Handling of recommendations etc. from each accident investigation committee

Explanatory note: Already done/ In progress/ In review with the intend to　We will judge it in future

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Earthquake	Measure against collapse of transmission tower / Reinforcement of seismic resistance of external power supply (switchyards ,etc)	[Countermeasure 3 ;Improve earthquake resistance of switchyard] Upgrading from air blast breakers (ABB) to gas insulated switchgear (GIS) →Already adopted				
	Reinforcement of seisemic resistance of cooling water injection functions		The piping of Fire Protection System could have broken and been made unusable at the time of the last earthquake →Already reinforced of seismic resistance of MUWC, and arranged portable equipments (power supply cars, fire pumps ,etc)			
Tsunami	Prevention from flood to an buildings (Keep on a dry site)		No measures had been taken before the accident except for some minor measures regarding water-sealing of the seawater pump. →In progress		Overseas, although there was a geographic factor, several pump stop examples by the external flooding had arisen. →In progress	
	Improvement in water tightness (Protection of safety related facility)	[Countermeasure 6; Enhance countermeasure for flooding] Adopting watertight buildings/rooms and draining function →In progress [Countermeasure 13; Disperse the cooling water system and prevent flooding] Adopting watertight buildings and pumping rooms, and draining function →In progress	Internal water leaking measures →In progress		Not only the measure against "height" like installation of a flood embankments but the improvement in the watertight building or important equipments was needed. →In progress	Verifying capability to mitigate an flooding event both internally and externally →In progress
	Installation of flood embankments	[Countermeasure 6; Enhance countermeasure for flooding] Adopting watertight buildings/rooms and draining function →Already done [Countermeasure 14; Enhance UHS at a time of accident] Installing portable alternative RHRSs and/or air-cooling equipment →In progress of improvement in watertight Hx/B →Already secured spare motor of seawater pump		The Investigation Committee is of the view that specific measures against tsunami should have been implemented including measures against severe accidents for the purpose of preventing nuclear disaster, because it is considered that: i) natural phenomena entail by nature major uncertainties ii) with regards to tsunamis in particular, →In progress		
	Installation of tidal walls					

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Tsunami	Disposition of discharge pumps	[Countermeasure 6; Enhance countermeasure for flooding] Adopting watertight buildings/rooms and draining function **→Already arranged portable discharge pumps** **→In review of instllation of drain system in R/B** [Countermeasure 13; Disperse the cooling water system and prevent flooding] Adopting watertight buildings and pumping rooms, and draining function **→In progress of improvement in water tightness** **→Already arranged portable disucharge pumps** **→In review of instllation of drain system in R/B**				
	Construction of tsunami warning system	[Countermeasure 12; Improve the response capabilities for accidents] Establishing procedure manual Securing both hardware (dosimeters and masks) and software (operation manuals and blueprints) to help judgement R&D of tsunami prediction systems **→In review**				
Power Supply	Formation of 2 routes (also including substation), 2 transmission lines of an external power supply	[Countermeasure 1; Improve reliability of external power supply and grid] Ensuring power supply from various routes (transmission power lines, electrical substations **→Already ensured 3 routes, 5 transmission lines** [Countermeasure 2; Improve earthquake resistance of substation] Using gas insulated equipment and high-strength isolators **→Already adopted GIS**				
