Tomoyuki Takahashi *Editor*

Radiological Issues for Fukushima's Revitalized Future

Springer Open

Radiological Issues for Fukushima's Revitalized Future

Tomoyuki Takahashi
Editor

Radiological Issues for Fukushima's Revitalized Future

Springer Open

Editor
Tomoyuki Takahashi
Research Reactor Institute
Kyoto University
Kumatori, Osaka, Japan

ISBN 978-4-431-55847-7 ISBN 978-4-431-55848-4 (eBook)
DOI 10.1007/978-4-431-55848-4

Library of Congress Control Number: 2015958094

Springer Tokyo Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer Japan KK is part of Springer Science+Business Media (www.springer.com)

Foreword

When the Fukushima Daiichi nuclear power plant accident occurred in March 2011, Japanese society lost trust in nuclear safety. Many ordinary people hated radiation and radioactive materials, although quantum beams and radioisotopes are very useful for basic research and industry. We struggled to decide upon what efforts we should make in this situation, and finally we at the Kyoto University Research Reactor Institute (KURRI) started a new program called "KUR Research Program for the Scientific Basis of Nuclear Safety" in 2012.

As an educational part of this program, we started the "Across-the-Board Nuclear Educational Program". The weakness in the education about nuclear engineering is the fragmentation of different areas of expertise, although all experts know that nuclear engineering should be an integrated discipline. Therefore, we tried to take a new approach to cultivate highly educated nuclear engineers with a wide perspective and a synthesis of engineering judgment. Our institute has a wide variety of nuclear research facilities, such as research reactors (KUR and KUCA), accelerators (FFAG, cyclotron, e-linac), hot laboratory and tracer lab. We can create practical training courses for graduate students to experience the usage of radiation and/or radioisotopes. This experience will give them deeper knowledge than working on paper.

As a research module, we started the "Research Program for Scientific Basis of Nuclear Safety," which includes integrated nuclear safety research and the amassing/verification of accident data. One of the most important activities is the development of KURAMA (Kyoto University Radiation Mapping system), which is a GPS-aided mobile radiation monitoring system. It was developed in KURRI and has played an important role in evaluating the air dose rate in Fukushima and other parts of Eastern Japan.

Four international symposia also have been held annually for summarizing the results of this program. The titles of the symposia were "Environmental Monitoring and Dose Estimation of Residents After the Accident of TEPCO's Fukushima Daiichi Nuclear Power Stations" (December 14, 2012), "Nuclear Back-end and Transmutation Technology for Waste Disposal" (November 28, 2013)

and “Earthquake, Tsunami and Nuclear Risks After the Accident of TEPCO’s Fukushima Daiichi Nuclear Power Stations” (October 30, 2014). The final one was also held in Fukushima (May 30–31, 2015), entitled “Radiological Issues for Fukushima’s Revitalized Future”. It is very significant for us that the final symposium was held at the starting point of our program.

On behalf of KURRI, I wish to thank all the participants in our four symposia and the collaborators in our program. We also express our special gratitude to the people in Iizaka, Fukushima. KURRI hopes that this publication will promote further progress in nuclear safety research and will contribute to the revitalization of Fukushima.

Kyoto University Research Reactor Institute Yuji Kawabata
Kumatori, Osaka, Japan

Preface

Four years have passed since the accident at Tokyo Electric Power Company's Fukushima Daiichi nuclear power station, and gradual steps have been taken toward environmental recovery in Fukushima. However, there are still many issues that need to be tackled in order to achieve the full revitalization of Fukushima. These issues encompass many different disciplines such as economics, psychology, and sociology. I believe the role of the sciences related to radiation and radioactivity is especially important.

An international symposium titled "Radiological Issues for Fukushima's Revitalized Future" was held in Iizaka-onsen, Fukushima, Japan, May 30–31, 2015. We invited experts, researchers, and the general public to attend this symposium and think together, through lectures, poster presentations, and panel discussions, about the concrete steps that need to be taken toward the revitalization of Fukushima.

In this symposium, 14 invited lectures and more than 70 scientific posters were presented. We selected 20 presentations for publication in this book. These manuscripts were peer-reviewed by experts in the field to form the chapters of the book and were divided into the four contents as follows:

Part 1 Radioactivity in the Terrestrial Environment

This part consists of six chapters related to the identification and migration of radionuclides in the terrestrial environment. It is important to clearly define the behavior of radionuclides, such as radiocesium in the terrestrial environment, to evaluate the long-term effect of the accident. These chapters give useful information on the present status and characteristics of radionuclides in the terrestrial environment.

Part 2 Decontamination and Radioactive Waste

This part consists of three chapters related to the safety of the decontamination system and the treatment of radioactive waste. The safe treatment and disposal of waste generated by decontamination are the most important problems needing quick resolution for the revitalization of Fukushima. These chapters focus on the safe treatment and reduction of cesium in waste.

Part 3 Environmental Radiation and External Exposure

This part consists of four chapters related to the development of a measurement system for environmental radiation and the evaluation of external exposure. For the residents of Fukushima, external exposure comes predominantly from contact with radiocesium. Therefore, development of a high-accuracy system for measuring environmental radiation and a method for evaluating external exposure are required. These chapters are a response to the request of government bodies and the public for such developments.

Part 4 Radioactivity in Foods and Internal Exposure

This part consists of seven chapters related to the identification of radionuclides in farm products, control of radionuclide root uptake, the decrease in radionuclide concentration by food processing, and the evaluation of internal exposure. Some of the chapters report that the internal dose by ingestion is not very high. However, the level of uneasiness among the public with regard to contamination of food is high. In addition, some agricultural products, such as peaches, are special products of Fukushima. These chapters provide information about the safety of food products and should help ease some of the worries of the public. This information can also be useful for the revitalization of some industries.

This book focuses on Fukushima's revitalized future. It is difficult to cover all the radiological issues; however, I believe that the advanced research presented here provides useful information and data to help in that revitalization.

Osaka, Japan Tomoyuki Takahashi

Cooperators

Hirofumi Tsukada (Vice-Director, Institute of Environmental Radioactivity, Fukushima University)
Hirokuni Yamanishi (Kinki Univ.)
Hiromi Yamazawa (Nagoya Univ.)
Itsumasa Urabe (Fukuyama Univ.)
Noriyuki Momoshima (Kyushu Univ.)
Takeshi Iimoto (Univ. Tokyo)
Sumi Yokoyama (Fujita Health Univ.)
Minoru Yoneda (Kyoto Univ.)
Jiro Inaba (REA)
Kimiaki Saito (JAEA)
Shigeo Uchida (NIRS)
Takatoshi Hattori (CRIEPI)
Masahiro Osako (NIES)
Hajimu Yamana (NDF)
Yuji Kawabata (Director, Research Reactor Institute, Kyoto University)
Sentaro Takahashi (Vice-Director, Research Reactor Institute, Kyoto University)
Tomoyuki Takahashi (Research Reactor Institute, Kyoto University)
Satoshi Fukutani (Research Reactor Institute, Kyoto University)
Hiroshi Yashima (Research Reactor Institute, Kyoto University)
Nobuhiro Sato (Research Reactor Institute, Kyoto University)
Maki Nakatani (Research Reactor Institute, Kyoto University)