Annex 4

Summary of Open Seminar
- Radiation Protection in Nuclear and Radiation Facilities -

Sep 11th, 2014, Nazarbayev University

Presentation

1) Presentation1: Overview of FNCA Activities and MEXT Programs Supporting HRD for Nuclear Energy and Radiation Utilization in Asian Countries
(Prof.Tomoaki Wada, Japan Foundation of Public Communication on Science and Technology)

At present 12 countries are participating in the FNCA. Kazakhstan joined the FNCA in 2001, and has been actively participating in all the projects of the FNCA.

At the last FNCA Ministerial Level Meeting in Tokyo, there were discussions on current status of the Fukushima Daiichi Nuclear Power Station, effective implementation of project outcomes and relationship-building with end-users, and nuclear security culture development.

MEXT Human Resource Development Program consists of the Nuclear Researchers Training Program and Instructors Training Program that are carried out in cooperation with FNCA activities.

Asian Nuclear Training and Education Program (ANTEP), the network system proposed by the FNCA Human Resources Development (HRD) project, can be used as a reference tool to provide information and available programs/courses and to promote HRD activities in all the FNCA member countries including MEXT Programs.

2) Presentation2: Basics of Radiation Safety
(Prof. Toshiso Kosako, The University of Tokyo)

Radiation is applied in various areas such as Medical use (X-ray procedure, CT scanning, Intracorporeal injection, Sterilization), agricultural use (breed improvement, sterilization, tracer), food irradiation (potato, pepper, frozen shrimp), industrial use (X-ray thickness gauge, hardening, fabrication, wear measurement), environmental protection technologies (disposal of exhaust gas, dirt, and sewage), civil engineering (tunnel construction, leakage water detector, water analyzer) and others (carbon dating/age determination, archaeological survey, baggage inspection etc.).

There are two kinds of radiation effects, Deterministic effect and Probabilistic effect.

Radiation protection is based on three fundamental principles: justification of practice,

optimization of protection, and dose limitation.
International organizations for radiation protection and safety include International Commission on Radiological Protection(ICRP), International Commission on Radiation Units and Measurements(ICRU), International Atomic Energy Agency(IAEA), United Nations(UN), Organization for Economic Cooperation and Development/Nuclear Energy Agency(OECD/NEA) and others such as ILO, WHO, etc.

3) Presentation3: IAEA Safety Standard and ICRP Recommendations (Dr. Mohd Abd Wahab Bin Yusof, Malaysian Nuclear Agency)

At early presentation he touched about the background of International Commission on Radiological Commission (ICRP) which was founded in 1928 under the name of the International X-ray & Radium Protection Committee. The name was changed to the present name in 1950. The functions, which are to formulate recommendations and guidance on all aspects of protection on ionising radiation, of ICRP were explained. He also explained about ICRP 103 Recommendations.
The second part of the presentation was about the establishment of International Atomic Energy Agency (IAEA) and the total number of states which became members of the organisation. Later, he talked about the functions of IAEA as independent body under United Nation and explained the structure of the IAEA Safety Standards with regard to radiation safety.
Finally he touched on latest IAEA standards requirements, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards General Requirements 2014 (BSS 2014). He explained some of the most important requirements under this standard. He also showed the annual dose limits for worker, public and student and apprentice.

4) Presentation4: Radioisotope Application in Japan (Dr. Shoji Futatsukawa Japan Radioisotope Association)

Japan Radioisotope Association (JRIA) takes a very important role on the use of radioisotopes in Japan. Radioisotopes and radiopharmaceuticals imported or produced by domestic manufacturers are supplied to users (institutes, universities, hospitals, etc.) through the JRIA in Japan. JRIA also collects and stores the radioactive wastes generated from the use of radioisotopes in users as supplier's responsibility. JRIA maintains the Japanese system from supply to disposal of radioisotopes. The Japanese system gives security of radiative sources to the country.

Radioisotope is a very useful tool as a trace reagent with high accuracy. It is simple to handle with no power supply needed. Because of this, radioisotope is usually used in various fields, especially in medical field to provide greater comfort and better quality of life. Approximately 6,000 establishments are permitted by or reported to the Authority for the use of radiation or radioisotope in Japan. Approximately 1,200 hospitals or clinics are regulated by the Medical Service Law for the use of radiopharmaceutical. The economic scale of radioisotope use in Japan is approximately 500 million dollars every year.

Almost unsealed radioisotopes (H-3, C-14, P-32, etc.) are used as a tracer with high sensitivity and good quantification in Life-Science field. But recently, more and more users are shifting to use fluorescence reagents instead of radioisotope. Irradiation using radiations from radioisotopes are used for sterilization of medical device, food irradiation, selective breeding, vermin prevention and so on. Sealed radioisotopes are also used for quality control to make a good product as radiography apparatus, thickness gauge, moisture & density and so on in many facilities. Moreover, sealed radioisotopes are used in medical field for teletherapy with gamma knife, high dose rate brachytherapy remote after loading system (HDR-RALS) and low dose rate brachytherapy with seed sources.

Radiopharmaceuticals are used for in vitro test and in vivo test on nuclear medicine. In vitro test can measure a very small amount of ingredient and hormone in blood or urine. In vivo imaging can diagnose the function of organ or tissue. Moreover, PET imaging is a diagnostic imaging method having high sensitivity and quantification.

Recently, therapeutic radiopharmaceuticals are evolved. I-131 has been used for thyroid cancer for long time, Sr-89 is used for sharp pain relaxation of bone and Y-90 is used for cell lymphoma. Ra-223 of alpha nuclide as new therapeutic radiopharmaceutical is under the clinical trial for bone metastases in Japan. It is expected to provide significant effect for the treatment of cancer. On the other hand, severe radiation management is necessary to deal with alpha nuclide.

