

Guidelines for Relief Activities under Nuclear Disasters

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Introduction

2 years have passed since the Great East Japan Earthquake and Tsunami outbreak. Once again I would like to offer my sincere condolences for all who were killed by the disaster, and also I would like to express my sympathies to all the affected people.

Japanese Red Cross Society has dispatched the relief teams from all over the country to the affected areas since the day one of the Great East Japan Earthquake and Tsunami, and in Fukushima Prefecture, the relief teams have started their relief activities at the coastal cities, towns and villages.

However, in the Japanese Red Cross Society relief activities, traditionally there were no specific relief activity guidelines on the occurrence of a nuclear disaster, and therefore, when the Tokyo Electric Power Company Fukushima Daiichi Nuclear Power Plant Accident occurred, the safety could not be guaranteed for the relief teams that were not prepared for the nuclear disaster.

As a result, in the evening on March 13 at the Fukushima Chapter, the Chapter staff and the each relief teams gathered and held the meeting to discuss the relief activity measures under the radiation environment. At the meeting it was determined that Fukushima Chapter would be unable to secure the safety measure under the radiation environment and therefore, each relief team was to contact its own Chapter or hospital where it belongs to and received the orders from them. So the relief teams from outside have left Fukushima one after another.

Subsequently, on March 15 Japanese Red Cross Society decided the response policy of not performing the relief activities within 30 kilometers from the affected nuclear power plant. From March 22, in Fukushima Chapter, the dispatch of the Radiation Emergency Medical Care Advisers and the preparation for the necessary protective equipment and materials have started. With the note from Japanese Red Cross Society National Headquarters on April 22, the safety measure structure in Fukushima Prefecture has finally been established. Because of these safety measures, the relief activities in Fukushima Prefecture have restarted gradually.

Unfortunately because the clear standard for the safety confirmation for the relief team under the radiation environment did not exist, and also the necessary equipment and materials were not prepared, the relief activities in Fukushima Prefecture were not necessarily performed as desired. From these painful experiences of the Great East Japan Earthquake and Tsunami, Japanese Red Cross Society has learned an important lesson: At the relief activities on the occurrence of a nuclear disaster, prepare the complete set of the necessary equipment and materials, have the relief teams understand the radiation correctly, and clarify the standard of behavior for the relief teams.

The relief teams of Japanese Red Cross Society are not the professional radiation emergency medical care teams. Therefore, naturally there is a limitation on the nuclear disaster responses. However, on the occurrence of radiation damages under the complex disasters, the cooperation among the concerned medical institutions as well as the collaborative relationships between the radiation emergency medical care institutions and the disaster medical care institutions are very important. For this purpose it is now essential for Japanese Red Cross Society to clarify what can be done as well as what cannot be done.

With the background described above, and hereby, with the guidance from the internal and external professionals such as Dr. Masao Tomonaga, Director of Japanese Red Cross Nagasaki Genbaku Hospital, Dr. Makoto Akashi, Executive Director at National Institute of Radiological Sciences and Dr. Hisayoshi Kondo, Director at National Disaster Medical Center, we have published the activity guidelines under the nuclear disaster for the relief teams of Japanese Red Cross Society.

Based on these guidelines, starting at 2013, by preparing for the necessary protective equipment and materials and setting up the safety measure facilities for the relief teams, we will steadily strengthen our capabilities at the disaster.

March, 2013

Hiroki Tomita
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Chapter 1 Course of Action and Code of Conduct for the Relief Team

1. Course of Action

On the occurrence of a nuclear disaster, the Japanese Red Cross Society will conduct the relief activities outside of the area restricted by the national/local authorities. The individual cumulative exposed doses during the relief activities shall not exceed 1 mSv.

