Ministry of Education, Culture, Sports, Science & Technology (MEXT) “Program for Leading Graduate Schools” accepted for 2011

HIROSHIMA UNIVERSITY

Phoenix Leader Education Program (Hiroshima Initiative) for Renaissance from Radiation Disaster

THE 5TH INTERNATIONAL SYMPOSIUM

REVITALIZATION STRATEGIES AFTER RADIATION DISASTER

放射線災害後の復興方策

February 13-14, 2016

Hiroshima University Faculty Club (Higashi Hiroshima Campus)

General Information

Date

February 13 and 14, 2016

Venue

Hiroshima University Higashi Hiroshima Campus 'Faculty Club'

1-2-2 Kagamiyama, Higashi Hiroshima, Hiroshima, Japan

Language

Sat., February 13 (Day 1) English

Sun., February 14 (Day 2) English and Japanese (simultaneous interpretation available)

Organized by

Organization of the Leading Graduate Education Program, Hiroshima University

Phoenix Leader Education Program® (Hiroshima Initiative) for Renaissance from Radiation Disaster

Development of internationally minded personnel capable of managing the recovery of people, society, and environment of areas affected by radiological disaster

This program establishes “Radiation Disaster Recovery Studies” as an interdisciplinary and practical discipline, based on Hiroshima University’s experience and achievements in supporting recovery from the atomic bombing. The program will develop personnel with the skills to “protect human lives from radiation disasters”, “protect the environment form radioactivity”, and “protect the human society from radioactivity”. Graduates from the program will become core leaders in situations requiring recovery from radiation disasters. The 5-year or 4-year integrated curriculum is designed to develop global leaders (Phoenix Leader®) who have the judgment and behavioral abilities to take appropriate actions in circumstances of radiation disaster and lead recovery with a clear philosophy and innovative knowledge across discipline.

Ministry of Education, Culture, Sports, Science and Technology (MEXT)
“Program for Leading Graduate Schools (Cross Sectional Theme)” accepted for FY2011

Contents

Welcome Address

Dear guests and colleagues,

I am honored and privileged to welcome you all to the 5th Phoenix Leader Education Program International Symposium, 'Revitalization Strategies after Radiation Disaster.' It's been almost five years since the accident at the Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Station. Hiroshima University has been involved in the recovery efforts, across a wide range of areas including medical support, since immediately following the incident. In addition to its Fukushima efforts, Hiroshima University also has more than 70 years involvement in the local recovery from the atomic bombing. Drawing on this extensive range of experience, we established the Phoenix Leader Education Program which was formally accepted by MEXT as a 2011 Program for Leading Graduate Schools. In order to contribute to any necessary future recovery efforts, we aim to develop global leaders (the Phoenix Leaders) who have the capacity for sound judgment and the ability to take appropriate actions in the face of a radiation disaster.

This international symposium will be held for two days: Student presentations on the first day followed by the international symposium on the second day. The intention of this international symposium is to promote international and interdisciplinary academic interaction by inviting esteemed speakers and panelists representing a variety of fields. We also have the pleasure of welcoming many distinguished researchers and specialists who have been active in the affected areas in Fukushima. We look forward to learning about their research efforts. We expect to receive suggestions for future recovery while taking this opportunity to reflect on our efforts thus far, as we reach this milestone of five years.

I hope this interactive event will serve as an opportunity for all attendees to consider disaster recovery from many different perspectives, and to share new findings and creative ideas. Your interest in and understanding of the Phoenix Leader Education Program will most certainly be enhanced. Thank you again everyone for joining us.

Masaki Sakakoshi
Executive and Vice President (Education/Peace)
Deputy Director
Organization of the Leading Graduate Education Program
Hiroshima University

Message from Program Director

Dear guests and colleagues

I would like to express my sincere appreciation to you for joining the 5th International Symposium of the Phoenix Leader Education Program. Nearly five years have passed since the accident at the Fukushima Daiichi Nuclear Power Station. Extensive efforts have been taken, by a large number of people in Japan and abroad, to support the recovery. For example, the evacuation order was lifted in Naraha-machi last September which became a symbol of the first important steps to full recovery. However, many challenges remain before us as more than 100,000 people are still living away from their homes with ongoing health concerns, while jobs, homes, and communities remain lost.

In the year which marks the 5th year following the accident, this symposium is organized to allow us time to reflect upon radiation disaster and to define reconstruction from it. We have invited researchers from different fields who have been working at sites in Fukushima: among them, Professor Tomoko Nakanishi has collected data about the impact of radioactivity on agriculture, and Professor Ryugo Hayano developed the 'BABYSCAN' scanner which is used for the inspection of infants to identify internal radiation exposure, as well as working on the 'D-Shuttle' project with Fukushima high school students about their external exposure to radiation for comparison with their European counterparts.

Here at Hiroshima University we established the Phoenix Leader Education Program in 2011 with government funding. With the continued support from collaborating institutions and organizations, both international and Japanese, we are determined to contribute tangibly to local and international communities by educating future leaders to effectively deal with the recovery from radiation disaster. I hope this symposium will be an opportunity for participants to think about recovery and to take their own steps for accelerating the revitalization of affected areas as well as the preparation for a better future. Thank you very much.

Kenji Kamiya
Vice President (Reconstruction Support/Radiation Medicine)
Director of Phoenix Leader Education Program
Hiroshima University

Program

The 5th International Symposium
Phoenix Leader Education Program (Hiroshima Initiative) for
Renaissance from Radiation Disaster
'Revitalization Strategies after Radiation Disaster'

Saturday, February 13

(Reception Hall: 2nd floor)

13:00-	Opening Remarks Dr. Toshinori Okuda (Chairman, International Exchange Committee, Phoenix Leader Education Program, Hiroshima University)
13:05-	Graduate student oral presentation I Break Graduate student oral presentation II
15:30-16:00	Break

(Lobby: 2nd floor)

16:00-18:15	Poster Presentation (Student Research Presentation)

(Restaurant La Boheme: 1st Floor)

18:30-20:00	Reception party

Sunday, February 14

(Reception Hall: 2nd floor)

10:00-10:10 **Opening Remarks**
Dr. Masaki Sakakoshi (Executive and Vice President (Education/Peace), Hiroshima University)

10:15-11:00 **Keynote lecture**
Effect of Nuclear Accident on Agricultural Products
Dr. Tomoko Nakanishi (The University of Tokyo)

11:00-11:10 Break

11:10-11:35 **Challenges and Controversies of Protecting the Environment from Radiation**
Dr. Thomas G. Hinton (Fukushima University)

11:35-12:00 **Uncertainties in Radiation Dosimetry: Facts and Perceptions**
Dr. Ahmed Meghzifene (International Atomic Energy Agency)

12:00-12:25 **Measure and Communicate in Fukushima with BABYSCAN and 'D-shuttle'**
Dr. Ryugo Hayano (The University of Tokyo)

12:25-13:35 Break (12:25-12:35 Group photograph)

13:40-14:05 **Development of International Humanitarian Law and its Application in Times of Disaster**
Mr. Atsuhiko Kakuda (Japanese Red Cross Institute for Humanitarian Studies)

14:05-14:30 **Citizen Participation and Consensus Building in Environmental Planning after the Fukushima Nuclear Accident: Discussing the Example from a Participatory Project in EU**
Dr. Yukio Hirose (Kansai University)

14:30-14:55 **ICRP: Five Years of Dialogue, and Improving Recommendations for Post-Accident Recovery**

Mr. Christopher Clement (International Commission on Radiological Protection)

14:55-15:10 Break

15:10-16:40 **Panel Discussion**

'Revitalization Strategies from Radiation Disaster'

Chair:

Dr. Jacques Lochard (CEPN, ICRP)

Dr. Rethy K. Chhem (CDRI)

Panelist:

Dr. Albert L. Wiley (REAC/TS)

Dr. Thomas E. Johnson (Colorado State University)

Dr. Tomoko Nakanishi

Dr. Thomas G. Hinton

Dr. Ahmed Meghzifene

Dr. Ryugo Hayano

Mr. Atsuhiko Kakuda

Dr. Yukio Hirose

Mr. Christopher Clement

16:45-17:00 **Poster Award Ceremony**

Closing Remarks

Dr. Kenji Kamiya (Vice President, Director of Phoenix Leader Education Program, Hiroshima University)

Abstracts

Lectures

February 14, 2016

10:15 –15:00

Effect of Nuclear Accident on Agricultural Products

Tomoko M. Nakanishi

Graduate School of Agricultural and Life Sciences
The University of Tokyo

More than 4 years have passed since the Fukushima Daiichi nuclear power plant accident. Right after the nuclear accident, 40 to 50 academic staff members of the Agricultural Department of The University of Tokyo began to study the movement of radioactive materials emitted from the nuclear reactor, because most of the contaminated area in Fukushima is related to agriculture.

The targeting research fields are very wide, from soil, plants, animals, fish, mountain, water, etc. Our Graduate School of Agricultural and Life Sciences comprises many research areas and there are many facilities attached to the School, such as meadows, experimental forests, and farm fields. Together with these facilities, many on-site research studies have been conducted in Fukushima.

The feature of the fallout was that they are still staying at the initially falling sites and hardly move. However, in the case of living things, like animals, the amount of radioactivity was decreased with time much faster than that by physiological half-life, because of their metabolic activities and the biological half-life in animals was estimated to be within 100 days.

Soil plays a major role in fixing the fallout. When fallout nuclides were adsorbed to soil, plants growing in the soil could hardly absorb the radioactive cesium. In the mountain, radioactive cesium was gradually transferred from litter to soil and hardly moved even washed with hard rain. The way of contamination by radioactive nuclides is completely different from those by heavy metals.

Researchers are still continuing their work to find out what effects the accident has had on agriculture.

[Biography]　(Tomoko Nakanishi, Ph.D)

She got Ph.D. from The University of Tokyo in radiochemistry. But she started plant physiological study when she began to work as a visiting researcher at Chemical Bio-dynamics at Mervin Calvin's Lab. (Laurence Berkeley Lab., California, USA). Then she was able to get a permanent position in Faculty of Agriculture, The Univ. of Tokyo in 1987 as an assistant. After 14 years, she had become a professor in Graduate School of Agricultural and Life Sciences, The Univ. of Tokyo. She was incorporated to the university revision project and was appointed as an Adviser to the President or a Director General of the Environment, Health and Safety Division created under the Office of the President of The Univ. of Tokyo as concurrent posts. Outside of the university, she was appointed as a member of Science Council of Japan. And now she is a Vice President of Engineering Academy of Japan, President of The Japan Society of Nuclear and Radiochemical Sciences and a Foreign member of the Royal Swedish Academy of Engineering Sciences (IVA).

She got Saruhashi award (2000), Contribution Award from Atomic Energy Soc. of Japan (2001), Society Award from The Japan Society of Nuclear and Radiochemical Sciences (2011) and L'ordre national du Mérite from French President (2014).

Challenges and Controversies of Protecting the Environment from Radiation

Thomas G. Hinton

Professor, Fukushima University
Institute of Environmental Radioactivity (IER)

Radiation is the unique, and therefore, odd, environmental contaminant among all other pollutants on Planet Earth for two reasons. The first oddity is that no other contaminant has been managed from the perspective that if humans are adequately protected then the environment is automatically protected as well. This approach of focusing solely on humans has been the method for protecting the environment from ionizing radiation for many decades. Agencies responsible for radiological protection, such as the International Commission on Radiological Protection (ICRP), recognize that a change in demonstrating environmental health is needed. They are now developing frameworks for better and more publicly acceptable approaches to radiological protection of the environment. However, a consensus of how best to demonstrate compliance with proposed dose-rate criteria has not been reached. Interestingly, the same radiological sciences that have made huge strides in developing an accurate assessment of radiation hazards for humans are poorly developed in regard to understanding the effects of radiation on the environment. Our knowledge of environmental effects suffer from a lack of studies that are directly relevant to understanding the responses of plant and animal populations to radionuclides in their natural environments. The second oddity about radiation as an environmental contaminant is that when levels of radiation are large enough to cause humans to evacuate, such as occurred at Chernobyl and Fukushima, populations of wildlife appear to increase. The increase is not because of any beneficial aspect of the radiation (we know that radiation is harmful to individual plants and animals); instead, the increase in wildlife numbers is attributable to the removal of humans and aspects of their lifestyle (e.g., cars, industries, farming). Thus, post-accident revitalization strategies, aimed at restoration of damaged areas for resumed human occupancy, will not benefit the environment. Removing contaminated topsoil, cutting down contaminated trees, and conducting other remediation methods that result in humans returning to evacuated areas are all detrimental to wildlife populations. Strictly from an environmental perspective, the evacuation of humans is beneficial,.....their return is not.