	Diversification of emargency power supply (air cooling D/G, GTG, power supply cars ,etc)	[Countermeasure 5; Disperse On-site power equipment] Strengthening the redundancy of power supply and switch boards **→Already arranged power supply cars, air cooling GTG** **→In progress of other measures** [Countermeasure 7; Enhance diversity and redundancy of emergency AC power supply] Strengthening the diversity of the cooling methods through air cooling, water cooling and etc. **→Already arranged power supply cars, air cooling GTG** **→In progress of other measures** [Countermeasure 10; Facilitate alternative power supply from outside] Standardization of the power supply inlets outside of the buildings from power supply car **→Already created of the manuals using alternative power supply** **→Already installed several power supply inlets**		simultaneous and multiple losses of power **→Already arranged power supply cars, air cooling GTG** **→In progress of other measures**		The measure which secures a power supply at the time of SBO **→Already arranged power supply cars, air cooling GTG** **→In progress of other measures**

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Power Supply	Facilitate alternative power supply from outside	[Countermeasure 10; Facilitate alternative power supply from outside] Splitting them into two locations or more (including measures against salt water) **→Already done**				
	Strengthening of the capability at the time of Loss of external power	[Countermeasure 7; Enhance diversity and redundancy of emergency AC power supply] Strengthening the diversity of the cooling methods through air cooling, water cooling and etc. **→Already arranged power supply cars, air cooling GTG** **→In progress of other measures**				
	Instllation of switch boards for emergency	[Countermeasure 5; Disperse On-site power equipment] Strengthening the redundancy of power supply and switch boards **→Already arranged power supply for emergency on the hill**				
	measures which can simply isolate the load on the ground fault side	[Countermeasure 10; Facilitate alternative power supply from outside] taking measures which can simply isolate the load on the ground fault side **→Already done**				
	Diversification of instllation location of power supply	[Countermeasure 5; Disperse On-site power equipment] Ensuring the diversity of installation locations of on-site power equipment **→Already arranged power supply for emergency on the hill** **→In progress of other measures (distributed arrangement of portable batteries ,etc)**		No measures had been ever taken for ensuring independence of Emergency DGs and power distribution panels by multiplexing and diversification of their locations. **→Already arranged power supply for emergency on the hill** **→In progress of connecting additional line**	Not only the measure against "height" like installation of a tide embankment but ensuring independence of power distribution panels was needed. **→Already arranged power supply for emergency on the hill** **→In progress of connecting additional line**	
	Securing electrical spare parts/equipments	[Countermeasure 11; Stock backup electrical equipment] Securing spare parts of M/Cs, P/Cs and cables Installing backup equipment **→Already arranged power supply for emergency on the hill** **→Already Installed warehouse on the hill**				
	Instllation of cross-connect power supply cable (Permanent instllation/all unit)		It did not take into consideration the power loss of all nearby power plants caused by external events. **→Already done**			The ability to cross-connect electrical power between units at Fukushima Daiichi units 5 and 6 and Fukushima Daini greatly improved the operator response following the tsunami. **→Already done**

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Power supply	Interlock review at the time of the loss of power					[Add. 4.4] extraction and review the interlock that might assume important security system uselessness in emergency →Done(RCIC of K6 dialect movement interlock review)
	Facilities restoration at the time of the external power supply loss(setting of the time aim)	[Countermeasure 4] Recover external power supply quickly Example: Preparing materials and equipment, and manuals Installing fault locators **→Done(The faultlocator setting to a 500kV system). The spare choice and manual maintenance is under examination.**				
	Securing of fuel for power supply	[Countermeasures 7] Reinforcement of the multiplicity and variety of the AC power supply for emergency use About overall the AC power supply for emergency use, secure enough fuel which anticipated the restoration period of the external power supply. **→Done**				[11-4-3][Add. 4.4] Secure fuel oil in the emergency and enable the use (storage, supply both sides) →Done(Light oil tank setting under ground, the emergency supply contract has been concluded) →Done(Two mini-tankers for supply deployed) . The reinforcement of the further supply is in review.
