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INTERIM REPORT OF TASK FORCE

ON

SAFETY EVALUATION OF THE SYSTEMS OF KKNPP

POST FUKUSHIMA EVENT

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1.0 <u>Introduction</u>

1.1 General:

Kudankulam Nuclear Power Project (KKNPP) consisting of two VVER-1000 type of units having 1000 MWe rating each is under advanced stage of completion at Kudankulam in Tirunelveli district of Tamil Nadu. Construction activities at site started on 31st March 2002 with first pour of concrete of Unit -1. Unit -1 is presently undergoing prestart up commissioning activities and construction and erection works of unit-2 is nearing completion.

Two units at KKNPP are being implemented with technical assistance of Russian Federation (RF) as per the Inter Government Agreement (IGA) between the two countries. As per the agreement, design and supply of all major equipments are done by RF while construction, erection, commissioning and operation are being carried out by Indian side.

KKNPP design incorporates advanced safety features complying with current standards of redundancy, reliability, independence and prevention of common cause failures in its safety systems. Design takes care of Anticipated Operational Occurrences (AOO), Design Basis accidents (DBA) and Beyond Design Basis Accidents (BDBA) like Station Black Out (SBO), Anticipated Transients Without Scram (ATWS), metal water reaction in the reactor core and provision of core catcher to take care of core degradation. The design includes provisions for withstanding external events like earthquake, tsunami/storm, tidal waves, cyclones, shock waves, aircraft impact on main buildings and fire.

1.2 In light of the accident at Fukushima, Japan, initiated by natural phenomenon, the Task Force constituted, has reviewed the capability of KKNPP to withstand and mitigate extreme natural phenomenon which have very low probability of occurrence but potential for loss of significant operational and safety systems In view of the advanced safety features including passive decay heat removal system, the plant has very high capability to withstand severe natural events with margins available from design input parameters. However in order to enhance the safety levels further and building additional defense in depth the task force has recommended some short term and long term measures.

1.3 Site characteristics:

Kudankulam NPP is located close to the equator at the shore of Gulf of Mannar. The South Eastern coast where Kudankulam NPP is located can experience cyclonic storms. Five storms with maximum wind speeds ranging from 17 m/s to 31.7 m/s were recorded in this region during the period from 1891 to 1986. One of the storms had passed near to the KKNPP construction site, while two of the storms, including the strongest one passed 100 km north of the site.

High and low tides influence the sea water levels. The maximum observed high tide is plus 0.62 m (MSL), while minimum observed low tide is minus 0.49 m (MSL). The tidal range is about 1 m. The local mean sea level (LMSL) near Kudankulam NPP is minus 0.03 m with reference to average mean sea level.

The KKNPP is situated in an area with an expected earthquake intensity of up to V on Modified Mercalli Intensity Scale (MMI scale) and falls in Zone-2 seismic category. The strongest earthquake near this area and within the Indian peninsula is the Coimbatore earthquake of February 08, 1900. The epicentral intensity has been reported as VII (MMI scale) and Indian Meteorological Division (IMD) has estimated its magnitude to be equal to 6.0 on the Richter scale. The earthquake epicenter was situated at a radial distance of 300 km from the KKNPP site.

The nearest epicenter of a recorded earthquake was located near Trivandrum, which is situated at a distance of 88 km north-north-west of the Kudankulam NPP site, where two earthquakes of V (MMI scale) intensity, corresponding to 4.3 magnitude on Richter scale, were recorded.

Different buildings in the plant are built taking into account the above natural phenomenon.

2.0 Scope and Objective:

The objective of this Task Force is to review the consequences of occurrence of a similar situation like Fukushima Daiichi NPP postulated at KKNPP resulting in the unavailability of electric power and the designed water supply route and to recommend augmentation measures to mitigate the situation. This includes:

1. Evaluate the capabilities of the systems

2. Identify the required augmentation measures and infrastructure facilities, hook-up points to mitigate this beyond design basis scenarios.