[Biography]

Dr. Hinton took a professor's position at Fukushima University's Institute of Environmental Radioactivity (IER) in March 2015, where he is conducting research on dosimetry of free-ranging wildlife and the environmental effects from chronic, low level irradiation. His position at IER is partially funded by Colorado State University. Prior to Japan, Dr. Hinton was at the French Institute of Radioprotection and Nuclear Safety (IRSN) for six years, where he coordinated a European Network of Excellence in Radioecology. Dr. Hinton conducted radioecological research at the University of Georgia's Savannah River Ecology Laboratory from 1992-2008, following a post-doctoral position at the Paul Scherrer Institute in Switzerland. His expertise has often been requested by the International Atomic Energy Agency on topics that include the Chernobyl Forum, remediation of Chernobyl's cooling reservoir, and modeling environmental radiation effects.
(CV found at http://www.ier.fukushima-u.ac.jp/english/staff.html)

Uncertainties in Radiation Dosimetry: Facts and Perceptions

Ahmed Meghzifene

Section Head, Dosimetry and Medical Radiation Physics
Division of Human Health
International Atomic Energy Agency

Patients and the general population are becoming increasingly sensitized to the issue of radiation exposure from man-made applications used in medicine and nuclear power industry. Incidents and accidents arising from these applications increase this sensitization and are often exacerbated by a lack of consistency in communication from health professionals, scientists, regulatory agencies and the media on radiation doses and potential health consequences. At the bottom of many controversies lies also a lack of understanding on how radiation dose is estimated from measurements and calculations, and most important on its related uncertainty. Many reports on radiation exposure simply overlook to at least include a word of caution on the uncertainty of the dose estimations. Reporting radiation dose estimations without expressing their uncertainty gives a false sense of confidence on the results. Furthermore, these dose estimations are often used to derive risk estimates for a group of people, defined by several characteristics such as gender, age, ethnicity, occupation, and for specific exposure conditions. Whether a given individual will be affected or not depend on many other unknown factors such as genetics, general health status, specific repair capacity, exposure conditions, etc. Consequently, it is important for all scientists who are involved in the process of dose estimations and dose reporting to be fully aware of the need to integrate an uncertainty analysis in their reports. This lecture will highlight the main known uncertainties in external and internal dosimetry and how they might impact dose estimations for both radiation workers and members of the public.

[Biography]

Ahmed Meghzifene was born in Algeria in 1954. After graduating in engineering in 1981, he entered the field of radiation dosimetry and obtained his PhD (Charge de Recherche) in 1989.

He was awarded a post-doc research grant and worked as a research fellow at the French Henri Becquerel Laboratory (1989) and the Canadian National Research Council (1991) dosimetry laboratory. Back to his home country, he has been involved in the development of medical physics in hospitals, education and training of medical physicists, and the establishment of national radiotherapy infrastructure. He has experience in both clinical radiotherapy physics and also in standardization at the level of primary and secondary standards dosimetry laboratories. In 1997, he joined the International Atomic Energy Agency (IAEA) as a radiation physicist and in charge of the IAEA/WHO Network Secondary Standards Dosimetry Laboratories (SSDLs). In 2007, he was appointed Section Head of the Dosimetry & Medical Radiation Physics Section of the IAEA and also co-secretary of the IAEA/WHO Network of SSDLs. During the past 15 years, his profile has a dominant component of scientific and international activities, co-authoring publications, reports and guidelines on radiotherapy physics and dosimetry. In the recent years, he has developed a special interest and commitment to promote the medical physics profession and support education and clinical training activities in IAEA Member States. He has been a scientific secretary for many international conferences and meetings and organized and lectured in numerous training courses on radiation dosimetry. In 2012, he was the recipient of the IOMP Harold Johns Medal for excellence in teaching and leadership in medical physics education.

He has also contributed to the work of several scientific and professional committees in dosimetry and medical physics. He has published over 40 papers, 4 book chapters and delivered numerous key note talks at international conferences.

Measure and Communicate in Fukushima with BABYSCAN and 'D-shuttle'

Ryugo Hayano

Professor
Graduate School of Science
The University of Tokyo

In my presentation, I will first discuss briefly why an "antimatter physicist" started to work actively in Fukushima. I will then focus on our two recent activities in Fukushima, BABYSCAN and the 'D-shuttle' project.

The BABYSCAN is a whole-body counter (WBC) developed in 2013 for measuring the internal radiation doses of small children in Fukushima. We have so far deployed three units in Fukushima, and scanned nearly 3000 children between the ages of 0 and 11 in 2014. None had detectable levels of radiocaesium. However, analysis of the questionnaire filled out by the parents of the scanned children regarding their families' food and water consumption revealed that there is a wide gap between the scientific results and the risk perception of the residents [1].

The 'D-shuttle' project was launched in 2014 to compare personal doses of high-school students living in Fukushima, outside of Fukushima, France, Poland and Belarus, using electronic personal dosimeter called D-shuttle [2]. More than 200 students and teachers participated in this study, which has clearly shown that the personal external individual doses in locations where residence is currently allowed in Fukushima Prefecture and in Belarus are well within the range of estimated annual doses due to the terrestrial background radiation level of other regions/countries.

References

[1] R.S. Hayano et al, "Whole-body counter surveys of over 2700 babies and small children in and around Fukushima Prefecture 33 to 49 months after the Fukushima Daiichi NPP accident", Proc. Jpn. Acad., Ser. B91 (2015) 440-446.

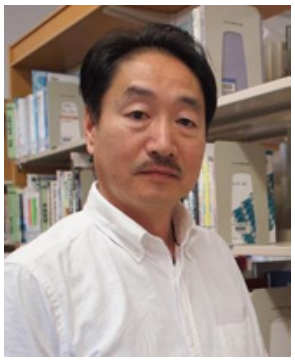
[2] N. Adachi et al., "Measurement and comparison of individual external doses of high-school students living in Japan, France, Poland and Belarus—the 'D-shuttle' project—", J. Radiol. Prot. 36 (2015) 49-66.

[Biography]

Dr. Ryugo Hayano is professor of experimental nuclear physics at the University of Tokyo. His research concerns fundamental symmetries and interactions of nature using "antimatter". In 2008 he received the Nishina Memorial Prize, the most prestigious physics prize in Japan, for this study.

Since March 2011, his tweets related to the Fukushima Dai-ichi accident attracted some 150,000 followers; his activities in Fukushima include systematic measurement of school lunch for radiocaesium, study of internal exposures using whole body counters, development of a whole-body counter for small children (BABYSCAN), and comparison of external radiation doses of high school students living in Fukushima, outside of Fukushima, France, Poland and Belarus. He is also known as the author of a successful book "知ろうとすること。", a conversation about radiation and its effects in the aftermath of the accident.

Development of International Humanitarian Law and its Application in Times of Disaster



Atsuhiko Kakuda

Researcher
Japanese Red Cross Institute for Humanitarian Studies

About 150 years ago, in 1864, the first international humanitarian law – the Geneva Convention (the so-called 'Red Cross Convention') was adopted. Its original purpose was to protect and provide care for the wounded in the battlefield and to recognize and respect the humanity of combatants once they had had given up their weapons. This concept of international humanitarian law, which originated as a result of war, is now being applied as humanitarian assistance to peacetime victims of conflicts and disasters. In this talk, we will discuss how this humanitarian perspective can be applied to relief and reconstruction assistance.

As one of the fundamental principles of the Red Cross, "humanity" refers to the need "to prevent and alleviate human suffering, protect life and health, and to ensure respect for human dignity." Following this principle, it can be said that humanitarian assistance is 'to preserve life while preserving human dignity and eliminating suffering'. This definition recognizes that how to assist people is equally as important as the type of assistance being provided.

Every year, life-threatening conflicts and disasters occur leaving victims in need support. This support requires considerable resources and has become increasingly broad in scope (often, for example, including mental health care etc.). Many organizations work hard to respond to these events however, in order to provide the best possible quality of aid to victims, there is a need to ensure the right to life with dignity, to enable victims to receive proper humanitarian assistance, protection and safety. This is not only necessary for saving lives, but also to preserve respect for the culture and customs of the victims.

[Biography]

Atsuhiko KAKUDA is a Researcher of the Japanese Red Cross Institute for Humanitarian Studies. In a career spanning more than 20 years with the Japanese Red Cross Society (JRCS), he has experienced several relief operations in the field including earthquake and tsunami disasters in Papua New Guinea (1998) and Indonesia (2004) and the 2003 earthquake in Iran. He also joined the evaluation program for JRCS medical assistance in Afghanistan, 2003, as a Deputy Director of International Relief Division, JRCS National Headquarters in Tokyo. He was a member of a working group for establishing the Asia and Pacific Region disaster database under the International Federation of Red Cross and Red Crescent Societies (IFRC) from 1996-1998. He has also played a leading role in conducting training in International Humanitarian Law (IHL) to Red Cross staffs and school children, and in developing IHL educational materials such as "*Handbook on the Red Cross Emblem*" and "*Exploring Humanitarian Law*".

Citizen Participation and Consensus Building in Environmental Planning after the Fukushima Nuclear Accident: Discussing the Example from a Participatory Project in EU

Yukio Hirose

Professor
Faculty of Safety Science
Kansai University

Abstract

(In environmental planning after the Fukushima nuclear accident, consensus building is now needed more than ever, through collaboration among governments, citizens and experts. This lecture provides the findings of a case study of a participatory consensus building approach developed in the EU, and considers how consensus can be built on a project that involves fierce conflicts of interest through a participatory approach, which features citizen participation and deliberation.)

Summary of Lecture

In environmental planning for nuclear power-related projects after the Fukushima nuclear accident, it is often difficult to reach consensus on such projects due to conflicting arguments and interests between citizens and the government, or among the citizens themselves. For example, regarding the permanent disposal of specified radioactive and other waste from the nuclear accident, the Japanese government plans to construct final disposal facilities in each prefecture. However, the plan has made little headway. In Miyagi Prefecture, government officials explained the selection procedures for potential sites for final disposal facilities to a conference of all municipalities in the prefecture. Based on the results of expert assessments, a number of candidate sites were selected. However, amid opposition from local residents, even field surveys of potential sites have not been conducted. The construction of a permanent nuclear waste disposal facility is a Not-In-My-Back-Yard (NIMBY) project, in that although the central government's plan to construct a facility in the prefecture has been agreed in principle, once a candidate site is selected, the plan encounters strong local opposition because of the potentially heavy burden on nearby residents.

What are the requisites for reaching a public consensus in such environmental planning? A consensus cannot be built simply by describing the potential social benefits

of the proposed project and explaining that it is a low-risk project. The argument has been growing that in addition to providing such information, it is absolutely necessary to employ fair public involvement procedures that offer various participation and deliberation opportunities to citizens in the planning process.

Responding to the problem of confrontation between citizens and stakeholders with different values and conflicting interests, and ineffective communication between experts and citizens, various citizen participation tools such as consensus conferences and planning cells were developed to help consensus building in environmental planning. Those tools have been actually employed in environmental planning for waste, transport and other projects mainly in the European Union.

However, it remains unclear what kind of participation procedures for such tools would be considered fair by citizens. It is also unclear whether citizens will actually accept the project even if they consider the procedure to be fair.

To examine whether public acceptance can be gained through successful citizen participation and deliberation procedures, the presenter first describes a transport project conducted in Karlsruher City as an example of a successful participatory project that involved stakeholders, citizens and experts in intensive deliberations, then reports the findings of a social survey of the citizens. The survey results indicated that the procedural fairness of citizen participation is an important determinant for public acceptance of the project. The important factors contributing to the perceived procedural fairness are representative participants, opportunities to discuss and express views on the proposed project, and disclosure of related information to participants and other citizens. The survey also revealed that citizens who opposed the plan think that they have to accept the conclusion reached through the citizen participation project as long as they recognize that the participation procedure was fair.

Drawing lessons from this case in the EU, we can consider what is necessary for consensus building on the construction of radioactive waste disposal facilities. First, all project stakeholders and local residents need to share the recognition that they will work together to develop an acceptable solution as parties concerned. Second, they also need to share a perception of the procedural fairness of the public participation process, characterized by adequate information disclosure by experts and governments, opportunities for dialogue and discussions between representatives of all stakeholders including citizens, and a transparent decision-making process. In addition, it is also

necessary that all parties concerned have confidence in the experts who will be entrusted with the task of examining and evaluating the selection criteria of suitable candidate sites in accordance with this recognized, fair procedure. In this way, consensus building will require all stakeholders and citizens to continue to generate agreements at different stages of the decision-making process.

