

Nuclear Disaster Response Basic Training Session

## Relief Team Activities during a Nuclear Disaster

and

#### **Collaboration with Radiation Emergency Medical Care Advisors**

(English translation)

(Translated by the Red Cross Nuclear Disaster Resource Center)





#### Relief activities during a nuclear disaster

If you are a relief team member...

Are you really able to engage in relief activities in areas affected by a nuclear disaster?

If you are a leader...

Are you really able to send your staff to areas affected by a nuclear disaster?





Source: "Photos and Videos Library", a webpage of Tokyo Electric Power Company Holdings, Inc. <u>http://photo.tepco.co.jp/en/index-e.html</u>



#### What is your image about relief activities during a nuclear disaster?





Photo: IFRC

#### TEPCO's Fukushima Daiichi Nuclear Power Plant accident



# What are JRCS\* relief teams required to do during a nuclear disaster?

\* Japanese Red Cross Society



Medical relief activities during a nuclear disaster affecting a wide area

- ★ General disaster relief activities outside of areas to which the government, etc. restricts public access ("restricted areas, etc.").
- $\star$  Body contamination screening for survivors.
- $\star$  Radiation emergency medical care.



#### General disaster relief activities outside of restricted areas, etc.



Photo: JRCS

2011.3.12 First aid station set up at Koyo Junior High School in Soma City, Fukushima Prefecture



2011.3.13 Photo: Mobile clinic activities in Kawamata Town, Fukushima Prefecture



#### Body contamination screening to survivors



Photo: JRCS



#### Radiation emergency medical care



Photo: JRCS

2011.3.13 Nihonmatsu City, Fukushima Prefecture Exercise for radiation emergency medical care



Photo: JRCS



Medical relief activities during a nuclear disaster affecting a wide area

Activity that JRCS relief teams are supposed to provide.

- ★ General disaster relief activities outside of the restricted areas, etc.
- $\star$  Body contamination screening for survivors.
- ★ Radiation emergency medical care.

### Who is targeted for JRCS relief activities?



Source: Shiga Prefecture's manual for radiation emergency medical care. (Partially edited.) <u>http://www.pref.shiga.lg.jp/e/kenko-t/files/kinkyuhibakuiryoumanual2015.pdf</u>

Disorder from radiation exposure Body surface contamination	No disorder	Mild	Moderate	Severe
Still contaminated even after decontamination procedures.	Diseases and traumas will be responded by primary/secondary radiation emergency hospitals.	Radiation disc responded by primary/secor radiation eme hospitals.	orders will be ndary rgency	Radiation disorders will be responded by tertiary radiation emergency hospitals.
Not contaminated or no contamination left after decontamination procedures.	Diseases and traumas will be responded by normal medical arrangements.	Whether or not any radiation disorder is observed. Radiation disorders will be responded by primary/secondary radiation emergency hospitals.		

Whether or not any body surface contamination is left.

(The table above was translated by the Red Cross Nuclear Disaster Resource Center.)

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## Who is targeted for JRCS relief activities?



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Radiation emergency medical care

Radiation disorder from radiation exposure Body surface contamination	No disorder	Mild	Moderate	Severe
Still contaminated even after decontamination procedures.	Diseases and traumas will be responded by primary/secondary radiation emergency hospitals.	Radiation disorders will be responded by primary/secondary radiation emergency hospitals.		Radiation disorders will be responded by tertiary radiation emergency hospitals.
Not contaminated or no contamination left after decontamination procedures.	Diseases and traumas will be responded by ordinary medical arrangements.	Radiation disorders will be responded by primary/secondary radiation emergency hospitals.		

## JRCS relief team activities

(The table above was translated by the Red Cross Nuclear Disaster Resource Center.)

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# Radiation exposure and surface contamination



## Radiation exposure and surface contamination

Make sure to understand the difference!



