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Final Report	98	1	Lowness of tsunami assumption	Verification is necessary that it is sufficient just to have an evaluation by an academic society.	About an earthquake or tsunami, in the future, there will no longer be any waiting just for the regulatory agency to move, but a framework will be created to construct and review an independent approach to ensuring safety.
		2		Consider a framework for reviewing evaluations of tsunami voluntarily and periodically	
		3	Destruction of access roads	Strengthened measures to prevent liquefaction of trunk roads	Measures to reinforce road surfaces are being implemented
		4		Ensure multiple access roads, etc.	Specify multiple access routes (secure routes with heavy machinery when there is scattered debris or other such instances)
		5	Risk assessment of tsunami in which height is the focus	Review of system for assessing risks such as the destructive force, energy, etc. of tsunami	Referencing the "Guidelines for Tsunami Evacuation Buildings, etc." (June 2005, Cabinet Office), design such that able to withstand three times the hydrostatis pressure
		6		Anchor heavy fuel oil tanks, etc.	Heavy fuel oil tanks are considering in being removed. Also, since light oil tanks are installed inside the sea wall, the possibility of becoming a debris is low.
		7		Deploy heavy machinery for removing debris and ensure such operators	Heavy machinery to remove debris (wheel loaders, etc.) have been deployed. Station personnel are currently obtaining licenses for large special-purpose vehicles (to ensure there are operators).
		8	Error in starting up diesel generators (D/G)	Find out the cause of the malfunction	It is estimated that the D/G startup event at Fukushima Daini was due to the occurrence of a line-to-ground fault resulting from the earthquake which input a bus voltage low signal.
		9		Review required of methods for startup when there has been an emergency shutdown due to earthquake	Even if it is in case of an earthquake, if the external energizer is maintained, there will be no necessity of starting D/G. Moreover, when an external energizer is lost irrespective of a reason, an emergency diesel generator starts automatically.
		10	At Fukushima Daiichi NPS and Daini NPS, the seawater system pumps were destroyed	Permanently station mobile power sources and seawater cooling system pumps	Underwater pumps and generators capable of recirculating sea water have been deployed and fuel has been secured in the auxiliary machinery seawater cooling system.
		11		Install motor washing facility and ready spare components	At Fukushima Daini, attempts were made to wash the submerged pumps, but these were not effective. For this reason, measures to waterproof the building housing the heat exchanger are to be implemented. Also, spare components for replacement motors have been secured in preparation for a failure. (one unit each of K1 RHSW, RHIW, and EEIW; one unit at units K2〜7 RSW, RCW)
	99	12	Large quantity of inundation at turbine building (T/B) and annexes	Review locations for installation of diesel generators and power panels	Measures to prevent inundation of important equipment rooms (D/G, power panels, etc.), and installation of emergency M/C on high ground
		13		Ensure that mobile power-generating vehicles are stationed there at all times	Air-cooled gas turbine power-generating vehicles have been deployed. Also, procedures have been prepared for supplying electricity to existing systems using these.
		14	Inundation through open service entrances	Review operation of truck bays and other areas with low water tightness	Create watertight doors on areas including truck bays. Even if left open during outage work, execute operations to close such doors during emergencies.
		15		Prepare work procedures for times when disasters occur, and conduct such training	Formulate a tsunami accident management (AM) guide, and conduct such training.

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Final Report	99	16	Loss of power to the seismic-isolated building	Tsunami countermeasures for the seismic-isolated building and securing emergency power sources	Flood preventive measures for the seismic-isolated building were implemented. Emergency power sources of the seismic-isolated building were installed before the accident.
		17	Inflow of seawater at Onagawa and Tokai Daini NPSs	Reinforce water tightness and aseismicity of locations where seawater system pumps are installed	Waterproofing measures already implemented for heat exchanger building (pumps for D/G cooling were installed). Spare motors of auxiliary machinery seawater cooling pumps were secured and the drainage measure for the heat exchange building are under enforcement.
	100	18	Instantaneous and total failure of DC power sources	Reinforce water tightness and aseismicity of power source equipment	Measures to prevent inundation of important equipment rooms (batteries, power panels, etc.)
		19		Ensure alternate DC power source. Important to assure power source having diversity.	Reinforce DC power source (decentralized deployment of storage batteries, deployment of rechargers, etc.) is under enforcement.
		20		Increase battery capacity	Currently implementing measures to augment DC power source so that 8 hours may be maintained without load rejection and 24 hours maintained with load rejection
		21		Secure means for charging batteries	Recharing equipment deployed at seismic-isolated building. Also, emergency recharging equipment is scheduled to be installed also in a building on high ground.
		22	Total loss of off-site power	Reinforce the seismic resistance for off-site power (particularly, power transforming facilities, etc.)	Pylons have been assessed for ground aseismicity, and among the switchyards assessed in seismic evaluations (according to JEAC 4601), GIS has been adopted for 500kV transmission lines. There is a policy for reinforcement for seismic resistance and replacing points where vulnerabilities have been confirmed with facilities having the necessary seismic resistance. In the future, there will no longer be any waiting for the government or other entities to move, but a framework will be created to construct and review an independent approach to ensuring safety.
		23		Multiplexing of off-site power supply routes (transmission network)	Ensuring three routes of five external power lines, collaboration with internal power sources via the West Gunma switchyard, and collaboration with Tohoku Electric Power Company through the Kariwa substation. ※At the KK site, there are facilities receiving electricity on independent routes from Tohoku Electric Power Company in addition to TEPCO's Shin-Niigata and Minami-Niigata trunk lines
		24		Multiplexing and diversification through reinforcment of interchange operations and collaboration with each plant for off-site power	Interchange through emergency M/C and interchange through P/C with adjacent units is possible. When a unit is operating, interchange through a 500kV bus is also possible.
		25	Seawater had a harmful effect on the cooling source for emergency diesel generators	Review locations for installation of diesel generators and power panels	Air-cooled GTG and power supply vehicles already deployed on high ground. Emergency M/C and underground heavy oil tanks have been installed as facilities related to power sources on high ground.
		26		Ensure emergency power sources for a variety of types of cooling systems and drive systems	
		27	Sudden shutdown of emergency diesel generators	Identify routes where seawater flowed into emergency diesel generator room and implement measures	Investigate and specify within emergency safety measures, etc. and implement the necessary waterproofing measures
		28		Prevention of inundation of cooling pump and reinforcement of watertightness	Same as No.17.
		29		Securing replacement components for emergency diesel generators	Deployment of air-cooled GTG and other equipment on high ground
	101	30	Importance of power source interchange	Strengthening of routes for power source interchange within site	Same as No.24.
		31	Deficiency in accident measures	Review in AM procedures assuming loss of AC power sources for an extended period of time	Formulated operating procedures (accident management guide, etc.) assuming SBO or LUHS for an extended period of time
		32	Simultaneous loss of AC and DC power sources not assumed	Securing alternate AC power sources	Formulation of measures to strengthen all types of power sources and the preparation of procedures for supplying electricity to existing systems using emergency power sources
		33		Securing alternate DC power sources	
		34		Formulation of procedures for rapid installation of the aforementioned	