[Biography] (Yukio Hirose, Professor, Faculty of Safety Science, Kansai University)

Yukio Hirose received a degree in Psychology at Nagoya University. His PhD research pertained the action research strategy to solve social dilemma in environmental issues. He was professor at the graduate school of environmental studies at Nagoya University, specializing in environmental policy, environmental management, and environmental psychology. Since 2001 he is professor at Kansai University, specializing in risk communication and environmental psychology. His current research focuses in procedural and distributive justice in consensus building of environmental planning. He published various books and articles on environmental conscious behavior, gaming-simulation of environmental conflict and cooperation, citizen participation, and risk communication.
Momentarily he is involved in various projects such as: effects of procedural fairness and trust on public acceptance of geological disposal of high level radioactive waste in UK, France, and Japan.

ICRP: Five Years of Dialogue, and Improving Recommendations for Post-Accident Recovery

Christopher Clement CHP

Scientific Secretary
International Commission on Radiological Protection

Following the Fukushima Daiichi nuclear power plant accident, ICRP initiated a dialogue focused on working with the people living in Fukushima prefecture. In cooperation with a multitude of organisations (Japanese, foreign, and international; government, and non-government) this initiative sought to: transfer experience from communities affected by the Chernobyl accident; facilitate discussion among stakeholders; learn for ICRP to improve future recommendations; and, share ICRP recommendations directly with communities. To capture a wide variety of viewpoints, this initiative also encompasses discussions with the industry, government, and the international community. This presentation will trace the path of the twelve main dialogue meetings from November 2011 to September 2015 and the International Workshop on the Fukushima Dialogue Initiative in December 2015, and describe work now being done by ICRP to improve its recommendations for global radiological protection.

[Biography]

Mr Clement graduated from McMaster University (Hamilton, Canada) with a Master of Science degree in medical physics, and Diplomate of the American Academy of Health Physics. His career began with more than a decade working for the Canadian government in low-level waste management and environmental restoration. He then worked for the Canadian Nuclear Safety Commission for about a decade, in uranium mine decommissioning, radiological counter-terrorism, and ultimately as Director of Radiation Protection. The latter included duties as the Canadian representative to the International Atomic Energy Agency's Radiation Safety Standards Committee, and the OECD Nuclear Energy Agency's Committee on Radiation Protection and Public Health. Since 2008 he has been the Scientific Secretary of the International Commission on Radiological Protection (ICRP), and since 2012 he has also been a member of the International Radiation Protection Association Executive Council.

Chairs and Panelists

Panel Discussion

February 14, 2016
15:10 –16:40

Chair:

Jacques Lochard

Director, Nuclear Protection Evaluation Centre (CEPN), Fontenay-aux-Roses, France
Vice-chair, International Commission on Radiological Protection

Jacques LOCHARD was educated in Economics at the University of Besançon-France and Pantheon-Sorbonne in Paris. He joined the Nuclear Protection Evaluation Centre (CEPN) as a research associate in 1977 and became its director in 1989. CEPN is a non-profit organization, founded in 1976, for research and consulting in the nuclear energy area in the evaluation of the technical, health economic and social dimensions of radiation protection (http://www.cepn.asso.fr/).

Jacques LOCHARD's main contribution in radiation protection has been in the development of methodologies for the implementation of the optimisation principles. He has published several tens of articles in scientific journals and in proceedings of international conferences covering both the theoretical and practical aspects of optimisation.

Since the early nineties he has been involved in several international projects related to the management of the post-accident situation of Chernobyl particularly in Belarus where he spent more than a year in the contaminated areas in the context of the ETHOS project (1996-2001) and the CORE programme (2004-2008). He is currently engaged in Japan in activities related to the long-term consequences of the Fukushima accident.

Jacques LOCHARD has been President of the French Society of Radiation Protection (SFRP), Chairman of the Committee on Radiation Protection and Public Health (CRPPH) of the Nuclear Energy Agency of the OECD and Executive Officer of the International Radiation Protection Association (IRPA). Jacques LOCHARD is currently Vice-Chair of ICRP.

For more curriculum vitae, check the following website:
http://www.icrp.org/icrp_membership.asp

Chair:

Rethy K. Chhem

Executive Director of the Camboidian Development Resources Institute (CDRI)
(Former Director, Division of Human Health, IAEA)

Dr Chhem Rethy is a medical doctor, biomedical scientist, science diplomat, historian of medicine, and educationalist, with experience in global health policy and ASEAN Higher Education. He has taught radiology at various universities in Canada, Singapore, Japan and Austria for 28 years. He was the Chairman of Medical Imaging Department at Western University (Canada) before joining the International Atomic Energy Agency as Director of the Division of Human Health (2008-2014). He is currently the Executive Director of the Cambodian Development Resource Institute, a leading think tank in Cambodia and the ASEAN region. He holds a MD, a PhD in Education and a PhD in History. He published more than a hundred scientific articles and edited 17 textbooks on radiology, radiology education, paleoradiology, philosophy of medical imaging and radiation sciences with two on Fukushima nuclear accident. He is currently a distinguished visiting professor at the Atomic Bomb Disease Institute, Nagasaki, Hiroshima and Fukushima Medical University.

Panelist:

Albert L. Wiley, Jr., BNE, MD, PhD, FACR

Senior Physician and Scientific Advisor of REAC/TS, and Head of the World Health Organization (REMPAN) Collaborating Center at Oak Ridge
Emeritus Professor of Human Oncology and Radiology, University of Wisconsin-Madison

Albert L. Wiley, Jr., BNE, MD, PhD was director (2004-2016) and now is senior physician and scientific advisor at REAC/TS and Head, WHO Collaborating Center at Oak Ridge. He was also a committee member and lead writer for medical sections of the UNSCEAR and the IAEA Comprehensive Reports on the FUKUSHIMA Accident. His professional career began as a Nuclear Engineer with a Bachelor of Nuclear Engineering and an AEC (ORINS) sponsored fellowship for nuclear engineering graduate studies at North Carolina State University. He worked in the nuclear industry prior to obtaining an MD degree from University of Rochester School of Medicine, did a surgical internship at University of Virginia, and later a PhD in Radiological Sciences (radiobiology) from the University of Wisconsin Graduate School of Letters & Science. He received residency training in Radiation Therapy & Nuclear Medicine at the University of Wisconsin Medical Center and at the Stanford University Medical Center in Palo Alto, Calif. He is currently Professor Emeritus at the Department of Radiology & Human Oncology at the University of Wisconsin – Madison and was, prior to coming to REAC/TS, professor and chairman of the Department of Radiation Oncology, and Cancer Center interim Director at East Carolina University, Greenville, NC. He has over 180 journal, book and abstract publications in radiation oncology, nuclear medicine, radiobiology and radiation medicine. In recent years he has served as the medical team leader on NNSA sponsored training and exercises in Iraq, Kuwait, Korea, South Africa, Morocco, Vienna (IAEA), Argentina, Israel, Mexico, Ukraine, Singapore and Japan, and the NNSA (DOE) medical representative at the RADCC launch control team for the NASA Mars Science Lab and the Pluto launches. He is also a retired member of the USN Reserve (retired).

For more curriculum vitae, check the following website:
http://orise.orau.gov/reacts/symposium/speakers/Wiley.html

Panelist:

Thomas E. Johnson

Associate Professor
Colorado State University

Dr. Johnson is currently an assistant professor and the head of the Radiation Protection and Measurements Section at Colorado State University. He was appointed by two successive Governors to the State of Colorado Radiation Advisory Board, and was elected chair in 2015. He has authored or co-authored over 30 peer reviewed papers, two textbooks, and mentored over 40 graduate students. He has been responsible for multiple research projects funded by the Department of Defense, Nuclear Regulatory Commission, Department of Energy, United States Department of Agriculture, and other agencies. Dr Johnson has worked as a consultant for electric utilities in the USA and Canada, as well as multiple government agencies. He earned his PhD in Health Physics from Purdue University, is a Certified Health Physicist, and Certified Laser Safety Officer. In addition to his academic duties, Dr. Johnson was an active member of the United States Air Force reserves until 2009 when he retired the rank of major. Dr. Johnson also served for six years in the United States Navy, as an engineering laboratory technician, on the nuclear powered submarine USS Cavalla.

Abstracts

Student Oral Presentation

February 13, 2016

13:05 –15:30

Phoenix Leader Education Program
The 5th International Symposium Student Oral Presentation
February 13, 2016

RADIATION DISASTER MEDICINE COURSE

Abstract No	Time	Name	Oral Presentation Title
1	13:05-13:20	Uranchimeg Tsegmed	My Long-term Internship at the IAEA
2	13:20-13:35	Lin Yen Hwa	The Impact of Different Multi-leaf Collimator Thicknesses on Dose Distribution and Skin Dose for Lung and Liver Stereotactic Body Radiation Therapy
3	13:35-13:50	Ekaterina Royba	Application of Genome Editing Technology into Radiation Biology for Understanding Individual Difference of Radiosensitivity

RADIOACTIVITY ENVIRONMENT PROTECTION COURSE
RADIOACTIVITY SOCIAL RECOVERY COURSE

4	13:50-14:05	Do Xuan Bien	Impacts of the Fukushima Nuclear Accident-related Migration on Demography of the Affected Areas
5	14:05-14:20	Russell Sarwar Kabir	Uncertainty Intolerance: Radiation as Source of Prospective Anxiety

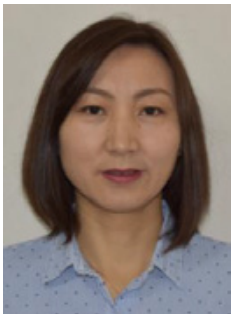
(Break Time: 14:20 - 14:30)

6	14:30-14:45	Fumie Yamaguchi	Difference in Attitudes towards Nuclear Power Plants in High-risk and Low-benefit Situations: Factors Determining Public Acceptance of Nuclear Power Plants
7	14:45-15:00	Yurika Oba	Seasonal Change in Cs-137 Concentration of a Shoot of an Evergreen Conifer (*Abies firma*) in Fukushima, Japan
8	15:00-15:15	Momo Takada	Radiocesium Dynamics in Soils in Deciduous Broadleaf Forests in Fukushima

GROUP PRESENTATION: 1st year students

9	15:15-15:30	Chryzel Angelica Babaan GONZALES, Tatsuhiro SUZUKI, Mari ISHIMORI, and Basuki TRIYONO	Strengths and Challenges for Fukushima's Road to Recovery

My Long-term Internship Program at the IAEA



Uranchimeg Tsegmed

Department of Radiation Oncology
Graduate School of Biomedical and Health Sciences,
Hiroshima University

Keywords: internship experience, overexposure prevention

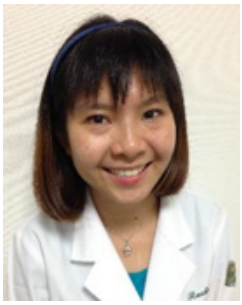
I worked as intern at the IAEA's Incident and Emergency Centre (IEC) under Mr. Jean Francois Lafortune's supervision for a period of four months (March 2nd to June 30th, 2015). During this period, I was the main researcher in a project involving development of a tool for medical follow up of overexposed patients. The work required a broad knowledge of the medical aspects in radiation overexposure, as well as the ability to analyze and organize medical information about overexposed patients in a context of a user-based platform.

During the four months working with IAEA – IEC, I gained experience in developing functional design of computer tools and database structures. I considerably improved my knowledge concerning radiation disaster medicine and management of radiation emergencies by working on the above project and attending conferences concerning this field.

This internship program provides the opportunity to gain practical work experience at professional levels in line with one's studies and interests. I strongly believe that the experience I gained within IAEA - IEC will be a major influence in my future work and career.

I would like to thank the Phoenix Leader Education Program, Department of Radiation Oncology of Hiroshima University and IAEA - IEC for supporting me during this internship.

The impact of different multi-leaf collimator thicknesses on dose distribution and skin dose for lung and liver stereotactic body radiation therapy



Yen Hwa Lin[1], Shuichi Ozawa[2], Daisuke Kawahara[3], Akito Saito[2], Tejii Nishio[2], Yasushi Nagata[2]

[1]Graduate School of Biomedical and Health Sciences, Hiroshima University; [2]Department of Radiation Oncology, Institute of Biomedical and Health Sciences, Hiroshima University; [3]Section of Radiation Therapy, Department of Clinical Support, HiroshimaUniversity Hospital.