Body surface contamination



Contaminated patient and people around him/her may be exposed to radiation

Source: Chapter 1 (basic knowledge on radiation and health effects) of a comprehensive document published by the Ministry of the Environment about basic knowledge and data regarding health effects, etc. from radiation. http://www.env.go.jp/chemi/rhm/kisoshiryo/h27shiryo1a.html (in Japanese) (The chart above was translated and modified by the Red Cross Nuclear Disaster Resource Center.) 12

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## External exposure





#### Response to external exposure



In case of any disorder from radiation exposure: **Response by** radiation emergency medical care

> In case of no disorder from radiation exposure: Medical response by **JRCS** relief teams

# from the patient.







#### Internal exposure





#### Internal exposure





#### Response to internal exposure



Skin and tissues shield  $\alpha$ -ray and  $\beta$ -ray. The radiation will barely be released out of the body.

Even if you touch the body surface of a patient, radioactive materials will not contaminate you.



#### Relief team members will unlikely be exposed to radiation.



#### Prevention of internal exposure





#### Surface contamination



Radioactive materials that are attached to surface of the body/subject.



#### Surface contamination

# , **6** 0 M **Problem of the surface contamination:** The contamination will spread if it is , Č, not respond to in a proper way.



#### Response to surface contamination



In case that the body surface contamination is still substantially left: Radiation emergency medical care is needed.

In case that the body surface contamination is reduced: (Less than a hazardous level ≠ 0) Medical response by relief teams is provided.



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#### Prevention of surface contamination



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## Make sure to understand the JRCS's code of conduct for relief team activities during a nuclear disaster.







1. Activities by relief teams shall be conducted outside of restricted areas, etc.

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

1. Course of action

In the event of a nuclear disaster, the Japanese Red Cross Society (hereinafter called "JRCS") will conduct the relief activities <u>outside of</u> an area restricted by the national/local authorities to enter (hereinafter called "restricted area, etc."), as long as cumulative doses of radiation do not exceed 1 mSv during an activity.

("Manual for Relief Activities during Nuclear Disasters")

#### Flow chart during a nuclear disaster





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#### Flow chart during a nuclear disaster





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# 2. Activities by relief teams shall be conducted as long as cumulative doses of radiation do not exceed 1 mSv.

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

1. Course of action

In the event of a nuclear disaster, the Japanese Red Cross Society (hereinafter called "JRCS") will conduct the relief activities outside of an area restricted by the national/local authorities to enter (hereinafter called "restricted area"), as long as cumulative doses of radiation <u>do not exceed 1 mSv</u> during an activity.

("Manual for Relief Activities during Nuclear Disasters")



#### Types of external exposure

- External exposure from a point source.
- External exposure from the environment.

#### External exposure from a point source



#### Dose decays to 1/distance<sup>2</sup>. $\Rightarrow$ <u>Get away from the source !</u>



#### External exposure from the environment





#### Radiation exposure from the environment during a nuclear disaster





#### Calculation of cumulative radiation dose





#### Calculation of cumulative radiation dose



To reduce the 3-day cumulative dose to less than 1 mSv $\cdots$ 1 mSv $\div$ 72 hours  $\doteqdot$  13.9 µSv/h

Your activity area should be only an area of less than 14µSv/h of air dose rate?

Distribution of air radiation level during the Great East Japan Earthquake





Source: Results of the 2nd Airborne Monitoring by the Ministry of Education, Culture, Sports, Science and Technology and the U.S. Department of Energy (Conducted in May 2011.) <u>http://radioactivity.nsr.go.jp/en/contents/4000/3165/24/1304797\_0616e.pdf</u>

Even outside the restricted areas, etc. (i.e. beyond 20 km of the nuclear power plant), the air dose rate reached as high as about 45 µSv/h in some areas.

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#### Control of cumulative radiation dose





#### Shielding from environmental exposure



Wooden house: approx. 40µSv/h



Block- or brick-house: approx. 20µSv/h

First floor of 3- to 4story building: approx. 5µSv/h



Multi-story building: Upper floors: approx. 1µSv/h Basement: approx.0.5µSv/h

Air dose rate  $\times$  (Hours exposed to radiation + (Hours staying inside a building capable of shielding  $\times$  Shielding factor))