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Final Report	101	35	Delay in supplying electricity from power-generating vehicles	Consideration of permanently stationing, diversification and multiplexing of power-generating vehicles (DC, AC and DC&AC consolidated, etc.)	Deploy air-cooled GTG and power supply cars are to be deployed. Along with these, it is possible to supply electricity from emergency M/C on high ground, and power supply cars can be placed near buildings and supply electricity by connecting cables. Spare battery components have already been deployed. With regard to the DC power supply, it is possible to be supplied to a DC bus through a converter from an AC power-generating vehicle.
		36		Ensuring there are batteries, temporary lighting, small generators, fuel, cables, etc.	All spare components have been secured. In the future also, necessary components will be secured as required.
		37		Formulation and training in procedures for using power supply cars	Connecting terminals have been standardized for power panels and power supply cars. Connection routes are to be configured and training implemented in making connections from power supply cars. In the future as well, such implementation will be continued. Electricity can be supplied from emergency M/C on high ground by both air-cooled GTG and power supply vehicles. Various procedures to be prepared for supplying electricity.
	102	38	Loss of function of power panels	Consideration given to installation of power panels on high ground	Install emergency M/C on high ground
		39		Securing connection terminals on power panels with power supply cars, cables, etc.	Connection terminals on power panels and power supply cars have been standardized.
		40		Preparation of connection routes and strengthening training	Configuration of connection routes and training in making connections from power supply cars. Feedback from the results will be given and the procedures reviewed as necessary. In the future as well, such measures will be continued and training implemented.
		41	Main control room (MCR) made a "dark place"	Multiplexing and diversification of alternate batteries	Batteries for instrumentation have been deployed. Also, waterproofing measures are to be implemented for the existing battery room and other areas.
		42	Delay in restoration in a deteriorated environment	Strengthen training which assumes a worst case scenario (setting of target time for restoration, continued recurrences, etc.)	Conduct training which assumes adverse conditions (SBO, LUHS, Core Damage, etc.). All types of environments to be assumed (darkness, stormy weather, etc.), and training is scheduled to be conducted in the future as well. Training supposing the case where seven plants suffer a great deal of damage simultaneously is conducted. Training when the function of the main control room loses is conducted (1 traing per year for each team)
	103	43	Loss of seawater cooling system made diesel generators inoperable as well	Secure backup including fuel, drive motors, underwater pumps for seawater cooling system	Same as No.10.
		44		Prepare air-cooled cooling lines not dependant on seawater	Deployment of air-cooled gas turbine power supply cars to high ground as a power source not dependent on water cooling
		45		Introduce motors with high water resistance and other measures	Measures to waterproof the building housing the heat exchanger are to be implemented from the standpoint of protecting facilities associated with seawater systems. Also, spare components for replacement motors (auxilialy cooling system and auxiliary cooling seawater system) have been secured in preparation for a failure.
		46	At Units 5 and 6, rearrangement of the seawater cooling system function successful	Define in manuals the connection routes for temporary pumps, power supply cars, etc. and conduct training periodically	Configure connection routes, and conducting training in making connections from power supply cars. Connection routes for all materials and equipment are specified in tsunami AMG and other procedures.
	104	47	Lack of capability to ascertain parameters was setback	Measures to counter loss of power to main control room (MCR)	Multiplexing and diversification are to be implemented for alternate batteries for main control room monitoring functions (deployment of auxiliary batteries, procedures for interchanging with other systems, etc.)
		48		Prevent inundation of DC power sources (reassess installation location and aument watertightness and water resistance)	Measures to prevent inundation of important equipment rooms (batteries, power panels, etc.) have been implemented. Distributed disposition of the reserve battery is carried out, and also, emergency batteries and rechargers are scheduled to be installed at high locations within buildings.
		49		Ensure reserve batteries (including DC power source vehicles as well)	Same as No.35.

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Final Report	**104**	50	Shutdown of isolation condenser system at Fukushima Daiichi Unit 1 and malfunction of the high-pressure coolant injection system	Restore AC and DC power sources within a target time of 2 hours	Measures to prevent inundation of important equipment rooms were enforced. To respond within 2 hours, it is assumed that electricity is supplied from GTG on high ground, the RCIC is started up manually, etc.
		51		Have the capability to operate valves with both DC and AC power	It is anxious about sparks occurring within PCV, and uses AC power supply for the source of a drive.
		52		Study a framework for opening valves which is not dependent on power sources (manual/automatic)	Reviews are to be performed for interlocks on valve operations when there is a loss of power. Procedures are to be developed for manual RCIC startup. There are plans to reinforced DC power sources and set up new alternate high-pressure coolant injection system (TWL(not requiring DC during control))
		53	Activity of the reactor core isolation cooling system at Fukushima Daiichi Unit 2	It is important to have procedures and training for preparing low-pressure cooling functions when high-pressure cooling systems are functioning	Procedures including response times in tsunami AMG were prepared.
	105	54	Hydrogen explosion at Fukushima Daiichi Unit 1 impacted Unit 2	Reconfirmation of risk associated with multiple plants operating	Materials and equipment are basically deployed to each unit in order to respond to simultaneous disasters occurring at multiple plants. At the same time, more interchange lines are being constructed for power source cross-ties.
		55	Hydrogen explosion at Fukushima Daiichi Unit 3 impacted Unit 2	Absolutely prevent a hydrogen explosion	【Assessment of hydrogen explosion mechanism】 The path has been investigated. At Units 1 and 3, hydrogen was generated by the reaction between water and zirconium as a result of independent reactor core damage, and it leaked into the R/B mainly from the PCV head flange which was sealed. At Unit 4, the hydrogen generated at Unit 3 flowed backward through the vent line and through the Unit 4 standby gas treatment system (SGTS) and then into the Unit 4 building. 【Management of hydrogen concentration in R/B and appropriate release】 At locations where hydrogen is likely to accumulate, passive autocatalytic recombiners (PAR) are scheduled to be installed. As a final means, the hydrogen on the R/B refueling level (highest floor) may be released by opening the blowout panel or the R/B top vent equipment. 【Installtion of filtered venting equipment】 Filtered venting equipment is scheduled to be installed (inactivates inside of system with nitrogen gas), and it is possible to release hydrogen after the removal of FP To prevent backflow of hydrogen gas into a unit during venting, procedures have been developed for closing the SGTS discharge vent. (At KK, there are no parts which is sharing the exhaust line among units to the exhaust stack. 【Injection water through the PCV top vent】 By injecting water through the top of the PCV vent for cooling, a temperature rise is controlled and a decline in seal performance is prevented. 【Diversitification of residual heat removal functions for the PCV】 There are procedures for PCV spraying by means of fire engines. 【Installation of hydrogen sensors】
	105	56	Effect of HPCI identified at Fukushima Daiichi Unit 3	Multiplexing and diversification including adding power sources and such training is to be implemented	Same as No.32~34.
		57	Deficiencies in accident management led to depletion of power sources at Unit 3	Multiplexing and diversification as well as securing backups for DC power sources (when all batteries have been submerged, even if the AC power sources are restored, they cannot be recharged)	Bolster DC power sources (decentralized distribution of auxiliary batteries, deployment of rechargers, etc.). Currently implementing measures to augment DC power sources so that 8 hours may be maintained without load rejection and 24 hours from SBO maintained with load rejection. In addition, it is possible to supply to a DC bus from an AC power supply car through a charger, and diversification of a power supply is being addressed.
		58		AM design and training which assumes the instantaneous loss of all DC power sources and a situation in which rechargers are inoperable due to having been submerged	Even if the DC power sources are lost, procedures have been developed and training implemented so that the RCIC can be started manually.