2. Code of Conduct

- (1) On the occurrence of an actual or a potential nuclear disaster, a relief team member shall undergo a special medical examination prior to the dispatch. The permission of the dispatch to the affected areas shall be determined and authorized by the dispatching Director of the Red Cross Hospital. Furthermore, if at all possible, the relief team shall be staffed by a radiological technologist who will pay attention to the sufficient safety measures during the relief activities.
- (2) The relief team member shall wear a complete set of the protective suit and carry a personal digital dosimeter, iodine tablets necessary for the radiological protection. In addition, if at all possible, each relief team shall carry a dosimeter for measuring the air dose rate and a GM survey meter for the body contamination screening. In order to guarantee the true and real measurements of the radiation exposure of each relief team member, these personal digital dosimeters, shall be examined and calibrated as necessary for their precisely specified functions and accuracies beforehand.
- (3) At the Disaster Response Headquarters of the affected area, (hereinafter called “Response Headquarters”), the relief team member shall gather the information on the nuclear disaster and its associated safety measures, while verifying the regulations and considerations concerning their activities.
- (4) The relief team member shall measure and document his/her own radiation exposure levels at the end of each daily operation. If the cumulative dose of radiation is in danger of exceeding 1 mSv, the relief team leader shall mandate him/her to discontinue the activities and evacuate to the safety neighbor.
- (5) When dealing with the evacuees from the restricted areas, the relief team shall perform its activities under the condition of the integrated accommodating system consisting of the screening, decontamination, and the medical relief by the local authorities, following the instructions by the professionals engaging in these activities. Furthermore, the relief team shall define its own scope of the medical relief activities, and shall thoroughly publicize them to every authority concerned.
- (6) Upon the completion of the relief activities, the relief team shall submit the records of each team members' radiation exposure measurements to the Response Headquarters when pulling out from the affected area.

The Response Headquarters shall in turn submit the radiation exposure measurement records (hereinafter called “radiation records”) to the Headquarters of the Japanese Red Cross Society. The Headquarters of the Japanese Red Cross Society shall lock up the radiation records.

- (7) The Director of the Red Cross Hospital, who dispatched the relief team members, shall make certain that any individual member with the cumulative exposed doses measurement exceeding 1 mSv shall not be engaged in the relief activities at the affected areas for the period of 1 year, except for the radiation workers whose cumulative exposed doses measurements are separately managed and controlled by the government.

[Reference 1] The concept for the 1 mSv cumulative dose of radiation criteria

1. Respecting the individual dose of radiation limits advised by the International Commission on Radiation Protection (ICRP)

- The limit of the dose set by ICRP is defined as the base to restrict the effective individual dose of radiation from various radiation sources as the total amount. The specific limit value of the dose of radiation is defined according to the concept to prevent the deterministic effect as well as to rationally minimize the stochastic effect.

As for the specific tissues such as the crystalline lens and the skin, .., the limit of the dose of radiation is defined based on the individual threshold from the point of view to prevent the deterministic effect.

About the stochastic effect such as cancer and the genetic diseases, in case of a radiation worker, the lower limit of dose at the impermissible risk level is estimated at 20 mSv annually (equates to the life time dose of radiation of 1 Sv).

In case of the public, considering the estimated result of the age-specific mortality risk by the life time dose of low level radiation and the 1 mSv annual dose of radiation by the natural background radiation exposure excluding the radon exposure, the effective annual dose value of 1 mSv is advised as the limit of dose.

Incidentally, the limit of dose has been set in order to restrict the individual dose of radiation, and therefore, it restricts the total amount of the radiation doses from the entire sources of radiation (however, the medical radiation exposure and the natural background radiation exposure are excluded).

2. Referring to the advice by the International Committee of the Red Cross (ICRC)

- As a result of the Fukushima Nuclear Power Plant Accident, the nuclear disaster specialists from ICRC visited the Japanese Red Cross Society on March 19, 2011 and gave advices on the nuclear disaster handling. The contents of the advises are as follows:
 - Any relief team member who has not received the nuclear disaster training is considered to be the same as the general public, and therefore, he/she is limited to be exposed to the upper limit of 1 mSv per dispatch based on the ICRP advice.
 - The relief team member shall carry a personal dosimeter during the relief activities.
 - In order to shorten the exposure time, the relief team member shall evacuate to the safe area and rest at night.
 - Maintain the structure that the professionals can always give advises.
 - Record the exposure time, place of the activities and the radiation exposure levels of each relief team member.

Japanese Red Cross Society referred to these advices and performed the relief activities in Fukushima.

