

Mid-and-long-Term Roadmap towards the Decommissioning of Fukushima Daiichi Nuclear Power Units 1-4, TEPCO (Digest Version)

1. Story behind the Mid-and-long-term Roadmap formation

- Per an order issued on November 9, 2011 by Mr. Edano, the Minister of Economy, Trade and Industry and Mr. Hosono, the Minister for the Restoration from and Prevention of Nuclear Accident, this roadmap was drafted by TEPCO, ANRE and NISA and finalized at the Government and TEPCO's Mid-to-Long Term Countermeasure Meeting.

<Basic Policy towards Addressing the Mid-and-long Term Issues>

- [Policy 1] Systematically tackle the issues while placing top priority on the safety of local citizens and workers.
- [Policy 2] Move forward while maintaining transparent communications with local and national citizens to gain their understanding and respect.
- [Policy 3] Continually update this roadmap in consideration of the on-site situation and the latest R&D results etc.
- [Policy 4] Harmonize the individual efforts of TEPCO, ANRE, and NISA to achieve our goal.

2. The Overall Plan to Secure Mid-and-long-Term Safety

- In the upcoming three years, TEPCO will implement the operation and management plan for their facilities based on "SAFETY DIRECTIVE "Ensuring Mid-Term Safety"" issued by NISA. NISA will review and assess TEPCO's report based on their investigative standards and thus will secure safety.
- Mid-and-long-term actions will be implemented as well. TEPCO will conduct a safety and environmental impact assessment at each juncture where TEPCO will consider concrete measures for each task. NISA will assess and confirm the working measures prior to task implementation. Thus, ensuring the securement of safety.

3. Mid-and-long-Term Roadmap

(1) Primary Targets

- This roadmap divides the term of decommissioning into the following three phases and will detail the main onsite work and R&D schedule to be implemented as effectively as possible hereafter.
 - Phase 1: From the completion of Step 2 to the start of fuel removal from the spent fuel pool, (Target: Accomplish within 2 years after completion of Step 2)
 - Phase 2: From the end of Phase 1 to the start of fuel debris* removal. (Target: Accomplish within 10 years after completion of Step 2)
 - Phase 3: From the end of Phase 2 to the end of decommissioning. (Target: Accomplish within 30 to 40 years after the completion of Step 2)
- * Material in which fuel and its cladding tubes etc. have melted and resolidified.

(2) Target Timeline and Confirmation Points

- Established all possible targets with timelines in the present 3 year-schedule, which are updated and released on a yearly basis

- Regarding the schedule of three years later, established holding points, which are significant ones to judge whether going ahead according to schedule, implementing additional R&D, or re-scheduling the process

