AOCR-3

Report of the Third Asian and Oceanic Congress on Radiation Protection (AOCR-3)

Congress Organizing Committee of
the Third Asian and Oceanic Congress on
Radiation Protection*

I MESSAGE FROM THE PRESIDENT Summary of the Third Asian and Oceanic Congress on Radiation Protection (AOCR-3)

The Third Asian and Oceanic Congress on Radiation Protection (AOCR-3) is a congress for radiation protection held every four years under Asian and Oceanic Association for Radiation Protection (AOARP). The AOARP is a regional association of International Radiation Protection Association (IRPA). AOCR is also placed as a regional congress of IRPA, and has a history of holding in Seoul, Korea (AOCR-1, 2002) and in Beijing, China (AOCR-2, 2006).

Now we had AOCR-3, 2010, in Tokyo, Japan. The Congress continued from May 24 (Monday) to 28 (Friday). The gathered participants are 465 persons: the items are Japan, 325, Korea, 55, China, 17 and others, 68. The countries are 29. The program and structure of AOCR-3 are the followings: Opening Session; Poster presentation, 13 frames, 248 subjects; Oral presentation, 12 frames, 64; Refresher course, 9; Luncheon Seminar, 8; Student session, 4 frames; International affairs session; 8 frames. Other Congress arrangements are: Exhibition of instruments by industrial groups; Nine video sessions in the morning; Technical tours (Tokyo, Chiba, Tsukuba three routes); and Welcome party (24, Monday) and Farewell party (27, Thursday). The selected papers will be published as a supplement volume of "Radiation Protection Dosimetry" Journal.

The characteristics of this Congress are the followings. The first is 12 frames of Poster and Oral presentations; (i) Radon, (ii) Emergency preparedness and response, (iii) Radiation measurement, (iv) Radiation control and management, (v) Radioactive waste management, (vi) NORM/TENORM, (vii) Dosimetry, (viii) Standard, criteria and regulation, (ix) Exposure to medical radiation, (x) Health effects of

ionization radiation, (xi) Environmental radioactivity, and (xii) Radiological protection as a part of the global nuclear expansion. The second is a Student session; which was arranged by themselves through a deep discussion in the Tokyo University dormitory of their accommodation. The third is an International affairs session; covering not only international organizations e. g. International Atomic Energy Agency (IAEA), International Commission on Radiological Protection (ICRP), World Health Organization (WHO) but also the developing countries' members by supporting their attendance.

The mutual communications through AOCR-3 Congress brought a deep understanding of radiation protection of this region and a robust network of radiation protection communities. We can conclude a successful summary here.

We would like to acknowledge all attendants and speakers, the members of International Congress Council (ICC), International Academic Advisers (IAA), Executive Committee (EC), Congress Organization Committee (COC) and Fund Contributors.

(Toshiso KOSAKO, the University of Tokyo)

Table. 1 General information on AOCR-3, Tokyo

No. of total participants	465	No. of countries	29
No. of poster presentations	248	No. of oral presenters	120

II REVIEW OF THE PRESENTATIONS FOR EACH SESSION

1. Opening Session

The Opening Session was started by the opening remarks from Dr. KOSAKO, the University of Tokyo, Japan, as the president of the AOCR-3. He highlighted the following ten points; (1) the oral/poster presentations allocated to 12 themes, (2) selected papers in the proceedings of the congress to be published in Supplementary Journal of Radiation Protection Dosimetry, (3) invited presenters from various international organizations, (4) refresher courses in the morning performed not only for educations for young scientists but also for summaries of academic progresses, (5) Japanese cultures through the special seminars (English Rakugo; Japanese sit-down story in English version), (6) Nine Video Sessions set in the morning. (7) radiation measurement instruments exhibited, (8) three technical tours prepared on the last day. (9) Asian/Oceanic Students' sessions programmed for the progress in the future. (10) welcome and farewell parties. After the opening remarks, congratulatory Remarks were presented by Dr. KIM, the president of AOARP and Dr. KASE, the president of IRPA.

The last part of the Opening Session, the keynote address entitled "Nuclear Civilization for Sustainable Development of Mankind" was presented by Dr. FUJIE (former chairman of Japan Atomic Energy Commission). The presentation consisted of three parts; (1) lessons learned through the past with talking his view on the present civilization based on chemical reaction and necessity to find out as a possibility of science and technology to solve or to improve energy and environmental issues, (2) concern with nuclear development in 20th century separated to first half and second especially

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to evaluate positively the result of the development in the latter half of the century, and (3) discussion on our future development of nuclear science and technology and whole aspect of civilization based upon nuclear reaction with time span necessary for the development. He concluded that future civilization is recommended to be based on nuclear science and technology with self-consistent energy system, advanced science and technology and syntheses with conventional technology.

(Takuya ABE, the University of Tokyo)

2. Special Sessions

AOARP & FNCA Session

In the first half of the session, current state about radioactive waste management and radiation safety of each Forum for Nuclear Cooperation in Asia (FNCA) member country was introduced. The member discussed about the following themes continuously; How to improve radiation safety system and radioactive waste management, and issues to be solved and themes to be discussed in FNCA Radiation Safety (RS) & Radioactive Waste Management (RWM). Future plan for the FNCA RS & RWM project and 6 themes were focused as important issues; Radioactive waste management and decommissioning, NORM/TENORM, Clearance, Safety & security, Emergency, and Nuclear power plant program.

In the second half of the session, there was round table discussion about 6 themes focused in the before session under the sub title of "Towards the better international cooperation in the field of radiation safety". Each country's project leader of FNCA RS & RWM presented a brief update summarising the main highlights and developments in radiation safety and radioactive waste management in member countries. Dr. KOSAKO opened the session with an introduction of the FNCA RS & RWM program providing the background of the FNCA structure, terms of reference and some examples and highlights of the recent FNCA RS & RWM achievements. The Project Leaders from Australia, Bangladesh, China, Indonesia, Malaysia, Philippines, Thailand and Vietnam provided brief summaries of the main activities relating to RS & RWM in each FNCA member country.

(Tadashi OUMI, the Japan Atomic Power Company)

IRPA Associated Societies Forum

Dr. KASE, President of IRPA, introduced the IRPA Strategy with the emphasis of the recent IRPA initiative on Radiation Protection Culture by welcoming the Asian regional workshop on RP Culture, which is scheduled to be held on 24 November 2010 in Korea. It followed by the remarks by Dr. LOCHARD, Executive Officer of IRPA, on the IRPA Rules Changes to adapt the revision of the IRPA Charter and to clarify the terms of the references of IRPA committees and the procedures of EC members election and IRPA Congress venue selection. Mr. GUEN, a member of IRPA EC, briefly introduced the first International Workshop on RP Culture, which was held in November 2009 in Paris and pointed out that there are still needs for the further development of the definition, elements and values of RP Culture.

These were followed by the introduction of the current activities of Asian associate societies. Dr. CHO, Chairman of International Relations Committee of KARP (Korean Association for Radiation Protection), introduced the 'Feedback experience with the implementation of ICRP Recommendations' in China, Japan, Korea and Malaysia. He pointed out that the set up of dose constraints and reference level in each country taking into account their own national social and cultural environments is the most outstanding issue to be incorporated and most Asian countries are taking the appropriate steps for the implementation of ICRP 103 and new IAEA BSS (Basic Safety Standard). Dr. YONEHARA, Japan Health Physics Society (JHPS), presented the 'Discussion and activity on the revision of IAEA-BSS in Japan'. Dr. YOON, President of KARP, introduced the 'Issue of Medical Exposures in Korea'.

Representatives of the Associate Societies of the AOARP including Australian Radiation Protection Society, China Society for Radiation Protection, Indian Association for Radiation Protection, Japan Health Physics Society, Korean Association for Radiation Protection, and Malaysian Radiation Protection Association have introduced their recent activities, which mainly devoted to the further facilitation of the exchange of the information among specialists and also for the education and training.

Finally the round table discussion session was followed with the host of Dr. KIM, President of AOARP, for the exchange of views on the matters raised by Associate Societies and for the summary of IRPA AS Forum. There was general feeling that all Associate Societies of the AOARP have been active during the past four years, though the number of membership of the AOARP is not well represented in the IRPA and there is also a need for inviting the new member Societies to the AOARP, and the allocated time for the conduct of the Forum was not enough for the full and thorough discussion.

