</td>
<td>Human-Radiation Interface: (Application of Radiation in Medical Science ~ A Course of Radiation Therapy ~)</td>
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<td>Target Group</td>
<td>Medical doctors who have several years’ experience in radiation therapy or its related fields at hospital, research or educational institutions or governmental organizations.</td>
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<tr>
<td>Course objectives</td>
<td>By the end of the training period, participants are expected to be able to deepen their understanding of: (1) basic and fundamental knowledge related to the Human-Radiation Interface, (2) latest knowledge on radiation therapy and its related fields, (3) updated techniques related to current topics in radiation therapy.</td>
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<tr>
<td>Training Institutions</td>
<td>National-Institute of Radiological Sciences (NIRS)</td>
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<td>Address</td>
<td>4-9-1, Anagawa, Inage-ku, Chiba-shi, Chiba 263-8555, Japan</td>
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Human-Radiation Interface; Application in medical Science

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<td>To obtain basic and fundamental knowledge on radiation therapy</td>
<td>1. General aspects</td>
<td>Present status of radiotherapy in Japan</td>
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<td>2. Radiation physics</td>
<td>Database and clinical trial</td>
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<td>3. Radiation biology</td>
<td>Dosimetry</td>
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<td>Effects of radiation on the cells</td>
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<td>Radiation biology with particle beams</td>
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<td>2. Treatment techniques</td>
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<td>3. Conformal radiation technique</td>
<td>CT-Planning</td>
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<td>5. Particle radiation therapy</td>
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<td>Proton, heavy-ion</td>
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<td>Cobalt, iridium</td>
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<td>HDR, LDR</td>
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<td>Clinical practice</td>
<td>1. Results of radiation therapy</td>
<td>Head &amp; neck</td>
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<td>Lung</td>
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<td>Uterine cervix</td>
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<td>Others</td>
<td>1. Radiation genetics</td>
<td>Gene-study</td>
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<td>2. Acute radiation exposure</td>
<td>Management of over exposed patients</td>
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<td>3. Country report presentation</td>
<td>Visit to Hiroshima</td>
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Total 18 7 1 4

*P/D: Presentation & Discussion  **Obs./V: Observation & Visit

There will, however, be minor changes in several subjects.
2.7 Training Course Coordinated by RCA Cooperation

2.7.1 Enhancement and Harmonisation of Radiation Protection
RAS/9/018

Kenzo Fujimoto, National Project Coordinator of RAS/9/018
Director of Human Radiation Environment
National Institute of Radiological Sciences
4-9-1, Anagawa, Inage-ku, Chiba, JAPAN

1. Introduction

After the Japanese proposal of Project on Strengthening Radiation Protection Infrastructures to the RCA Working Group Meeting in General Conference in 1987, RCA activities in the field of radiation protection were initiated with full support from Japanese extrabudgetary contribution. In the first phase (1987-1992) Programme Formulation Meeting (PFM) and Expert Advisory Group Meeting (EAGM) of National Project Coordinators (NPC) were organized in Japan. During the second phase (1993-1997) the responsibility of the project was gradually shared among the Member States. In Phase 1 and 2 many activities were successfully conducted and the Member States obtained knowledge as well as techniques required in the radiation protection through training workshops, exchange experts and trainees, intercomparisons and expert advisory group meetings. Intercomparison of personal dosimeters, intercomparison on radioactivity measurement and compilation of Reference Asian Man data are one of those noticeable achievement which were mainly supported by Japan.

Japanese government understands that radiation protection is the foundations of all radiation-related practices and an important aspect for the peaceful use of radiation. She keeps the same stance to the third phase project (1998-2002) on Enhancement and Harmonization of Radiation Protection with her efforts to enhance the radiation protection standards in Member States in this region.

2. Structure of Radiation Protection Programmes in IAEA/RCA.

RAS/9/018 is a complex project, involving multiple funding sources, multiple topic areas in radiation protection, multiple types of activity and countries with a wide range of needs. Main areas in radiation protection are classified as shown below. Assigned persons are responsible to keep an eye on the activities in the area. Each year the coordination group of NRP's assembled to review the activities with the consideration of the needs in the member states. In February 2000, the Mid-Term Review Meeting was held in Bali, Indonesia by sixteen NPCs for Phase 3 of RAS/9/018 (Myanmar could not attend) and the IAEA Technical Officer.

The areas of responsibility of the Coordination Group were confirmed as:

- Standards and Regulations – Mrs Valdezco (Philippines)
• Accident management – Dr Cameron (Australia)
• Radiation Protection in Medicine – Dr Fujimoto (Japan)
• Radiation Protection in Industry – Ms Cong Huiling (China)
• Occupational and Environmental Exposure – Dr Pradhan (India)

3. Activities Related to Japan

Japan has implemented training courses, workshops and a coordinated research programme in accordance with the project document, which was set at the Project Formulation Meeting as well as the Expert Advisory Group Meetings. Three important activities mainly supported by Japan are described below.

3-1. RCA Personal dosimetry Intercomparison
16 Participants: Australia, Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Malaysia, Mongolia, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Viet Nam

JAERI has been taken an important role in this programme. The second phase RCA personal dosimeter intercomparison consisted of two sub-programmes, i.e., reference exposure value intercalibration with RPL glass dosimeters and personal dosimeter intercomparison exercises. These intercomparisons provided the participating facilities access to calibration fields and resources not available to most participants, with radiation energies covering the full range normally encountered in the work place. The results provide the Agency and the RCA Member States with a valuable picture of strengths and weaknesses in their individual monitoring programmes. Review of the results help identify ways to improve the calibration, measurement and assessment methods. The third phase is planned to carry out during 2001 to 2002 with the consultant meeting held in Japan on 23 and 24 October 2000.

3-2. Intercomparison of Environmental Samples
15 Participants: Australia, Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Malaysia, Mongolia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Viet Nam

PNC played as a key laboratory for the intercomparison of environmental samples with Seibersdorf and ARL. Intercomparison of reference samples was conducted involving 15 participating regional analytical laboratories. This exercise upgraded regional capabilities and harmonization of the techniques used for environmental radioactivity measurements.

3-3. Reference Asian Man Project
11 Participants: Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Malaysia,
Pakistan, Philippines, Thailand, Viet Nam.

In the year 1987, Reference Asian Man Project was proposed by Japan and the two
phases of these projects have been carried out by 100% Japanese financial support. The
proposal was made in the background of increasing interest in radiation dose to the general
public in context of revision of the ICRP Reference Man, as well as the Chernobyl Accident.
Following a review and approval by the IAEA, the CRP on Compilation of Physical,
Physiological and Metabolic Characteristics for Reference Asian Man was carried out
between 1989 - 1993. The first major outcome of this CRP was completion of the physical
measurements of the male and female subjects, and the second, documentation of the mass of
internal organs. These results were published as an IAEA TECDOC-1005 (volumes 1 and 2)
in the year 1998. The second phase of the Reference Asian Man was initiated in 1995 for the
acquisition of data on trace elements in diets and organs with the same form of CRP. The final
meeting was held in Vietnam in June 2000. The project is in the final stage to publish their

3-4. Annual Activities
2001 –

• Workshop for medical personnel with responsibilities in an emergency on:
  Medical preparedness and response to radiological accidents
  NIRS, 20-24 August, 2001

• Workshop on effluent monitoring for liquid discharges
  JNC and JAERI, October 2001.

2000

• Workshop on calibration of dosimeters and survey instruments for occupational
  protection
  JAERI and JNC, 16-20 October, 2000
  19 Participants: Bangladesh, China, India, Indonesia (2), Republic of Korea, Malaysia,
  Mongolia (2), Philippines (2), Singapore, Sri Lanka (2), Thailand (2), Viet Nam (2).

• Expert Advisory Group Meeting on the third RCA dosimetry intercomparison
  IAEA, Australia, Japan, Republic of Korea, New Zealand

• Training Workshop on Effluent Monitoring and Environmental Assessment,
  JNC and JAERI, 6-10 March, 2000
  11 participants: Bangladesh (2), Republic of Korea (2), Malaysia (2), Philippines (2),
  Thailand and Vietnam (2).

1999: one proposed activity was postponed to March 2000.

1998
• Regional Training Workshop on Application of Indirect Methods for Internal Dosimetry of Internally Deposited Radionuclides
  JAERI and PNC, 16-20 November 1998.
  8 participants: Bangladesh, China, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Viet Nam.

1997
• Workshop on Biological Dosimetry
  The Radiation Effects Research Foundation, Hiroshima, 29 September-3 October, 1997
  15 Participants: Bangladesh, China, India (2), Indonesia, Republic of Korea (2), Malaysia (2), Pakistan, Philippines, Sri Lanka, Thailand, Viet Nam (2).
• Training course on Recent Developments in Basic Radiation Protection
  PNC and JAERI, 10-21 November, 1997 (Two weeks)
  13 participants: Bangladesh (2), China, India (2), Indonesia, Republic of Korea, Malaysia, Mongolia, Pakistan, Philippines, Sri Lanka, Viet Nam

1996
• Regional Training Workshop on Contamination Monitoring
  JAERI and PNC, 21-25 October 1996.
  15 participants: Bangladesh, China, India (2), Indonesia, Republic of Korea, Malaysia, Mongolia, Myanmar, Pakistan (2), Philippines, Sri Lanka, Thailand, Viet Nam

1995
• Workshop on Intercomparison Programme on Measurement of Radioactivity
  PNC and JAERI, 23-27 October, 1995
  12 participants: Bangladesh, China, India, Indonesia, Republic of Korea, Malaysia, Mongolia, Pakistan, Philippines, Sri Lanka, Thailand, Viet Nam

4. Activity List of RAS/9/018
All IAEA/RCA activities in the frame of RAS/9/018 are provided in Tables for 1999 to 2002.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Venue</th>
<th>Funding Source</th>
<th>Costs</th>
<th>Course Director</th>
<th>Technical Officer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert Advisory Group Meeting for RAS/9/018 Project review</td>
<td>Philippines, 22-24 February</td>
<td>IAEA</td>
<td>25,000</td>
<td>Mrs. Valdezco</td>
<td>M Oresegun</td>
</tr>
<tr>
<td>Radiation protection in medical exposure for regulators, hospital staff</td>
<td>Singapore, postponed up to March 2000</td>
<td>IAEA</td>
<td>40,000</td>
<td>S. Chong</td>
<td>P Ortiz-Lopez</td>
</tr>
<tr>
<td>including protection of patients, staff and the public</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workshop on latest IAEA and ICRP recommendations, concepts and approaches</td>
<td>India, 1-5 November</td>
<td>IAEA/INDIA</td>
<td>40,000</td>
<td>B.K.S Murthy</td>
<td>A Wrixon</td>
</tr>
<tr>
<td>Participation in a research reactor emergency response exercise</td>
<td>Australia, 25-29 October</td>
<td>AUSTRALIA</td>
<td>35,000</td>
<td>B Holland</td>
<td>C Nogueira de Oliveira</td>
</tr>
<tr>
<td>Training Course on optimization of collective dose from uses of</td>
<td>Malaysia, 19-24 April</td>
<td>IAEA</td>
<td>30,000</td>
<td>Mohd Syion</td>
<td>M Oresegun</td>
</tr>
<tr>
<td>diagnostic radiography, including QA systems and dose assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training Course on radiation safety in industrial radiography</td>
<td>Indonesia, 28 June-2 July</td>
<td>IAEA</td>
<td>35,000</td>
<td>Sudarnadi</td>
<td>M Oresegun</td>
</tr>
<tr>
<td>Training Course on occupational radiation protection</td>
<td>Australia, 21-25 June</td>
<td>IAEA</td>
<td>40,000</td>
<td>Ches Mason</td>
<td>S Na</td>
</tr>
<tr>
<td>EAGM on internal dosimetry</td>
<td>Korea, 6-10 September</td>
<td>IAEA</td>
<td>50,000</td>
<td>S Chang</td>
<td>S Na</td>
</tr>
<tr>
<td>Training Course on effluent monitoring and environment assessment</td>
<td>Japan, postponed up to 2000</td>
<td>JAPAN</td>
<td>60,000</td>
<td>K Shinohara</td>
<td>Inoue</td>
</tr>
<tr>
<td>Reference Asian Man CRP (Phase II)</td>
<td>N/A</td>
<td>JAPAN</td>
<td>75,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental radiation monitoring and regional database workshop</td>
<td>Korea, 25-29 October</td>
<td>KOREA</td>
<td>To be determined</td>
<td>K Cho</td>
<td>Y Inoue</td>
</tr>
<tr>
<td>Phase 2 trials of Distance Learning training materials in selected</td>
<td>Continuing (Phase II)</td>
<td>AUSTRALIA</td>
<td>60,000</td>
<td>C Hacker</td>
<td>P Weiland</td>
</tr>
<tr>
<td>Member States</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 1 - 1999 RAS/9/018 ACTIVITIES**


