

Report

## Report on the Training Course for Fostering the Leaders in Radiation Emergency Medicine in Aomori Prefecture 2016

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This report introduces part of “Training Course for Fostering the Leaders in Radiation Emergency Medicine in Aomori Prefecture” which was held at Mutsu City in Aomori Prefecture in 2016. In collaboration with Aomori Prefecture, Hirosaki University promoted the “Education Program for Professionals in Radiation Emergency Medicine” from 2010 to 2014. The aim of the program was to develop and support human resources with advanced expertise, abilities, and skills related to radiation emergency medicine in the area. In the training course described here, the trainees who had completed the “Education Program for Professionals in Radiation Emergency Medicine” took part as instructors. Seventeen people mainly from the Shimokita District local government of Aomori Prefecture participated in the training. Before the training, participants underwent preliminary learning through an e-learning system focusing on topics such as radiation, biological effects of radiation, radiation protection, and effects of radiation on the human body. Then, lectures and practical training were conducted for three days. Although it was a valuable opportunity for trainees who had finished the “Education Program for Professionals in Radiation Emergency Medicine” to share their knowledge and skills to the participants, it seems necessary to have a multifaceted continuous training system.

*Key words:* radiation emergency medicine, human resources development, local government

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### 1. Introduction

There are numerous nuclear-related facilities in Aomori Prefecture, and human resource development in preparation for radiation emergency medicine is an essential task. In collaboration with Aomori Prefecture, Hirosaki University promoted the “Education Program for Professionals in Radiation Emergency Medicine” from

**Table 1.** Training program to foster the leaders in Radiation Emergency Medicine in Aomori Prefecture 2016

Previous learning (e-Learning)				
	Title	Contents	Class Person in Charge	Instructors
1)	Introduction to Radiation	Basic knowledge about units of radiation and the nature of radiation	Masahiro Hosoda, Lecturer, Hirosaki University Graduate School of Health Sciences	
2)	Introduction to Biological Effect of Radiation	Basic knowledge on biological effects of radiation	Hironori Yoshino, Assistant Professor, Hirosaki University Graduate School of Health Sciences	
3)	Introduction to Radiation Protection	Basic knowledge on radiation protection and regulation	Yoichiro Hosokawa, Professor, Hirosaki University Graduate School of Health Sciences	
4)	Introduction to Radiation Effect on Human Body	Effect of external and internal radiation exposure on human body	Ikuo Kashiwakura, Professor, Hirosaki University Graduate School of Health Sciences	
—Day 1— October 7 (Friday), 2016				
9:00 - 9:10	Opening Guidance	Opening Ceremony and Guidance	Ikuo Kashiwakura, Director & Professor, Hirosaki University Center for Radiation Support and Safety	
9:10 - 10:00 (50 min)	Outline of Radiation Exposure Medicine 1	"Aomori prefecture disaster prevention plan" Outline of Aomori Prefecture Regional Disaster Management Plan (Nuclear Power Edition)	Toshiya Kubo, Nuclear Safety Division, Aomori Prefecture Crisis Management Office	
10:10 - 11:00 (50 min)	Outline of Radiation Exposure Medicine 2	"Medical system for Nuclear disaster in Aomori Prefecture" Outline of medical system in Aomori prefecture at nuclear disaster	Taichi Kitaya, Medical and Pharmaceutical Administration, Aomori Prefecture Health and Welfare Department	
11:10 - 12:00 (50 min)	Outline of Radiation Exposure Medicine 3	"Problem of the atomic energy disaster prevention" Response of Hirosaki University to the Fukushima Daiichi Nuclear Power Plant incident and the issues of nuclear disaster prevention learned from investigation of radiation areas	Tomisato Miura, Associate Professor, Hirosaki University Graduate School of Health Sciences	
12:00 - 13:00	Lunch			
13:00 - 13:50 (50 min)	Fundamental Radiation Exposure Medicine 1	"Radiation Fundamentals" Confirmation of Basic Knowledge about Units of Radiation and the Nature of Radiation	Shinji Tokonami, Professor, Institute of Radiation Emergency Medicine, Hirosaki University	
14:00 - 14:50 (50 min)	Fundamental Radiation Exposure Medicine 2	"Influence of Radiation on Human Body and Radiation Protection" Fundamentals of Deterministic effect, Stochastic effects, External exposure, Internal exposure, Radiation Protection	Shinji Tokonami, Professor, Institute of Radiation Emergency Medicine, Hirosaki University	
14:50 - 15:00	Questionnaire			

