HIROSHIMA UNIVERSITY

The 4th International Symposium on Phoenix Leader Education Program (Hiroshima Initiative) for Renaissance from Radiation Disaster

"LEADERSHIP and TRUST in RADIATION DISASTER"

Venue

International Conference Center Hiroshima
(Peace Memorial Park, Hiroshima, Japan)

Date

February 14(Sat.)-15(Sun.), 2015

Ministry of Education, Culture, Sports, Science and Technology - MEXT
"Program for Leading Graduate Schools" accepted for 2011

Phoenix Leader Education Program
The 4th International Symposium
"Leadership and Trust in Radiation Disaster"

Toshimasa Asahara
President of Hiroshima University

It is my great pleasure to open the 4th International Symposium of the Phoenix Leader Education Program (Hiroshima Initiative) for Renaissance from Radiation Disaster: titled "Leadership and Trust in Radiation Disaster," with distinguished speakers from both Japan and abroad.

Use of radioactivity for industries, medicine and energy has been increasing and contributes positively in many ways to our lives. On the other hand, as this use increases, so do the risks of a nuclear disaster. The Phoenix Leader Education Program was adopted as a FY2011 Program for Leading Graduate Schools of the Ministry of Education, Culture, Sports, Science and Technology, and started in October 2012 with eight students. Based on our decades-long experience in supporting the recovery of Hiroshima from the a-bombing in 1945, we aim to develop global leaders (Phoenix Leaders) who have the capacity to make sound judgments to take appropriate actions in the face of a radiation disaster. They will be able to lead the recovery with a clear philosophy and innovative knowledge that spans across disciplines. Last October, six new students joined the program, for a total of 25 students representing nine countries and a range of diverse backgrounds. These students, devoting themselves to their research every day, will also report on the outcomes of their efforts and learning activities, in the student presentations.

The symposium working group was organized last June and included four students as key members, for planning and organizing. The theme, 'the role of leadership in strengthening trust with various stakeholders' was developed thanks to their activities. We expect a lively discussion, including the floor. I hope this symposium will offer a useful opportunity for you to learn about the latest findings in the field, as well as to enhance your interest and understanding of the Phoenix Leader Education Program.

フェニックスリーダー育成プログラム

第 4 回国際シンポジウム

「原子力災害におけるリーダーシップと信頼」

広島大学長　浅原利正

放射線災害復興を推進するフェニックスリーダー育成プログラム第 4 回国際シンポジウムを今年も 2 日間にわたり開催し，1 日目はプログラムに所属する大学院生の研究・学修活動に関する発表とポスター発表，2 日目は国内外から招聘した専門家の方々に講演していただきます。

放射線の産業，医療，エネルギー分野での利用が増加し，私たちの暮らしに多大な恩恵をもたらす一方で，災害を引き起こす危険性も増してきました。本プログラムは，平成 23 年度文部科学省「博士課程教育リーディングプログラム」に採択され，平成 24 年 10 月からプログラムを開始しています。私たちは被爆地ヒロシマの復興を支えた広島大学の経験をもとに「幅広い学際的な知識を基盤として放射線災害に適切に対応し，明確な理念のもとで復興を指導できる判断力と行動力を有した，国際的に活躍できるグローバルリーダー（フェニックスリーダー)」の育成をめざしています。昨年 10 月には第 3 期生 6 人を迎え，第 1 期生 8 人，第 2 期生 11 人と合わせて 9 か国 25 人の多様な背景をもつ大学院生が，日々研さんを積んでいます。

昨年 6 月から，学生代表 4 人を中心としたワーキンググループを組織し企画・準備をすすめる中で，本シンポジウムの「ステークホルダーとの信頼を高めるリーダーシップの役割とは」というテーマは生まれてきました。会場の皆様も含め活発な意見交換を期待しています。本シンポジウムを通して，放射線に対する専門家の知見が多くの皆様に共有され，またフェニックスリーダー育成プログラムへの関心と理解が高まることを願っております。

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General Information

Date

February 14-15, 2015

Venue

International Conference Center Hiroshima

1-5 Nakajima-cho, Naka-ku, Hiroshima 730-0811, Japan

Phone: +81-82-242-7777 Fax: +81-82-242-8010

Language

English and Japanese

Hosted by

Organization of the Leading Graduate Education Program, Hiroshima University

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

Development of global personnel who manage recovery from breakdown of people, society, and environment, caused by radiation 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" accepted for FY2011)

放射線災害復興を推進する
フェニックスリーダー育成プログラム®

放射線災害による人と社会と環境の破綻からの復興を担う

グローバル人材養成

本プログラムでは、原爆からの復興を支えた広島大学の実績と経験を生かして、分野横断的・実践的学問領域である「放射線災害復興学」を確立し、放射線災害からの復興の核となる「放射線災害から生命を護る人材」、「放射能から環境を護る人材」、「放射能から人と社会を護る人材」を育成します。5 年もしくは 4 年一貫の徹底した人材育成カリキュラムにより、放射線災害に適切に対応し、明確な理念の下で復興を指導できる判断力と行動力を有した、国際的に活躍できるグローバルリーダー（フェニックスリーダー®）を育成します。

（文部科学省「博士課程教育リーディングプログラム」　平成 23 年度採択プログラム）

The 4th International Symposium on
Phoenix Leader Education Program (Hiroshima Initiative) for
Renaissance from Radiation Disaster

Leadership and Trust in Radiation Disaster

Schedule

Saturday, February 14

(Dahlia 1)

13:00-	Opening Ceremony
13:10-	Graduate student presentation I
	Break
	Graduate student presentation II
16:00-16:15	Break

(Dahlia 2)

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

(Dahlia 1)

18:30-20:00	Reception

Sunday, February 15

(Himawari)

9:45-10:00	Opening Ceremony
10:00-10:40	Dr. May Abdel-Wahab

'Medical Radiation Disasters'

10:40-11:20 Dr. Albert Wiley

'Community Hospitals and Local Health Care Providers Can Medically Manage the Radiation Carcinogenic Risk from Internal Contamination In Radiological, Mass- Casualty Scenarios by Use of the "CDG"'

11:20-11:30 Break

11:30-12:10 Dr. Rethy Chhem
'Trust in Science Leadership Process in Radiation Disaster'

12:10-13:20 Break

13:20-14:00 Dr. Noboru Takamura
'Communicating Radiation Risk to the Population of Fukushima'

14:00-14:40 Dr. Jacques Lochard
'Enhancing cooperation between experts and local communities: the co-expertise process in post-nuclear accident rehabilitation'

14:40-14:50 Break

14:50-15:30 Dr. Kiriko Sakata
'The role of trust in the necessary leadership for renaissance from radiation disaster'

15:30-15:40 Break

15:40-16:20 Discussion

16:30-16:45 Award Ceremony, Closing Ceremony

Abstracts

Lectures

February 15, 2015
10:00-15:30

International Conference Center Hiroshima
Room : HIMAWARI

Medical Radiation Disasters

May Abdel-Wahab

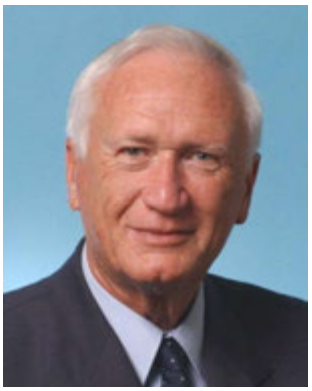
Director of the Division of Human Health
International Atomic Energy Agency

Benefits from medical radiation are palpable throughout modern medicine. Enhancement of diagnostic capability has resulted in better management of various diseases and conditions. This has led to improved medical outcomes. In addition, therapeutic radiation has had a significant impact on curability for patients who had definitive or adjuvant radiation for cancer. In addition medical radiation has led to improvement in quality of life and freedom from pain and led to a significant impact on quality of life for palliation of cancer symptoms. The role of radiation in benign disease management is also noted. Inspite of these successes, the rare instances of medical radiation errors will be considered, with an emphasis on understanding the factors contributing to them, lessons learned and QA practices or programs that may minimize their occurrence.

[PROFILE] May Abdel-Wahab (Director of the Division of Human Health, International Atomic Energy Agency)

May Abdel-Wahab, MD, PhD is the current Director of the Division of Human Health at the International Atomic Energy Agency, Vienna Austria. She has over 30 years of patient care, teaching and research experience in the field of radiation medicine. Before joining IAEA she was section head of GI Radiation Oncology at the Cleveland Clinic, USA and Professor at the Cleveland Clinic Lerner School of Medicine, Case Western University. She has served, both as a member and chair, on various National and International committees. She has also served on advisory boards and professional journal editorial boards She is a fellow of the American board of Radiology and is on the Best doctors in America listing, among other honors. Dr Abdel-Wahab has been an avid lecturer and participant on scientific panels. She has also served on expert panels for treatment guidelines and published widely (over 150 publications). She has a special interest in education and curriculum development as a former residency program director and has organized numerous symposia and scientific meetings. In addition, she has an interest in healthcare access and training, as well as novel solutions to address disparity and diversity issues.

Community Hospitals and Local Health Care Providers Can Medically Manage the Radiation Carcinogenic Risk from Internal Contamination in Radiological, Mass- Casualty Scenarios by Use of the "CDG"



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

ABSTRACT:

This paper is a discussion of how local health care professionals may rapidly become quite capable of diagnosing, treating and monitoring radiological internal contamination and thereby decreasing the radiation carcinogenic risk from radionuclide internal contamination (following radiological mass-casualty scenarios), through the use of a new public health guidance tool, the Clinical Decision Guidance (CDG).

Various specific medical countermeasures are now available to medical and health care professionals for reducing the internal radiation dose and the subsequent stochastic and deterministic risks to persons internally contaminated with radionuclides from nuclear power plant, fuel processing and nuclear weapon accidents. (1)

There is a public health need for rapidly identifying the type and the quantity of such radiation exposures and assessment of the associated committed doses, so that the appropriate medical countermeasure(s) can be given as soon as possible. The Clinical Decision Guidance (CDG), which was initially defined in National Council on Radiation Protection (NCRP) -161, was specifically developed to be a new public health tool for facilitating the integration of the community physician into the general mass-casualty triage and treatment response which will be required in the medical management of internally- contaminated populations.

GENERAL INTRODUCTION and DISCUSSION:

Internal contamination from fission products primarily may occur in certain scenarios from inhaling fission products (as a plume descends and from re-suspension from ground deposition or from ingesting contaminated food/water). Such internal contamination scenarios would cause significant

public health issues, if large populations of people were either exposed or perceived to have been exposed.

Many public health and medical professionals will necessarily become involved in any mass-casualty response. However, most of these medical and public health professionals who will be called to assist in the response will have minimal training and no experience with the management of such scenarios. This report is a brief review of some of the medical and public health issues associated with radiological internal contamination mass casualty scenarios, along with a discussion of how a new public health tool (the CDG) can now be used to enable the local community health professionals to participate in the radiological, emergency response. Many general practice/internal medicine and other health care professionals (who are unfamiliar with the practice of radiation medicine) will be required to provide the emergency diagnosis, treatment and follow-up monitoring of large numbers of the public who are either contaminated, or perceived to be contaminated, following radiological accident/incident scenarios.

SOME OF THE ISSUES and MEDICAL COUNTERMEASURES ASSOCIATED WITH THE MEDICAL AND PUBLIC HEALTH MANAGEMENT OF RADIOLOGICAL MASS-CASUALTY SCENARIOS:

Medical professionals should always understand that the treatment of radiation exposure and/or contamination is never a true medical emergency. The most important principal for the medical triage of all patients whether contaminated or not is always: “Medical stabilization of the patient ALWAYS comes first!”

Following medical stabilization, “radiological triage” does then become important.

It is also important to obtain, as soon as possible in the scenario, identification of the scenario radionuclide(s), and estimates of the relative medical risk(stochastic and/or deterministic) based on the radionuclide -specific physics dose assessment. This information is necessary to establish an internal contamination “radiological triage--” by defining, “who should be treated”; “who should be treated first” and, finally, “what is the appropriate radionuclide - specific medical countermeasure(s) required for the scenario in question”.

Such medical countermeasures are generally and primarily used to reduce the stochastic risks (ie. the risk of radiation –induced cancer), essentially by reducing the “residence times “or the effective half-life of the radionuclides in the body or organ and subsequently averting some of potential internal radiation dose (the Committed Effective Dose (CED). (The reduction and averting of the radiation dose reduces the cancer and deterministic risks to the patient, because these radiological risks are directly related to increasing radiation dose.)

Suitable drugs and procedures are currently available for the treatment of most kinds of radionuclide intakes. In general, for almost all internal contamination scenarios, the treating

physician's primary concern will be to minimize the stochastic risks (ie, primarily the radiation risk of cancer).

Even severe deterministic risks are, however, also possible from certain internal contamination scenarios, such as was seen in the well-known Goiania Cesium137 dispersion accident, and the London incident Polonium 210 i ncident, where deaths occurred. (4)But, scenarios which cause deterministic risks are fortunately rare. Thus, the primary goal of the treating physician in managing most internal contamination scenarios is to reduce the risk that the patient may develop a radiation-induced cancer –and, this type of clinical practice specialty might, therefore, even be defined as the practice of "preventive oncology".

A prompt treatment with an appropriate medical countermeasure protocol must be developed for those patients at risk to avert the potential internal radiation dose (CED) as much and as quickly as possible, thereby decreasing the long term stochastic risk of the development of a radiation- induced cancer, (since increasing radiation dose is directly correlated with an increasing risk of leukemia and other types of solid tumor cancers).

The specific spectrum of the hundreds of fission products from an improvised nuclear device (IND) scenario varies somewhat, depending on whether the nuclear explosion occurs on the ground, in the air or whether the source was enriched uranium-235 or plutonium-239.

For nuclear power plants, fuel processing and spent fuel storage facility type accidents, there will also be some source term variation in the specific type and quantity of fission products released. Prompt physics assessment of the "source term" radionuclides is essential for the optimization of medical management. Generally, the "more medically- significant" fission product radionuclides which are distributed into the environment and become public health risks are primarily radionuclides of Iodine, Cesium, Strontium, Uranium and Actinides (such as Pu), such as occurred in the mass casualty NPP accidents at Chernobyl and Fukushima. The relative medical significance of each of these specific radionuclides will vary with the scenario and will also vary as a function of time into the scenario-- i.e., "early" in a nuclear power plant accident, I-131 will be a major health concern; but, "later" in the scenario (such as with the Fukushima accident) public health attention will then become focused on Cesium (Cs) and Strontium (Sr) radionuclides. Interest in the development of medical countermeasures for the treatment of internal contamination has been a long term concern since, even in 1942, Einstein had recognized and cautioned that serious public health issues would be associated with the release of fission products into the environment.

A wide variety of countermeasure drugs having different types of pharmacological activity have been developed, -ie, "decorporation", "blocking" and dilution" are some of the usual mechanisms of action for these drugs which are tailored for specific radionuclide(s). (2)

In fission product-producing scenarios, the use of concurrent multiple drug combinations "cocktails" of countermeasures with different mechanisms of action may be necessary. Such countermeasures are needed to decrease or avert the long term dose (the committed effective dose CED) to the whole body and organs from the presence of the contaminating radionuclides work by increasing the rate of elimination of the nuclides from the body in the urine, the stool—or, by blocking their uptakes, or both.

Some medical countermeasures work very simply by dilution (such as in the treatment of tritium), where the treatment is simply to drink 3 to 4 liters of water a day, which increases the rate of tritium excretion by the kidneys).

