

**Instructions in the Use of Radiation Protection  
Equipment and Radiation Measuring Instruments by  
Disaster Response Personnel in a Nuclear Emergency**

**December 28,2022**

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(Fourth edition:December 28,2022)

**Cabinet Office, Nuclear Emergency Preparedness and Response**

### **Purpose and Use of this Booklet**

**This booklet is intended to explain the radiation protection equipment and its use and the method of radiation contamination detection by disaster response personnel for protection from radiation in a nuclear emergency.**

**Actually, which the equipment is used depends on the operation in charge.**

**Please use this booklet in addition to the materials for basic training for a nuclear emergency.**

# 1. Radiation Protection Equipment

## 1.1. Protective Equipment for Firefighters, Police and Medical Personnel

### (1) Protective Mask

To prevent inhalation of radioactive materials

Wear a mask to prevent inhalation of radioactive materials from respiration.

A dust mask should be used for dusty radioactive materials.

The mask made of nonwoven fabric is disposable.



### (2) Protective Clothing (Nonwoven fabric as protective clothing: Tyvek® etc.)

To prevent radioactive contamination of the skin and regular clothing

Wear disposable protective clothing over regular clothing, to prevent adhesion of radioactive materials on the skin and clothing.



### (3) Gloves

To prevent radioactive contamination of hands

Disposable rubber gloves should be used over thin cotton gloves.

In order to prevent tearing of the rubber gloves, cloth work gloves should be used over the rubber gloves depending on the case.



### (4) Shoe Covers

To prevent radioactive contamination of the shoes

Disposable shoe covers should be used if radioactive materials might adhere to shoes.



### (5) Cap

To prevent radioactive contamination of the head and hair

Wear a disposable cap on the head.

The cap should be worn under the hood of protective clothing (nonwoven fabric as protective clothing: Tyvek® etc.).

When a helmet is used, wear it over the hood of the protective clothing.



## 1.2. Protective Equipment for workers inspecting and decontaminating evacuees

(This is for workers who may be contaminated by radioactive materials.)

### (1) Surgical Mask

To prevent inhalation of radioactive materials

Wear a mask to prevent inhalation of radioactive materials from respiration.



Surgical Mask(Example)

### (2) Isolation Gowns

To prevent radioactive contamination of the skin and regular clothing

Wear disposable Isolation gowns over regular clothing, to prevent adhesion of radioactive materials on the skin and clothing.



Isolation Gowns

### (3) Gloves

To prevent radioactive contamination of hands

Disposable rubber gloves should be used over thin cotton gloves.

In order to prevent tearing of the rubber gloves, cloth work gloves should be used over the rubber gloves depending on the case.



Cotton Gloves



Rubber Gloves

### (4) Cap

To prevent radioactive contamination of the head and hair

Wear a disposable cap on the head.



Cap(Example)

## (6) Personal Dosimeter

To measure exposure dose

The personal dosimeter is a device to measure the individual radiation exposure dose.

There are two types of device to measure radiation exposure :  
the electronic type and integrating type.



Electronic Personal Dosimeter (Example)

### (i) Electronic Personal Dosimeter

The electronic personal dosimeter provides direct readings of individual radiation exposure doses.

There are two types of the personal electronic dosimeter: one is reset just by turning off the power switch;  
the other is reset by holding down the power switch.

[Glass Badge]

[Quixcell Badge]



Integrating Personal Dosimeter(Example)

### (ii) Integrating Personal Dosimeter

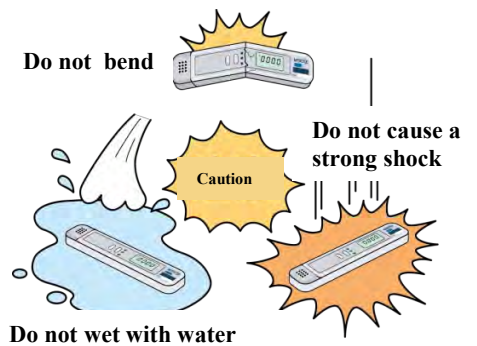
The integrating personal dosimeter measures the integrated exposure dose for every month or during the wearing period.

Then the dose vale is read using a dedicated device.

#### ※Precautions for Use of Personal Dosimeter

Electromagnetic radiation emitted from a cellphone may induce malfunction to an electronic dosimeter, so never place it in a pocket with a cellphone.

Causing a strong shock, bending, or wetting with water must be avoided to either the electronic or integrating personal dosimeter.



