

Progress Status Classified by Countermeasures

Red colored letter: newly added to the previous version,
Red frame: progressed countermeasures (countermeasures which are mentioned concretely at this revision)

Reference 1

September 20, 2011
Tokyo Electric Power Company

*Not necessary at this moment since we changed the original plan and will implement fuel cooling by circulating water cooling

Legend	 : Implemented	 : Under Construction	 : Field work started, but construction not started	 : Field work not started yet
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Areas	Issues	Target	Countermeasures	Unit 1	Unit 2	Unit 3	Unit 4	
Cooling	(1) Reactors	Cold shutdown condition	Countermeasures started by April 17	Countermeasure [1]: Injecting fresh water into the RPV by pumps	- In progress (from Mar. 25)	- In progress (from Mar. 26)	- In progress (from Mar. 25)	
				Countermeasure [2]: Injecting nitrogen gas into the PCV (start from Unit1)	- In progress (from Apr. 6)	- In progress (from Jun. 28)	- In progress (from Jul. 14)	
				Countermeasure [3]: Consideration of flooding the PCV up to the top of active fuel	- Not necessary at this moment*	- Not necessary at this moment*	- Not necessary at this moment*	
				Countermeasure [4]: Lower the amount of steam 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	- Completed in Countermeasure [50]		- Completed in Countermeasure [50]	- Completed in Countermeasure [50]
				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			
				Countermeasure [6]: Consideration of sealing the leakage location in the PCV		- Not necessary at this moment*		
			Countermeasures after Step 1	Countermeasure [9]: Flood the PCV up to the top of active fuel	- Not necessary at this moment*	- Not necessary at this moment*	- Not necessary at this moment*	
				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 Apr. 6)	- In progress (from Jun. 28)	- In progress (from Jul. 14)	
				Countermeasure [12]: Circulate the accumulated water back into the RPV after processing it (Circulating water cooling)	- Circulating water cooling in progress (from Jun. 27)	- Circulating water cooling in progress (from Jun. 27)	- Circulating water cooling in progress (from Jun. 27)	
				(Countermeasures in Step 2) Countermeasure [45]: Reuse of processed water as reactor coolant (Circulating water cooling)	- In progress in Countermeasure [12]	- In progress in Countermeasure [12]	- In progress in Countermeasure [12]	
				Countermeasure [13]: Secure heat exchange function for the reactor	- Not necessary at this moment*	- Not necessary at this moment*	- Not necessary at this moment*	
				Countermeasure [14]: Continue cooling by minimum water injection rate (Circulating water cooling)	- Preparation of water injection for stable cooling	- Preparation of test for stable cooling - Injecting water via Core Spray system in addition to reactor feed water system (from Sep. 14)	- Preparation of test for stable cooling - Injecting water via Core Spray system in addition to reactor feed water system (from Sep. 1)	- Change the water injection volume experimentally, while confirming transition of temperature in the reactor
				Countermeasure [16]: Seal the leakage location in the PCV	- Not necessary at this moment*	- Not necessary at this moment*	- Not necessary at this moment*	
				Countermeasure [76]: Improve working environment	- Removal of debris, measurement of radiation dose, entering into the building (May 9)	- Measurement of radiation dose, entering into the building, start operation of local exhausters purification mode (from Jun. 11 to 19)	- Removal of debris, measurement of radiation dose, entering into the building (Jun. 9)	- Cleaning using robots (Jul. 1) - Placing steel plates in truck bay door entrance (Jul. 4)
				Countermeasure [12,14,45]: Installation of centralized monitoring system in the main anti-earthquake building	- Establishing the centralized system to monitor the plant parameters (water injection volume, injection pressure, water level of the buffer tank etc.) by using the monitors installed in the main anti-earthquake building			
				Countermeasure [17]: Maintain and improve countermeasures of Step1 as needed	- Explained in above progress status of countermeasures			

Areas	Issues	Target	Countermeasures	Unit 1	Unit 2	Unit 3	Unit 4	
Cooling	(2) Spent Fuel Pools	More stable cooling	Countermeasures started by April 17	Countermeasure [18]: Consideration/implementation of improving reliability of external water injection by concrete pampers ("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.	- Analyzed water of the pool in FPC pump drain pipes. Confirmed that most of the fuel were intact	- 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 after 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	- Water injection through normal cooling system (from May 29 to Aug. 9)		- Water injection through normal cooling system (from May 16 to Jun. 29)	- Water injection by installing alternative facility to "Giraffe" (from Jun. 17 to Jul. 30)
				Countermeasure [25]: Install heat exchangers	- Circulating water cooling operation (from Aug. 10)	- Circulating water cooling operation (from May 31)	- Circulating water cooling operation (from Jun. 30)	- Circulating water cooling operation (from Jul. 31)
				(Countermeasures in Step 2) Countermeasure [27]: Cooling by installation of heat exchangers	- Same as Countermeasure [25]	- Same as Countermeasure [25]	- Same as Countermeasure [25]	- Same as Countermeasure [25]
				(Countermeasures in Step 2) Countermeasure [28]: Expand remote-controlled operation area of "Giraffe", etc	- "Elephant 3"(modified as remote-controlled operation) is waiting at 1F (from May 17) - "Mammoth 2"(modified as remote-controlled operation) is waiting at 1F (from Jun. 21)		- Same as Unit 1	- Same as Unit 1

