Appendix 2

Progress Status Classified by Countermeasures

:Progressed Countermeasures (Legend color changed)

Legend
:Implemented :Under construction :Field work started, but construction not started :Field work not started yet

Areas	Issues	Target	Countermeasures		Unit 1	Unit 2	Unit 3	Unit 4
I Cooling	(1) Reactors	Target [1] [2] Stable cooling	Countermeasures started by April 17	Countermeasure [1]: Injecting fresh water into the RPV by pumps	-In progress (from March 25)	-In progress (from March 26)	-In progress (from March 25)	
				Countermeasure [2]: Injecting nitrogen gas into the PCV (start from Unit1)	-In progress (from April 6)	-Injection line is under preparation (from April 16)	-Injection line is under preparation (from April 16)	
				Countermeasure [3]: Consideration of flooding the PCV up to the top of active fuel	-Under consideration (from April 13)	-Under consideration (from April 13)	-Under consideration (from April 13)	
				Countermeasure [4]: Lower the amount of steam generated by sufficiently cooling the reactor (to be achieved by countermeasures in Step1 and Step2)	-Various countermeasures have been taken	-Various countermeasures have been taken	-Various countermeasures have been taken	
				Countermeasure [5]: Consideration of shielding the leakage by covering the reactor building	-Consideration is completed		-Designing is in progress (continue to Step 2)	-Designing is in progress (continue to Step 2)
				Countermeasure [7]: Cooling at minimum water injection rate (control the leakage of contaminated water)	-In progress	-In progress	-In progress	
				Countermeasure [8]: Install interconnecting lines of offsite power soon	-Installation completed			
			Countermeasures in Step 1	Countermeasure [6]: Consideration of sealing the leakage location in the PCV		-Under consideration (various tests of grout materials are in progress)		
				Countermeasure [9]: Flood the PCV up to the top of active fuel	-While flooding operation started from May 6, consideration of shielding measure of leakage in the PCV is in progress. (Countermeasure [16])	-Flooding measure is under consideration (Countermeasure [3])	-Flooding measure is under consideration (Countermeasure [3])	
				Countermeasure [10]: Reduce the amount of radioactive materials (utilization of standby gas treatment system (filter), etc.) when PCV venting (release of steam containing radioactive materials into the atmosphere)	-Not necessary at this moment	-Not necessary at this moment	-Not necessary at this moment	
				Countermeasure [11] (integrate with countermeasure [15]): Inject nitrogen gas into the PCV	-In progress (from April 6)	**-Start injection (planned on June 27)**	**-Under consideration**	
				Countermeasure [12]: Circulate the accumulated water back into the RPV after processing it (Circulating injection cooling)	**-Water injection with processed accumulated water (from June 17)**	**-Water injection with processed accumulated water (from June 17)**	**-Water injection with processed accumulated water (from June 17)**	
				(Countermeasures in Step 2) Countermeasure [45]: Reuse of processed water as reactor coolant (Circulating injection cooling)	**- In progress in Countermeasure [12]**	**- In progress in Countermeasure [12]**	**- In progress in Countermeasure [12]**	
				Countermeasure [13]: Sesure heat exchange function for the reactor	-Installation work is in progress (May 13)	-Basic design is completed. Detailed design is in progress. -Manufacturing heat exchanger	-Basic design is completed. Detailed design is in progress. -Manufacturing heat exchanger	
				Countermeasure [14]: Continue cooling by minimum water injection rate (Circulating injection cooling)	- In progress	- In progress	- In progress	
				Countermeasure [16]: Seal the leakage location in the PCV	-Confirming leakage spot and leaking amount (plant parameter confirmation, site survey, etc)	-Sealing measure is under consideration (Countermeasure [6])	-Confirming leakage status (plant parameter confirmation)	
				Countermeasure [76]: Improve working environment	-Removal of debris, measurement of radiation dose, entering into the building (May 9)	**-Measurement of radiation dose, start operation of local exhausters（June 11)**	**-Removal of debris, measurement of radiation dose (June 9) , decontamination / shielding (late June)**	

