

# Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station Units 1-4 (Summary)

June 27, 2013

Council for the Decommissioning of  
TEPCO's Fukushima Daiichi NPS

## 1. Introduction

It was decided at the meeting of the Nuclear Emergency Response Headquarters on February 8, 2013 to establish the “the Council for the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station” (hereafter referred to as “Council”). It aims to accelerate the decommissioning and to enhance the further collaboration between on-site work and government-led R&D program through the involvement relevant R&D bodies into Government of Japan and TEPCO. The first Council meeting on March 7, 2013, deliberated on the acceleration of fuel debris removal and other matters. Chairman of the Council and Minister of Economy, Trade and Industry Toshimitsu Motegi directed to complete the revised Mid-and-Long-Term Roadmap by the end of June 2013.

“The basis for discussing the revision of the Mid-and-Long-Term Roadmap” was released on June 10 and opinions were collected from Fukushima Prefecture, local governments, and experts. Based on these opinions, the revised Mid-and-Long-Term Roadmap was compiled and adopted by the Council for the Decommissioning.

## Major Points for the Revision

### 1. Review schedules based on the condition of each unit

- Individually review schedules based on the condition of each unit, accelerate the initial target for commencement of fuel debris removal (originally set to begin 10 years)
- Prepare multiple plans for the removal of the fuel and fuel debris in order to make it possible to take measures flexibly depending on the on-site situation
- Examine acceleration of the target for commencement of fuel debris removal (by approximately one-and-a-half years from the originally planned December 2021, at the earliest) and review research and development plans

### 2. Strengthen communications with local people and across all levels of society

- Establish the Fukushima Advisory Board (provisional title) under the Council for Decommissioning, with the participation of Fukushima Prefecture, surrounding local communities, relevant local organizations, and experts in the fields of regional development and communications, and make efforts to provide more detailed information while simultaneously seeking feedback from the public on decommissioning work and on the best ways of providing information and conducting PR activities to strengthen the provision of information and communications with local people, etc.
- Provide opportunities to participate in the decommissioning work to relevant companies in Fukushima Prefecture, foster local companies that supply required equipment and machinery on a long-term basis, and promote to set up new companies to revitalize local economies.

### 3. Develop a comprehensive structure to gather international expertise

- Appoint international advisors who provide advice to the R&D management organization and establish an international collaboration department in the organization and an international decommissioning expert group consisting of foreign experts in various fields
- Develop an environment which facilitates the participation of foreign research institutes and companies in the decommissioning work
- Strengthen cooperation with the international community through the frameworks of bilateral and multilateral cooperation

## Basic Principles for Mid-and-Long-Term Initiatives

- [Principle 1] Systematically tackle the issues while placing top priority on the safety of local citizens and workers.
- [Principle 2] Move forward while maintaining transparent communications with local and national citizens to gain their understanding and respect.
- [Principle 3] Continuously update the roadmap in consideration of the on-site situation and the latest R&D result.
- [Principle 4] Harmonize the efforts of TEPCO and Government of Japan to achieve the goals indicated in this Roadmap. The Government of Japan should take the initiative in promoting the efforts to implement decommissioning measures safely and steadily.

## Concept of Ensuring Safety in Implementing Mid-and-Long-Term Initiatives

### ➤ Ensuring safety as Specified Nuclear Power Facilities (Basic Concept)

Under the framework of Specified Nuclear Power Facilities, safety measures should be established for TEPCO's Fukushima Daiichi NPS Units 1-4 with the aim of reducing the risks associated with the facilities as a whole and optimizing safety within and outside the NPS. At the same time, the safety measures should be reviewed timely and flexibly based on the circumstances in order to avoid any hindrance to on-site work.

### ➤ Efforts to ensure safety

#### (1) Equipment safety – continuous efforts to improve equipment reliability –

- Efforts will be continued based on the Implementation Plan related to Countermeasures for Improving Reliability (established in May 2012).
- Measures to improve reliability will be timely reviewed and implemented under framework of the Emergency Response Measures Headquarters for Reliability Improvement in the Fukushima Daiichi NPS (established in April 2013).