Other drugs are more complex in their mechanism of action, such as Prussian Blue (PB), (ferric hexacyanoferrate (ll)), when given in oral capsules and in the GI tract binds to cesium, thallium and rubidium isotopes in the gastrointestinal tract ,thereby interrupting the normal hepato-enteric cycle of these isotopes. For example, when Cs combines with the Prussian blue in the GI tract, this Cs/PB complex becomes insoluble in the GI tract and is eliminated via fecal excretion. The chelating drugs, Ca or Zn diethylenetriaminepentaacetate (DTPA), which chemically combine in the blood or other body fluids with actinides (plutonium, americium, californium, curium) to produce a soluble complex which is efficiently excreted by the kidneys into the urine, will reduce deposition of these actinides into such target organs as bone and liver, where they have very long residence times.

Potassium iodide (KI) acts as a blocking agent by replacing uptake of the Iodine-131 by stable Iodine in the target organ (thyroid), during the synthesis of thyroid hormones. I-131 is a much greater risk to the fetus and to children under 18 years, than it is to adults. It is essential that the young age groups be treated with KI either hours before exposure, or within a few hours after exposure (as was tragically demonstrated in the Chernobyl accident, where the incidence of thyroid cancer in the younger age groups seems to be about 200 time above the normal incidence rate). Only one dose of KI treatment should be necessary for a brief "puff" type plume; but, if there is radioiodine exposure from a "continuous" plume, it should be repeated daily up to several weeks.

The CED from inhaled Strontium radionuclides can be reduced by administration of Calcium containing drugs (such as intravenous Ca-gluconate) where the Ca competes with or displaces Sr in the target organ (bone) metabolism. Oral administration of sodium alginates, barium sulphate or calcium phosphate will reduce the CED of ingested Sr (primarily Sr-90 from milk consumption).

Although Uranium is not a fission product perhaps it should be also mentioned here, since it is generally associated with many fission product producing scenarios. The toxicity of Uranium can be

mitigated generally by relatively simple drugs, such as oral or intravenous sodium bicarbonate, if treatment is give within a few days of exposure. The bicarbonate ion complexes in the blood with the uranium and forms a uranyl/bicarbonate complex. If treated within a few days of exposure, is rapidly excreted in the alkalinized urine, preventing deposition of the uranium in bone and kidney tubules.

Unless uranium is enriched with U-235 to above 10-15 %, it is not a significant radiological hazard; but it needs to be addressed as a kidney chemical toxin, regardless of the level of U-235 enrichment.

While the medically significant, metabolically active fission products (except for Iodine's, which are volatile) are generally large particles (>20 microns) and of low risk from inhalation. They are generally strong beta emitters which can also produce severe skin injury and even death from cutaneous injury (as was seen from "fall out" on fishermen in the Marshall Islands nuclear weapon accident, and among some firefighters in the Chernobyl NPP accident). These large particles, however, are generally cleared in the upper respiratory system and are also not highly soluble, so, significant respiratory hazards are unlikely to cause short-term, deterministic effects from internal contamination by inhalation. The stochastic risks to such exposed populations may become quite significant from inhalation of the small (<5 micron) particles which also ultimately generally become systemic and localized in target organs. The increased stochastic risk of developing radiation –induced cancers in large populations from such exposures could eventually become a major public health issue, following an IND (improvised nuclear detonation, dirty bomb or severe NPP accident) after the emergency phase is under control. As part of the United States medical preparedness for possible IND scenarios or Chernobyl type incidents, the Strategic National Stockpile (SNS) was advised to stock and currently does stock KI, Prussian Blue and Ca and Zn-DTPA (ref 1). A summary of some of the other, more commonly- used medical countermeasures for some other common radionuclides is shown in Table 1.

The medical/public health requirements and the logistics for mass casualty medical management of internal contamination from fission products with these medical countermeasures are complex. The radionuclides of concern will initially need to be promptly and specifically identified; and, the population at risk will first need to be radiologically triaged with respect to "who needs treatment" and then for "who needs treatment first." Additionally, the question of "when to stop" treatment can also be complex. (The answers to such questions are scenario dependent since some countermeasures should be started on treatment earlier than others). Another medical issue which must be considered by the physician in the treatment of people contaminated with a number of different fission products is that a "cocktail" of different drugs may be required. The "cocktail" use of drugs may at times become problematic (for example, the treatment of a patient simultaneously contaminated with both uranium and plutonium (such as is in "MOX fuel") may be a complex

pharmacologic issue since uranium treatment with bicarbonate involves a change in body fluid ph level. Bicarbonate induced ph changes in the blood and urine could affect the efficacy of the use of DTPA when concurrently administered for the treatment of simultaneous internal contamination with plutonium and uranium. Further discussion of such issues is beyond the scope of this paper and may be best worked out in pre-defined, scenario-specific table-top exercises involving the treating physicians. The discussion here is to encourage the treating physician to be aware of such issues, when considering the use of countermeasure "cocktails" and to advise them to have consultations with a pharmacist about possible scenario-specific multi-drug interactions. (2)

OTHER BIO-ASSAY and BIODOSIMETRY ISSUES:

A mass-casualty radiation disaster plan must also include preparation of a list of those special laboratories (commercial, Department of Energy (DOE), Center of Disease Control (CDC), Environmental Protection Agency (EPA), etc.) which are prepared to handle large numbers of bioassay specimens (urine, feces, etc.). This may seems like a trivial item---but, "preparedness exercises" have shown that only a few labs in the United States are capable and certified to performing clinical, radionuclide analysis of human bioassay specimens. There is also a similar need to pre-identify any locally available and certified, clinical whole body and lung counting facilities. In addition, it may be useful to also pre-identify clinically -certified biodosimetry laboratories for mass casualties' analysis. Such bioassays are generally used for radiation dose assessment of external radiation dose. But, dicentric chromosome analysis, micronuclei and FISH analysis of peripheral lymphocytes are also occasionally useful clinical tests for some internal contamination scenarios-i.e., such biodosimetry methods have been used (Tokamura, Fukushima) and may be particularly useful in fission product -producing scenarios, where the half-life of some of the fission products (like I-131) may be logistically too short for the collection and analysis of urine bioassays in a mass-casualty situation. (3)

Definition and Discussion of the Use of the CDG in Mass Casualty Scenarios:

A new operational quantity, the CLINICAL DECISION GUIDANCE, (CDG), for facilitating mass-casualty management of internal contamination was recently defined and operational tables were developed and published in NCRP 161 (2).

The CDG is defined in NCRP161 (ref 2) as the maximum, once-in a lifetime intake of a radionuclide which represents "Stochastic risk, as judged by the calculated Effective Dose (ED) over 50 years for intake by adults (and to age 70 by children) that is in the range of risks associated with guidance on dose limits for emergency situations (DOE, 2008, FEMA, 2008, ICRP, 1991, NCRP,

2005), furthermore, based on these Department of Energy (DOE), etc. recommendations, deterministic risks are also considered)".

Department Of Energy (DOE) numerical values were then used to compute both the stochastic and deterministic components of the CDGs for different radionuclides in adults (these numbers are 0.25 Sv (25 rem) for consideration of stochastic risks–and for the deterministic risks a 30 day RBE weighted absorbed dose value of 0.25 Gy (25 rad-Eq for bone marrow and 1.0 Gy for lungs was assumed).

Thus, the intake for a radionuclide, the adult CDG is the maximum intake satisfying these dose constraints for both stochastic and deterministic effects; these parameters are mathematically expressed as:

$$\text{CDG} = MIN\left[\frac{0.25\ \text{Sv}}{e(\text{Sv Bq}^{-1})}, \frac{0.25\ \text{Gy-Eq}}{d_{\text{Red Marrow}}(\text{Gy-Eq Bq}^{-1})}, \frac{1.0}{d_{\text{Lung}}(\text{Gy-Eq Bq}^{-1})}\right] \quad (11.1)$$

where:

e = effective dose coefficient for the radionuclide

$d_{\text{Red Marrow}}$ and d_{Lung} = RBE-weighted absorbed-dose coefficients for red marrow and lung, respectively

MIN = minimum value of the three arguments

The CDG was created to be a mass-casualty scenario so the clinical triage tool could assist the treating physician (most of whom are not educated about or accustomed to health physics units and terminology) with internal contamination triage, (to help them make clinical decisions on which patients need prompt consideration of treatment with dose averting countermeasure drugs and to define which of these patients can be designated for a later follow-up evaluation).

NCRP-161 provides simple CDG tables for 30 of the more medically significant radionuclides; and, these CDG values then may provide rapid guidance to the physician in the triage of who should be treated first since increasing radiological risks are associated with increasing CDG bioassay values. These tables' present CDG values for several kinds of bioassay for mass casualty scenarios, the urine bioassay will almost always be the most practical and commonly used type of bioassay. This assay is simply expressed in "Bq per 24 hour urine collection". For example: If a urine laboratory bioassay report has a Bq number above the number specified for "one CDG", as listed in the CDG table, (for the specific radionuclide of concern), this would prompt the physician to give serious consideration for the initiation of treatment with the appropriate drug countermeasure. (The CDC is

now even further developing the CDG tables into a very user-friendly format which is available for the physician in a clinic anywhere to access as an I-phone application “AP”.

The delivery and use of these medical countermeasures are not the immediate, high medical priorities following fission product release scenarios since, as mentioned earlier, the initial patient stabilization for any trauma, is always the more important immediate, life-saving concern.
Appropriate sheltering or evacuation, as well as guidance on special issues such as the use of KI in the emergency phase, is initially the best “preventive medicine” strategy-- since these public health directives provide some early protection of the public from internal contamination by inhalation and minimize external beta and gamma doses from any external contamination and exposures to “fall out” radiations.

The Department Of Energy (DOE) – National Nuclear Safety Administration (NNSA), the Federal Radiological Monitoring and Assessment Center (FRMAC) (Nellis Air Force Base, Nevada and LL Lab, Calif.) has multiple resources such as aerial monitoring systems, teams for ground monitoring and very sophisticated computer plume modeling and dose assessment capabilities. Following radionuclide - producing accidents, the FRMAC will promptly provide essential information to decision makers on public health issues such a sheltering in place, prophylactic use of KI and evacuation. There will always be intermediate and long term medically significant stochastic risks following such scenarios due to internal contamination by inhalation and ingestion of soluble fission products, which may also contaminate the water, milk and/or food supplies. The Environmental Protection Agency (EPA) and United States Department of Agriculture (USDA) will then also advise on such matters.

Conclusions:
This report considers and discusses some of the basics of the medical management of radiological internal contamination (and the associated risk of radiation carcinogenesis) to the public following exposure to radionuclides in certain mass casualty scenarios.
Such mass casualty internal contamination scenarios will necessarily involve many local community physicians (who unexpectedly may suddenly have many exposed patients show up in their emergency rooms and offices requiring rapid dose assessment and management of their radionuclide internal contamination).
Irrespective of the fact that very few of these physicians in any given local community health care system will have ever had any training in this area of medicine, they will very likely be required to radiological triage and promptly treat many patients with the appropriate countermeasures, in order

to reduce and avert the internal dose -associated stochastic risks. Accordingly, a very brief 'just in time", web- based or "on site" education of the local, community health care professionals on the use of the CDG and the use of the appropriate, basic countermeasures seems practical and essential, and should enable them to provide the prompt triage and treatment program which is necessary to reduce the public's real and perceived concerns about their subsequent development of a radiation - induced cancer.

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This document was produced under contract number DE-AC05-06OR23100 between the U.S. Department of Energy and Oak Ridge Associated Universities.

The opinions expressed in this paper are those of the author, not the Dept. of Energy.

The author has no conflict of interest.

Table 1:

Some Useful Medical Countermeasures for Treatment of Internal Contamination with Fission Products

Nuclide	Medication	Comments
Am-241	Ca and Zn DTPA, can be given by IV, aerosol, IM	Clelation—Best to Rx within 2hrs, but also is effective for liver uptake, even later on
Cf-252	Same as Am and Pu (DTPA)	Chelation, neutron emitter
Cs-137	Prussian Blue, oral	Binds Cs, hepato-enteric cycle
Co-60	? DTPA, EDTA, DMSA	Gastric lavage for early oral intake, DTPA
Fission Products	Concurrent use of multiple drugs may be necessary-dependent on time in scenario	Need to ID nuclides (dependence on time in scenario and use of specific drugs, i.e., KI early; Ca- gluconate, PB later)
H-3	Forced H_2O	Isotopic dilution
I-131	KI or SSKI, oral	Within a few hrs before or after exposure
Y-90	? DTPA	May also need concurrent Sr treatment with DTPA
Pu-239 and Pu238	Ca and Zn DTPA	Chelation, Best to give within first 2 hrs
Sr-89/90	Ca gluconate, iv(inhalation)	Consider alginates, Ba sulphate for ingestion

［PROFILE］ Albert L. Wiley (Director, REAC/TS)

Albert L. Wiley, Jr., BNE, MD, PhD is the Medical and Technical Director at REAC/TS and Head, WHO Collaborating Center at Oak Ridge. 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, 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. He is also a retired member of the USN Reserve (retired).

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Trust in Science Leadership Process in Radiation Disaster

Rethy Chhem

Cambodia Development Resource Institute (CDRI)

Public trust in science and technology – particularly the field of nuclear energy – has historically been fragile because of well-publicized nuclear accidents, including TMI and Chernobyl. The Fukushima disaster caused even greater damage to the public's perception of nuclear energy. Public mistrust has been compounded by a perceived close relationship between government and the nuclear industry; this mistrust has also been projected on to the work of scientists. Building trust between the public and political leaders, and reemphasizing the integrity of scientists, is crucial to building public acceptance of nuclear technology. Therefore, the purpose of my lecture is to explore the causes and consequences of public mistrust in scientific elite in Japan during and after the Fukushima disaster, and to identify strategies to overcome this mistrust.

First, I shall provide an overview of the importance of trust in the leadership *process,* because leadership is not about a person or a position, but a series of actions taken in order to achieve a particular goal. Second, I shall assess the ways in which trust in the science authorities in Japan has deteriorated after the nuclear accident. Third, I shall present various examples of post-disaster resilience and recovery to identify successful strategies utilized by science authorities to regain public trust.

A critical assessment of trust in the leadership process in the context of nuclear disaster yields important policy implications. Crucially, to overcome mistrust it is important to build education programs that provide scientists with skills beyond their technical expertise in radiation medicine, radiation biology or radiation ecology, which will enable them to forge strong

relationships with the public. This requires a major paradigm shift in the education and training of future scientists built on the precept that science, technology and society are inextricably intertwined. As well as technical experts, scientists must also be leaders that serve their community, nation and the world in a time of nuclear crisis.

I shall argue that STS (Science and Technology Studies) is an essential educational tool to nurture a new generation of trusted future leaders in radiation disaster. The innovative Phoenix Leader Education Program for Renaissance from Radiation Disaster of Hiroshima University fulfills this purpose well because of the admission criteria that has been established to recruit the right graduate students. They include:

"-Describe the knowledge and skills required for a *leader* who promotes interdisciplinary recovery from
a radiation disaster
-Considering radiation disaster medicine, describe the teamwork and *leadership* required
-Describe the idea of *"global-mindedness"* as it relates to radiation disaster medicine"

[PROFILE] Rethy K. Chhem (Executive Director, CDRI)

Dr. Chhem was born in Cambodia. He holds a medical degree from the University of Paris VI, a PhD in education and a PhD in history, both from the University of Montreal. For the last 20 years, he taught radiology at the University of Sherbrooke, McGill University, and University of Western Ontario in Canada and at the National University of Singapore. His history thesis was on medicine and public health in 13th century in the Khmer empire at Angkor. He was the former Chair of radiology and nuclear medicine at the University of Western Ontario. He is currently the director of the Division of Human Health at the International Atomic Energy Agency and is a guest professor at the Medical University of Vienna and Ulm University. He has published 9 books with one on Paleoradiology of mummies and fossils. His current research encompasses the history and philosophy of medicine and science with a focus on medical imaging, paleoradiology, Angkorian medicine and natural history in Southeast Asia.