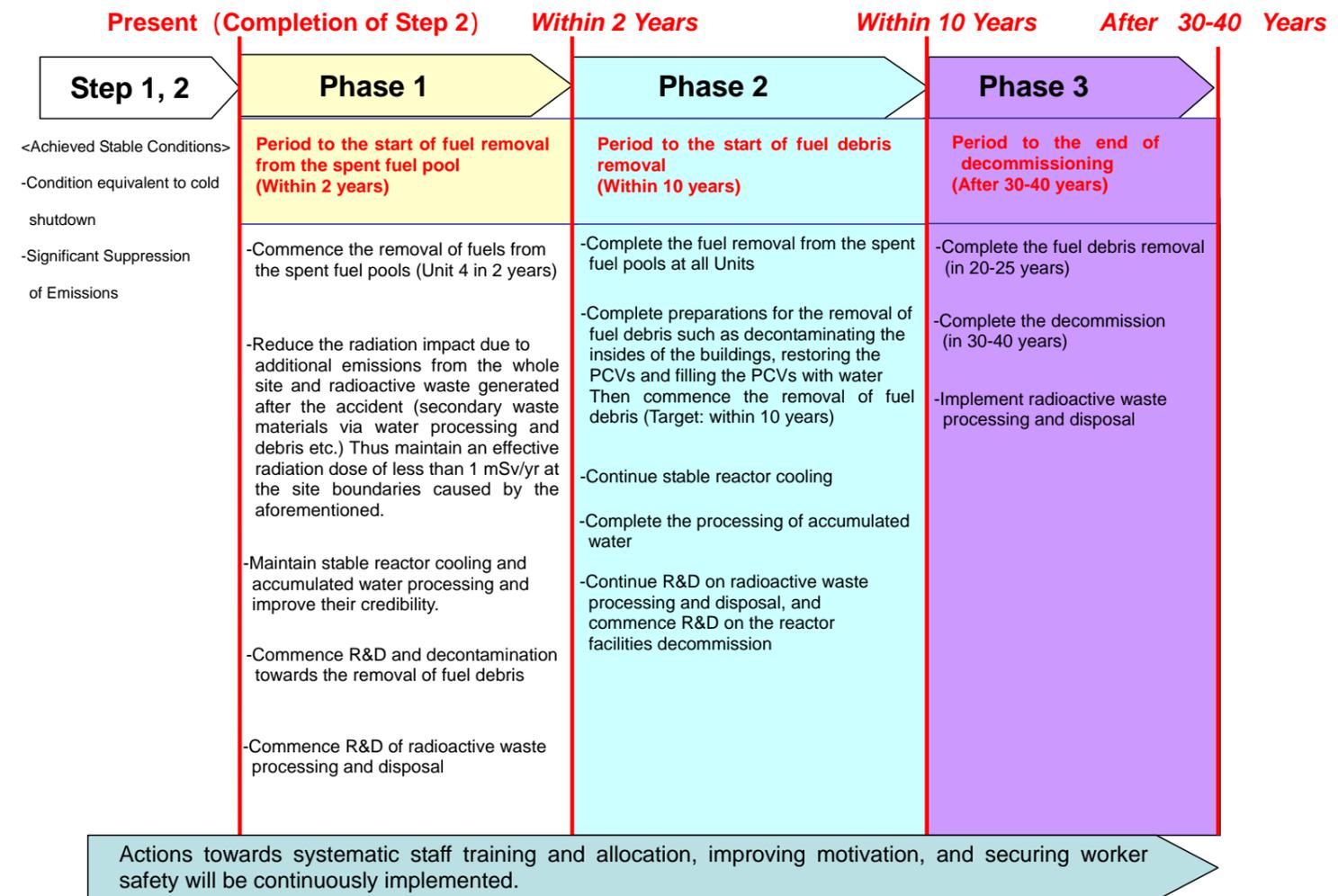


Figure 1 . Mid-and-long-Term Roadmap Summary

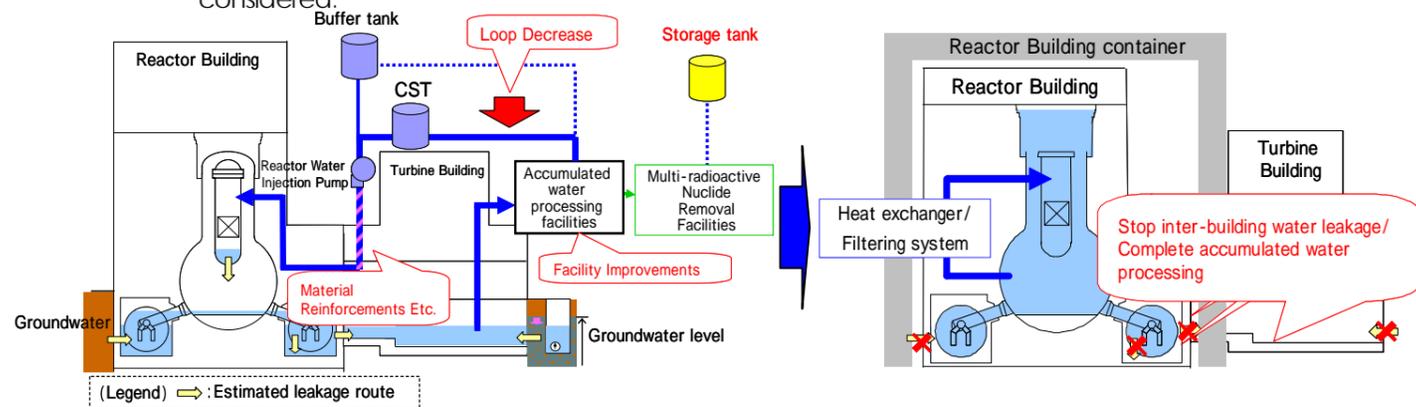
4. Organizational Structure of the Mid-and-long-Term Roadmap

- Established frameworks for onsite project operations and R&D promotion to ensure steady implementation of the mid-and-long term roadmap.
- As we are facing many difficult research development issues that are unprecedented and challenging even from a global perspective, we will work hand-in-hand with our domestic and overseas supporters, and compile wisdom and knowledge from all over the world as we move forward.
- Concerning the onsite work, TEPCO will maintain the current structure with the approx. 400 partner companies, and at the Headquarters, establish the specialized organization to deal with everything of mid-and-long term roadmap issues. Improvement of the work environment and systematic staff training will be able to secure the performable organization and staff.