(Kun-Woo CHO, Korea Institute of Nuclear Safety)

IRPA Special Session

The highlights which marked the evolution of the conduct of IRPA since IRPA 10, held at Hiroshima and their impacts on the radiation protection profession and the role of the IRPA were presented in more details by Dr. LOCHARD. According to the new strategic plan for 2008–2020 adopted by the executive council of IRPA the Mission and Vision for IRPA have been restarted and 4 goals were also set. Two goals specially related to enhancing the radiation protection professional have been identified and these goals are 1) Promoting excellence in national and regional associate societies and 2) Promoting excellence in radiation protection professionals. Dr. KASE discussed how to achieve these goals the challenges to which IRPA members and associate societies have to face and how they have to participate in this effort with the IRPA executive council.

Round table discussion was held on "Promoting excellence and recognition of radiation protection in Asia" with the participation of Dr. KIM from Korea, Dr. LIU from China, Dr. HATTORI from Japan and Dr. LOCARD, Dr. KASE from IRPA. They discussed the impotency of having a mechanism in each member society to interact internationally for enhance

communications and future expectations. Ordinance considered the representatives from India, WHO, IAEA. India commented on their training mechanism and their experience in professional development in the field of Radiation Protection. The representative from WHO Dr. PEREZ pointed out that it would be beneficial if personals from medical sector were provided with the opportunity in RP workshops and to be members in RP societies. IAEA commented that it was important to get the feedbacks from regulators and other RP professionals from IAEA member countries for IRPA. It was requested to inform any update on IRPA web site to officials of the member society by e-mails and get their quick attention and response. Dr. HATTORI asked Dr. KASE to do so at this session. However IRPA web site provides RSS (Rich Site Summary) feed service (IRPA Feed). Therefore it is easy to be informed update on IRPA web site by e-mails.

(Prasad MAHAKUMARA, Atomic Energy Authority of Sri Lanka)

IAEA Special Session

Session theme is “Long term management of disused sealed sources”. Session presenters and their subjects are as follows: Dr. AMARAL, IAEA, “Safety of disused sources -background, issues, safety standard and the code of conduct-“, Dr. ZHIWEN, CIRP (China Institute for Radiation Protection), “The program of disused sealed source management and disposal in China”, Dr. METCALF, IAEA, “demonstrating the safety of disused sealed source strage and disposal”. Following information exchanges were performed after the presentations:

The implementation of control of disused sources was started in the 1950s in China. At that time, China started to build storage facility. After the big accident 20 years ago, heavy discussions started in IAEA. Borehole is surely a possible solution, but nobody knows the price. IAEA are trying to make member states aware that this is a problem. Some countries don't think about a strategy for disposal or even storage. IAEA are trying to facilitate exchange of information between those who have a solution and those that do not. For the past Goiânia's case, costs were in the tens of millions of dollars for recovery. From a governmental point of view, this kind of problem should be seen almost like a social service. Use of sources has benefit for society. Perhaps there should be a tax for revenue.

(Satoshi IWAI, Mitsubishi Research Institute, Inc.)

WHO Special Session

Dr. TAKAMURA, WHO, points out that information on cancer risks associated with diagnostic medical radiation during early childhood is still limited. Because of the dramatic increase in the numbers of children undergoing CT examinations, it is urgent to study occurrence of pediatric, adolescent, and adult cancer risks associated with these procedures. Newly projected investigations are definitely needed to obtain a novel information in the field. Dr. PEREZ, WHO, summarizes different aspects related to children's radiation protection, focusing on the medical use of radiation pediatric imaging. Key issues and challenges are identified and policy options are discussed based on the two pillars of radiation protection in medical exposures:

justification of procedures and optimization of doses. Actions to address those issues in the field of risk assessment, risk management and risk communication are proposed. The medical community, professional bodies and governments share the responsibility of promoting safe and effective use of radiation in children healthcare. Dr. LAU, International Radiology Quality Network (IRQN), focuses on global collaborative actions towards appropriate use of radiation in pediatric imaging. When performing procedures in children, it is important to ‘child size’ the technique. Three control measures are used which are supported by five implementation strategies. The control measures are: procedure justification; optimization of protection; and error minimization. The five strategies are to: promote awareness; conduct research; develop and provide education and training; strengthen system infrastructure; and implement effective polochies.

(Hiroki OHTANI, Tokyo Metropolitan University)

ICRP Special Session

Session theme is “current and future topics on ICRP activities”. Session presenters and their subjects are as follows: Dr. LEE a member of ICRP Main Commission, “Recent, current and future activities of ICRP”, Dr. LOCHARD, a member of ICRP Main Commission, “Ethics and values underlying the principles and concepts of the ICRP radiological protection system”. Following information exchanges were performed after the presentations:

The role of ICRP is to look at the challenges that are coming from radiation protection, not the challenges of the nuclear industry. ICRP thinks about the future. However, the keys for challenges are natural radiation and radon, and medical exposure, and basically this is what ICRP focuses on. We also have to take into consideration that we cannot control the source of radon, that this is an existing exposure situation, and this is the flexibility which has been introduced in Publ.103, that we optimize as low as reasonably achievable taking into account the context and the constraints of the situation.

ICRP defines the nominal risk coefficient by using the age averaged and also the gender averaged. However the higher radon risk coefficient is due to the cigarette and smoking. This is a hobby matter, not a nominal risk concept.

(Satoshi IWAI, Mitsubishi Research Institute, Inc.)

3. Luncheon Seminars

LS-1: NORM/TENORM Management and Its Discussion Points Focusing Mainly on Closed Uranium Mine Sites

Dr. ISHIMORI, JAEA (Japan Atomic Energy Agency), in his lecture focused on NORM/TENORM management. Nowadays managing the NORM and the TENORM is a very important topic everywhere in the world not only in Japan. Unfortunately this problem is related to other ores excavation process also, not only but uranium mining. Whereas this problem means natural radioactive materials occurring, many times the health risk is originated by gamma dose rate and radon and its progeny inhalation. In this presentation the main emphasis was on closed uranium mine sites, but results of some radon studies and new attempts also were shown. History of the Japanese Nuclear

Energy Industry and Ningyo-toge was detailed from 1955 when the first uranium deposits were discovered in Japan, but actually there are new challenges like decommissioning and remediating projects. The operation and results of the monitoring system around the closed uranium mine also were displayed. To confirm the effectiveness and reliability of the applied measuring units and methods, ancient iron melting ruins were discovered due to the remained and beneficiated natural radionuclide. The presentation adverted to the problems and deficiency of the Basic Safety Standard. It was very interesting to see that after the remediation work finished the landscapes around the closed uranium mine sites are very similar to the origin circumstances and in Ningyo-toge one exhibition tunnel was opened to teach and inform the next generation about the past of the uranium mining. Finally, new radon researches on animals and regulation problems were demonstrated.

(Norbert KAVASI, National Institute of Radiological Sciences)

LS-2: Radiation Health Effects of Atomic Bombs and Accidents of Nuclear Power Plants

Dr. NAGATAKI, Professor emeritus of Nagasaki University, Japan, lectured radiation health effects. Studies on the radiation health effects of atomic bomb survivors are still the gold standard of the world. Current knowledge on the radiation health effects on humans was shown at first using the results of studies obtained from the atomic bomb survivors. It should be noted that by the examination of a single patient, it is impossible to differentiate a radiation-induced cancer patient from a naturally-generated cancer patient even by the most updated medical and scientific techniques. Therefore, the investigation of radiation effects on humans, especially the late health effects has been based on the epidemiological and statistical procedure. In brief, radiation health effects have been investigated by the relation between the exposed radiation doses and the incidence of diseases in cohorts of atomic bomb survivors. It is well accepted that the incidence of cancer or the risk of cancer increase lineally as radiation doses increase. However, there is controversy as to whether the threshold exists or not, and health effects on non-cancer diseases are not yet accepted by international authorities. The accident of Chernobyl nuclear power plant occurred in 1986 and international collaborations started in 1990. After extensive review of individual studies, the scientific results were summarized by international organizations at the 20 years anniversary symposia in 2006. Conclusions on the late health effects are that the childhood thyroid cancer is increased by the accident and more than 4,000 children are suffering from thyroid cancer. However, except thyroid cancer and acute radiation effects, no other diseases proved to be increased by Chernobyl accident.

The thesis of this presentation is that what is the newest knowledge. Almost human data on radiological health effects and dose-response relationship model were organized from this thesis point of view, that is, from conflicting ideas and debate to international agreement. Followings are presented as summary of this presentation:

1) Radiation dose > 100 mSv has shown a statistically

significant radiation risk.