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Final Report	106	59	Delay in low-pressure injection of cooling water at Fukushima Daiichi Unit 1	Augmenting and increasing auxiliary water sources (installation of large fire protection tanks)	Seismic resistance is being reinforced on tanks and reservoirs and wells are being installed. The introduction of desalinization devices are being studied. In addition, diversification is being implemented for the following sorts of water sources and transfer lines. 〇Reservoir→fresh water tank→(MUWC, FP)→CSP, RPV, SFP 〇Reservoir→(fire engine)→fire protection tank→(fire engine)→CSP, RPV, SFP 〇Sea→(fire engine)→CSP, RPV, SFP Etc.
		60		Augmentation of fire engines and hoses	The number of fire engines and hoses deployed have been increased.
		61		Reassessment of locations where fire engines are placed	Fire engines and related materials and equipment have been deployed on high ground
		62		Securing in advance routes for moving fire engines	Connection routes for fire engines, etc. have been specified in tsunami AMG, etc.
		63		Securing auxiliary water sources and pumps, enhancing the capability of fire engines, etc.	Multiple fire engines are to be deployed. Also, water sources are to be augmented by among other means installing new wells and reservoirs.
		64		Finding out the cause of the failure of diesel-driven fire pumps (DDFP) and implementing countermeasures	It is estimated that grounding of the cell motor (TEPCO accident investigation report, final version, p. 129) was the cause. With regard to the D/DFP, capacity of diesel drive coolant injection system is also being studied, including measures for waterproofing equipment rooms.
	107	65	Inefficient injection of cooling water by means of the form of a fire protection tank	Reassessment of the configuration for fire protection tank hose connections	It is possible to draw water simultaneously from multiple fire protection tanks at KK. (It would be difficult to fall into the circumstances experienced at Fukushima Daiichi where there was a shortage on connections and personnel agonized over the response)
		66	Delay in preparing the standby liquid control system	Securing auxiliary power sources (high voltage power supply cars)	Multiple GTG and power supply cars have been deployed on high ground
		67		Multiplexing and diversification of cables, fire engines, etc.	Multiple fire engines are to be secured as well as cables and other necessary materials and equipment are to be secured. Multiple connection points are to be installed. With regard to the D/DFP, capacity of diesel drive coolant injection system is also being studied, including measures for waterproofing equipment rooms.
		68		Checking a hydrogen explosion	Same as No.55.

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Final Report	108	69	Loss of function of safety relief valve (SRV) at Fukushima Daiichi Units 1 and 2	Securing auxiliary batteries, battery vehicles, recharing function from AC power sources, etc.	Same as No.35.
		70		Enhancing the watertightness of batteries	Same as No.18.
		71		Increasing the speed for installation of auxiliary batteries and training in doing so	Auxiliary driving batteries for the SRV are to be deployed inside buildings. Procedures are stipulated in Tsunami AMG and training in installation is to be implemented.
		72		Studying a system for safety relief valve (SRV) not dependent on batteries	In order to improve the reliability of the SRV in an emergency, augment DC power sources (decentralized placement of auxiliary batteries, deployment of rechargers, etc.) and deployment of reserve nitrogen gas cylinder are improgress. Moreover, being considered to diversify depressurization means, it is under consideration to construct decompression means other than SRV.
		73	Delay in operation of safety relief valve (SRV) at Fukushima Daiichi Unit 3	Extending battery duration	In addition to deploying auxiliary batteries for the SRV, measures are currently being implemented to augment DC power sources so that 8 hours may be maintained without load rejection and 24 hours from SBO maintained with load rejection
		74		Shortening the time for construction of a low-pressure water injection line using fire engines, etc.	Procedures are stipulated in Tsunami AMG and training is to be implemented. The results are fed back and procedures are reviewed as necessary.
	109	75	Risk of delay in implementing depressurization	Reassessment of accident management (AM) as described below	
		76		①Reflection of unexpected events identified this time	Measures to improve the reliabiltiy of depressurization operations have been adopted based on the knowledge from the Fukushima Daiichi accident, and procedures for implementing such have been specified in tsunami AMG.
		77		②Configuration of standards for determining that ordinary cold shutdown procedures are not possible, configuration of target time for preparation of low-pressure water cooling system, etc.	Response according to decision-making flowchart for tsunami AMG (There are procedures for cases where an ordinary cold shutdown due to SBO+LUHS is not possible, and the target time for each response and the decision-making standards for transitions are also stipulated.)
		78		③Configuration of secondary action policy for occassions when ordinary procedures are inoperable **(not aiming for 100 points, but to prevent a worst case event. Prevention of hydrogen explosion, building venting, seawater injection, rapid depressurization, etc.)**	Response according to decision-making flowchart for tsunami AMG (Basic ranking of priorities is stipulated.)
		79		Enhancing capabilities to respond and periodic training	Training for times of emergency has been conducted several times, and is scheduled to be continued in the future as well.
		80	Delay in PCV venting at Fukushima Daiichi Unit 1	Securing power sources	Development of procedures for supplying electricity to existing system (vent valve driving source) by using emergency power sources and measures to reinforce all types of power sources
		81		Securing lighting (in addition to that for buildings, hand held for field work, etc.)	Portable lighting equipment has already been deployed (headlights, floodlight ballons, etc.)
		82		Securing communication tools	Measures to be implemented to strengthen all sorts of communication functions (reservation of comunication tools among those in the field, MCR,
		83		Securing auxiliary compressors and other equipment required for the work	Auxiliary cylinders have already been deployed in order to secure the pressure which drives a valve. When power cannot be supplied by power supply cars, manual actions are also possible (improvements are being considered for manual action mechanisms).
		84		Change systems so that venting can be reliably performed even when there is a SBO (make it so that the vent can be opened by an auxiliary driving force without going to the site)	By making connecting with power supply cars, it is possible to secure valve driving force during SBO as well