<table>
<thead>
<tr>
<th>Activity</th>
<th>Venue</th>
<th>Tentative Funding Source</th>
<th>Course Director</th>
<th>Technical Officer</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAS/9/018 Project Mid-term Review</td>
<td>Indonesia 14-18 February</td>
<td>IAEA</td>
<td>Hiswara</td>
<td>Oresegun</td>
</tr>
<tr>
<td>Radiation protection in medical exposure for regulators, hospital staff</td>
<td>Singapore 13-24 March</td>
<td>IAEA</td>
<td>S. Chong</td>
<td>Ortiz-Lopez</td>
</tr>
<tr>
<td>including protection of patients, staff and the public</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training Course on safe transport of radioactive materials</td>
<td>Australia 27 Nov to 8 Dec</td>
<td>IAEA</td>
<td>Mountford-Smith</td>
<td>Pope</td>
</tr>
<tr>
<td>Workshop on radiation protection principles applied to waste</td>
<td>Korea 22-26 May</td>
<td>IAEA</td>
<td>Shin</td>
<td>Linsley</td>
</tr>
<tr>
<td>management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency response workshop – to be decided.</td>
<td>Australia – August</td>
<td>AUSTRALIA</td>
<td>??</td>
<td>Nogueira de Oliveira</td>
</tr>
<tr>
<td>Distance Learning – finalisation of material and final meeting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workshop on radiation safety and QA of radiotherapy devices</td>
<td>Philippines 21-25 August</td>
<td>IAEA</td>
<td>Valdezco</td>
<td>Ortiz</td>
</tr>
<tr>
<td>Workshop on effluent monitoring and environmental assessment</td>
<td>Japan 6-10 March</td>
<td>JAPAN</td>
<td>Shinohara</td>
<td>Inoue</td>
</tr>
<tr>
<td>on the safe handling and waste disposal from NORM and TENORM</td>
<td>Malaysia POSTPONED</td>
<td>IAEA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for operators and regulators concerned with the mineral sands, gas and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oil industries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercomparison on internal dosimetry – needs and equipment survey</td>
<td>N/A</td>
<td>None needed</td>
<td></td>
<td>Cruz-Suarez</td>
</tr>
<tr>
<td>Workshop on calibration of dosimeters and survey instruments for</td>
<td>Japan 16-21 October</td>
<td>JAPAN</td>
<td>Yamamoto</td>
<td>Massara</td>
</tr>
<tr>
<td>occupational protection.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAGM on 3&lt;sup&gt;rd&lt;/sup&gt; phase external intercomparison</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workshop for environmental radiation monitoring</td>
<td>India 20-24 November</td>
<td>KOREA</td>
<td></td>
<td>Inoue</td>
</tr>
<tr>
<td>Activity</td>
<td>Date and Location</td>
<td>Funding</td>
<td>Course Director</td>
<td>Technical Officer</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------</td>
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<td>-----------------</td>
<td>-------------------</td>
</tr>
<tr>
<td><strong>2001</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>EAGM</td>
<td>NZ (Feb)</td>
<td>IAEA</td>
<td>McEwan</td>
<td>Oregun</td>
</tr>
<tr>
<td>Internal dosimetry intercomparison workshop</td>
<td>India (Feb)</td>
<td>Tbd (Singapore)</td>
<td>Sharma</td>
<td>Cruz-Suarez</td>
</tr>
<tr>
<td>External dosimetry intercomparison</td>
<td>N/A</td>
<td>Japan ??</td>
<td>Murakami</td>
<td>Cruz-Suarez</td>
</tr>
<tr>
<td>Workshop on industrial irradiator safety</td>
<td>Thailand (November)</td>
<td>IAEA</td>
<td>Pongpat</td>
<td>Ortiz</td>
</tr>
<tr>
<td>Neutron dosimetry workshop</td>
<td>Korea (May)</td>
<td>IAEA</td>
<td>Chang</td>
<td>Tbd</td>
</tr>
<tr>
<td>Effluent monitoring for liquid discharges workshop</td>
<td>Japan (October)</td>
<td>Japan</td>
<td>Shinohara</td>
<td>Tbd</td>
</tr>
<tr>
<td>Workshop for medical management of overexposed people</td>
<td>Japan (tbd)</td>
<td>IAEA (tbc)</td>
<td>Tsuji</td>
<td>Turai</td>
</tr>
<tr>
<td>Environmental monitoring workshop</td>
<td>Malaysia (May/June)</td>
<td>Korea</td>
<td>Mohd Yusof</td>
<td>Inoue</td>
</tr>
<tr>
<td>Workshop on source notification and control</td>
<td>Indonesia (July)</td>
<td>IAEA</td>
<td>Azhar</td>
<td>Oregun</td>
</tr>
<tr>
<td><strong>2002</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Formulation Meeting</td>
<td>Bangladesh (February)</td>
<td>IAEA</td>
<td>Awal</td>
<td>Oregun</td>
</tr>
<tr>
<td>External dosimetry intercomparison final workshop</td>
<td>Australia or Japan (February)</td>
<td>Japan?</td>
<td>Tbd</td>
<td>Cruz-Suarez</td>
</tr>
<tr>
<td>Internal dosimetry intercomparison workshop</td>
<td>China</td>
<td>Tbd</td>
<td>Ma jizeng</td>
<td>Cruz-Suarez</td>
</tr>
<tr>
<td>Workshop on QA in diagnostic radiology</td>
<td>India</td>
<td>IAEA</td>
<td>Tbd</td>
<td>Ortiz</td>
</tr>
<tr>
<td>Workshop on QA in nuclear medicine</td>
<td>Philippines</td>
<td>IAEA</td>
<td>Tbd</td>
<td>Oregun</td>
</tr>
<tr>
<td>Workshop on occupational exposure measurement</td>
<td>China</td>
<td>IAEA</td>
<td>Tbd</td>
<td>Na</td>
</tr>
<tr>
<td>Radiation safety in well logging and gauges workshop</td>
<td>Malaysia</td>
<td>IAEA</td>
<td>Mohd Yusof</td>
<td>Wheatley</td>
</tr>
<tr>
<td>Environmental monitoring workshop</td>
<td>Pakistan</td>
<td>Korea</td>
<td>Afzar</td>
<td>Inoue</td>
</tr>
<tr>
<td>Emergency response team training workshop</td>
<td>Australia</td>
<td>Australia</td>
<td>Holland</td>
<td>Crick</td>
</tr>
</tbody>
</table>
1. BACKGROUND

(1) 1985 -1986: Inception of the Project in Japan

(a) Rapidly expanding application of nuclear technology in industrial, medical and research areas in RCA Member States with increasing potential or manifested risk of radiation exposure.

(b) Chernobyl accident in April 26, 1986
Public concerns on radiation risk, Confusion in administration in RCA Member States on export/import regulation levels of radioactivity in food staff, and etc.
(2) 1987 - Proposal from Japan Government to
   RCA Working Group Meeting /
   General Conference Meeting

(3) 1987 - Project Formulation Meeting in Tokyo
   Funding in full by extra-budgetary contribution from Japan.
   Participation by all 13 Member States
   RCA Coordinator: P. Airy;
   Project Officer: P. Strohal

(4) 1987 - 1992 (Phase I)

   - Training Courses, Workshops and CRP

   - Annual review and planning meetings (EAGMs) in Japan
     participants: Australia, China, India, Japan and IAEA.

   - Additional funding by Australia and others.

   - 1992: Project Formulation Meeting for Phase II
     Tokai, Japan
(5) 1993 - 1997 (Phase II):
- TC, Workshops and CRP
- Annual EAGM in
  China (1993),
  Australia (1994)
  Mid-Term Review Meeting
  Sydney (1996)
- Additional Participation by
  Mongolia, New Zealand and Myanmar
- Increased financial contribution and
  sharing of responsibilities by Member States

(6) 1998 - 2002 (Phase III):

- Project Formulation Meeting in Taejon, Korea (1997)

Changes in scope (title)

*Strengthening of Radiation Protection Infrastructure* $\Rightarrow$
*Enhancement and Harmonization of Radiation Protection*

Clarification of needs of Member States
Selection of activities
Relationship with other projects.
2. PROGRAMMES in Phase III

- Training courses
- Workshops
- Coordinated research programmes

in accordance with the project document

Project Formulation Meeting for the Phase III
Taejon, Korea (1997)

Expert Advisory Group Meetings in
1998 (Sri Lanka),
1999 (Philippines),
2000 (Indonesia) and
2001 (New Zealand).

Project Formulation Meeting for the Phase IV
2002 (Bangladesh)

3. JAPANESE CONTRIBUTIONS

Training Workshops by JAERI and JNC

JAERI (Dr. Murakami)

* Regional Intercomparison of Personal Dosimetry for External Photons
  16 participants
  access to calibration fields and resources
  Third phase is scheduled in 2001-2002.

JNC (Dr. Katagiri)

* Radioactivity Measurement Intercomparison of Environmental Samples
  15 participants
  upgrade regional capabilities of techniques

NIRS (Dr. Kawamura)

* CRP on Reference Asian Man
JAPANESE CONTRIBUTIONS

FOR THE PHASE III

♦ JAERI
  - Workshop on indirect methods for internal dosimetry
    • in 1998
  - Workshop on calibration of dosimeters
    • in 2000
♦ PNC JNC
  - Workshop for effluent monitoring and environmental assessment
    • in 1999 and 2001
♦ NIRS
  - Central reference laboratory in CRP on reference Asian man
    • till 2001
  - Workshop on medical preparedness and response to radiological accidents
    • in Aug. 2001
2.7.2 IAEA-RCA Program Activities in Medical Field

KOBUYASHI Sadayoshi, Ph.D.
National Project Coordinator for RCA Medical Projects
Technical Counselor, Nuclear Safety Commission, Prime Minister’s Office
Senior Research Counselor, National Institute of Radiological Sciences, Japan

1. Introduction

Japan has been placing grave emphasis on the role of nuclear techniques in solving health problems in developing RCA Member States as it is understood from the fact that IAEA-RCA medical and biological project was firstly formulated and initiated in 1993 by extra-budgetary funding from Japan in response to the needs identified by the experts from RCA Member States. This paper tries to describe the historical background, current status and future prospects of IAEA-RCA program activities in medical field with some emphasis on the contribution, views and strategy of Japan in their formulation and implementation.

2. Historical Background

Contribution by Japan to RCA program in medical field started quite a way back in 1982 when Ministry of Foreign Affairs of the Government of Japan, in consultation with IAEA and in collaboration with Japan International Cooperation Agency (JICA), sent a survey team to RCA member countries in order to find out actual status of, and the needs for application of nuclear techniques to medical practice and biological research. The survey team was consisted of Japanese medical doctors and experts of relevant subject fields together with an IAEA expert. It visited major hospitals and medical education and research organizations in Indonesia, Malaysia, Philippines, Sri Lanka and Thailand for discussion with medical doctors, professors, researchers and government officials in these countries. The report of the team indicated presence of positive needs in these countries for introduction of cooperative program within the framework of RCA in initiating and promoting nuclear application in medicine and biological research. It pointed out, in particular, as high priority areas (1) radiotherapy of cancers of uterine cervix, oral, and head and neck, (2) nuclear medicine of liver disease (hepatitis and liver cancer) and of thyroid’s, and (3) radiobiological approach for
anti-malaria campaign.