(e.g. )Shift to water injection from the condensate storage tank; change to accumulated water transfer lines made of polyethylene; review and establishment of maintenance policies for the water treatment equipment; change of power supply sources for the important load, etc.

#### (2) Work safety – safety and radiation control for workers –

In addition to ensuring general work safety of workers, measures to reduce workloads and dose rates to the extent possible will be implemented through optimizing protective equipment and implementing decontamination .

#### (3) Reducing the impact on the surrounding environments – reducing and controlling radiation doses at the boundaries of the site

As the reactors have been cooled in a stable condition, the radioactive material release from the reactor buildings has been kept in a low level. Secondary waste from accumulated water treatment, rubbles and contaminated water will be managed properly with the aim of reducing radioactive material release from the site. The dose rates at the site's boundaries will be reduced to less than 1mSv/year.

### ➤ Development of new standards and regulatory response actions

The basic concepts for regulatory responses and supporting data will be presented as soon as possible so that the relevant entities can timely take regulatory responses for proceeding with the decommissioning work.

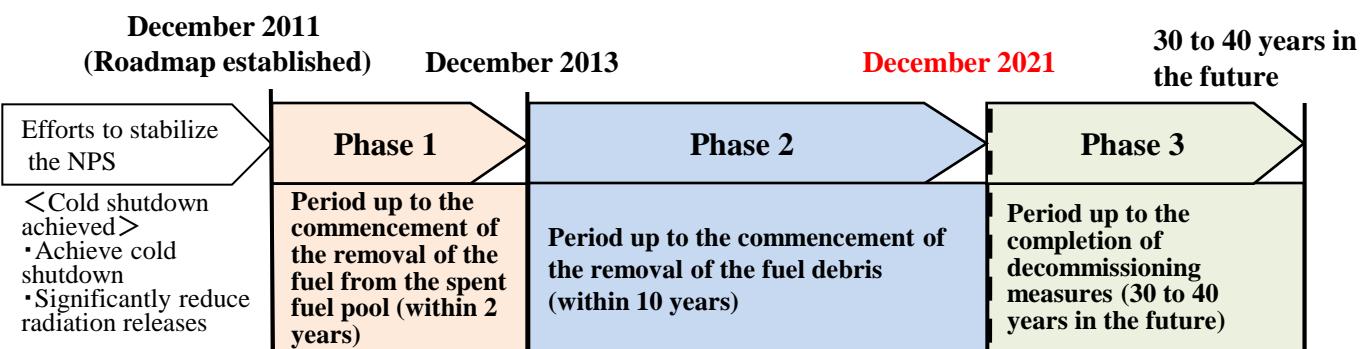
## 2. Plan for Removing the Fuel and Fuel Debris from Each Unit