Communicating Radiation Risk to the Population of Fukushima

Noboru Takamura and Shunichi Yamashita
Department of Global Health Medicine and Welfare and Department of Radiation Medical Sciences, Atomic Bomb Disease Institute, Nagasaki University, Nagasaki, Japan

Radiological specialists from Nagasaki University have served on the medical relief team organized at Fukushima Medical University Hospital (Fukushima City) ever since the accident at the Fukushima Dai-ichi nuclear power plant. Furthermore, we have conducted the radiation crisis communication efforts by spreading correct information on the health effects of radiation as 'advisors on radiation health risk control'.

Nagasaki University has also been assisting the reconstruction efforts of Kawauchi Village in Fukushima Prefecture, which was the first village to declare that residents could safely return to their homes because radiation doses were found to be at comparatively low levels. In April 2013, N agasaki University and the Kawauchi government office concluded an agreement concerning comprehensive cooperation toward reconstruction of the village. As a result, we established a satellite facility of the university in the village. Through the activities of satellite facility, we have prepared "mushroom map" which includes the information of radiocesium concentrations of wild mushroom in the village. Furthermore, we evaluated individual doses in residents who temporally stayed in evacuation order area in Kawauchi village and showed that individual doses are low levels even in the evacuation order area, and external effective dose levels are certainly decreasing due to the decay of artificial radionuclides and the decontamination of contaminated soil. We expect that the activities at satellite facility in Kawauchi village would be one of the model for radiation health risk communication in Fukushima. Training of specialists who can take responsibility for long-term risk communication regarding the health effects of radiation as well as crisis communication in the initial phase of the accident is an essential component of all such recovery efforts. Establishment of a training system for such specialists will be very important both for Japan and other countries worldwide.

[PROFILE] Noboru Takamura, M.D., Ph.D.
Professor, Department of Global Health, Medicine and Welfare
Atomic Bomb Disease Institute, Nagasaki University)

EDUCATION

Medical School	Nagasaki University School of Medicine Nagasaki, Japan Graduated in 1993
4/1993-3/1997	Postgraduate Fellow at Department of Preventive Medicine Atomic Bomb Disease Institute Nagasaki University School of Medicine

CAREER

5/1997-10/2001	Assistant Professor Department of International Health and Radiation Research Atomic Bomb Disease Institute Nagasaki University School of Medicine
9/1999-7/2000	Technical Officer, World Health Organization, Geneva Switzerland (in order to promote "WHO-SMHF Health Telematic Project: Medical Relief for Children Affected by the Chernobyl Accident through the Development and Implementation of Health Telematics)
11/2002-	Associate Professor Department of Preventive Medicine and Health Promotion Nagasaki University School of Medicine
03/2003-	Associate Professor Department of Public Health Nagasaki University Graduate School of Biomedical Sciences
04/2008-	Professor, Department of Radiation Epidemiology Atomic Bomb Disease Institute Nagasaki University Graduate School of Biomedical Sciences
01/2010-09/2010	Technical Officer, Department of Essential Health Technology World Health Organization

SOCIETY MEMBERSHIP

The Japanese Society of Internal Medicine
The Japan Endocrine Society
The Japan Radiation Research Society
Japanese Society of Hygiene
Japan Association for International Health

SPECIALTY

Radiation Medical Sciences
Hygiene
Molecular Epidemiology
Endocrinology
Internal Medicine

HONORARY PROFESSORSHIPS

Honorary Professor, Gomel State Medical University (Gomel, Belarus)
Honorary Doctor, Belarussian State Medical University (Minsk, Belarus)

Enhancing cooperation between experts and local communities: the co-expertise process in post-nuclear accident rehabilitation

Jacques Lochard

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

The experience of Chernobyl and now from Fukushima shows that developing the cooperation between experts and local communities is critical to recovery. Information and scientific explanations are not enough to create confidence and to restore the autonomy of people, which was severely amputated by the sudden irruption of radioactivity in their immediate environment. It is only through a process of dialogue between experts and local communities, combined with the characterization of the local radiological situation and of every individual, conducted together, that it is possible to progressively develop a radiological protection culture able to give everyone the opportunity to make informed decisions to protect oneself, given the prevailing circumstances.

This process, called co-expertise, relies on:

- the establishment of places for dialogue allowing experts to listen and to discuss together with affected people their questions, concerns, challenges, but also expectations,
- an assessment conducted jointly by locals and experts on the situation of the people and their community,
- the implementation of actions and projects to address the problems identified at the individual and the community levels with the support of local professionals, experts and authorities,
- the evaluation and dissemination of results and good practices.

The lecture will present the main steps of the co-expertise process that allow to develop the radiological protection cultural among people and thus enable everyone to act wisely with regard to exposures to radiation of themselves, their families, and their communities. This will be illustrated by the experiences of local communities in Belarus after the Chernobyl accident and in the Fukushima prefecture.

[PROFILE] Jacques Lochard (Director, CEPN, and Vice-chair, ICRP)

Jacques Lochard was educated in Economics at the University of Besançon-France (BS) and Paris-Pantheon-Sorbonne (MS). After 3 years experience as a teacher he joined the Centre d'étude sur l'Evaluation de la protection dans le domaine Nucléaire (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. The objective was to open the discipline to the social sciences and the emerging concepts of risk assessment and management (http://www.cepn.asso.fr/). His main contribution in radiation protection has been in the development of methodologies for the implementation of the optimisation principles. He has published many articles in scientific journals and in the proceedings of international conferences covering both the theoretical and practical aspects of optimisation. He has been President of the French Society of Radiation Protection (SFRP) from 1997 to 1999. He is also widely involved in the international radiation protection scene. He is the Executive Officer of the International Radiation Protection Association (IRPA) since 2000. He was the Chairman of the Committee on Radiation Protection and Public Health (CRPPH) of the OECD Nuclear Energy Agency from 2005 to 2009. He joined ICRP in 1993 as secretary of Committee 3, became a member of Committee 4 in 1997 and it's Chair in 2009.

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The role of trust in the necessary leadership for renaissance from radiation disaster

Kiriko Sakata

Graduate School of Integrated Arts and Sciences,
Hiroshima University, Hiroshima, 739-8521, JAPAN

During the process of a ‘renaissance’ from a disaster and while coping with the various risks, consensus building among stake-holders – the administrators, the scientists, and the local citizens – is often required. Given the backdrop of these circumstances, what kind of leadership is necessary to foster collaboration among such a diverse group? This lecture will focus on this problem by drawing upon research that has been carried out within the field of social psychological studies on ‘risk communication’ and ‘leadership’.

Due to the Fukushima nuclear power plant disaster, public trust in both the government and scientists has been greatly eroded. When considering consensus building and its importance for risk management, "trust" is a keyword. Many social psychology researchers have examined the role "trust" plays in people’s judgments and social acceptance of risk. Trust is comprised of an expectation of “competency" and “good intention". In other words, for the sender of a message to gain trust, not only a recognized high level of expertise is needed, but also genuine sincerity. For example, research carried out on one city-planning case indicated that procedural justice, such as providing citizens with the opportunity to voice their opinions about planning and development, and giving the local administration time to hear and reflect upon what was discussed, can lead to improved social acceptance and helps to promote overall citizens’ trust in the local administration.

Thus far, the majority of leadership studies have focused on top-down influence of formal leaders in hierarchical/single-agency structures. However, disaster prevention and a ‘renaissance’ from disasters can only be accomplished through the collaboration of all affected stakeholders including the various levels of administration, private enterprises, non-profit organizations, local citizens, etc. Therefore, the leadership

required for the 'renaissance' from disasters, and the mechanisms needed for coping with risk must reflect an integrated model. An integrated leadership model fosters collective action by stakeholders from a range of social sectors, in a coordinated effort for the common good. Certain studies point out that for integrative leadership to be effective at building trust, it needs to share information across the disaster management network and its leadership.

A 'renaissance' from a disaster requires fairness, not power, two-way communication, not one-way, accurate information sharing, not persuasive statements, and collaborative leadership that shares power as called for by the circumstances, never a dictator attempting to micro-manage. In short, healthy consensus building is only possible when leadership inspires the construction of mutual trust among affected stakeholders. A goal to which we should endeavor and strive.

[PROFILE] Kiriko SAKATA, Ph.D (Professor, Graduate School of Integrated Arts and Sciences, Hiroshima University, JAPAN)

Educational Background:
1989 M. P. Hiroshima University
1995 Ph.D. Hiroshima University

Major Professional Experiences:
Research Associate, Hiroshima University, 1991-1995
Assistant Professor, Hiroshima University, 1995-2001
Associate Professor, Hiroshima University, 2001-2008
Professor, Hiroshima University, 2009-

Major Publications:

Sugiura,H., Sakata, K., & Shimizu, H. Effects of intergroup and intragroup status on Social Dominance Orientation (in Japanese). *Japanese Journal of Social Psychology*, **30**, 75-85, 2014.

Hayase, R., Sakata, K., & Kohguchi, H. Inter-profession cooperation and patient satisfaction with medical treatment (in Japanese). *Japanese Journal of Experimental Social Psychology*, **52**, 104-115, 2012.

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Sakata, K., Fujimoto, K., & Kohguchi, H. Leadership and group membership: Effects of group prototypicality on influences of a leader (in Japanese). *Japanese Journal of Experimental Social Psychology,* **44**, 109-121, 2005.

Major Activities in Academic Societies;
Standing committee, The Japanese Group Dynamics Association (2010-2012)
Editorial committee, Japanese Association of Industrial/Organizational Psychology (2007-2014)

Academic Awards;
Prize for best article, The Japanese Group Dynamics Association (2004)

Abstracts

Graduate Student Presentation

February 14, 2015
13:10-16:00

International Conference Center Hiroshima
Room : Dahlia 1

The influence of land use and slope position to the declining rate of radioactivity in Fukushima prefecture

Wim Ikbal Nursal, Toshinori Okuda, Toshihiro Yamada

Graduate School of Integrated Arts and Sciences, Hiroshima University

Keywords
Airborne survey, monitoring, radioactivity, Fukushima

The influence of landscape features such as land use types and terrain characteristics to the dynamic of radioactivity in large landscape is poorly studied. Mostly studies have been done in patchy places with limited range of environmental gradient. In our study, we examine the influence of landscape features as such to the dynamic of radioactivity on the contaminated areas in Fukushima prefecture, by using airborne monitoring of air dose rate data since April 2011 to June 2012. The airborne monitoring data cover almost all area of Fukushima prefecture. The study area were chosen on east coast region of the prefecture which has relatively high radioactivity (0.14 μSv/h - 70.1 μSv/h from the first airborne monitoring). Five digital images were generated from airborne monitoring datasets and then utilized to calculate the average of decreasing rate of radioactivity. Superimposing air dose intensity data on to the vegetation and terrain data, we analyzed the effect of vegetation types and slope positions. Based on the result, we found that the vegetation types and slope position significantly influenced the air dose reduction rate at the 0 - 5 μSv/h radioactivity range. The model's R-squared explained little the variation of the data (R^2 = 12.4%), which implies that the reduction dose rate is highly varied from place to place. This further implies that any ground level study about the reduction air dose rate cannot be extended to other places without caution.

2

Functional MRI guided Stereotactic Body Radiotherapy planning using the Intensity Modulated Radiation Therapy technique for liver cancer

Uranchimeg Tsegmed[1)], Tomoki Kimura[1)], Nakashima Takeo[1)] ,Yuko Nakamura[2)], Toru Higaki [2)], Nobuki Imano[1)] , Yoshiko Doi[1)], Masahiro Kenjo[1)] , Shuichi Ozawa[1)] , Yuji Murakami[1)] , Kazuo Awai [2)], Yasushi Nagata[1)]

1) Department of Radiation Oncology, Hiroshima University
2) Diagnostic Radiology, Hiroshima University
Keywords: SBRT liver, EOB-MRI, Functional image guided RT

Purpose/Objective(s): To investigate the efficacy of functional MRI-guided stereotactic body radiation therapy (SBRT) planning using intensity modulated radiation therapy (IMRT) techniques for liver cancer in order to preserve the functional liver.

Materials/Methods: In this analysis, 20 patients with liver cancer (hepatocellular carcinoma) were enrolled. A gadoxetate disodium enhanced hepatic magnetic resonance imaging (EOB-MRI) was performed before planning, and the functional liver was defined as a liver-spleen contrast ratio (LSC) ≥ 1.5 in the hepatobiliary phase. These functional images were fused with the planning CT images in the treatment planning system. Two SBRT plans were designed using “step and shoot” static IMRT technique with eight non-coplanar beams for each patient as follows: 1) Plan A; anatomical SBRT plan based on the total liver; 2) Plan F; functional SBRT plan based on the functional liver. The total prescribed dose was 48 Gy in 4 fractions and the prescription dose should encompass 95% of the planning target volume (PTV). The dosimetric parameters including dose to 95% of PTV (D95), the percentages of total and functional liver volumes irradiated with 5-30 Gy [V5-30, fV5-30], and the mean doses to the total and functional liver minus gross tumor volume (GTV) [MLD, fMLD] of the two plans were compared in order to minimize dose to normal liver.

Results: The median PTV was 16.2 cc (range, 2.4 - 87.3 cc). The PTV D95 (mean, Plan A: 48.0 and Plan F: 48.0 Gy, p=0.78) was not significantly different between two plans. Compared with Plan A, Plan F significantly reduced MLD (mean, Plan A: 5.5 Gy and Plan F: 5.1 Gy, $p < 0.0001$) and fMLD (mean, Plan A: 5.4 Gy and Plan F: 4.9 Gy, $p < 0.0001$). Furthermore in comparison of the two SBRT plans, Plan F significantly reduced total liver minus GTV V5 (mean, Plan A: 30%, Plan F: 27%, p=0.0002), V20 (Plan A: 6.6%, Plan F: 6.3%, p=0.006), and V30 (Plan A: 3.53%, Plan F: 3.46%, p=0.03), respectively. For functional liver, we also found significant reduction in fV5 (mean, Plan A: 31%, Plan F: 28%, p=0.002), fV20 (Plan A: 6.4%, Plan F: 5.7%, $p<0.01$), and V30 (Plan A: 3.3%, Plan F: 3.1%, p= 0.015), respectively.

Conclusion: Functional MRI-guided SBRT planning using the IMRT technique appears to be effective in preserving functional liver in patients with liver cancer.

Making of the “Citizenship”

Mariko Komatsu

Graduate School of Integrated Arts and Sciences, Hiroshima University

Recovery and reconstruction from the disaster occurs in various levels, and when considering the society to be built back better, collective efforts of the citizens are necessary. We may expect such contribution to come from any member of the society, but it certainly is a choice of each individual whether and how much to devote for the public.

Children are often expected to love their hometown and naturally serve as citizens. Current educational materials and activities ubiquitously plan to lead children so based on such straightforward hypothesis to call for their citizenly devotion. However, we need to scrutinize this model as it has not been proven so successful.

This presentation will reexamine the concept of “citizenship” and aim to find its relevance for the ongoing interviews and future research.

4

Investigation in physical activity and physical fitness of elderly persons living at temporary housings in a radiation affected area

Nobuaki Moriyama1), Yukio Urabe1), Noriaki Maeda1),
Tomoyoshi Oikawa2), Shuichi Onoda2)

1) Graduate School of Biomedical & Health Sciences, Hiroshima University, Japan
2) Minamisōma Municipal General Hospital, Japan

Background

The Great East Japan Earthquake occurred on March 11, 2011. These natural events caused reactors at the Fukushima Daiichi Nuclear Power Plant to explode.

The city of Minamisōma is located in Fukushima Prefecture, a part of which is within a 20-km radius of the power plant. Following the Fukushima Daiichi nuclear disaster, many citizens in Minamisōma were evacuated from their housings. Evacuees at temporary housings may decrease their physical fitness and amount of physical activity because they lost their daily duty after the disaster. This is one of serious issues faced by evacuees, especially elderly persons.

