Preparedness for Future Nuclear Emergencies
-Based on Lessons Learned from TEPCO
Fukushima Daiichi NPP Accident-

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(Concept)

• Deliberation and Review by Expert Meeting

(Ordinance)

1. Dose Control during Emergency Works
2. Special Education Provided to Exceptional Emergency Workers
3. Healthcare during Emergency Works

(Ministerial Guidelines)

1. Long-term Healthcare after the Emergency Works
2. Dose Control for Workers Exposed beyond the Dose Limits
# Deliberation and Review by Expert Meeting

## 1 Objectives of the expert meeting

- Review of long-term healthcare for **emergency workers at the TEPCO Fukushima Daiichi Nuclear Power Plant** exposed beyond regular dose limits.

- Deliberation of adequate medical and health care systems, dose control and special education **in the case of future nuclear emergencies**.

## 2 Deliberated issues at the meeting

A) Management of long-term healthcare of former emergency workers  
B) **Medical examinations during the emergency works**  
C) Adequate mid- to long-term dose control for the emergency workers exposed beyond the regular dose limit during emergency works  
D) **Adequate healthcare during the emergency works**  
E) Special education provided to exceptional emergency workers

(Note) Underlined items are those related to the revision of the ministerial ordinance.
1. Dose Control during Emergency Works (Objectives)

Experience at the Fukushima Daiichi NPP Accident

- After the nuclear emergency declaration, an emergency dose limit of 250 mSv was stipulated in the exemption of the Ministerial Ordinance while balancing health risks of the workers and the benefits of protecting life and property of the neighboring residents (March 14, 2011).
- In light of the principle of optimization, the application of the limit was limited in a step-by-step manner and the exemption of the Ministerial Ordinance was abolished when the stability of the nuclear reactors was ensured (December 16, 2011).
1. Dose Control during Emergency Works (Objectives)

**Principles**

- **ICRP’s Principles of Justification**
  - Emergency dose limit beyond 100 mSv needs a special justification.
  - Reason used in international documents is “to avoid a catastrophic situation”.
  - Application should be limited to those workers who can respond to such a situation (*with sophisticated knowledge and skills*).

- **Value of the emergency dose limits**
  - Base on the experience in the Fukushima Accident, **necessity** of limits **beyond 250 mSv** is **unforeseeable** at this point.
  - For ensuring prevention of depression of the immune function, it is conservative, yet appropriate to adopt 250 mSv, which certainly falls below the threshold value.

- **Emergency management for a nuclear disaster**
  - The “catastrophic situation” is defined as the case of a “**state of nuclear emergency**” or a “situation highly likely to lead to the state”.
  - For emergency management, **emergency responses need to be taken immediately**.

- **ICRP’s Principles of Optimization** (minimize the dose)
  - Limit the application of the emergency limit and conduct the step-by-step reduction of the limit as early as possible, depending on the work progress.
  - **Lift the exceptional emergency limit immediately if** the stability of the nuclear facility is secured.
1. Dose Control during Emergency Works (Ordinance)

(1) Setting of the exceptional emergency dose limit

- In consideration of the situation of emergencies and other circumstances, the MHLW may set a special dose limit (exceptional emergency dose limit) not exceeding 250 mSv in the case that it is difficult to observe the dose limit of 100 mSv for completion of the emergency works.

- In particular, if a state of a nuclear emergency or a situation highly likely to lead to the state occurs, the MHLW shall immediately designate the exceptional emergency dose limit as 250 mSv.

- The MHLW shall lift the limit as early as possible by taking into consideration the dose of the emergency workers, and further required works to control the accident.

- When the MHLW has designate, changed or lifted the exceptional dose limit, the MHLW shall issue a public notice.
(2) Limitation of exceptional emergency workers

- The exceptional emergency workers should be selected from among the nuclear disaster prevention workers* specified in the Act on Special Measures Concerning Nuclear Emergency Preparedness.

* The workers designated in nuclear operators’ disaster prevention plan, who are the workers of nuclear operators, in principle.
* However, in the case that a nuclear operators outsources a part of the works (e.g. remediation of damaged equipment), the workers belonging to the outsourced operator shall be included among the nuclear disaster prevention workers.
### 1. Dose Control during Emergency Works (Ordinance)

#### (3) Optimization of dose for exceptional emergency workers

- Employers **shall ensure that the dose of workers will not exceed the exceptional dose limit** during the exceptional emergency works.
- Employers **shall make efforts**, depending on the circumstances of the accident, **to minimize the dose to which exceptional emergency workers are exposed**.