Keywords: SBRT, 3D-CRT, VMAT, MLC thickness, skin dose

Multi-leaf collimator (MLC) is a computer-controlled aperture that made up of leaves with high atomic numbered material. The MLC is mounted on the gantry of linear accelerator to provide conformal beam shaping, by moving each leaf independently based on the radiation treatment plan. Different MLC thicknesses are expected to have different impacts on the dose distribution and on the tissue sparing. We are interested to know how much difference does the 2.5 mm MLC compared with the 5 mm MLC for stereotactic body radiation therapy (SBRT). Non-small cell lung carcinoma and hepatocellular carcinoma cases were planned by using Eclipse treatment planning system with 2.5 mm and 5 mm MLC thicknesses. Dose of 48 Gy/ 4 fractions was prescribed to 95% of the planning target volume as 80% marginal prescription. The three dimensional conformal radiation therapy (3D-CRT) planning technique used four coplanar and four non-coplanar beams. For volumetric modulated arc therapy (VMAT) planning technique, one or two coplanar arcs were used. Treatment plan verification was performed on slab phantoms using orthogonal films and ion chambers. Skin dose was measured on Rando phantom with dosimeter (e.g., film, and ion chamber) and compared with the calculated dose on treatment planning system. Monitor units and dosimetric parameters (e.g., conformity index, $D_{95\%}$, V_{5Gy}, V_{20Gy}) were compared for different planning techniques and different MLC thicknesses. The actual irradiation time for each planning technique was measured. The dose to healthy tissues is expected to be higher with the 2.5 mm than 5 mm MLC thickness due to the dose spillage resulted from the interleaves leakages. However, the conformity index is higher in 2.5 mm MLC with smaller tumor volume than in 5 mm MLC thickness. Total monitor units is expected to be higher in VMAT, however the total treatment time is expected to be shorted compared with 3D-CRT. This quantitative study would be a useful data to establish the treatment planning protocol for SBRT.

Application of genome editing technology into radiation biology for understanding individual difference of radiosensitivity

Ekaterina Royba[1], Silvia Natsuko Akutsu[1], Hiromi Yanagihara[1], Kosuke Hosoba[1], Hiroshi Ochiai[2], Yoshiki Kudo[3], Satoshi Tashiro[4], Tatsuo Miyamoto[1], Shinya Matsuura[1*]

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Although current radiological protection system is based on the standards uniformly established to the public, so far the numerous scientific publications have been postulated that individual difference of radiosensitivity exists in human population. Moreover, we have developed quantitative cytokinesis-blocked micronucleus formation (CBMN) assay and cytogenetic approach to demonstrate that the heterozygous carriers of hyper-radiosensitive diseases including Ataxia-telangiectasia and Nijmegen breakage syndrome showed intermediate chromosomal instability post IR between normal individuals and the patients. These carriers are clinically normal and exist at several percent in human population. Therefore, the future radiological protection system should rely on the heterogeneity of radiosensitivity in human population.

It has been speculated that the single nucleotide polymorphisms (SNPs) on DNA repair genes might be genetic determinants of different sensitivity to IR. To clarify that the candidate SNPs are indeed responsible for the heterogeneity of individual radiosensitivity, comparative analysis of radiosensitivity in primary cells carrying the candidate SNPs is fruitful but difficult to evaluate their small-sized biological effects due to some confounding factors and diverse genetic background of human population. Thus, precise inter-comparison of the candidate SNPs underlying individual radiosensitivity requires the experimental system using human cultured cell lines with uniform genetic background. However, human cultured cells have not been good model for reverse genetic approach because of the extreme low activity of homologous recombination. The recent genome editing technology using artificial nucleases TALENs and CRISPR/Cas9 system enables us to establish the candidate SNP-knock-in cell line efficiently. Previously, we developed a new approach termed "TALEN-mediated two-step single-base-pair editing" to introduce a causative variant linked with chromosomal instability into human cultured cell line (Ochiai et al., *PNAS* 2014). Here we used CRISPR/Cas9 system and single-strand oligonucleotides (ssODN) as a targeting donor to generate a single-step single-base-pair editing technique in human cultured cells. Using these reverse genetic approaches, we attempt to establish human model cells with the candidate SNPs on DNA repair genes and evaluate their radiosensitivity.

Impacts of the Fukushima Nuclear Accident-related Migration on Demography of the Affected Areas

Do Xuan Bien

Graduate School of Letters, Hiroshima University

Keywords: demographic changes, nuclear accident evacuees, Fukushima nuclear accident

Secondary data reveals that the nuclear accident, which occurred at the Fukushima Daiichi Nuclear Power Plant in March 2011, has led to significant changes in the demography of its affected areas. A number of studies have investigated the impacts of the incident on the population. The acceleration of the rates of depopulation in general and the aging population in particular have been observed in the Tohoku region, especially in Fukushima Prefecture where the nuclear power plant was located (Hino, 2011; Ishikawa, 2012; Oikawa, 2013). Oda (2012), and Ishikawa (2012), described the geographical distribution of evacuees outside Fukushima Prefecture using secondary data. In addition, research on evacuee characteristics with regard to age and gender has been initiated (Isoda, 2011). However, the differences of demographic changes between municipalities, especially those under the evacuation zones and those outside the evacuation zones, have not been clearly analyzed. The dynamics of the movement of evacuees associated with spatial and temporal aspects also have not been well investigated.

In this presentation, I will discuss my PhD research plans related to the demographic changes before and after the nuclear accident in Fukushima Prefecture, with particular emphasis on changes in the affected areas. Based primarily on reporting from the recently available National Census 2015, the demographic changes between affected areas and non-affected areas will also be considered. The analysis will be focused on the changes in the total population, in gender and age structure, and in the geographical movement of the population. I hope this study will elaborate the impacts of the nuclear accident on the population, especially in the domain and aspects that previous research has not yet investigated.

Uncertainty Intolerance: Radiation as Source of Prospective Anxiety

Russell Sarwar Kabir

Graduate School of Education, Hiroshima University

Keywords: anxiety; dread risk; intolerance of uncertainty; disaster-related cognitive science

Nonspecific psychological distress has been reported as an outcome of disasters associated with radiation exposure, specifically in Chernobyl-affected workers and migrants in Ukraine and survivors of the atomic bombs in Hiroshima and Nagasaki. This suggests that the threat associated with radiation exposure invokes chronic components of fear or anxiety either through dreaded, unknown or unbounded relative risk appraisal, the marginalizing social phobia of radiation as a human-to-human contaminant, or by some other mechanism. Results from corpus linguistics research on sentiment valences expressed in social media responses to the 2011 disasters of Japan also indicate a chronic tendency towards the consequences of the nuclear incident in Fukushima, perhaps due to the anthropogenic nature of the disaster, stigmatized attitudes toward nuclear technology and its status as a political good, or maladaptive beliefs in radiation risk perception.

The Fukushima Health Management Survey (FHMS) and other studies have observed a number of other psychological phenomena related to the nuclear incident, to include ambiguous loss, migration leading to family stress, problem behavior and regression to childhood in youth, and purported mother-child attachment-related stress transference. However, this presentation focuses on possible cognitive factors implicated in radiation exposure and hypothesizes them as contributors to a kind of *prospective anxiety* due to the sensory uncertainty, dread risk characteristics, ambiguous nature of the onset of deterministic effects, and social phobia-inducing potential that radiation exposure promulgates. The nature of radiation as a dread-inducing threat perhaps makes it a unique disaster stressor to be avoided in the processing of emotional upheaval and ultimately leaves its perceived threat unresolved, thereby agitating the chronic worry at the heart of radiation-related psychological distress, if it exists. Another component might be the cognitive vulnerability factor for generalized anxiety disorder (GAD) known as *intolerance of uncertainty* (IU), which is involved in the anticipation of future perceived threats. These dread and cognitive factors will be emphasized in my research plans for psychometric construct clarification, creation, validation, and investigation of radiation-related anxiety.

Difference in Attitudes Towards Nuclear Power Plants in High-risk and Low-benefit Situations: Factors Determining Public Acceptance of Nuclear Power Plants

Fumie Yamaguchi, Kiriko Sakata, Hitomi Sugiura

Graduate School of Integrated Arts and Sciences, Hiroshima University

Keywords: Urgent Proactive Action Planning Zone (UPZ), nuclear power plant, trust, group identification

Before the Fukushima accident, only areas within a 5-10 kilometer radius of nuclear power plants (NPPs) were selected as focus areas when they were required to develop disaster prevention plans in Japan. However, focus areas were expanded to a 30-kilometer radius of NPPs after the accident, subsequently named Urgent Protective Action Planning Zones (UPZs).

This study aimed to investigate the characteristics and determinants of attitudes regarding NPPs in UPZs. We particularly focused on trust as a determinant of attitudes regarding NPPs. We hypothesized it was likely that residents have a different recognition of NPPs, because of their 'high risk and low benefit' situation in UPZs without NPPs.

600 participants completed online questionnaires inquiring about their demographic variables, group identification with cities/towns and prefectures, social fairness and trust towards the national and local governments, attitudes towards NPPs and radiation and basic knowledge about radiation, as well as the General Trust Scale. Participants were selected from three areas: areas where NPPs are located (NPP areas), UPZs without NPPs (UPZ areas), and areas where NPPs are not located (no-NPP areas).

Contrary to our prediction, the results of an analysis of variance showed no significant differences between the three areas on attitudes towards NPPs. On the other hand, results of structural equation modeling (SEM) indicated people that trusted the national and local governments had more positive attitudes towards NPPs in all the areas. However, those that trusted the local government accepted less NPPs only in no-NPP areas. This could be because residents in nuclear-related areas could trust (or wanted to trust) NPPs, because these areas have already accepted NPPs. In addition, those with high group identification with cities/towns had more negative attitudes about NPPs only in NPP and UPZ areas, whereas those with high group identification with prefectures had more positive attitudes about NPPs only in NPP areas. These results suggest there are differences in determinants of public acceptance related to NPPs between different areas investigated in this study.

Seasonal Change in Cs-137 Concentration of a Shoot of an Evergreen Conifer (*Abies firma*) in Fukushima, Japan

Yurika Oba*[1], Toshihiro Yamada[1], Kiyoshi Shizuma[2], Toshinori Okuda[1]

[1]Graduate School of Integrated Arts and Sciences, Hiroshima University

[2]Graduate School of Engineering, Hiroshima University

Radiocesium concentration in a tree body varies among parts of a tree such as leaves, branches and stems. To understand this heterogeneity, a destructive sampling that fells a tree was often conducted in forests contaminated with radiocesium. But this approach does not allow us to monitor contamination level of a tree over time. Off-course, continuous monitoring by a non-destructive sampling is necessary to do this. We are interested in the change in contamination level of a tree with time after the contamination. We used a non-destructive sampling method instead of destructive ones. Our non-destructive approach focuses on the needle-leaves of conifers that are known to accumulate radiocesium more than other parts of trees. Collecting only leaves every season from same individuals makes it possible to monitor changes of radiocesium in tree bodies over time. In this study, we investigated the concentration of radiocesium in needles of Japanese fir (*Abies firma*) growing in secondary mixed forests located about 40 km northwest from the Fukushima Daiichi Nuclear Power Plant to clarify the seasonal change of radiocesium concentration in needles of this species. We collected needles from upper and lower parts of a tree to understand the vertical movement of radiocesium in a tree body.

There was a significant difference in the radiocesium concentration in needles between upper and lower parts of trees in every season. The difference was amplified in summer and lessened in winter. Leaves from upper parts showed greater seasonal change in the concentration of radiocesium than those from lower parts. This indicated that the relocation of radiocesium in needles differs between them.

Radiocesium Dynamics in Soils in Deciduous Broadleaf Forests in Fukushima

Momo Takada

Graduate School of Integrated Arts and Sciences, Hiroshima University

Keywords: forest soil, Cs-137, temporal variation, spatial distribution

Radioactive materials released from the Fukushima Daiichi Nuclear Power Plant remain in the neighbouring forests where large amounts of radiocaesium were deposited on the forest floor. To understand the dynamics of radiocaesium within a forest ecosystem and its outflow from the forest to other ecosystems, the temporal and spatial variations of radiocaesium in litter on the forest floors and in forest soils need to be clarified. We examined the downward migration of radiocaesium and the spatial distribution of radiocaesium in the forest soil. Field surveys were conducted in Fukushima Prefecture from July 2013 to November 2015. Study sites were placed in mixed deciduous forests dominated by *Quercus crispula* and *Abies firma*. Radiocaesium migration from the litter layer to the soil layer was observed. During our study, the activity of radiocaesium in the litter layer decreased by 90%, while the activity in the soil layer increased. The migration rates from the litter layer to the soil layer were much larger than those within the soil layer, suggesting that most radiocaesium persists near the soil surface as shown in many previous studies after the Chernobyl accident. In addition, there was marked spatial heterogeneity of the radiocaesium distribution in the forest soil. The activity of radiocaesium in the soil decreased with increasing distance from trees, while it increased with tree size around the bases of deciduous broadleaf trees. This pattern is thought to be affected by throughfall and stemflow containing radiocaesium.

