

Progress Status Classified by Countermeasures

Underline: changed content, Red frame: progressed countermeasures (countermeasures which are mentioned concretely at this revision)

Reference 1

October 17, 2011
Tokyo Electric Power Company

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

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	- Implement in Countermeasure [50]		- Implement in Countermeasure [50]	- Implement 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] (integrated 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 at minimum water injection rate (Circulating water cooling)	- Water being injected to achieve cold shutdown condition - The temperature at RPV bottom is stable below 100	- Water being injected to achieve cold shutdown condition - Verified that the temperature at RPV bottom can stabilize below 100 by changing the water injection volume experimentally	- Water being injected to achieve cold shutdown condition - The temperature at RPV bottom is stable below 100	
				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)	
					- Closing of the underground open areas in T/B and R/B etc.			
				Countermeasures [12,14,45]: Installation of centralized monitoring system in the main anti-earthquake building	- Established 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 (Sep. 30)			
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 Countermeasures [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)	- 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, <u>Oct. 8: 15,000 tons</u> < Plan > approx. 20,000 tons / month (~ Step 2)			
				(Countermeasure in Step 2) Countermeasure [42]:Expansion of additional tanks to store high-level radioactive water	- 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 in Step 2) Countermeasure [43]:Elimination and continuous processing of contaminated water in the buildings	- Enhancement of processing equipments (installed 2nd Cesium Adsorption Apparatus (SARRY), operation started on Aug. 18) - Enhancement of desalination apparatus (installed evaporative concentrated apparatus (250 tons / day) (term , until Oct. 9), installed evaporative concentrated apparatus (750 tons / day) (term , until Oct. 9)			
				(Countermeasure 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 [64]:Mitigation of contamination in the ocean	- Putting sandbags including radioactive decontaminants (zeolite) into the port (May 19, put 10 additional sets) - Circulating purifying equipments in operation (from Jun. 13) - Installation of water intake sliding concrete plate (<u>completed on Jun. 29</u>) - Installation of steel pipe sheet pile (<u>completed on Sep. 28</u>)						
	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	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)			
	(4) Underground Water	Prevent contamination spread into the sea (continuation)	Countermeasures after Step 1	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)			
Countermeasure [66]:Consideration of mitigation measures of groundwater contamination				- Examined mitigation measures of groundwater contamination (countermeasures [67], [68])				
Countermeasure [67]:Implementation of mitigation measures of groundwater contamination				- Restoration of sub-drainage pumps around reactor building of Unit 1 ~ 4 - Restoration of sub-drainage together with the expansion plan of storage / processing facility				
Countermeasure [68]:Consideration of shielding wall of groundwater				- <u>Basic design of impermeable steel pipe sheet installation in front of the existing seawalls of Units 1 to 4 has been completed (Aug. 31)</u> - <u>Detailed specifications on the land side are now under consideration</u> (~ Step 2)				
			Countermeasure [83]:Establishment of shielding wall of groundwater	- <u>Construction work on the sea side will commence from around the end of October.</u>				