2) Radiation dose < 1 mSv cannot be distinguished from those of natural health hazard.

3) Effect of radiation dose from 1 to 100 mSv and the existence of a threshold has not been proved nor has not been denied.

Finally, it is emphasized that explanation of the scientific results to the public is the duty of scientists concerned. It is important to explain to the public about various stages of the scientific results, not only the scientific agreement, but also the disagreement in a way to let the public understand the significance of the scientific results.

(Kazuhiko CHIKAMOTO, Japan NUS Co., Ltd.)

LS-3: IAEA's Future Activities in Radiation, Transport and Waste Safety

Dr. AMARAL, Director of division of Radiation, Transport and Waste Safety, presented the current activity and future plan of her division. They plan to develop the regulatory system for radiation safety along with the expansion of radiation and sources usage. They put emphasis on several topics, such as protection of medical exposure, environmental protection, and long term management of disused sources. They also care about developing countries with provision of many standards and guidance for radiation safety.

Current status of revision of IAEA BSS was the most stimulative topic of this seminar. There are some questions about the revision process of BSS. IAEA employed "open process" to edit the BSS with member states and cooperative organizations. However, several audiences complained about the exclusivity of editing board. It is because there are so many stakeholders that it is hard to respond to all comments and request of every stakeholder. And it is the reason that the revision of BSS took such long time.

I felt that Asian countries are expected to contribute the global action of IAEA. We should make efforts to show our presence in IAEA.

(Makoto HASHIMOTO,
Secretariat of Nuclear Safety Commission)

LS-4: Safety Culture and the Transfer to Future Generation

Dr. MATSUURA, the president of Nuclear Safety Research Association, Japan, explained the background of the key word "Safety Culture". The International Nuclear Safety Advisory Group (INSAG) stressed the importance of a 'nuclear safety culture' in the INSAG-Doc. 1, the Summary report on the Chernobyl Accident in 1986 and published the INSAG-Doc. 4, 'Safety Culture' in 1991 in order to promote enhancement of nuclear safety culture among nuclear power generation activities in the world. Since that time, the concept of nuclear safety culture has been disseminated in the field of nuclear power generation and the concept has presently become a strong base for nuclear safety assurance of nuclear power industry. In these several years, the concept of safety culture is more widely expanded, such like as 'the Security Culture' and 'Radiation Protection Culture'. Nuclear Safety Culture and Radiation Protection Culture, both are aiming at the identical

target and work on some common scientific and technological backgrounds. The enhanced and integrated radiation protection culture could work as an efficient and effective vehicle by itself for transferring the culture to the next generation. He said that the definition of 'culture' was difficult but talked about Japanese 'culture', such as 生花 (flower arrangement), 茶道 (tea ceremony), 能 (Noh play) and 柔道 (Judo), all of which contain 'idea', structure, education system, transfer to next generation in common. They need both conservatism and innovative features, and social acceptance. As nuclear activities have global features, he said that technical support, global standards and integrated system of education are essential for the enhancement of nuclear related culture.

To the chair's question, he answered that the recognition of the value of safety to human beings was the most important to foster 'safety culture'.

(Masahito KANEKO, Radiation Effects Association)

LS-5: Development of PHITS and Its Application

Dr. NAKASHIMA, JAEA, Japan, introduced the Particle and Heavy Ion Transport code System, PHITS. This is a comprehensive code system based on a three-dimensional Monte Carlo method. PHITS makes possible to calculate various particle and heavy ion transport phenomena of wide energy range, by using JAM (Jet AA Microscopic Transport Model), JQMD (JAERI Quantum Molecular Dynamics), R-JQMD (a relativistically covariant version of JQMD) and GEM (Generalized Evaporation Model) codes with elementally nuclear data sets.

PHITS is a power tool for shielding and target designs of high energy accelerator facilities. PHITS has been developed based on the NMTC/JAM code which was developed for shielding design of the J-PARC (Japan Proton Accelerator Research Complex) project. The accelerator complex of J-PARC consists of three accelerators: a 400 MeV Linac, a 3 GeV rapid cycle synchrotron with 1 MW beam power, and a 50 GeV synchrotron with 750 kW beam power, and four major experimental facilities. In addition, proton and heavy ion therapy is an important field for the development of PHITS, since the accuracy demanded by this field is quit high and the components included in the facilities. BNCT (Boron neutron capture therapy) is also applicable field for PHITS. Furthermore, because the space radiation is composed of a various kinds of radiation such as proton and heavy ions, PHITS might play an important role. PHITS is still developed to extend the application fields by considering the following modifications: a) coupling with the DCHAIN-SP code¹⁷ for radioactivity calculation, b) incorporating photo-nuclear reaction, c) coupling with the EGS code for high energy photon and electron transport, and d) coupling with some burn-up codes.

(Takeshi IIMOTO, the University of Tokyo)

LS-6: Radioactive Waste Management and Clearance System Adopted in Decommissioning Site

Mr. YAMAUCHI, Japan Atomic Power Company, Japan, made a presentation with the title, "Radioactive Waste Management and Clearance System Adopted in Decommissioning Site" in

the Luncheon Seminar 6. First of all, the profile of Tokai-1 in JAPC was introduced and then its decommissioning strategy was explained. This decommissioning is the first project for commercial reactor in Japan. The outline of the project was shown together with dismantling schedule. They have been trying to dismantle four Steam Raising Units (SRUs) with "Jack-down" method and "remote cutting" method. Most equipment will be recycled because it is classified as clearance Material (CL) or non radioactive waste (NR). Regarding radioactive waste, the classifications and disposal methods together with waste amounts were shown. They also have developed waste management strategy in accordance with classified radioactive level of wastes to decrease dismantling cost. They have received an approval of the clearance measurement and the verification method from regulatory body. Finally, their application experiences through this decommissioning project were explained. In the questions and answers corner, hot discussions on the clearance of the medical accelerator were made.

(Yuya KOIKE, the University of Tokyo)

4. Oral Presentation Sessions

OP-1: Radon

Keynote lecture: Francesco BOCHICCHIO, Italian National Institute of Health, Italy

"The Newest International Trend about Regulation of Indoor Radon"

1-O-1 Tracy WRIGHT, Australian Radiation Protection and Nuclear Safety Agency, Australia

"Calibration and Standardisation for Radon and Thoron"

1-O-2 Yong-Jae KIM, Korea Institute of Nuclear Safety, Korea
"National Survey in Korea"

1-O-3 R. C. RAMOLA, H. N. B. Garhwal University, India
"Radon, Thoron Survey in Himalayan Homes, India"

1-O-5 Jing CHEN, Radiation Protection Bureau, Health Canada, Canada

Comments:

1-C-1 Shinji YOSHINAGA, National Institute of Radiological Sciences, Japan

"For Epidemiology"

1-C-2 Takao IIDA, Professor Emeritus of Nagoya University, Japan

"For Radiation Measurement"

The keywords of this session were calibration of radon and thoron, national surveys, and epidemiology. International trend (WHO, IAEA, ICRP et al.) about the regulation of indoor radon which is gaining importance in recent years was introduced in Keynote lecture. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has maintained radon calibration facilities since the early 1980's. Calibration and standardization for radon and thoron in the ARPANSA was introduced. A nationwide radon survey in Korean dwellings has been conducted in 1989, 2000, and 2002–2005 and radon survey in public building (local governmental office and elementary schools) was conducted in 2008–2009. Results of measurement of radon, thoron and their progeny in Himalayan homes were presented. The measurements were carried out

using a solid state nuclear track detector. A detailed analysis of the distribution of radon, thoron and their decay products inside the house was also discussed. Based on new scientific information and broad public consultation, the Government of Canada updated the guideline for exposure to indoor radon and launched a multi-year radon program in 2007. Major achievements accomplished in the past three years and current activities underway were presented.