[The Mid-and-long-Term Roadmap's Target Timeline]

1) Reactor Cooling / Accumulated Water Processing

- In order to stably maintain "a condition equivalent to cold shutdown", water injection cooling will be continued up to the completion of the fuel debris removal.
- By examining the reliability of the system, system improvements will be continuously implemented. In addition, the water circulation loop will be decreased step-by-step.
- By 2012, new decontaminated water processing facilities against multi-radioactive nuclides, which can not be removed by existing Cesium treatment facilities, will be installed.
- During Phase 2, processing the accumulated water in the buildings will be completed after the water shielding between the Turbine Building and the Reactor Building, and the repairs of the lower part of the PCVs. In order to achieve more stable cooling, scaling down of the circulation loop is being considered.



Actions during Phase 1

Actions during Phase 2 (loop decrease)

Figure 2: Mid-and-long-Term Actions Regarding Reactor Cooling and Accumulated Water Processing

2) Plans to Mitigate Sea Water Contamination

- Should underground water be contaminated, in order to prevent underground water flowing into the ocean, installing water shielding walls by mid FY2014.
- Covering and solidifying seabed soil in front of the intake canal will prevent the diffusion of radioactive materials in the soil. By the end of FY2012, continuing the operation of the circulating seawater purification facilities will reduce radioactive materials in the seawater inside the site port to the level below the limit outside of the environment surveillance area as predetermined by a notification of the government. Sediments dredged in order to secure the navigable depth for large ships will be similarly covered.
- Since then, while maintaining the facilities which will be installed, underground water and sea water etc. will be continuously monitored.

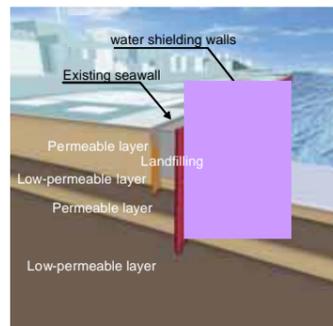


Figure 3: Water Shielding Wall (Image)

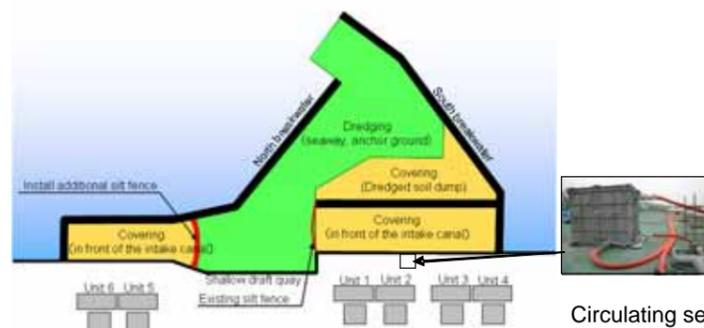


Figure 4: Harbor's Seabed Soil Image

Circulating seawater purification facilities

3) Radioactive Waste Management and Dose Reduction at the Site Boundaries

- Plan to reduce the effective radiation dose at the site boundaries to below 1 mSv / year by FY2012 as a target date, due to additional emissions from the whole site and radioactive waste stored on the site after the accident (secondary waste materials via water processing and debris etc.).
- Plan to develop a facility renewal plan by the end of FY2014 that includes the lifetime assessment of the containers for secondary waste materials via water processing.
- Plan to continue ongoing land and sea environmental monitoring.