3. Review of Emergency Operating Procedures (EOPs).

3.0 Design Features of KKNPP:

3.1 General:

VVER types of reactors are Pressurised Water Reactors (PWR), consisting of primary and secondary circuits. Primary circuit comprises of a vertical reactor, four coolant recirculation loops each having a coolant recirculation pump and a steam generator (horizontal) and a pressuriser connected to one of the coolant loops. Main technical parameters of KKNPP are given in the following table:

Parameter	Value
Reactor nominal thermal power, MW	3000
Reactor thermal power considered in design,	3120
Primary coolant	Light Water (Borated)
Primary coolant inventory, m^3	290
Primary system design pressure, MPa	17.64
Coolant pressure at the core outlet, absolute, MPa	15.7
Coolant temperature at the reactor inlet, ºC	291
Coolant temperature at the reactor outlet, ºC	321
Coolant flow rate in one loop, m^3/h	21500
Coolant flow rate through the reactor, m^3/h	86000
Pressuriser volume, m^3	79
Number of fuel assemblies	163
Average fuel enrichment, % during equilibrium cycle	3.6
Av. Fuel burn up, MW days/kg of uranium	43
Operation time at nominal power, h	7000
Number of control and protection absorber rods	121 (max)
Steam Generator (SG) capacity, t/h(for each SG)	1470
Steam pressure at nominal load , MPa	6.27
Temperature of generated steam at nominal load, ºC	278.5
Feed water temperature under nominal condition, ºC	220

3.2 Safety Features:

On initiation of emergency protection system, automatic reactor trip takes place and reactor becomes subcritical due to simultaneous gravity drop of all the Control and Protection System Absorber Rods (CPSAR) into the core on de-energisation of the holding electromagnets. There are also provisions for injection of concentrated boric acid in to the primary coolant system by Emergency Boron Injection System (EBIS) using positive displacement pumps supplied by Group-II Emergency Power Supply and also Quick Boron Injection System (QBIS) which injects concentrated boric acid to the Reactor Coolant System (RCS).

Safety Systems are provided to ensure the core cooling under various conditions of Postulated Initiating Event (PIE) considered in the design, which includes Anticipated Operational Occurrences (AOO), Design Basis Accidents (DBA) and most of the BDBAs. Salient features of the safety system design are:

- ✓ Four 100% capacity trains for redundancy.
- ✓ Each train has its own emergency power supply backed up by Diesel Generator (DG) sets and battery banks.
- ✓ Active systems backed up by passive systems.
- ✓ Physical separation of the four trains to preclude any common cause failure.
- ✓ Systems are provided for BDBA conditions also.

All these safety equipments are located in safety building (UKA) located below Reactor Building (RB). This building is seismic category-1 and protected with double seal water leak tight doors.

Containment Systems are provided for confinement of radioactivity during an accident condition. Salient features of the containment system design are:

- ✓ Double Containment
- ✓ Primary Containment designed for LOCA peak pressure of 0.4MPa.
- ✓ Containment spray system for pressure control.
- ✓ Secondary Containment designed for various external effects, such as missile attack, aircraft crash, shock waves, etc.
- ✓ Hydrogen re-combiners for combustible gas control inside the primary containment.
- ✓ Core catcher for confining and cooling the molten core under severe accident conditions.

Safety systems provided at KK NPP is summarized in the following table:

Function	Active Systems	Passive Systems
Reactor shutdown	Emergency Boron Injection System or EBIS (for **ATWS**)	CPSARs Quick Boron Injection System or QBIS (for **ATWS**)
Decay Heat Removal	Steam generator Emergency cool down system or SGECD (JNB 10-40) High pressure boron	1st stage accumulators 2nd stage accumulators (for **BDBA**) Passive Heat Removal System-