2010 to 2014. As a nuclear disaster prevention measure, this is a plan to develop human resources with advanced expertise, abilities, and skills related to radiation emergency medicine. By contributing to human resource development and networking in the area, it is possible to construct a more advanced emergency radiation medical system.

From this point of view, Hirosaki University received a request from Aomori Prefecture to carry out the "Training Course for Fostering the Leaders in Radiation Emergency Medicine in Aomori Prefecture" in 2015. The first training course was carried out at Hirosaki University, and the second one was held in Mutsu City in Aomori Prefecture in 2016. In both training courses, the trainees who had finished the Education Program for Professionals in Radiation Emergency Medicine took part as instructors. The program in the second training course is shown in Table 1. Seventeen people mainly from the

Shimokita District local government of Aomori Prefecture participated in the training. Before the training, participants underwent preliminary learning through an e-learning system focusing on topics such as radiation, biological effects of radiation, radiation protection, and effects of radiation on the human body. Then, lectures and practical training were conducted for three days following the schedule shown in Table 1. In this paper, we will report the training contents on the second and third days, wherein the trainees who had finished the Education Program for Professionals in Radiation Emergency Medicine were involved.

## 2. Fundamentals of Radiation Emergency Medicine

Lectures and practical training on the Fundamentals of Radiation Exposure Medicine were carried out on day 2 by 13 trainees who had finished the Education Program

—Day 2— November 11 (Friday), 2016				
14:00 - 15:40 (100 min)	Fundamental Radiation Exposure Medicine 3	“(Practice) Basics of radiation measurement” Lecture on radiation measurement equipment (air dose rate, surface contamination, individual dose), handling of individual dosimeter, handling of survey meter, nature of radiation, characteristics of radiation measuring instrument	Yoichiro Hosokawa, Professor, Hirosaki University Graduate School of Health Sciences	Instructors for Practice (Finished Trainees of Education Program for Professionals in Radiation Emergency Medicine)
15:50 - 16:50 (60 min)	Inspection for Evacuees; Simplified Decontamination Procedure 1	“Outline of Inspection for Evacuees and Simplified Decontamination Procedure” The purpose of inspection at evacuation exit zone, understanding of reference value (OIL 4), procedure of inspection, simplified decontamination method, handling of contaminants	Takakiyo Tsujiguchi, Assistant Professor, Hirosaki University Graduate School of Health Sciences	Teruaki Maeda, Akiyoshi Yamada, Kenichiro Watanabe, Yoshinori Fukui, Megumi Hattori, Taiga Kawamura, Hidetomo Sugisawa, Akira Numayama, Ayumi Abe, Junko Mikami, Masataka Narita, Hikaru Sasatake
16:50 - 17:10	Q & A, Questionnaire			
17:30 - 19:30	Information Exchange Meeting			
—Day 3— November 12 (Saturday), 2016				
9:00 - 11:00 (120 min)	Inspection for Evacuees; Simplified Decontamination Procedure 2	“Outline of Inspection for Evacuees and Simplified Decontamination Procedure” Confirmation of equipments necessary for simplified decontamination, methods of simplified decontamination (residents etc.), role play (residents and inspectors)	Takakiyo Tsujiguchi, Assistant Professor, Hirosaki University Graduate School of Health Sciences	Instructors for Practice (Finished Trainees of Education Program for Professionals in Radiation Emergency Medicine)
11:10 - 12:10 (60 min)	Distribution, Taking Stable Iodine Agent 1	“Distribution, Taking Stable Iodine Agent” Stable iodine agent taking, effects and distribution method etc.	Hitoshi Yamamura, Director & Professor, Advance Emergency and Critical Care Center, Hirosaki University Hospital	Teruaki Maeda, Akiyoshi Yamada, Kenichiro Watanabe, Yoshinori Fukui, Megumi Hattori, Taiga Kawamura, Hidetomo Sugisawa, Akira Numayama, Ayumi Abe, Junko Mikami, Masataka Narita, Hikaru Sasatake
12:10 - 13:10	Lunch			
13:10 - 14:40 (90 min)	Distribution, Taking Stable Iodine Agent 2	“(Practice) Emergency Distribution of Stable Iodine Agent” Consultation on emergency distribution of Stable Iodine Agent, Preparation of Liquid Iodine Agent	Chieko Itaki, Professor, Hirosaki University Graduate School of Health Sciences	
14:40 - 15:10	Review, Q & A, and Comment		Toshiya Nakamura, Professor, Hirosaki University Graduate School of Health Sciences	
15:10 - 15:20	Closing Ceremony		Ikuo Kashiwakura, Director & Professor, Hirosaki University Center for Radiation Support and Safety	
15:20 - 15:40	Questionnaire			