(Shinji TOKONAMI and Masahiro HOSODA,
National Institute of Radiological Sciences)

OP-2: Emergency Preparedness and Response

Keynote lecture: Wolfgang WEISS, The Federal Office for Radiation Protection, Germany

“Recent Development of Concepts for Emergency Exposure Situations and Its Implementation in the International Safety Standards”

2-O-1 Xiao-Qiu CHEN, Ministry of Environmental Protection, China

“Preparedness and Response for a Nuclear Facility Emergency”

2-O-2 Mohd Abdul Wahab YUSOF, Malaysian Nuclear Agency, Malaysia

“Radiological Emergency: Malaysian Preparedness and Response”

2-O-3 Masashi KANAMORI, Japan Atomic Energy Agency, Japan

“Preparedness and Response for Radiological Emergency in Japan”

2-O-4 Maria Visitacion B. PALATTAO, Philippine Nuclear Research Institute, The Philippines

“Medical Response to a Radiation Emergency in the Philippines”

2-O-5 Shigenobu NAGATAKI, Professor Emeritus of Nagasaki University, Japan

“International Association of Radiopathology (IAR) as Non-profit Association”

This session basically discussed the current status of emergency preparedness and response for a nuclear or radiological emergency in Asian countries. The keynote lecture emphasized that the new approach developed by the 2007 recommendations of the ICRP provided a framework that focused on the combined effects of all individual protective measures in the protection strategy rather than on any single measure. Regulatory basis in China for simplifying off-site emergency plan for advanced nuclear power plant was presented. Before proposing opinions to simplify off-site EP, it was suggested that it be necessary to review the new advances associated with EP in foreign countries and to conduct the research on the technical criteria of EP for advanced nuclear power plant. The current status of emergency preparedness and response in Malaysia was also presented. It is concluded that although preparedness for nuclear or radiological emergency has been already in place, Malaysia still needed to enhance its capabilities for emergency preparedness and response in accordance with the international standards and requirements. The new system for emergency preparedness and response in Japan based upon the lessons learned from the Tokai-mura criticality accident in 1999 was presented. The followings were

emphasized; the importance for sharing lessons learned from past nuclear or radiological accidents and also the knowledge gained from various exercises with other Asian countries. The current status of medical response to a radiation emergency in the Philippines was presented. The medical response consists of pre-hospital and hospital level management and their activities and procedures are adapted so as to suite the local capabilities and resources. Finally, the activities on International Association of Radiopathology (IAR) as non-profit association were introduced. IAR is a unique association in the fields of emergency preparedness and response. This session concludes that although the issues associated with emergency preparedness and response are different within Asian countries, it is important to share information gained from their activities and to harmonize the procedures and practices of emergency preparedness and response.

(Toshimitsu HOMMA, Japan Atomic Energy Agency)

OP-3: Radiation measurement

Keynote lecture: Fang-Yuh HSU, National Tsing Hua University, Taiwan

“Assessment of Skin Doses Due to Different Treatment Techniques Used in the Nasopharyngeal Carcinoma Radiotherapy”

3-O-1 Yong Kyun KIM, Hanyang University, Korea

“Performance of the Neutron-gamma Separation by Using a Composite Stilbene Scintillator for the Fast Neutron Measurement”

3-O-2 Xiao-na REN, China Institute of Radiological Protection, China

“Monte Carlo Simulation for Energy Deposition of Ionization Chamber Based on the Equivalent Electron Source Theory and Experimental Verification for the Theory”

3-O-3 Attakovit Sa-NGUENSAT, Ministry of Public Health, Thailand

“In Light OSL for Routine Radiation Monitoring Service in Thailand”

3-O-4 Kikuo SHIMIZU, Osaka University, Japan

“Fundamental Study of the Radiation Monitoring System Based on Evaluation of DNA Lesions”

3-O-5 Ngoc Toan TRAN, Vietnam Atomic Energy Commission, Viet Nam

“Calibration of kVp Meters Used in Quality Control Tests of Diagnostic X-ray Units”

This session discussed the application of radiation measurements for radiation protection. New technologies of radiation detection, radiation analysis, radiation quantification, current applications of conventional radiation measurement method, calibration, standardization, and optimization of radiation measurement were presented. Six themes on the application of radiation measurements for radiation protection were presented. For measurements in medical fields, an example of estimation method for skin doses in Taiwan was introduced. They use a Rando-Phantom and luminescent dosimeters. This technique is effective for the treatment of Nasopharyngeal Carcinoma (NPC), the most common cancer in Southern China and Taiwan. A composite stilbene scintillator of $\phi 200 \times 20$ mm, developed in Korea was also introduced. The thickness of the new detector is a half of that of BC-501A which is one of

traditional detectors. The stainless steel ionization chamber with sensitive Xe can make the detector compact. The history and situation of personal radiation monitoring service in Thailand were also introduced. After the historical monitoring service with film badge or TLD system, an OSL system was started from 2009 in Thailand. Finally, one of calibration techniques for diagnostic radiology in Vietnam was introduced.

(Masahiro HIROTA, the University of Tokyo)

OP-4: Radiation Control and Management

Keynote lecture: Nanthavan YA-ANANT, Thailand Institute of Nuclear Technology, Thailand

“Radiological Accident and Incidents in Thailand and Lessons to be Learned”

4-O-2 Yoshihiro ASANO, RIKEN, Japan

“Characteristics of the Radiation Safety for Synchrotron Radiation and X-ray Free Electron Laser Facilities”

4-O-3 Minh Quang PHAM, Institute for Technology of Radioactive & Rare Elements, Viet Nam

“Management of Radioactive Sources and Stabilization, Store of Expired Sources such as Ra Needles and Co Disused Sources in Vietnam”

4-O-4 Sadaaki FURUTA, Japan Atomic Energy Agency, Japan

“Radiation Protection in Nuclear Fuel Cycle Facilities”

4-O-5 Hiroshi YASUDA, National Institute of Radiological Sciences, Japan

“Management of Cosmic Radiation Exposure for Aircraft Crew in Japan”

This session mainly discussed serious or typical radiation accidents and incidents. Their causes and backgrounds, what happened, how to confronted them, what has been changed, what kind of problems are still remained, and what should be done in the future, were presented. From Thailand, one of the world serious radiological accidents occurred in Samut Prakan in 2000 was introduced as the keynote lecture. A disused ^{60}Co tele-therapy head caused deaths and serious injuries. How it happened, and how to prevent similar accidents were presented. The four presentations were arranged after this. These are Radiation safety problems for typical electron accelerators, Synchrotron Radiation (SR) and X-ray Free Electron Laser (XFEL) facilities in Japan, current status of legislative framework, legal documents and activities concerning the control and management of radioactive sources in Vietnam, radiation protection methodologies concerning individual monitoring, workplace monitoring and environmental monitoring in nuclear fuel facilities in Japan, and reviewing the guide line for the annual aviation dose of aircraft crew as well as original easy-to-use software program “JISCARD EX” which can provide the annual individual doses of aircraft crew.

(Hirokuni YAMANISHI, National Institute for Fusion Science)

OP-5: Radioactive Waste Management

Keynote lecture: Phil METCALF, International Atomic Energy Agency, Austria

“The Global Nuclear Safety Regime Applied to Radioactive Waste Management”

5-O-1 Chang-Lak KIM, Korea Radioactive Waste Management

Corporation, Korea

“Recent Radioactive Waste Management Practices in an AOCRP Member State, Korea”

5-O-2 Yuji INOUE, Ministry of Education, Culture, Sports, Science and Technology, Japan

“Development of Clearance Levels in Japanese Radioisotope Regulations”

5-O-3 Nanthavan YA-ANANT, Thailand Institute of Nuclear Technology, Thailand

“Regional Cooperation in Radioactive Waste Management in the Asian and Oceanic Countries”

Comments:

5-C-1 Hideo KIMURA, Japan Atomic Energy Agency, Japan

“Safety Analysis for Radioactive Waste Management”

5-C-2 Toyoaki YAMAUCHI, Japan Atomic Power Company, Japan

“Decommissioning and Radioactive Waste Management”

This session dealt with principles, policy, or practices of radiation protection for radioactive waste management. The update of the IAEA waste safety standards was introduced as the keynote lecture. The conclusions of the third review meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management were presented. Some of the recent developments in radioactive waste management and radiation protection of the public and the environment were focused. The regional cooperation in radioactive waste management in the Asian and Oceanic countries was also introduced. The cooperation has been successfully developed continuously for more than 20 years. Several success stories in the cooperation, including those in the FNCA, the Asian Nuclear Safety Network (ANSN) and the IAEA Regional Projects were presented. The development of clearance levels in Japanese radioisotope regulations was introduced. Clearance levels will be the criteria for removing wastes from the regulatory control. Japan is planning that the clearance levels are to be enforced as national regulation from 2012. Some technological comments on probabilistic method applied to the development of clearance levels were also made. The fundamental principles and implementation of the national radioactive waste management policy of the Republic of Korea were introduced. The Korean practices of radioactive waste management in focusing radiation protection for low- and intermediate-level waste disposal were summarized. Some recent experiences in radioactive waste management practices in the decommissioning project of the Japan's oldest nuclear power plant were introduced. The session participants have reached the common understandings on the challenges in radioactive waste management issues.