In response to the conclusion and recommendation of the said report, an workshop meeting was held in Tokyo in 1983 inviting leading doctors, research scientists and/or responsible officials from all the RCA Member States, 12 countries at that time, to identify subject areas of urgent needs and to formulate a strategy to coup with the identified health problems by nuclear application. This event was the starting point from which evolved a variety of training activities as well as coordinated research programmes. For example, a series of JICA group training course started in 1984 under the title of “Workshop Meeting on Medical and Biological Application of Radiation and Radioisotopes”, which was held yearly in Japan as hosted by National Institute of Radiological Sciences (NIRS) on the subjects of (1) Radiotherapy, (2) Nuclear Medicine and (3) Environmental Health Sciences, taking one subject in one year in rotation. This Workshop Meeting was later renamed as Study Meeting on Medical and Biological Application of Radiation and Radioisotopes, incorporating in its program a new component on Radiation Biology as a 4th subject. This renamed group-training event continues at present under a new terminology of “JICA-STA Group Training Course on Human Radiation Interface” since 1997, which is now programmed and implemented with no official relationship with IAEA-RCA but with participating country limited to those in RCA region. (See Session 6, 6-3)

3. IAEA-RCA Program Activities

A. Activity in early years

When RCA Medical and Biological Project was initiated in 1983 with Japanese extra-budgetary contribution, Japan picked up three subjects as priority areas to concentrate cooperative efforts, i.e., (1) Radio-therapy of cancer of uterine cervix, (2) Nuclear medicine diagnosis of liver and thyroid disease, and (3) Radiobiological research of anti-Malaria vaccine, as explained below.

(1) Radio-therapy of cancer of uterine cervix

There were two main activities in this subject area, i.e., (a) Co-ordinate Research Program (CRP) on “Modification of radiation sensitivity of tumor cells by chemical agent”, and (b) Training for high dose-rate brachytherapy of cancer of uterine cervix by use of Ralstron. One Ralstron machine was donated to IAEA by Japan that was installed in Malaysia (National University of Malaysia Hospital in Kuala Lumpur), where a number of regional training courses were held utilizing the installed machine.

(2) Nuclear medicine diagnosis of liver disease

One CRP was formulated and implemented in this subject on “ In vivo nuclear
medicine imaging of liver disease”. This CRP was succeeded by a follow-up CRP on “Comparison of ultra-sound and nuclear medicine imaging for diagnosis of liver disease”. These two CRPs produced two publications in the form of Atlas of Liver Imaging for Diagnosis of Liver Diseases. By completion of Liver CRPs, another CRP started as funded by Japan, on the treatment of thyroid disorders by nuclear medicine technique.

(3) Radiobiological research of anti-Malaria vaccine

One CRP was formulated and implemented on this subject titled as “Radiation attenuation of malaria antigens”. This ambitious CRP aimed at developing an anti-Malaria vaccine by combined use of nuclear and molecular techniques. However, it was concluded without visible results due mainly to the lack of sufficient technologies then available. Current advancement in biotechnology might warrant a revived challenge on this subject.

B. Activity in recent years

In addition to the Japan-funded programme activities, IAEA started several Agency-initiated projects mostly in in vitro nuclear medicine area and tissue banking (radiation sterilization of bone graft). Since 1976 onwards Agency’s new policy as to the management of RCA prompted RCA to adopt “Lead Country System” by which a designated lead country plays leading role in formulating, implementing and coordinating programmes of certain thematic field of nuclear application. Indonesia was designated to be the lead country for thematic health care project and has been playing that role. However, it is at present a transient period whereby a number of small projects are running independently with not much of good coordination and strategy. It resulted in an unbalanced weighting among the subject areas of health care such as nuclear medicine, radiotherapy and tissue banking. Unbalance is noted, for example, in the number of trained personnel in 1999: 118 in nuclear medicine, 13 in radiotherapy, and 13 in tissue banking. Some of the programme activities during the year 1999 to 2000 are listed below.

(1) Distance learning in the applied sciences of oncology
(2) Distance learning in nuclear medicine technologists
(3) Quality assurance in radiation oncology; LDR and HDR brachytherapy in treating cervical cancer
(4) Treatment of liver cancer with radionuclides
(5) Radionuclide application in the management of diabetic nephropathy
(6) Cardiac SPECT
(7) Myocardial perfusion scintigraphy

- 277 -
(8) Serological and tissue markers for breast cancer
(9) Upgrading immunoassay capabilities
(10) Radiation sterilization of tissue grafts

C. Activity in coming years

The “Thematic Health Care Project” was re-constructed by an Advisory Group Meeting held in Lombok, Indonesia, 29 May – 2 June 2000. The AGM, which way hosted by Indonesia as lead country, formulated a new set of projects in health care after identifying the needs of the region and available resources and interests by the Member States.

Some major sub-projects that were proposed to constitute the thematic project are listed below.

(1) Up-grading clinical capability through the use of second-hand equipments
(2) Improvement of brachytherapy for prevailing cancers in the region
(3) Evaluation of bone turnover by in vitro (RIA) and in vivo nuclear medicine methods
(4) Rh-188 therapy in patients undergoing angioplasty for coronary artery disease

Sub-projects (1) and (2) are inter-related in that it is planned to make available the second-hand brachytherapy instrument in working condition, Ralstron in particular, to be utilized by developing countries through the sub-project (1) for the objectives of the sub-project (2).

In this connection, another programme activity is currently in progress by which technologies to manufacture the Co-60 source to be installed in Ralstron for high dose-rate brachytherapy of cancers of uterine cervix is transferred from Japan to China and India. This technology transfer programme is being implemented as a small sub-component of Industrial Project titled as “Quality assurance in Co-60 Brachytherapy Source Production”. Through this programme it will become possible in near future to produce and supply quality controlled Co-60 brachytherapy sources within the RCA region in a cost-effective way. Table I indicates the reason why Japan is trying hard in promoting high-dose rate brachytherapy using Ralstron (or Rals) in treating carcinoma of uterine cervix.

4. Views and Strategy of Japan in RCA Thematic Medical Project

Prior to the aforementioned AGM in Lombok, Indonesia, a team of Japanese medical doctors and experts from NIRS and Japan Atomic Industrial Forum (JAIF) made a
Table 1. Comparison of low and high dose rate intracavitary afterloading techniques in the treatment of carcinoma of uterine cervix

<table>
<thead>
<tr>
<th></th>
<th>Low Rate* Dose</th>
<th>High Dose Rate**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation source</td>
<td>Ra, Cs-137, Co-60</td>
<td>Co-60, Ir-192</td>
</tr>
<tr>
<td></td>
<td>10-40mCi</td>
<td>1-5 Ci</td>
</tr>
<tr>
<td>Radiation hazard to staff during routine operation</td>
<td>(+)</td>
<td>(−)</td>
</tr>
<tr>
<td>Risk of radiation exposure in case of machine trouble</td>
<td>(−)</td>
<td>(±)</td>
</tr>
<tr>
<td>Problem on nursing</td>
<td>(++)</td>
<td>(−)</td>
</tr>
<tr>
<td>Irradiation time</td>
<td>15-24 hrs.</td>
<td>3-10 min.</td>
</tr>
<tr>
<td>Possible number of patients treated per day</td>
<td>2</td>
<td>More than 10 to 15</td>
</tr>
<tr>
<td>Discomfort of patient</td>
<td>(+++)</td>
<td>(+)</td>
</tr>
<tr>
<td>Local infection or cystitis</td>
<td>(+++)</td>
<td>(±)</td>
</tr>
<tr>
<td>Unexpected shifting of the source during treatment</td>
<td>(+)</td>
<td>(−)</td>
</tr>
<tr>
<td>Cost of machine</td>
<td>(+)</td>
<td>(+++</td>
</tr>
<tr>
<td>Financial burden on patient</td>
<td>(++)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

*Manual afterloading **Remote-controlled afterloading

survey tour to several RCA Member countries in order to see what are the health care problems, actual status and the role of nuclear application in these countries in solving such health problems, and to confirm the needs and its justification of promoting nuclear techniques in health care. The conclusion of the team indicated the strong needs for "essential resource building", meaning that leveling-up of standard base-line as regard to human and material (equipment) resources is needed in most of the countries, especially in their rural regions, while recognizing that several leading medical institutions in capital cities of these countries have already reached, and in certain aspects, exceeded the levels of those in developed countries.

The policy of Japan for the new thematic project in health care area is, therefore, to exert RCA's joint efforts in a concerted way on strengthening medical infrastructure in developing Member States, but not on the introduction or development of most
up-to-date, state-of-the-art nuclear techniques in medical care. It aims at "Building-up of capability" and "Development of self-sustainability" to be responsive to essential base-line needs of the public health. In other words, the vision of RCA for the new century is "Strengthening Medical Infrastructure ". It is considered that the IAEA's regular programmes could more appropriately accommodate the aspects of introducing and/or developing most up-to-date, state-of-the-art nuclear techniques in medicine while RCA.

--- End
### RCA Activities - Funding by Program Area

<table>
<thead>
<tr>
<th>Area</th>
<th>Amount (US $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>671,895</td>
</tr>
<tr>
<td>Health</td>
<td>826,510</td>
</tr>
<tr>
<td>Industry</td>
<td>1,038,860</td>
</tr>
<tr>
<td>En/RR/Wm</td>
<td>397,210</td>
</tr>
<tr>
<td>Environ.</td>
<td>102,1410</td>
</tr>
<tr>
<td>Rad.Prot.</td>
<td>493,450</td>
</tr>
<tr>
<td>General</td>
<td>146,800</td>
</tr>
<tr>
<td><strong>Total - 2000</strong></td>
<td><strong>4,596,135</strong></td>
</tr>
</tbody>
</table>

#### Pie Chart

- Agriculture: 15%
- Environ.: 11%
- Health: 18%
- Energy etc.: 9%
- Industry: 22%
- General: 3%
RCA Activities — No. of Trained Personnel

NM: Nuclear Medicine
RT: Radiotherapy
TB: Tissue Bank

<table>
<thead>
<tr>
<th></th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>193</td>
<td>499</td>
<td>608</td>
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<tr>
<td>Male</td>
<td>157</td>
<td>380</td>
<td>428</td>
</tr>
<tr>
<td>Female</td>
<td>36</td>
<td>119</td>
<td>180</td>
</tr>
</tbody>
</table>
Comprehensive Approach - Radiotherapy of Uterine Cancer

**Training, Education**
- RCA Thematic Health Care Project
  - Rad. Oncologist
  - Medical Physicist
  - Medical Technologist

**Uterine Cancer**
- High Dose Rate Brachytherapy
  - Ralstron

**Supply of Second Hand Equipment**
- RCA Industrial Project
  - Q.C. Production Technology Transfer

**IAEA TCDC Project**
- Cost-Effective Supply within the Region
Thematic Project on Health Care

Executive Committee

Nuclear Medicine
- Advisory Group
  - NM Sub-Projects
- Cancer
  - Uterine cervix
  - Breast
  - Lung

Radiotherapy
- Advisory Group
  - RT Sub-Projects
- Cancer
  - Breast, Liver
  - Heart
  - Bone
  - Infectious Disease

Other Health
- Advisory Group
  - Sub-Projects
- Nutrition
- Tissue Bank
2.7.3 Regional Cooperation on Radiation Processing

Tamikazu Kume
Takasaki Radiation Chemistry Research Establishment, JAERI

1. Title: On the job training on radiation processing
2. Organizer: JAERI, STA, IAEA
3. Conductor: Takasaki Radiation Chemistry Research Establishment (TRCRE), JAERI
4. Outline:

The RCA program was initiated in 1978 and the Workshop and Training course were conducted at TRCRE under the UNDP/RCA/IAEA program. In addition, TRCRE received many scientists under the STA scientist exchange program, bilateral cooperation and others.