Panel Discussion

1) Safety management of Naturally Occurring Radioactive Material(NORM)

Mr. Zhantikin Timur, Deputy Chairman, Committee of Safety in Power and Nuclear Industry, delivered a keynote speech for this discussion. In Kazakhstan, there is a set of legislative acts regulating issues of radiation safety assurance in general, and a set of regulatory legal acts which establish detailed requirements for providing of

radiation safety. These acts are compulsory for certain governmental agencies authorities which are involved in activities concerning usage of radioactive materials and local executive bodies.

Approximately 75 % of the uranium reserves of Kazakhstan are localized in deposits related to regional zones of interbedding corrosion. This type of deposits is not widely-distributed in the world and is mined by the most advanced, relatively cheap and ecologically preferred way of underground situ leaching (ISL process).

Radiation hazardous factors at enterprises of uranium situ leaching and productive solutions reprocessing include: personnel external irradiation, radon and its decay daughters in the air of working zone, total alpha-activity of long-lived radionuclides of uranium decay series. Radiation situation also characterizes the contamination level of premises, equipment, transport vehicles and packages, overalls and hands of personnel.

In the process of field exploitation the following low-radioactive solid waste can be formed: soil, accumulated during operative cleaning of productive solutions; sorted out sorbent agents; sludge in sand traps; contaminated scrap metal and other materials. The main contaminating radionuclide in solid wastes is natural uranium. Wastes are stored in departmental surficial repositories. Low-radioactive solid wastes mainly represent soil-ground layer, removed during remediation activities, and have specific activity which is lower considerably than acceptable for disposal in surficial repositories.

Radiation safety ensuring remains one of the principal directions of uranium mining enterprises activity. Radiation safety management system at enterprises involves all production stages, where works with radioactive substances (RS) and ionizing radiation sources are conducted. Regular personnel trainings on RS handling and compulsory briefings are conducted. At Kazatomprom uranium mining enterprises, number of personnel with annual exposure dose above 5 mSv is 95 people(2%), below 5 mSv is 4,524 people (98%).

Monitoring Program conducted by each enterprise includes the following principal directions: control pollution emissions, underground waters monitoring, control over soil and ground contamination, production and consumption wastes. Soil contamination assessment in the territory of sanitary protection area and industrial site is carried out once per year on the basis of pedestrian gamma-survey data. Final inspection of contaminated equipment and vehicles provides nonproliferation of radiation contamination beyond working site. This is achieved by observance of acceptable contamination levels non-exceedance by special vehicles and packing

sets, used for finished product transportation, as well as equipment, transported beyond the territory of industrial site.
To carry out remediation activities establishment of abandonment fund is provided by legislation. Contribution to the abandonment fund is made by subsoil user using special deposit account in any bank in the territory of the Republic of Kazakhstan.

A panel discussion was conducted followed by the above keynote speech. The following were pointed out:

- One of problems with NORM's handling (such us uranium mining residual, monazite sands, oil residual and so on) in many FNCA countries is that there are no any special regulatory guidelines for taking countermeasures against exposure to NORM, but only common regulatory standard on radiation safety based on excessively conservative approaches and values in case of NORM.
- It follows from this problem that there are difficulties with keeping balance between environmental protection and economic activity.
- Other problem is difficulties in control of inhalation level from radon gas emanated from NORM, and experience of some FNCA countries shows that simple countermeasures (like ventilation and access limitation) are best way than measurement of concentration and dose assessments.

2) **Safety management of radioactive sources in medical institutions**

Ms.Nanthavan Ya-anant gave a keynote speech for this discussion. She gave a first talk on "Utilizations of Radioactive Sources in Medical Institutions". Many kinds of radioactive sources have been used in hospitals such as Co-60, Cs-137, I-131, Mo-99m, and etc. She mentioned why the safety management of radioactive sources in medical institutions are need, and Thailand got an experience in Samut Pakan Radiological Accident in 2000. The accident occurred when 425 Ci Cobalt-60 source was unshielded. It caused 10 people highly exposed and 3 of whom died, but no contamination. She explained about the fundamental safety principle and justification principle Radiation Safety Management are need to implement in order to reduce the exposure dose to radiation workers and public . She also mentioned the radiation protection program should be applied in the medical institutes.

Following the above keynote speech, the points below were emphasized during the discussion:

- Based on experience of radiological accident in Thailand, where radioactive source

was lost, several problems were found: who has to be responsible for disused radioactive sources, who has to pay for damage from these disused sources if it belongs to poor organization (like some hospitals) and was missed, how to return the disused source to foreign country, how to avoid losses of disused radioactive sources, how to organize the risk management system in hospital.

In the Philippines, applicants including hospitals must apply and obtain a radioactive materials license prior to possession and use of radioactive materials. The same shall apply to other stakeholders and practitioners in commercial selling and services, industry, radiography, research and education where radioactive materials are involved. To ensure compliance with the relevant regulatory requirements and license conditions, regulatory inspections are conducted at the site on regular basis. Unannounced inspection and investigation are warranted if radiation safety is compromised that will cause harm and unnecessary radiation exposure to the workers and the general public.

- In Bangladesh, regulatory bodies conduct regular inspection of hospital to control radioactive sources and check knowledge of medical personnel. There are special training courses on radiation safety for medical staff.
- In Japan, doctors learn only procedures on treatment with radioactive sources. Management of sources is provided by special supervisor.
- In Malaysia, not company but doctor has license and is responsible for management of usage of radioactive sources.