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Final Report	110	85	Venting failure at Fukushima Daiichi Unit 2①	Study construction of venting line which does not use air pressure	Setting up manual action mechanisms (improvements are under consideration).
		86	Venting failure at Fukushima Daiichi Unit 2②	Review operating pressure of rupture disk	Following the installation of filtered venting systems, take the direction of switching over from rupture disks to valves.
		87		Verify reasons for configuring rupture disk to high operating pressure	The background to this is based on the approach of configuring the design that does not impede the isolation function fo the PCV due to operating error or leakage from the isolation valve mounted on the venting pipe so that a rupture disk was installed and the opening pressure was configured to be the venting commencement pressure (PCV design use pressure).
		88		Study removing rupture disk and replacing it with a system for opening and closing a venting valve	Same as No.86.
		89	Delay in work at Fukushima Daiichi Unit 3	Ensure readiness of cylinders, etc. for driving venting valve	Same as No.83.
		90		Training in cylinder replacement work	Training is being conducted in transporting the cylinders in everyday business.
		91	Opened valve was closed at Fukushima Daiichi Unit 3	Enhancing driving cylinders (securing air supply line, studying multiplexing)	Auxiliary cylinders have already been deployed in order to secure the pressure which drives a valve. When power cannot be supplied by power supply cars, manual actions are also possible. Multiplexing is also being considered in conjunction with filtered vents.
	111	92	Frequency of aftershocks hindered the work	Necessity of accident management design and training assuming muliple simultaneous occurrence and stratification of deteriorated environment	Same as No.42.
		93	Work during the night was difficult	Training assuming a loss of power at night or holidays	Same as No.42.
		94		"Increasing visualization (painted with a fluorescent coating)" of valves and instruments	Same as No.81.
		95	Risk in sharing water sources, etc. for multiple purposes	Studying segregation of water sources	Water sources such as installation of a reservoir, a well, etc. are currently being augmented. The policy is not to use water sources for different purposes because it is throught to be more appropriate to have an operation that uses water sources as appropriate to adapt to the circumstances as necessary for responsind to a fire, injecting cooling water into the fuel pool or injecting cooling water into the reactor.
		96		Multiplexing and diversification of most important water sources	Same as No.59.
		97	Risk of multiple plants operating	Arrangement of issues concerning framework for the field at the time an accident occurs	Issues are being deduced and the framework reassessed.
		98		Arrangement of points at issue due to the simultaneous occurrence of severe events at multiple plants	Issues are being deduced and measure premised on simultaneous disasters at all plants are being implemented.
		99		Reflection of the aforementioned in AM manuals and training in such matters	Same as No.42.

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Final Report	112	100	Risk of long-term failure of DC power sources and off-site power	Multiplexing and diversification of DC and AC power sources	Same as No.32~34.
		101		Preparation of equipment to connect alternate power sources	Connection routes for various types of materials and equipment are stipulated in tsunami AMG.
		102		Enhancing training with regard to the aforementioned connnections, etc.	Training is implemented with regard to each procedure
		103	Relationship between the hydrogen explosion mechanism and vent operating pressure as well as other factors	Identification of the hydrogen explosion mechanism (leakage path, accumlation path, ignition factors, etc.)	Pathways, etc. have been investigated The reactor core damage generated hydrogen in Units 1 and 3 as a result of the water-zirconium reaction, which mainly leaked into the R/B from the PCV head flange. The hydrogen which was generated in Unit 3 flowed in through the vent line and then flowed back into Unit 4 standby gas treatment system (SGTS) and into Unit 4 building.
		104		Preventing the accumulation of hydrogen (hydrogen detector, venting function to release hydrogen in the building, etc.)	Procedures have been prepared for the R/B roof venting equipment and blowout panel opening . PCV filtered venting equipment (inerted by nitrogen gas) is to be installed to prevent from PCV deterioration due to increase of pressure and temperature, and to filter out redionuclides contained in venting gas (hydrogen) before its release. Hydrogen detectors have been installed on the R/B refueling level.
		105		Verification of the relationship between venting and hydrogen explosion, and refection of such results	TEPCO accident investigation report completed. Because there are no units with shared venting lines at KK, an event such as occurred at Fukushima Unit 4 will not arise. As a measure to prevent backflow into the unit itself, it has been noted in the procedures to reliably close vents required at the time of venting.
		106	Impact brought about by malfunction of the main control room (MCR)	Reliably guarantee that there is illumination in the main control room (MCR), a work environment, operation of instrumentation, etc. (power sources, lighting, work clothes, dosimeters, etc.)	Securing power sources, illumination, work cloths, dosimeters and other spare items Implementation of multiplexing and diversification of alternate batteries for MCR monitoring (distribution of spare batteries, procedures for interchanging with other systems, etc.)
		107		Reflection on accident management as well as continuation and reinforcement of such training	Implementation of training for times when the MCR is inoperable (once annually per team)
		108		Adoption of remote measuring instruments	With regard to the installation of instruments from the standpoint of monitoring for recriticality, this is not treated as a subject of technical consideration. With regard to a recriticality when the molten core has fallen through, it is estimated that this is an event which would not likely occur when taking into consideration the configuration to be taken by the molten core.
		109	There are risks other than those of Fukushima Daiichi NPS	Even at plants which have successfully achieved a cold shutdown, it has been reconfirmed that there are potential risks which are not pleasant if there is no restraint, and countermeasures and training are to be implemented	Lessons learned from accident management of Fukushima Daini has been confirmed when reviewing countermeasures.
	113	110	-	Securing external AC power sources	
		111		・Securing seismic resistance and watertightness of switchyards or their installation on high ground	Within the switchyard seismic evaluation (JEAC4601), points confirmed to be vulnerabilies are to be replaced with facilities having a high seismic resistance as the need arises. Flooding embankments are to be installed in front of switchyards.
		112		・Improvement of the seismic resistance of off-site power facilities, multiplexing transmission routes, and **making it possible to interchange electric power among the power station and plants**	The stability of ground arouns pylons has been assessed, and within hte seismic evalation of switchyards (JEAC4601), GIS has been adopted for 500kV transmission lines. Securing of three routes of five lines, collaboration with in-house power sources through the Nishi-Gunma switchyard, and collaboration with Tohoku Electric Power Company through the Kariwa substation ※For the KK site, in addition to the TEPCO Shin-Niigata and Minami-Niigata trunk lines, there are facilities receiving electricity along independent routes from Tohoku Electric Power Company It is possible to interchange power sources between units through emergency M/C and buses
		113		・Placing of power source cables underground	The cables from the power station switchyard (high ground) to each unit have been laid underground.