The purpose of the regional cooperation on radiation processing at TRCRE is on the job training of research work and the support for the RCA activities.

The participants for each program are as follows.

1) RCA program and STA fellowship: for all the member states
2) Bilateral cooperation: China, Indonesia, Malaysia, Thailand and Vietnam

The duration for RCA training course and workshop is 1-2 weeks and for the scientist exchange program under STA and bilateral cooperation is 3-12 months. The numbers of participants are 10-20/year for RCA training and workshop, 10-15/year for STA fellow and 5-10/year for bilateral cooperation.

The TRCRE has been conducted many training course and workshop on radiation processing as the lead country in industrial field of RCA project up to 1999. In 1999, the TRCRE conducted the IAEA Consultants’ Meeting on “Radiation Synthesis of Intelligent Hydrogels and Membranes for Separation Purposes” on 17-20 May, and the Research Co-ordination Meeting of the Co-ordinated Research Programme (CRP) on “Improvement of Physical Properties of Radiation Vulcanized Natural Rubber Latex” on 18 - 22 Oct. The TRCRE sent an expert and lead the “Regional (RCA) Training Course on Upgrading of Cellulosic Agro-Waste to Useful Products” on 10-14 May 1999 and “Regional (RCA) Workshop on Radiation Processing of Agro-wastes” on 2-6 Oct. 2000 held at MINT, Malaysia.
Table 1. Number of Foreign Researchers at TRCRE, JAERI in 1999

<table>
<thead>
<tr>
<th>Program</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>STA Scientist Exchange Program</td>
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<tr>
<td>Bilateral Cooperation</td>
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<tr>
<td>JAERI Research Fellow</td>
<td>3</td>
</tr>
<tr>
<td>Student of University</td>
<td>3</td>
</tr>
<tr>
<td>STA Research fellow</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
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</table>

Table 2. Number of Foreign Researchers for each Country (1999)

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<th>Country</th>
<th>Number</th>
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<tbody>
<tr>
<td>China</td>
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</tr>
<tr>
<td>Indonesia</td>
<td>6</td>
</tr>
<tr>
<td>Vietnam</td>
<td>5</td>
</tr>
<tr>
<td>Thailand</td>
<td>4</td>
</tr>
<tr>
<td>Malaysia</td>
<td>3</td>
</tr>
<tr>
<td>Philippines</td>
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</tr>
<tr>
<td>Bangladesh</td>
<td>1</td>
</tr>
<tr>
<td>Korea</td>
<td>1</td>
</tr>
<tr>
<td>Czech</td>
<td>1</td>
</tr>
<tr>
<td>Poland</td>
<td>1</td>
</tr>
<tr>
<td>Australia</td>
<td>1</td>
</tr>
<tr>
<td>Russia</td>
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Table 3. Time Schedule of UNDP/IAEA/RCA Regional Training Course on Application of Radiation Processing for Decontamination of Liquid Wastes, 10-21 July, 1995

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<tr>
<td></td>
<td>9:10 - 10:00</td>
<td>10:10 - 11:00</td>
<td>11:10 - 12:00</td>
<td>13:30 - 14:20</td>
<td>14:30 - 15:20</td>
<td>16:00 - 16:50</td>
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<td>July</td>
<td>Mon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>Opening</td>
<td>Introduction to radiation applications to environmental conservation</td>
<td>Initial test / Test 1</td>
<td>Free time</td>
<td>Decomposition of organic wastes</td>
<td>T. Sawai</td>
</tr>
<tr>
<td>11</td>
<td>Tue</td>
<td>Discussion / Evaluation of Test 1</td>
<td>Radiation engineering-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V. Markovic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Wed</td>
<td>Dosimetry - 1 / Basics</td>
<td>Dosimetry - 2 / CTA dosimeter</td>
<td>Experiment / dosimetry - 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T. Kojima</td>
<td>H. Sunaga</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Thu</td>
<td>Radiation chemistry of water systems</td>
<td>Treatment of wastewater</td>
<td>Experiment / Dosimetry - 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T. Miyata</td>
<td>H. Arai</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>14</td>
<td>Fri</td>
<td>Improvement of coagulation property by radiation</td>
<td>Experiment / Treatment of model wastewater</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T. Kume</td>
<td></td>
<td></td>
<td></td>
<td>H. Arai</td>
</tr>
<tr>
<td>17</td>
<td>Mon</td>
<td>Radiation inactivation of microorganisms</td>
<td>Experiment / Inactivation of microorganisms in sewage sludge - 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>H. Ito</td>
<td></td>
<td>H. Ito, M. Takigami</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Tue</td>
<td>Wastewater treatment system and composting of irradiated sludge</td>
<td>Treatment of wastewater by radiation and coagulants</td>
<td>Wastewater treatment by ultraviolet light irradiation</td>
<td>Facility visit in TRCRE</td>
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<tr>
<td></td>
<td></td>
<td>S. Hashimoto</td>
<td>H. Arai</td>
<td></td>
<td></td>
<td>Y. Takeda</td>
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<tr>
<td>19</td>
<td>Wed</td>
<td>Experiment / Inactivation of microorganisms in sewage sludge - 2</td>
<td></td>
<td>Facility visit to sewage treatment facility and Radio Industry</td>
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<tr>
<td></td>
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<td>H. Ito, M. Takigami</td>
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<td></td>
</tr>
<tr>
<td>20</td>
<td>Thu</td>
<td>Free time</td>
<td></td>
<td>Final test / Test 2</td>
<td>Monitoring of pollutants in water by radiation</td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>H. Ise</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Fri</td>
<td>Discussion / Evaluation of Test-2</td>
<td>General discussion</td>
<td>Closing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.8 UNIVERSITY EDUCATION ON NUCLEAR ENGINEERING
FOR FOREIGN STUDENTS AND RESEARCHERS

Masanori ARITOMI

Research Laboratory for Nuclear Reactors,
Tokyo Institute of Technology
2-12-1 Ohokayama, Meguro-ku, Tokyo, 152-8550 Japan
TEL +81-3-5734-3063, FAX +81-3-5734-2959
E-mail: maritomi@nriitech.ac.jp

1. Introduction

Graduate Education of nuclear engineering in Japanese universities has been provided for foreign students to learn the fundamental knowledge through the lectures and to master his/her professional ability through the related researches such as on-the-job-training. In addition, cooperative works on nuclear engineering with foreign universities and research institutes have been carried out by joint researches, exchange of technical information and exchange of research fellows. In this paper, the following activities are introduced: (1) graduate course program of nuclear engineering carried out in Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology, and (2) my cooperative works with Asian universities and research institutes.

2. Graduate Courses in Department of Nuclear Engineering of Tokyo Institute of Technology

Undergraduate course of Nuclear Engineering is not provided at Tokyo Institute of Technology. However, the Department of Nuclear Engineering provides two kinds of graduate courses: (1) General Graduate Course in which the lectures are given in Japanese as its academic language, (2) International Graduate Course where lectures are given in English, so that it is not required for foreign students to have mastered Japanese. As a general rule, master course program is for two years, to learn the fundamental knowledge by attending lectures, seminars, conducting experiments and finally writing a Master thesis. Doctor course program is for three years to conduct both analytical and experimental works, and finally to compose a doctor dissertation under the supervision and guidance from his/her professor.

As for foreign students in General Graduate Course, there are scholarship students awarded by Japanese government or by their own governments, and non-scholarship students. In general, scholarship students come to Japan in April, attend Japanese intensive course for six months, conduct the research for six months in their supervisor's laboratory as a researcher, and enter the graduate course in the following April. The application system of scholarship is different in every country,
and the acceptance procedure will differ for applicants nominated by a Japanese embassy and applicants nominated directly by Japanese university. Therefore, the candidates can either apply their scholarship directly to their own governments, or, Japanese supervisors can apply it to the Japan Society of Science Promotion (JSPS). I would like to recommend that the candidates should ask their own governments or Japanese Embassy on the application method and deadline. Non-scholarship students can enter Department of Nuclear Engineering in Graduate Course of Tokyo Institute of Technology in April or October.

There are two kinds of foreign students studying in our International Graduate Course: One is a scholarship student awarded by Japanese government and the other is a non-scholarship student. For the candidates who live in foreign countries, the application deadline is at the end of February and the result of their entrance examination is decided based only on the review of the application form. Therefore, the candidates for Doctor course must contact frequently with their intended advising professor in Department of Nuclear Engineering before six months to the application deadline, appeal their scholar and research ability to the professor and write their three-year research plan for doctor course based on his/her supervisor's suggestion. Two or three scholarship students can be admitted to Department of Nuclear Engineering each year.

The candidates who live in Japan can apply for this course in June. The entrance examinations, paper and oral tests, are carried out from the end of August to the beginning of September. In this case, scholarship will not be awarded to the successful candidates. The curriculum for Department of Nuclear Engineering in International Graduate Course, Tokyo Institute of Technology is summarized in Table 1.

The JSPS supports and promotes the Asian researchers, who have achieved excellent research activities, to pursue the doctor degree from Japanese universities. This program is called JSPS Ronpaku (Dissertation Ph.D.) program. In this program, the successful candidate should complete his/her doctor thesis within five years. Let me share my experience: I accepted a researcher from Bhabha Atomic Research Center, India as a Ronpaku researcher from FY1996. He completed his doctor thesis and presented it in FY1999, which is the fourth year of his study. He took the final examination at the end of August, 2000 and has just successfully received Doctor of Engineering at the end of September, 2000. A Ronpaku researcher should visit his supervisor's laboratory for 90 days every year. Likewise, his supervisor shall visit his research institute for at least seven days every year to supervise and guide the student in conducting his doctorate works. Four papers published in academic journals are required to get Doctor of Engineering by dissertation (Ronpaku) in the Department of Nuclear Engineering, Tokyo Institute of Technology.

3. Acceptance State of Asian Researchers in Research Laboratory for Nuclear Reactors

Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology actively accepts young and excellent researchers and students from Asia to teach them to be excellent professors and researchers and to promote cooperative works in the future. Since the system of Japanese universities is different from that of American ones, the professor is not in position to give the
scholarship to doctor students and cannot employ postdoctoral researchers directly from his research fund. The researchers, who wish to attend the Japanese universities, must obtain travel and living allowance from their own government, or pass the JSPS program such as “JSPS Invitation Fellowship Program for Research in Japan”, “JSPS Postdoctoral Fellowship for Foreign Researchers” and so on. It is important to notice that Japan Science and Technology Agency (STA), and Japan Atomic Industry Forum (JAIF) and other Japanese organizations have set up the programs to support excellent foreign researchers and engineers to work in Japanese universities and/or research institutes.

Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology accepts foreign professors and senior researchers as a visiting researcher and young excellent researchers as an associate visiting researcher in order to enable them to make use of the research facilities in our university. In the case of short-term visit about one or two weeks, the acceptance program in Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology is to exchange technical information of nuclear engineering, to make a plan of cooperative works on it and to discuss their research achievement. On the other hand, in the case of long-term visit more than six months, visiting researchers can performed his desired subjects upon his request. Furthermore, special lectures, which are not of regular curriculum in International Graduate Course, but are temporary and voluntary, can be given in English upon request. For instance, request for the lectures of “Nuclear Reactor Theory” and “Nuclear Thermal Hydraulics and Safety” are available on the basis of JAIF arrangement in FY2000.