(Hideaki YAMAMOTO, Japan Atomic Energy Agency)

OP-6: NORM/TENORM

Keynote lecture: Sen-lin LIU, China Institute of Atomic Energy, China

“The Status on the Radiological Protection of NORM Exposure”

6-O-1 Byung-Uck CHANG, Korea Institute of Nuclear Safety, Korea

“The Current Status of NORM/TENORM Industries and Establishment of the Regulatory Frameworks in Korea”

6-O-2 Cameron JEFFRIES, St Vincent's Hospital, Australia
 "Regulation of Naturally Occurring Radioactive Materials in Australia"

6-O-3 Shintaro HARA, Ministry of Education, Culture, Sports, Science and Technology, Japan
 "Japanese "U-Th Guideline" and Its Background"

6-O-4 Michael COWIE, Saudi Aramco, Saudi Arabia
 "Saudi Aramco's NORM Management Strategy"

This session focused on how to manage NORM/TENORM effectively. As the keynote lecture, the international activities (IAEA, ICRP, etc.) facing NORM/TENORM problems, and relating actions to be performed as well as future tasks for NORM/TENORM problems in China were introduced. Following this, from Korea, Australia, and Japan, current status of related industries and establishment situation of the regulatory framework in each country were presented. In addition, an example of NORM management strategy in an oil/gas production company in Saudi Arabia was also introduced. For example, in Australia there is a large and diverse range of industries involved in mining of mineral processing, and the production of fossil fuels. Enhanced levels of naturally occurring radionuclides can be associated with mineral extraction and processing, other industries (e. g. metal recycling) and some products (e. g. plasterboard). National regulatory body in conjunction with industry (and State regulators), has undertaken a review and assessment of NORM management in industries. This fact-findings procedure is the most important step to manage NORM/TENORM and has resulted in guidance on the management of NORM. Asian and Oceanic countries are deeply involved in the NORM/TENORM issues as consumers and/or producers in the world. This session was effective and useful for us to exchange the present and/or future information on each country's situation and agenda. Continuous discussion and cooperation to overcome our difficulty on NORM/TENORM are strongly needed.

(Takeshi IIMOTO, the University of Tokyo)

OP-7: Dosimetry

Keynote lecture: Hans-Georg MENZEL, European Organization for Nuclear Research, Switzerland

"Current Activities of Committee 2 of the International Commission on Radiological Protection"

7-O-1 Tatsuhiko SATO, Japan Atomic Energy Agency, Japan
 "Impact of the Introduction of ICRP Publication 103 on Neutron Dosimetry"

7-O-2 Ji-Zeng MA, China Institute of Atomic Energy, China
 "Gas Scintillation Proportional Counter for In Vivo Measurement"

7-O-3 Jong Hwi JEONG, Hanyang University, Korea
 "Development and Application of Computational Human Phantoms"

7-O-4 A. C. JAMES, Washington State University, USA
 "Development of Computational Code for Internal Dosimetry"

7-O-5 Yi-ren XUAN, China Institute for Radiation Protection, China
 "Current Status of Dosimetry in China"

This session intended to discuss numerical dosimetry for external/internal irradiation based on ICRP Committee-2, and related activities including high-energy dosimetry, internal dose calculation models, etc. The key-note lecture introduced present activity of ICRP Committee-2. The committee has been discussing external and internal dose assessment and measurement. One of the recent highlighted results was the modification of radiation and tissue weighting factors, w_r and w_t in the ICRP 2007 recommendations (Publication 103). The committee is now working to revise dose conversion coefficients for external and internal dose assessment based on the ICRP Publication 103. The activities include the development of high-energy dosimetry and reference hybrid phantoms for fetus and various ages. From Japan, the impact of the introduction of ICRP Publication 103 on neutron dosimetry was presented. A set of the conversion coefficients from fluence to effective dose for neutrons were calculated using the PHITS code based on the ICRP Publication 103, and compared with those based on ICRP Publication 60. The calculated coefficients were generally smaller than those based on ICRP Publication 60 due to the change of w_r . It was also shown that the ambient dose equivalent, $H^*(10)$, could provide a conservative estimation for the ICRP103-based effective doses in most neutron fields, and, thus, the current radiological protection system for neutrons was able to be maintained after implementing ICRP Publication 103. From China, the newly developed gas scintillation proportional counter, (GSPC), for in-vivo measurement was introduced. The GSPC has a good potential ability for in-vivo measurement for low energy photons emitting from transuranic radionuclides, because it has energy resolution as high as Ge detector, large detection area capability, room temperature operation, etc. Improvement of the GSPC was made in China Institute of Atomic Energy (CIAE) by adding wavelength shifting material to adjust the central wavelength to a normal photo multiplier tube, PMT, and using a PMT with large area. It was shown that the improved GSPC had a good performance but further development was needed. From Korea, development and application of computational human phantoms were presented. The hybrid phantom based on polygon surface was developed by converting the voxel phantom, and it was directly ported into the Geant-4 Monte Carlo code. The hybrid phantom has the same reality as the voxel phantom and deformable feature. The method and essential key-techniques to make the hybrid phantom were shown, and some animations were presented to demonstrate the move of the polygon phantom linking with motion capture data. From USA, the development of computational code for internal dosimetry was introduced. The Integrated Modules for Bioassay Analysis (IMBA) code was originally developed in UK. The code was updated and customized to various versions in USA to implement the biokinetic and human respiratory tract models developed by ICRP and local dosimetry rules. Then, the international version, IMBA Professional Plus (IPP), was developed and adopted in worldwide. IPP is being modified to implement the proposed new ICRP models based on ICRP Publication 103. Again from China, the current status of dosimetry in China was introduced. There are 200,000 to 250,000 radiation workers in China, and

most of them are from medical services. Only 100,000 radiation workers are monitored regularly by about 200 service units. TLDs are still used widely as personal dosimeters, but OSL and electronic dosimeters become more and more popular. As for internal dosimetry, the current situation of direct and indirect measurement, including ^{222}Rn and its daughters, were shown. Every interesting presentation consumed the session time and, regrettably, discussions were quite limited. However, the audiences would be able to get useful information on and techniques of the latest external and internal dosimetry throughout the session.

(Michio YOSHIZAWA and Takumaro MOMOSE,
Japan Atomic Energy Agency)

OP-8: Standard, criteria and Regulation

Keynote lecture: Eliana AMARAL, International Atomic Energy Agency, Austria

“Revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS)”

8-O-1 Kun-Woo CHO, Korea Institute of Nuclear Safety, Korea
“Consideration with the Application of the IAEA Standard from the Viewpoint of Atomic Energy Use”

8-O-2 Noriah Mod ALI, Malaysian Nuclear Agency, Malaysia
“Consideration with IAEA Standard from the Viewpoint of Medical, Agriculture, Industry, Manufacturing Industry, Health and Environment”

8-O-3 Nobuyuki SUGIURA, Kinki University, Japan
“Consideration with the Application of the IAEA Standard from the Viewpoint of Radioactive Waste Disposal”

Comments:

8-C-1 Takashi NAKAMURA, Professor Emeritus of Tohoku University, Japan

8-C-2 Ralph ANDERSEN, Nuclear Energy Institute, USA

ICRP published a new basic recommendation of radiation protection in 2007, as ICRP Publication 103. IAEA has revised Basic Safety Standard in accordance with the new recommendation. The latest information on the reviews of standard, criteria and regulation in Asian Oceania countries were introduced and discussed on the future radiation protection. As the keynote lecture, revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS) was introduced by IAEA. Following this, three oral presentations and 2 comments from the viewpoints of atomic energy use, medical/agriculture/industry uses, and radioactive waste disposal were made. These were from Korea, Malaysia, Japan and USA. Lots of discussions were made, such as the participation method with the stakeholder, deal of dose constraints, and the balance of medical exposure between general occupational exposure. Through the discussion, I felt the future focal points on radiation protection is moving to NORM (radon etc.) and medical exposure and harmonization with other exposures would be emphasized more. To cope up with the movement, I think that we should exert ICRP and IAEA to take into account for Asian – Oceania situations more and more.