	Reinforcement of the DC power supply (capacity, spare battery and so on)	[Countermeasure 5] Disperse On-site power equipment Example: Strengthening the redundancy of power supply and switch boards Ensuring the diversity of installation locations of on-site power equipment **→Done(AC power supply ability evaluation finished. Reinforcement for DC power supply from SBO outbreak to 24 hours later).** [Countermeasure 9] Prepare dedicated backup power supply Example: Securing a power supply dedicated to particularly important instrumentation & control system, by separately preparing a charging system and batteries in addition to the existing and alternative power supplies **→Done** [Countermeasure 27] Improve reliability of the measurement equipment for accidents Example: Securing power source Providing storage batteries dedicated to instruments, and spare instrumentations & parts **→Done**	Addition of the important backup DC power supply whichi distributing dispersively(P598) **→Done(Reinforcement of the DC power supply: despersion deployment of the battery and battery charger)**	Underestimate of the battery drying up risk(interim report P5) **→Done(Battery reinforcement)** The preparation for SBO(interim report P12) **→Done(Various power supply reinforcement)** DC power supply loss measures were not planned(The last report text P409) **→Done(Various power supply reinforcement)**		[11-4-2]Clarify an instrument for emergencies necessary for monitoring of the safety of the core of the nuclear reactor,nuclear reactor containment, spent nuclear fuel . **→Done(choose a necessary instrument, preliminary battery deployment, take measure for prolongation of life of the battery)**

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Cooling・Water injection	Diversification of the water injection	[Countermeasure 16] Enhance the alternative water injection functions To ensure diversity of drive sources for the entire water injection system including existing design basis water injection facilities, steam power, diesel power and other power sources are required as the drive source of alternate water injection facilities. **→Done(To raise credibility of RCIC, introduction of high pressure alternate water injection facilities, the fire engine deployed).** Alternate water injection facilities must be able to withstand the harsh environments that are present following an earthquake or a severe accident **→Done(Inundation of the important equipment room, the important facilities for nuclear safety are designed to be able to almost tolerate standard earthquake vibration, earthquake resistance of the MUWC plumbing and deploy a fire engine on the hill).** Alternate water injection facilities must have sources of water, e.g. tank, pond and dam, also need to be diverse and redundant. **→Done(Improve the quake resistance of the fresh water tank, setting of a reservoir and a well, construction the wat** When facilities designed for other purposes such as fire ext **→Done(establishment of the external connection line to MU**	Addition of the high pressure water injection function(P598) **→Done(To raise credibility of RCIC, introduction of high pressure alternate water injection facilities, the fire engine deployed).**	Examination and maintenance of the seawater injection plan(interim reportP494) **→Done(deploy a fire engine on the hill and maintenance of the seawater injection procedure)**		
	The discharge pressure reinforcement of the low-pressure pump	[Countermeasure 16] Enhance the alternative water injection functions Pumps with high discharge pressures (for example, 1 MPa or more), the installation of injection inlets outside of the reactor building, a clearly defined water injection procedure, and regular training are essential. **→Done(the fire engine of discharge pressure 1.4MPa deployed and carrying out the traning).**				
	Settinf of seawater UHS system (Setting of the substitute seawater heat exchanger)	[Countermeasure 14] Enhance UHS at a time of accident Example: Installing portable alternative RHRSs and/or air-cooling equipment **→Done(Installing portable Heat exchanger car deployed).**	Addition of the exclusive heat sink for the suppression pool water **→Done(portable Heat exchanger car will, depending on the situation)**			[Add. 4.4] Setting the ti-line among different units by seawater or fresh water system →Done(Installing portable Heat exchanger car deployed).