4. Conclusions

In Japanese universities, an expensive research fund cannot be obtained, and the number of research staffs is limited. Therefore, it is not viable to conduct the research using large-scaled test facilities connected directly with real plants, which are normally carried out in Japan Atomic Energy Research Institute (JAERI) and/or reactor venders. The research objectives in Japanese universities are to create new concepts of systems and components of nuclear power plants based on revolutionary ideas, to study their scientific feasibility, and to investigate physical phenomena which have never been well-presented by analytical codes applied to design and safety assessment of nuclear power plants.

Currently, I have organized a cooperative effort on nuclear thermal hydraulics with two-phase flow dynamics as a central figure, and Future Light Water Reactor development with Korea Atomic Energy Research Institute (KAERI), Chulalongkorn University of Thailand and Indian Bhabha Atomic Research Center on the basis of cooperative Memorandum and Protocol. In addition, I am going to arrange cooperative works on future LWR development with Vietnam and Indonesia.

Since there are many kinds of scholarships and fellowships systems awarded to the foreign students, researchers and engineers, and these systems are frequently changed, the detailed description cannot be introduced in this paper. If exchange of research personnel including students to Japanese university is desired, please contact with the intended supervisor or myself in the planning stage.
Table 1 Curriculum in Department of Nuclear Engineering

<table>
<thead>
<tr>
<th></th>
<th>Course Title</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Basic Nuclear Physics</td>
<td>2002 Spring Semester (2-0-0)</td>
</tr>
<tr>
<td></td>
<td>Assoc. Prof. M. Igashira, Prof. M. Ogawa</td>
<td>(Even Years)</td>
</tr>
<tr>
<td>2.</td>
<td>Nuclear Reactor Theory</td>
<td>2001 Spring Semester (2-1-0)</td>
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<tr>
<td></td>
<td>Prof. H. Sekimoto</td>
<td>(Odd Years)</td>
</tr>
<tr>
<td>3.</td>
<td>Nuclear Chemistry and Radiation Science</td>
<td>2001 Autumn Semester (2-0-0)</td>
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<td>Prof. Y. Fujii</td>
<td>(Odd Years)</td>
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<tr>
<td>4.</td>
<td>Reactor Thermal Hydrodynamics</td>
<td>2001 Autumn Semester (2-0-0)</td>
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<tr>
<td></td>
<td>Prof. M. Aritomi, Assoc. Prof. M. Takahashi</td>
<td>(Odd Years)</td>
</tr>
<tr>
<td>5.</td>
<td>Nuclear Reactor Safety</td>
<td>2001 Spring Semester (2-0-0)</td>
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<td></td>
<td>Assoc. Prof. M. Saito, Prof. H. Ninokata</td>
<td>(Odd Years)</td>
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<td>6.</td>
<td>Nuclear Energy System</td>
<td>2001 Autumn Semester (2-0-0)</td>
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<td>(Odd Years)</td>
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<tr>
<td>7.</td>
<td>Energy Systems and Environment</td>
<td>2002 Spring Semester (2-0-0)</td>
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<tr>
<td></td>
<td>Prof. Y. Yoshizawa, H. Yamasaki, Assoc. Prof. Y. Okuno and D. Biswas</td>
<td>(Even Years)</td>
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<tr>
<td>8.</td>
<td>Electric Power System</td>
<td>2000 Autumn Semester (2-0-0)</td>
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<td></td>
<td>Prof. R. Shimada</td>
<td>(Even Years)</td>
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<tr>
<td>9.</td>
<td>Nuclear Materials Science</td>
<td>2000 Autumn Semester (2-0-0)</td>
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<td>(Even Years)</td>
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<td>10.</td>
<td>Energy Economy and International Relations</td>
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<td></td>
<td>Prof. Y. Fujii</td>
<td>(Even Years)</td>
</tr>
<tr>
<td>11.</td>
<td>Accelerators Applied Research and Technology</td>
<td>2001 Spring Semester (2-0-0)</td>
</tr>
<tr>
<td></td>
<td>Prof. T. Hattori, Assoc. Prof. Y. Oguri</td>
<td>(Odd Years)</td>
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<tr>
<td>12.</td>
<td>Plasma Science</td>
<td>2001 Spring Semester (2-0-0)</td>
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<tr>
<td></td>
<td>Assoc. Prof. H. Akatsuka, T. Aoki and T. Watanabe</td>
<td>(Odd Years)</td>
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<td>Nuclear Engineering Laboratory</td>
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<td>2002 Spring Semester (0-0-2)</td>
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<td>Exercises in Nuclear Engineering IV</td>
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<td>2001 Spring Semester (0-1-0)</td>
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<td>19.</td>
<td>Seminar in Nuclear Engineering II</td>
<td>2000 Autumn Semester (0-1-0)</td>
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<td>20.</td>
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<td>Seminar in Nuclear Engineering IV</td>
<td>2001 Autumn Semester (0-1-0)</td>
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<td>Seminar in Nuclear Engineering VI</td>
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<td>24.</td>
<td>Seminar in Nuclear Engineering VII</td>
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<td>Seminar in Nuclear Engineering VIII</td>
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</tr>
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<td>26.</td>
<td>Seminar in Nuclear Engineering IX</td>
<td>2003 Spring Semester (0-2-0)</td>
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<tr>
<td>27.</td>
<td>Seminar in Nuclear Engineering X</td>
<td>2002 Autumn Semester (0-2-0)</td>
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</table>
UNIVERSITY EDUCATION IN NUCLEAR ENGINEERING FOR FOREIGN STUDENTS AND RESEARCHERS

November 29, 2000

Masanori ARITOMI
Professor
Research Laboratory for Nuclear Reactors,
Tokyo Institute of Technology

CONTENTS

1. Graduate Courses in Department of Nuclear Engineering
   - Master and Doctor Courses
   - General Graduate Course and International Graduate Course
   - Scholarship Systems
   - JSPS Ropaku (Dissertation Ph.D.) Program

2. Acceptance State of Asian Researchers in Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology

3. Cooperative Works on Nuclear Engineering with Asian Universities and Research Institutes
1. GRADUATE COURSES
IN DEPARTMENT OF ENGINEERING
- Tokyo Institute of Technology -

• Our Department of Nuclear Engineering provides graduate courses.
  X Undergraduate course of Nuclear Engineering is not provided.
• Master course program is for two years, to learn the fundamental
  knowledge by attending lectures, seminars, conducting researches and
  finally writing a Master thesis under the guidance from his/her
  professor.
• Doctor course program is for three years to conduct both analytical
  and experimental works as on-the-job-training, and finally to
  compose a doctor dissertation under the guidance from his/her
  professor.

Tokyo Institute of Technology

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General and International Graduate Courses

• General Graduate Course
  – The lectures are given in Japanese as its academic language.
• International Graduate Course
  – The lectures are given in English.
  → It is not required for foreign students to have mastered Japanese.

Tokyo Institute of Technology
Scholarship Systems for Foreign students in General Graduate Course

- There are scholarship students awarded by Japanese government or by their own governments, and non-scholarship students.
  - Scholarship students come to Japan in April, attend Japanese intensive course for six months, conduct the research for six months in their supervisor's laboratory as a researcher, and enter the graduate course in the following April.
- The application system of scholarship is different in every country, and the acceptance procedure will differ for applicants:
  - nominated by a Japanese or their own governments,
  - The candidates should ask their own governments or Japanese Embassy on the application method and deadline.
- Non-scholarship students can enter Department of Nuclear Engineering in Graduate Course of TITTech in April or October.

Tokyo Institute of Technology

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Scholarship Systems for Foreign students in International Graduate Course

- There are scholarship students awarded by Japanese government and non-scholarship students, who enter the Course on October.
- For the candidates who live in foreign countries and for both scholarship and non-scholarship students
  - The application deadline is at the end of February.
  - The result of their entrance examination is decided based only on the review of the application form.
  - The candidates for Doctor course must contact frequently with their intended advising professor before six months to the application deadline.
    - to appeal their scholar and research ability to the professor,
    - to write their three-year research plan for doctor course based on his/her supervisor's suggestion.

Tokyo Institute of Technology
TITech nominates the successful candidates by the end of March.
- They will receive the formal notification at the beginning of August after the final decision of the Ministry of Education.
- All the candidates nominated by our university always enter our International Graduate Course.

Two or three scholarship students can be admitted to Department of Nuclear Engineering every year.

The candidates who live in Japan can apply for this course in June.
- The entrance examinations, paper and oral tests, are carried out from the end of August to the beginning of September.
- Scholarship will not be awarded to the successful candidates.

JSPS Ronpaku (Dissertation Ph.D.) Program

There are two methods to get Doctor Degree in Japan:
- Doctor student,
- Ronpak; to apply his/her Doctor dissertation to Japanese university, to be reviewed by professors and to conduct its final examination.

The JSPS supports and promotes the Asian researchers, who have achieved excellent research activities, to pursue the doctor degree from Japanese universities.
- The successful candidate should complete his/her doctor thesis within five years.
- A Ronpaku researcher should visit his supervisor's laboratory for 90 days every year.
- His supervisor shall visit his research institute for at least seven days every year to supervise and guide the researcher in conducting his doctorate works.
More than four papers published in academic journals are required to get Doctor of Engineering by dissertation (Ronpaku) in the Department of Nuclear Engineering, Tokyo Institute of Technology. One published paper is necessary for students to graduate the Doctor Course.

For instance
- I accepted a researcher from Bhabha Atomic Research Center, India as a Ronpaku researcher from FY1996.
- He completed his doctor thesis and presented it in FY1999, which is the fourth year of his study, took the final examination at the end of August, 2000 and has just successfully received Doctor of Engineering at the end of September, 2000.

2. ACCEPTANCE STATE OF ASIAN RESEARCHERS IN RESEARCH LABORATORY FOR NUCLEAR REACTORS

To accepts actively young and excellent researchers and students from Asia to teach them to be excellent professors and researchers and to promote cooperative works in the future.

The system of Japanese universities is different from that of American ones.
- The professor is not in position to give the scholarship to doctor students and cannot employ postdoctoral researchers directly from his research fund.
The researchers, who wish to attend the Japanese universities, must obtain travel and living allowance from their own government, or pass the JSPS program

- "JSPS Invitation Fellowship Program for Research in Japan",
- "JSPS Postdoctoral Fellowship for Foreign Researchers".

It is important to notice that Japan Science and Technology Agency (STA), and Japan Atomic Industry Forum (JAIF) and other Japanese organizations have set up the programs to support excellent foreign researchers and engineers to work in Japanese universities and/or research institutes.

To accept foreign professors and senior researchers as a visiting researcher and young excellent researchers as an associate visiting researcher in order to enable them to make use of the research facilities in our university.

-- Tokyo Institute of Technology --

- short-term visit about one or two weeks
  - to exchange technical information of nuclear engineering, to make a plan of cooperative works on it and to discuss their research achievement.
- long-term visit more than six months
  - visiting researchers can performed his desired subjects upon his request.

Special lectures, which are not of regular curriculum in International Graduate Course, but are temporary and voluntary, can be given in English upon request.

- Lectures of "Nuclear Reactor Theory" and "Nuclear Thermal Hydraulics and Safety" are available on the basis of JAIF arrangement in FY2000.

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3. COOPERATIVE WORKS ON NUCLEAR ENGINEERING WITH ASIAN UNIVERSITIES AND RESEARCH INSTITUTES

- In Japanese universities, an expensive research fund cannot be obtained, and the number of research staffs is limited.
  - It is not viable to conduct the research using large-scaled test facilities connected directly with nuclear power plants which are normally carried out in JAERI and/or reactor venders.
- The research objectives in Japanese universities are to create new concepts of systems and components of nuclear power plants based on revolutionary ideas, to study their scientific feasibility, and to investigate physical phenomena which have never been presented enough by analytical codes applied to design and safety assessment of nuclear power plants.