(Ichiro INOMATA, Japan Nuclear Technology Institute)

OP-9: Exposure to Medical Radiation

Keynote lecture: Maria PEREZ, World Health Organization
New challenge of WHO for medical radiation protection

9-O-1 Kanaga Kumari CHELLIAH, Universiti Kebangsaan Malaysia, Malaysia

“A Comparison of Average Glandular Dose Values between Screen Film Mammography and Digital Mammography”

9-O-3 Vincent WU, Hong Kong Polytechnic University, Hong Kong

“A Case Report on the Effect of Fan Beam Thickness in Helical Tomotherapy of Nasopharyngeal Carcinoma”

9-O-4 Yuzuru KONO, National Cancer Center Central Hospital, Japan

“Radiation Exposure to Family Members and the General Public After Permanent Brachytherapy for Prostate Cancer”

This session discussed radiation protection including measurements, dosimetry and optimization in medical fields. Coordinate research programs are necessary in order to rapidly identify and carry out feasible and simple radio sensibility tests. On the basis of best national practices, regulatory bodies and health authorities have to provide more efforts to promote actions on adequate regulations, on quality assurance, on risk analysis, on clinical audits, on good clinical practices, etc. In the keynote lecture, a new challenge was pointed out by WHO: getting the patient voice in the dialogue through involvement of patients and their associations on advocacy, assessment of the quality and safety of treatments, risk acceptance and communication. From Malaysia, comparing the average glandular dose (AGD) of three mammography imaging systems to determine if the value is below the recommended limit by European protocol were presented, which were screen film mammography (SFM), computed radiography mammography using digital storage phosphor plates (DSPM) and full field digital mammography (FFDM). The AGD values obtained using the systems are below the recommended limit by European protocol. However over exposure with post processing is not taken into consideration. As a conclusion, the AGD values obtained from SFM, DSPM and FFDM systems can be used as a reference for patients undergoing screening mammography. From Hong Kong, a case study was presented to evaluate the dosimetric influence of changing the FBT in the treatment of a nasopharyngeal carcinoma (NPC) patient. Fan beam thickness (FBT) in helical tomotherapy is defined by a pair of collimator parallel to the rotational orbit of the radiation beam and is fixed for a specific patient treatment. This case study demonstrated that the variation of FBT in tomotherapy affected the quality of the treatment plan mainly in the OAR doses, but not so much in the PTV. Increasing the FBT reduced the effectiveness in the sparing of OARs. Finally from Japan, investigation to determine the amount of radiation exposure to family members and the general public from the patients after ^{125}I prostate brachytherapy were presented. Radiation exposure measurements were performed unselected patients with stage T1 or T2 prostate carcinoma on 1 day after the brachytherapy. Radiation exposure from the patients after I-125 prostate brachytherapy to family members and the general public is very low.

(Hiroki OHTANI, Tokyo Metropolitan University)

OP-10: Health Effects of Ionizing Radiation

Keynote lecture: Otsura NIWA, Professor Emeritus of Kyoto University, Japan

“The LNT Model and Beyond; Mechanisms Underlying the Low Dose Health Effects”

10-O-1 Hiromitsu OGATA, National Institute of Public Health, Japan

“A Review of Some Epidemiological Studies on Cancer Risk from Low Dose Radiation or Other Carcinogenic Agents”

10-O-2 Kotaro OZASA, Radiation Effects Research Foundation, Japan

“Risk of Cancer and Non-cancer Diseases in the Atomic-bomb Survivors”

10-O-3 Hee-sun KIM, Korea Hydro & Nuclear Power Corporation, Korea

“Experimental Animal Studies on Low Dose and Low-dose-rate Irradiation: The Adaptive Response and the Decreased Thymic Lymphoma Incidence in Low-Dose-rate Irradiated AKR/J Mice”

In this session newly emerging challenge to the current paradigm of radiation protection, including non-cancer effects, cancer risk linearity at low dose/dose-rate, and adaptive responses, were discussed. The strength and the limitation of Linear Non-threshold (LNT) model were presented as the keynote. Best available data show the linear increase above 100 mSv and experimental data support LNT at dose rate above 1 mGy/min. There are some observations which are not explained by the simple LNT model. Examples include dose rate dependent linear term in dose response of chromosome exchanges, the absence of increase in cancer mortality in the high background area in China and India, the relative risk decline with age in the A-bomb survivors and uranium miners. Practically, any model can be fit at dose below 100 mSv and the dose rates below 1 mGy/min. Some key questions to be addressed were pointed out before we understand risks from low dose/dose-rate radiation; “What are the target cells of radiation carcinogenesis?”, “How do the target cells respond to radiations?”, “What is the turnover kinetics of the target cells?”. He also mentioned that in the society surrounded by various risks, each risk should be evaluated for their impact on the society. Thus societal judgment on the risk is needed. From Japan, 17 major epidemiological studies on cancer risk from low dose radiation or other carcinogenic agents were also reviewed. It is extremely difficult to estimate exactly the cancer risk from low-dose radiation or from low-level exposure to other carcinogenic agents. This is because, most of epidemiological studies lack the statistical power to find very small excess cancer risk, and also there are large uncertainties in exposure evaluation. As for the statistical power, theoretically enormous sample size is required to obtain stable results on cancer risk estimation. In addition, the up-to-date results of the Life Span Study on A-bomb survivors were introduced. (1) During 1950–2003, the risk of death of malignant neoplasm in most sites increased, and that of some non-cancer diseases including circulatory diseases was suggested to increase. (2) The relative risk for solid cancer was larger in those who were exposed at young age and getting smaller along with subjects’ age. (3)

The results on the risk of mortality are consistent with the previous reports. (4) Interpretation of epidemiological results on biological mechanism remains to be investigated. From Korea, some experimental animal studies on low dose and low-dose-rate irradiation were presented. (1) The frequency of micronuclei in peripheral blood cells induced by 2 Gy irradiation was reduced by prior irradiation at low-dose rate. (2) Fewer abnormal forms of sperm were observed in low-dose-rate irradiated mice than those of high-dose-rate (0.8 Gy/min) irradiated mice. (3) In AKR/J mice irradiated at low dose rate showed decreased thymic lymphoma incidence (15%) and prolongation of lifespan (35 days). In the thymocytes increase in apoptosis was observed. (Masahito KANEKO, Radiation Effects Association)

OP-11: Environmental Radioactivity

Keynote lecture: Hiromi YAMAZAWA, Nagoya University, Japan

“Present and Future of Environmental Radioactivity”

11-O-1 Yong-Ho CHOI, Korea Atomic Energy Research Institute, Korea

“Radioecological Studies in Korea Atomic Energy Research Institute, KAERI”

11-O-2 Jian ZHENG, National Institute of Radiological Sciences, Japan

“Distribution of Artificial Radionuclides in Lacustrine Sediments in China”

11-O-3 John TWINING, Australian Nuclear Science & Technology Organisation, Australia

“Environmental Studies in Australia: Current Radioecological Priorities”

11-O-4 Shoichi FUMA, National Institute of Radiological Sciences, Japan

“Environmental Protection: Researches in National Institute of Radiological Sciences”

Comment:

11-C-1 Sentaro TAKAHASHI, Kyoto University, Japan

“Cooperative Studies”

With expansion of nuclear energy utilization in Asia and Oceania regions, the study of this field has been becoming more and more important. In this session, the latest results regarding the behavior of radionuclides in the environment, transfer model and environmental protection were presented, and their implications for future studies were discussed. In the keynote lecture, recent studies on this topic as “Present and future of environmental radioactivity” were reviewed. The importance of ^{14}C cycle in the environment for the public in Asian countries was shown from the viewpoint of exposure pathway through rice ingestion. Especially, the results of study on transfer of ^{14}C from accumulated soil organic carbon to edible parts of the rice in paddy fields were emphasized. Subsequently, to improve emergency preparedness, the physical models and simulation techniques using the long-range atmospheric transport of natural radioactive materials as a tracer were introduced. From Korea, the 25 years’ investigations on the environmental transfer of radionuclides into staple food crops as “Radioecological studies in KAERI” were presented. The investigations focused on roots uptake and direct deposition of the nuclides, and involved both field studies and radiotracer experiments in greenhouses

at Korea Atomic Energy Research Institute (KAERI). The results demonstrated that site specific parameters are the most valuable for a realistic dose evaluation. "Distribution of artificial radionuclides in lacustrine sediments in China" was also introduced. The recent sedimentation of Pu isotopes in some lakes in China was shown, studied with a sector-field ICP-MS and ^{137}Cs analyzing by the conventional methods. Particularly, the results of low distribution peak of $^{240}\text{Pu}/^{239}\text{Pu}$ activity ratio in the core profiles suggested additional Pu isotopes from the Chinese explosion tests above the global fallout. This investigation gave a potential application of Pu isotope ratio to sediment dating. From Australia, behavior and migration of radionuclides within an Australian ecosystem at the Little Forest Burial Ground was presented, which was a near surface nuclear waste site. The interesting thing in this presentation was that concentration factors (CRs) for animals, including Australian unique animals such as kangaroo were shown. The data are very useful for studying environmental protection strategy from the ecological viewpoint. From Japan, dose (rate)-effect relationships for survival, growth and reproduction in reference animals and plants, medaka (small fish), conifers and aquatic microbial communities in particular, were presented. The interesting points were that the numbers of some kinds of microbes increased after irradiation due to interspecies interaction and bacterial community structure also changed after chronically irradiation. Finally, the importance of "Cooperative Studies" was emphasized and it was proposed to construction of new cooperative networks in this field among Asia and Oceania regions. After presentations, situation and opinion about environmental protection in each country were lively discussed. This session was very fruitful for future activity in this field, and I strongly hope the important pieces of work are synthesized to establish comprehensive knowledge in the near future.