Cumulative radiation dose =



## Shielding factor for surface deposition

Structure or location	Representative shielding factor	Representative range
1 m above an infinite smooth surface	1.0	-
One and two story wood-frame house (no basement)	0.4	0.2 - 0.5
One and two story block and brick house (no basement)	0.2	0.04 - 0.4
House basement, one or two walls fully exposed		
- one-story, less than 1 m of basement wall exposed	0.1	0.03 - 0.15
- two story, less than 1 m of basement wall exposed	0.05	0.03 - 0.07
Three or four story structures (500 to 1000 m <sup>2</sup> per floor)		
- first and second floor	0.05	0.01 - 0.08
- basement	0.01	0.001 - 0.07
Multi-story structures (> 1000 m <sup>2</sup> per floor) - upper floors - basement	0.01 0.005	0.001 - 0.02 0.001 - 0.15



#### Reduction coefficient of gamma ray of radioactive materials floating in the air

Place	Reduction coefficient
Outdoors	1.0
Inside a car	1.0
Wooden house	0.9
Stone building	0.6
Basement of a wooden house	0.6
Basement of a stone building	0.4
Large concrete building (when staying away from doors and windows)	0.2 or less

Source: Guidelines for disaster prevention at nuclear power generation facilities published by the Nuclear Safety Commission (Partially revised in August 2010), Table 1: Reduction coefficient of gamma ray of radioactive materials floating in the air.

The table above was translated by the Red Cross Nuclear Disaster Resource Center.



#### If using "shielding"...



#### Air dose rate: 45µSv/h

Relief activities outdoors: 7 hours Breaks inside a building: 17 hours (on the first floor)

**Relief activities for 3 days** 

Shielding factor for the first floor of a building: 0.05



Photo: JRCS

 $45\mu$ Sv/h × (7 hours + (17 hours × 0.05)) × 3 days = 1.06mSv



# Course of action for each JRCS relief team member:

# 1 mSv







Source: Chapter 1 (basic knowledge on radiation and health effects) of a comprehensive document published by the Ministry of the Environment about basic knowledge and data regarding health effects, etc. from radiation. http://www.env.go.jp/chemi/rhm/kisoshiryo/h27shiryo1a.html (in Japanese)

#### ★ Dose limit of artificial radiation that the general public can be exposed to for one year (Recommendation by the International Commission on Radiological Protection)

(The chart above was translated by the Red Cross Nuclear Disaster Resource Center.)

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## Course of action for JRCS relief teams

# 1 mSv:

# The assumption for this dose limit is relief activities for about 3 days.



10 mSv/month



120 mSv/year



# Legal dose limit for radiation worker:



#### Less than 100 mSv for 5 years. (However, less than max. 50 mSv per year)

#### Average: 20 mSv/year

A radiation worker wearing a film badge



What do you think?



JRCS's code of conduct during a nuclear disaster

1. JRCS relief teams shall provide their relief activities outside of restricted areas, etc.

2. JRCS relief teams shall provide their relief activities as long as a cumulative radiation dose of each member does <u>not exceed 1mSv</u>.





# What JRCS relief teams are required to do during a nuclear disaster.



During a nuclear disaster,

What JRCS relief teams are required to do:

- Have a good knowledge and the skills to provide general relief activities as a relief team.
- Prepare necessary equipment and materials and be able to use them.
- Be able to decide on whether the activity area environment allows them to continue their relief activities and be able to estimate whether or not they have to leave the area.
- Be aware of who they should ask for advice when they cannot make a decision on whether or not to leave the area.



#### To have knowledge and skills

# National Red Cross Relief Team Seminar: 4 times/year



Photo: JRCS

Photo: JRCS



#### To prepare equipment and be able to use them





## Be aware of who you should ask for advice when you cannot make a decision.



Are we OK with staying here? Better to leave? We want someone to give us advice!!



## Be aware of who you should ask for advice when you cannot make a decision.





#### JRCS Radiation Emergency Medical Care Advisors

# 1. Appointment and Placement of the Radiation Emergency Medical Care Advisors

(1) In the event of an actual or a potential nuclear disaster, in order to perform the relief activities under a radiation environment safely and properly, the JRCS shall select and place the Radiation Emergency Medical Care Advisors, consisting of a radiological expert (physician) and a radiological support member (radiological technologist) at the Local Chapter Disaster Control Headquarters in the affected area and at the Disaster Control National Headquarters, as needed.