Strengths and Challenges for Fukushima's Road to Recovery

Chryzel Angelica Gonzales[1], Mari Ishimori[3]
Triyono Basuki[2], Tatsuhiko Suzuki[1]

Hiroshima University

[1]Graduate School of Biomedical and Health Sciences
[2]Graduate School of Science
[3]Graduate School of Integrated Arts and Sciences

The Great East Japan Earthquake in 2011 was considered the first triple disaster (earthquake, tsunami, and nuclear) that happened in history. The aftermaths of these disasters were observed during our trip to Iitate Village, Minamisoma City, and several affected towns in Fukushima Prefecture. There were still some remaining tsunami damages at the mouth of Ota river, abandoned properties (e.g. houses, cars, bicycles, stores, etc.) in Odaka station, background radiation doses recorded from our dosimeters that suddenly went up in many areas of Iitate Village and along Route 6, and countless piles of bags containing contaminated soils, grasses, and muds.

The experiments and presentations by experts during our one-day trip taught us a lot of lessons and realizations about the real situation of Fukushima after the triple disaster incident. However, Fukushima today is on its way to recovery. We witnessed the ongoing rehabilitation and reconstruction of Soma Port which was badly hit by the tsunami. Residents were relocated to higher ground for safety measures and higher sea walls were also built. The bridge at the mouth of Ota River that was wiped out after the tsunami is now under construction. In Odaka Station, some residents were already preparing for their return in April 2016. We were also informed that the radiation doses during our trip were much lower compared to last year's trip. Despite our different nationalities and academic disciplines, we shared one thing in common during our visit to Fukushima: hope for continuous recovery. Furthermore, this trip gives us determination and motivation to make a difference in our respective researches and on the communities we will visit again next year. In this presentation, we will share our first personal experiences with Fukushima, knowing the importance of disciplinary approach and understanding the basis to develop radiation disaster recovery studies.

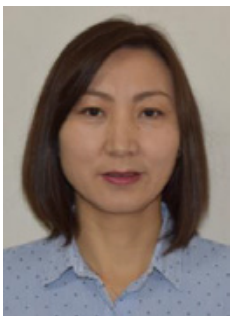
Abstracts

Student Poster Presentation

February 13, 2016

16:00 –18:15

Accidental overexposure related to new radiation therapy technologies



U. Tsegmed[1,3], N. Fahim[1], A. K. Batcha[1], T. Nakashima[2] , Y. Nagata[3], M. Abdel-Wahab[4]

[1]Intern at the International Atomic Energy Agency, Vienna, Austria
[2]Division of Radiation Therapy, Hiroshima University Hospital, Hiroshima, Japan
[3]Department of Radiation Oncology, Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan
[4]Division of Human Health, International Atomic Energy Agency, Vienna, Austria

Keywords: radiation therapy accidents, overexposure in radiotherapy

The discovery of X-ray at the end of nineteenth century allowed the use of radiation in medicine for diagnostic and therapeutic purposes. Over the decades, new diagnostic and therapeutic techniques developed rapidly and contributed to improvements in health care. Along with the greater realization of the benefits of these advances in healthcare came a greater recognition of the impact of medical accidental overexposures as well as the importance of preventive measures to avoid or minimize their occurrence. Furthermore, recent literature suggests that medical radiation can contribute to radiation exposure at the population level [1]. During the period between 1966 and 2007, accidents in medical use was one of the leading causes of acute health effects and even deaths [2]. The greatest number of people overexposed and deaths due to radiation therapy overexposure were during 1980-2013 period [1]. Hence, enhancing safety of the currently available techniques in the radiation oncology field is essential.

This study will examine medical overexposure incidents related to new technologies in radiation therapy during the period between 2000-2009. The main causes of the accidents will be analyzed, and conclusions made regarding opportunities for quality- improvement for patients receiving radiation therapy.

This poster will show that with proper preparation in general training, focusing on quality-assurance, can reduce the number of accidental events in radiation therapy using new technologies.

References

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2. UNSCEAR 2008 Report: Volume II, Annex C: Radiation exposures in accidents, p. 38.

Factors that determine the level of trust among Fukushima mothers

Mariko Komatsu

Graduate School of Integrated Arts and Sciences, Hiroshima University

Keywords: Fukushima, psychosocial issues, trust, institutional confidence

In radiation disasters, the mental and social well-being of the residents were profoundly affected by the enormous impact of the disaster and various changes in their daily lives, as well as the fear and stigma of radiation. The most significant public health consequence in both the Chernobyl and Fukushima accidents have been told to be mental health effects among the residents (Bromet et al., 2011; Chernobyl Forum, 2006; UNSCEAR, 2013).

What determined their post-accident behaviours and sense of well-being? This study hypothesizes that the social support and kinds of information that the residents had previously acquired may be key factors. Trust towards various information sources, and an individual's media literacy were also considered to play a role, and thus to be included in the models and questionnaires.

For this survey, Fukushima mothers of infants and toddlers were selected as the sample, as because we presume that their desire for accurate information is amplified due to their need to protect their children from radiation. Total 311 mothers were asked to fill in the questionnaire and then interviewed at their homes during the period of October 2014 to February 2015. The data collection was part of the project, "Development of an inclusive support system for protection of the Fukushima toddlers from the effects of the nuclear accident", funded by the Ministry of Environment for the years 2014-2017.

The analysis indicated that socio-environmental factors such as economic condition, mother's academic background, health condition of the child had statistically significant correlation with the institutional confidence among Fukushima mothers. Different factors are accentuated as the confidence determinants in different institutions. In general, mothers' affective states such as anxiety and self-efficacy seemed not to influence their confidence towards institutions while the level of information literacy did.

Spatial characteristics of soil ^{137}Cs in a mixed deciduous broadleaf forest in Fukushima, Japan

M. Takada[1)], T. Takahara[1, 2)], T. Yamada[1)], T. Okuda[1)]

[1)] Graduate School of Integrated Arts and Sciences, Hiroshima University
[2)] Faculty of Life and Environmental Science, Shimane University

Keywords: forest soil, spatial heterogeneity, stemflow, canopy interception

Radiocesium in forest soils derived from Fukushima Daiichi Nuclear Power Plant is known to show spatial heterogeneity. A precise study of radiocesium dynamics within a forest ecosystem requires accurate evaluation of contamination in soil, but the spatial heterogeneity may prevent the precise studies of radiocesium dynamics. Therefore, spatial characteristics of soil radiocesium in a forest ecosystem are important information for the dynamics study. In the present study, we studied the relationship between spatial variation of radiocesium in forest soil and tree distribution c.a. 44 km northwest of the Fukushima Daiichi Nuclear Power Plant, Japan. This study focuses on canopy interception and downward transfer from the forest canopy to the forest floor via stemflow and throughfall as the main causes of the spatial heterogeneity.

We established a study plot (400 m^2) in the canopy layer of a secondary mixed deciduous forest, dominated by Japanese oak (*Quercus crispula*) and Japanese fir (*Abies firma*), in August and November 2014. Soil was sampled from 0 to 5 cm depth and ^{137}Cs was measured under the canopy using a 2-m grid and also at the tree trunk bases.

The total estimated activity of ^{137}Cs in soil was approximately 203.6 kBq m^{-2} and showed large spatial heterogeneity within the study plot. The soils around tree trunk bases showed the highest activity. It was presumably due to the stemflow containing ^{137}Cs. The activity in soil at the south-facing side of the tree trunk bases was generally higher than that at the north-facing side. It is probable that the direction of the radioactive plume from southeast to northwest over the study site led to the directional bias for radiocesium deposition on the tree bodies. The unevenly deposited radiocesium was washed down with precipitation and infiltrated into the soil around the tree trunk bases via stemflow. Consequently, for most trees, ^{137}Cs activity in soil on the south-facing side was higher than that on the north-facing side of the trees. As soil ^{137}Cs activity under the crowns was higher than that in the crown gaps, an effect of canopy interception was not observed in the present study site. Our results suggest that the large spatial heterogeneity of ^{137}Cs activity in soil may be partially explained by tree distribution in a mixed deciduous forest.

Migration pathway of radioactive materials from the Agano River mouth to the southern Okhotsk Sea

Yasushi Nabae[1, 2)], Sunao Miyashita[1)], Satoru Nakashima[1, 3)]

1) Radioactivity Environmental Protection Course, Phoenix Leader Education Program for Renaissance from Radiation Disaster, Hiroshima University
2) Hydrographic and Oceanographic Department, Japan Coast Guard
3) Natural Science Center for Basic Research and Development, Hiroshima University

1. Introduction

The Fukushima Daiichi Nuclear Power Plant (FDNPP) accident occurred in March 2011. A large quantity of radioactive materials was released into the environment, contaminating the area around Fukushima. The Japan Coast Guard observed ^{134}Cs in seawater and seabed soil in Ishikari Bay during surveys conducted in 2011 and 2012. However, the migration pathway of radioactive materials from Fukushima to Ishikari is unknown. In this study, seabed soils were collected from the points shown Fig. 1, and we found that a small amount of radiocesium migrated from the FDNPP to the Notsuke Strait.

2. Methods

We collected seabed soils from the Notsuke Strait, Sōya Strait, and Sakata offing in 2015. The seabed soils were gathered with a bottom sampler and their radioactivity was measured with a germanium semiconductor detector. The γ radioactivity was measured for 1–3 days.

3. Results and Discussion

In the Notsuke Strait, the concentration of ^{134}Cs was estimated as 0.14 ± 0.12 Bq/kg, with the mean being only 1.1 times the standard deviation. At the Sōya Strait and Sakata offing, radiocesium was detected in seabed soils. Figure 2 shows the concentrations of ^{134}Cs and ^{137}Cs versus distance from the Agano River mouth. In the Japan Sea, the Tsushima Warm Current runs from the Agano River mouth to the Sōya Strait. The Sōya Warm Current runs from the Sōya Strait to the Notsuke Strait in the Okhotsk Sea. We concluded that the radioactive materials released by the FDNPP accident reached the Notsuke Strait from the Agano River mouth via the Tsushima Warm Current and the Sōya Warm Current.

Fig. 1 Sampling points

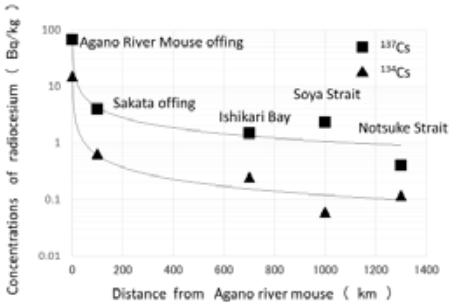

Fig.2 Concentration of radiocesium versus distance from the Agano River mouth.

Implementation of exercise programs to elderly persons living in temporary housing in a radiation affected area

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Keywords: intervention, temporary housing, elderly persons

Introduction

The Great East Japan Earthquake occurred on March 11, 2011, in the northeastern district of Japan. The s showed that many evacuees living in temporary houses were at a risk for decreased physical activity, which may adversely affect their health. This presentation shows the problems identified by the s regarding the evacuees' health and some solutions for the same.

Summary of the previous investigation (from December 2014 to January 2015)

Sixty-four residents, aged ≥ 65 years, of temporary houses in Minamisoma City participated in the study. This study aimed to investigate the amount of physical activity of the evacuees living in the temporary houses, and to identify the factors related to the physical activity. The average daily steps (a representative of physical activity) of the elderly male residents were 4,716, and those of the elderly women were 4,165, which were less than the national average daily steps of age-matched individuals. The ability to perform activities of daily living (i.e., cleaning, laundry, and bathing) was extracted as the factor related to the subjects' physical activity.

Current study plan

The problem is that this decrease in the level of the physical activity of the elderly residents increases the risk for lifestyle diseases among them. The chief reasons for the decreased physical activity of the evacuees living in temporary houses are thought to be the lack of a linkage with the community and narrow life space. One possible solution for the problem is implementation of exercise programs for these residents so that they remain physically active until they return to their own homes. The s designed an exercise program that can be easily performed daily by the elderly persons. The current attempt is to clarify the effect of this program on the amount of the subjects' physical activity.

Impact of mutations in *ATM* gene on individual radiosensitivity in Ataxia-Telangiectasia family members

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Keywords: individual radiosensitivity, *ATM* gene, high-dose rate irradiation, low-dose rate irradiation, cytokinesis-blocked micronucleus assay, γ-H2AX foci, PNA FISH

Although current radiological protection system is based on the standards uniformly established to the public, so far numerous scientific publications have postulated that individual differences of radiosensitivity exist in the human population. Therefore, future generation of radiological protection systems should be established by taking into account the heterogeneity of radiosensitivity in the human population.