Areas	Issues	Target	Countermeasures	Unit 1	Unit 2	Unit 3	Unit 4	
Mitigation	(3) Accumulated Water [High radiation level]	Decrease total amount of accumulated water	Countermeasures started by April 17	Countermeasure [29]: Identify leakage path and consider / implement preventive measures	- Putting sandbags including radioactive decontaminants (zeolite) into the port (from Apr. 15 to 17: put 10 sets of baskets including sandbags) - Installation of contamination preventive fences (silt fence) in the port (from Apr. 11 to 14: installation) - Shielding between trench and building (Apr. 6: completed in Unit 4) etc.			
				Countermeasure [30]: Transferring accumulated water to facilities that can store it (condenser and Centralized Waste Processing Building)	- Unit 2 Turbine Building accumulated water -> condenser (Apr. 13 transfer completed) - Implementation of waterproof work etc. in order to transfer water from Unit 2 Turbine Building to Centralized Waste Processing Building			
				Countermeasure [31]: Preparing decontamination and desalination of transferred accumulated water.	Selection of decontamination / desalination 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 after Step 1	Countermeasure [37]: Utilization of "Centralized Waste Processing Building", etc. to store water	- After waterproof check in Centralized Waste Processing Building (Main Process Building), transferring accumulated water in Unit 2 (from Apr. 19) - After waterproof check in Centralized Waste Processing Building (High-temperature Incineration Building), transferring accumulated water in Unit 3 (from May 17)			
				Countermeasure [38]: Install water processing facilities	- Decontamination facility and desalination equipment in operation			
				Countermeasure [39]: Consideration and implementation of backup measures (installation of additional tanks) (Countermeasure in Step 2)	- Installation of tanks [For receiving treated water] May 10: 11,000 tons, May 22: 2,000 tons, Jul. 14: 20,000 tons, Aug. 13: 22,000 tons, Sep. 16: 23,000 tons < Plan > approx. 20,000 tons / month (continue to Step 2)			
				Countermeasure [42]: Expansion of additional tanks to store high-level radioactive water (Countermeasure in Step 2)	- Site preparation for installing underground tanks (from May 16 to Jun. 25) - Transportation and installation of underground tanks (from late Jun. to Sep. 17) : 2,800 tons			
				Countermeasure [43]: Elimination and continuous processing of contaminated water in the buildings (Countermeasure in Step 2)	- Enhancement of processing equipments (installed 2nd Cesium Adsorption Instruments (SARRY), operation started from Aug. 18) - Enhancement of desalination apparatus (installed evaporative concentrated apparatus (250 tons / day) (term , Aug. 7, Aug. 31), Install evaporative concentrated apparatus (750 tons / day) (term , by middle of Oct.)			
				Countermeasure [45]: Reuse of processed water as reactor coolant (Circulating water cooling) (Countermeasure in Step 2)	- In progress in Countermeasure [12]	- In progress in Countermeasure [12]	- In progress in Countermeasure [12]	
				Countermeasure [64]: Mitigation of contamination in the ocean	- Putting sandbags including radioactive decontaminants (zeolite) into the port (May 19, put 10 additional sets) - Preparation work for installation of steel pipe sheet pile [removal of curtain wall] from Jun. 2 - Circulating purifying equipments in operation (from Jun. 13) - Installation of water intake sliding concrete plate (from Jun. 12) - Installation of steel pipe sheet pile (from Aug. 17)			
				Countermeasure [65]: Isolation of high-level radioactive water	- Completed closing of pits etc. (May 17)	- Completed closing of turbine trenches of seawater pipes (Jun. 2) - Completed closing of pits etc. (Jun. 9)	- Completed closing of turbine trenches of seawater pipes (May 26) - Completed closing of pits etc. (Jun. 13)	- Completed closing of turbine trenches of seawater pipes (Apr. 6) - Completed closing of pits etc. (Jun. 13)
				Countermeasure [81]: Storage / management of sludge waste	- Appropriate storage / management of sludge waste with high-level radioactivity , which derived from the treatment of high-level radioactive water			
				Countermeasure [82]: Consideration of full-scale water processing facilities	- Consideration of full-scale water processing facilities			
				(3) Accumulated Water [Low radiation level]	Prevent contamination spread into the sea (continuation)	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 desalination of contaminated water	- In progress in Countermeasure [41]							
Countermeasure [35]: Preparing to install a reservoir	- Using tanks 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 after Step 1	Countermeasures started by April 17	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)					
		Countermeasure [41]: (Integrated with Countermeasures 44 and 46, Countermeasures in Step 2) Decontaminating contaminated water using decontaminants to below acceptable criteria	- Use of decontaminants (zeolite) in full operation (from May 1)					
(4) Underground Water	Prevent contamination spread into the sea (continuation)	Countermeasures after Step 1	Countermeasure [66]: Consideration 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 - Management of sub-drainage together with the expansion plan of storage / processing facility				
			Countermeasure [68]: Consideration of shielding wall of groundwater Countermeasure [83]: Establishment of impermeable wall against groundwater	- Considering most appropriate method of impermeable wall of underground water by evaluating the effect of water shield, earthquake resistance, and durability (Continue to Step 2) - Begin establishment of impermeable wall against groundwater (to Step 2)				