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Final Report	113	114	-	Ensuring the function of emergency diesel generators	
		115		・Ensuring the watertightness and aseismicity of the D/G room or installing such facility on high ground	Tidal wall to be installed at the D/G air intake. The D/G room has been made water tight (preventing from flooding). Air-cooled GTG have been deployed on high ground.
		116		・Reinforcing the power interchange function of D/G (all D/G is to be made capable of sharing with all reactors. At Fukushima Daiichi NPS, this was able to be done at Units 5 and 6, but not at Units 1 thru 4).	Same as No. 24
		117		・Installation of air-cooled D/G, gas turbine generators, etc. (What survived at Fukushima Daiichi NPS were the air-cooled D/G which did not need a seawater pump)	Development of procedures for supplying electricity to existing systems by using emergency power sources and measures to reinforce all types of power sources It is possible to supply electricity from emergency M/C on high ground along with air-cooled GTG and power supply cars. Various procedures for supplying electricity have been prepared.
		118		･Installation of heavy fuel oil tanks and light fuel oil tanks on high ground and prevent them from drifting	Same as No. 6
		119		Adoption of D/G automatic startup when there is an emergency shutdown (scram) due to an earthquake	Same as No. 9
		120		Securing other AC power sources	
		121		・Interchanging AC power sources (interchanging between high voltage power panels (M/C) and low voltage operational power panels)	Same as No. 24
		122		・Permanent installtion, augmentation, and review of installation location of power panels and other equipment	Procedures is developed for supplying electricity to existing systems by using emergency power sources and measures to reinforce all types of power sources Emergency M/C has been installed on high ground
		123		・Increase the types of power supply cars (DC, AC, DC&AC combined, those with generators, D/G equipped, etc.)	Same as No. 35
		124		・Actively utilizing airlifts to move power supply cars, auxiliary power sources, etc. (installation of helipads in surrounding area and on roofs)	Measures to ensure transport means using helicopters are being implemented. There are heliports within the site.
		125		・Deployment of tools for installation of power cables, etc.	Materials and machinery including the necessary tools are have secured. Those required at any time in the future are to be confirmed and will be secured.
		126		・Installation of multiple locations for connections to power panels from power supply cars, and ensuring their water resistance	It is possible to make connections with the emergency M/C as well as two locations on the side of the R/B, and multiplexing of connection locations have been completed. The connection locations when connecting adjacent to the building are inside the building, and water resistance is to be ensured by waterproofing . Connection terminals for power panels and power supply cars have been standardized. Training is to be implemented in configuring connection routes and making connections from power supply cars. This will continue to be implemented.
		127		Securing of DC power sources (batteries, etc.)	
		128		・Ensuring watertightness and pressure resistance, or installation on high ground	Same as No. 48

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Final Report	113	129	-	・Increase in DC power source capacity (to handle an extended period of time from 8 hours to 24 hours)	Same as No. 20
		130		・Deployment of cables and mobile battery vehicles for cases where DC power sources can no longer be used.	Same as No. 35
		131		・Installation of batteries with high portability which can be connected instantly	Augmentation of DC power sources (decentralized deployment of batteries, deployment of rechargers, etc.) is implemented.
	114	132		Securing of cooling function	
		133		・Supplying water from storage tanks, reservoirs, lakes, rivers, ocean and muliple other locations, and establishment of such pathways and methods	Same as No. 59
		134		・Securing the number of fire engines necessary and installing such on high ground	Increasing the number of fire engines deployed and the number of fire protection hoses, and deploying such on high ground has been completed
		135		・Installation of multiple locations for connecting cooling water injection from fire engines	Securing multiple connection locations
		136		・Ensuring watertightness and pressure resistance of high voltage and low voltage cooling facilities, or their installtion on high ground	Water proofing measures had been implemented for important equipment rooms (high pressure cooling water injection, low pressure water injection, etc.). Alternate high-pressure coolant injection system (HPCI) is scheduled to be installed on a floor higher than the RCIC (lowest floor). Fire engines are deployed on high ground within the site.
		137		・Securing the water tightness and pressure resistance of bulidings where seawater pumps are installed	Same as No. 17
		138		・Installation of devices for cleaning motors and such preliminary preparation	Same as No. 11
		139		・Preparation of alternate core cooling systems (independent water sources, power sources, cooling water injection systems, etc.)	In regard to power sources, GTG have been installed on high ground, and as new water sources, reservoirs are being installed. Also, as new alternate water injection system, TWL is being considered for installation, and various new facilities independent from existing facilities are being prepared.
		140		・Preparation of portable underwater pumps	Same as No. 10
		141		・Performance of feed and breed by means of the wet well (W/W) vent (resupply of water by means of high pressure cooling water injection = feed, and discharge by means of vents = breed, which will secure a heat sink until the move to a cold shutdown)	It is possible to feed and breed by means of existing facilities, and according to the flowchart in tsunami AMG, a conversion to feed and breed can be made when necessary.