Purpose

The purpose of this study was to evaluate the amount of daily physical activity engaged by elderly persons residing in temporary housings in Minamisōma. We hypothesized that the amount of physical activity and physical fitness of elderly persons residing at temporary housings are lower than those of elderly persons residing at their own housings.

Method

Seventy two elderly persons (74.3 ± 12.7 years) living at temporary housings in Kashima ward, Minamisōma city were recruited in this study, and sixty two age-matched persons living at their own housings(73.7 ± 6.9 years) were also recruited as controls. The average daily steps were measured for seven days using a triaxial accelerometer (Suzuken Co., Ltd.) as representative data of physical activity. Grasping power, muscle strength of knee extension were also measured. Dynamic balance was evaluated using Timed Up and Go test (TUG). These data were collected as representative data of physical fitness. An independent t-test was used to compare measured scales of evacuees with those of controls.

Result

Number of steps, grasping power, muscle strength, and TUG were lower in evacuees compared with those of controls ($p<0.05$).

Conclusion

Elderly persons living at temporary housings were less physically active and they had less physical fitness than those who reside at their own housings in the last three years after the disaster. Change of their living place due to evacuation and lives at narrow housings may decrease amount of their physical activity. Encouraging exercise to these displaced residents could help them remain active until they can return to their housings.

Spatiotemporal variation of Cs-137 concentration in Japanese fir (*Abies firma*) distribution in secondary forest in Fukushima, Japan

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

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

Tree leaves, especially evergreen coniferous leaves, are known to accumulate radioactive materials than other parts of trees. After being absorbed in tree bodies, radioactive materials stay in different part of trees, leaves, branches, trunks and roots. Then, they tend to move and accumulate into specific tissues. As a result, the radioactive materials are differently concentrated within the different part of trees. In other words, there is the heterogeneity of accumulation of radioactive materials in an individual tree.

The concentration of radioactive materials among each part of trees is not also homogeneous. For example, previous studies have reported that the concentration of Cs-137 in current-year leaves of Norway spruce was higher than old leaves (>1 year) after the Chernobyl accident. Thus, there is a difference in the radioactive materials concentration among different leaf ages that may possibly attributed to the leaf position within a branch or among different strata of branches. However, factors related to these heterogeneous accumulations of radioactive materials among leaves have not been well documented.

Focusing on a coniferous tree species, Japanese fir (*Abies firma*) commonly found in the hill slopes of the coastal region of Fukushima Prefecture, we studied the spatial-temporal distribution of radioactive materials (Cs-137) contained in this species after the Fukushima Daiichi Nuclear Power Plant accident.

In this study, we classified leaves as follows; (1) different leaf age groups (current-year leaves, 1st-year leaves, 2nd-year leaves), (2) different position within a tree body (upper part near the shoot apex and lower part). Trees chosen for the study were all in younger stage growing in the understory with the size of 1-3m in height. The measurements of Cs-137 in these leaves by Germanium detector showed that of Cs-137 concentration was different with leaf ages. In addition, the concentration of Cs-137 in leaves sampled from the upper part of a tree was higher than the lower part. These results imply that the accumulation of Cs-137 in leaves was influenced by the physiological activity of trees.

Based on these results, we plan to develop the spatiotemporal distribution model of Cs-137 within the tree body of this species with aiming spatial mapping of radioactive materials in a forest community level.

6

One Consideration Concerning Migration Pathway of Radioactive Materials Caused by Tsushima Current and Soya Current

Yasushi Nabae[1] and Satoru Nakashima[2]

1) Radioactivity Environmental Protection Course, Phoenix Leader Education Program for Renaissance from Radiation Disaster, Hiroshima University
2) Natural Science Center for Basic Research and Development, Hiroshima University

Keywords: Tsushima Current, Soya Current, ^{134}Cs, Ishikari Bay, Japan Coast Guard, Agano river

1. Introduction

East Japan great earthquake disaster occurred on March 11, 2011, and radioactive materials were released into the atmosphere and the ocean from TEPCO Fukushima Daiichi Nuclear Power Plant. Japan Coast Guard observed ^{134}Cs in Ishikari Bay (Hokkaido prefecture) in 2011 and 2012. However, there is no study of Migration Pathway of Radioactive Materials to Ishikari Bay. In the present study, we considered migration pathway of radioactive materials from FDNPP to Ishikari Bay.

2. Method

We carried out a reverse trajectory prediction of drifting object using Japan Ocean datacenter ocean current statistics. We considered possible radioactive materials migration pathway using a radioactivity surveys of Japan Coast Guard (2006 ～ 2012) and a radioactivity surveys (2011 and 2012) of Niigata prefecture. Finally, the plane monitoring result (October, 2011) by MEXT was used to investigate the distribution of the radioactivity on the land area.

3. Results and Discussion

The reverse trajectory prediction showed that radioactive materials outflow source was the offshore of Tohoku and the offshore of Hokuriku. According to the radioactivity survey by Japan Coast Guard, ^{137}Cs of 2-3 times higher than the average value was detected in surface seawater of west sea area of Hokkaido in 2011. This result supports the reverse trajectory prediction. The radioactivity surveys of Niigata prefecture and the plane monitoring result can be used to confirm that ^{134}Cs deposited on the earth surface near a prefectural border of Fukushima and Niigata. We supposed that the radioactive materials arrived at the Ishikari Bay by rivers and an ocean current. However, this is one consideration concerning migration pathway. Therefore we are going to get evidence.

Spatial heterogeneity of radiocesium concentration in a forest community in Fukushima

M. Takada, T. Takahara, T. Yamada, T. Okuda

Graduate School of Integrated Arts and Sciences, Hiroshima University

Radioactive fallout caused by the nuclear power plant accident 2011 in Fukushima still remains in the surface of forest floors. Its distribution is known to be spatially heterogeneous, but little is reported about causes generating it. Horizontal distribution of radiocesium within a forest community needs to be clarified for understanding spatio-temporal dynamics of radiocesium within a forest community and its outflow from the ecosystem to others (e.g. downstream). Structural variation of above ground vegetation (trees) possibly enhances the spatial heterogeneity of radioactive materials on the forest floor.

Focusing on horizontal distribution of radiocesium on a forest floor within a forest community, we tested following hypothesis that radiocesium accumulates at the bases of trees.

The field surveys were conducted in a broadleaf and mixed forest dominated by *Quercus crispula* and *Abies firma* in Soma city in Fukushima Prefecture in August and November, 2014. A 20 m × 20 m plot was established in the study site. Top soils (0 – 5 cm) were collected from 121 points in a grid system of every 2 m interval within the plot and additional 136 points from south and north sides at bases of all trees (≥ 5 cm of diameters at breast height) in the plot. Diameters at breast height of all the trees were measured, and the tree species were identified. The soil samples were dried and measured by a germanium detector. Activity concentrations of Cs-137 were decay-correlated to the data of the first field survey (August 2014).

Average concentration of Cs-137 radioactivity in the plot was 14,007 Bq/kg and its coefficient of variance was 74 %, showing large spatial variation of radiocesium distribution on the forest floor. Average concentration collected in the grid points 2 m apart each other was 10,826 Bq/kg, while average concentration from the bases of all trees was 16,836 Bq/kg. Concentrations at the tree bases were significantly higher than that those collected in the grid points (Student's t-test $P < 0.001$). We found very high radioactive concentration points defied as statistical outlier in the present study (≥ median value + 1.5 times the interquartile range; ≥ 26,716 Bq/kg). We found 25 very high radioactive concentration points in total in the plot. Out of the 25 points, 20 points (80 %) were observed at tree bases in the plot. Any specific tendency such as tree size or species did not observed at very high radioactive concentration points at the tree bases.

Spatial heterogeneity of radiocesium distribution can be explained to some extent by tree distribution. High concentration of radiocesium activity at tree bases is probably due to stemflow water containing radiocesium caught by canopies of trees, but the process may occur by chance because the high radioactive concentration points was not affected by tree characteristics. Radiocesium accumulated at tree bases indicates possibility to up take radiocesium by the tree roots.

8

Identification of factors influencing people's decision of relocation due to Fukushima nuclear accident: Case study in Minami Soma City.

Do Xuan Bien

Department of Geography, Graduate School of Letters, Hiroshima University.

The compound disaster occurred in March 2011 in Fukushima has caused substantial damages both physically and socially. The spread out of radioactive materials from the explosion of Fukushima Daiichi nuclear plant has led to not only environmental contamination, but also to the fear of people health and the large scale of evacuation. About 150,000 people have moved away from their homes to evacuation centers, temporary housing, and relatives' or friends' houses. Geographically, people in the affected areas have evacuated to almost all prefectures around Japan. This disaster migration amplified the depopulation and the demographic aging in disaster stricken areas. Human capital is the core as the decisive factor for the recovery process from a nuclear disaster. Mankiw (1997) and Zhou (2013) concluded that human capital contributes to the recovery from disasters more than that of physical capital, particularly in terms of economy. All the efforts to decontaminate the environment and to restructure the economy and society are for the better living conditions of the people. In turn, the population plays a crucial role in the success of the rehabilitation. The proper understanding of population relocation is therefore important for better planning to revitalize the affected areas. Regardless of this importance, the attention seems mostly paid in investigating psychological effects, changes in people perception of nuclear power, human health related to the accident and so on. A research on the trend of people movement and the factors that shape their decision of residing is therefore in the necessity.

Taking the fact that after the nuclear accident population changes have been observed in many municipalities in affected areas, together with the importance of human resources in rehabilitation process, this study firstly aims at investigating the current trends of people mobility among the affected population. Secondly the research also investigates the drivers that influence the demographic mobility. Among these factors, which one contributes most to people's decision of migration and which contributes less will also be examined.

For achieving the research objectives, Minami Soma City is chosen as the research location because of its representatives in population size, covering of different evacuation zones, and the large number of evacuees in which many of them still reside outside their original places. Mailing – questionnaire survey will be used to collect primary information from about 300 evacuees in two main groups: people who have already returned and people who are still living apart from their original places as before the accident.

The findings from this research can help to answer the question: is there any difference of what shapes people in making their decision of relocation between a nuclear accident and a natural disaster. These expected results are believed very important for local government in making appropriate policy. The possible correlation between variances such as age, gender and occupation and the decisions of relocation will also be examined. The findings of the factors that shape population mobility will contribute to the speculation of the changes in population structure in the future.

Keywords : nuclear disaster, disaster relocation, Minami Soma, disaster migration, disaster social recovery.

Individual difference of radiosensitivity evaluated by semi-automatic cytokinesis-blocked micronucleus (CBMN) assay

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

[1] Dept. Genetics and Cell Biology, RIRBM, Hiroshima University
[2] Research Center for the Mathematics on Chromatin Live Dynamics, Hiroshima University
[3] Dept. Obstetrics and Gynecology, Grad. Sch. Bio. Med., Hiroshima University
[4] Dept. Cellular Biology, RIRBM, Hiroshima University

Keywords: *Cytokinesis-block micronucleus assay, radiosensitivity*

Current standard for radiological protection is uniformly established to the public. However, it has been suggested that the individual difference of radiosensitivity exists in human populations, and that the nucleotide variants on DNA repair genes might be the genetic determinant for the individual difference.

DNA double strand breaks (DSBs) induced by ionizing radiation are recognized and fixed by the DNA repair system. Dampened DNA repair system causes chromosomal aberrations and cell death to induce acute and/or chronic radiation syndromes. Cytokinesis-block micronucleus (CBMN) assay is a sensitive method for detection of cellular radiosensitivity, which is based on a cellular event that when cells with unrepaired DSBs enter to mitotic phase, micronuclei form during telophase. Through the CBMN assay for cells with diverse genetic background, we are trying to develop the custom-made system for estimation of individual radiosensitivity.

In this study, we tested automated microscopically counting of micronucleated cells with using Metasystems Metafer MNScore algorithm combined with re-checking them by the human eyes. This semi-automatic approach appeared to be much faster and accurate system for targeted selection of the binucleated cells with micronucleus in comparison with manual counting procedure. The semi-automatic CBMN analyses using peripheral blood lymphocytes (PBLs) and isolated lymphocytes collected from the same individuals suggested the existence of individual differences in radiosensitivity. We also adapted a set of preparation protocol and Metafer algorithm for investigating the micronucleus formation in the adherent skin fibroblasts obtained from Japanese patients with genetic disorder. Our results proved that the developed semi-automatic CBMN approach could be successfully adapted for the estimation of radiosensitivity in different cell types.

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Concentration of Cesium-134 and Cesium-137 in Soil and Rice in Fukushima Prefecture

NGUYEN Thanh Hai1, 2) and Satoru NAKASHIMA1, 2, 3)

1) Radioactivity Environmental Protection Course, Phoenix Leader Education Program, Hiroshima University

2) Department of Chemistry, Graduated School of Science, Hiroshima University

3) Natural Science Center for Basic Research and Development, Hiroshima University

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 cesium-134 and cesium-137 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 50 km far from FDNPP in 2012. The situation was investigated by Subcommittee concerning by chemical treatment, Japanese Society of Radiation Safety Management in 2013.2) There were four paddy fields (A, B, C and D). The fields are close to mountains. The water is taken from water of the mountain and Abukuma River. The radioactivity of rice in the husk from B was higher than those from A, C and D. In the present study we chose the paddy field in Oguraji as research field.

Soil, water, rice plant were obtained on April 26th, August 11th, and September 25th, 2014. 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 cesium-134 and 137, potassium-40 was measured by Ge semiconductor detector.

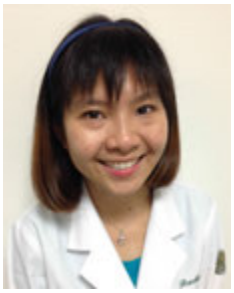
The water of field B in the sample of August 11th has much iron ion compared with other fields. Such condition may affect the solubility of cesium from soil. All the radioactivity of cesium-137 in rice was less than its 3σ. The radioactivity, however, in rice from B was slightly larger than 1σ. The measurements are ongoing.

1) T. Saito et al., Proc Int Symp Environ Monit Dose Estim Resid Accid TEPCO's Fukushima Daiichi Nucl Power Stn 2012.

2) N. Matsuda and S. Nakashima, Radioactive Cesium in Water and Soil and Its Absorption by Rice Plant (in Japanese), Japanese J. Rad. Safety Manage., 13, 89 (2014).

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

VMAT multiple divided partial arcs in SBRT



Yen Hwa Lin, Shuichi Ozawa, Uranchimeg Tsegmed, Takeo Nakashima, Shintaro Tsuda, Yusuke Ochi, Daisuke Kawahara, Takuro Okumura, Tomoki Kimura, Yasushi Nagata

Department of Radiation Oncology, Graduate School of Biomedical and Health Sciences, Phoenix Leader Education Program, Hiroshima University, Japan

Keywords: SBRT, VMAT, flattening filter free, partial arcs, single breath hold

Purpose of study: To investigate the feasibility of single breath hold for liver stereotactic body radiation therapy (SBRT) using high dose rate volumetric modulated arc therapy (VMAT) multiple divided partial arcs against intensity modulated radiation therapy (IMRT).

Method: Ten hepatocellular carcinoma cases were planned with 10 MV flattening filter free beams using Pinnacle3 treatment planning system, which delivered by TrueBeam to administer 48 Gy over four fractions to the D95 of planning target volume. Eight non-coplanar beams were assigned to IMRT with step-and-shoot technique. For VMAT, two non-coplanar partial-arcs (< 180 degrees) were further divided into sub-arcs (< 80 degrees) to limit delivery time within 15 s. Dose distributions were verified using OCTAVIUS II system and pass rates were evaluated using gamma analysis of 3% per 3 mm at threshold of 25% to the maximum dose. The actual irradiation time was measured.

Results: The VMAT multiple divided partial-arcs are able to produce highly conformal plan compared with IMRT. The beam-on-time of VMAT (72.81 s) is shorter than IMRT (120.14 s) with $p \leq 0.01$. The percentage volume of liver-minus-gross-tumor-volume receiving 5 Gy for VMAT (31.90%) is lower than IMRT (36.27%) with $p \leq 0.01$. The plan verifications for both VMAT and IMRT acquire the pass rates higher than 90%.