#### (4) Monitoring and recording of dose, and reporting to the MHLW

- Employers shall conduct **internal dose measurements once within a month**.
- Also, employers shall calculate and record the **cumulative effective doses monthly, annually and in every 5 years**, and preserve records for 30 years.
- Employers shall **periodically report** the dose distribution and **records of medical examinations and the dose** of individual emergency workers to the MHLW.
  - These records will be stored in the **database operated by the MHLW** for long-term healthcare management of the emergency workers.
The purpose of special education is to reduce doses of the workers during the exceptional emergency works by ensuring their understanding of risks such as potential health effects of radiation exposure and as well as giving knowledge and skills for emergency works and wearing personal protective equipment.

Target of the education is those workers who have already had the special education for regular radiation workers.

Limited to those workers who have sophisticated knowledge and skills to respond to emergencies.
2. Special Education Provided to Exceptional Emergency Workers

Implementation of Special Education

- When assigning workers to the exceptional emergency work, employers shall provide workers with the special education for the following subjects.

< Lectures (6.5 hours) >

1. **Structures and operation of facilities and equipment** to be used in exceptional emergency works (2 hours),
2. **Work methods** involved in exceptional emergency works (3 hours),
3. **Health effects of radiation exposure** and the **dose control** method (1 hour)
4. **Relevant laws and regulations** (0.5 hours)

< Practices (6 hours) >

1. **Operation of the facilities and equipment** to be used for exceptional emergency works (3 hours)
2. **Work methods** involved in the exceptional emergency works (3 hours)
3. Healthcare during Emergency Works

Emergency Medical Examinations

- Employers shall provide medical examinations for the following items* to the emergency workers **once within a month periodically**, when workers are transferred from emergency works to other works or at the time of termination of their employment.
  
  a. Subjective and objective symptoms
  b. White blood cell (WBC) count and differential WBC count
  c. Red blood cell count and hemoglobin content or hematocrit
  d. Thyroid stimulating hormone (TSH), free triiodothyronine (T3) and free thyroxine (T4)
  e. Eye examination for cataract
  f. Skin examination
  
  * Employers can **omit the medical examinations** for items other than a) in the case that physicians recognized those examinations are unnecessary.

- Employers shall conduct **recording, hearing** of opinions from the medical doctor, and **notifying** workers the results, and take necessary **aftercare** in accordance with the medical examination results.
4. Long-term Healthcare after the Emergency Works (Ministerial Guideline)

**Principles**

- Medical examinations of emergency workers such as **cancer screening** in accordance with the Ministerial guideline were reviewed based on the latest scientific knowledge.

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**Amendments of Health Care**

- Newly added screening items for workers exposed to more than 100 mSv
  - Cancer screening items (**Chest CT** and **colonoscopy**)
  - Infectious disease tests (**pylori antibody test** and **hepatitis screening**), and mandated **thyroid ultrasound examination**.
  - **Chronic kidney disease screening** (renal function test) and **antismoking education**

- Implementation of a **mental stress check**
  - To be provided to all emergency workers as much as possible
  - Support by nuclear operators and primary contractors to contract workers in implementing the check.
Workers exposed beyond dose limits in the 5-year period including the occurrence of accidents

**Principle**

- For the 5-year period including the occurrence of an accident, a certain margin should be adopted regarding application of the regular dose limit only if it is inevitable to guarantee safe operation of other nuclear facilities.

**Implementation**

- Employers may assign regular radiation works to a worker whose **total dose of emergency and regular doses** exceeds 100 mSv/5-year, where additional radiation exposure is being controlled under **5 mSv/year***, only if he/she is needed to guarantee safe operation of nuclear facilities other than the affected plant.

  *Minimum level for setting-up radiation control areas.
Workers exposed beyond the dose limits during subsequent 5-year periods

Principles

- Preserve 1 Sv for the lifetime employed by ICRP as a basement of dose limit (100 mSv/5y).
  - Dose should not be exceeded the regular dose limits (100 mSv/5 year and 50 mSv/1 year) as well as 1 Sv for the lifetime for cumulative dose.

Implementation

Employers should set the additional 5-year dose limit in the following manner

- Dose limit for 5 years* = \((\text{Remaining dose}/\text{Residual working period}) \times 5 \text{ years}\)
  - Remaining dose: Subtracting cumulative dose (total of emergency and regular doses) from lifetime dose (1Sv).
  - Residual working period: Subtracting the current age from the last age of the working period (age 68 assuming to 50 years from age 18).

- Example: Emergency dose = 500 mSv, regular dose = 100 mSv (cumulative dose = 600 mSv); age = 45
  - \((1000 \text{ mSv} – 600 \text{ mSv})/(68 – 45) = 17.4 \text{ mSv/year}\)
  - Dose limit per 5-year period: 17.4 mSv/year \times 5 \text{ years} = 87 mSv (85 mSv by rounding down to every 5 mSv.)

* The yearly dose limit (50 mSv/years) shall not be exceeded.
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