## (7) Radiation Measuring Instruments

### (i) Ambient Dose Rate Measuring Instrument (NaI Scintillation Survey Meter)

The NaI scintillation survey meter can be used for measurement of the ambient dose rate from the natural background level with high sensitivity.



NaI Scintillation Survey Meter(Example)

### (ii) Surface Contamination Measuring Instrument (GM Survey Meter etc.)

The GM survey meter can be used for the surface contamination measurement of radioactive materials on the body clothing, or surface of the object.

The GM survey meter is often used for surface contamination measurement. In addition, a plastic scintillator survey meter is also used.



GM Survey Meter(Example)

Measurement using the surface contamination measuring instrument should be kept a distance between the detector and the object surface at about 1 cm to avoid adhesion of radioactive materials on the GM tube surface.

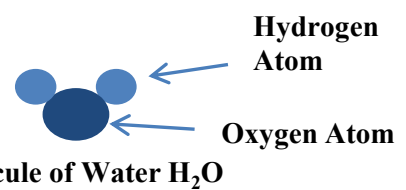
#### **【Reference】 What is Becquerel (Bq)?**

1Becquerel (Bq) is a unit of radioactivity.

Bq is defined as disintegration of atom per second.

An atom is the smallest unit that constitutes a substance.

For example, a molecule of water consists of two hydrogen atoms and one oxygen atom.



## 2. How to Wear Radiation Protection Equipment

### 2.1. How to wear the Protective Equipment for Firefighters, Police and Medical Personnel

**(Put on the instrument and equipment as shown in the following order.)**

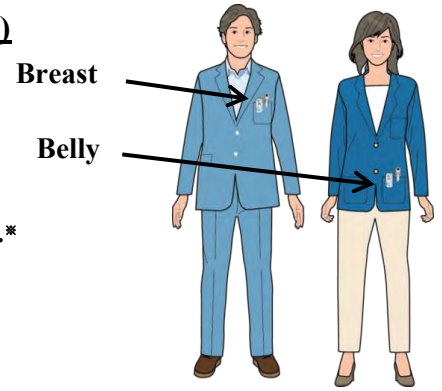
① Put on the personal dosimeter (Both the electronic personal dosimeter and the integrating personal dosimeter)

(A female who may be pregnant should place the device on the belly and other female and male should place the device on the breast.)

Place the electronic personal dosimeter with its display (LCD) facing the body.\*

※ depending upon the dosimeter type.

Place the integrating personal dosimeter with your name facing outside.



② Put on the protective clothing. Pull up the zipper of the clothing all the way to the neck.

③ Put on the cap.

④ Wear thin cotton gloves.

⑤ Put shoe covers on both shoes.

⑥ Put on the dust mask.

Make sure that the dust mask is not upside down.

Do not place the string of the mask on your ears but around the back of your head.

Make sure the gap between the ridge of the nose (the foot of the nose between both eyes) and the mask is securely closed.

⑦ Wear rubber gloves.

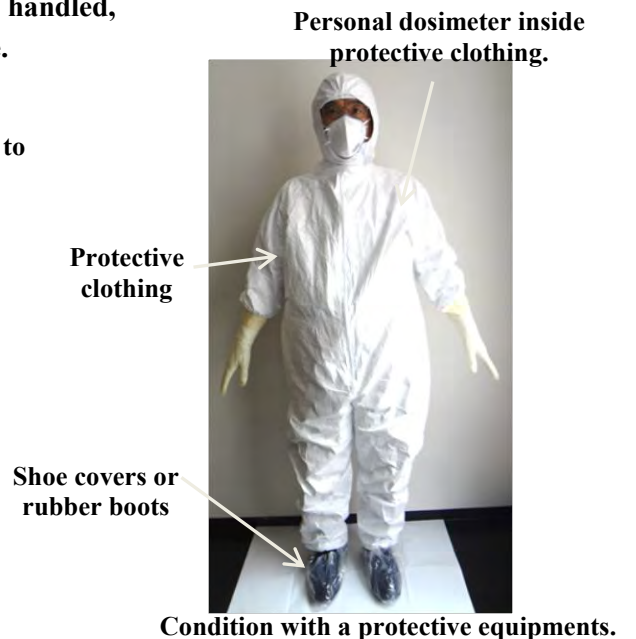
Seal the gap between the rubber glove and the cuff of the protective clothing using adhesive tape.

If the fender of a vehicle or other sharp object may possibly be handled, put on work gloves over the rubber gloves to prevent breakage.