Germline mutations of the *ATM* gene, which encodes a key protein kinase in the cellular response to radiation, cause a radiation hypersensitive autosomal-recessive disorder Ataxia-Telangiectasia (A-T). Previously, Kato *et. al.* reported that skin fibroblasts from heterozygous carriers of A-T were slightly defective in phosphorylated-H2AX (γ-H2AX) foci formation after low-dose-rate irradiation (Rad. Res. 2006), suggesting that defects in *ATM* gene are involved in the individual difference of radiosensitivity. In order to clarify that the *ATM* gene variation is a genetic factor underlying the individual differences in radiosensitivity, we have accessed and compared cellular response to high and low-dose rate irradiation among the patient with ataxia-telangiectasia ($ATM^{-/-}$), heterozygous carriers of ataxia-telangiectasia ($ATM^{+/-}$), and normal individuals ($ATM^{+/+}$) using three different biological methods (CBMN assay, γ-H2AX assay, and PNA FISH) combined with the automated microscopic modules integrated in the software of Metafer system. All chromosomal analysis reveals that radiation-induced chromosomal instability in *ATM* heterozygous fibroblasts is enhanced more than that in the cells of normal individuals.

Our results of semi-automatic evaluation of radiosensitivity among Ataxia-Telangiectasia family members supported the assumption that the *ATM* gene variations might be the genetic determinants for the individual sensitivity to radiation.

Detection of suppressive activity on innate immune DAMPs response in sepsis

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Keywords: Sepsis, immunosuppression, innate immune response, DAMPs molecules

Introduction: Sepsis is a serious medical condition characterized by systemic inflammatory response syndrome (SIRS) caused by infection. Damage-associated molecular patterns (DAMPs) are dangerous signals released during SIRS, which play roles in innate immune responses. This study aims to investigate the immunosuppression in septic patient.

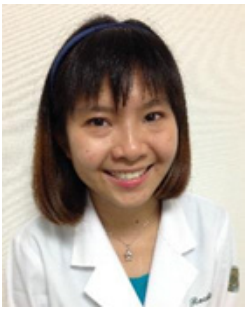
Materials and methods: We collected human serum samples from 5 healthy donors and 49 septic patients admitted to the ICU of Hiroshima University Hospital at the time of admission. For DAMP activity assays, THP-1 derived macrophages were treated with the serum or mixture of serum and DAMP molecules (ATP, Monosodium Urate (MSU), etc.), and cell-culture medium was collected for detection of IL-1β.

Results: We found a group of septic serum (n=42, 85.7%) resulted in significantly lesser IL-1β production than those of healthy donors. Moreover, the suppression of IL-1β secretion was observed in almost all of septic patients in the presence of ATP, but not in MSU. The serum from twenty septic patients was further examined at three points: the first day, the 3rd day, and the 7th day from admission. In the addition of ATP, the immunosuppressive activities were evident from the first week and the IL-1β secretion was inhibited the strongest at the 3rd day. Interestingly, we observed clear difference between survival and non-survival group on suppressive profile of IL-1β secretion in the presence of ATP at the 7th day.

Conclusions: This study indicates that septic serum may contain immunosuppressive components associated with ATP signal, but not with MSU, HMGB1. Further clinical study is required.

Collaborator: Koichi TANIGAWA (Department of Global Medical Science Center, Fukushima University)

Dosimetric comparison between 3DCRT and VMAT using high dose rate radiation beams for lung stereotactic body radiation therapy



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Keywords: High dose rate, SBRT, 3D-CRT, VMAT

Lung tissues inhomogeneity is always a concern in radiation therapy as the dose distribution in air is different compared with in soft tissues. With the high precision radiation treatment planning technique, the desired dose distribution can be optimized and thus provide a better tissue sparing for healthy organs. The objective of this study was to compare the dosimetric parameters between three dimensional conformal radiation therapy (3D-CRT) and volumetric modulated arc therapy (VMAT) planning techniques for lung stereotactic body radiation therapy. Non-small cell lung carcinoma cases were planned by using Eclipse treatment planning system with an 80% marginal prescription dose of 48 Gy per 4 fractions to 95% of the planning target volume. The 3D-CRT technique used four coplanar and four non-coplanar beams. For VMAT technique, one or two partial arcs were used. Comparison of monitor units and dosimetric parameters (e.g., conformity index, $D_{95\%}$, V_{5Gy}, V_{20Gy}) were made between these two radiation treatment planning techniques. The beam-on time for each technique was measured. VMAT is expected to have higher conformity index compared with 3D-CRT. Total monitor units is expected to be higher in VMAT, however the total treatment time is expected to be shorted compared with 3D-CRT. VMAT may be feasible for lung stereotactic radiation therapy as it is highly efficient in delivering radiation treatment and superior in sparing health tissues compared with 3D-CRT. This quantitative study would be a useful data to establish the treatment planning protocol for lung SBRT.

A Discussion of Disposal Facility for Designated Waste including Radioactive Material

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Keywords: waste disposal, designated waste

The disposal of designated wastes such as garbage incineration ash and sewage sludge, including radioactive materials released by TEPCO Fukushima Daiichi nuclear power plant accident triggered by the Great East Japan Earthquake in March 2011, has become a significant issue. Designated waste is defined as radioactive cesium concentration per 1 kg exceeds 8,000 Bq according to the Act on Special Measures Concerning the Handling of Radioactive Pollution enforced in January 2011. The amount of the designated waste at September 30, 2015, is estimated to be total 166,329 ton in Tokyo and 11 prefectures and 138,490 ton in Fukushima Prefecture which has the largest amount among them.

Designated waste is determined to be disposed in each prefecture by responsibility of the government. In five prefectures such as Miyagi, Tochigi, Chiba, Ibaraki, and Gunma, storage situation has been particularly tight, and they need to create new final disposal facilities. The government has ensured the final disposal facilities, and designated wastes will be basically disposed in one place in the prefecture. In Miyagi Prefecture, three detailed investigation candidate sites for presenting the final candidate of final disposal facility were presented by the government on January 20, 2014. A detailed investigation in the three candidate sites has been tried from late August 2014. However, a field survey has not been carried out due to opposition by a candidate town. In Tochigi Prefecture, the nationalized forest in Yaita City were selected as a candidate site on September 3, 2012, however, the selection were withdrawn once due to the activity seeking the withdrawal of the selection, and the selection process was revised. On July 30, 2014, Shioya Town was newly selected as a candidate site, however, detailed investigation has not been carried out due to strong opposition of the residences in the town. In Chiba Prefecture, a part of TEPCO Chiba thermal power plant site in Chiba City has been presented as a detailed investigation candidate on April 24, 2015. However, Chiba City stated that we cannot accept the detailed investigation, and the investigation has not been conducted. In almost all prefectures, the construction of waste disposal sites is facing difficulty for getting the agreement of residences near construction site.

The government is promising to construct a final disposal facility for wastes stored in the interim storage facility in 30 years out of Fukushima Prefecture. Considering the present situations of disposal facilities for designated wastes, it is predicted that the determination of the site for the final disposal facility will be extremely difficult. In this paper, the process of selection of the construction sites of disposal facilities for designated wastes in five prefectures is analyzed, and how to select the disposal sites and get the agreement of residences are discussed.

A correlation between the transfer factor of the radioactive cesium into the rice in the husk and grain size distribution of paddy soil in Fukushima

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Keywords: radioactive cesium, paddy soil and rice, grain size distribution, transfer factor, Fukushima

The Great East Japan Earthquake occurred on March 11th, 2011. Tsunami caused by the magnitude 9.0 earthquake inflicted the catastrophic damages on Tohoku section (the north area from Tokyo), and triggered the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident. The tsunami whose height was even up to 15 m, caused a loss of all sources of electricity including the power for emergency, and FDNPP lost any abilities of cooling the nuclear fuel rods. Hydrogen gas was produced by water reacting with cladding tube containing zirconium with increasing temperature. Eventually, a series of hydrogen explosions resulted. A lot of radioactive materials were transferred to environment by rain and wind. Among them, half-lives of cesium-134 and 137 are about 2 and 30 years, respectively, and comparatively long. Thus, the measurement of cesium for radioactivity is especially very important.

After the accident, some contaminated rice has been detected in a paddy lying downstream of forests in Fukushima City. Japanese Society of Radiation Safety Management investigates to reveal the causality1). Our research group has also picked the samples of soil and rice plants in the paddies, which are located in this downstream water area and approximately 60 km northwest of FDNPP, and measured cesium-134 and 137 for radioactivity2). This study aims to make it clear how the grain size of this paddy soil is related to the radioactivity of cesium-134 and 137 and their transfer factor into the rice in the husk.

The sampled soils were air-dried at the room temperature for a day, and bone-dried by oven at 105 °C for a day. After drying, the soils were classified by grain sizes using the standard sieves (JIS Z 8801, NONAKA RIKAKI Co., LTD.). It was to be that the samples whose grain sizes were 2 mm or more, 2 mm - 75 μm, and less than 75 μm were gravel, sand, and silt and clay, respectively. Each mass of them was measured and grain size accumulation curves were described. The samples were checked for radioactivity of cesium-134 and 137 by Ge semiconductor detector. After all, the transfer factor of the radioactive cesium into the rice in the husk from the paddy soil was calculated. The present poster presents a consideration for a correlation between the transfer factor and grain size distribution of paddy soil in Fukushima.

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The emerging contaminated rice by 134Cs and 137Cs in Fukushima Prefecture after the nuclear accident

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Keywords: contaminated rice, Ge detector, ICP-AES, Fukushima

East Japan great earthquake disaster occurred on March 11th, 2011, and radioactive material was released onto the field from TEPCO Fukushima Daiichi Nuclear Power Plant. The plant was also contaminated with radioactive cesium. Foliar absorption was important in the early stage after FDNPP accident. But in these days the absorption of radioactive cesium from root is important. The contamination to rice is a focus point of interest especially in Japan, East and Southeast Asian countries. The accumulation of ^{134}Cs and ^{137}Cs on rice depends on the concentration of potassium on paddy field[1)]. However, there are some points which deviate from the correlation. It is very important to know the detailed mechanism emerging contaminated rice.

Contaminated rice was observed in the rice from the paddy field in Oguraji, Fukushima City, which is northwest, approximately 60 km far from FDNPP. The situation was investigated by Subcommittee concerning by chemical treatment, Japanese Society of Radiation Safety Management in 2013.[2)] There were four paddy fields (which is named as A, B, C and D). The fields are close to mountains. The supplied water is taken from water of the mountain and Abukuma River.

Soil, water, rice plant were obtained on April 26th, August 11th, and September 25th, 2014, August 22nd, and October 30th, 2015. Potassium and other ions in water were analyzed by ICP-AES. After drying at room temperature the rice plant was divided into root, body and rice in the husk. The rice plant and soil were encased separately in a U-8 vessel and the radioactivity of ^{134}Cs and ^{137}Cs, ^{40}K was measured by Ge semiconductor detector.

Although the radioactivity of ^{137}Cs in top soil of Field B is not so high compared with those in Field A, C, and D, the radioactivity of rice in the husk from B (5.58±0.78 Bq/kg) was higher than those from A, C, and D. One of the reasons is the low concentration of ^{40}K in soil of Field B. Compared with the radioactivity in 2013[2)], it may be said that the radioactivity of rice ear in 2014 decreases drastically. The measurements are ongoing.

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Transfer coefficient of young pine plants growing at contaminated area

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Keywords: Young plants, Iitate village pines

The large amount of radioactive materials has been released into environment due to Fukushima Daiichi Nuclear power plant accident in March, 2011. Transfer mechanisms of radioactive cesium from soil to plants or cesium dynamics in the environment has been investigated by some researchers. The standard technique of estimation of transfer process characterized by the transfer coefficient which is defined by the radioactivity concentration ratio of in-plant to in-soil could not apply to that in forest areas. This is because the radioactivity concentration of cesium has a depth profile at the undisturbed ground in forest. Therefore, we introduce a new formulation of transfer coefficient to discuss a radioactivity transfer processes at the undisturbed ground. The new formulation is defined by products of an average transfer coefficient from soil to root and a translocation factor from root to stem. In this research, the new formulation is applied for young pines and soil cores which were sampled at three locations of Iitate village. The results by the new formulation are shown and discussed in this presentation.

The young pines which grow after Fukushima Nuclear power plant accident have been collected at Yamtsumi shrine, Iitate farm and Nagadoro rice field in Iitate village. 30 cm soil cores at the closed location are also collected. The 30 cm soil cores were divided into 7 layers (2.5 cm step for surface to 5 cm depth, and remaining soil of 5 to 30 cm depth was cut with 5 cm step). These layer soils were dried with a dry oven for about 20 hours. After dry, each layer sample was sieved with 2 mm mesh, and 20-40 g soil was filled into U-9 containers. The young pine samples were washed by RI soap, and used for measurement of radioactivity distribution by an imaging plate. After measuring radioactivity distribution, the pine samples were divided into root in each soil layer and stem. The stem samples were minced to small pieces and filled in U-9 containers. The root sample in each soil layer was minced to small pieces and filled in polyethylene tubes. Gamma-ray spectra of the samples were measured with a low-background Ge detector (ORTEC, GMX-30200-P and GWL-120230-S).