### Individual Schedule for Each Unit

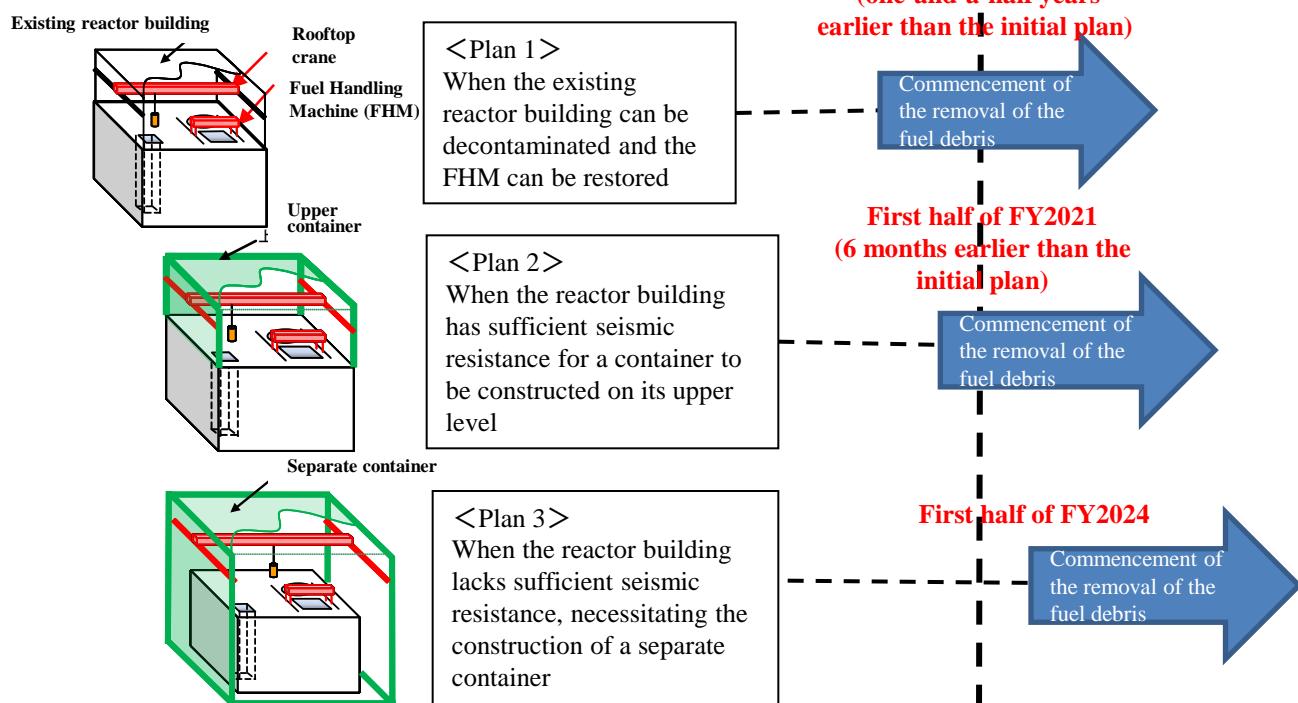
To reduce risks, (i) removal of the fuel from the spent fuel pool and (ii) removal of the fuel debris will be carried out at the earliest possible time. According to the condition of each unit, work processes will be accelerated and multiple plans will be formulated.

	Fuel removal	Fuel debris removal
Initial targets	December 2013 (the earliest unit)	December 2021 (the earliest unit)
Unit 1 (Earliest plan = Plan 2)	Second half of FY2017	<b>First half of FY2020 (one-and-a-half years earlier than the initial plan)</b>
Unit 2 (Earliest plan = Plan 1)	Second half of FY2017	<b>First half of FY2020 (one-and-a-half years earlier than the initial plan)</b>
Unit 3 (Earliest plan = Plan 1)	First half of FY2015	Second half of FY2021
Unit 4	<b>November 2013 (one month earlier than the initial plan)</b>	—