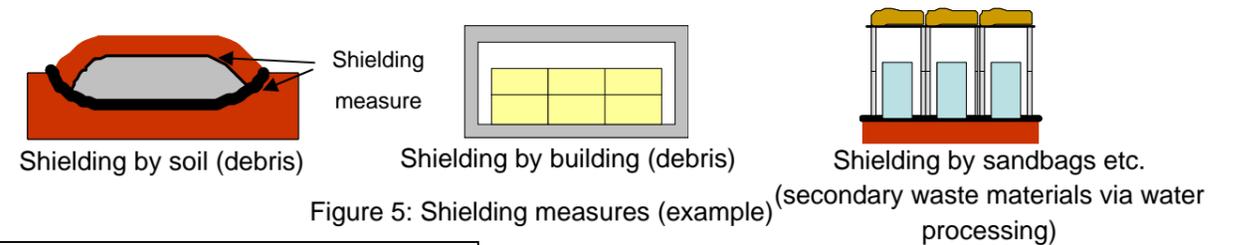


Figure 5: Shielding measures (example)

4) Plan for Decontamination within the site

- In order to reduce exposure to the public and workers while improving the work environment, step-by-step decontamination measures will be implemented starting from the offices and working areas such as the Main Anti-Earthquake Building in conjunction with efforts to reduce radiation dosage outside the site.

5) Plan for Fuel Removal from the Spent Fuel Pool

- Plan to start fuel removal from Unit 4 within 2 years after completing Step 2 (within 2013).
- Plan to start fuel removal from Unit 3 approximately 3 years after completing Step 2 (end of 2014).
- As for Unit 1, plan to develop a fuel removal plan based on experiences at Units 3 & 4 and investigations of rubble, and finish fuel removal in the Phase 2.
- As for Unit 2, plan to develop a fuel removal plan based on the situation after the inside-building decontamination etc. and investigations of the installed facilities, and finish fuel removal in the Phase 2.
- Plan to complete fuel removal from all Units during Phase 2.
- Plan to determine reprocessing and storing methods for removed fuels during Phase 2.

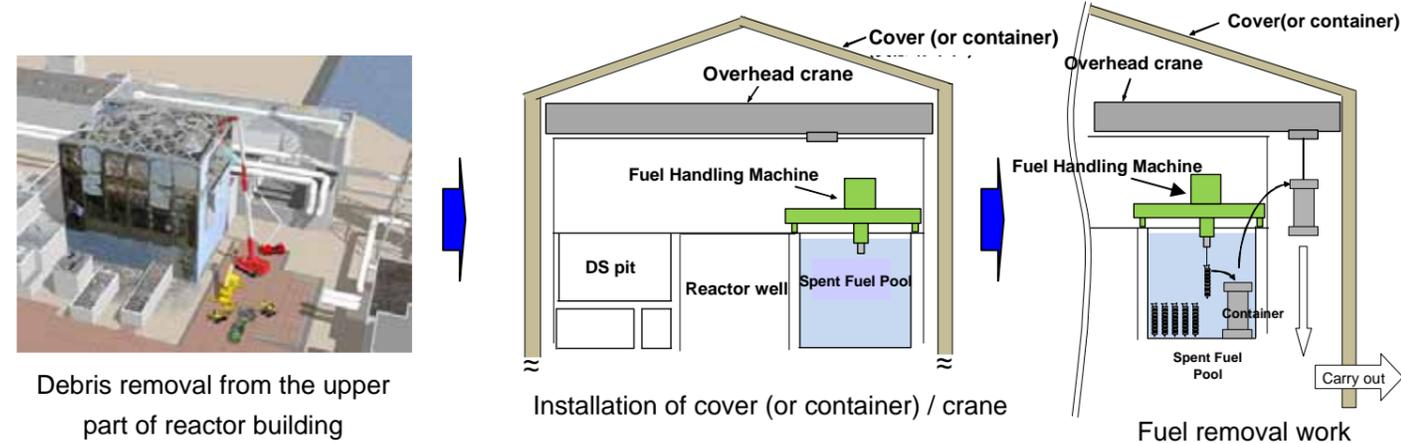


Figure 6: Fuel removal work (image)