[Reference 2] Scope of activities based on 1 mSv cumulative dose of radiation
(Incorporating the Tokyo Electric Power Company
Fukushima Nuclear Power Plant Accident as an example)

- As a base, the activity durations for the JRCS relief team are 3 days for the initial primary dispatch, 5 days or less for the secondary dispatch, and 1 week or less thereafter, respectively.
- Suppose the relief team continuously performs the relief activities for 3 days ceaselessly at the site where the average hourly air dose rate is $10 \mu\text{Sv}$, the cumulative dose of radiation will be estimated at $720 \mu\text{Sv}$ ($10 \mu\text{Sv} \times 24 \text{ hours} \times 3 \text{ days}$). However, this is just an imaginary case assuming the relief team member stayed outdoors for the maximum of 24 hours a day and therefore, if he/she moves to a place where the dose of radiation exposure is lower at night, the influence on the dose of radiation can be further reduced.
- Figure 1 (page 5) indicates the air dose rate measurement points and their corresponding measured values in the area at 20 km and further beyond Tokyo Electric Power Company Fukushima Nuclear Power Plant on March 17, 2011 (source: Ministry of Education, Culture, Sports, Science and Technology).
At certain places like the Measurement Point 32, higher air dose rates greater than $100 \mu\text{Sv}/\text{hour}$ were detected and therefore, hindering the relief activities under the 1 mSv cumulative dose of radiation limitation even though they are outside of the evacuation zone (subsequent restricted zone). (However, likewise a sufficient bandwidth for the relief team to evacuate to the safer areas can be secured).
Meanwhile, at the vast majority of the places, the air dose rates are $10 \mu\text{Sv}/\text{hour}$ or less, and hence one can easily understand that the relief activities for 3 days or more will be well within their capacity in many places.
- Furthermore, back in those days, while the outside air dose rates surrounding Fukushima Red Cross Hospital were 8 to $10 \mu\text{Sv}/\text{hour}$, the air dose rates inside the hospital were $1 \mu\text{Sv}/\text{hour}$ and less. This means that when performing the relief activities indoors the actual air dose rates will be considerably low.
- Consequently, for the relief activities at the nuclear disaster, it is important to comprehend the air dose rates at the place of the relief activities and the individual cumulative dose of radiation and to get a handle on the situation while performing the activities calmly without being hasty.

<Figure 1> Air Dose Rates Surveillance Results Surrounding Fukushima Nuclear Power Plant



Quoted from the Ministry of Education, Culture, Sports, Science and Technology homepage Translated by Japanese Red Cross Society.

[Reference 3] Special Medical Examinations

The special medical examination shall be performed mainly by the history taking.

At the history taking the existence of radiation exposure and subjective symptom shall be checked and evaluated, and if the physician determines the necessity, the examinations, based on the ones for the radiologist, listed on the Table 1 shall be taken:

Ordinance on Prevention of Ionizing Radiation Hazards

(Medical examination)

Article 56

1. The employer shall let the worker, who is regularly engaging in the radiological operation and entering the controlled area, undergo a series of medical examinations listed below by a physician at the time of hiring or at the transferring to the concerned operations and every 6 months thereafter periodically:
 - (1) Check and evaluate the existence of radiation exposure (for the person with the radiation exposure, the place of the activities, the existence of subjective symptom, and other items related to the radiation exposure).
 - (2) The number of leucocyte and the differential leukocyte count.
 - (3) Inspection of the erythrocyte count and the inspection of the hemoglobin content or the hematocrit value.
 - (4) Eye examination concerning cataract.
 - (5) Skin Examination.
2. Among the examination items listed above, for those that should be performed at the time of hiring or at the transferring to the concerned operations, the item (4) can be skipped depending on the types of the radiation sources.
3. Regarding the 5 examination items listed above, for those that should be performed periodically, if the physician confirms and determines, some or all of the items 2 through 5 can be skipped.
4. Regardless of the orders described in the Section 1 above, for the medical examinee, if the cumulative dose of radiation in the prior year does not exceed 5 mSv and there is no possibility of accumulating doses exceeding 5 mSv in the current year, the items 2 thorough 5 need not be performed if the physician does not determine their needs.