Areas	Issues	Target	Countermeasures	Unit 1	Unit 2	Unit 3	Unit 4	
Mitigation	(5) Atmosphere / Soil	Mitigate scattering of radioactive materials (Continuation)	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 dump trucks for dispersion			
				Countermeasure [48]:Prevent rain water contamination by dispersion of inhibitor	- Started installation of remote-controlled heavy machinery (Apr. 6 test run, Apr. 10 full operation) (Removed debris (volume of 31 containers of approx. 4m ³) (by Apr. 17))			
				Countermeasure [49]:Removal of debris	- Consideration of basic design for reactor building cover - Basic design of container in progress			
				Countermeasure [50]:Consideration and implementation of basic design for reactor building cover and full-fledged measure (container with concrete roof and wall, etc.)	- Consideration 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 status of soil by dust inhibitor			
				Countermeasure [52]:Dispersion of inhibitor	- Approx. 400,000 m ² inside of the power station (plane and slope) (as of Jun. 28) - Approx. 160,000 m ² around Units 1 to 4 (as of Jun. 27) - Removed debris (volume of approx. 800 containers) (as of Sep. 20) - Continuation of removal work - Manage removed debris etc. in storage area according to its kinds and radiation dose			
			Countermeasures after Step 1	Countermeasure [53, 87]:Removal / management of debris	- Started preparation construction work (from May 13) - Started construction (from Jun. 27) - Installation work of steel-frame work for reactor building cover (from Aug. 10 to Sep. 9) - Started installation of wall panel (from Sep. 10)			
				Countermeasure [54, 55]:Installation of reactor building covers				
				Countermeasure [84]:Removal of debris at the upper part of the reactor building (Unit 3 and 4)	- Started preparation work (from Jun. 20) - Started construction (from Sep. 10)			
				Countermeasure [84]:Removal of debris at the upper part of the reactor building (Unit 3 and 4)	- Started preparation work (from Jun. 24) - Started construction (from Sep. 21, planned)			
				Countermeasure [86]:Consideration and installation of PCV gas control system	- Design specifications are under consideration	- Design specifications are under consideration	- Design specifications are under consideration	
				Countermeasure [86]:Consideration and installation of PCV gas control system	- Design specifications are under consideration	- Design specifications are under consideration	- Design specifications are under consideration	
Monitoring / Decontamination	(6) Measurement, Reduction and Disclosure	Decontamination	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 dose rate within 20 km radius from the power plant. Implemented measurement at 128 spots within 2km from main road (Apr. 18). Implemented fixed point measurement at 50 spots (May 6, 13)			
			Countermeasures after Step 1	Countermeasure [60, 61]:Evaluate the amount of radioactive materials currently released	- Assess the current release rate of radioactive materials from Units 1 to 3 utilizing the airborne radioactivity concentration at the upper part of the reactor buildings - In order to assess the decreasing trend of the release rate due to mitigation countermeasures, continue to measure airborne radioactivity concentration at the upper part of the reactor buildings and inside the power station as well as measure radioactive fallout in and out of the power station (1point in the power station, 10 points out of the power station)			
				(Countermeasures in Step 2) Countermeasure [62]:Implementation of monitoring in cooperation with the government, prefectures, municipalities and operators	- Land area: radiation dose rate in air (50 spots / week), soil survey in progress. - Sea area: expanding to offshore of Fukushima, Ibaraki and Miyagi prefectures. Introduce unmanned survey ship.			
				(Countermeasure in Step 2) Countermeasure [63]:Consideration / start of full-fledged decontamination	- Individual and detailed monitoring is in progress. Based on findings of investigations, contributing to model project for decontamination in living area such as houses.			