	Reliability improvement of the SRV drive source [Decompression functional enhancement]	[Countermeasure 15] Improve the maneuverability of isolation valves The installation of mechanisms (such as supplying power to each electronic valve from external power sources) is required to ensure that cooling systems of the reactor remain operational when they are required, even in the event of a loss of drive power to the isolation valves. Measures also need to be implemented so that each individual valve can be operated quickly, safely and accurately if an accident occurs, and installed in an area that is easily and readily accessible. It is required that the SRV remains properly operational by, for example, providing backup drive air systems (such as portable air compressors), ensuring sources of power, and allowing manual operation. **→Done(deployment of the spare battery for drive, the spare cylinder, the compressor and procedure maintenance).**	When SRV breaks down, a delay occurs for the later accident correspondence and a question is left whether there was substitute decompression means(P196) **→Done(deployment of the spare battery for drive, the spare cylinder, the compressor and procedure maintenance).**	Deployment of the portable air compressor(interim reportP442, 493) **→Done(the spare cylinder deployed), In progress(compressor)**		

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SFP	Air-cooling middle storage facilities	[Countermeasure 17] Improve the reliability of cooling and injection system for spent fuel pool When taking into account the decay heat of the stored fuel, a sufficient quantity of cooling water, a decentralized storage configuration, air-cooled facilities, and the use of dry storage must be examined to ensure that there is ample time before measures for cooling need to be implemented. **→In Progress(SFP irrigation (Existing system utilization, fire engine deployment, exclusive irrigation plumbing setting))** **→In review(the adoption of the dry storage).**				
	Water injection in SBO					[11-2-4] (Supply of the SFP water) **→In Progress(SFP irrigation (Existing system utilization, fire engine deployment, exclusive irrigation plumbing setting))**
	Improvement of establishment and irrigation means of the management plan for function maintenance for the used nuclear fuel pool.	Countermeasure 17 Improve the reliability of cooling and injection system for spent fuel pool Ensuring redundancy and diversity of functions is essential for making improvements to the reliability of the water cooling and supply of the spent fuel pool. **→In progress(SFP water injection (Existing system utilization, fire engine deployment, exclusive irrigation plumbing setting))**	Not having adopted substitute irrigation means to SFP shown in B.5.b(P104) **→Done(SFP water injection line)** In United States, It is told about a safekeeping method to SFP of the fuel just after the takeoff, that keep fuel into a checks form.(P142) **→It is examined the review of the fuel safekeeping method in future**			
	Reinforcement of the measurement device of the used nuclear fuel pool					[11-2-2-a / 11-2-2-b / 11-2-3 / 11-2-4] (Enhancement of Water level and temperature monitoring function) **→Done(The hydrograph setting that is measurable at the time of the water level drop)**
Vent	Hand-operation of the vent line dialect	Countermeasure 21 Improve maneuverability of venting system it should be possible to securely open the vent valve by introducing a compressor battery or equipment to manually open the valve. It is also required to examine the bypass pipe line with the rupture disk for early-stage operation of the vent according to the progression of an accident. In an accident for which the vent needs to be operated, the radiation dose rate could be high in the basement floor of the R/B where the vent valve was installed. It is therefore necessary to find appropriate places for installing or operating a valve for example by allowing the valve operation from place where dose rate is low inside/outside the R/B, in order to improve the maneuverability of the vent valve under such circumstances. **→Done(setting steering wheel for hand-operation: procedure for an emergency guide for adaptation to circumstances)** **→In review(the steering wheel remodeling for remote control in conjunction with a filter vent).**	There are no procedure book about the hand-operation(P101) **→Done(setting steering wheel for hand-operation: procedure for an emergency guide for adaptation to circumstances)**		In Europe, there are nuclear power plant whichi have a vent valve with a shaft (axis), that was devised to operate the vent line from the considerably remote place exists.(P263) **→In review(the steering wheel remodeling for remote control in conjunction with a filter vent).**	[Add. 4.2.2] Development of the guidance for The power supply loss, high radiation environment bottom, vent enforcement under the high temperature situation. →In review(the timings of the vent enforcement as use after the filter vent setting) [Add. 4.5] Setting of the hand-operated vent mechanism →Done
