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Temporary Increase in the Emergency Exposure Dose Limit in Response to the TEPCO Fukushima Daiichi NPP Accident

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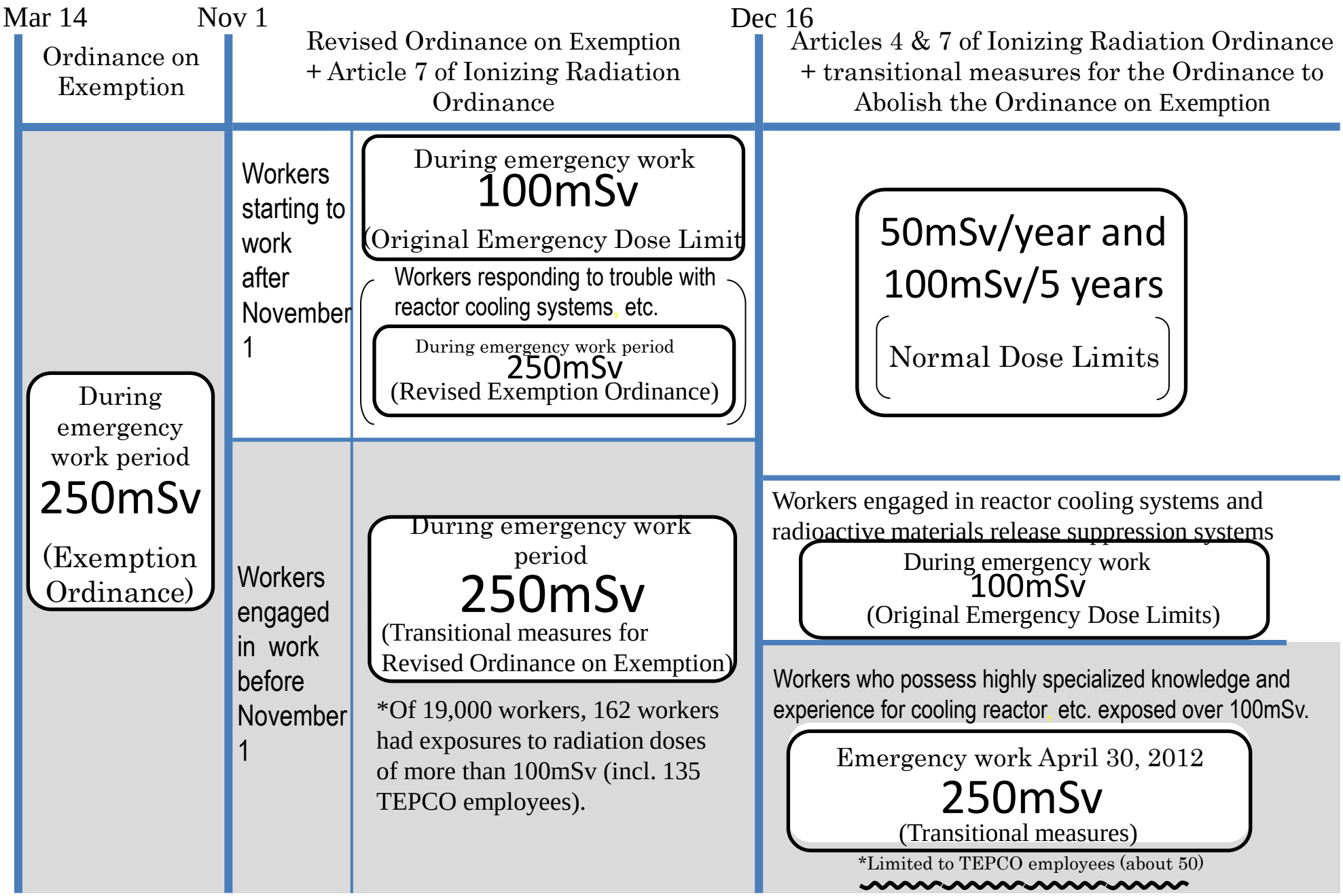
1. Introduction

- Responding to the Fukushima Daiichi NPP accident, the government
  - Declared a **nuclear emergency** on March 11, 2011,
  - initiated **emergency operations** to prevent further expansion of the nuclear disaster.
- To expedite the operations, MHLW issued an **exemption ordinance** to
  - increase **emergency dose limits** from **100 mSv to 250 mSv**
  - **solely** at the plant in **unavoidable** circumstances.
- Subsequently, MHLW succeeded in reducing the emergency dose limit **back to the original limit** through a **phased approach**.
- This paper explains
  - the **decision-making process** and deliberation on temporarily raising the emergency dose limit and
  - **key challenges** that require further deliberation to be resolved.