for Professionals in Radiation Emergency Medicine (shown in Table 1, Photo 1).

The class started with a lecture on the basics of radiation and radioactivity (Photo 2) and then moved to handling of dosimeter, survey meter, etc. The lecturers used easy-to-understand words tailored to fit the educational level of participants. Afterwards, the participants were divided into six groups (with three participants each) and underwent practical training for various survey meters with the assistance of trainees who had finished the Education Program for Professionals in Radiation Emergency Medicine. They listened attentively to the explanation in handling the survey meters and thereafter practiced using them (Photo 3 & 4).

After the explanation in handling the dosimeter, the

discussion proceeded to the use of Geiger-Mueller (GM) and NaI scintillation-type survey meters. After the background measurement method was explained, the participants learned how to handle the GM survey meter. They observed the influence of the distance (5 cm, 10 cm, 15 cm, 20 cm, 25 cm, and 30 cm) from the Co-60 sealed source on the measurement of the radiation. Then, they practiced attenuation of radiation dose by using shielding materials of 2 mm Al and 2 mm Pb.

Furthermore, in the surface contamination test, participants were able to observe how changes in measurement speed and time constant affected the measured values.



Photo 1.



Photo 2.



Photo 3.



Photo 4.

### 3. Inspection for Evacuees and Simplified Decontamination Procedure

Following the lecture and practice about the Fundamentals of Radiation Exposure Medicine, training of the inspection for evacuees and simplified decontamination procedure was carried out after the second training day. Participants learned how to put on and take off the Tyvek® protective suit (Photo 5 & 6). Then, with the help of the staff, who played the role of evacuees, background measurement training using the NaI scintillation counter and body surface contamination screening using the GM survey meter were carried out (Photo 7 & 8). Furthermore, in simplified decontamination practice, participants learned how to undress and wipe off for decontamination, and how to treat when it did not become below Operational Intervention Level 4 (OIL4, which is the screening level for decontamination against surface contaminations on the skin, clothes and others) even after the procedure of decontamination (Photo 9). It was the first experience for most participants in handling measuring instruments. It

seemed necessary to continue the future holding in order to acquire what they had learned. From that point of view, the authors would like to propose that the participants of this training be utilized as guiding instructors for future training. By doing so, the contents learned during the present training can be brushed up, and also the participants may be able to form relationships with new participating members.

### 4. Distribution and Intake of Stable Iodine Agent

On the third day of training, lectures and practical training on the “Distribution and intake of stable iodine agent” were provided.

The lecture on the “distribution and intake of stable iodine agent” was carried out in the morning and also included topics such as the description of iodine, thyroid exposure to radioactive iodine during nuclear accidents and disasters, anatomical description of the thyroid gland, thyroid cancer, the Chernobyl and Fukushima Daiichi nuclear power plant accidents, pediatric thyroid cancer, pharmacological explanation of stable iodine agent,



Photo 5.



Photo 6.



Photo 7.



Photo 8.

nuclear disaster medical system of Aomori Prefecture and Japan, nuclear disaster preparedness guideline, the distribution system of stable iodine agent, etc. It seems that not many participants (government officials) fundamentally understood the necessity of a stable iodine distribution system, especially advanced and emergency distributions. Based on cases of actual accidents, the lecture showed how iodine (including radioactive iodine) acts on the thyroid gland, how stable iodine is used properly, and why pre- and urgent distribution are necessary.