The end of the adhesive tape (only one side) should be folded to form a triangle so that it can be easily removed. So, it will be difficult to peel off during work and easy to peel off when undressing.

⑧ Place the hood of the protective clothing over the cap.



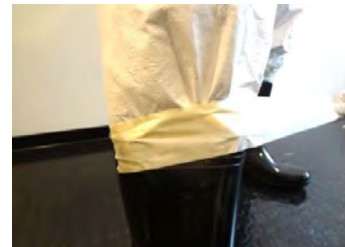
★ Measures for special situation ★

★ When boots are used:

When boots for contaminated areas are provided, use this.

Put the special socks over your personal socks.

Put the bottom of the protective clothing into the boot and seal the gap with adhesive tape.



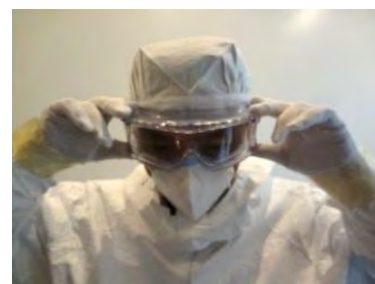
★ When a helmet is worn:

When the operation is made in an area of possible flying objects or under scaffolding, wear a helmet over the hood of the protective clothing and properly tighten the strap .



★ When goggles are worn:

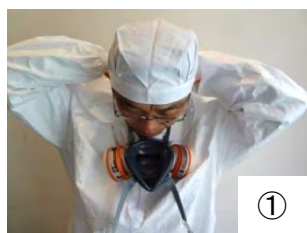
Wear goggles when the operation is made in dusty areas.



★ When a half mask with a charcoal filter is used:

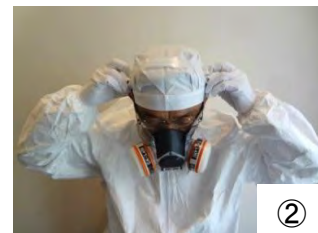
Wear a half mask with a charcoal filter when inhalation of radioactive iodine is likely to occur.

① Wrap the lower tightening string of the mask around your neck. Wrap the upper string around the back of your head.



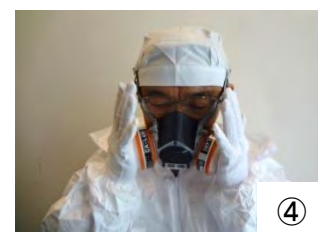
② Pull the lower string to tighten.

Squeeze the upper string to tighten around the back of your head.



③ Make sure the mask is in tight contact with your face moving the face should move the mask up and down.

④ Inhale air with the canister of the mask blocked by your hand and to make sure there are no air leaks between the mask and your face.



⑤ If the mask is in close contact with your face when air is inhaled, the mask is properly placed without leakage of air.

**2.2. How to wear the Protective Equipment for workers inspecting and decontaminating evacuees**

**(Put on the instrument and equipment as shown in the following order.)**

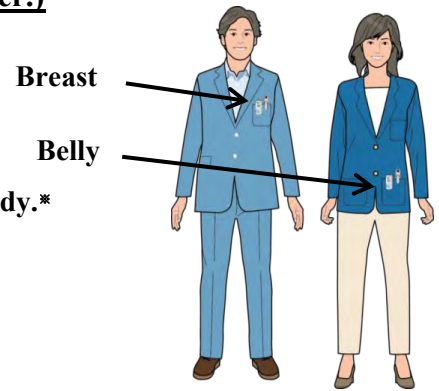
① Put on the personal dosimeter (Both the electronic personal dosimeter and the integrating personal dosimeter)

(A female who may be pregnant should place the device on the belly and other female and male should place the device on the breast.)

Place the electronic personal dosimeter with its display (LCD) facing the body.\*

※depending upon the dosimeter type.

Place the integrating personal dosimeter with your name facing outside.



② Put on the isolation gowns.

③ Put on the cap.

④ Wear thin cotton gloves.

⑥ Put on the surgical mask.

Make sure that the dust mask is not upside down.

Make sure the gap between the ridge of the nose (the foot of the nose between both eyes) and the mask is securely closed.



⑦ Wear rubber gloves.

Seal the gap between the rubber glove and the cuff of the protective closing using adhesive tape.



The end of the adhesive tape (only one side) should be folded to form a triangle so that it can be easily removed. So, it will be difficult to peel off during work and easy to peel off when undressing.

Personal dosimeter inside isolation gowns.

Isolation gowns



Condition with a protective equipments.