6) Fuel Debris Removal Plan

- Plan to start fuel debris removal in the first unit within 10 years after completion of Step 2.
- Removal of fuel debris will be implemented in accordance with the following steps in light of the site situation, safety requirements, and R&D progress of the remote control technology required in the operations.
 - a) By the end of FY2014, start a full investigation of the leaking parts while applying the newly developed technology to the site as well as starting the decontamination of the inside of the reactor building.
 - b) By around the end of FY2015, plan to complete verification of “PCVs (lower part) repair technology” at the site. Plan to stop water leakage at the parts(lower part) identified in step “a)” by applying the new technology. After this, the bottom part of the PCVs will be flooded.
 - c) By the end of FY2016, plan to complete verification of the “PCVs inside investigation technology” at the site after flooding the bottom part of the PCV, and fully investigate the inside of the PCVs.
 - d) Plan to repair the PCVs (upper part) and then flood it, and after installing the reactor building container (or modified cover) in order to secure the enclosed space, open the RPVs cap.
 - e) By mid-2019, plan to complete verification of the “RPVs inside investigation technology” at the site, and implement a full investigation of the inside of the RPVs.
 - f) Following the establishment of a methodology to remove debris, the development of the fuel debris container, and the establishment of a measuring method to weigh fuel debris based on the results of the PCVs and RPVs investigation, fuel debris removal will begin within 10 years after the completion of Step 2

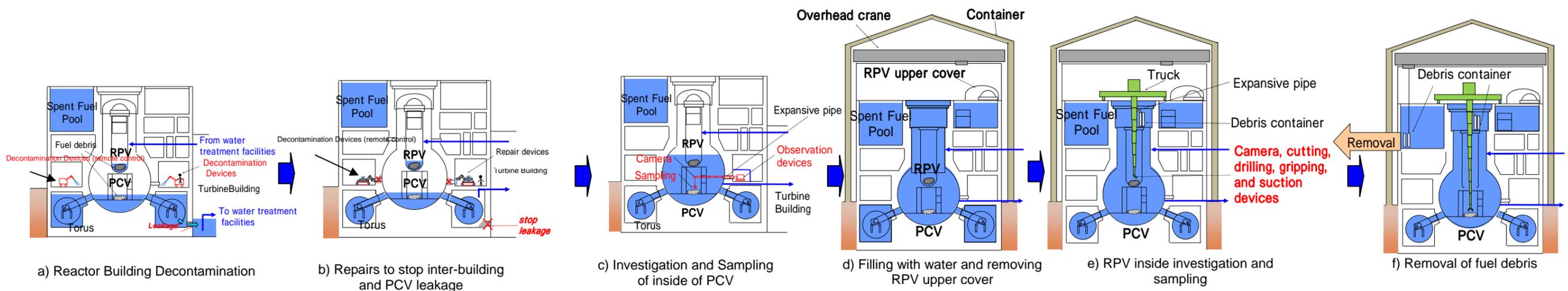


Figure 7: Removal of fuel debris (image)

7) Plan for Disassembly of Reactor facilities

- Plan to complete the reactor facility demolition in Units 1 to 4 within 30 to 40 years after the completion of Step 2.
- Plan to start demolition in Phase 3 after establishing a basic database to monitor contamination etc. required when considering demolition and decontamination methods, achieving R&D progress of remote controlled demolition operations, and having a plan for waste disposal following demolition with necessary regulatory modifications.