Areas	Issues	Target	Countermeasures		Unit 1	Unit 2	Unit 3	Unit 4
Ⅰ Cooling	**(2) Spent Fuel Pools**	**Target [4] Stable cooling**	**Countermeasures started by April 17**	Countermeasure [18]: Consideration/implementation of improving reliability of external water injection by concrete pumpers (“Giraffe”, etc.)/switch to remote-controlled operation.	-Reliability improvement: installing hoses with enhanced durability (high-spec polyethylene pipe) -Measures to reduce radiation dose: allocated concrete pumping vehicle equipped with remote controllable arm		-Same as Unit 1	-Same as Unit 1
				Countermeasure [19]: Sampling and measurement of steam/pool water by “Giraffe”, etc.	-Sampling method of pool water is under consideration	- Analyzed water of the pool in skimmer surge tank. Confirmed that most of the fuel were intact.	-Confirmed that most of the fuel were intact by analyzing water in the pool	-Confirmed that most of the fuel were intact by analyzing water in the pool
			Countermeasures in Step 1	Countermeasure [22]: Continuation of water injection by “Giraffe”, etc	-Reliability improvement: installing hoses with enhanced durability (high spec polyethylene pipe) -Measures to reduce radiation dose: allocated concrete pumping vehicle equipped with remote controllable arm (2 vehicles)		-Same as Unit 1	-Same as Unit 1
				Countermeasure [23]: Restoration of water injection through normal cooling system.		- Continue water injection through normal cooling system - Addition of heat exchange function is treated in Countermeasure [25,27]		
				Countermeasure [24]: Restoration of normal cooling system	**- Continue water injection through normal cooling system (from May 29)**		**- Continue water injection through normal cooling system (from May 16)**	**-Debris removal, scaffolding etc. in process**
				Countermeasure [25]: Install heat exchangers.	**-Site survey（from May 28） -Manufacturing heat exchanger**	**-Circulating water cooling operation (from May 31）**	**-Debris removal, drainage treatment (from June 1） -Preparation construction work in progress（from June 10） -Transfer heat exchange to the site（planned on June 17）**	**-Site survey（from June 10） -Manufacturing heat exchanger**
				(Countermeasures in Step 2) Countermeasure [27]: Cooling by installation of heat exchangers	**-Cooling will start after installing heat exchanger (Countermeasure [25])**	**-Same as Countermeasure [25]**	**-Cooling will start after installing heat exchanger (Countermeasure [25])**	**-Cooling will start after installing heat exchanger (Countermeasure [25])**

Areas	Issues	Target	Countermeasures		Unit 1	Unit 2	Unit 3	Unit 4
Ⅱ Mitigation	(3) Accumulated Water	Target [6]: Secure sufficient storage place for water with high radiation level	Countermeasures started by April 17	Countermeasure [29]:Identify leakage path and examine and implement preventive measures	- Putting sandbags including radioactive decontaminants (zeolite) into the port (from April 15 to 17: put 10 sets of baskets including sandbags) - Installation of contamination preventive fences (silt fence) in the port (from April 11 to 14: installation) - Shielding between trench and building (April 6: completed in Unit 4) etc.			
				Countermeasure [30]:Transferring accumulated water to facilities that can store it (condenser and Centralized Waste Treatment Facility)	- Unit 2 Turbine Building accumulated water -> condenser (April 13 transfer completed) - Implementation of waterproof work etc. in order to transfer water from Unit 2 Turbine Building to Centralized Waste Treatment Facility			
				Countermeasure [31]: Preparing decontamination and desalt of transferred accumulated water.	- Selection of decontamination / desalt process, consideration of basic design etc.			
				Countermeasure [32]:Preparing to install tanks	- Arrangement of tanks, selection of installation place, preparation - Cancellation application of permission and authorization regarding deforestation			
			Countermeasures in Step 1	Countermeasure [37]:Utilization of “Centralized Waste Treatment Facility”, etc. to store water	- After waterproof check in Centralized Radiation Treatment Facility (Main Process Building), transferring accumulated water in Unit 2 from April 19 - After waterproof check in Centralized Radiation Treatment Facility (High-temperature Incineration Building), transferring accumulated water in Unit 3 from May 17			
				Countermeasure [38]:Install water processing facilities	- Planed to begin decontamination facility / salinity removing equipment			
				Countermeasure [39]:Examination and implementation of backup measures (installment of additional tanks)	- Installation of tanks [For receiving treated water] May 10 : Approx. 11,000 tons, May 22 : Approx. 2,000 tons ＜Plan＞early July : Approx. : 20,000 tons, late July : 20,000 tons, Approx. 20,000 tons / every month (to Step 2)			
				（Countermeasure in Step 2） Countermeasure [42]:Expansion of additional tanks to store high radiation-level contaminated water	-Site preparation for installing underground tanks (from May 16 to late June) - Transportation and installation on underground tanks（from late June to Step 2）			
				（Countermeasure in Step 2） Countermeasure [43]:Continuation and reinforcement of decontamination and desalt of high radiation-level water	- Consideration and preparation for enhancement of treatment equipments - Preparation for enhancement of desalt equipments			
				（Countermeasure in Step 2） Countermeasure [45]:Reuse of processed water as reactor coolant (Circulating injection cooling)	- In progress in Countermeasure [12]	- In progress in Countermeasure [12]	- In progress in Countermeasure [12]	
				Countermeasure [64]:Mitigation of contamination in the ocean	-Injection of sandbags including adsorption material of radioactive material (zeolite) into inside of the bay（May 19, injected 10 additional sets） -Preparation construction work for installation of steel pipe sheet pile [removal of curtain wall]（from June 2） -Circulate purifying equipments in operation（from June 13） -Installation of water intake sliding concrete plate(from June 12)		<Plan> -Installation of steel pipe sheet pile (continue to Step 2)	
				Countermeasure [65]:Isolation of high-level radioactive water	-Completed closing of pits etc.（May 17）	-Completed closing of turbine trenches of seawater pipes（June 2） -Completed closing of pits etc.（June 9）	-Completed closing of turbine trenches of seawater pipes（May 26） -Completed closing of pits etc.（June 13）	-Completed closing of turbine trenches of seawater pipes (April 6) -Completed closing of pits etc. (June 13)
				Countermeasure [81]:Storage / management of sludge waste	- Storage / management of sludge waste, which derived from the treatment of high-level contaminated water			
		Target [7]: Store and process water with low radiation level	Countermeasures started by April 17	Countermeasure [33]:Preparing to store with tanks and barges	- In progress in Countermeasure [40]			
				Countermeasure [34]:Preparing for decontamination and desalt of contaminated water	- In progress in Countermeasure [41]			
				Countermeasure [35]: Preparing to install a reservoir	- Planning to use tank instead of reservoir			
				Countermeasure [36]:Preparing to decontaminate sub-drainage water after being pumped up	- Preparing to decontaminate in tank on the ground etc. (zeolite etc.)			
			Countermeasures in Step 1	Countermeasure [40]:Increase storage capacity by adding tanks, barges, Megafloat, etc	- Megafloat docked (May 21 : 10,000 tons), Installation of tanks (May 31: 18,400 tons) <note> barges (late June : 1,200 tons and 1,000 tons)			
				Countermeasure [41]:Decontaminating contaminated water using decontaminants to below acceptable criteria	- Use of decontaminants (zeolite) : full operation (from May 1)			
	(4) Underground Water	Target [13]: Prevent contamination spread into the sea	Countermeasures in Step 1	Countermeasure [66]:Examination of mitigation measures of groundwater contamination	- Examined mitigation measures of groundwater contamination (countermeasure [67],[68])			
				Countermeasure [67]:Implementation of mitigation measures of groundwater contamination	-Restoration of sub-drainage pumps around reactor building of Unit 1～4（to Step 2） -Management of sub-drainage together with the expansion plan of treatment facility（to Step 2）			
				Countermeasure [68]:Examination of shielding wall of groundwater	- Choose most appropriate method to shield wall underground water by evaluating the effect of water shield, earthquake resistance, and durability(Continue to Step 2)			