	Deployment of the drive source for the vent line dialect operation(air compressor)					[Add. 4.4]Setting the ti-line among different units of IA/SA system →Done(already exists)

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	Improvement of the radiological removal function of the vent system [Filter vent]	Countermeasure 22 Mitigate the effect of radioactivity caused by venting It is therefore necessary to install radioactive material removal (filtering) facilities to not only the D/W vent but also the W/W vent. For doing this, it is necessary to prevent hydrogen explosion due to steam condensation. **→Done(Filter vent setting: The system substitutes it for nitrogen)**	Introduce TEPCO's past examination process about a filter vent .Do not mention what TEPCO did not set up.(P100) **→Done(Filter vent setting:)**		In Europe,The structure which reduces radiological quantity released via a vent line to original 1/100 - 1/1000 by attaching a huge filter to the terminal of the vent line・・・(P263) **→Done(Filter vent setting)**	[Add. 4.4] Filter setting to the vent line →Done
	Optimization of the PCV vent					[Add. 4.2.2] Development of the guidance to orede a vent, hydrogen discharge and water injection →In review(the timings of the vent enforcement as use after the filter vent setting)

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Vent	Improve the reliability of the vent line	[Measure 21] Improvement of reliability and operability of vents To improve the reliability of the vent, thereby improving the multiplicity of equipment and seismic. From the viewpoint of the vent flexibly implemented early event in response to the progress, consider the bypass line with rupture disk. **→Reviewing with filter vent. Planning to change the rupture disk to valve.** [Measure 23] Securing autonomy of venting pipes Ensure the autonomy of venting lines by independence of SGTS piping and not sharing the vent exhaust stack between Units. Because of hydrogen retained in the PCV never flow into the R / B which flow back from the SGTS or the vent piping of other Units. **→There is no connection at KK. Backflow prevention procedures of own plants are already established.**	Mentions the fact that venting lines were connected to other systems and there was the possibility of backflow, and the multiple venting lines with poor operability should be remedied.(P191) **→There is no connection at KK. Backflow prevention procedures of own plants are already established. Evaluating the impact of corrosive gas.**			
Hydrogen	Management of hydrogen concentration and appropriate release at R/B	[Measure 24] Prevention of hydrogen explosion (management of concentration and appropriate release) Measurement to maintain the integrity of the PCV, manage the release of the hydrogen. The hydrogen leaked into the building are controled by management of hydorogen concentration and suppressing the release of radioactive material by the installation of equipment such as hydrogen recombiner and the use of standby gas treatment system. **→Implementing the filter vent installation. (lines are purged with nitrogen)** **→installation of R/B roof vent、refurbished procedure of manually opening blowout panel** **→Implementing the meaurement ,installation of PAR to R/B**	Factors of hydrogen explosion discribed as assumption of risk of leakage of hydrogen to the R / B is insufficient, had not been provided a means of ventilation of the reactor building at the time of loss of power.(P266) **→Implementing the filter vent installation. (lines are purged with nitrogen)** **→installation of R/B roof vent、refurbished procedure of manually opening blowout panel** **→Implementing the meaurement ,installation of PAR to R/B**	Hydrogen measures are discribed as a combination of several measures should be taken.(P264) **→Implementing the filter vent installation. (lines are purged with nitrogen)** **→installation of R/B roof vent、refurbished procedure of manually opening blowout panel** **→Implementing the meaurement ,installation of PAR to R/B**		
	Installation of R/B top vent equipment	[Measure 24] Prevention of hydrogen explosion (management of concentration and appropriate release) If it is necessary to discharge the hydrogen, the openings should be large enough on a quantitative evaluation performed for each plant. Emissions should be done on the prevention of hydrogen explosion and suppression of the release of radioactive material by equipment with radioactive material removal function and ventilation with explosion-proof. **→Implementing the filter vent installation. (lines are purged with nitrogen)** **→Installation of R/B roof vent、refurbished procedure of manually opening blowout panel** **→Implementing the meaurement ,installation of PAR to R/B**				