### Targets under the Initial Roadmap



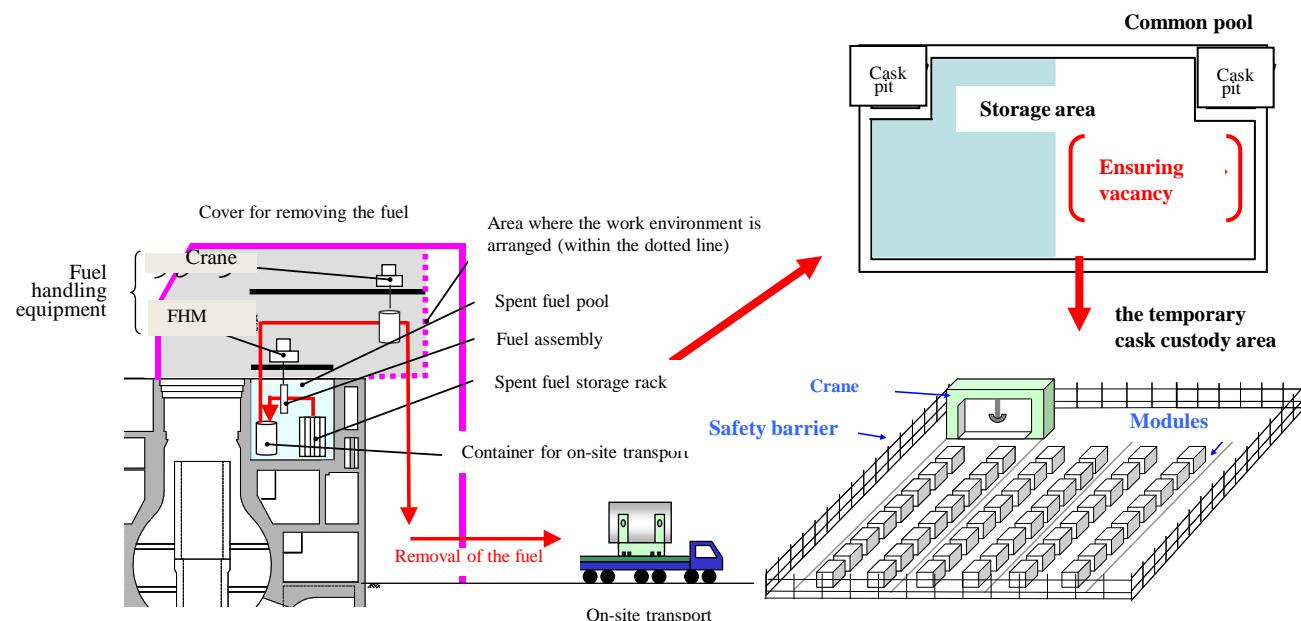
### Plan under the Revised Roadmap (example: Unit 2)



Future plans will be narrowed down in the first half of FY2014 based on the results of analysis of the likelihood of the existing reactor building's decontamination or restoration of the FHM, as well as the results of the assessment of the seismic resistance of the existing reactor building.

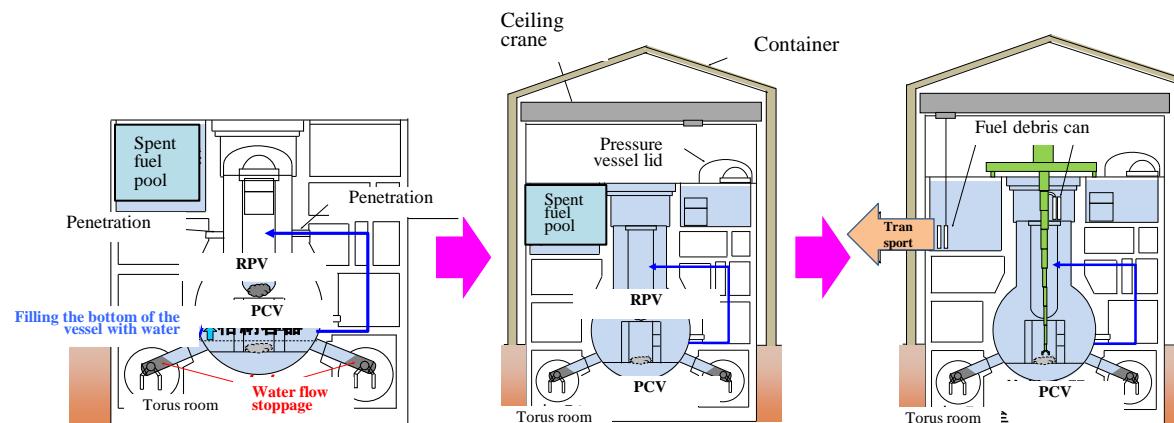
### Fuel Removal Work Processes

- In order to remove the fuel from the spent fuel pool, (i) rubbles in the upper level of the reactor building needs to be removed (this process has been completed for Unit 4 and is ongoing for Unit 3), and then (ii) a cover or a container for the entire reactor building is to be constructed and the fuel handling equipment is to be installed (now under construction for Unit 4).
- At the same time, (iii) the fuel stored in the common pool is to be moved to the temporary cask custody area to make vacancy in the common pool for the fuel removed from the spent fuel pool, and (iv)
- Transportation of the fuel removed from Unit 4 is scheduled to commence in November 2013.