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- A cooperative effort on nuclear thermal hydraulics with two-phase flow dynamics as a central figure, and Future LWR development on the basis of cooperative Memorandum and Protocol.
  - KAERI, BARC and Chulalongkorn University.
- To arrange cooperative works on future LWR development with Vietnam and Indonesia.
- There are many kinds of scholarships and fellowships systems awarded to the foreign students, researchers and engineers, and these systems are frequently changed.
  - The detailed description cannot be introduced.
- If exchange of research personnel including students to Japanese university is desired, please contact with the intended supervisor or myself in the planning stage.

Tokyo Institute of Technology
A Letter of Proposal from the Project Leader of Japan to the Project Leaders of Participating Countries and Answers and Comments from Each Country for Japanese Proposal
Dear Mr./Ms. Project Leaders,

On behalf of JAERI, NuTEC, I would like to express our thanks for your participation in “The 2nd Workshop on Human Resources Development in the Nuclear Field” held on November 27th and 28th, 2000 in Tokai, Japan as an activity of the Project of HRD in the framework of the Forum for Nuclear Cooperation in Asia (FNCA).

If you have any addition or revision to your country report presented at the second workshop, please submit a revised version by January 20, 2001.

Although I have made a proposal on future activities on HRD including the three year schedule from 2001 to 2003 at the second workshop, I am proposing a revised version (See Attachment 1). I would appreciate your comments. This schedule will be presented as a result of the Second Workshop on HRD to the Second Coordinators’ Meeting (March 14-16, 2001, Tokyo)

I would like to propose the following as the annual action items until the next workshop. I would appreciate your comments by January 20, 2001.

(1) Publication of JAERI-Review Report
The proceedings of the second workshop and the “Presentation on International Training and Education in Japan for Asian Countries” will be published as the “Annual Activities of FNCA HRD Project for FY 2000”.

(2) Mutual support for the needs in HRD
We could not discuss sufficiently about the mutual support for the needs of member countries.
• I would like to propose from Japan, to start an internet homepage 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. Your comments on mutual support activities are appreciated.
• Please give us your proposal of mutual support and your comments.
(3) Your comments on the “Japanese Proposal on HRD presented to the first FNCA Meeting”

Dr. Machi, the FNCA Coordinator for Japan proposed the following topics on HRD for discussion. These topics will be discussed in the Third Workshop. I would like to hear your comments on this matter.

- Support the formulation of HRD strategy to meet national and regional needs
- Prepare HRD scenario to ensure safety in RI and research reactor
- Investigate HRD scenario in young generation
- Propose items for personnel exchange such as STA SEP. (This topic will be discussed at the second Coordinators’ Meeting on March 2001 so that your proposal by January 20, 2001 will be appreciated.)

Best wishes for the New Year and looking forward to your comments.

Sincerely,

Yasushi Seki
Project Leader of Human Resources Development for Japan Director,
Nuclear Technology and Education Center (NuTEC)
Japan Atomic Energy Research Institute (JAERI)

Tokyo Training Center
Honkomagome 2-28-49
Bunkyo-ku, Tokyo, Japan 113-0021
TEL: +81-3-3942-4220 FAX: +81-3-3944-4445

Tokai Training Center
Shirakata Shirane 2-4, Tokai-mura
Naka-gun, Ibaraki-ken, Japan 319-1112
TEL: +81-29-282-5444 FAX: +81-29-282-6041
January 24, 2001

Dear Mr./Ms. Project Leaders,

In the letter I sent you by e-mail on Dec.28, 2000, I would like to add some more explanation on the last item of (3) Your comments on the “Japanese Proposal on HRD presented to the first FNCA meeting” as it was not stated clearly.

(3) Your comments on the “Japanese Proposal on HRD presented to the first FNCA meeting”
I would like to add the following explanation.
Please propose in addition to the desired theme for exchange, any idea needs to be improved or comments for personnel exchange programs in Japan such as STA SEP-Science Exchange Program and training programs (Dispatch of experts, acceptance of trainee and various training seminars).

I have not yet received the reply concerning the letter mentioned above from some countries. I would like you to reply as soon as possible. As mentioned before, your comments will reflect the Second Coordinators’ Meeting held in March, 2001. Your cooperation on this matter will be highly appreciated.

Best regards,
Yasushi Seki
TEL: +81-3-3942-4220, FAX: +81-3-3944-4445
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Nuclear Technology and Education Center (NUTEC)
Tokai Research Establishment
Japan Atomic Energy Research Institute
Shirakata Shirane 2-4, Tokai-mura,
Naka-gun, Ibaraki-ken Japan, 319-1106
Answers and Comments form each country for Japanese Proposal

- China -
1. I agreed to your proposal (1) and to set an Internet homepage.
2. About Dr. Machi's proposal on HRD in the first FNCA conference:
   "Investigate HRD scenario in young generation" needs to make detail plan including investigation contents, fixing some young group, finding some investigation area units, collecting and analysis information etc. A great deal of works needs to be done by some people and financial support. I think it is difficult to carry out and to finish because of our limited manpower and finance.

- Indonesia -
Develop homepage for information exchange on HRD in Asia Pacific.

   We may discuss about the information items to be installed at the homepage. Currently BATAN has developed homepage containing information about activities and research conducted in our organization. Also, Education Training Center in BATAN has developed homepage containing yearly training activities. It would be very convenience if we could link all homepages of member countries to make a single website. Meanwhile, to update regularly the main contents of the homepage should be very important.

Japanese Proposal on HRD

   Nuclear technology has been extensively used in Indonesia, especially in the industrial and Medical sectors. Mishandling incident of nuclear material or radiation source in Indonesia has been pictured that insufficient message was brought to the public. It means only a very few people in the user organization received the incident information. I observe that not all organizations regard the safety utilization of nuclear technology. I doubt if sufficient information received by all level of managers. In fact, training courses have been conducted with only skill and knowledge gained from media, and then they have been transferred to lower talented managers. Therefore, formulation of HRD strategy to meet national and regional needs should cover strategy on public awareness program, and especially it should be established through the industrial and medical seminar as well as training course. Also the curriculum should be designed specifically based on the level of the participants.

   Investigation of HRD scenario in young generation should be based on well-developed Human Resource Information System. Using the database information system we can get personal career as well as human resource profile of our organization. BATAN wants to establish one, but it would be very helpful if we can learn other countries experiences on this matter.

   Items for personnel exchange may cover technical issues on the development of information system, database and homepage, which require to be supported for human resources issues.
- Philippines -

We agree with the "Proposal on Future Activities for Human Resources Development". We will provide you with Philippine inputs to the Internet homepage of the HRD subproject of FNCA. We also agree with the "Japanese Proposal on HRD". We will coordinate with the Department of Science and Technology and help in the formulation of the national HRD strategy in the nuclear field.

We will also propose new items for personnel exchange under the STA;
1. Personnel exchange for High School Science Teachers who are teaching unclear science topics in High School Physics
2. Academic scholarships or M.S. Nuclear Engineering in Japan
   (Dr.Machi mentioned in his presentation that the STA Program might include academic scholarships in the future)
3. Dispatch of experts who could be the thesis advisers of some Philippine students in the M.S. Medical Physics Program, or who could be lecturers

We would like to submit the following proposal from the Philippines:
The Philippines, through the Philippine Nuclear Research Institute, is offering to host the 4th HRD Workshop in 2002. Regarding mutual support for needs, if you have good instructional visual aids such as video (VHS) which are in Japanese, we could help in translation these to English.

- Thailand -

I support the propose of Japan to use this homepage for exchange information by sending information of member country to post in this homepage.

I'm thinking of arranging a course in Chulalongkorn University concerning the operational radiation protection in research reactor facilities and accelerator. Can I propose to the STA for Dr.Kagagiri to lecture and instruct the course? And can I use instrument of the Joint Training for this course? (The condition for Japanese expert in the STA Program is only to research.)

- Vietnam -

I agree with your proposal and expect that the activities will be successfully implemented.

- Korea -

1. Revision of our country report presented at the second Workshop.
   We would like to inform you that it is not requested to revise it.
2. Comments for the proposal on future activates for human resources development.
   We think that the proposal was prepared well. We agree with you.
3. Item (2) and (3) for the annual action items until the next Workshop.

We would like to accept your proposal on Internet homepage which will provide the information network for the HRD Project. We also would like to agree with your topics which will be discussed on the third Workshop in Korea.

- Malaysia -

1. Mutual recognition of status and needs in HRD in each country has been achieved. Participants also agreed to carry out several activities which are common interest and achievable within a year i.e till the next workshop (support for HRD strategy formulation, investigate HRD scenario in younger generation, and prepare HRD scenario to ensure safety in RI application research reactor). Other than these activities, mutual support can be achieved, maybe, if countries who are in a position to offer support to do so, or for countries in need of support to make request to the relevant country. These mutual support activities would be reported at subsequent workshop.

2. Japan's proposal to start an Internet homepage is very much welcomed and appreciated.
This is a blank page.
4 Document on the Human Resources Development for the Third Coordinators Meeting of FNCA
Materials for Session 3

The Second Coordinators Meeting

March 14-16, 2001, Tokyo, Japan

Human Resources Development
Summary of the Second Workshop on Human Resources Development in the Nuclear Field

Yasushi Seki
Project Leader in the Area of Human Resources Development
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 the Atomic Energy Bureau of the Science and Technology Agency (STA) 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. The first Workshop was held on November 25 and 26, 1999, at the Tokyo International Forum. The objective of the workshop 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 second Workshop on Human Resources Development in the Nuclear Field was held on November 27 and 28, 2000, at the Tokai Research Establishment, JAERI. Participating countries were China, Indonesia, South Korea, Japan, Malaysia, the Philippines, Thailand, and Vietnam. 39 people participated: 22 members and 17 observers. The participant list and the Workshop program are attached as Attachment 1 and Attachment 2, respectively. On the first day of the Workshop, presentations were made by each countries on the HRD needs in the nuclear field. On the second day, the needs of each country were classified into three areas, i.e., training needs, training techniques, and infrastructures. Dr. Sueo Machi of the Japan Atomic Industrial Forum (JAIF), the Japanese Coordinator proposed 4 items for possible collaboration. The possibility of the collaboration in the 4 items were discussed.
In addition to the clarification of issues and needs in each country and the mutual support activities for the needs, it was agreed to study the following four items:

1. Assist the formulation of HRD strategy in each country
2. Provide HRD scenario to secure safety in RI and research reactor utilization
3. Investigate the HRD scenario for young generation
4. Propose items for improvement of STA Scientists Exchange Program

It was agreed to hold the next workshop in Korea in 2001.

3. Workshop results and summary

(1) This Workshop was the first gathering of human resources development officers in Asia under the new FNCA framework. It was a significant occasion from the perspective of international exchanges. The HRD needs in each participating country were identified and classified through discussions as shown in Table 1.

(2) In order to support the HRD program conducted by the training institutions in Asian countries, the result of the Workshop will be reflected effectively in the various kinds of training program in our country.