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 Countermeasure [48]:Prevent rain water contamination by dispersion of inhibitor Countermeasure [49]:Removal of debris Countermeasure [50]:Consideration and implementation of basic design for reactor building cover and full-fledged measure (container with concrete roof and wall, etc.) Countermeasure [51]:Consideration of solidification, substitution and cleansing of contaminated soil (mid-term issues.)	- Confirmed unevenness of dispersion and solidification status of soil by test dispersion - Developed remote-controlled crawler dump trucks for dispersion				
			Countermeasures after Step 1	Countermeasure [52]:Dispersion of inhibitor Countermeasures [53, 87]:Removal / management of debris Countermeasures [54, 55]:Installation of reactor building covers Countermeasure [84]:Removal of debris at the upper part of the reactor building (Units 3 and 4) Countermeasure [86]:Consideration and installation of PCV gas control system	- 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. 900 containers) (as of Oct. 17) - Continuation of removal work - Manage removed debris etc. in storage area according to its kinds and radiation dose - Sprinkle processed water which meets the bathing standard in the site for fire prevention purpose (from Oct. 7). - Completed preparation construction work - Started construction (from Jun. 27) - Completed installation work of steel-frame and wall panels for reactor building cover (from Sep. 10 to Oct. 14) - Started installation work of ancillary facilities such as exhauster and comprehensive test (from Oct. 14) - Started installation work (from Oct. 7) - Started installation work (from Oct. 10)	<Termination of dispersion of inhibitor > - Continuous confirmation of solidification of inhibitor where dispersed			
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.) Countermeasure [58]:Monitoring radiation dose at the site boundary (12 locations.) Countermeasure [59]:Consideration of monitoring methods in evacuation area / deliberate evacuation area/ evacuation prepared area in case of emergency.	- In progress - Implemented atmosphere monitoring when opened the door of reactor building in Unit 1 (May 8, 9) - In progress - Implemented atmosphere monitoring when opened the door of reactor building in Unit 1 (May 8, 9) - 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	Countermeasures [60, 61]:Evaluate the amount of radioactive materials currently released (Countermeasures in Step 2) Countermeasure [62]:Implementation of monitoring in cooperation with the government, prefectures, municipalities and operators (Countermeasure in Step 2) Countermeasure [63]:Consideration / start of full-fledged decontamination	- Comprehensively estimate the current release rate of radioactive materials from Units 1 to 3 by utilizing the airborne radioactivity concentration (dust concentration) at the upper part of the reactor buildings, sea areas and land areas - Current total release rate from Units 1 to 3 is estimated as approx. 0.1 billion Bq/hour (provisional) at the maximum (1/8,000,000 of that at the time of the accident) - Radiation exposure at the site boundary is assessed as approx. 0.2 mSv/year (provisional) at the maximum (Target is 1 mSv/year excluding the effect of the radioactive materials already released up until now) - Continuously implement the measurements of airborne radioactivity concentration at the upper part of the reactor buildings, sea areas and land areas, thus grasping the reduction tendency of the release rate due to the mitigation countermeasures. - Land area: continue radiation dose rate measurement in air at 50 spots (once a week) and dust sampling near 10km radius at 5 spots (once a month) - Wide-area monitoring (radiation dose survey) conducted in restricted areas and deliberate evacuation areas (results were publicly announced in Sep. 1). Individual detailed monitoring (radiation dose survey in air, fields, roads and water environment etc.) is being conducted (from mid June to end of October). - Sea area: expanding to offshore of Fukushima, Ibaraki and Miyagi prefectures. Sampling of sea water and sea bed soil etc. are planned utilizing unmanned survey ships. [Government activities] - A decontamination model project is being prepared in a rapid manner. Currently, pre-monitoring is being implemented at a part of the area. [Activities where the operator is participating] - The operator is collecting useful information for effective decontamination through wide-area monitoring as well as ongoing individual detailed monitoring. (The operator will support the pilot decontamination projects conducted by the government.)				

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		
				Countermeasure [69]:Countermeasures against tsunami	- Transferred emergency power sources to the upland (Apr. 15)						
				Countermeasure [70]:Enhancement of countermeasures against tsunami	- Added redundancy of water injection line (by Apr. 15), Set fire trucks etc. to the upland (by Apr. 18)						
				Countermeasure [26]:(Unit 4) Installation of supporting structure under the bottom of the pool	- Completion of installation of temporary tide barriers (Jun. 30)						
				Countermeasure [71]:Planning/implementation of reinforcement work of each Unit	- Completed seismic assessment (Aug. 26)					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 [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 (12 rest stations installed by TEPCO, 8 rest stations installed by affiliated companies : as of Oct. 5)			
							Countermeasure [75]:Continuation and enhancement of improvement of living/working environment of workers	(- Step 2) - Installation of temporary dormitory : Accommodation for 1,600 people constructed (Aug. 31). Approx. 1,100 people moved in (as of Oct. 1). - Twenty on-site rest stations have been established (approx. 4,400m ² in size with a capacity to accommodate approx. 1,500 persons) (as of Oct. 5).			
(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	- Expanded whole-body counters as planned (12 installed as of Oct. 3). Internal radiation exposure measurement once a month started from September. - Automated recording of individual APD is under preparation (currently, exposure data is manually recorded for future use). - Guideline was publicly announced for examinations according to exposure dose etc. (Oct. 11).						
				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)						
				Countermeasure [80]:Continue improvement of medical system	- 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. - Allocate nurses and radiation specialists (not regular basis in the meantime.) - By establishing speedy transportation system for patients via the enhancement of medical and decontamination facilities, transfer seriously injured persons who are not contaminated directly to hospitals. - Ambulance cars have been prepared (Sep. 16). * 3 transportation vehicles. - Implementation of prevention and mitigation countermeasures against flu. (start flu vaccination etc. from Nov. 1.)						
(10) Staff training/ personnel allocation	Thorough radiation exposure control	Countermeasures after Step 1	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. 3,000 personnel. - The government has been conducting "radiation survey staff development training" (7 times until Oct. 7, approx. 200 people trained) and "radiation protection staff development training" (approx. 10 people trained from Aug. 8 to Aug. 12, and 30 people trained after Sep. 26). These trainings will be continued. - According to affiliated companies needs, launched a new framework of recruiting workers widely through Japan Atomic Industrial Forum (JAIF).							