(Provisional Translation) **Measures for Mid-term* Risk Reduction at TEPCO's Fukushima Daiichi NPS (as of March 2021)**

March 3,2021
Nuclear Regulation Authority Japan

Issue	Issues for Risk Reduction and Major Measures
Liquid Radioactive Material	・Progress the treatment of stagnant water containing α nuclides in buildings and maintain as drainage completed area except for reactor buildings. ・Decrease rainwater and groundwater flowing into buildings to prevent stagnant water in buildings from increasing and complete the treatment of all stagnant water. ・Decrease water in S/C of Unit 1 and 3 to the level at which the water will not leak out of the buildings Condition to be realized by taking the above measures : Treat all the liquid radioactive material including those remaining in tanks
Spent Fuel	・Complete removing all fuels from spent fuel pools of Unit 1,2,3,5 and 6 ・Establish additional dry storage cask area and secure spent fuel storage ・Store fuels which are stored in common pool, in dry storage casks as far as possible Condition to be realized by taking the above measures : Store all spent fuels in dry storage casks
Solid Radioactive Material	・Remove high-dose zeolite sandbags in Process Main Building, etc. and store stably ・Store spent Cesium adsorption vessel stably in facilities, and stabilize ALPS slurry for storage ・Proceed with reducing the volume and incineration of solid waste such as rubble to reduce the amount of solid waste and eliminate temporary storage outside Condition to be realized by taking the above measures : Store and manage the above and other solid radioactive materials in a safe condition by solidification, etc. ・Install facility to analyze fuel debris and other solid radioactive materials and secure proper staffing and capacity ・Take safety measures in removing fuel debris and store debris in stable status Condition to be realized by taking the above measures : Store fuel debris stably
Countermeasures for External Events	・Seal outer wall of buildings and restrain inflow of groundwater into buildings significantly ・Repair damaged parts such as building roof to prevent rainwater inflow ・Take measures such as blocking the openings of buildings to prevent stagnant water from flowing out or increasing by tsunami ・Take measures in accord with deterioration and damage level of building structures, etc.
Important Issues to Progress Decommissioning	・Reinforce structure to progress risk reduction swiftly and strengthen quality management ・Reduce radiation doses by removal of high-dose radiation sources such as lower part of Exhaust stack of Unit 1 and 2 or shielding against them, and take measures for suppressing dust scattering during operation inside R/B ・Handle the ALPS treated water (e.g. Discharge into the sea) ・Consider the effect of the contamination beneath the shield plugs to each decommissioning works

*about 10 years later

Countermeasures for Risks which would have an effect on the human and the environment

○Treatment of Stagnant Water in Reactor Buildings etc.

○Removal and Stabilization of Zeolite Sandbags in basement floors of Process Main Building etc.

○Transfer and Stabilization of Sludge from Decontamination Equipment

○Measures to prevent structures from collapsing or being damaged by earthquake, tsunami, etc.

○Countermeasures for other Risks which should pay attention to（Risks which effect on offsite are smaller than the above）

- ・Stabilization of ALPS Slurry
- ・ Store spent Cesium adsorption vessel stably in facilities
- ・Removal of Fuels from SFPs of Unit 1 and 2

Measures for Mid-term Risk Reduction at TEPCO's Fukushima Daiichi NPS (Main Goals)