From measured results of the Ge detector, the inventory of Cs-137 at Yamatsumi shrine, Iitate farm and Nagadoro rice field are 958, 497 and 2041 kBq/m^2, respectively. The depth profiles of soil cores show that high concentrations of Cs-137 are located at the region from the surface to 5 cm of soil core. The depth profiles are ascertained by imaging plate measurements. The radioactivity concentration in young pine tree sample of Iitate farm is 37.96 Bq/kg at, and those one of Yamatsumi Shrine and Nagadoro rice field are within range of 120-764 Bq/kg and 1450-5291 Bq/kg, respectively. The radioactivity concentration in root has an increasing tendency from surface to deeper layers. Using the new formulation, the average transfer coefficient from soil to root and the translocation factor are estimated to be ranged from 0.01 to 0.22 and 0.63 to 1.63, respectively. Based on these results, the transfer coefficient from soil to plant is ranged within 0.01 - 0.22. The transfer coefficient results by the new formulation have good agreement with the calculation formula by Albrecht *et al*. which is assumed by the root uptake as a function of root density in soil. It is concluded that the new formulation of transfer coefficient can be applied for the undisturbed soil.

Spatial analysis of radiocesium concentrations in a bryophyte (*Hyophila propagulifera*, Musci) within 50km from Fukushima Daiichi Nuclear Power Plant.

Nabihah Othman

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Keywords: Biomonitor, *Hyophila propagulifera*, Radiocesium, Environment factors, Fukushima accident

We investigated the radiocesium concentration in *Hyophila propagulifera,* a moss species, in relation to their habitat and environmental factors; distance from FDNP (Fukushima Daiichi Nuclear Power Plant), altitude and air dose rate and slope angle of the substrate to which the moss colony inhabited. The moss samples were collected from 45 sites in the northeast region of Fukushima Prefecture on November 2014 and the radiocesium concentration was measured using GEM series high-purity (HP) Ge coaxial detector system (ADC AM-100, EC & GORTEC Company, USA).

We found significant relationship between radiocesium concentration in the moss and air dose rate (Pearson's rank analysis, r=0.87, P<0.001) where the samples were collected. The radiocesium concentration and altitude was significantly correlated within a range of 25-40 km away from FDNP (r=0.69, P<0.01)and (r=0.43, P>0.01) compared to the distance within a range of 10-25km (r=0.43, P>0.01). There was no correlation between radiocesium concentration in the moss and the slope angle of the substrate that moss colony inhabits.

Demographic changes in affected areas before and after the Fukushima Nuclear Accident

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Keywords: Demographical changes, nuclear accident evacuees, Fukushima nuclear accident

The accident which occurred in the Fukushima Daiichi Nuclear Power Plant led to a large scale evacuation. Roughly 150,000 people left their homes and moved to evacuation centers, temporary housing, or the homes of relative's or friend's. As of October 2015, a total of 105,000 people in Fukushima prefecture have not yet returned to their homes. Although a number of research have been done association with evacuation, the dynamic of the nuclear accident related migration seems not be well understood.

This poster will present the demographical changes of the nuclear accident affected areas by using Geographic Information System (GIS). The analyses will focus on the changes in the total population, in gender and age compositions, and in occupational structure before and after the incident. In addition, the geographical characteristics of evacuees will be analyzed to have a better understanding about their choices of location for the migration. Together with location, the dynamics of migration flows of evacuees who remain staying away from their original places, and who have returned to their home will also be observed. The underlying disaster migration theories will be employed to discuss the facts, which have been observed in the study areas. This will help to find out the knowledge gap for further investigation.

Factors Determining Public Acceptance of Nuclear Power Plants in Urgent Proactive Action Planning Zones

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Keywords: Urgent Proactive Action Planning Zone (UPZ), nuclear power plant, trust, group identification

Background: Urgent Protective Action Planning Zones (UPZs) that are within a 30-kilometer radius of nuclear power plants (NPPs) are required to develop disaster prevention plans and stepwise implementation of evacuation plans in case of nuclear disasters. In UPZs without NPPs, it is likely that residents have a different recognition of NPPs, because of their 'high risk and low benefit' situation.

Purpose: The aim of this study was to investigate the characteristics and determinants of attitudes regarding NPPs in UPZs. We particularly focused on trust as a determinant of attitudes regarding NPPs.

Methodology: Participants (N = 600) were selected from three areas: areas where NPPs are located (NPP areas), UPZs without NPPs (UPZ areas), and areas where NPPs are not located (no-NPP areas). Participants completed online questionnaires inquiring about their demographic variables, group identification with cities/towns and prefectures, social fairness and trust towards the national and local governments, attitudes towards NPPs and radiation and basic knowledge about radiation, as well as the General Trust Scale.

Results and conclusions: Contrary to our prediction, the results of an analysis of variance indicated no significant differences between the three areas on attitudes towards NPPs. On the other hand, results of structural equation modeling (SEM) indicated people that trusted the national and local governments had more positive attitudes towards NPPs in all the areas. However, those that trusted the local government accepted less NPPs only in no-NPP areas. This could be because residents in nuclear-related areas could trust (or wanted to trust) NPPs, because these areas have already accepted NPPs. In addition, those with high group identification with cities/towns had more negative attitudes about NPPs only in NPP and UPZ areas, whereas those with high group identification with prefectures had more positive attitudes about NPPs only in NPP areas. These results suggest there are differences in determinants of public acceptance related to NPPs between different areas investigated in this study.

Insufficiency of *BubR1* gene increases structure-chromosomal instability post ionizing radiation

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Keywords: PCS syndrome, chromosome instability, radiation, BubR1

The germline mutations of BUB1B gene encoding BubR1 protein, a central player of mitotic spindle assembly checkpoint, cause Premature Chromatid Separation (PCS) [Mosaic Variegated Aneuploidy (MVA)] Syndrome. These patients show predisposition to develop childhood cancer (Wilms tumor or rhabdomyosarcoma), due to numerical chromosomal instability (N-CIN). However, it`s unknown whether PCS (MVA) syndrome is related with structure chromosomal instability (S-CIN) post ionizing radiation (IR).

In this study, we tried to evaluate the S-CIN post IR in PCS (MVA) syndrome using cytogenetic study and cytokinesis block micronucleus (CBMN) assay. We irradiated the fibroblasts from two patients (CB1SK and CB4SK) and two normal individuals (GM03941 and GM22277) with different high dose rates (0Gy, 1Gy and 2Gy) of gamma-radiation using Cs-137 (40 Gammacell Extractor, 1Gy/min) and evaluate the structure chromosome instability (S-CIN) post IR. We counted dicentric, ring and acentric chromosome fragments in 100 metaphases of the irradiated cells using PNA-FISH assay. The results comparing control and patient cells showed statistical difference between average percentage of total abnormalities in 0Gy($p=0.02$), 1Gy($p=0.006$) and 2Gy($p=0.04$). The PCS (MVA) syndrome showed total number of chromosomal abnormalities higher than control cells in a dose-dependent manner.

To consolidate the CIN, we performed cytokinesis block micronucleus (CBMN) assay using 0Gy, 1Gy, 2Gy and 4Gy. We found PCS patients (1.3%, 6.3%, 16.4% and 38.2%) had higher percentage of micronuclei in comparison with normal individual (0.6%, 3.2%, 6.9% and 22.4%) in dose depended manner. These results suggest PCS (MVA) syndrome is a unique type of radio-sensitivity disease characterized with S-CIN post IR.

Awareness of the public to evacuate with pets under emergency disaster circumstances

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Keywords: pets, pet owners, evacuation with pets, internet-based survey

The Fukushima Daiichi Nuclear Disaster occurred in combination with the Great East Japan Earthquake of 2011. Not only humans, but also many animals suffered from this disaster. Even now, five years later, many pet owners are worried about pets that were left behind or went missing in the exclusion zones in Fukushima Prefecture. The Ministry of the Environment has identified that evacuation with pets during disasters is important not only from the perspective of animal protection, but also from the perspective of victims' health. In addition, there is evidence of positive psychological effects that can be obtained by living with pets (e.g., stabilizing one's mental state, reducing alienation and loneliness, increasing motivation and physical activity, and promoting well-being). On the other hand, it is posited that pet owners worry about being judged by others for prioritizing their pets under evacuation circumstances, especially by those without pets. This anxiety, made from an attempt to avoid criticism, plausibly hinders pet owners from evacuating with their pets.

In this study, an Internet-based survey was conducted to investigate psychological factors that might facilitate or inhibit evacuation with pets among the public at-large. Data was collected from people with and without pets. The effects of differences in awareness about pets on evacuation with pets are discussed. Further research will incorporate the results of this study to inform the content of planned interviews and item criteria of future surveys in disaster-affected areas with respect to the domains of pet ownership, evacuation behavior, and their effects on mental health.

Psychological factors of radiation-related anxiety: cognitive and dread consequences

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Keywords: anxiety; dread risk; intolerance of uncertainty; disaster-related cognitive science

Radioactive waste and nuclear reactor accidents are two of the highest contributors of dread risk in the public perception of hazards and catastrophes (Slovic, 1987). This is due to the unbounded outcomes that radiation poses as a contaminant and chronic source of threat. Concerns over radiation exposure have been associated with increased psychological distress due to perceived relative risk appraisals of the effects of radiation on health. This presentation proposes possible cognitive aspects of radiation-related anxiety (RRA) in an effort to clarify it as a construct and develop a valid psychometric instrument that addresses it for future research on interventions.

The dread equation consists of the following components: uncontrollability, unfamiliarity, imaginability, suffering, unfairness, and scale of destruction. Together, these factors comprise the "dread consequences" of radiation that arouse distortions, stigmatize nuclear technology, and perpetuate negative emotions. Thus, these risk characteristics are suggested as item criteria for a cross-sectional survey. Another proposed aspect is intolerance of uncertainty (IU), a cognitive vulnerability risk factor for generalized anxiety disorder (GAD) that is marked by excessive worry. Intolerant reactions to uncertainty bias information processing and lead to faulty appraisals of heightened threat and reduced coping (McEvoy & Mahoney, 2012). IU specifically mediates *prospective anxiety*, or the anxiety that occurs in anticipation of future uncertainty, and hence might be tied to relative risk appraisals of radiation exposure.

Finally, cognitive avoidance is an important facet in the mechanism of chronic worry and rumination. The nature of radiation as a dread-inducing threat perhaps makes it a unique disaster stressor whose promoted maladaptive beliefs target it as something to be avoided in cognitive processing. This avoidance might leave the threat unresolved, thereby instigating the chronic worry at the heart of radiation-related psychological distress. These dread and cognitive factors will be emphasized in construct creation, validation, and investigation.

A study on the postwar history of foreign atomic-bomb victims: atomic-bombed special students from Southeast Asia (*Nanpo Tokubetsu Ryugakusei*) and Japanese society

Yuji Hirano

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Keywords: foreign atomic-bomb victims, Special Students from Southeast Asia, Japanese Society, memory

Special Students from Southeast Asia (*Nanpo Tokubetsu Ryugakusei*) were victimized by the atomic bombing of Hiroshima. Although few, less than ten, had suffered injury or death from the attack, this fact has been kept alive and passed on in Japanese society since its "discovery." I would like to consider how knowledge of the bombed foreign students has been recorded in postwar Japanese history and memorized in postwar Japanese society, with a specific focus on the period from the mid-1950s to the 1970s. How has Japanese society responded to this fact after its "discovery" in the mid-1950s? I reveal my findings based on a variety of documents from Hiroshima University, the Asian Students Cultural Association, and the citizens of Hiroshima.

Revealing the Real Situation of Atomic-Bombed Foreign Students and Their Memorialization in the "Hiroshima University Record of Atomic Bomb Disaster" (1957-1975)

In July of 1957, 12 years after the atomic bombing of Hiroshima, elder brother of the late Mr. Syed Omar, a foreign student from Malaya who died from atomic bombing, sent a letter to the president of Hiroshima University to ask that his brother's death certificate be issued. In response to this request, the University launched an effort to investigate the real situation of foreign student victims of the atomic bomb. This investigation became an official record of Hiroshima University and the victims' names were memorialized in the "Hiroshima University Record of Atomic Bomb Disaster" issued in 1975.