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Hydrogen	Manually opening blowout panel	[Measure 24] Prevention of hydrogen explosion (management of concentration and appropriate release) If large amount of hydrogen is generated and even take any action variety, as a last resort, consider the measure to residence hydrogen due (including the establishment of the opening by the aerial part) opening of the blow-out panel. **→Implementing the filter vent installation. (lines are purged with nitrogen)** **→installation of R/B roof vent, refurbished procedure of manually opening blowout panel** **→Implementing the meaurement ,installation of PAR to R/B**				
	Installation of hydrogen detector	[Measure 24] Prevention of hydrogen explosion (management of concentration and appropriate release) Know exact situation of R/B by installation of a device for detecting hydrogen concentration. **→Installation of hydrogen detector to operating floor of R/B (done)**				
	Installation of a static recombination catalyst					[Add 4.5] Installation fo PAR inside of PCV **→hydrogen treatment are not expected by static recombination catalyst because the inside of PCV are purged with nitrogen.** **→Implementing the installation of PAR of R/B from the point of view of hydrogen leakage.**
	Ensure the air-tightness of the through-hole of the PCV (heat-resistant gaskets, seals, pressure resistance)	[Measure 19] Prevention of heat damage to top flange of PCV To consider measures of overtemperature damage of PCV top head flange in case of effects of PCV spray is hard to expect even though susceptible to PCV thermal radiation close to the pressure vessel top head flange. It could be cooled from the outside of the top head Alternatively, or if there are any negative effects evaluation of the degree of overtemperature by anti invention, consider each plant individually possibilities other measures. **→Install the water flooding line for PCV top head flange.**				
	Diversification of PCV residual heat removal function	[Measure 18] Diversification of PCV residual heat removal function In order to prevent over-pressure and over-temperature of PCV, PCV spray that does not rely on AC power supply: add functionality to ensure heat removal due and RHR (Note: There is also the effect of removing radioactive material in the CV). To ensure the functional diversity of containment heat removal due to the alternative containment heat removal function that can secure a position dispersion which can avoid the common failure due to the tsunami or no coolant from sea water. **→Ongoing measures to strengthen the heat removal capability PCV using RHR, MUWC, fire truck combined with the power supply like power car and GTG,**				

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Emergency Corresponds	Feature-rich monitoring parameters (RPV that can be used at SA, instrumentation equipment PCV)	[Measure 28] Strengthening of functions for managing plant status To grasp the situation smooth further, use of robots and surveillance cameras including the PCV, to know exactly the state of the plant, such as water level even at the time of core damage, research and development in order to expand the scope of the specification instrument to proceed. **→Implementing by both sides of the development of new instruments and the use of existing instruments**	Mention the need for instrumentation at SA(P104) **→Implementing by both sides of the development of new instruments and the use of existing instruments**		Instruments that allow a reliable even after the SA(P263) **→Ongoing by both sides of the development of new instruments and the use of existing instruments**	[Add 4.3.3, 4.4] Provide the alternative method for critical equipment and parameter monitoring functions.**→→Ongoing by both sides of the development of new instruments and the use of existing instruments**
	Securing fuel oil and establish a method for refueling fire engine, power source car from the oil tank.					[Add 4.4] Ensure the fuel oil even at emergency and utilize(two-sided supply-stockpile). **→Installed underground diesel tank.Signed contract of emergency supply.** **→Two mini tank truck placement as replenishment. Considering the increase in supply means further.**
	Secure working environment of plant control room and command post	[Measure25] Secure and maintenance of command post Secure the emergency command post which doesn't loss the function also by natural disasters such as earthquakes. Secure as follows; Housing space for required personnel, required to supply electric power to the main control room and command post can demonstrate fully functional even in the event of an accident,Inflow prevention of radioactive material(Ensure functionality of HVAC),to ensure the monitoring function and communication function of the situation due to the camera and other peripheral buildings. **→Seismic building installed (emergency power included),enhanced communication function,already implemented measures to prevent flooding caused by the tsunami.** **Considering a further increase seismic isolation building.** **Considering a further increase seismic building.**	Backup air conditioning for electronic equipment and for the main control room. **→MCR HVAC can be operated by connecting a power supply from emergency vehicles,** **→During the evaluation details such as livability**	Considering the design of the corresponding portion of the increasing dose at emergency(Referred to off-site center) (Interim reportP2) **→Additional shielding are ongoing to seismic building**		