Areas	Issues	Target	Countermeasures		Unit 1	Unit 2	Unit 3	Unit 4
Ⅱ Mitigation	(5) Atmosphere / Soil	Target [9]: Prevent scattering of radioactive materials on buildings and ground	Countermeasures started by April 17	Countermeasure [47]:Inhibit scattering of radioactive materials by full-scale dispersion of inhibitor after confirming its performance by test	- Confirmed unevenness of dispersion and solidification status of soil by test dispersion - Developed remote-controlled crawler damp for dispersion			
				Countermeasure [48]:Prevent rain water contamination by dispersion of inhibitor				
				Countermeasure [49]:Removal of debris	- Started installation of remote-controlled heavy machinery (April 6 test run, April 10 full operation) (Removed debris (volume of 31container of approx. 4m3) (by April 17))			
				Countermeasure [50]:Examination and implementation of basic design for reactor building cover and full-fledged measure (container with concrete roof and wall, etc.)	- Examination of basic design for reactor building cover '-Basic design of container in progress		- Examination of basic design for reactor building cover '-Basic design of container in progress	- Examination of basic design for reactor building cover '-Basic design of container in progress
				Countermeasure [51]:Consideration of solidification, substitution and cleansing of contaminated soil (mid-term issues.)	- Confirmed solidification of soil by dust inhibitor			
			Countermeasures in Step 1	Countermeasure [52]:Dispersion of inhibitor	-Approx. 340,000 m2 of plane and slope (as of June 14) -Approx. 120,000 m2 around Units 1 to 4 (as of June 14)		<Plan> -Approx. 420,000 m2 of plane and slope (to the end of June) -Around building of Unit 1～4 : Disperse inhibitor to the R/B of Unit 4 after coordinating area and equipment（planned around on June 18）	
				Countermeasure [53]:Removal of debris	- Removed debris (volume of 279 containers of approx. 4m3 and volume of 30 containers of approx. 8m3) (from April 6 to June 14) - Continuation of removal work			
				Countermeasure [54]:Installation of reactor building covers	- Started preparation construction work (from May 13) - Start construction（planned on June 27）		- Designing is in progress(Continue to Step 2) - Started preparation construction work (planned on late June)	
Ⅲ Decontamination / Monitoring	(6) Measurement, Reduction and Announcement	Target [11]: Expand/enhance monitoring	Countermeasures started by April 17	Countermeasure [57]:Monitoring sea water, soil and atmosphere within the site boundary (25 locations.)	- In progress - Implemented atmosphere monitoring when opened the door of reactor building in Unit 1(May 8, 9)			
				Countermeasure [58]:Monitoring radiation dose at the site boundary (12 locations.)	- In progress - Implemented atmosphere monitoring when opened the door of reactor building in Unit 1(May 8, 9)			
				Countermeasure [59]:Consideration of monitoring methods in evacuation area/ deliberate evacuation area/ evacuation prepared area in case of emergency.	- Measurement of airborne radiation within 20 km radius from the power plant. Implemented measurement in 128 spots within 2km from main road (April 18). Implemented fixed point measurement in 50 spot (May 6,13)			
			Countermeasures in Step 1	Countermeasure [60, 61]:Expansion, enhancement and announcement of monitoring	<Monitoring inside and outside of the power station area is in progress, and under evaluation of released radioactive nuclide>（to Step 2） - Land area：radiation dose rate in air（50 spots / week）, soil survey etc - Sea area：expanding to offshore of Fukushima, Ibaraki and Miyagi prefectures. Considering to introduce marine life monitoring and unmanned survey ship			
Ⅳ Countermeasures against aftershocks, etc.	(7) Tsunami, reinforcement, etc.	Target [15]: Prevent expansion of disaster	Countermeasures started by April 17	Countermeasure [20]:Seismic tolerance assessment of Unit 4.				-Evaluated resistance against earthquake of SFP in Unit 4
				Countermeasure [21]:Continue monitoring and examine necessary countermeasures				-Continue surveillance and considered reinforcement work
			Countermeasures in Step 1	Countermeasure [69]:Countermeasures against tsunami	- Transferred emergency power sources to the upland (April 15) - Added redundancy of water injection line (to April 15), Set fire trucks etc. to the upland (to April 18			
				Countermeasure [70]:Enhancement of countermeasures against tsunami	- Installation of temporary tide barriers (start preparation work : April 30, construction : from May 18 to the end of June)			
				Countermeasure [26]:(Unit 4) Installation of supporting structure under the bottom of the pool				・Structure already evaluated, installation in progress（from May 20）, supporting structure effective (from late June)
				Countermeasure [71]:Planning/implementation of reinforcement work of each Unit	- Plan to evaluate earthquake resistance (Continue to Step 2)			
				Countermeasure [72]:Preparation of various countermeasures for radiation shielding (application of slurry)	- Completed pipe work and pumping vehicle set (May 17)			
				Countermeasure [73]:Continuation of various countermeasures for radiation shielding	・Maintain facilities（to Step 2） ・Training of workforce etc（to the end of June）			