Fiscal Year	Liquid Radioactive Material	Spent Fuel	Solid Radioactive Material		Countermeasures for External Events	Important Issues to Progress Decommissioning
Issue						
2021	Approach toward stopping water injection to reactor	Design of shielding related to fuel removal from Unit 2, etc.	Install large waste storage facility (Cs adsorption vessel)	Operate analysis facility on full-scale and build up structure for analysis	Block the openings of buildings, etc. 【tsunami】	Improve workplace environment continuously Reinforce quality management structure of Decommissioning Project
	Approach to decrease the water level in S/C of Unit 1 and 3	Start installation of additional dry storage casks		Investigate inside Unit 1 PCV	Widen the paving area around buildings 【rainwater】 (completed in FY2023)	Investigate and grasp the contamination around the shield plugs Remove high-dose SGTS pipes in lower part of exhaust stack of Unit 1 and 2, etc.
2022	Process untreated water in tanks (continues on and after 2023)	Start fuel removal from Unit 6 Provide shielding in Unit2 R/B Operating Floor and suppress dust scattering (completed in FY2023)	Start operating additional incinerator Install ALPS slurry (HIC) stabilization facility	Retrieve fuel debris from Unit 2 experimentally and investigate inside PCV and analyze debris Install volume reduction facility and 10th solid waste storage facility		Dose reduction under high-dose environment Take measures to suppress dust scattering from buildings, etc. Handle the ALPS treated water (e.g. Discharge into the sea)(Timing has not been decided) Consider the effect of the contamination beneath the shield plugs to each decommissioning works
2023	Half the amount and treat stagnant water in R/B (Establish method to remove α nuclides until FY 2021)	Install Unit 1 R/B cover	Start removing Sludge from Decontamination Facility Safety measures for fuel debris retrieval (Timing has not been decided) Start removal of Zeolite etc. in Process Main Building, etc.(decide method until FY 2021)			
Further future goals 2024 ～ 2032	Dry up Process Main Building, etc.	Start fuel removal from Unit 5	Install analysis building No.2 and other fuel debris analysis facility		Prevent deterioration and maintain soundness of buildings	