(3) The 3rd day program "Presentations on International Training and Education in Japan for Asian countries", which was held together with the 2nd HRD workshop was useful for understanding the present status in Japan and also useful for Japanese participants to be able to grasp the whole idea of it.
<table>
<thead>
<tr>
<th>Country</th>
<th>Training Type</th>
<th>Training Techniques Development Issues</th>
<th>Infrastructure Development Issues</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Training of professionals and senior management personnel</td>
<td>On-the-job training, Technical/experience exchange, Lecture, Introduction of software (short-term) Training</td>
<td>(following have been operated)</td>
<td>- The training center in Qinshan Nuclear Power Base&lt;br&gt;- Nuclear Training Center&lt;br&gt;- The Graduate School of Nuclear industry</td>
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<tr>
<td>Republic of Korea</td>
<td>Exchange of training course curricula in the field of RI utilization courses and nuclear power/safety related courses&lt;br&gt;Exchange of training content and equipment descriptions in the field of RR experiment training courses for university students&lt;br&gt;Exchange of experts who have experience in HRD and exchange of lecturers&lt;br&gt;Exchange of group training course visits to nuclear facilities for young nuclear executives&lt;br&gt;Mutual cooperation projects such as establishment of cyber-learning system and development of multi-media training materials</td>
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<tr>
<td>Country</td>
<td>Training Type</td>
<td>Training Techniques Development Issues</td>
<td>Infrastructure Development Issues</td>
<td>Note</td>
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</table>
| Indonesia | Leader training  
- should be able to accommodate the diverse activities of the research  
- should be stressed on the strategy of technology transfer implementation  
Instructor training  
- to teach specific skills and knowledge  
R&D expert training  
- should cover development of "technology for operation and maintenance of RR", "nuclear safety system", "long term energy program", "nuclear fuel technology" | On-the-job techniques  
Off-the-job techniques  
- use of satellite communication  
Mutual visiting to training facilities | Establishment of HRD program  
Establishment of facilities for training  
Establishment of education and training program | |
| Malaysia | Instructor training (review)  
Specialized training and expert (new) | Development of computer-based training techniques and CAI training materials (review)  
- transformation from lecture notes/text books/power point slides to multimedia or CAI knowledge, and providing training materials | (Soft)  
- Analysis of human resources needed for NPP (review)  
- Countermeasures for the outflow of talents (review)  
- Recognition of nuclear medicine practitioners  
(Physical)  
- Development of educational infrastructure using internet (review) | |
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<tr>
<th>Country</th>
<th>Training Type</th>
<th>Training Techniques Development Issues</th>
<th>Infrastructure Development Issues</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Philippines</td>
<td>Academic Training to M.S. and Ph.D. in Nuclear Engineering, and to M.S. Medical Physics Exchange Program (high school science teachers - to other countries for training in the teaching of nuclear Science and technology - from other countries for demonstration of the teaching - for Faculty development in Medical Physics)</td>
<td>Development of training courses  - RI application in agriculture, biotechnology and research  Development of training materials, visual aids and simple equipment for detecting radioactivity  Development of distance learning modules</td>
<td>Modification of the curricula for high school and college education to include nuclear science topics  Development of internet-based teaching and learning modules on nuclear science and technology  Development or enhancement of graduate academic programs in nuclear science and technology</td>
<td></td>
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<tr>
<td>Thailand</td>
<td>Training in the management function for handling of radiation/radioactive material  School-teacher training on nuclear science (Material should include social, economic and legislative aspects)</td>
<td>Computer-based training technique (suggested by Korea) for university students  Multi-media training material for young scientists</td>
<td>Development of a system of national accreditation for radiation protection officer  Development of radiation safety scheme (regulatory and management control for use the radiation and radioactive materials)  Building of competency in operational radiation protection</td>
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<tr>
<td>Country</td>
<td>Training Type</td>
<td>Training Techniques Development Issues</td>
<td>Infrastructure Development Issues</td>
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<tr>
<td>Viet Nam</td>
<td>Personnel/manpower training in the aspects concerning nuclear power, including project management</td>
<td>Training on basic knowledge in radiation protection and nuclear safety</td>
<td>Establishment of a Center for Training on Radiation Protection Techniques and Nuclear Experiment</td>
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<td></td>
<td>Teachers and instructors training</td>
<td>Training on reactor technology, radiation protection, nuclear safety and radwaste management</td>
<td>Upgrade the Training Center at Dalat Nuclear Research Institute</td>
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<td></td>
<td>Staff training in the field of diagnostic and treatment by nuclear medicine</td>
<td>Training on accelerators techniques, radiation protection and medical physics</td>
<td>Setting-up a Center for Application of Nuclear Techniques in Medicine</td>
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<td></td>
<td>techniques</td>
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<tr>
<td>Japan</td>
<td>Education and training of practical use of the most advanced technology using</td>
<td>Education and training of practical use of the most advanced technology using the advanced R&amp;D facilities</td>
<td>Establishment of a system for enhancing mutual exchange of the human resources and technologies among universities, R&amp;D institutions and industries</td>
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<tr>
<td></td>
<td>the advanced R&amp;D facilities</td>
<td>Provision of information on training courses and teaching materials in English (the copyright of texts and figures is one of technical issues to be solved)</td>
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</table>
Proposal on Future Activities
for Human Resources Development

On November 27 and 28, 2000, the Second Workshop on Human Resources Development (HRD) in Nuclear Field was held in Tokai Research Establishment of the Japan Atomic Energy Research Institute in the framework of the Forum for Nuclear Cooperation in Asia (FNCA). The status of HRD in each country was presented and through discussions, the needs were identified. A proposal to support the formulation of HRD strategy and scenario in member countries were made by Japan and discussed.

The action plan for the future cooperative activities for the HRD Project is to be communicated and agreed among the project leaders through the outside-the-workshop activities and presented to the Coordinators Meeting held on March 2001.

This proposal summarizes some thought on objectives and an action plan for the coming three years, i.e. from 2001 to 2003.

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 second workshop, an action plan based on the activities of the past year and a Japanese proposal for HRD presented at the first FNCA in Thailand was derived based on an extensive discussion among the countries.

1. Long term targets of cooperative activities

   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 for mutual support will be included in the annual action plan and will be conducted as project activities. In addition, the need to mutually support the formulation of HRD strategy and scenario was identified.

2. The 3-year schedule for FY2001-2003

   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 schedule 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 supporting 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 schedule of the Workshop for FY2001-2003 (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 STA SEP)
- Develop annual action plan of the year
- Develop 3 years plan (2002-2004)

(2) The Fourth Workshop (FY2002: to be discussed)
Target: Evaluate the achievements of 3 years, conduct mutual support activities, formulate HRD strategy and study HRD scenario
a. General presentation
   - Evaluate the achievements of mutual support of 3 years
   - Report HRD strategy and scenario
   - Information exchange on HRD in each country
b. Round table discussion
   - Review and revise medium-long term targets
   - Review HRD strategy and scenario
   - Develop annual action plan
   - Develop 3-year schedule for FY2003-2005

(3) The Fifth Workshop (FY2003: to be discussed)
Target: Conduct mutual support activities and develop HRD scenario
a. General presentation
   - Report of mutual support activities
   - Report HRD scenario
   - Information exchange on HRD in each country
b. Round table discussion
   - Review mutual support activities
   - Review HRD scenario
   - Develop annual action plan
   - Develop 3-year schedule for FY2004-2006

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

(1) Publication of JAERI-Review Report
   The proceedings of the second workshop and the "Presentation on International Training and Education in Japan for Asian Countries" will be published as the "Annual Activities of FNCA HRD Project for FY 2000".

(2) Mutual support for the needs in HRD
   - Proposal from Japan, to start an internet homepage 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.

(3) Consideration of the following topics on HRD proposed at the Second Workshop by Dr. Machi, the FNCA Coordinator for Japan for discussion in the Third Workshop.
   - Support the formulation of HRD strategy to meet national and regional needs
   - Prepare HRD scenario to ensure safety in RI and research reactor
   - Investigate HRD scenario in young generation
   - Propose items for personnel exchange such as STA SEP.
# Table 1 Proposal on Three-year Schedule for Human Resources Development

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<tbody>
<tr>
<td><strong>MASTER SCHEDULE</strong></td>
<td>1st CRD</td>
<td>Nov. 1st Forum (Thailand)</td>
<td>2nd CRD</td>
<td>3rd Forum (Korea)</td>
<td>4th Forum (Japan)</td>
</tr>
<tr>
<td><strong>Annual Target</strong></td>
<td>-Promote mutual recognition on the status, problems and needs in each country -Develop medium-long term target and 3-year schedule for Y2000-2002</td>
<td>-Clarify status and needs in each country -Propose items for mutual support</td>
<td>-Conduct mutual support activities for problems and needs in each country -Support HRD strategy formulation -Study HRD scenario</td>
<td>-Evaluate achievements of 3 years -Conduct mutual support activities -Formulate HRD strategy -Study HRD scenario</td>
<td>-Conduct mutual support activities -Develop HRD scenario</td>
</tr>
<tr>
<td><strong>Workshop on HRD</strong></td>
<td>1st (Japan)</td>
<td>2nd (Japan)</td>
<td>3rd (Korea)</td>
<td>4th (Not decided)</td>
<td>5th (Not decided)</td>
</tr>
<tr>
<td><strong>Outside-the-Workshop activities</strong></td>
<td>-Resolved undecided issues at Seminar -Published FY1999 activities as a JAERI-Conference 2000-014</td>
<td>-Conduct annual activities 3-year schedule 2001-2003 -Publish FY2000 activities as a JAERI-report</td>
<td>-Conduct annual activities -Publish FY2001 activities as a JAERI(KAERI?) report</td>
<td>-Conduct annual activities -Publish FY2002 activities as a report</td>
<td>-Conduct annual activities -Publish FY2003 activities as a report</td>
</tr>
</tbody>
</table>
Proposal for FNCA from Japan
Human Resources Development

1. Summary

Background

At the Tenth International Conference for Nuclear Cooperation in Asia (ICNCA) in March 1999, the importance of human resources development (HRD), a topic proposed by Japan, was recognized. The First Seminar was held in November 1999, in Tokyo. It was then agreed that participants would clarify the issues and needs on the human resources development in each country, and support/cooperate with each other in their HRD activities, through, for example, exchanging information.

Work plan:

The HRD program activities are broad, covering education at schools; systems (including those for certification) to educate and train young engineers and scientists; improvements of training skills, including the development of teaching materials; and quasi-national programs to ensure adequate human resources. The Workshops will try to solve difficulties common in the region, including identifying the needs of each country, by formulating resolution scenarios.

HRD is closely related to each country’s program for utilizing nuclear technology. Issues that cannot be resolved by the Workshops will be further discussed at Coordinators Meetings and FNCA meetings.

2. Expected Results

(1) Regional collaboration program activities to respond the needs of FNCA countries in HRD will be formulated by the WS and implemented accordingly. Homepage of the program is proposed to enhance information exchange. Information exchanges on training curriculums and teaching materials will be carried out.

(2) FNCA will support member countries in developing HRD strategies toward implementing their programs to utilize nuclear technology.

(3) Countries will cooperate with each other to formulate HRD scenarios for each of them, aimed at securing safety in the use of RI and research reactors.

(4) Countries will cooperate with each other to formulate scenarios for each of them, aimed at nurturing young human resources, including students, who will be able to carry on nuclear research and development.

(5) Japan will make efforts to reflect proposals made at Workshops, Coordinators Meetings and FNCA Meetings within the framework of the existing exchange
system and training programs (sending experts, systems to accept trainees, training seminars).

Japan will make its contribution to cooperation in international HRD activities by proposing the above-mentioned results to related organizations.
I. TITLE OF PROPOSED PROJECT:
Asian Institute of Nuclear Science and Technology (AINST)

II. OBJECTIVE OF PROJECT:
The primary objective of the project is to develop an educational and training institute to fulfill the qualified nuclear manpower needs in Asian countries. The objective can be describe as the following:
- to develop nuclear human resources within the framework of peaceful utilization of nuclear science and technology in Asia;
- to support supplies of qualified nuclear human resources for industrial and medical purposes in the region;
- to ensure better public acceptance and public appreciation toward nuclear science and technology application in member's countries;
- to establish form of communication and information exchange among nuclear scientists and researchers in the region.

III. PROJECT DESCRIPTION:

1. Background:
The general problems of many developing countries regarding the education and training requirement for nuclear technology have been primarily associated with the limitations on the resources and capabilities of their universities, training institution providing the scope and quality of these requirement. While experience has shown that one of the critical conditions for the successful program of nuclear power and industries is the availability of well-educated and trained manpower of the required quality and quantity. Failure of providing well trained manpower would increase the possibility of accident occurrence and would finally deteriorating public appreciation and public acceptance toward nuclear technology.