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Final Report	114	142	-	・Monitoring of the SFP (thorough monitoring of temperature and water level)	Water level and temperature gauges have been installed that are capable of measuring even when there has been a loss of power and the water level is low. Also, an ITV has been installed which is capable of monitoring the SFP by means of an emergency power source from a power supply car, etc.
		143		Securing control room functionality	
		144		・Preparation of auxiliary batteries so that instruments will not become impossible to monitor	Same as No. 47
		145		・Maintaining and improving the main control room environment (deployment of emergency power sources, etc.)	Procedures for supplying the MCR ventilation system with electricity by means of power supply cars, etc. had been prepared. Measures for shielding the MCR are being additionally considered.
		146		・Preparation of radiation protection clothing, masks, dosimeters, etc.	Same as No. 106
		147		Ensuring venting function	
		148		・Reassessment of venting system (effectiveness of the previous system is uncertain), and reassessment of the design pressure and other specifications of the rupture disk	Based on the approach of creating the design so that isolation function of the PCV is not impeded due to a leak from or mishandling of an isolation valve installed on a venting pipe, rupture disks ahve been installed, and the opening pressure is set as the pressure to open the vent (PCV design operating pressure). Replacement of the rupture disks with valves are positively considered in conjunction with filtered vents installation.
		149		・Reassessment of locations for installation of vent line operational valves (emphasis on operability)	Venting valves of KK units are not in the torus rooms as the ones of Fukushima Daiichi but in R/Bs, which have better accessibility compared to torus rooms. Procedures have been prepared for venting valve manual/remote operation during SBO.
		150		・In consideration of rupture disks that did not operate, conversion of all to valves that open and close is being considered.	Same as No. 86.
		151		・With regard to the reactor depressurization function, a reassessment is to be undertaken so that multiple measures can be taken (to create a system not dependent only on DC power sources for the safety relief valve, etc.)	Same as No. 72
	114	152	-	・Preparation of driving cylinders and temporary power sources so that a venting line can be configured promptly during a loss of power	Same as No. 83
		153		・Preparation of batteries near the MCR in order to reliably implement operations to depressurize the safety relief valve	Batteries for emergency SRV operation have been deployed near the MCR
		154		・Installation of filters to lower radiation levels when venting	Filtered vents are being installed voluntarily

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Final Report	115	155	-	Prevention of hydrogen explosion	
		156		・Increase the air-tightness of the PCV (electric penetrations, batteries and other components and materials are to be reassessed, and resistance to high temperatures and pressures strengthened)	Since the main leakage path for outflow of hydrogen from the PCV is the PCV top vent, a rise of temperature can be controlled by cooling by means of filling water from the top of the PCV to prevent a deterioration of seal performance. Quantity of a leakage from electric penetrations, etc. and other leakage paths are expected to control amount of accumulation of hydrogen by installing PAR(Paasive autocatalytic recombiner) . Also, heat-resistant strengthening of O rings of PCV top head flange is being studied.
		157		・Prevention of accumulation between closed spaces in buildings if a large amount of hydrogen has been generated	A review is being conducted in the direction of installing PAR (Paasive autocatalytic recombiner) on parts of buildings inside the R/Bwhere accumulation of hydrogen is assumed. But a response has already been implemented with the opening of blowout panels and Rx/B top vents.
		158		・Installation of hydrogen detectors	Hydrogen detectors have been installed on the R/B refueling floor (highest floor).
		159		・Carrying out the injection of nitrogen into the PCV when venting	Means for injecting nitrogen are being reviewed (transportation by means of a tank lorry, nitrogen generating devices, etc.)
		160		・Designing canopy to make it possible to vent hydrogen (remote drive, manual drive, etc. And, installation of filters to absorb fission gas)	Means have been installed for opening the blowout panels and Rx/B top vent which are able to be opened from outside the building
		161		Preparation of accident measures	
		162		・Set definite numerical values to answer the question "In a worst case scenario, how much time is there with the power sources and water sources on site?" and design a manual	Time limitations for each respons and flowcharts are specified in the tsunami AMG.
		163		・At the same time, with the time of the previous paragraph, design an operation manual and prepare a system to be sure to complete the installation and other work on site for supplying additional power sources, water sources, materials, machinery, etc.	Time limitations for each response and flowcharts are specified in the tsunami AMG, and training, etc. will be implemented as well as a framework and operations prepared
		164		・Implementation of periodic training to be able to confirm that it is possible to implement the items noted at left (training needs to assume nights, holidays, accidents at all units and other deteriorated conditions)	Same as No.42.
		165		Strengthening of the infrastructure, etc.	
		166		・Gathering operators at the power station after an earthquake, and securing personnel for the technical support room at ERC (Gathering within the time set. Selection of alternate locations for gathering assuming a large-scale disaster)	The number of shift personnel are being increased. Also, measures are being implemented aimed at further improving.
		167		・Securing access through to the power station (reinforcement of roads, bridges, etc.)	Walk downs (out-site survey) have been carried out, and routes have been confirmed where it is possible to reach the power station even at time of disaster.

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Final Report	115	168		・Improvement of accessibilty within the power station after the occurrence of an earthquake or tsunami (reinforcement of trunk road with measures to prevent liquefaction, deployment of heavy machiner to remove scattered debris, secuing operators, etc.)	Measures are being implemented to reinforce road surfaces. Also, heavy machinery to remove debris has been deployed. Station personnel are acquiring licenses for operaing large special vehicles (operators have secured such).
		169		・Anchoring of heavy fuel oil tanks, etc.	There are plans to remove heavy fuel oil tanks, so these will not become debris. Light oil tanks are set up within flooding embankments, so there is a low likelihood these will become debris. The waterproofing of doors around the R/B referenced the "Tsunami evacuation building, etc. guidelines (Cabinet Office, June 2005)" and have been designed to withstand three times the hydrostatis pressure. Also, after the construction of flooding embankments, even if debris is generated, it will be able to be significantly reduced.
		170		・Ensuring means of communicating with site workers, technical support room at ERC, and MCR	Implementation of measures to strengthen the functions of various types of communications (among field, emergency office, and headquarters)
	118	171	Thorough communication to personnel of the procedures for responding to an accident and implementation of such training on a routine basis	Reaffirmation of the importance of routine training and further strengthening of such training	Repeatedly implementing comprehensive training and individual response training. Feeding back the results, and reassessing the procedures as necessary including the standpoint of shortening the response time. In the future, continue to implement training.
		172		In particular, speeding up countermeasures actions	
		173	Lack of procedures and functions for information sharing and communication tools Setting up an integrated headquarters	Enhancement of the quality, quantity and speed of information sharing	In accordance with revised laws and regulations, an operation is set up to launch a joint central government and operator headquarters at the operator's headquarters at the same time an event occurs. A system is currently being constructed in which the central government, headquarters, power station and prefecture will connect and share information in real-time. (It is thought that with regard to municipalities situated near the site, it is possible to handle such connection with an off-site centrer, but the functions per se of the off-site center are being reassessed)
		174		Creation of a system for enhacing the quality, quantity and speed of information sharing	
		175		Reaffirmation of the importance of a framework for sharing information in realtime	
		176	Lack of anticipation in responding to multiple plants simultaneously and a delay in the responses	Determination of personnel required and personnel responding to each plant at the time of severe accidents at multiple plants, and such training	The division of roles assuming simultaneous disasters at seven plants and the required personnel are being determined and training implemented.