Conclusion: VMAT with multiple divided partial arcs is a promising technique for liver SBRT as it is highly efficient and able to design 15 s breath hold beams without affecting the dose distribution compared with IMRT.

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Geographical distribution and radiocesium accumulation in a bryophyte *Hyophila propagulifera*, Musci.

Sharifah Nabihah Syed Othman, Okuda, T., Yamada, T., Takahara, T.
(Graduate School of Integrated Arts and Sciences)
Oguri, E., Deguchi, H. (Graduate School of Science)
Endo, S., Shizuma, K. (Graduate School of Engineering)

Even few years after the FNPP (Fukushima Nuclear Power Plant) accident, little is known about the biological contamination by the fallout of radioactive materials. This is particularly true for the taxonomically lower living organism, such as mosses, lichens. Focusing on a bryophyte species, *Hyophila propagulifera*, Murci that is widely distributed in the Fukushima region, we studied its radiocesium accumulation in relation to their habitat conditions.

As preliminary study, we collected 14 samples at 3 sampling sites around; Minami soma, and Soma city (Yokokawa dam, Mano dam area), on December 2013 The radiocesium were measured using gamma-spectrometry ranged from 2.7kBq/kg to 116.87 kBq/kg for radiocesium^{134} and from 7.37kBq/kg to 304.24 kBq/kg for radiocesium^{137}. The contamination levels usually higher in the slope than the other topography.

As a part of main studies, we expanded the study area Minami-soma city, Futaba, Namie-Cho and Iitate village and collected the samples of *Hyophila propagulifera* from 45 sites within the area mentioned above in November 2014. During the samplings, we also recorded habitat condition such as substrate type that the mosses were attached, slope angle, bearings and wind direction. Almost all the sample sites were located either near the roadside slopes or wall surface of residential area. Radiosecium contamination has not been measured yet, but we soon start to analyze the rediosecium contamination levels of collected mosses in relation to the distance from FNPP and habitat environments, and ultimately examine its phytoremediation potentials in absorbing and storing radioactive materials. For further study and survey, we continue the sampling at the same area (sites) in order to examine chronological variation of contamination level after the FNPP explosion.

Estimation of migration velocity of radio cesium in soil at Iitate Village

THANH TAT NGUYEN [1)], TAKUYA OKADA [1)*], KENICHI TANAKA [1)], TSUYOSHI KAJIMOTO [1)], SATORU ENDO [1)]

[1)] Graduate School of Engineering, Hiroshima University

* Present address: Kitagawa Iron Works Co.,Ltd.

Enormous earthquake and associated massive tsunami on March 11th, 2011 led to the accident of Fukushima nuclear power plant. Due to this accident, large amount of radionuclides had been released into the air. Wide area from Tohoku to northern Kanto was contaminated by these radionuclides. The radionuclides such as I-131, I-132, Te-132, Te-129 and Te-129 which have short half-lives of 8 days, 2 hours, 3days, 33days, respectively, has been decayed for a few months. In contrast, Cs-134 and Cs-137 have relatively longer half-lives of 2 years and 30 years. Contamination of Cs-134 and Cs-137 radionuclides are important for the environmental ecosystem. Movement of these radio cesium in soil are characterized by a migration velocity and a diffusion co-efficient, these data were accumulated and discussed by many researchers after Chernobyl accident. However, Japanese soil is quite different from those near Chernobyl, therefore the migration velocity and the diffusion co-efficient for Japanese soils are useful to estimate the transfer characteristics in the environmental ecosystem. In this report, depth profile of radio cesium concentration in 30 cm soil core has been measured and discussed.

The 30 cm soil cores have been collected from selected location in Iitate village in 2011, 2012, 2013 and 2014, annually. These cores were cut into 7 layers of 0-2.5 cm, 2.5-5cm, 5-10cm, 10-15cm, 15-20cm, 20-25cm and 25-30cm. Each sample was dried up at 800C for 17 to 24 hours, and sieved with 2.5 mm mesh size. Dried samples were filled into U-9 container (size 4.8 cm diameter and 3 cm height). Gamma-ray spectra have been measured by low background G-detector (ORTEC, GMX-30200-P) at Hiroshima University. The detection efficiency of Ge-detector has been obtained with the standard volume sources (Japan Radioisotope Association, MX-033). S um-correction for Cs-134 gamma-rays of 605 keV and 796 keV are carried out by 1.13 and 1.14 which factors are estimated by EGS5 Monte Carlo simulation.

The depth profile results from 2011 to 2014 show that radioactivity concentration of Cs-137 has small change from surface soil to next layers. It means the migration velocity for soil in Iitate village is slow. Besides that, the migration velocity and diffusion co-efficient of each type of soil has difference. Calculation of the migration velocity and diffusion co-efficient for three locations show that the migration velocity and diffusion co-efficient are in range of 1.0 - 1.9 mm/year and 0.26 - 2.67 cm^2/year, respectively.

14

Doctors and the responsibilities to disaster recovery

Pham Thi Binh Trang

Radiation Disaster Medicine course, Phoenix Leader Education Program student
Department of Molecular Pathology, Institute of Biomedical and Health Sciences, Hiroshima University

Radiation is a difficult term to explain even though we are exposed to it from our surroundings in our natural environment. On the other hand, as technology advancement we also get benefits from radiological applications in medicine, industry, agriculture, etc. The point is people could not easily "see" radiation. Moreover, the knowledge about this source is not yet understood clearly as this field is still new and needed more evidence as well as research to answer many questions.

When a disaster happens, especially in the case of radiation, people want to get more information about health effects. As we know if something is unclear, it will cause more anxiety, anger and people try to blame because they were not explained well. Therefore, the role of Health professionals should be aware in the relationship and corporation with others in the concept of recovery by various ways such as: medicine, environment and society. Medical staffs, or doctors are expected to give proper information and participate in activities concerned to disaster-induced health. Moreover, radiation education should be provided specifically as it is different from ordinary medical practice.

After one year enrolling in Phoenix Leader Education Program, I appreciate so much as we could learn based on real experiences from experts, who actually engaged in radiation disaster activities during the accident happened in Fukushima almost four years ago. In addition, after understanding the philosophy of the program, I felt my responsibility as a medical doctor to participate in disaster recovery as well as transfer my knowledge to others.

Detection of immune suppressive activity in septic patient serum through DAMPs signals

Ho Minh Van[1], Kong Weng Sheng[2], Nobuyuki Hirohashi[1], Masamoto Kanno[2], Koichi Tanigawa[1]

[1.] Department of Emergency and Critical care Medicine, Hiroshima University
[2.] Department of Immunology, Hiroshima University

Background: Sepsis is a serious medical condition characterized by systemic inflammatory response syndrome (SIRS) caused by infection. Uncontrolled inflammatory responses to infection result in the collapse of the cardiovascular function, leading to multiple organ dysfunction syndrome (MODS) and death. Damage-associated molecular patterns (DAMPs) are danger signals, which are released during SIRS, and stimulate macrophages to produce interleukine-1 beta (IL-1ß) which is an important mediator of the inflammatory response. DAMPs are involved in a variety of cellular activities including cell proliferation, differentiation, and apoptosis.

Purpose: To investigate the immune suppressive activities content on septic patient serum under DAMPs signals.

Materials and methods: Serum of patients admitted to the ICU of Hiroshima University Hospital were taken on admission and analyzed for DAMPs activity at the Immunology department. DAMPs activity assays used THP-1 derived macrophages, which provide a well characterized DAMPs-induced secretion model of IL-1ß. THP-1 cells were treated with PMA for differentiation for 48hs. Cells were treated with serum of healthy donors, patients, and human serum mixed with DAMPs molecular (MSU, ATP, etc…) for 12hs. Cell culture medium was collected for detection of IL-1ß by Enzyme-linked immunosorbent assay (ELISA). After cells were treated for 12hs, cell-viability was examined by staining with Annexin V-FITC and PI via flow cytometry analysis. Septic patients were separated into two groups for further experiment based on the concentration of IL-1ß released after treatment. Those with values that showed a significant decrease were defined as suppression sepsis (sepsis (-)) or vice versa (sepsis (+)) in comparison with those of healthy donors.

Results: Five healthy donors and twelve septic patient serum samples were used in this study. The mean concentrations of IL-1ß in healthy donors, septic (+), and septic (-) patients were 309.8±41.4, 323.6±61.5, and 170.8±31.8 (pg/mL) respectively. We also measured the concentration of IL-1ß in macrophages stimulated by Adenosine Tri-phosphate (ATP) in the presence of serum, which was 397.4±16.3 pg/mL (donor), 360.7±56.2 pg/mL (sepsis (+)) and 186.7±45.0 pg/mL (sepsis (-)). The concentration of IL-1ß produced by Monosodium Urate (MSU) stimulation in the same condition was not difference. Total number of cell death after stimulation also decreases significant at sepsis (-) groups.

Conclusion: In this experiment, we found a subset of septic patients of which treatment of THP-1 macrophages resulted in significantly lesser production of IL-1ß than those of healthy donors. These suppression of IL-1ß released was also observed in the presence of DAMP molecules. The results indicate that these patient serum possesses an ability to inhibit inflammatory responses. The factor underlying this suppression is yet to be defined.

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Measurement and Decontamination of Radioactive Cesium from Soil in Fukushima

Masaya Tsujimoto[1, 2)], Sunao Miyashita[2, 3)], and Satoru Nakashima[1, 2, 3)]

1) Radioactivity Environmental Protection Course, Phoenix Leader Education Program, Hiroshima University
2) Department of Chemistry, Graduated School of Science, Hiroshima University
3) Natural Science Center for Research and Development, Hiroshima University

The East Japan Great Earthquake with magnitude 9.0 occurred in the east of Japan h 11th 2011, about 4 years ago. The tsunami originating in this earthquake was as high as up to 15 m far beyond our imagination. Fukushima Daiichi Nuclear Power Plant (FDNPP) halted safely at the moment after the earthquake. It was, however, damaged seriously by tsunami. The cooling systems for nuclear reactor cores on Marc were lost, and the hydrogen was produced by the reaction of water with zirconium in the zircaloy cladding tube. Ultimately, the hydrogen explosions were triggered, and an enormous amount of radioactive nuclide was spread. A lot of surface soil on the ground was gathered and piled up in each temporary yard. It is necessary to make every effort to transfer radioactive waste efficiently to interim storage facilities and final disposal site. The purpose of this research is to explore the effective methods for decontaminating the soil contaminated by radioactive cesium. In the present study, we investigated the basic condition for decontamination.

The surface soil was sampled in the paddy field in Oguraji, Fukushima City, which is northwest, approximately 50 km far from FDNPP, on April 26th 2014. After drying at room temperature for 24 hours, the soil was separated by sizes, which were gravel (upward of 2 mm), sand (2 – 0.075 mm), silt (0.075 – 0.005 mm), and clay (less than 0.005 mm). The sieve classification was conducted for more than 72 hours with 250 rpm for separating gravel, sand, and silt including clay. In addition, clay was separated from silt by precipitation in the water for 1 hour. The separated gravel, sand, and silt were encased separately in a U-8 vessel and the radioactivity of cesium-134 and 137 were measured by Ge semiconductor detector.

The measurements revealed that silt had the highest radioactivity concentration (Bq/kg) among gravel, sand, and silt. However, the volume of silt is few and it is difficult to decontaminate cesium-134 and 137 from silt. On the other hand, the volume of sand is large and then large amount of radioactive cesium is adsorbed in sand, although the concentration is relatively low. In conclusion, we would like to propose that soil should be separated using sieve and the silt is transferred to interim storage facilities. The rest sand should be decontaminated. This is an effective way to reduce the total amount of stored soil. The decontamination study is ongoing.

Keywords
classification of particles, measurement of radioactive cesium in soil, decontamination, Fukushima

A Day in Fukushima - Doses of Reality and Hope for Recovery

HIRANO Yuji, CHANNARENA Chuon, NGUYEN Quang Tam,
KABIR Russell Sarwar, MATSUMOTO Chika,
AKUTSU Silvia Natsuko (Upper left to lower right in photo)

Hiroshima University
Graduate School of Education; Graduate School of Biomedical and Health Sciences
Graduate School of Social Sciences; Graduate School of Integrated Arts and Sciences

The repercussions of radiation disaster came into increasingly sharper focus on our trip through Iitate Village, Minamisouma City, and myriad affected towns throughout Fukushima Prefecture. We caught a glimpse of remaining tsunami destruction at the mouth of the Ota River, ghost town abandonment of property and possessions near Odaka Station, countless black bags filled with contaminated soil from rice paddies to street corners, and hard-working security guards policing barricades on the recently-opened, formerly-prohibited exclusion zones of Route 6. We were regaled with elegant experiments and perceptive presentations by experts, as well as given opportunities to take in the atmosphere and appraise the environment firsthand. We came to a number of conclusions given our collectively diverse background, from the visceral, sobering reality of infrastructure loss and human capital insufficiency, to the liability of the media in causing harmful stress from fictitious image constructions of Fukushima. These newfound observations piqued interests in radiation pathology and psychology, called to question the salience of certain policy directives under disaster circumstances, and caused us to probe the limitations of what we can achieve individually in the recovery process. We felt a spectrum of emotions spanning from surprise at the nature and frequency of fixed dosimeters, tension from sudden hotspot readings, sympathy for both evacuees and residents of temporary housing complexes, and simultaneously life-affirming and conflicting existential crises about the underpinnings of our individual research themes. However, where it mattered most, our day in Fukushima gave us hope. It strengthened our resolve to make a positive difference in our research and on the communities we will visit again on a one-week return trip next year. In this presentation, we impart how our first personal encounter with Fukushima as a field shaped our resolution to take an active, interdisciplinary role in the recovery process, our perspectives of our research as a whole, and our knowledge of historical antecedents to set the framework for "radiation disaster recovery studies."

Abstracts

Graduate Student Poster Presentation

February 14, 2015
16:15-18:15

International Conference Center Hiroshima
Room : Dahlia 2

The influence of land use and slope position to the declining rate of radioactivity in Fukushima prefecture

Wim Ikbal Nursal, Toshinori Okuda, Toshihiro Yamada

Graduate School of Integrated Arts and Sciences, Hiroshima University

Keywords
Airborne survey, monitoring, radioactivity, Fukushima

The influence of landscape features such as land use types and terrain characteristics to the dynamic of radioactivity in large landscape is poorly studied. Mostly studies have been done in patchy places with limited range of environmental gradient. In our study, we examine the influence of landscape features as such to the dynamic of radioactivity on the contaminated areas in Fukushima prefecture, by using airborne monitoring of air dose rate data since April 2011 to June 2012. The airborne monitoring data cover almost all area of Fukushima prefecture. The study area were chosen on east coast region of the prefecture which has relatively high radioactivity (0.14 μSv/h - 70.1 μSv/h from the first airborne monitoring). Five digital images were generated from airborne monitoring datasets and then utilized to calculate the average of decreasing rate of radioactivity. Superimposing air dose intensity data on to the vegetation and terrain data, we analyzed the effect of vegetation types and slope positions. Based on the result, we found that the vegetation types and slope position significantly influenced the air dose reduction rate at the 0 - 5 μSv/h radioactivity range. The model's R-squared explained little the variation of the data (R^2 = 12.4%), which implies that the reduction dose rate is highly varied from place to place. This further implies that any ground level study about the reduction air dose rate cannot be extended to other places without caution.