### Work Processes to the Removal of the Fuel Debris (Units 1, 2 and 3)

- The most reliable method of fuel debris removal is to remove the fuel debris in keeping them covered with water in terms of reducing the risk of radiation exposure during work processes.
- Accordingly, the fuel debris will be examined and the primary containment vessel (PCV) will be examined and repaired for filling the PCV with water. Furthermore, R&D for the removal and storage of fuel debris will be implemented.



Rough picture of the process from repairing the bottom of the RCV (water flow stoppage) to filling the bottom of the vessel with water

Rough picture indicating the process of removing the fuel debris

## 4. Development of System and Environment to Facilitate Work

### Personnel Plan towards Mid-and-Long-Term Initiatives

- The number of personnel required will remain at a same level for the next three years.
- Because it will be necessary to work under much higher dose rates in the mid-and-long-term, personnel plans will be reviewed when the Roadmap is revised.

### Plan towards Improving Work Environment and Conditions

- Work safety and health management: Improvement of rest area, heat stroke preventive measures, ensuring of the medical system, etc.
- Radiation control: Expansion of areas where a full-face mask is not required, improving exit/entrance bases, etc.
- Efforts to ensure appropriate working conditions: Education concerning the ensuring of working conditions, survey on efforts made by prime contractors concerning working conditions, etc.

## 5. Coexistence with Local Communities and Communication with All Levels of Citizens

- In order to enhance providing information and communication with local stakeholders, the Fukushima Advisory Board (provisional title) will be established under the Council for the Decommissioning, with the participation of Fukushima prefecture, the surrounding local communities, relevant local organizations, and experts in the fields of regional development and communications.

## 6. R&D and Human Resource Development

### Research and Development Plan

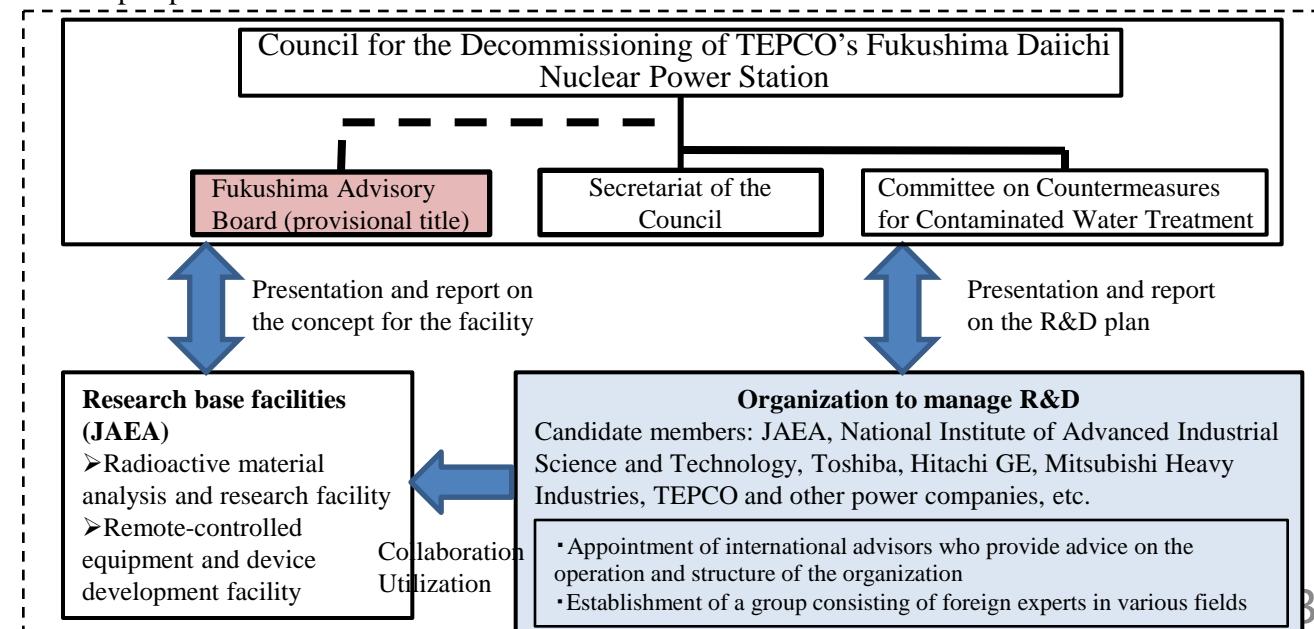
- Research and development concerning the removal of the fuel from the spent fuel pool, preparation for the removal of the fuel debris, and the processing and disposal of radioactive waste will be promoted systematically.