	Ensure the passage way of monitoring car			Ensure the movement and patrol at the time of road damage caused by earthquake(Interim reportP480, Final reportP482) **→Ongoing reinforcement measures of on-site road. Considering alternatives such as monitoring car impassable.** Consider of migration routes during the road damage caused by disasters(Final reportP436) **→Ongoing reinforcement measures of on-site road. Considering alternatives such as monitoring car impassable.**		
		[Measure 29] Enhancement of monitoring function during accident To accommodate the possibility of the release of radioactive material from other than stack, maintain the monitoring function for monitoring post by suppluying from emergency power or installation of a dedicated power		Assuming complex disasters, monitoring take measures of monitoring relationship.(Interim reportP480) **→Increasing a amount of placement such**		

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Emergency Corresponds	Placement of alternative environmental monitoring	emergency power or installation of a dedicated power supply. **→Deployed the emergency power supply equipment dedicated for monitoring post.** Consider the accurate monitoring, even if ambient pollution at monitoring post. **→Consider the multiple monitoring system or mobile monitoring facilities.**		**as monitaring-car and various equipment.** Examination of the monitoring system assuming complex disaster(Interim reportP480, Final reportP436) **→Increasing a amount of placement such as monitaring-car and various equipment.**		
	Securing means of telecommunications	[Measure 12] Improvement of decision-making capability during accident To understanding the plant status at TSC even under the conditions of the plant accident occured, development and improvement of relation facilities including communication facility is also important. **→Ongoing enhancement measures various means of communication for emergency** [Measure 26] Securing communication functions during accident To ensure the implementation of the emergency power.Also, assuming the emergency, to maintain the communication functions such as the main communication base, making an considering the installation of earthquake resistance and anti-flooding device. Order to respond quickly and appropriately in the relevant organizations, Promote the establishment of a system, such as TV conference and emergency response information systems, including the transmission system. Further, in order to ensure that the function at the time of the accident. **→Ongoing enhancement measures various means of communication for emergency**	Secure communication means(P149) **Ongoing enhancement measures various means of communication for emergency**	Lack of communication with the TSC about the operation fo IC(Interim reportP5) **→Ongoing enhancement measures various means of communication for emergency** To mention that there was a problem, such as Battery depletion of PHS, area not be communicated even transceiver etc.(Interim reportP494, Final reportP409) **→Ongoing enhancement measures various means of communication for emergency**		[INPO11-4] Loss of all power during prolonged events, secure communications equipment that meet the communication needs of the on-site and off-site. **→Ongoing enhancement measures various communication functions** [Add 4.3.5] Placement of multiple diverse means of communication. **→Ongoing enhancement measures various communication functions** [Add 4.3.5] Planning and infrastructure for receive vast amounts of information, arrange, and share. **→Enhanced communication and reviewing the operation.** [Add 4.4] Such as transceiver, including the placement of a relay that can be used when loss of power **→Ongoing enhancement measures various communication functions**
	Ensure lighting	[Measure 11] Stockpiling of spare components for electrical equipment Ensure the restoration work environment, such as providing a portable lighting equipment **→Placement completed such as personal portable lighting equipment**	Securing means of lighting(P149) **→Placement completed such as headlight and personal portable lighting equipment**			[Add 4.4]Establishment of an independent and battery-powered emergency lights(include flashlight, batteries) to the critical paths. **→Placement completed such as headlight and flashlight.**