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Functional MRI guided Stereotactic Body Radiotherapy planning using the Intensity Modulated Radiation Therapy technique for liver cancer

Uranchimeg Tsegmed[1)], Tomoki Kimura[1)], Nakashima Takeo[1)] ,Yuko Nakamura[2)], Toru Higaki [2)], Nobuki Imano[1)] , Yoshiko Doi[1)], Masahiro Kenjo[1)] , Shuichi Ozawa[1)] , Yuji Murakami[1)] , Kazuo Awai [2)], Yasushi Nagata[1)]

1) Department of Radiation Oncology, Hiroshima University
2) Diagnostic Radiology, Hiroshima University

Keywords: SBRT liver, EOB-MRI, Functional image guided RT

Purpose/Objective(s): To investigate the efficacy of functional MRI-guided stereotactic body radiation therapy (SBRT) planning using intensity modulated radiation therapy (IMRT) techniques for liver cancer in order to preserve the functional liver.

Materials/Methods: In this analysis, 20 patients with liver cancer (hepatocellular carcinoma) were enrolled. A gadoxetate disodium enhanced hepatic magnetic resonance imaging (EOB-MRI) was performed before planning, and the functional liver was defined as a liver-spleen contrast ratio (LSC) ≥ 1.5 in the hepatobiliary phase. These functional images were fused with the planning CT images in the treatment planning system. Two SBRT plans were designed using “step and shoot” static IMRT technique with eight non-coplanar beams for each patient as follows: 1) Plan A; anatomical SBRT plan based on the total liver; 2) Plan F; functional SBRT plan based on the functional liver. The total prescribed dose was 48 Gy in 4 fractions and the prescription dose should encompass 95% of the planning target volume (PTV). The dosimetric parameters including dose to 95% of PTV (D95), the percentages of total and functional liver volumes irradiated with 5-30 Gy [V5-30, fV5-30], and the mean doses to the total and functional liver minus gross tumor volume (GTV) [MLD, fMLD] of the two plans were compared in order to minimize dose to normal liver.

Results: The median PTV was 16.2 cc (range, 2.4 - 87.3 cc). The PTV D95 (mean, Plan A: 48.0 and Plan F: 48.0 Gy, p=0.78) was not significantly different between two plans. Compared with Plan A, Plan F significantly reduced MLD (mean, Plan A: 5.5 Gy and Plan F: 5.1 Gy, $p < 0.0001$) and fMLD (mean, Plan A: 5.4 Gy and Plan F: 4.9 Gy, $p < 0.0001$). Furthermore in comparison of the two SBRT plans, Plan F significantly reduced total liver minus GTV V5 (mean, Plan A: 30%, Plan F: 27%, p=0.0002), V20 (Plan A: 6.6%, Plan F: 6.3%, p=0.006), and V30 (Plan A: 3.53%, Plan F: 3.46%, p=0.03), respectively. For functional liver, we also found significant reduction in fV5 (mean, Plan A: 31%, Plan F: 28%, p=0.002), fV20 (Plan A: 6.4%, Plan F: 5.7%, $p<0.01$), and V30 (Plan A: 3.3%, Plan F: 3.1%, p= 0.015), respectively.

Conclusion: Functional MRI-guided SBRT planning using the IMRT technique appears to be effective in preserving functional liver in patients with liver cancer.

Investigation in physical activity and physical fitness of elderly persons living at temporary housings in a radiation affected area

Nobuaki Moriyama1), Yukio Urabe1), Noriaki Maeda1), Tomoyoshi Oikawa2),
Shuichi Onoda2)

1) Graduate School of Biomedical & Health Sciences, Hiroshima University, Japan
2) Minamisōma Municipal General Hospital, Japan

Background

The Great East Japan Earthquake occurred on March 11, 2011. These natural events caused reactors at the Fukushima Daiichi Nuclear Power Plant to explode.

The city of Minamisōma is located in Fukushima Prefecture, a part of which is within a 20-km radius of the power plant. Following the Fukushima Daiichi nuclear disaster, many citizens in Minamisōma were evacuated from their housings. Evacuees at temporary housings may decrease their physical fitness and amount of physical activity because they lost their daily duty after the disaster. This is one of serious issues faced by evacuees, especially elderly persons.

Purpose

The purpose of this study was to evaluate the amount of daily physical activity engaged by elderly persons residing in temporary housings in Minamisōma. We hypothesized that the amount of physical activity and physical fitness of elderly persons residing at temporary housings are lower than those of elderly persons residing at their own housings.

Method

Seventy two elderly persons (74.3 ± 12.7 years) living at temporary housings in Kashima ward, Minamisōma city were recruited in this study, and sixty two age-matched persons living at their own housings(73.7 ± 6.9 years) were also recruited as controls. The average daily steps were measured for seven days using a triaxial accelerometer (Suzuken Co., Ltd.) as representative data of physical activity. Grasping power, muscle strength of knee extension were also measured. Dynamic balance was evaluated using Timed Up and Go test (TUG). These data were collected as representative data of physical fitness. An independent t-test was used to compare measured scales of evacuees with those of controls.

Result

Number of steps, grasping power, muscle strength, and TUG were lower in evacuees compared with those of controls ($p<0.05$).

Conclusion

Elderly persons living at temporary housings were less physically active and they had less physical fitness than those who reside at their own housings in the last three years after the disaster. Change of their living place due to evacuation and lives at narrow housings may decrease amount of their physical activity. Encouraging exercise to these displaced residents could help them remain active until they can return to their housings.

4

One Consideration Concerning Migration Pathway of Radioactive Materials Caused by Tsushima Current and Soya Current

Yasushi Nabae[1] and Satoru Nakashima[2]

1) Radioactivity Environmental Protection Course, Phoenix Leader Education Program for Renaissance from Radiation Disaster, Hiroshima University
2) Natural Science Center for Basic Research and Development, Hiroshima University

Keywords: Tsushima Current, Soya Current, ^{134}Cs, Ishikari Bay, Japan Coast Guard, Agano river

1. Introduction

East Japan great earthquake disaster occurred on March 11, 2011, and radioactive materials were released into the atmosphere and the ocean from TEPCO Fukushima Daiichi Nuclear Power Plant. Japan Coast Guard observed ^{134}Cs in Ishikari Bay (Hokkaido prefecture) in 2011 and 2012. However, there is no study of Migration Pathway of Radioactive Materials to Ishikari Bay. In the present study, we considered migration pathway of radioactive materials from FDNPP to Ishikari Bay.

2. Method

We carried out a reverse trajectory prediction of drifting object using Japan Ocean datacenter ocean current statistics. We considered possible radioactive materials migration pathway using a radioactivity surveys of Japan Coast Guard (2006 ～ 2012) and a radioactivity surveys (2011 and 2012) of Niigata prefecture. Finally, the plane monitoring result (October, 2011) by MEXT was used to investigate the distribution of the radioactivity on the land area.

3. Results and Discussion

The reverse trajectory prediction showed that radioactive materials outflow source was the offshore of Tohoku and the offshore of Hokuriku. According to the radioactivity survey by Japan Coast Guard, ^{137}Cs of 2-3 times higher than the average value was detected in surface seawater of west sea area of Hokkaido in 2011. This result supports the reverse trajectory prediction. The radioactivity surveys of Niigata prefecture and the plane monitoring result can be used to confirm that ^{134}Cs deposited on the earth surface near a prefectural border of Fukushima and Niigata. We supposed that the radioactive materials arrived at the Ishikari Bay by rivers and an ocean current. However, this is one consideration concerning migration pathway. Therefore we are going to get evidence.

Radiocesium behavior in different soil layers in deciduous forests in Fukushima

M. Takada, T. Takahara, T. Yamada, T. Okuda

Graduate School of Integrated Arts and Sciences, Hiroshima University

Radioactive fallout caused by the Fukushima nuclear power plant (NPP) accident still remains in neighboring forests. Large amount of the radiocesium is known to have deposited on surface of forest floors such as litter layers soon after the accident, and subsequently started to migrate into soil layer. The migration process should be clarified for the long-term prospect of behavior of radiocesium in forest ecosystems and decontamination practices.

In the present study, we focused on downward migration of radiocesium in soil within forest ecosystem. The objectives of our study are to evaluate temporal change of migration rates, differences of migration rates between litter layer to soil layer and within soil, and differences of migration rates among forest communities. Finally, radiocesium behaviors on forest floors for a long period were prospected by a compartment model.

The field surveys were conducted in Fukushima Prefecture for 16 months from July 2013 to November, 2014. Study sites were placed in six mixed deciduous forests dominated by *Quercus crispula* and *Abies firma*. In each study sites, litter layer, surface soil (0 – 5 cm in depth) and deeper soil (5 – 10 cm) were collected for 5 times (July 2013, December 2013, March 2014, July 2014, and November 2014) during the field surveys. The samples were dried and measured by a germanium detector. Activity concentrations of Cs-137 were decay-correlated to the data of the first field survey. To describe the decay-corrected behavior of Cs-137 in soil, a compartment model was developed for estimating the radiocesium flow from litter layer to deeper soil via surface soils, each of which were regarded as “compartment”.

The results showed radiocesium in litter layers had the biggest concentration in July 2013, accounting for 45 – 80 % of the total amount (from litter layer to deeper soil). In November 2014, approximately 5 % of radiocesium was in litter layer, while 80 % was in surface soil. Total amount of radiocesium did not show large temporal change during the field survey period. This is probably because that radiocesium in litter layer migrated into soil layer. Migration rates decelerated gradually with time, but seasonal changes of the migration rates were not observed. From the results of the compartment model, the migration rates of radiocesium in soil layer were approximately ten times lower than those from litter layer to soil layer. The decrease rates of radiocesium from litter layers did not show large variation among study sites. Additionally, its decrease rates are almost same as decomposition rates of carbonyl carbon contained in litter in broadleaf deciduous forests in Japan. Therefore, radiocesium in litter layer is assumed to migrate into soil layer with litter being decomposed. In contrast to the litter layer, migration rate in soil layer varied among study sites. With material flow analysis using the compartment model, we estimate more than half of radiocesium will remain between litter layer and surface soil for 5 years after the NPP accident, and consequently migrate into deeper soil.

6

Identification of factors influencing people's decision of relocation due to Fukushima nuclear accident: Case study in Minami Soma City.

Do Xuan Bien

Department of Geography, Graduate School of Letters, Hiroshima University.

The compound disaster occurred in March 2011 in Fukushima has caused substantial damages both physically and socially. The spread out of radioactive materials from the explosion of Fukushima Daiichi nuclear plant has led to not only environmental contamination, but also to the fear of people health and the large scale of evacuation. About 150,000 people have moved away from their homes to evacuation centers, temporary housing, and relatives' or friends' houses. Geographically, people in the affected areas have evacuated to almost all prefectures around Japan. This disaster migration amplified the depopulation and the demographic aging in disaster stricken areas. Human capital is the core as the decisive factor for the recovery process from a nuclear disaster. Mankiw (1997) and Zhou (2013) concluded that human capital contributes to the recovery from disasters more than that of physical capital, particularly in terms of economy. All the efforts to decontaminate the environment and to restructure the economy and society are for the better living conditions of the people. In turn, the population plays a crucial role in the success of the rehabilitation. The proper understanding of population relocation is therefore important for better planning to revitalize the affected areas. Regardless of this importance, the attention seems mostly paid in investigating psychological effects, changes in people perception of nuclear power, human health related to the accident and so on. A research on the trend of people movement and the factors that shape their decision of residing is therefore in the necessity.

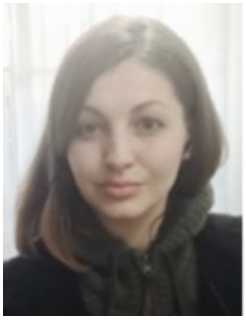
Taking the fact that after the nuclear accident population changes have been observed in many municipalities in affected areas, together with the importance of human resources in rehabilitation process, this study firstly aims at investigating the current trends of people mobility among the affected population. Secondly the research also investigates the drivers that influence the demographic mobility. Among these factors, which one contributes most to people's decision of migration and which contributes less will also be examined.

For achieving the research objectives, Minami Soma City is chosen as the research location because of its representatives in population size, covering of different evacuation zones, and the large number of evacuees in which many of them still reside outside their original places. Mailing – questionnaire survey will be used to collect primary information from about 300 evacuees in two main groups: people who have already returned and people who are still living apart from their original places as before the accident.

The findings from this research can help to answer the question: is there any difference of what shapes people in making their decision of relocation between a nuclear accident and a natural disaster. These expected results are believed very important for local government in making appropriate policy. The possible correlation between variances such as age, gender and occupation and the decisions of relocation will also be examined. The findings of the factors that shape population mobility will contribute to the speculation of the changes in population structure in the future.

Keywords : nuclear disaster, disaster relocation, Minami Soma, disaster migration, disaster social recovery.

Individual difference of radiosensitivity evaluated by semi-automatic cytokinesis-blocked micronucleus (CBMN) assay



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

[1] Dept. Genetics and Cell Biology, RIRBM, Hiroshima University
[2] Research Center for the Mathematics on Chromatin Live Dynamics, Hiroshima University
[3] Dept. Obstetrics and Gynecology, Grad. Sch. Bio. Med., Hiroshima University
[4] Dept. Cellular Biology, RIRBM, Hiroshima University

Keywords: *Cytokinesis-block micronucleus assay, radiosensitivity*

Current standard for radiological protection is uniformly established to the public. However, it has been suggested that the individual difference of radiosensitivity exists in human populations, and that the nucleotide variants on DNA repair genes might be the genetic determinant for the individual difference.

DNA double strand breaks (DSBs) induced by ionizing radiation are recognized and fixed by the DNA repair system. Dampened DNA repair system causes chromosomal aberrations and cell death to induce acute and/or chronic radiation syndromes. Cytokinesis-block micronucleus (CBMN) assay is a sensitive method for detection of cellular radiosensitivity, which is based on a cellular event that when cells with unrepaired DSBs enter to mitotic phase, micronuclei form during telophase. Through the CBMN assay for cells with diverse genetic background, we are trying to develop the custom-made system for estimation of individual radiosensitivity.

In this study, we tested automated microscopically counting of micronucleated cells with using Metasystems Metafer MNScore algorithm combined with re-checking them by the human eyes. T his semi-automatic approach appeared to be much faster and accurate system for targeted selection of the binucleated cells with micronucleus in comparison with manual counting procedure. T he semi-automatic CBMN analyses using peripheral blood lymphocytes (PBLs) and isolated lymphocytes collected from the same individuals suggested the existence of individual differences in radiosensitivity. We also adapted a set of preparation protocol and Metafer algorithm for investigating the micronucleus formation in the adherent skin fibroblasts obtained from Japanese patients with genetic disorder. Our results proved that the developed semi-automatic CBMN approach could be successfully adapted for the estimation of radiosensitivity in different cell types.

8

Concentration of Cesium-134 and Cesium-137 in Soil and Rice in Fukushima Prefecture

NGUYEN Thanh Hai1, 2) and Satoru NAKASHIMA1, 2, 3)

1) Radioactivity Environmental Protection Course, Phoenix Leader Education Program, Hiroshima University

2) Department of Chemistry, Graduated School of Science, Hiroshima University

3) Natural Science Center for Basic Research and Development, Hiroshima University

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 cesium-134 and cesium-137 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 50 km far from FDNPP in 2012. The situation was investigated by Subcommittee concerning by chemical treatment, Japanese Society of Radiation Safety Management in 2013.2) There were four paddy fields (A, B, C and D). The fields are close to mountains. The water is taken from water of the mountain and Abukuma River. The radioactivity of rice in the husk from B was higher than those from A, C and D. In the present study we chose the paddy field in Oguraji as research field.

Soil, water, rice plant were obtained on April 26th, August 11th, and September 25th, 2014. 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 cesium-134 and 137, potassium-40 was measured by Ge semiconductor detector.

The water of field B in the sample of August 11th has much iron ion compared with other fields. Such condition may affect the solubility of cesium from soil. All the radioactivity of cesium-137 in rice was less than its 3σ. The radioactivity, however, in rice from B was slightly larger than 1σ. The measurements are ongoing.