### Structure to Promote R&D

- It is under preparation to establish an organization to manage R&D activities in an integrated way. The appointment of international advisors and the establishment of an international decommissioning expert group are under discussion.

### Human Resource Development

- The Government of Japan, the JAEA, and the private sector will cooperate with each other to promote human resource development by setting priority fields and core bases from mid-and-long-term perspective.



## 3. Other Plans Necessary for the Implementation of the Mid-and-Long-Term Roadmap

### Continuous Monitoring Cold Shutdown State of the Reactors and Cooling Plan

- Keep the cold shutdown state
  - Improve backup system of the monitoring temperatures in the PCVs and RPVc

### Contaminated Water Treatment Plan

- Necessary discussions will be held on the following contaminated water treatment measures, and discharges of contaminated water into the ocean will not be implemented lightly.

#### (i) Fundamental measures to prevent the intrusion of groundwater into reactor buildings, etc. and a consequent increase in the amount of contaminated water

Several countermeasures need to be prepared for the risk of the failure of current measures. Water levels should be managed by restoring the sub-drain, and the intrusion of groundwater into the reactor buildings should be eliminated by installing frozen-soil shielding walls on their landward side. Ways of resolving technical problems will be verified while the design of frozen soil shielding walls to be installed on the landward side is promoted.

#### (ii) Improvement of the capacity and stable operation of contaminated water treatment facilities

Efforts to enhance the reliability of contaminated water treatment facilities will be promoted with a view to the operation of multi-nuclide removal equipment.

#### (iii) Construction of new tanks to manage contaminated water

Based on the estimated tank capacity required on a mid-and-long-term basis, a plan to construct new tanks will be set up. A plan to increase the capacity to 0.8 million m<sup>3</sup> by FY2016 will be examined. Construction plans should be reviewed and implemented flexibly depending on the circumstances.



### Plan towards Reducing Radiation Doses of Entire Plant and Preventing Expansion of Contamination

- In order to prevent expansion of ocean contamination, the shielding walls on the seaward side will be constructed by the middle of FY2014.
- Measures will be taken, including land improvement to prevent the expansion of contamination and the removal of contaminated water in the trench on the seaward side, while simultaneously dealing with the increased concentration of radionuclides in groundwater near the seawall and strengthening monitoring (including investigation of contamination routes).
- Waste management and radiation dose reduction at the boundaries of the site will be continued.

### Plan for Storage, Management, Processing and Disposal of Solid Waste

- Measures to reduce the amount of waste will be taken in the following priority: Reduce the amount carried in > Minimize waste generation > Reuse > Recycle
  - R&D for characterizing and analyzing waste properties will be promoted to explore processing and disposal methods.

### Plan for Decommissioning Reactor Facilities

- Decommissioning scenarios will be considered and established through gathering worldwide information on how to ensure safety of decommissioning in consideration of end state of facilities.