



The Accident at Tokyo Electric Power Company Incorporated's Fukushima Daiichi Nuclear Power Station: A Review of Radiation-Exposed Medical Care and Waste (Secondary Publication)

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ABSTRACT

This review is based on articles published in *Japanese Journal of Health Physics* on “Radiation-exposed medical care and waste” related to Tokyo Electric Power Company Incorporated (TEPCO)'s Fukushima Daiichi Nuclear Power Station accident. Here, we have considered three original articles; one technical data, one special article, one 50th anniversary article, one preface, three topics, and two cases of From Japan to the World (J to W). These articles have reported the system and standards that were established after the accident. Moreover, they have summarized rare experiences such as the fumbling response at the time and the evaluation of samples in that disaster. These articles constitute valuable records of the situation.

Keywords: Fukushima Daiichi Nuclear Power Station, 1F Accident-Related Articles, Japanese Journal of Health Physics, 1F Accident-Related Articles, Radiation Medicine, Radioactive Waste

Review

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Introduction

The articles related to Tokyo Electric Power Company Incorporated (TEPCO)'s Fukushima Daiichi Nuclear Power Station accident published in the *Japanese Journal of Health Physics* include: (1) three original articles; (2) one technical data; (3) one special article; (4) one 50th anniversary article; (5) one preface; (6) three topics; and (7) From Japan to the World (J to W), including two articles.

This study presents an overview of these 12 articles.

Research Papers

Three original articles, and one technical data were evaluated in this study.

The three original papers were “The rectal temperature estimation method based on tympanic temperature for workers wearing protective clothing in nuclear facilities” by Takahashi et al. [1], “Estimation of doses from radioactively contaminated disaster wastes reused for pavements” by Sawaguchi et al. [2], and “Dose estimation for the re-use of wooden chips contaminated by radioactive cesium” by Takai et al. [3].

Takahashi et al. [1] attempted to develop an equation to predict rectal temperature

based on tympanic membrane temperature and heart rate of the workers. The researchers wore protective clothing at nuclear facilities for reducing the risk of heat stroke among workers and for more safety-oriented work management. Sawaguchi et al. [2] evaluated radiation doses when contaminated concrete debris was used as recycled materials for roadbeds. This was performed to provide technical information for the formulation of handling policies for the reuse of disaster waste contaminated by radioactive materials. Takai et al. [3] evaluated the exposure dose of wood and wood wastes potentially contaminated by radioactive cesium when they were reused as recycled materials.

Technical data was presented under the title “Developing an educational program to help students learn about the resident evacuation protocols and contamination inspection undertaken during nuclear disasters” by Tsujiguchi et al. [4]. The authors introduced table-top teaching materials developed to help university undergraduates understand the evacuation exit inspection in a comprehensive manner.

Special Articles and 50th Anniversary Articles

In the special article, Sugiyama [5] introduced “Framework concept of radiological protection from radioactive waste management in existing exposure situations.” The main point of the article is that the target value of the reference level for the disposal of buried waste should be set at 1 mSv/yr. The reduction of exposure doses through waste management should be achieved toward this goal; and it should be done by selecting a balanced and gradual reference level according to the progress of environmental remediation.

In an article commemorating the 50th anniversary of the first issue by Hattori [6] in 2015, a record of trial calculations of provisional regulation values for radioactive iodine for fish and shellfish is presented. The article refers to a commentary paper on an article by Suga and Ichikawa [7] published in 2000. It covers the index for food and drink intake limits in the disaster prevention guidelines. The commentary article includes details of the method used to derive the provisional regulation values, which is informative. The author expresses hope that more such articles will appear in the future.

Preface, Topics, and from Japan to the World

In the preface on food contamination (Magwood [8]), the author discusses not just the concerns regarding exposure

from ingestion of contaminated food, but the wide-ranging effects on domestic distribution and trade with other countries too. The preface also addresses the need for agreement on international distribution standards and measurement methods for potentially contaminated food, based on lessons learned from this incident. The three articles on the topic are related to the state of radiation exposure medicine (Ohno [9] and Sei [10]) and exposure medicine training (Hosoda et al. [11]).

In the first article (Ohno [9]), regarding the phenomenon that confused medical personnel at the time of the Fukushima nuclear accident (e.g., people who did not need radiation exposure medicine, visited hospitals), the idea of radiation education for the entire population was expressed. It includes the education of medical personnel by health physics personnel as a necessity to prevent such phenomenon. The second article (Sei [10]) expresses the author’s opinion on the future of radiation exposure medicine from the standpoint of a diagnostic radiologist with administrative experience. The third article (Hosoda et al. [11]) reports on the participation in the Radiation Emergency Medicine training at Radiation Emergency Assistance Center/Training Site (REAC/TS) in the United States. The training comprised lectures on the basics of health physics, exercises in handling survey meters, and emergency medical training. The training was found to be sufficient for those new to radiation exposure medicine.

In J to W, there were two reports: “Toward safe decommissioning of nuclear facilities: development of safety assessment code for decommissioning activities” [12] and “The Radiation Emergency Medical Assistance Team and their vehicles” [13].

The former, “Toward safe decommissioning of nuclear facilities,” is an article about a calculation code developed for safety assessment of decommissioning of nuclear facilities and reports calculated doses for workers and the public during dismantling of Japan Power Demonstration Reactor. The article concludes that the calculated values are in good agreement with the measured values during the dismantling work and are reliable, and that the code will be applied to the decommissioning of nuclear facilities in the future. The Japan Atomic Energy Agency (JAEA) published JAEA R&D Review in 2011, and this article was reprinted from the journal.

The latter article, “The Radiation Emergency Medical Assistance Team and their vehicles,” describes Radiation Emergency Medical Assistance Team (REMAT) vehicles owned by the former National Institute of Radiological Sciences. It describes in detail the functions of three vehicles: a vehicle that

serves as a field command post, a vehicle that transports contaminated patients in an emergency, and a vehicle for dosimetry that specializes in estimating internal radiation doses.

Conclusion

This paper has presented an overview of 12 articles on radiation exposure medicine and waste. They were published in *Japanese Journal of Health Physics*. The articles include the contents related to systems and standards established after the TEPCO's Fukushima Daiichi Nuclear Power Station accident. They present valuable records and experiences of the authors. The authors investigated in tough conditions and conducted the measurements with passion and determination in the disaster area.

Conflict of Interest

Dr. Kuniaki Nabatame is an employee of Fujita Corporation.

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Ethical Statement

This article does not contain any studies with human participants or animals performed by any of the authors.

Author Contribution

Conceptualization: Fujibuchi T. Supervision: Fujibuchi T. Validation: Fujibuchi T. Writing - original draft: all authors. Writing - review & editing: all authors. Approval of final manuscript: all authors.

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