Areas	Issues	Target	Countermeasures	Unit 1	Unit 2	Unit 3	Unit 4			
Countermeasures for aftershocks, etc.	(7) Tsunami, reinforcement, etc.	Mitigate disasters	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 after Step 1	Countermeasure [69]:Countermeasures against tsunami	- Transferred emergency power sources to the upland (Apr. 15)	- Added redundancy of water injection line (by Apr. 15), Set fire trucks etc. to the upland (by Apr. 15)				
				Countermeasure [70]:Enhancement of countermeasures against tsunami	- Completion of installation of temporary tide barriers (Jun. 30)					
				Countermeasure [26]:(Unit 4) Installation of supporting structure under the bottom of the pool						- Structure already evaluated, installation in progress (from May 20), completion of installation of steel pillar (Jun. 20), supporting structure effective, work completed (Jul. 30)
				Countermeasure [71]:Planning/implementation of reinforcement work of each Unit	- Completed seismic assessment (Aug. 26). Planning to inspect inside of the building after taking measures to reduce radiation dose					
				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) - Implemented training of workforce (Jun. 16, 17) - Developed manual and confirmed system (Jun. 30)									
Environment Improvement	(8) Improvement of living/working environment	Enhance the environment improvement	Countermeasures after Step 1	Countermeasure [74]:Improvement of living/working environment of workers	- Improvement of meals, upgrade of lodging facility, securing daily life water, installation of rest station at the site (11 rest stations installed by TEPCO, 6 rest stations installed by affiliated companies : as of Sep. 9)					
				Countermeasure [75]:Continuation and enhancement of improvement of living/working environment of workers	(Continue to Step 2) - Installation of temporary dormitory : after the end of June until September, 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	Enhancement of healthcare	Countermeasures after 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]:Continue improvement of radiation control	- Expansion of whole-body counters (from Jul. 11), additional expansion (plan to start operation from October) - Expansion of decontamination equipment: installation of survey place in case of rain (from Jul. 15) and cleansing place (from Jul. 31) - Automated recording of individual APD (Fukushima Daiichi; from Apr. 14, Full operation is planned to start from December)									
Countermeasure [79]:Improvement of medical system	- Considering heat strokes countermeasures in summer, established 24-hour doctor's office in the main anti-earthquake building at Fukushima Daiichi with the aid of the government. (from May 29)									
(10) Staff training/ personnel allocation	Thorough radiation exposure control	Countermeasures after Step 1	Countermeasures after Step 1	Countermeasure [80]:Continue improvement of medical system	- With the aid of the government, opened emergency medical facility at Unit 5/6 Service building and 24-hour resident doctors who has knowledge of emergent exposure medical have been in place. [Realized plural doctors] (from Jul. 1) - Establishment of sustainable medical system and establishment of industrial hygiene system such as preventive healthcare - Speedy transportation of patients (Enhancement of transportation vehicle and review of transportation rules etc.) - Implementation of countermeasures for mental health (Support and physical checkup by specialists from National Defense Medical College etc.) - Implementation of regular physical checkup and various extraordinary physical checkup [workers who exceeded the dose limit of 100mSv, workers who take potassium iodide, workers who engaged in emergency work for more than one months etc.] - Intensive preventive measures against heat stroke (trainings for new workers etc.) - Decided to install emergency medical room permanently at Unit 5/6 Service Building after September, which was established only for the summer season, and to continuously allocate doctors familiar with emergency medical care - Started to allocate nurses and radiation specialists (irregular assignment for the time being) - Enhance decontamination facility at 5/6 emergency medical room and directly transfer seriously injured persons without contamination to hospitals - Enhancement of health management by assigning doctors from Univ. of Occupational & Environmental Health, Japan or Labor Hospital at J Village					
				Countermeasure [85]:Systematic staff training and personnel allocation	- Conducting training for staffs engaged in radiation related work, who will be in great demand. - TEPCO has been conducting "radiation survey staff training" targeted for employees and TEPCO group companies employees and has already trained approx. 2,500 personnel. - The government has been conducting "radiation survey staff" and "radiation protection staff" development trainings and will train 250 personnel. - According to affiliated companies needs, launched a new framework of looking for workers widely through Japan Atomic Industrial Forum (JAIF).					