(Minoru TAKEISHI, Japan Nuclear Fuel Limited)

OP-12: Radiological Protection as Part of the Global Nuclear Expansion

Keynote lecture: Sylvain Saint-PIERRE, World Nuclear Association, United Kingdom

"Centering Radiological Protection on Today's Global Challenge in Energy, Climate Change, Environment and Public Health? with Nuclear Energy Playing a Key Role"

12-O-1 Akira SUZUKI, Tokyo Electric Power Company, Japan

"Current Status of Radiological Protection in Nuclear Power Stations in Japan"

12-O-2 Byongil LEE, Korea Hydro & Nuclear Power Company, Korea

"Current Status of Radiological Protection in NPPs in Korea"

12-O-5 Marcel LIPS, Kernkraftwerk Goesgen, Switzerland

"Current Status of Radiological Protection in NPPs in Switzerland"

12-O-6 Bernard le GUEN, Electricité de France, France

Results and Challenges for the Radiation Protection in French NPPs

The objectives of this session was to share informative knowledge on radiological protection (RP) in nuclear advanced countries taking into consideration active plans to newly

construct nuclear power plants (NPPs) in Asian countries. Therefore, speakers were invited from European countries in addition to three countries, China, Korea and Japan from Asian countries, but unfortunately we missed two speakers from China and Sweden because of notification of cancellation. Keynote speech emphasized that the tiny risk from ionizing radiation associated with nuclear energy must be weighted in a context that recognizes the enormous public benefits to be gained by curtailing pollution and greenhouse emissions through an expanded use of nuclear power in order to help meet the world challenge of this era on energy and climate change. In addition, he explained that there is a need for a continued BSS revision which would open – for as long as necessary – the process to experts able to contribute both practical expertise and broad vision in weighting true risks, costs and benefits. He offered their participation and support for a sound BSS revision. Subsequently, four presentations on current status of radiological protection in Japan, Korea, Switzerland and France were carried out. During their presentations, there were some questions and answers for clarification, e. g. experience of cost benefit analysis in Japanese NPPs, detailed meaning of "rational" radiation protection system, discharge limit used in the regulation in Switzerland and so on. The interest was mainly focused into RP system for public exposure. The need for more rationalization in RP related to the control of public exposure was taken as a significant issue by the co-chair. To facilitate active discussions on radiological protection for public exposure, the co-chair made a short presentation entitled "Understanding of tiny assumed risk due to public exposure below dose limit 1 mSv/y" according to the request by the co-chair. After this presentation, discussions and comments on inconsistency between real public safety and current RP system were carried out for 15 min. Examples of excess public concerns against tiny exposure were internal exposures to tritium in United States and discharge from NPPs developed in the future in U. K. Experiences of cost-benefit analysis were additionally introduced from France and United States. Through the active exchange of knowledge on the status in RP, participants of this session would have a lot of input on imbalance of the current RP system and what is real safety of public understanding the negligible dose level. This session served to demonstrate that the current RP rules have led to exposure from nuclear energy is so strict, that the average exposure of workers is now of the order of the public dose limit of 1 mSv/y and that the average exposure of the public is of the order of the micro-sievert per year (0.001 mSv/y) or even lower. All of these discussions nicely substantiated the need for greater rationalization in RP rules on the control of tiny nuclear energy exposure.

(Takatoshi HATTORI, Central Research Institute of Electric Power Industry)

5. Refresher Courses

RC-1: Radiation Protection System: History of Dose Limits and Constraints

Dr. MENZEL is the chairman of ICRP Committee 2. He gave the excellent lecture on the radiation protection system focusing the history of dose limits. He explained the meaning, significance,

and influence to the radiation protection system of the changes of dose limit from the beginning stage to now comprehensively. He emphasized that "The current applied system of radiological protection is based on the principles of justification, optimization and dose limitation introduced by ICRP in publication 26 (1977). The successful implementation of this concept is largely due to the use of the quantity effective dose, E." The meaning of the reduction of dose limit for the members of public from 5 mSv/y to 1 mSv/y in Paris statement in 1985 was discussed after the lecture. One of the answers is to intend to change to the risk-based system (previously one tenth of the workers). Another answer is the feasibility from the viewpoint of optimization.

(Nobuyuki SUGIURA, Kinki University)

RC-2: UNSCEAR to Provide Scientific Bases for Radiation Protection

In the international framework of radiation protection, the International Atomic Energy Agency provides practical standards based on the principles recommended by the International Commission on Radiological Protection, which, in turn, based on scientific information on the sources, doses, and effects of ionizing radiation collected and reviewed by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR).

Dr. YONEKURA, National Institute for Radiological Sciences (NIRS), Japan, summarized the history, background and aims of the UNSCEAR which was established in 1966. Dr. SAKAI, NIRS, categorized 92 reports so far published as Annexes to the Report for the UN General Assembly. Data regarding basic concepts were collected in earlier days, as shown in 1958 reports: (i) Definitions of quantities, units and symbols; (ii) Radiation from natural sources; (iii) Man-made sources; (iv) Environmental contamination; (v) Methods of measurement; (vi) Fundamental radiobiology; (vii) Mammalian somatic effects; and (viii) The genetic effects of radiation. More specific data were dealt with later as shown in 2006 reports: (i) Epidemiological studies of radiation and cancer; (ii) Epidemiological evaluation of cardiovascular disease and other non-cancer diseases following radiation exposure; (iii) Non-targeted and delayed effects of exposure to ionizing radiation; (iv) Effects of ionizing radiation on the immune system; and (v) Sources-to-effects assessment for radon in homes and workplaces.

Dr. WEISS, the vice-chair of the UNSCEAR, attended the Course and appreciated to have this Course on the UNSCEAR in the AOCRP-3.

(Kazuo SAKAI, National Institute of Radiological Sciences)

RC-3: Definition of Various Radiological Units and Its Future

Dr. MA, China Institute of Atomic Energy, lectured the quantities in radiation protection. At the beginning, the lecturer pointed out that it was very important to understand the definitions and concepts of radiation quantities, and then showed the requirements for the quantities in radiation protection, such as clear concept, convenient to be measured, good relation with radiation effect, easy for assessment, relatively stable, additivity, easy for calculation, etc. The definition and unit were presented

for the following quantities: activity, fluence, kerma, absorbed dose, protection quantities (equivalent and effective dose), and operational quantities (ambient, directional and personal dose equivalent). Then, the brief history of the protection quantities and the changes in ICRP Publication 103 were well summarized. After the lecture, applicability of the effective dose to medical exposure was discussed.

(Michio YOSHIZAWA, Japan Atomic Energy Agency)

RC-4: Radiation Protection in Health Care

Medical use of radiation is the largest contributor to the exposure of the general population. Dr. PEREZ, WHO, addresses the proper application of the principles of radiation protection in health care, including the medical exposure of patients, their comforters and cares, and volunteers in biomedical research. She mentioned dose limits (individual-related principle) or dose constraints (source-related principle) to the medical exposure of patients are not applied, because such limits or constraints would often do more harm than good. She emphasizes the 'justification' of the medical procedures and the 'optimization' of radiological protection to prevent unnecessary exposure. She introduced the current status of CT scan utilization in health care which has been dramatically increased last years. Diagnostic reference levels was introduced which could be used in fluoroscopic guide in interventional procedures to reduce stochastic radiation risks. She insisted that dose constraints can not be applied for radiation protection of patients. The responsibility for the justification of the use of a particular medical procedure falls on the relevant medical practitioner. The fulfillment of radiation protection is dependent on the ability and attitude of each medical doctor. Education of the staffs who are responsible for radiation protection in health care is important.