Classes in the afternoon focused on the storage of stable iodine and precautions on its use; details on pre-distribution, urgent distribution, and dosage of stable iodine; and the preparation of liquids from stable iodine powder. Afterwards, simulation on the distribution of stable iodine agent was carried out, wherein the participants played as distributors and instructors as citizens (Photo 10).

The stable iodine agent has no effect on nuclides other than radioactive iodine and is mainly taken for supplementing protective measures such as evacuation



Photo 9.

and indoor escape. The distribution patterns are divided into (1) preliminary distribution and (2) emergency distribution, and the correspondence between the two is different, so detailed explanation was provided.

In addition, the preparation of a stable iodine solution was also mentioned during the class. The liquid preparation is to be formulated for infants who have



Photo 10.



Photo 11.

difficulty taking in potassium iodide pills. Even within the manual nuclear disaster countermeasures and issuance from the nuclear material protection department, in the PAZ, it is difficult to provide pills to infants and young children under three years because there is no liquid stable iodine available in advance. Depending on the description of preferential evacuation, some municipal governments need liquid formulations assuming urgent distribution is needed at the evacuation destination. With regard to the formulation of stable iodine solution, the participants were only allowed to observe the demonstration by university staffs, because the potassium iodide powder was considered a dangerous drug (Photo 11). As for liquid medicine, a jelly-like preparation was released by Nichi-Iko (Toyama City Generic Pharmaceutical Manufacturer) in July 2016, and its distribution already started in Tomari Village and Kyowa-cho in Hokkaido. With the introduction and promotion of this jelly preparation, manuals of the national and local governments are expected to be revised accordingly.

Based on the contents of these lectures, participants were simulated for both pre-distribution and emergency distribution. It was suggested that the participants should be aware of the procedures and problems at the time of their response and make use of the results of this practice.

##### 5. The Future of Fostering the Leaders in Radiation Emergency Medicine in Aomori Prefecture

As mentioned above, the 2016 training course for fostering the Leaders in Radiation Emergency Medicine in Aomori Prefecture was held for three days after prior learning through an e-learning system. With the current situation in Aomori Prefecture, distribution of stable iodine agent has started in Higashidori Village since November 2016, and the distribution rate was about 60%

in February 2017. There was also a request from Aomori Prefecture to Hirosaki University to have an intensive training on the distribution of stable iodine, and a program was organized based on this. On the other hand, basic knowledge of radiation emergency medicine is needed prior to the training of the distribution of iodine agents. Therefore, balance between the lecture and the practice concerning the basic knowledge related to radiation was necessary in this training. We, the trainees who underwent the Education Program for Professionals in Radiation Emergency Medicine, have completed a specialized and systematic curriculum for three years. From that standpoint, it is impossible for participants without background knowledge about radiation to become leaders in just three days. Therefore, it seems necessary to have a multifaceted training system such as taking this continuously for such training and participating with the intention as a leading position in Aomori Prefecture's nuclear emergency drills.

Through this training course, however, participants gathered from each municipality were able to learn the fundamentals of radiation and radioactivity, and it may be possible to improve their skills as local government employees to provide reassurance and safety to local residents. In addition, we think that it is important for each participant to act as leaders in their area and share information they have learned to municipal officials.

It was a valuable opportunity for trainees who had finished the Education Program for Professionals in Radiation Emergency Medicine to impart his/her knowledge and skills to the participants. Some trainees were accustomed to teaching classes, while others had no experience in teaching; however, we think that they could cooperate with each other and give satisfactory guidance to the participants. If these courses continue to be held in the future, more leaders will be able to improve their nuclear disaster response capacity not only in Aomori

Prefecture but also for the rest of Japan. From the viewpoint of reducing the burden of staff and accumulating the experience of personnel in charge, we think that it is important for participants who finished this training to share their roles as instructors.

#### **Conflict of Interest Disclosure**

The authors declare that they have no conflicts of interest.