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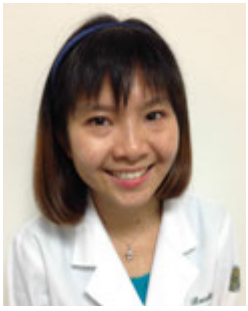
2) N. Matsuda and S. Nakashima, Radioactive Cesium in Water and Soil and Its Absorption by Rice Plant (in Japanese), Japanese J. Rad. Safety Manage., 13, 89 (2014).

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

VMAT multiple divided partial arcs in SBRT



Yen Hwa Lin, Shuichi Ozawa, Uranchimeg Tsegmed, Takeo Nakashima, Shintaro Tsuda, Yusuke Ochi, Daisuke Kawahara, Takuro Okumura, Tomoki Kimura, Yasushi Nagata

Department of Radiation Oncology, Graduate School of Biomedical and Health Sciences, Phoenix Leader Education Program, Hiroshima University, Japan

Keywords: SBRT, VMAT, flattening filter free, partial arcs, single breath hold

Purpose of study: To investigate the feasibility of single breath hold for liver stereotactic body radiation therapy (SBRT) using high dose rate volumetric modulated arc therapy (VMAT) multiple divided partial arcs against intensity modulated radiation therapy (IMRT).

Method: Ten hepatocellular carcinoma cases were planned with 10 MV flattening filter free beams using Pinnacle3 treatment planning system, which delivered by TrueBeam to administer 48 Gy over four fractions to the D95 of planning target volume. Eight non-coplanar beams were assigned to IMRT with step-and-shoot technique. For VMAT, two non-coplanar partial-arcs (< 180 degrees) were further divided into sub-arcs (< 80 degrees) to limit delivery time within 15 s. Dose distributions were verified using OCTAVIUS II system and pass rates were evaluated using gamma analysis of 3% per 3 mm at threshold of 25% to the maximum dose. The actual irradiation time was measured.

Results: The VMAT multiple divided partial-arcs are able to produce highly conformal plan compared with IMRT. The beam-on-time of VMAT (72.81 s) is shorter than IMRT (120.14 s) with $p \leq 0.01$. The percentage volume of liver-minus-gross-tumor-volume receiving 5 Gy for VMAT (31.90%) is lower than IMRT (36.27%) with $p \leq 0.01$. The plan verifications for both VMAT and IMRT acquire the pass rates higher than 90%.

Conclusion: VMAT with multiple divided partial arcs is a promising technique for liver SBRT as it is highly efficient and able to design 15 s breath hold beams without affecting the dose distribution compared with IMRT.

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Geographical distribution and radiocesium accumulation in a bryophyte *Hyophila propagulifera*, Musci.

Sharifah Nabihah Syed Othman, Okuda, T., Yamada, T., Takahara, T.
(Graduate School of Integrated Arts and Sciences)
Oguri, E., Deguchi, H. (Graduate School of Science)
Endo, S., Shizuma, K. (Graduate School of Engineering)

Even few years after the FNPP (Fukushima Nuclear Power Plant) accident, little is known about the biological contamination by the fallout of radioactive materials. This is particularly true for the taxonomically lower living organism, such as mosses, lichens. Focusing on a bryophyte species, *Hyophila propagulifera*, Murci that is widely distributed in the Fukushima region, we studied its radiocesium accumulation in relation to their habitat conditions.

As preliminary study, we collected 14 samples at 3 sampling sites around; Minami soma, and Soma city (Yokokawa dam, Mano dam area), on December 2013 The radiocesium were measured using gamma-spectrometry ranged from 2.7kBq/kg to 116.87 kBq/kg for radiocesium^{134} and from 7.37kBq/kg to 304.24 kBq/kg for radiocesium^{137}. The contamination levels usually higher in the slope than the other topography.

As a part of main studies, we expanded the study area Minami-soma city, Futaba, Namie-Cho and Iitate village and collected the samples of *Hyophila propagulifera* from 45 sites within the area mentioned above in November 2014. During the samplings, we also recorded habitat condition such as substrate type that the mosses were attached, slope angle, bearings and wind direction. Almost all the sample sites were located either near the roadside slopes or wall surface of residential area. Radiosecium contamination has not been measured yet, but we soon start to analyze the rediosecium contamination levels of collected mosses in relation to the distance from FNPP and habitat environments, and ultimately examine its phytoremediation potentials in absorbing and storing radioactive materials. For further study and survey, we continue the sampling at the same area (sites) in order to examine chronological variation of contamination level after the FNPP explosion.

Estimation of migration velocity of radio cesium in soil at Iitate Village

THANH TAT NGUYEN [1)], TAKUYA OKADA [1)*], KENICHI TANAKA [1)], TSUYOSHI KAJIMOTO [1)], SATORU ENDO [1)]

[1)] Graduate School of Engineering, Hiroshima University
* Present address: Kitagawa Iron Works Co.,Ltd.

Enormous earthquake and associated massive tsunami on March 11th, 2011 led to the accident of Fukushima nuclear power plant. Due to this accident, large amount of radionuclides had been released into the air. Wide area from Tohoku to northern Kanto was contaminated by these radionuclides. The radionuclides such as I-131, I-132, Te-132, Te-129 and Te-129 which have short half-lives of 8 days, 2 hours, 3days, 33days, respectively, has been decayed for a few months. In contrast, Cs-134 and Cs-137 have relatively longer half-lives of 2 years and 30 years. Contamination of Cs-134 and Cs-137 radionuclides are important for the environmental ecosystem. Movement of these radio cesium in soil are characterized by a migration velocity and a diffusion co-efficient, these data were accumulated and discussed by many researchers after Chernobyl accident. However, Japanese soil is quite different from those near Chernobyl, therefore the migration velocity and the diffusion co-efficient for Japanese soils are useful to estimate the transfer characteristics in the environmental ecosystem. In this report, depth profile of radio cesium concentration in 30 cm soil core has been measured and discussed.

The 30 cm soil cores have been collected from selected location in Iitate village in 2011, 2012, 2013 and 2014, annually. These cores were cut into 7 layers of 0-2.5 cm, 2.5-5cm, 5-10cm, 10-15cm, 15-20cm, 20-25cm and 25-30cm. Each sample was dried up at 800C for 17 to 24 hours, and sieved with 2.5 mm mesh size. Dried samples were filled into U-9 container (size 4.8 cm diameter and 3 cm height). Gamma-ray spectra have been measured by low background G-detector (ORTEC, GMX-30200-P) at Hiroshima University. The detection efficiency of Ge-detector has been obtained with the standard volume sources (Japan Radioisotope Association, MX-033). Sum-correction for Cs-134 gamma-rays of 605 keV and 796 keV are carried out by 1.13 and 1.14 which factors are estimated by EGS5 Monte Carlo simulation.

The depth profile results from 2011 to 2014 show that radioactivity concentration of Cs-137 has small change from surface soil to next layers. It means the migration velocity for soil in Iitate village is slow. Besides that, the migration velocity and diffusion co-efficient of each type of soil has difference. Calculation of the migration velocity and diffusion co-efficient for three locations show that the migration velocity and diffusion co-efficient are in range of 1.0 - 1.9 mm/year and 0.26 - 2.67 cm^2/year, respectively.

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FKTN gene expression in gastric cancer of atomic bomb survivors related to radiation exposure

Pham Thi Binh Trang, Htoo Zarni Oo, Kazuhiro Sentani,
Naohide Oue, Wataru Yasui
Department of Molecular Pathology, Hiroshima University
Institute of Biomedical and Health Sciences

Keywords: gastric cancer, atomic bomb survivor, radiation exposure

While the use of radiation in medicine, industry and nuclear power is accelerating, the effect of radiation on gastric cancer development has been estimated on the basis of the Life Span Study (LSS) conducted by Radiation Effects Research Foundation (RERF), and the excess relative risks per Gy were 1.20 for mortality and 1.32 for incidence. To identify genes associated with gastric cancer, we utilize Escherichia coli ampicillin secretion trap (CAST) method, which is a powerful tool for novel cancer biomarkers. By this method, we found that FKTN (fukutin) was overexpressed in gastric cancer. To elucidate the relation with radiation carcinogenesis, we analyzed FKTN expression from sporadic gastric cancer cohort and LSS cohort by immunohistochemistry. In the sporadic cohort of 695 gastric cancer samples, there was a significant correlation of FKTN expression in differentiated type gastric cancer. For mucin markers, a significant relationship was detected between FKTN and CD10 ($p<0.0001$). The LSS cohort of 86 gastric cancer samples showed FTKN expression downregulated in high-dose than in low-dose exposed patients ($p<0.0001$), but with no c orrelation between FKTN and mucin phenotype expression. This is the first analysis on the expression of fukutin protein in gastric cancers among atomic-bomb survivors and the radiation dose response, using immunohistochemistry. These results suggest that FTKN has a possible relationship with radiation exposure and gastric cancer among atomic bomb survivors.

Detection of immune suppressive activity in septic patient serum through DAMPs signals

Ho Minh Van[1], Kong Weng Sheng[2], Nobuyuki Hirohashi[1], Masamoto Kanno[2], Koichi Tanigawa[1]

[1.] Department of Emergency and Critical care Medicine, Hiroshima University

[2.] Department of Immunology, Hiroshima University

Background: Sepsis is a serious medical condition characterized by systemic inflammatory response syndrome (SIRS) caused by infection. Uncontrolled inflammatory responses to infection result in the collapse of the cardiovascular function, leading to multiple organ dysfunction syndrome (MODS) and death. Damage-associated molecular patterns (DAMPs) are danger signals, which are released during SIRS, and stimulate macrophages to produce interleukine-1 beta (IL-1ß) which is an important mediator of the inflammatory response. DAMPs are involved in a variety of cellular activities including cell proliferation, differentiation, and apoptosis.

Purpose: To investigate the immune suppressive activities content on septic patient serum under DAMPs signals.

Materials and methods: Serum of patients admitted to the ICU of Hiroshima University Hospital were taken on admission and analyzed for DAMPs activity at the Immunology department. DAMPs activity assays used THP-1 derived macrophages, which provide a well characterized DAMPs-induced secretion model of IL-1ß. THP-1 cells were treated with PMA for differentiation for 48hs. Cells were treated with serum of healthy donors, patients, and human serum mixed with DAMPs molecular (MSU, ATP, etc…) for 12hs. Cell culture medium was collected for detection of IL-1ß by Enzyme-linked immunosorbent assay (ELISA). After cells were treated for 12hs, cell-viability was examined by staining with Annexin V-FITC and PI via flow cytometry analysis. Septic patients were separated into two groups for further experiment based on the concentration of IL-1ß released after treatment. Those with values that showed a significant decrease were defined as suppression sepsis (sepsis (-)) or vice versa (sepsis (+)) in comparison with those of healthy donors.

Results: Five healthy donors and twelve septic patient serum samples were used in this study. The mean concentrations of IL-1ß in healthy donors, septic (+), and septic (-) patients were 309.8±41.4, 323.6±61.5, and 170.8±31.8 (pg/mL) respectively. We also measured the concentration of IL-1ß in macrophages stimulated by Adenosine Tri-phosphate (ATP) in the presence of serum, which was 397.4±16.3 pg/mL (donor), 360.7±56.2 pg/mL (sepsis (+)) and 186.7±45.0 pg/mL (sepsis (-)). The concentration of IL-1ß produced by Monosodium Urate (MSU) stimulation in the same condition was not difference. Total number of cell death after stimulation also decreases significant at sepsis (-) groups.

Conclusion: In this experiment, we found a subset of septic patients of which treatment of THP-1 macrophages resulted in significantly lesser production of IL-1ß than those of healthy donors. These suppression of IL-1ß released was also observed in the presence of DAMP molecules. The results indicate that these patient serum possesses an ability to inhibit inflammatory responses. The factor underlying this suppression is yet to be defined.

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Alternative Solution for Waste Disposal of Radiation Disaster

Ooki Kurihara[1)], Takashi Tsuchida[2)]

1) Graduate School of Engineering, Hiroshima University, Japan
2) Institute of Engineering, Hiroshima University, Japan

Keywords: Waste Disposal, Disaster Waste, Radioactive Waste

A large amount of disaster waste contaminated with radioactive cesium was generated by the accident of Fukushima Daiichi nuclear power plant in extensive area, mainly Fukushima Prefecture, and its disposal has become a big problem. Because there is no easy disposal method for topsoil generated by decontamination, incineration ash made by waste, and relatively high contaminated sludge in sewage treatment facilities and integrated river sediment, it has become a major obstacle in advancing the reconstruction projects. The amount of these wastes is estimated at 28 million m^3 in only Fukushima and Miyagi prefectures, but, there is moreover a possibility of further increase in the development of future reconstruction projects and decontamination.

Ministry of the Environment announced that the disaster waste below 8,000 Bq / kg is landfilled in the general waste disposal sites (managed final disposal site) as well as normal waste and the specified waste that exceeds 8,000 Bq / kg is disposed in managed final disposal site and cut-off type final disposal site by government responsibly. Ministry of the Environment is planning to build a final disposal site for the specified wastes such as rice straw and incineration ash in five prefectures that have a large amount of waste: Miyagi, Ibaraki, Tochigi, Gunma, and Chiba, however, there are opposition from local governments, for which no clear solution is yet in sight. Even now, four years will have passed from the earthquake, specified waste has been temporarily stored in such farmland and waste incineration facilities, and there is still no destination for the specified waste. It has become a challenge for the Ministry of the Environment that how they describe the safety of the facility and pave the way to safety disposal while obtaining an understanding from the residents and local governments.

In the recovery from the earthquake that Japan has experienced in the past, such as the Great Kanto Earthquake and the Great Hanshin-Awaji Earthquake, the disposal of disaster waste using the sea surface has been applied because a large amount of waste can be disposed and managed in one place compared with land disposal site. It has passed a few years from the earthquake, and as a result of changes in society, the contrary voice for disposal of the specified waste in each prefecture prescribed in the basic policy of the Act on Special Measures concerning the Handling of Contamination by Radioactive Materials has raised from the heads of relevant municipalities with respect to the final disposal site candidate site selection of specified waste containing radioactive material. Therefore, we considered the possibility use of waste disposal facility located off-shore for final treatment of wastes contaminated by radioactive cesium, from not only the scientific and technical aspects but also from historical, psychological and political aspects.

Measurement and Decontamination of Radioactive Cesium from Soil in Fukushima

Masaya Tsujimoto[1, 2)], Sunao Miyashita[2, 3)], and Satoru Nakashima[1, 2, 3)]

1) Radioactivity Environmental Protection Course, Phoenix Leader Education Program, Hiroshima University
2) Department of Chemistry, Graduated School of Science, Hiroshima University
3) Natural Science Center for Research and Development, Hiroshima University

The East Japan Great Earthquake with magnitude 9.0 occurred in the east of Japan h 11th 2011, about 4 years ago. The tsunami originating in this earthquake was as high as up to 15 m far beyond our imagination. Fukushima Daiichi Nuclear Power Plant (FDNPP) halted safely at the moment after the earthquake. It was, however, damaged seriously by tsunami. The cooling systems for nuclear reactor cores on Marc were lost, and the hydrogen was produced by the reaction of water with zirconium in the zircaloy cladding tube. Ultimately, the hydrogen explosions were triggered, and an enormous amount of radioactive nuclide was spread. A lot of surface soil on the ground was gathered and piled up in each temporary yard. It is necessary to make every effort to transfer radioactive waste efficiently to interim storage facilities and final disposal site. The purpose of this research is to explore the effective methods for decontaminating the soil contaminated by radioactive cesium. In the present study, we investigated the basic condition for decontamination.