On the other hand, availability of well-educated and trained nuclear manpower of the required quality and quantity to promote safety culture would ensure public acceptance and public appreciation toward nuclear science and technology implementation in the industry, as well as toward nuclear science and technology for nuclear power development program.

Knowing the economic growth in Asia countries would grow rapidly than those in the rest of the world from the fact that the economic fundamentals for long term in Asia countries are exceptionally strong, then it can be expected that demand of well educated and trained nuclear manpower would grow as well. Obviously this growth would increase the utilization of nuclear science and technology to support the industries in entering era of global competition. Especially for Indonesia case, the utilization of nuclear technology in industrial and medical areas has been grown very rapidly. It is estimated that there could be more than a few thousands radiation protection officers and radiation workers dealing intensively with radiation everyday. Therefore better nuclear human resource development in developing countries having strong economic growth is imperative.
2. **Project Activities:**

Having recognized the essential role of manpower development for nuclear technology application in industries and medical activities, the course of the program should be initiated with strategic research involving experts from Japan and Indonesia to assess the manpower program and institutional development in the form of Human Resource Development and Assessment Program (HRDAP).

The HRDAP for AINST shall provide information and action necessary to be taken with regard to the establishment of an effective form of cooperation; contribution of member countries; and the operation of AINST.

The HRDAP would cover: the assessment of current status of Asia regional and technical information regarding the application of nuclear technology in industrial and medical areas, as well as on power generation; and the availability of required researches, scientists, facilities in both countries to cover the mission of the institute.

Design of the academic program and the activity of the institute follow the result of the assessment.

3. **Project Output:**

- Result of the project will enhance cooperation among Asian countries, especially South East Asian countries in the area of nuclear human resource development.
- There will be a center of excellence in the Asian country where member's countries would take maximal advantage to prepare their human resource in promoting and implementing nuclear science and technology.
- Nuclear technology contributes sound and safely to the industrial and medical sectors.
- There will be a better manpower development strategy supporting the application of nuclear technology program in public sector.
- Actualization of the government roles through its technical competency in industrial and medical application of radiation sources and radioactive materials is attained.

4. **Proposed Project Duration:**


5. **Estimated Budget of the Project:**

To be determined later.

**IV. A LEAD/HOST COUNTRY AND A LEAD/HOST ORGANIZATION:**

1. A lead/host country: Japan/Indonesia
2. A lead/host organization: Education and training center/school for nuclear technician located in Yogyakarta

**V. AVAILABLE RESOURCE AND FACILITIES:**

School for Nuclear Technician in Yogyakarta has already been established since 1985. The center for nuclear human resource development through formal academic equipped with administrator offices, auditorium, several classrooms, and laboratories. Since the school is located nearby Center for Advance Technology Research, there are abundant of opportunity for students to utilize laboratories own by the center.
Human Resources Development Project Summary

Yasushi Seki

Nuclear Technology and Education Center
Japan Atomic Energy Research Institute
(NuTEC, JAERI)

Content of Talk

• Background
• Work Plan
• Expected Results
• System for Implementation
Background

• At 10th (ICNCA) in March 1999, importance of human resources development (HRD), was recognized

• 1st Seminar held in November 1999, in Tokyo

• 2nd Workshop held in October 2000, in Tokai

Agreed to clarify the issues and needs on HRD in each country, and support/cooperate with each other in HRD activities, through, for example, exchanging information

Work Plan(1)

• The HRD program activities are broad, covering;
• Education at schools
• Systems (including those for certification) to educate and train young engineers and scientists
• Improvements of training skills, including the development of teaching materials
• quasi-national programs to ensure adequate human resources
Work Plan (2)

- The Workshops will try to solve difficulties common in the region, including identifying the needs of each country, by formulating resolution scenarios.

- HRD is closely related to each country's program for utilizing nuclear technology. Issues that cannot be resolved by the Workshops will be further discussed at Coordinators Meetings and FNCA meetings.

Expected Results (1)

- Regional collaboration program activities to respond the needs of FNCA countries in HRD will be formulated by the WS and implemented accordingly.

- Homepage of the program is proposed to enhance information exchange. Information exchanges on training curriculums and teaching materials will be carried out.
Expected Results (2)

- FNCA will support member countries in developing HRD strategies toward implementing their programs to utilize nuclear technology.
- Countries will cooperate with each other to formulate HRD scenarios for each of them, aimed at securing safety in the use of RI and research reactors.

Expected Results (3)

- Countries will cooperate with each other to formulate scenarios aimed at nurturing young human resources to carry on nuclear research and development.
- Japan will make efforts to reflect proposals made at Workshops, Coordinators Meetings and FNCA Meetings within the framework of the existing exchange system and training programs (sending experts, systems to accept trainees, training seminars).
国際単位系 (SI) と換算表

### 表 1 SI基本単位および補助単位

<table>
<thead>
<tr>
<th>量</th>
<th>名称</th>
<th>記号</th>
</tr>
</thead>
<tbody>
<tr>
<td>長さ</td>
<td>メートル</td>
<td>m</td>
</tr>
<tr>
<td>質量</td>
<td>キログラム</td>
<td>kg</td>
</tr>
<tr>
<td>時間</td>
<td>秒</td>
<td>s</td>
</tr>
<tr>
<td>電流</td>
<td>アンペア</td>
<td>A</td>
</tr>
<tr>
<td>熱力学温度</td>
<td>ケルビン</td>
<td>K</td>
</tr>
<tr>
<td>物質のモル数</td>
<td>モル</td>
<td>mol</td>
</tr>
<tr>
<td>光度</td>
<td>カンダラ</td>
<td>cd</td>
</tr>
<tr>
<td>平面角</td>
<td>ラジアン</td>
<td>rad</td>
</tr>
<tr>
<td>立体角</td>
<td>ステラジアン</td>
<td>sr</td>
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### 表 2 SIと併用される単位

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<tr>
<td>分、時、日</td>
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<td>min</td>
</tr>
<tr>
<td>度、分、秒</td>
<td>度</td>
<td>°</td>
</tr>
<tr>
<td>リットル</td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>トン</td>
<td>t</td>
<td></td>
</tr>
<tr>
<td>電子ボルト</td>
<td>eV</td>
<td></td>
</tr>
<tr>
<td>原子質量単位</td>
<td>u</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>倍数</th>
<th>接頭語</th>
<th>記号</th>
</tr>
</thead>
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<td>10^18</td>
<td>エクサ</td>
<td>E</td>
</tr>
<tr>
<td>10^15</td>
<td>サタゴ</td>
<td>P</td>
</tr>
<tr>
<td>10^12</td>
<td>テラ</td>
<td>T</td>
</tr>
<tr>
<td>10^9</td>
<td>ギガ</td>
<td>G</td>
</tr>
<tr>
<td>10^6</td>
<td>メガ</td>
<td>M</td>
</tr>
<tr>
<td>10^3</td>
<td>キロ</td>
<td>k</td>
</tr>
<tr>
<td>10^2</td>
<td>ヘクト</td>
<td>h</td>
</tr>
<tr>
<td>10^1</td>
<td>デカ</td>
<td>da</td>
</tr>
<tr>
<td>10^-1</td>
<td>デシ</td>
<td>d</td>
</tr>
<tr>
<td>10^-2</td>
<td>センチ</td>
<td>c</td>
</tr>
<tr>
<td>10^-3</td>
<td>ミリ</td>
<td>m</td>
</tr>
<tr>
<td>10^-6</td>
<td>マイクロ</td>
<td>μ</td>
</tr>
<tr>
<td>10^-9</td>
<td>ナノ</td>
<td>n</td>
</tr>
<tr>
<td>10^-12</td>
<td>ピコ</td>
<td>p</td>
</tr>
<tr>
<td>10^-15</td>
<td>フェント</td>
<td>f</td>
</tr>
<tr>
<td>10^-18</td>
<td>アト</td>
<td>a</td>
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### 表 3 固有の名称をもつSI同様単位

<table>
<thead>
<tr>
<th>量</th>
<th>名称</th>
<th>記号</th>
<th>他のSI単位による表現</th>
</tr>
</thead>
<tbody>
<tr>
<td>周波数</td>
<td>ハertz</td>
<td>Hz</td>
<td>m·kg/s²</td>
</tr>
<tr>
<td>压力、応力</td>
<td>パスカル</td>
<td>Pa</td>
<td>N/m²</td>
</tr>
<tr>
<td>エネルギー、仕事、熱量</td>
<td>ジオル</td>
<td>J</td>
<td>m·kg/s²</td>
</tr>
<tr>
<td>力</td>
<td>ワット</td>
<td>W</td>
<td>J/s</td>
</tr>
<tr>
<td>電気量、電荷</td>
<td>クーロン</td>
<td>C</td>
<td>A·s</td>
</tr>
<tr>
<td>電位、電圧</td>
<td>ボルト</td>
<td>V</td>
<td>W/A</td>
</tr>
<tr>
<td>静電容量</td>
<td>ファラード</td>
<td>F</td>
<td>C/V</td>
</tr>
<tr>
<td>電気抵抗</td>
<td>オーム</td>
<td>Ω</td>
<td>V/A</td>
</tr>
<tr>
<td>コンダクタンス</td>
<td>ジオーム</td>
<td>S</td>
<td>V/A</td>
</tr>
<tr>
<td>磁場強度</td>
<td>ウェーバ</td>
<td>T</td>
<td>Wb/m²</td>
</tr>
<tr>
<td>磁束密度</td>
<td>チューラ</td>
<td>B</td>
<td>Wb/m²</td>
</tr>
<tr>
<td>インダクタンス</td>
<td>ヘンリー</td>
<td>H</td>
<td>Wb/A</td>
</tr>
<tr>
<td>セルシウス温度</td>
<td>セルシウス度</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>光長度</td>
<td>ルーメン</td>
<td>lm</td>
<td>cd·sr</td>
</tr>
<tr>
<td>光度</td>
<td>クルクス</td>
<td>lx</td>
<td>lm/m²</td>
</tr>
<tr>
<td>放射能</td>
<td>ベクレル</td>
<td>Bq</td>
<td>s⁻¹</td>
</tr>
<tr>
<td>放射線量</td>
<td>グレイ</td>
<td>Gy</td>
<td>J/kg</td>
</tr>
<tr>
<td>線量当量</td>
<td>シーベルト</td>
<td>Sv</td>
<td>J/kg</td>
</tr>
</tbody>
</table>

### 表 4 SIと共に制定的に

<table>
<thead>
<tr>
<th>量</th>
<th>名称</th>
<th>記号</th>
<th>他のSI単位による表現</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A = 0.1 mm = 10⁻¹⁸ m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 B = 100 m² = 10⁻² m²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 G = 3.7 × 10⁻¹⁰ Bq</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 R = 2.39 × 10⁻³ C/kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 rad = 10⁻² Gy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 rem = 10⁻² Sv</td>
<td></td>
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</tr>
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</table>

### 换算表

<table>
<thead>
<tr>
<th>量</th>
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<th>記号</th>
<th>他のSI単位による表現</th>
</tr>
</thead>
<tbody>
<tr>
<td>N(=10^5 dyn)</td>
<td>荷重</td>
<td>kgf</td>
<td>lbf</td>
</tr>
<tr>
<td>1</td>
<td>0.101972</td>
<td>0.224809</td>
<td></td>
</tr>
<tr>
<td>9.80665</td>
<td>1</td>
<td>2.20462</td>
<td></td>
</tr>
<tr>
<td>4.44822</td>
<td>0.45392</td>
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### 表 5 SI換算表

<table>
<thead>
<tr>
<th>量</th>
<th>名称</th>
<th>記号</th>
<th>他のSI単位による表現</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cal = 4.1865 J (計算値)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 cal = 1.8605 J (計算値)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 表 6 接頭語

<table>
<thead>
<tr>
<th>量</th>
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</tr>
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</table>

表1 ～5は国際単位系（SI）について、国際度量衡局（BIPM）の公表値を基に作成しています。

(86年12月26日現在)