Quoted from the Ministry of Health, Labor and Welfare homepage

<Table 1>

<Reference> Example: Dose of radiation exposure record of a relief team member

Individual dose of radiation control

Dispatch Origin	Dispatch Destination	Relief Team Name	Employee Number	Employee Name			
Date/Time	Area of Activities	Contents of Activities	Period of Activities	Dose of Radiation	Cumulative Dose of Radiation	Protective Method	Place of Stay
February 12, 2013	XXX Ave., City of YYY	First Aid Station Set Up	12:00-20:00	1µSv	1µSv	Relief Suit	XXX Ave., City of YYY
February 13, 2013	Same as above	Same as above	08:00-19:00	5µSv	6µSv	Relief Suit + Mask	Same as above
February 14, 2013	Same as above	Same as above	08:00 -17:30	10µSv	16µSv	Protection Suit	Same as above
February 15, 2013	Same as above	Same as above	08:00 -17:30	7µSv	23µSv	Relief Suit + Mask	Same as above
February 16, 2013	Same as above	Same as above	08:00 -17:30	6µSv	29µSv	Relief Suit + Mask	Same as above
February 17, 2013	Same as above	Withdrawal	07:0010:00	1µSv	30µSv	Relief Suit + Mask	

<Table 2>

Chapter 2 Radiation Emergency Medical Care Adviser

1. Appointment and Assignment of Radiation Emergency Medical Care Advisers

- (1) On the occurrence of an actual or a potential nuclear disaster, in order to perform the relief activities safely and properly, Japanese Red Cross Society shall appoint the Radiation Emergency Medical Care Advisers, consisting of the radiological expert (physician) and the radiological support member (radiological technologist) at the Local Chapter Disaster Control Headquarters in the affected area and if necessary, at the Disaster Response National Headquarters.
- (2) Japanese Red Cross Society National Headquarters shall, in advance, assign well-qualified persons to the Radiation Emergency Medical Care Advisers, and shall concurrently renew the persons' data every year to share with the Local Chapters and the facilities.
- (3) The assignments to the Radiation Emergency Medical Care Advisers shall be given by the JRCS President upon the recommendations from the Chapter Chiefs.

2. Roles of the Radiation Emergency Medical Care Adviser

(1) Radiological Expert (physician)

- A. Preliminary education on the safety measure for the relief team members
 - (a) Knowledge on the radiation
 - (b) How to put on and take off the protective suit
 - (c) How to use the dosimeters
- B. Emergency evacuation orders for the relief teams in action
 - (a) Orders to put on the protective suit
 - (b) Evacuation orders
- C. Subsequent education on the safety measure for the relief team members
 - (a) Health care based on the dosimeter measurements
 - (b) Caution on your future life

(2) Radiological Support Member (radiological technologist)

- A. Dosimeter management
 - (a) Comprehend the air dose rates by the air dose rate survey meter
 - (b) Explanation on the adjustment and the specific use of the dosimeter
 - (c) Record management of the relief team members' dose of radiation exposure
 - (d) Record management of the lending and return of the dosimeters
- B. Management of the protective suit
Supply, delivery to the relief team members, and the lending and return record management of the protective suit.
- C. Other items ordered by the Radiological Expert

3. Dispatch of the Radiation Emergency Medical Care Adviser

- (1) On the occurrence of an actual or a potential nuclear disaster, JRCS Headquarters shall immediately appoint the Radiation Emergency Medical Care Advisers to be dispatched to the Local Chapter Disaster Control Headquarters in the affected area, and shall request the dispatch to the Chapter where the Radiation Emergency Medical Care Adviser belongs.
- (2) The Chapter, upon receiving the request, shall dispatch the Radiation Emergency Medical Care Advisers to the Local Chapter Disaster Control Headquarters in the affected area.
- (3) The Local Chapter Disaster Control Headquarters in the affected area shall follow the advices from the Radiation Emergency Medical Care Adviser and performs the medical relief activities by the relief teams while paying close attention to the safety measures.