Areas	Issues	Target	Countermeasures		Unit 1	Unit 2	Unit 3	Unit 4
Ⅴ Environment Improvement	(8) Improvement of life/work environment at the site	Target [17]: Enhance the environment improvement	Countermeasures in Step 1	Countermeasure [74]:Improvement of life/work environment of workers	- Improvement of meals, upgrade of lodging facility, securing daily life water, installation of rest station at the site (7 rest station are installed by TEPCO : as of June 17)			
				Countermeasure [75]:Continuation and enhancement of improvement of life/work environment of workers	(Continue to Step 2) - Installation of temporary dormitory : after the end of June, moving to temporary dormitory and increasing temporary dormitory step by step - Increasing available amount of daily life water, expansion of rest station at the site			
	(9) Improvement of radiation control and medical system	Target [18]: Enhancement of healthcare	Countermeasures in Step 1	Countermeasure [77]:Improvement of radiation control	- Installation of decontamination equipment for people and vehicles - Issuance of individual examination certificate (May 7) - Introduction of bar-code reader for individual APD rental			
				Countermeasure [78]:Continuing improvement of radiation control	- Expansion of whole-body counters (plan to start operation from end of July), additional expansion (plan to start operation from October) - Expansion of decontamination equipment: installation of survey place in case of rain and cleansing place (plan to start operation from early July) - Automated recording of individual APD (In progress at Fukushima Daiichi from mid April. In progress at J-Village except for radiation value from June. Full operation is planned to start from December)			
				Countermeasure [79]:Improvement of medical system	- Considering heat strokes countermeasures in summer, 24-hour doctor's office in the Main Anti-Earthquake Building with the aid of the government. (from May 29)			
				Countermeasure [80]:Continuing improvement of medical system	-With the aid of the government, expansion of doctor's office, deployment of several more doctors and improvement of transportation of patients etc.			