Relatives Travel Overseas to Pay Their Respects (1964)

Relatives of foreign student victims of the atomic bomb came to Japan to pay their respects at the graves of their loved ones by invitation of the Asian Students Cultural Association. I reveal the process of realizing this visit, and its significance, based on documents from the Asian Students Cultural Association and from the citizens of Hiroshima.

Construction of the Cenotaph, "Remains of the KOUNAN Dormitory" (1976)

Mr. Toshio Hanaoka, a friend of many of the Special Students from Southeast Asia who lived and studied at Hiroshima University during the war period, planned to build a monument of "Remains of the KOUNAN Dormitory," their place of residence. Although he faced various obstacles such as the regulation of River Act, the need to gain support from neighboring residents, and a lack of financial resources to cover construction costs, the monument was at last completed in 1976. I reveal the process of building the cenotaph, and its significance, based on documents left behind by Mr. Hanaoka.

The development of new thermoluminescence dosimeter film and evaluation method in the build-up region

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Keywords: Medical Physics, Radiation therapy, Skin dose, TL dosimeter, Monte Carlo calculation

Radiation to the most important roles of medical physics has dosimetry for predicting the effect on the human body. In radiation therapy, dose administered to the patient's tumor and then evaluated in the treatment planning and dosimetry to be suitably formulated. Dose assessment of normal organs around in addition to tumor dose is also important as an indicator of the occurrence frequency prediction of radiation adverse events. Skin dose is of particular concern when high accuracy technologies such as intensity-modulated radiation therapy (IMRT) is used to treat head-and-neck cancer. Actually by the adverse effects of dermatitis can be the limiting factor, and it is a cause of interruptions in treatment. For high-energy photon therapy, there is built-up area where the dose gradient is steep in the body, both in dose calculations and dose measurement accuracy is a problem.

In this study, it is an object of the present invention to establish a skin dose evaluation method in the build-up region using the new film type of thermoluminescence (TL) dosimeter and a Monte Carlo calculation code PHTIS. TL dosimeter has been used previously to dose assessment, but new developing film type dosimeters has flexibility in the tissue equivalent and utilizing a linear response as a new feature. TL films dosimeter are useful for dose evaluation of the body surface as a thin two-dimensional detector, it is contemplated that the measurement at the patient geometry is also possible by tissue equivalent and flexibility. Monte Carlo simulations, the calculation time is increased greatly as compared with the planning device which is used in the actual treatment can be obtained a sufficient calculation accuracy. I present evaluation of the basic characteristics with respect to radiation of TLD film towards research, and introduce the computing environment and dose calculation accuracy verification of the Monte Carlo calculation code PHTIS.

Analysing Water-Sediment Cesium-137 Exchange and Its Possible Influencing Factors: Case of Fukushima Lake

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Keywords: Cs-137 behaviour, Exchange, Distribution Coefficient

Existence of artificial radionuclide in environment and its behaviour have been widely considered as an important issue since several decades ago. Aquatic environment such as fresh water system (river, lake, etc.) is one of the main focus due to their importance in water supply as well as source of biodiversity. This issue also has raised in Fukushima, Japan, after Great Eastern Japan earthquake on March 11th, 2011 which was followed by Nuclear Power Plant Accident. Lake nearby the nuclear plan in Fukushima is one of the environment that was impacted by radioactivity material.

Basic prediction to know the behaviour of radionuclide in aquatic ecosystem is based on distribution coefficient (Kd) which is partitioning of radionuclide between solid and liquid phase. Furthermore, exchangeable distribution coefficient (Kd^{ex}) was introduced as a ratio of the concentration of the radionuclide in exchangeable form in the solid phase to its concentration in solution at equilibrium. Several research proposed explanation about the factors that may influence, but it still remains some questions regarding the influence of physio-chemical factors. Particularly for case of Fukushima lake, it has not been enough studied.

In other side, more detail study regarding this topic has been widely carried out to be applied in radioactive waste water treatment by conducting several experiment using many types of adsorbents (inorganic, polymer and bio-adsorbent). Factors influencing Cs-137 adsorption-desorption from solution including pH, Temperature, Competing ion, Contact time, Initial Concentration of Cs-137 in adsorbent, Effect of adsorbent particle size and surface area.

This research will be conducted to examine water-sediment exchange of Cs-137 and its affected factors for case of Fukushima lakes. In detail, it will be done by analysing the exchange of Cs-137 between sediment and water phase in laboratory scale to calculate distribution coefficient (Kd) and exchangeable distribution coefficient (Kd^{ex}) and by analysing some factors that may influence Cs-137 water-sediment migration such as temperature, pH and competing ions.

References:

1. Journal Environment Radioactivity, 58 (2002) 1–11
2. Journal Environment Radioactivity, 102 (2011)
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4. RSC Adv., 2015. 5.

Effects of contamination by radiation on families and human relationships

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Keywords: radiation contamination, family relationships, evacuee mothers, fathers of evacuees

What are the interpersonal conflicts caused by radiation disaster? I consider them from following three points. This study was designed to investigate the mental health of mothers that evacuated with their children from the radiation disaster affected areas in Fukushima prefecture. Changes in relationships between mothers that evacuated and their husbands, grandparents-in-law, and friends left behind were identified. We focused on specific changes in relationships, and if major causes of stress in such mothers were health related anxieties caused by radioactivity, or changes in human relationships. This study also investigated the mental health of fathers remaining in Fukushima after their wives and children had evacuated. These fathers could be facing the dilemma of choosing between their wives, or their parents. Some fathers that are eldest sons could be affected by the patriarchal tradition of protecting the family grave and house. In addition the mental health of grandfathers and grandmothers remaining in Fukushima were also investigated. Feelings of parents-in-law regarding daughters-in-law that evacuated with their grandchildren and how their relationships with daughters-in-law have changed were observed.

Patient Dose Measurement in Radiation Therapy Procedures Using Photo-Stimulated Luminescence Dosimeter (PSLD) Film

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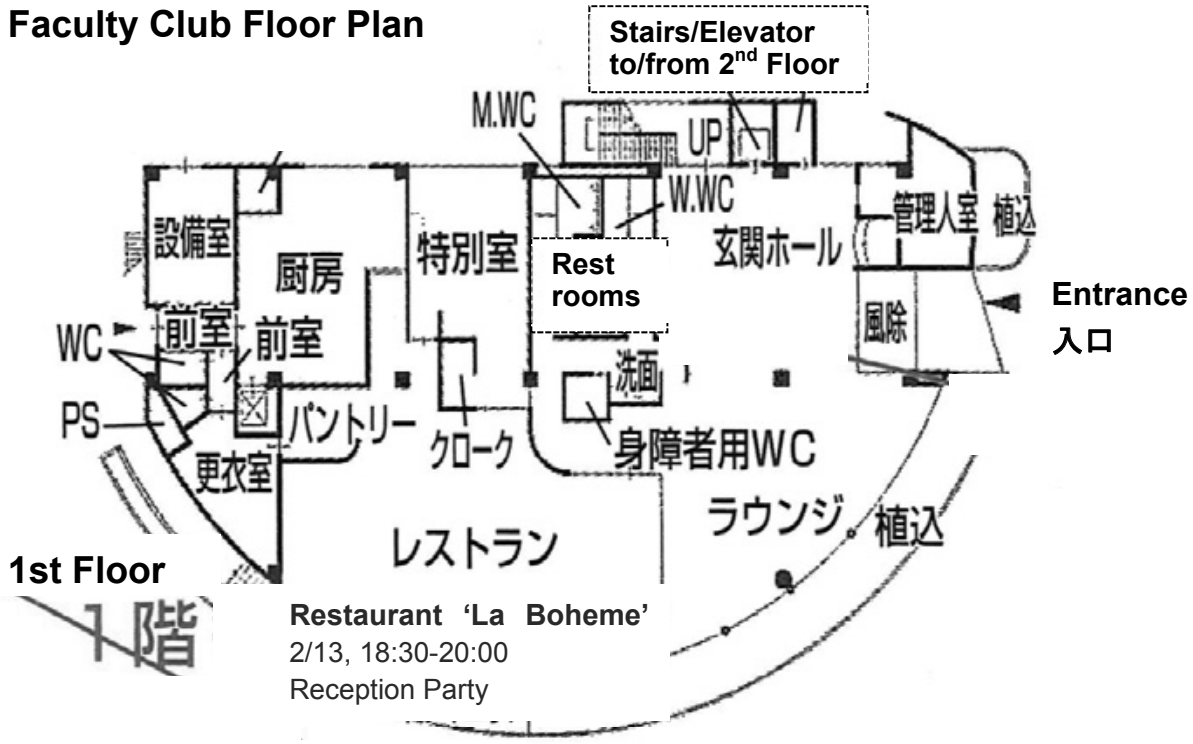
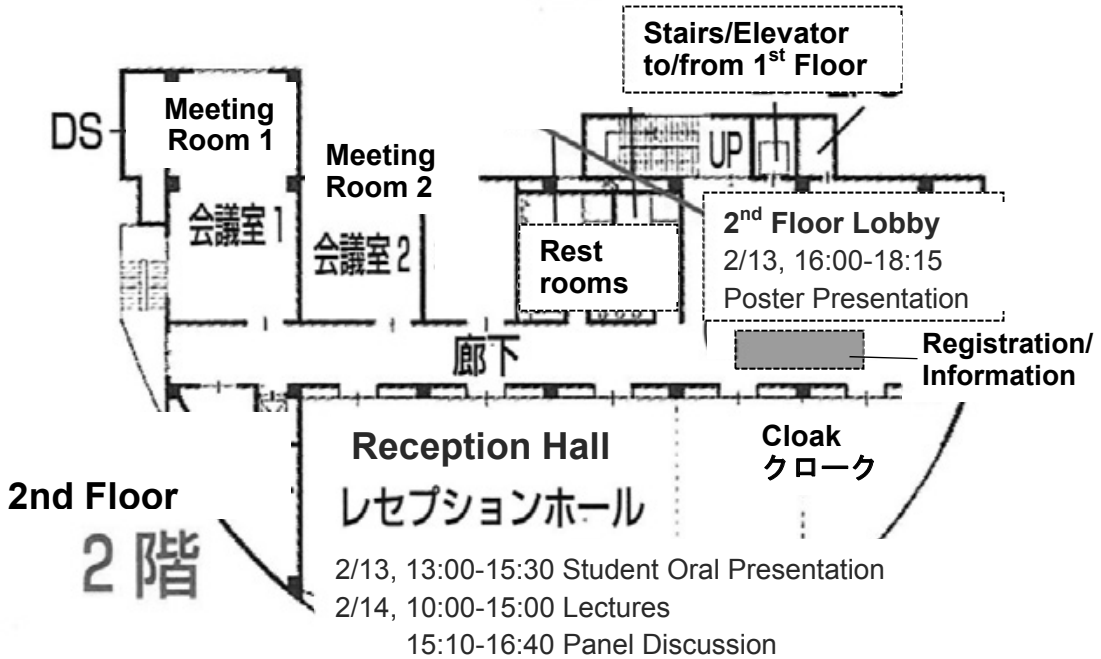
Keywords: patient dose, psld, dosimetry, radiation protection, radiation therapy

Optically stimulated luminesce (OSL) dosimeters are increasingly used for many areas of radiation dosimetry including personnel, workplace, environmental, and patient dose monitoring. However, only few studies have been done on the use of OSL for patient dose monitoring. Many patients are also not being counseled on the radiation risks that may lead to lens and skin injuries. In this light, experts and regulatory authorities agree that reducing patient dose in a radiation therapy procedure is a priority, but guidance on practical strategies is limited. This study aims to measure patient exposure doses by the use of photo-stimulated luminescence dosimeter (PSLD) film which is developed and owned by Professor Akio Urushiyama from Rikkyo University. The PSLD film is employed with silver containing lithium heptaborate ($Li_3B_7O_{12}$:Ag). It has an effective atomic number of 7.6 and dose operating range from 1 cGy up to 10 Gy. Since the European Union (EU) has issued a protocol for patient dosimetry using thermoluminescence dosimeter (TLD) which requires only one dosimeter per patient, this study will use four PSLD films to measure patient exposure doses during radiation therapy procedures. The use of four PSLD films is to allow the possibility that the maximum dose may be delivered elsewhere in the vicinity of the target radiation field. The exposure dose values of four PSLD films for each patient will not be uniformed across the radiation field. Thus, averaging the four exposure dose values may not be appropriate since there are several factors that may affect patient exposure doses. Considering those factors are important in assessing the results of this study.

Faculty Club Floor Plan



Restaurant 'La Boheme'
2/13, 18:30-20:00
Reception Party



2/13, 13:00-15:30 Student Oral Presentation
2/14, 10:00-15:00 Lectures
15:10-16:40 Panel Discussion

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Memo

Memo

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