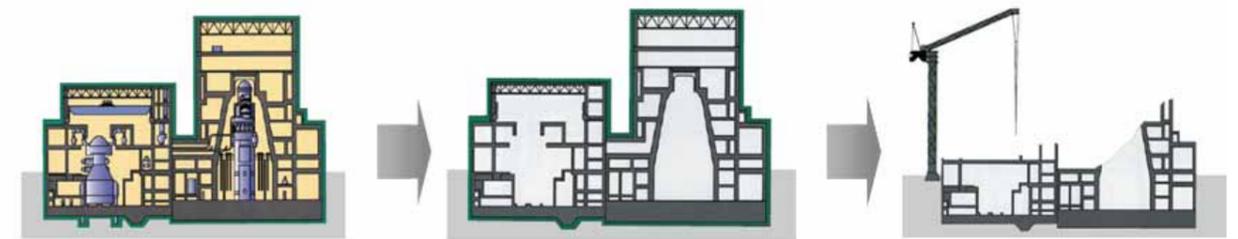


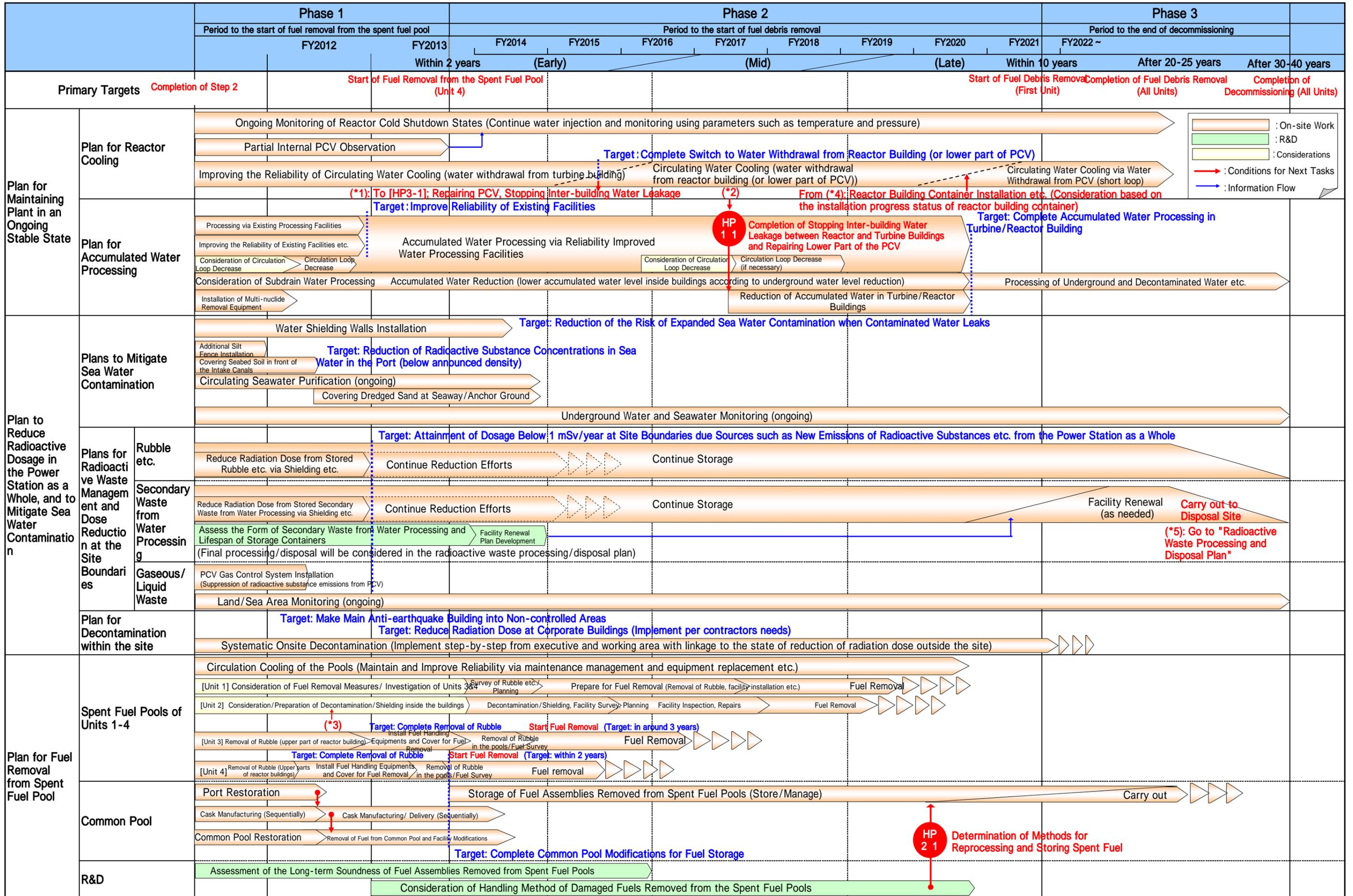
Figure 8: Demolishing of Nuclear Reactor Facilities (image)

8) Radioactive Waste Processing and Disposal Plan

- By FY2012, plan to establish an R&D plan for the post-accident waste, whose contents (nuclide composition, salt amount, etc.) differ from ordinary waste.
- Plan to determine waste specifications after considering safety and the applicability of the existing disposal concept as well as developing safety regulations and technical standards to govern disposal efforts based on the result of R&D activities.
- Plan to start processing and disposal during Phase 3 after the development of the disposal facility and the creation of a prospective disposal plan.