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Final Report	118	177	Lack of preliminary preparation for delivery of materials and equipment and such training Mobile material and equipment supplies by the Self-Defense Force	Design of a framework when delivering materials and equipment, communication tools, use lists, and checking incoming and outgoing deliveries, and such training	Measures are being implemented to strengthen logistic bases for smoothly supplying materials and equipment.
		178		Establishment of procedures and framework for cooperation with the Self-Defense Forces and other organizations at the time of a severe accident	With regard to the delivery and supply of materials and equipment, at the time of a compound disaster or other such event, there are limits to the Self-Defense Force giving priority to supplying the operators, so the operators has prepared beforehand on-site the materials and equipment (pumps, fuel, power supply cars, etc.) needed after the occurrence of a severe accident, and has strengthened its response, including radiation training, contracting with transport companies, securing logistic bases so that the necessary materials and equipment can be reliably transported. Even after undertaking the aforementioned response, in cases where a situation has arisen which cannot be covered by the operator, a central government nuclear facility situation response center will be established at the operators headquarters so that support can be received from related organizations of the state including the Self-Defense Forces (Revised Nuclear Emergency Act). There are plans to improve this effectiveness through comprehensive training jointly with the central government in the future.
	119	179	Lack of training in accident responses at TEPCO, central government, prefectural government and other such high levels	Strengthening practical training (in particular, speeding up operations, etc.)	Joint training is planned with the prefecture based on the knowledge gained from the Fukushima Daiichi accident. Internally, comprehensive training and individual response training are repeatedly implemented. The results are feed back and procedures are reassessed as necessary including from the standpoint of shortening the response time. This training will continue to be implemented in the future.
	121	180	-	Highest priority on safety	
		181		・For the respect of human life, a framework in which "securing the safety of the reactor" and "securing the safety of the community" are prioritized above all else (fostering a safety culture)	Measures to foster a safety culture are currently being studied in detail by the TEPCO Nuclear Reform Special Taskforce (In order to be very well aware of the importance of nuclear safety, which is to never repeat an accident, the "fostering of a safety culture(raising perfect awareness of nuclear power)" will be developed throughout the organization.)
		182		・Absolute prevention of hydrogen explosions and leakage of radioactive materials (prevent a recurrence of Fukushima)	Responding with the installation of filtered venting equipment and measures to prevent hydrogen explosions
		183	-	Real-time information-sharing network	
		184		・When a major accident occurs (or there is such risk), a network on which all concerned persons can share information in real-time and transparently	A system is currently being constructed in which the central government, headquarters, power station and prefecture will connect and share information in real-time. (It is thought that with regard to municipalities situated near the site, and the functons per se of the off-site center are being reassessed) It is possible to continually confirm the parameters for a situation check, and it is possible to share information and confer with concerned persons with the aforementioned system.
		185		・Framework in which it is known that there is a situation which should be responded to with AM, and the subsequent progression can be shared and deliberated in both directions	
		186	-	Participation of the community	
		187		・Framework in which the local municipalities can share information and made decisions	With regard to municipalities near the site, it is thought to be possible to share information and make decision at an off-site center, but the functions per se of the off-site center are being reassessed. Also, the number of response personnel are to be increased to increase the speed of notifications and contacts.

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Final Report	121	188	-	・Strengthen experts, advisors and other personnel concerning nuclear power in the local municipalities	Basically, these are considered to be matters for which consideration can proceed by local municipalities, but a teleconferencing system is being constructed among the central government (Nuclear Regulation Authority staff, regulatory agencies), prefecture, electric power headquarters (to be a nuclear facility situation response center to which are dispatched members of the emergency situation response and monitoring nuclear authority at the Head Office ERC) for times when there is a nuclear disaster so that timely advice will be available from experts of the Nuclear Regulation Authority.
		189		・Promote and strengthen education, study and training	The Niigata Prefecture operation plan for disaster preparation is to be revised and training implemented for municipalities in all areas of the prefecture, accident prevention leaders in municipal organizations and so on, and activities to disseminate knowledge about nuclear accident prevention are planned to be conducted for residents during normal times as well. The operator will cooperate with the prefecture through occassions for accident prevention training and so on.
		190	-	Transparent and prompt decision-making	
		191		・Design of organization and authority in which governance functions clearly Plant safety→Site (site superintendent and shift supervisor) is the highest decision maker. Local safety→Information from the plant is shared with the local community in real-time and a final decision can be made. ↑These decision-making processes are transparent, and due to external factors will not be delayed or contorted.	TEPCO decision-making is stipulated in the tsunami AMG, etc. The matters on which the shift supervisor and site superintendent make decision are to be clarified. With regard to municipalities near the site, it is thought to be possible to share information and make decision at an off-site center, but the functions per se of the off-site center are being reassessed. Also, the number of response personnel are to be increased to increase the speed of notifications and contacts. A system is currently being constructed in which the central government, headquarters, power station and prefecture will connect and share information in real-time, and it will become a framework for making decision in which transparency is ensured.
		192	-	Study and training in being responsible for safety	
		193		・AM operating procedures, measures, etc. are to be appropriately defined in order to ensure the aforementioned matters.	With regard to the operational rules of the framework constructed, these are stipulated in appropriate documents in the company.
		194		・Appropriate personnel are to be secured and the necessary study and training conducted to execute these operating procedures.	Accident prevention training according to the revised operational rules is scheduled to be conducted. (plans are underway for joint training with the prefecture)
		195		・From a neutral standpoint (or organization), periodic checks and assessments will be conducted as to the appropriateness of these (procedures, personnel, training)	The Nuclear Emergency Act has been revised, and with regard to accident prevention training assuming a severe accident, the results and assessments will be reported to the Nuclear Regulatory Commission, and when the Nuclear Regulatory Commission has deemed the results to be insufficient, revisions in training methods and necessary measures will be ordered. In addition, there are plans underway by TEPCO to have the IAEA or other international organizations evaluate TEPCO's activities.