Phased Approach to Reduce Emergency Dose Limit



2. Raising of Emergency Dose Limits

- On March 14, 2011, the Prime Minister Office demanded MHLW to **raise emergency dose limits**, which were kept at **100 mSv** since 1998.
- MHLW:
  - did **not have any other options except** to raise the emergency exposure dose limit because sufficient emergency response was needed to prevent the expansion of the disaster.
  - however, decided to employ **250 mSv** as the emergency dose limit.
- **250 mSv** is the minimum dose to cause **chromosome disorders in lymphocyte cells**,
  - an effect that is not clearly defined by the onset of clinical symptoms.
  - **500 mSv** is the level to cause **transient leukopenia as a clinical symptom** and could **reduce resistance to infections**.
- On 15 March 2011, the MHLW:
  - promulgated an **exemption ordinance** and put it into effect on **March 14, 2011**.
  - Taking advantage of this type of legislation as an "**exemption,**" made it clear that the increased dose limit **exclusively applied at the affected plant** and would **cease to exist** once the nuclear emergency is no longer declared.

2.1. Controversy Over the Combined Control of Emergency and Normal Exposure Dose

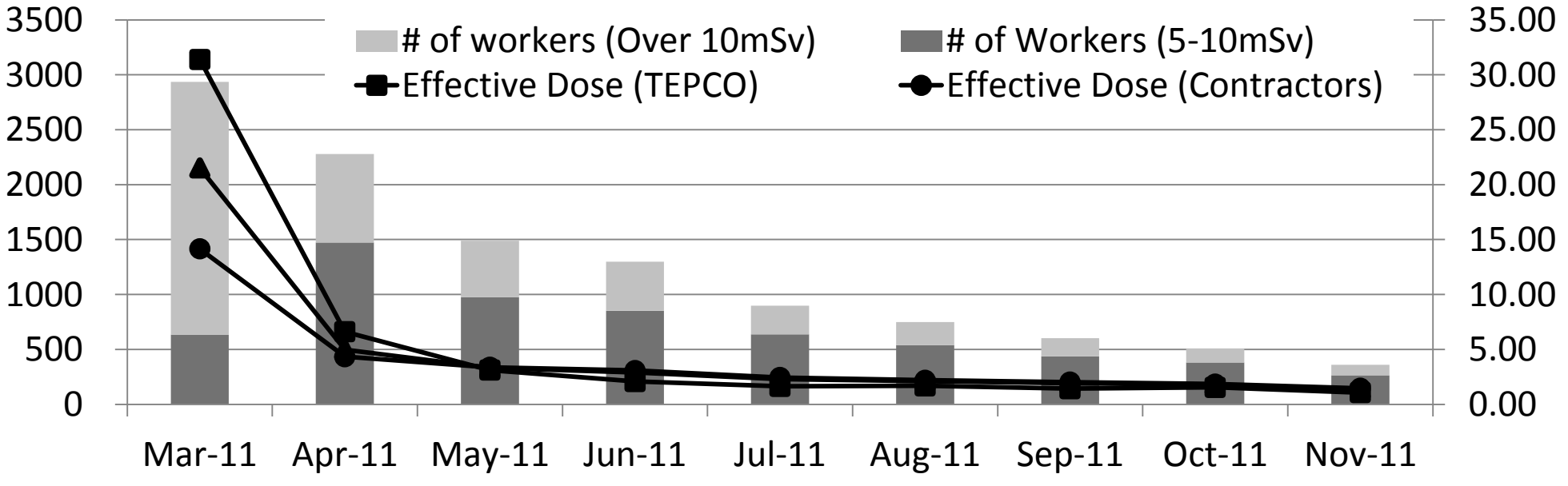
- MHLW has provided administrative guidance that
  - the **combined normal and emergency dose** should **not exceed the normal dose limit** if workers are engaged in normal operation.
- On April 1, 2011, NISA:
  - proposed that the emergency dose **should be distinct** from the normal dose.
  - argued that if the emergency work continued, approximately **320 workers** would **exceed 100 mSv** and **1,600 workers** would surpass **50 mSv**, resulting in a **shortage of qualified personnel** at other NPPs.
- MHLW declined the proposal from NISA for the following reasons:
  - **A) No sound reasons** were provided to distinguish emergency doses from normal doses, even though the **health effects from each of them are equal**.
  - B) A long-term shortage of personnel **would not occur** because qualified technicians and engineers in related industries **could be trained and transferred**.
- MHLW, however, issued guidance on April 28, 2011
  - allowing ex-emergency workers to exceed the **annual dose limit of 50 mSv** during normal operations with the presumption that the **combined doses would not exceed the 100 mSv in 5 years.**