	Treat all stagnant water in R/B	Expand dry storage cask area to install additional dry casks	Remove rubble stored outside	Store retrieved fuel debris in stable state	Seal outer wall of buildings 【groundwater】	
		Fuel removal from Unit 1 and 2	Control waste in safer and more stable state			
		Fuel removal from spent fuel pool of all units				

Countermeasures for Risks which would have an effect on the human and the environment

Countermeasures for Risks which effect on offsite is relatively small, but still should pay attention

Measures for Mid-term Risk Reduction at TEPCO's Fukushima Daiichi NPS (Other Tasks)

○Liquid Radioactive Material		Timing
To be conducted	Remove contaminated water in trenches, etc.(Unit 4 backwash pit)	Within 2021
Timing has not been decided	Remove underground cisterns	
	Treatment of sludge etc. remaining in dried up buildings	

○Spent Fuel		Timing
Timing has not been decided	Remove spent control rods	

○Countermeasures for external events		Timing
To be conducted	Restrain the inflow of rainwater into radioactive waste treatment buildings of Unit 1 and 2	Within FY 2021
	Install tide embankment against Nihon-trench Tsunami	Within FY 2023

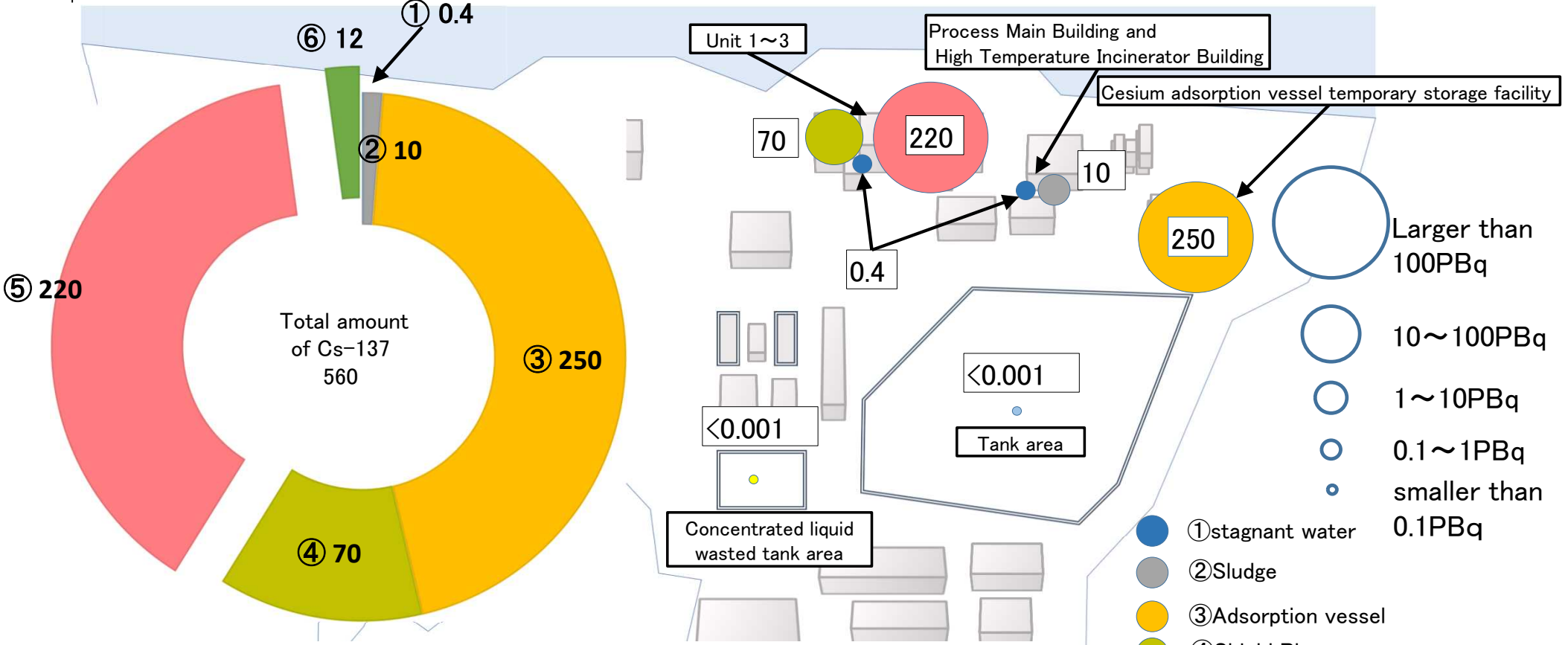
○Important issues to progress decommissioning		Timing
To be conducted	Survey the contamination status inside the reactor buildings, etc. (nuclide analysis, etc.)	Continue After FY 2020
	Grasp the properties and characteristics of the cooling water after the reactors have cooled down (nuclide analysis, etc.)	Continue After FY 2020
	Analyze the flow of contaminated water inside the reactor buildings, etc.	Continue After FY 2020
	Directly observe inside the containment vessel and pressure vessel	Continue After FY 2020
	Remove rubble around the buildings (South Side of Unit 3 R/B)	Within FY 2021
	Reduce concentration of radioactive materials in the water of drainages	
Timing has not been decided	Investigate contamination on the bottom and around Unit 1and 2 common stack	
To be considered necessary or not	Consider methods to improve the environment of ground level 2.5m, such as removal and decontamination of soil, purification of ground water, etc.	