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Final Report	123	196	-	Real-time information sharing network ･Dedicated lines ･Emergency power sources ･Seismic resistance ･Tsunami measures ･Security measures	A system is currently being constructed in which the central government, headquarters, power station and prefecture will connect and share information in real-time, and, at a minimum, for the portion under the jurisdication of TEPCO, dedicated lines have been installed and measures adopted for connecting to emergency power sources, seismic resistence, withstanding a tsunami, and security.
		197	-	Framework in which, once the accident management mode is entered, the network turns on, and, as necessary, the plant and relevant parties are able to connect to share information, conference, and make decision in real-time ･Target: plant, electric utility company head offices, government, municipalities situated near the power station, etc. ･Function: share information, deliberate, and make decisions concerning the plant status and measures, local safety, evacutations, etc. ･It will be known that the AM mode is on and any progression will be viewed ･To increase the transparency and speed of information sharing and decision making ･To prevent information leaks to the outside	A system is currently being constructed in which the central government, headquarters, power station and prefecture will connect and share information in real-time, which will become a framewok in which decision are made with transparency ensured. (With regard to municipalities near the site, it is thought to be possible to share information and make decision at an off-site center, but the functions per se of the off-site center are being reassessed.)
	134	198	-	Important matters in future study and training programs (examples)	
		199		・Practical training assuming the most severe environment such as that at Fukushima Daiichi Unit 1	Same as No.42.
		200		・Training in supplying alternate power sources and cooling function to a power station within (for example) two hours at the time of an SBO	Preparation of procedures including response times with tsunami AMG. Confirmation of feasibility with training.
		201		・Training in conducting measures will be sure to have detailed numerical targets set and the degree of proficiency checked	Before Earthquake disaster as well, numerical values were set in notification training, etc. and evaluations conducted. Numerical values have been set for training in the field activities (restoring power sources by means of power supply vehicles, and debris removal) strengthened based on this accident in Fukushima Daiichi, and evaluations have been started. In training in the future as well, the appropriateness of numerical values will continue to be enhanced and reassessed. (Examples of numerical values for notification training : time for ordinary personnel to assemble, percent of walking personnel assembling during an emergency, time for notification or contact)
		202		・Practial exercises will be conducted not only by the ultility operator alone, but also jointly with the central government, local government, relavant organizations, etc.	Same as No.194.
		203		・For all utility operators and all power stations in Japan, the construction of a framework for passing down to future generations the lessons learned which were gained from the field response at Fukushima Daiichi NPS	The lessons learned from the Fukushima Daiichi accident and other accidents have been compiled in the TEPCO report, and will be reported at other stations inside and outside of Japan. After review by INPO, the report will share knowledge with operators inside and outside Japan. A framework for handing down these lessons into the future both inside and outside Japan is to be studied.

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Interim Report	147	204	-	・For transmission from substations, a system is to be adopted for transmission from aerial wires to under**ground cables.**	Emergency M/C have been newly installed on high ground, and connected to each unit by underground cables.
		205		・Remote operation: Securing transmission routes, cables, etc. to supply electric power to a reactor remotely from po**wer supply cars (or, can wireless supply be provided?)**	Locations for connections to emergency M/C (high ground more than 100m away from buildings) have been installed
	148	206	-	・During periodic inspections, because there is a high likelihood that the D/B is to be inspected, it **is necessary to eradicate any vulnerabilities during annual outage. One D/G unit is to be added. For this additional construction, air-cooled D/G, gas turbines, etc. will be augmented on high ground. In the case of an air-cooled type, seawater pumps and seawater circulation systems are not necessary. A cooling system using fresh water will be installed on high ground to avoid any tsunami damage.**	Same as No.117.
	149	207	-	Securing control room functions	
		208		・So that there is not impact due to radiation during an emergency, the shielding effect for the main **control room will be enhanced.**	Studies are underway in the direction of installing shielding and assessing radiation levels
	150	209	-	Securing high-pressure cooling systems	
		210		・The SLC system, CRD system and CUW system are possible means of injecting cooling water into the reactor at **high pressure, so it is important also to secure power sources for these systems. It is necessary to take into consideration the temporary power capacity for securing power sources for these.**	In tsunami AMG, procedures developed for supplying electricity to existing systems by using emergency power sources and measures to reinforce all types of power sources and the high-pressure coolant injection system (HPCI)
	151	211	-	Securing PCV venting function	
		212		・In order to ascertain the status of behavior inside a reactor during a meltdown, neutron monitors wi**ll be deployed inside the PCV.**	Same as No.108.
		213		・In order to ensure reliability **of the venting line and air pressure supplied for driving force, a reassessment is to be conducted regarding assurance of reliability by raising the status to safey systems and multiplexing.**	Same as No.91.

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Interim Report	152	214	-	Securing low-pressure cooling system function	
		215		・To have a structure where contaminated water, etc. inside the building can be used for circulatory cooling.	At the Kashiwazaki-Kariwa NPS, the construction for all Units 1～7 is structured so that there is a suppression pool directly below the dry well (D/W). If cooling water is injected into a PCV after a molten core has fallen down, it is presumed that the contaminated water will be retained in the PCV which includes the suppression pool. The contaminated water inside the suppression pool is thought to be able to be used when performing circulating cooling using the heat removal system.
		216		・The status of the spent fuel pool could not be monitored, so as a prerequisite to securing power sources, temperature and water level monitoring instruments will be installed, and on the assumption that it will become impossible to take measurements, it will be necessary to ready hand-held noncontact temperature gauges and water level gauges.	Water level and temperature gauges have been installed that are capable of measuring even when there has been a loss of power and the water level is low. Also, an ITV has been installed which is capable of monitoring the SFP by means of an emergency power source from a power supply vehicle, etc. Hand-held noncontact temperature gauges have also been distributed.
		217		・Ensuring reliability by multiplexing cooling systmes for the spent fuel pool	The following procedures have been prepared in tsunami AMG etc.. 〇Cooling water injection to SFP by means of Fuel Pool Make-up Water system (FPMUW) (KK1), Suppression Pool Clean-up Water system (SPCU) (KK7) 〇Cooling water injection to SFP by means of MUWC 〇Cooling water injection to SFP by means of D/D FP 〇Cooling water injection to SFP, and heat removal of SFP by means of RHR pumps 〇Heat removal of SFP by means of FPC 〇Seawater injection by means of fire engines
	153	218	-	Securing of seawater cooling system function, etc.	
		219		・When emergency power sources are augmented or replaced, securing a air-cooled type of cooling line not dependent on seawater cooling as an auxiliary system.	Measures to prevent inundation of important equipment (D/G, Emergency M/C) rooms have been implemented and emergency M/C installed on high ground. Air-cooled GTG and power supply vehicles have been deployed on high ground.
	154	220	-	Prevention of hydrogen explosion	
		221		・If debris penetrates the PCV, it is also assumed that this will result in a debris and concrete reaction at the pedestal and the installation of concrete reinforcements, debris catchers, etc. are to be studied.	Measures to prevent the fall of a molten core are currently being studied.