("Manual for Relief Activities under Nuclear Disasters")



## Roles of the Radiation Emergency Medical Care Advisor

- (1) Radiological Expert (physician)
  - A. Preliminary education on safety measures for the relief team members
    - (a) Knowledge about radiation
    - (b) How to put on and take off the protective suit
    - (c) How to use the dosimeters
  - B. Advice to the relief teams regarding the activities
    - (a) Advice on further development of the activities
    - (b) Informing the relief team members of whether they need to wear a protective suit or not
    - (c) Informing the relief team members of whether they need to leave the activity area immediately or not
    - (d) Informing the relief team members of whether they need to take iodine tablets or not
  - C. Subsequent education on safety measures for the relief team members
    - (a) Health care based on the dosimeter measurements
    - (b) Considerations in their future life
  - D. Collaboration and cooperation with a JRCS disaster medicine coordination team
  - E. Response to other necessary matters according to instructions or requests from the JRCS Society National Headquarters

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#### Roles of the Radiation Emergency Medical Care Advisor

- (2) Radiological Support Member (radiological technologist)
  - A. Preliminary education on safety measures for the relief team members
    - (a) Conducting tasks ordered by the Radiological Expert
  - B. Record management of the air dose rate in the activity area and personal radiation dose, etc. of the relief team members
    - (a) Comprehending the air dose rates by obtaining information from public authorities, etc. and by the air dose rate survey meter
    - (b) Record management of the relief team members' dose of radiation exposure
  - C. Management of radiation survey meters/dosimeters and protective suits
    - (a) Maintenance of radiation survey meters/dosimeters, etc.
    - (b) Record management of the lending and return of the dosimeters
    - (c) Replenishment of protective suits, distribution to the relief team members, and management of the lending and return record for the protective suits.
  - D. Response to other items ordered by the Radiological Expert

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("Manual for Relief Activities under Nuclear Disasters")  $_{54}$ 



## **REMC\*** advisors' positioning







#### JRC hospitals related to radiation emergency medical care

Chapter	JRC hospital	Type of hospitals
Hokkaido	Date Red Cross Hospital	Primary Radiation Emergency Hospital
Miyagi	Ishinomaki Red Cross Hospital	Primary Radiation Emergency Hospital
Fukushima	Fukushima Red Cross Hospital	Examination hospital for Fukushima Health Management Survey
Ibraki	Mito Red Cross Hospital	Primary Radiation Emergency Hospital
Fukui	Fukui Red Cross Hospital	Primary Radiation Emergency Hospital
Shiga	Nagahama Red Cross Hospital	Secondary Radiation Emergency Hospital
Shiga	Otsu Red Cross Hospital	Primary Radiation Emergency Hospital
Kyoto	Maizuru Red Cross Hospital	Primary Radiation Emergency Hospital
Tottori	Tottori Red Cross Hospital	Primary Radiation Emergency Hospital
Shimane	Matsue Red Cross Hospital	Primary Radiation Emergency Hospital
Hiroshima	Hiroshima Red Cross Hospital & Atomic- bomb Survivors Hospital	Nuclear Radiation Effects Counter Measure Research Institute
Ehime	Matsuyama Red Cross Hospital	Secondary Radiation Emergency Hospital
Saga	Karatsu Red Cross Hospital	Secondary Radiation Emergency Hospital
Nagasaki	Japanese Red Cross Nagasaki Genbaku Hospital	Nuclear Radiation Effects Counter Measure Research Institute



#### Summary

- JRCS relief team activities in the event of a nuclear disaster are basically the same as the activities conducted in the event of other disasters. However, the following code of conduct shall be applied during a nuclear disaster:
  - 1. Relief activities shall be conducted outside of restricted areas (evacuation order areas), etc.
  - 2. Relief activities shall be conducted as long as a cumulative dose of each relief team member does not exceed 1 mSv during an activity.
- In the event of a nuclear disaster, REMC advisors will be sent to Disaster Control Headquarters which shall be set up both at the JRCS National Headquarters and a local chapter in the affected area.

The REMC advisors shall give advice to secure the safety of relief team members who provide relief activities in a radiation environment.