Location of radioactive materials (Mainly Cs-137) (except for spent fuels)　(unit; PBq)

	type*	characteristic	Explanation for each type
①	Stagnant water	liquid	Highly contaminated water stagnating in 1～3 Reactor Buildings, Process Main Building and High Temperature Incinerator Building
②	Sludge	Liquid/Solid	Precipitation from treatment of contaminated water soon after the accident/Sandbag containing zeolite installed before contaminated water started to be transferred
③	Adsorption vessel	Solid (including water)	Metal container containing adsorbent inside (used vessels are stored temporarily outdoor)
④	Shield plug	Solid (detail is unknown)	Shield cover above PCV (large amount of Cs-137 released in the accident is trapped between first and second layer of shield plug)
⑤	Cs-137 not included in any of category ①～④ and ⑥ (fuel debris, etc.)	Solid (detail is unknown)	Fuel debris remaining in 1～3 reactor building, etc.

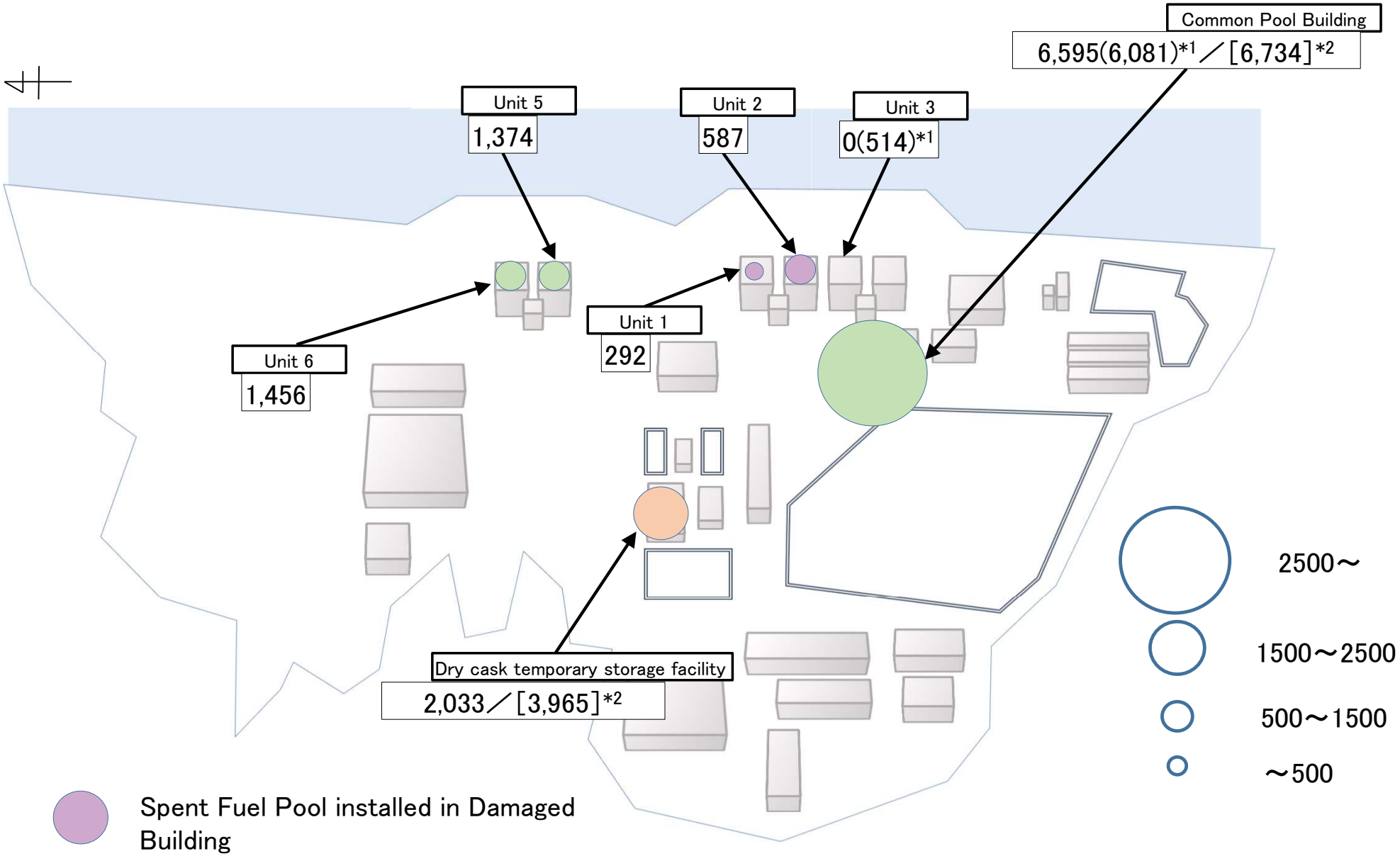
＊: listed up in order according to ease of migrating into environment

＊: listed up in the ascending order of stability



- Reduction of radioactivity is taken into account assuming that the radiation reduced for 10 years (11th March 2021) from the accident
- Total amount of Cs-137 is estimated using「JAEA-DATA／Code2012-018」considering reduction
- Amount of Cs-137 released to the environment is estimated, referring to「Additional report of the Japanese government to IAEA－about the TEPCO Fukushima Daiichi Nuclear Power Station accident －(the second report)」and considering reduction
- This material shows the location of Cs-137 except for spent fuels. However, besides Cs-137, 36 PBq of Sr-90 (in process main building and concentrated liquid waste tank area)、0.69 PBq of H-3 (in tank area) exist.
- Since fraction is rounded up or down, sum of ①～⑥ doesn't match the total amount.

Location of Spent Fuels



*1; Number inside ( ) is the number as of December 2019

*2; Number inside [ ] is the capacity of storage

Amount of spent fuels as of 1st March, 2021

List of Major Inventory (Cs-137)

Existing in Buildings and Adsorption Vessels

Location	Inventory (PBq)
Stagnant water	0．4
Sludge	10
Adsorption vessel	250
Shield Plug	70
Cs-137 not included in any of category ①～④ and ⑥（fuel debris, etc.）	220
Cs-137 released to the environment	12
Total amount	560

Spent Fuel

Location	Inventory (PBq)
Unit 1 Spent Fuel Pool	130
Unit 2 Spent Fuel Pool	360
Unit 3 Spent Fuel Pool	0
Unit 4 Spent Fuel Pool	0
Unit 5 Spent Fuel Pool	750
Unit 6 Spent Fuel Pool	790
Spent Fuel Common Pool	3，600
Dry Storage Cask	1，100
Total amount	6，700

- Inventory inside the red frame should be taken measures in high priority
- Each value above has an large error, because they are evaluated indirectly such as from the balance of the amount of Cs-137 in stagnant water, extrapolation from single data, estimation from the average amount of Cs-137 inside 1 spent fuel assembly, etc.
- Since fraction is rounded up or down, sum of each inventory doesn’t match the total amount