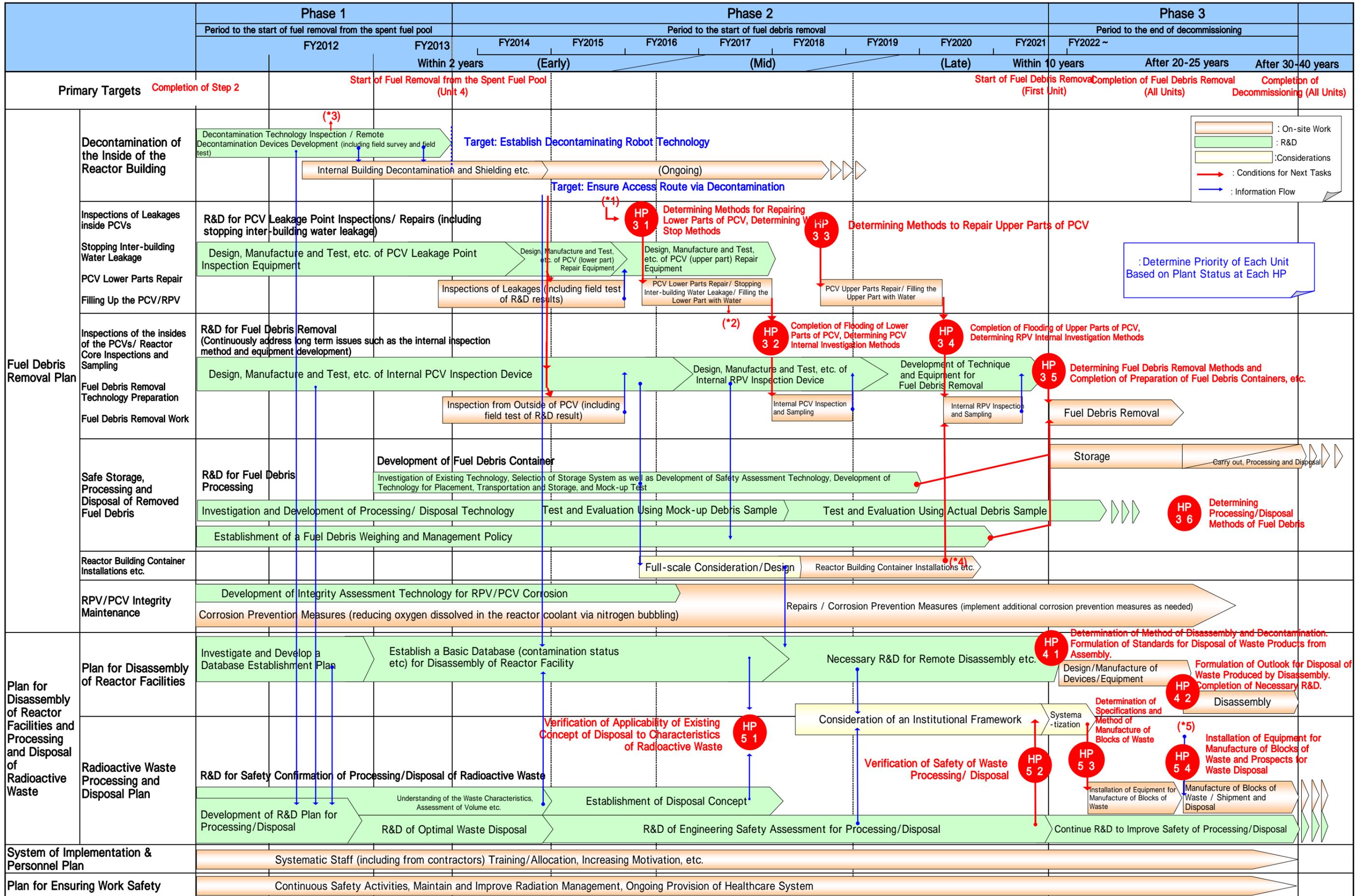
End

Main Schedule of Mid-and-long-term Roadmap towards the Decommissioning of Fukushima Daiichi Nuclear Power Station Units 1-4, TEPCO



*This roadmap will be updated in consideration of the on-site situation and the latest research and development results.

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