	Protective equipment such as protective clothing, masks, APD, transportable air purifier, and ventilation in the emergency operations.	[Measure 12] Improvement of decision-making capability during accident Develop a hardware(equipment(mask etc.) needed to verify the power supply, instrumentation system, status) and software(Such as design drawing of equipment and operation manuals) in order to enable the determination of an emergency. **→Ongoing power enhancement, additional deployment of equipment, instrumentation measuresof SA, the development of related documentation.**	Ensuring adequate equipment for internal exposure prevention such as full-face mask, etc.(P474) **→Placement of additional equipment such as a mask**			[Add 4.3.6] Arrangement of radiation protection and measurement equipment consider the convenience and loacational variance. **→Placement completed** [Add 4.3.6] Placement of radiation protection and measurement equipment of sufficient quantity to emergency. **→Placement completed**

Item	Lessons Learned	Technical Knowledge of the Accident at Fukushima Dai-ichi Nuclear Power Station of Tokyo Electric Power Co., Inc. (NISA's 30-item technical knowledge list)	Diet Accident Investigation Committee Report	Government Investigation Committee Report(Interim + Final)	Independent Investigation Committee Report	INPO Report ("Industry Event Report" or "lessons Learned from the Nuclear Accident at the Fkushima Daiichi Nuclear Power Station")
Others	Risk management during plant shutdown		Construction of strategy that takes into account of functional outservice etc. during the plant shutdown.(P198) **→About the management of plant safety during plant shutdown, corresponding internal manuals, etc.**			
Others	Ensure the independence and diversity for the common cause failure	[Measure 13] Securing cooling facilities against inundation /Location variance Take location variance of each facility, include alternative facilities, to avoid complete loss of function by common factors such as flooding. **→High ground and Location variance are taken for portable equipment such as tsunami and flood prevention measures and portable equipment etc.** [Measure 23] Securing autonomy of venting pipes There is a need to organize the concept of shared between Unit also for equipment other than venting pipes. **→Measures after 3.11 assumes concurrent 7 plant, Deployment to afford equipment, fuel oil, and fresh water required for each Unit.**				
Others	The need for overall risk assessment		To take measures against earthquakes, evaluate the equipment damage and triggering event like accompanying seismic events(eg, tsunami) as long as possible, etc.(P595) **→Further safety assessment due to PSA**	Doing a Overall risk assessment by considering the events of external and internal events that occur infrequently. Using a technique that can be actively at this stage, even if the standardization of External events PSA has not been completed(Final report P397, 398, 435) **→Further safety assessment due to PSA**		
Others	Reconfirmation of defense in depth against external events and advancement of quantitative risk assessment			Take measures assuming complex disasters such as earthquakes and tsunamis.(Interim reportP504, Final reportP411) **→Various hardware measures, tsunami AMG etc.**		[Add 2.0] Emergency corresponding can be strengthen using the defense-in-depth approach. **→To overall picture of measures, arrangement based on the concept of defense in depth.** [Add 2.0] In the safety assessment, the safety assessment is valid as cross-organizational with a walk down. **→Tsunami/earthquake Walk down implemented as stress test feasibility. PSA evaluation will be carried out among the future.**
Others	Counterterrorism		Cyber-terrorism measures, Counterterrorism(P204, 598, 599) **→For a variety of counter-terrorism, including cyber-terrorism are investigated in the future.**			

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	SA prediction tool development that can be updated in real time		Discribed that it was beneficial to share information if there is a predictive tool that can be updated in real time SA progress(P193) **→under consideration**			
	Fostering Safety Culture		Proposal4-(2) (Accident report says that the work should be done by regulatory)Among electric utilities, to build a mutual monitoring system to check for advanced cases of nuclear safety, encourage unremitting efforts towards its achievement. **→under consideration for implementation**	Problems exist at Tsunami countermeasures,education and training correspond to SA,attitude of the cause of the accident investigation etc. Build the safety culture throughout the company.(Final reportP406, P428, 429, 441) **→Various measures implemented continuously to improve the nuclear safety** The constant endeavor would taken of the latest national and international knowledge and outgoing lessons of the accident.(Interim reportP497, Final reportP407) **→Ongoing incorporation of knowledge. Also outgoing lesson in many places.** (Such as site verification after dose decreased) Continuation of the whole picture of the accident investigation.(Final reportP429, 441) **→Planning to implement(Supported by Project team of verification survey, task force team etc.)**		