(Monhee HAN, Korea Atomic Energy Research Institute)

RC-5: Radiological Protection for Non-human Species

Dr. KIM, Korea Hydro & Nuclear Power Corporation, described the concept of the radiation protection of the environment. He pointed out the need for an appropriate indicator to assess the impact of ionizing radiation on ecosystem. As one of the possible such indicator species, he described the dark-striped field mice (*Apodemus agrarius coreae*). The mice have been clearly identified taxonomically; it inhabits a broader range of areas and in considerable numbers; they maintain ecological characteristics; they are cohabitating with humans; they have been consuming food found in their habitat; and they indicate a clear dose response relationship with high sensitivity. He also described some experimental data in terms of taxonomical characteristics, survival rate and systemic effects following high- (0.8 Gy/min) and low-dose-rate (0.7 mGy/hr) gamma-irradiation, and chromosomal damage. Finally, he concluded that dark-striped field mice, *A. a. coreae* would have a high potential as a biological monitoring system to determine the impact of radiation effect for non-human species in radioecological environments.

(Kazuo SAKAI, National Institute of Radiological Sciences)

RC-6: Concept of Radioactive Waste Management

Dr. METCALF from IAEA emphasized the importance to have national policies and strategies for managing spent fuel and radioactive waste. They should be set out the country's agreed position and plans for managing spent fuel and radioactive waste. He gave us the definition of the words policy and strategy. The policy is mainly established by national government. The policy should be included goals and requirements for safe management, and definition of roles and responsibilities. The strategy is the means for achieving the goals and requirements. The strategy will be established by the relevant waste owner or operator, either governmental agency or a private entity. He also emphasized that it is desirable to have explicit national policy and strategy statements for transparency. He introduced several documents by IAEA related to radioactive waste management, e. g. Safety guide WS-G-2.7 "Management of Waste from the Use of Radioactive Material in Medicine, Industry, Agriculture, Research and Education". We can consult them anytime via its web site. After the lecture, there was one question regarding a balance on risk management between radioactive waste and other hazardous material e. g. chemical hazard from the audience. The answer was that the way of the management of radioactive waste should be isolated from others because the amount of the radioactive waste was less than other waste, and the concept of the management was so different.

(Hirokuni YAMANISHI, National Institute for Fusion Science)

RC-7: Radiation Safety around Nuclear Facilities (Management and Monitoring)

Mr. HAN, KAERI, lectured about radiological dose assessment and environmental radiation monitoring around nuclear facilities in Korea. Throughout this course, typical models such as Eulerian, Gaussian and Lagrangian were explained with numerical formula and understandable figures. These explanations effectively supported us to understand the complex events, for example, dispersion and intake processes. He also mentioned that analysis by using these models had infrequently ended in failure. For accuracy enhancement in dispersion calculations and environmental monitoring, nuclear facilities in Korea undertake some efforts. For instance they conduct field tracer experiments and performance tests. The former experiments are conducted as follows, nonradioactive substances are discharged from stacks of nuclear facilities and collected at some sampling points around the facilities and analyzed for dispersion calculations. As is often the case with some electric power suppliers, chemical analysts are supposed to take performance tests of authoritative organizations for quality control in environmental monitoring. These efforts contribute to increase the level of credibility in radiation safety in Korea.

(Akira SUZUKI, Tokyo Electric Power Company)

RC-8: Control of Radon, Space Radiation, Aircraft Exposure, and NORM

Dr. CHAMBERS, SENS Consultants Limited, Canada, started his lecture by introducing sorts of natural radiations – cosmic, terrestrial and radioactivity intake with inhalation, especially radon and thoron, and ingestion. The first half of the lecture was

allotted to comments on cosmic radiation. Unique characteristics of astronauts' exposure to the primary cosmic radiation in spacecrafts were explained with radiological effectiveness of heavy ions. The importance on aircrews' exposure to the secondary cosmic radiation was also concerned by showing some examples of dose calculations during air trips, as well as variation in cosmic radiation flux with the solar cycles. Some guidelines for aircrews were introduced to be established in some countries. The last part of the lecture was for radiations of terrestrial origin. The external radiation by industries such as mineral extraction, underground mining and tour guides of underground caves were mentioned. About indoor radon, it is also terrestrial, pathways of radon into indoor air were firstly explained, and some results of epidemiological studies on radon exposure of western people in home were stated. Some consensus documents about radon were introduced such as those by United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), Nuclear Regulatory Commission (NRC), WHO and ICRP. At the last, some interesting web sites about natural radiation were listed, and the lecture was closed. Next, some questions about standardization of measurement to extend measurement techniques, about a synergistic effect of smoking on radon exposure and setting different regulatory standards between smokers and non-smokers, and about necessity of epidemiological investigation on children living around a NORM site were asked and discussed.

(Jun MORIIZUMI, Nagoya University)

RC-9: Enhancing Radiation Protection Culture in Young Generation and the General Public

To avoid a classical lecture based on well established knowledge, Dr. LOCHARD, IRPA, selected two themes from his experiences to develop a scope of this refresher course. One was the production of an exhibition entitled "Did you say Radiation Protection? – Stories of X-rays, radioactivity...", and another one was the organization of radiation protection workshops for schoolchildren. Before stating the detailed lectures, he touched a concept of radiation protection (RP) culture that is key issue of recent IRPA activities. Usually RP culture is explained using three items, science (or knowledge), ethics (or value) and experiences, but in this refresher course, he introduced new three items for design of RP culture, namely science, ethics and art. It was emphasized that the art is well related to feeling or emotions and important factor to progress RP culture. As the first theme, outlines of scientific pavilion operated by the Scientific, Technical and Industrial Culture Centre (CCSTI), and the French Institute of Radiation Protection and Nuclear Safety (IRSN) were introduced using beautiful and interesting photograph which involves a few object and monuments. His experiences in cooperation among artist, museum and RP experts were also introduced together with a great number of photographs that gave us an impact because they seemed to be a fusion of art and RP monuments. In the second part of his lecture, he explained his experience during workshop operated in cooperation by CEPN, IRSN, CCSTI, etc. It was quite new for us to know RP experts and voluntary school children between 16 and 18 years old jointly participated in the workshop

to do practical work, presentation and visit of laboratories. To finalize his talk, he emphasized that there is a trend from risk analysis in 1970's to risk culture in 2010's through a history involving midway milestones of risk perception in 1980's, risk communication in 1990's and risk governance in 2000's, which gave us strong impressions in our minds.

(Takatoshi HATTORI, Central Research Institute of Electric Power Industry)

6. International Panel Discussion

In order to wrap up the congress, the International Panel Discussion was set up. Representatives from several organizations made short presentations and had a discussion on their visions for our future activities.

Dr. KANEKO, President of JHPS, described JHPS's profile and principal activities, such as the standardization committee for radiation protection, the education of the next generation, and the enrichment activity of the journal. Dr. KASE, President of IRPA, described the aims of IRPA's activities in recent years such as the enrichment of IRPA's activities and the advancement of exchange between societies of the various nations and regions. He also reported the 1st international workshop which was held in 2009 and informed the 2nd workshop which would be held in 2011. Dr. MENZEL, from ICRP, introduced ICRP's profile, activities, future work and so on. "Lung cancer risk from radon" and "draft on tissue reaction and other non-cancer effects" will be announced in this year. Dr. METCALF, from IAEA, described IAEA's activities such as a creation of human resource capacity for new nuclear power programmes, commitment to international safety conventions, etc. He also touched on the problems of radioactive waste including clearance. Dr. PEREZ, from WHO, described WHO's profile and activities. Their principal activities are to structure the united nation system for public health and radiation protection. A half of their principal departments are dealing with radiation protection. Dr. CHO, from AOARP, described AOARP's activities. In the 4th AOARP meetings held in 2008, AOCRP-3 and future membership of Russia were discussed. In the 5th AOARP meetings held during AOCRP-3, AOARP constitution amendment and election of new AOARP executive committee member were discussed. Finally, Dr. KOSAKO, President of AOCRP-3, described the Asian position among radiation protection associations in the world and expansion of students' activities. Furthermore, he mentioned that the AOCRP-3 conference was successful, and expressed his appreciation.

(Masahiro HIROTA, the University of Tokyo)

III CONGRESS ORGANIZING COMMITTEE

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