The surface soil was sampled in the paddy field in Oguraji, Fukushima City, which is northwest, approximately 50 km far from FDNPP, on April 26th 2014. After drying at room temperature for 24 hours, the soil was separated by sizes, which were gravel (upward of 2 mm), sand (2 – 0.075 mm), silt (0.075 – 0.005 mm), and clay (less than 0.005 mm). The sieve classification was conducted for more than 72 hours with 250 rpm for separating gravel, sand, and silt including clay. In addition, clay was separated from silt by precipitation in the water for 1 hour. The separated gravel, sand, and silt were encased separately in a U-8 vessel and the radioactivity of cesium-134 and 137 were measured by Ge semiconductor detector.

The measurements revealed that silt had the highest radioactivity concentration (Bq/kg) among gravel, sand, and silt. However, the volume of silt is few and it is difficult to decontaminate cesium-134 and 137 from silt. On the other hand, the volume of sand is large and then large amount of radioactive cesium is adsorbed in sand, although the concentration is relatively low. In conclusion, we would like to propose that soil should be separated using sieve and the silt is transferred to interim storage facilities. The rest sand should be decontaminated. This is an effective way to reduce the total amount of stored soil. The decontamination study is ongoing.

Keywords
classification of particles, measurement of radioactive cesium in soil, decontamination, Fukushima

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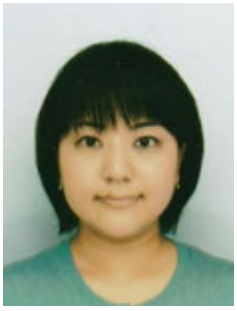
Effect of Fairness on Acceptance towards High Level Radioactive Waste Disposal Facilities



Fumie YAMAGUCHI, Kiriko SAKATA, and Hiroshi SHIMIZU

Graduate School of Integrated Arts and Sciences, Hiroshima University

NIMBY ("not in my backyard") problems have a contradictory nature: even though people recognize that NIMBY facilities contribute to public interests, they don't approve of their construction near their homes. The construction of high level radioactive waste (HLW) disposal facilities is a typical example of a NIMBY issue. The aim of this study is to investigate the effects of procedural fairness and loss of profits towards satisfaction and consent in group making decision. We conducted an online scenario-based experiment about consensus building of HLW disposal facilities and industrial waste disposal facilities (N = 800). We also investigated participants' attitudes towards nuclear power generation and radioactivity in order to make an exploratory study of specific determinants of nuclear-related facilities. In addition, we measured participants' attitudes towards stakeholders, e.g. local and national governments, in order to carry out an exploratory study of how people view issues about the construction of HLW disposal facilities.

Keywords: High level radioactive waste disposal facilities, NIMBY problem, procedural justice, consensus building

Chromosomal analysis in myelodysplastic syndrome and acute myeloid leukemia cell lines through the cytokinesis block micronucleous assay (CBMN) and cytogenetic study.

Silvia Natsuko Akutsu ,Ekaterina Royba, Tatsuo Miyamoto, Shinya Matsuura.

Department of Genetics and Cell Biology, RIRBM, Hiroshima University

Keywords: myelodysplastic syndromes, acute myeloid leukemia, cytogenetic, cytokinesis block micronucleus assay.

Introduction: Myelodysplastic Syndrome (MDS) and Acute Myeloid Leukemia (AML) are hematopoietic disorders characterized by various cytogenetic changes that are closely linked to the diagnosis. Chromosomal instability is considered one of the mechanisms of carcinogenesis in hematopoietic cells and is caused by the failure in the chromosome maintenance system. When unrepaired DNA double strand breaks exist during the mitosis, chromosomal fragments form micronuclei (MN) in a daughter cell. The increased frequency of MN thus is one of the markers of chromosomal instability. In contrast, the cytogenetic study can provide direct information about which kind of alterations on chromosomes occur when cells are exposed with ionizing radiations. Both these methods are useful for the quantitative evaluation of chromosomal instability.

Objective: MOLM-13 (AML cell line) and MDS-LGF (MDS cell line) were irradiated with different doses of gamma radiation, and the chromosomal instability was analyzed through CBMN assay and cytogenetic study.

Methods: The two cell lines were cultured in RPMI 1640 supplemented with 15% fetal calf serum at 37°C in humidified atmosphere containing 5% CO_2. After 24 hours, cell were diluted in new cell culture medium, at $2.5x10^5$ cells/culture, being five cultures of each strain were subjected to γ-radiation from 137Cs (40 Gammacell Extractor) at different doses (0 Gy, 0.5 Gy, 1.0 Gy , 1.5 Gy and 2.0 Gy). For CBMN assay, 3 μg/ml of cytochalasin B was added into each culture and cultured for 48 hours. For karyotype analysis, PHA was added, and after 48-hour culture, the cells were harvested.

Results: We counted the frequency of micronuclei in 2,000 binucleated cells for CBMN assay, and observed 100 metaphases for karyotype analysis. The MOLM-13 cell line exposed with 2 Gy of γ-radiation exhibited higher frequency of MN (6.35%) than MDS-LGF cell line (3.2%). Cytogenetic study also demonstrated more severe numerical (aneuploidy) and structural chromosome abnormalities (ring, dicentric, multicentric chromosome, chromosomal gap, chromosomal break, acentric fragments) in MOLM-13 before and after radiation exposure than those in MDS-LGF.

Conclusion: MOLM-13 cell line showed a higher frequency of MN as compared with LGF-MDS cell line when the level of radiation was more than 1 Gy, consistent with clinical severities. CBMN assay and cytogenetic study are techniques based on different cellular function but complementary for evaluating total chromosomal instability.

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Boshi hinanchu: Correspondence and Sentiment Analyses of Social Media Texts by Evacuated Mothers from Fukushima (Pilot Study)

KABIR Russell Sarwar

Hiroshima University Graduate School of Education,
Department of Clinical Psychology

Keywords: evacuation stress, affect classification, data mining, text and sentiment analysis, qualitative study, co-occurrence networks

The effects of prolonged exposure to low-dose radiation on health are still unknown. However, relative risks are higher in undifferentiated and developing tissues such as those found in children, infants, and the unborn. Childrearing insecurity from the uncertain prospects of living in radiation-affected communities has led to a degree of permanence in the migration patterns of evacuees, and taken a particularly heavy toll on the well-being of evacuated mothers. The nature of their migration suggests untreated mental health issues as sustained evacuees in migrated areas are less likely to have received area support services such as *Kokoro no Care* and the attention of the Fukushima Health Management Survey (FHMS). Purported stressors include fear of child deformities in pregnant women, fear of future cancer risk, loss of financial restitution, and loss of hometown support systems, among others. Results of the FHMS' Pregnancy and Birth Survey have shown a decrease in counseling questions by area mothers related to radiation and a steady increase in the "Other" free-comment category, suggesting unknown factors in childrearing anxiety post-radiation disaster. Moreover, the FHMS as a whole is suffering from participant attrition at an alarming rate. To account for these trends, this pilot study aims to supplement the FHMS by elucidating a new method for obtaining qualitative data on evacuated mothers which leverages their presence on social media and utilizes computational linguistics techniques to analyze their opinions. Through data mining, co-occurrence networks of words were found among evacuated mothers (n=8), and a novel text analytical tool known as "sentiment analysis" was conducted on hundreds of their Twitter microblogs available to the public. The results are forthcoming.

Impacts of the natural and human induced disaster on the domesticated animals

Chika Matsumoto, Toshinori Okuda, Kiriko Sakata, Toshihiro Yamada

Graduate School of Integrated Arts and Sciences Hiroshima University

When large scale disaster happened, not only human beings but also domesticated animals suffered seriously. The Great East Japan Earthquake accompanied by FNPP (Fukushima Nuclear Power Plant) accident caused large number of domesticated animals missed or left behind without food supply. Similar incidents could be seen elsewhere where local community and people suffered from natural disaster followed by heavy storms and landslides (e.g. in the outskirts of Hiroshima city in 2014). The negative feeling derived from guilty complex leaving the animal without care causes further psychological and social instability of evacuated residents. The sequential chains of physical and social damages upon the local community are due to the poor network and supporting system that could have been pre-established by administrative procedure (e.g. establishment of shelter for the missed/ accompanied animals, tracing back network of missing animals).

We hypothesize that these readiness / establishment of the supporting systems for animal care is a reflection of sociological maturity that can always pay attention to the vulnerable groups of a society. We examine this hypothesis with focusing on the readiness of the animal care by the local administration offices and networks. Under this hypothesis, we address the questions whether the local administrations offices in the disaster area have established any tracing back system for missing animals, food supply networks for the abandoned animals, or provision of sheltering space for missed or accompanied animals (e.g. companion animals rescued with local residents).

As a first step among these, we started preliminary study on the case of landslide disaster happened in August Hiroshima, 2014. We interviewed on officers at Animal Control Center of Hiroshima City Office, inquiring how the office encountered the problem for the provision of sheltering space for companion animals, and found that they practiced a project with NGO for establishment of sheltering space for domesticated animals accompanied by the evacuated peoples

For Future study, we are planning to extend the focal area to Fukushima and other disaster sites with the questions whether any similarity/ dissimilarity of animal care exists among the sites from the view points of the type of disaster (natural / human induced, periodicity of disaster or magnitude of disaster).

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Historical Implication of Special Student from Southeast Asia (Nanpo Tokubetsu Ryugakusei) who Survived the Atomic Bombing of Hiroshima

Yuji Hirano

Graduate School of Letters, Hiroshima University

Keywords: Atomic Bombing in Hiroshima, Special Students from Southeast Asia, Hiroshima University of Literature and Sciences, International Students Institute

Southeast Asian Students in Hiroshima in 1945:
During the Second World War, Southeast Asian students from the occupied areas were invited by the Japanese government in the framework of the "Nanpo Tokubetsu Ryugakusei" inviting program. About 200 young people came to Japan in two phases in 1943 and 1944. After their arrival, they received Japanese language education at the International Students Institute in Tokyo. Then they were sent to different higher education institutes all over the country.
Hiroshima Higher Normal School and the Hiroshima University of Literature and Science were important host universities for Special Southeast Asian Students. In 1944, 20 students entered Hiroshima Higher Normal School and in 1945, 9 students entered Hiroshima University of Literature and Science (4 of whom transferred from Hiroshima Higher Normal School).

Special Southeast Asian Students and Atomic Bombing in Hiroshima:
When the atomic bomb was dropped on Hiroshima, nine Southeast Asian students were enrolled at Hiroshima University of Literature and Science. Two of them died, but 7 of them miraculously escaped death. Although they had been exposed to radiation themselves, they did their best to help the citizens of Hiroshima. After going back to their countries, they conveyed the experience of being witness to the horrors of the atomic bomb and contributed extensively to the development of peace activities. Their work was considered as realization of Hiroshima University's principle of the "Pursuit of Peace". For these reasons HU decided to award 3 of the surviving former students from Southeast Asia (as of December 2012) with honorary doctorate degrees.

Future Research:
I would like to do my research on (1) historical implication of "Nanpo Tokubetsu Ryugakusei" inviting program, (2) the real situation of Special Student from Southeast Asia who survived the atomic bombing of Hiroshima. I am now collecting the related historical records and documents as well as interviewing with former Nanpo Tokubetsu Ryugakusei, former staff members of International Students Institute and Japan alumni associations in Southeast Asian countries.

Map
of
Hiroshima City
and
Symposium Venue

Map of Hiroshima central part

① JR Hiroshima Station

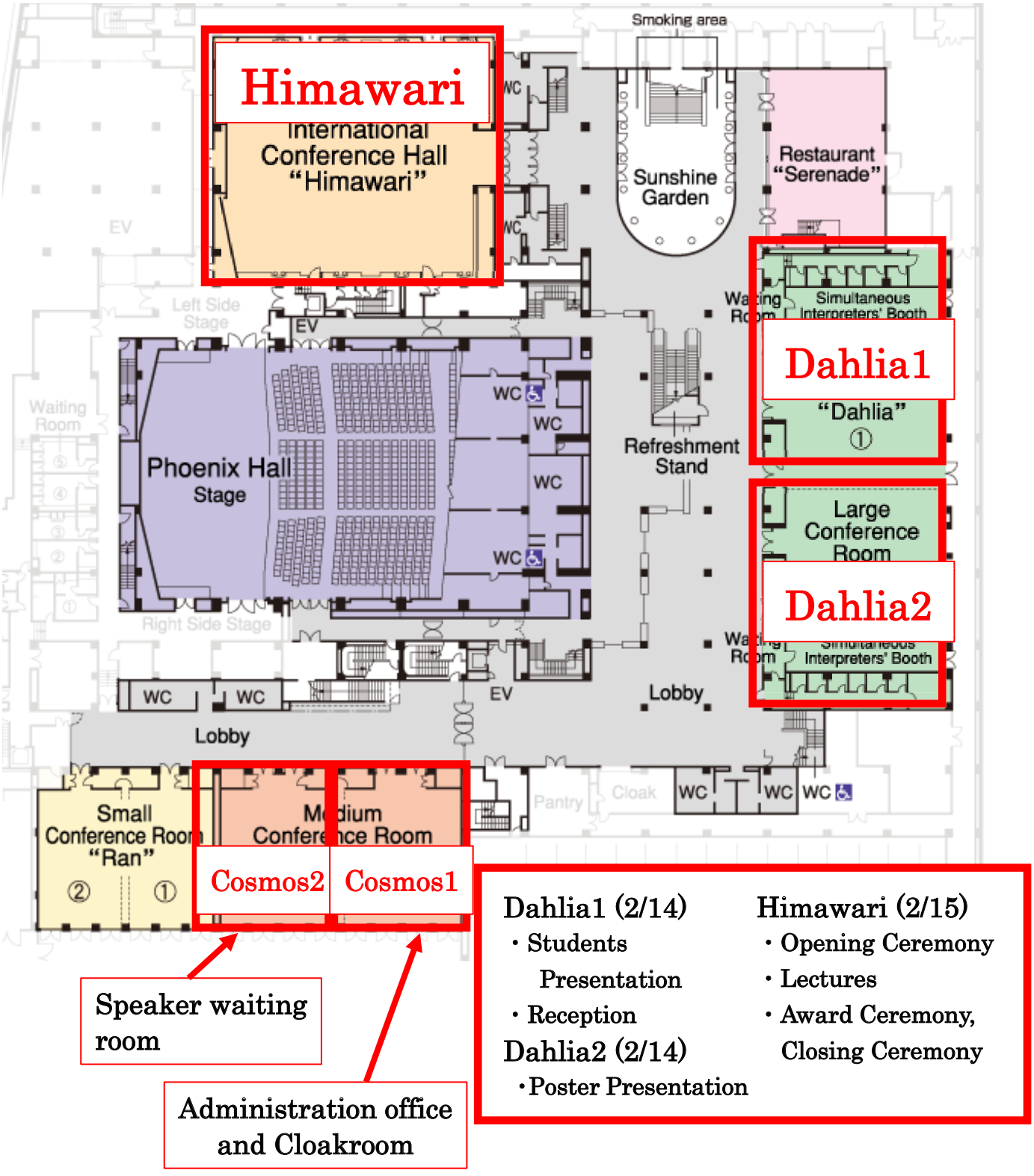
② International Conference Center Hiroshima（This symposium venue）

③ Hiroshima Peace Memorial Museum

④ Peace Memorial Park

International Conference Center Hiroshima

Floor Guide of second basement (B2F)



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Shuji Takahashi
(Associate Professor (Special Appointment), Graduate School of Science, Hiroshima University)

CONTACT

Hiroshima University Phoenix Leader Education Program Office
1-1-1 Kagamiyama, Higashihiroshima 739-8524　TEL: 082-424-6821
E-mail: phoenix-program@office.hiroshima-u.ac.jp
HP: http://www.hiroshima-u.ac.jp/en/lp/po/ra/

お問合わせ

広島大学フェニックスリーダー育成プログラム事務室
〒739-8524　広島県東広島市鏡山1-1-1　TEL: 082-424-6821
E-mail: phoenix-program@office.hiroshima-u.ac.jp
HP: http://www.hiroshima-u.ac.jp/lp/program/ra/