Chapter 3 Responses from the Radiation Emergency Medical Care Facility

1. Medical Activities of the Radiation Emergency Medical Care Facility

On the occurrence of a nuclear disaster, the radiation emergency medical care facilities assigned by the local authorities of the affected area where the Chapter is in, Hiroshima Red Cross Hospital & Atomic-bomb Survivors Hospital, Japanese Red Cross Nagasaki Genbaku Hospital and Fukushima Red Cross Hospital (hereinafter called “radiation emergency medical care facilities”) shall perform the feasible radiation emergency medical care activities at the facilities in the affected area, based on the requests from the local nuclear emergency response headquarters assigned by the government and the local authorities.

2. Dispatch of the Radiation Emergency Medical Care Specialists

Japanese Red Cross Society National Headquarters, based on the request from the local Chapter of the affected area, when it becomes necessary to send the radiation emergency medical care specialists, shall request the dispatch of the radiation emergency medical care specialists to the Chapters with the designated radiation emergency medical care facilities outside of the affected area.

The requested Chapter shall, if at all possible, dispatch the radiation emergency medical care specialists consisting of the physicians, radiological technologists and nurses to the medical facilities in the affected area in order to support the radiation emergency medical care activities.

3. Roles of the Radiation Emergency Medical Care Facilities

- (1) The Japanese radiation emergency medical care structure consists of “Primary Radiation Exposure Medical Institution” that performs the primary care and emergency medical care regardless of the existence of the body contamination, “Secondary Radiation Exposure Medical Institution” that performs specialized medical care, and “Tertiary Radiation Exposure Medical Institution” that performs highly specialized medical care. The radiation emergency medical care facilities of Japanese Red Cross Society are listed on Table 3.

Chapters	Hospitals	Designation
Miyagi Chapter	Ishinomaki Red Cross Hospital	Primary Radiation Emergency Medical Care Facility
Fukushima Chapter	Fukushima Red Cross Hospital	Prefectural Residents' Health Care Management & Survey Facility
Ibaraki Chapter	Mito Red Cross Hospital	Primary Radiation Emergency Medical Care Facility
Fukui Chapter	Fukui Red Cross Hospital	Primary Radiation Emergency Medical Care Facility
Shiga Chapter	Nagahama Red Cross Hospital	Secondary Radiation Emergency Medical Care Facility (planned)
Kyoto Chapter	Maizuru Red Cross Hospital	Primary Radiation Emergency Medical Care Facility
Shimane Chapter	Matsue Red Cross Hospital	Primary Radiation Emergency Medical Care Facility
Hiroshima Chapter	Hiroshima Red Cross Atomic Bomb Hospital	Nuclear Radiation Effects Counter Measure Research Institute
Ehime Chapter	Matsuyama Red Cross Hospital	Secondary Radiation Emergency Medical Care Facility
Saga Chapter	Karatsu Red Cross Hospital	Secondary Radiation Emergency Medical Care Facility
Nagasaki Chapter	Nagasaki Red Cross Atomic Bomb Hospital	Nuclear Radiation Effects Counter Measure Research Institute

<Table 3>

(2) The Radiation Emergency Medical Care Institutions are displayed on Table 4 below:

Categories	Primary Radiation Emergency Medical Care Facility	Secondary Radiation Emergency Medical Care Facility	Tertiary Radiation Emergency Medical Care Facility
Medical Care Functions	Outpatient Care	Inpatient Care	Specialized Inpatient Care
Medical Institutions	1. Evacuation center (First-aid station) 2. Health center 3. Office medical facilities(site first-aid stations) 4. Vehicles, ships, aircraft 5. Medical facilities designated in local disaster prevention plans ^{*1,2}	Medical facilities designated in local disaster prevention plans	1. National Institute of Radiological Sciences (includes the Institute's Radiation emergency medical care network council) 2. Local tertiary radiation exposure medical institutions
Surveillance, Screening, Dose Evaluation	1. Surveillance of body contamination 2. Screening 3. Individual dose evaluation with a simple dosimetry	1. Surveillance of body contamination 2. Screening 3. Specialized individual dose evaluation (technical support from the tertiary radiation exposure medical institutions)	1. Surveillance of body contamination 2. Highly specialized individual dose evaluation
Decontamination	Simple decontamination like wiping off	Decontamination using the shower facilities	In addition to the decontamination processes at the primary and the secondary radiation exposure medical institutions, a highly specialized decontamination like the lung wash as needed
Medical Treatments	1. Radiation syndrome preventive treatment like dosing potassium iodide 2. Resuscitation (ACLS ^{*3}) 3. Complicated injuries (wounds, burns) 4. Initial treatments for internal exposure patients	1. Treatment for patients with local exposure starts 2. Treatment for patients with high dose exposure starts 3. Treatment for complicated injuries 4. Treatment for patients with internal exposure starts	1. Treatment for patients with critical local exposure 2. Treatment for patients with high dose exposure 3. Treatment for critical complicated injuries 4. Treatment for patients with critical internal exposure
Equipment and Materials	Gadgets for the medical service workers to perform emergency outpatient care	Decontamination shower facilities, equipment and materials for the wide area disaster medical information system	Specialized equipment and materials for dose of radiation exposure evaluation, equipment and materials for the wide area disaster medical information system

Categories	Primary Radiation Emergency Medical Care Facility	Secondary Radiation Emergency Medical Care Facility	Tertiary Radiation Emergency Medical Care Facility
Hospital and Clinic Cooperation	1. Outpatient care 2. Outpatient care ⇒ transfer	1. Inpatient care 2. Treatment starts ⇒ transfer	Transfer between specialized medical institutions
Training, Practice	1. Perform training and practice 2. Prepare radiation emergency medical care manual	1. Perform training and practice 2. Prepare radiation emergency medical care manual 3. Raise radiation medical care leaders	
Support Functions	1. Cooperation between medical institutions and nuclear operators (various survey meters and dispatch of radiation administrator) 2. Cooperation between nuclear operators, support	1. Technical support and dispatch of specialists to primary and secondary radiation exposure medical institutions 2. Lending first aid medical equipment and materials for nuclear emergencies	1. Cooperation within the regional blocks 2. Technical support and dispatch of specialists to other radiation exposure medical institutions 3. Lending first aid medical equipment and materials for nuclear emergencies
Notes	1. Medical care functions can be divided and shared by each other within the multiple medical institutions including the existing evacuation centers, health care centers, and emergency medical institutions. 2. Streamline the facilities capable of providing primary emergency medical care for the radiation exposed patients.	1. At the existing medical institutions, the medical care functions like dosimetry, decontamination and emergency medical care can be divided and shared by each other within the multiple medical institutions. 2. For opening or relocating the emergency radiation exposure medical institutions, it is desirable to have the facilities, equipment and the materials, necessary for the emergency radiation exposure medical care, streamlined within the same medical institution.	

*1 Streamlines the facilities capable of providing primary emergency medical care for the radiation exposed patients (institutions near the nuclear facilities).

*2 Includes the medical institutions capable of providing emergency support contracted by the business facilities.

*3 Advanced Cardiac Life Support

Quoted from the Disaster Medical Center, National Hospital Organization homepage

<Table 4>

Chapter 4 Education and Training of Radiological Protection for the Relief Team Members

1. National Red Cross Relief Team Workshop

- (1) JRCS Headquarters shall, at the National Red Cross Relief Team Workshop, educate the relief team members the safety measures for the relief activities under the influence of the radioactive exposures instructed by the Radiation Emergency Medical Care Advisers.
- (2) JRCS Headquarters shall, in addition to the above, give practical training on the handling procedures of the equipment and the materials like the personal dosimeters, and the wearing tips for the protective suits to the relief team members.

2. Basic Relief Team Workshop at the Red Cross Chapters

Each Chapter, utilizing the educational materials from the National Red Cross Relief Team Workshop, shall provide the education and the training opportunities to disseminate the safety measures for the relief activities under the influence of the radioactive exposures within the jurisdiction of the Chapter.

Chapter 5 Basic Knowledge on Radiation

On the occurrence of a nuclear disaster, the knowledge on the radiation and the radiological protection are at most important to perform the relief activities. The relief team member himself must have an accurate knowledge of the radiation to wash out the excessive fear on the radiation.