3. Reduction of the Emergency Dose Limits

- On August 29, 2011, the **Minister of the MHLW** proposed the following to the **Minister for Nuclear Accident Settlement**.
  - A) As soon as the nuclear reactors are stabilized, the government **should terminate the application of the emergency dose limit** because the government should stress **balance** among the **benefit of preventing expansion of the damage** and the **health risk of emergency workers**.
  - B) Even **during emergency operation**, the government should **reduce emergency dose limits as soon as possible** to adhere to the **principle of optimization**.
- With **direct consultation** with ministers, they **agreed to reduce** the emergency dose limit on the following principles on September 15, 2011.
  - **A) Before** the stabilization of the reactors, emergency dose limits **for newcomers** would be **reduced from 250 mSv to 100 mSv**.
  - **B) Following** the stabilization of the reactors, the **exemption ordinance** would **be abolished.**
  - C) In both cases, **pay appropriate attention to avoid disturbing** of emergency work.

3.1. First Phase of the Dose Limit Reduction

- MHLW recognized that
  - newcomers' exposure **would not exceed 100 mSv** even if they were exposed to the **maximum exposure dose** in August, **18.3 mSv**, for six months.
- TEPCO emphasized that
  - newcomers' exposure **may exceed 100 mSv** if they were needed to engage in **troubleshooting tasks**.
- The MHLW decided on November 1, 2011
  - to apply 250 mSv emergency dose limits exceptionally to newcomers responding to troubles in the cooling systems of the nuclear reactors, etc.



3.2. Second Phase of Dose Limit Reduction (Abolishment of the Exemption Ordinance)

- In October 2011, TEPCO submitted reports to requesting MHLW:
  - **A)** **Re-establish emergency dose** of 250 mSv if serious problems arise.
  - **B)** **Apply an emergency dose limit** of 100 mSv during work related to nuclear reactor cooling, etc. after the stabilization of the reactors.
  - C) Provide **necessary transitional measures** for workers who were exposed to more than 100 mSv.
- MHLW
  - **agreed to the first and second** request, and, as a response to the third,
  - attempted to provide **transitional measures** that would apply the 250 mSv dose limit **exclusively to shift supervisors for a few months** to transfer knowledge and expertise.
- TEPCO insisted that
  - a few months was **insufficient to train replacements** for shift supervisors.
- MHLW
  - suggested that TEPCO **exclude** the inside of the Seismic Isolated Building **from its radiation control areas**.
  - **abolished the exemption ordinance** on December 16, 2011, the day of the declaration that **stability of the reactors** was achieved.

4. Discussion

- In the accident, the **political level initiated** the increase and reduction in the emergency dose limit.
  - **To avoid intervention**, the government needs a **pre-defined protocol for the process** and conditions to apply or amend emergency dose limits.
- **250 mSv was sufficient**
  - to implement the necessary emergency operations in response to the **large-scale nuclear accident** involving four nuclear reactors.
- In the process of application of the dose limits,
  - the application of a **single** high-level emergency dose limit to all workers was unavoidable in the **early stage of the accident**.
- After the chaotic situations were resolved,
  - based on the **principle of optimization**,
  - the government should have established **plural emergency dose limits** and applied them based on the **urgency** of the work and the **ambient dose rate**.

5. Conclusion

A) **Prior to the accident**, have **a protocol decided** to set emergency dose limits, such as **post-accident amendment** of the limits.

B) In light of the **principle of optimization**, have **plural emergency dose limits** established and apply them.

C) Designate **conditions to apply emergency dose limits**.

The conditions should be **clear and objective** for a **quick decision** based **on incomplete information**.

D) As soon as the situations allows, **terminate the application** of or **reduce** emergency dose limits using a **phased approach**, and to this end, designate the **conditions** prior to the accident such as:

(a) accumulated and expected **exposure dose** and

(b) the degree of **urgency** of the emergency operations.

E) Create a **procedure for radiation control** of workers who are exposed to more than the 100 mSv 5-year dose limit during emergency work

to keep **lifetime exposure below 1 Sv**.