Function	Active Systems	Passive Systems
	injection system (JND 10-40) Emergency and planned cool down and fuel pool cooling system (JNA 10-40) Component cooling system (KAA 10-40) Essential sea water cooling system (PEB 10-40) Emergency power supply system (Group-II)	PHRS (JNB 50-80) (for **BDBA**) Emergency Power Supply System (Group- I) for 2 Hrs Emergency Power Supply System for 24 Hrs (Gr-I) (for **BDBA**)
Confinement of radioactivity	Containment spray system (JMN 10-40) Containment Isolation System.	Primary containment Secondary containment Core catcher (for **BDBA**) Passive hydrogen re-combiners (for **BDBA**) Hydrogen monitoring system Annulus passive filtration system (for **BDBA**)

3.3 Emergency Power Supply Systems (EPSS):

KKNPP is connected to the grid through two separate systems of 400KV and 220 KV. Each of the four safety train has its own dedicated EPSS and control systems comprising of a 100% capacity DG sets, 6 KV, 380V, 220V AC/DC switchgear, battery banks. All the equipments are housed inside independent buildings and the pipelines and cables are laid through independent dedicated concrete tunnels. These buildings are seismic category-1 and protected with double seal leak tight doors which will also prevent water intrusion. Grade level of the EPSS building is 9.3 m above MSL.

3.4 Sea Water Cooling System For Emergency Loads:

All the heat exchangers of the Emergency Core Cooling System (ECCS) and DG sets are cooled by seawater supplied from sea water system for essential loads. There are four pumps; one for each safety train. Each pump is located in independent building near main pump house and power supplied from respective EPSS. Pipe lines and cables are laid through independent and separate concrete tunnels. These buildings are seismic category-1 and protected with double seal leak tight doors which will also prevent water intrusion. Grade level of this building is 7.65 m above MSL.

3.5 Spent Fuel Storage And Cooling System:

In KKNPP, Spent Fuel Pool (SFP) is located inside the primary containment adjacent to reactor cavity; bottom of the pool is +12.5m. It has the capacity to store 582 number of spent fuel assemblies. Water inventory inside the SFP is about 1500 m^3, out of which 500 m^3 is meant for ECCS operation. Cooling of the SFP is done using one train of Emergency and planned cool down and fuel pool cooling system (JNA 10-40). SFP make up is done using spent fuel pool makeup system (FAL).

3.6 Seismic Design:

All the safety related main plant buildings have been designed as seismic category-I.

The polar cranes in the reactor buildings are provided with seismic arrestors.

Design Basis Earthquake (DBE):

Estimated intensities of earthquakes and peak ground accelerations at the site for the design-basis earthquake and ultimate design-basis earthquake are given in the following table. It can be seen that substantial margins are available between design basis earthquake values and ultimate design basis earthquake values.

	Peak ground acceleration (g)		Earthquake intensity at the site (MMI)
	Horizontal	Vertical	
Ultimate design-basis earthquake	0.15	0.11	VII
Design-basis earthquake	0.05	0.036	V

3.7 Seismic instrumentation and protection:

The seismic instrumentation has been designed for monitoring seismic activity and providing automatic reactor shutdown in case of occurrence of an earthquake having free ground accelerations of 0.036g for the vertical component and 0.05g for the horizontal component. When the acceleration reaches 0.025g recording is initiated.

Two sets of seismic sensors each set containing three accelerometers are provided for generating Emergency Protection (EP) signals. These sensors are positioned on the base slab of the reactor building.

3.8 Flood design and Important plant levels and locations:

Design Basis Flood Level

The design maximum sea level with a 0.01 % probability (that occurs once every 10000 years) is estimated as plus 5.30m (MSL). The design minimum sea level of the same probability is minus 1.72m (MSL). Elevations and locations of various buildings are given in the table. A sketch showing the relative elevations of various structures is also given. The shore protection structure rises upto 8 meters height above mean sea level and hence will protect the site from direct impact from tsunami waves. The water level experienced at site during the December 26, 2004 tsunami triggered by earthquake of 9.2 magnitudes at Sumatra was only about 2.2 meters above mean sea level.

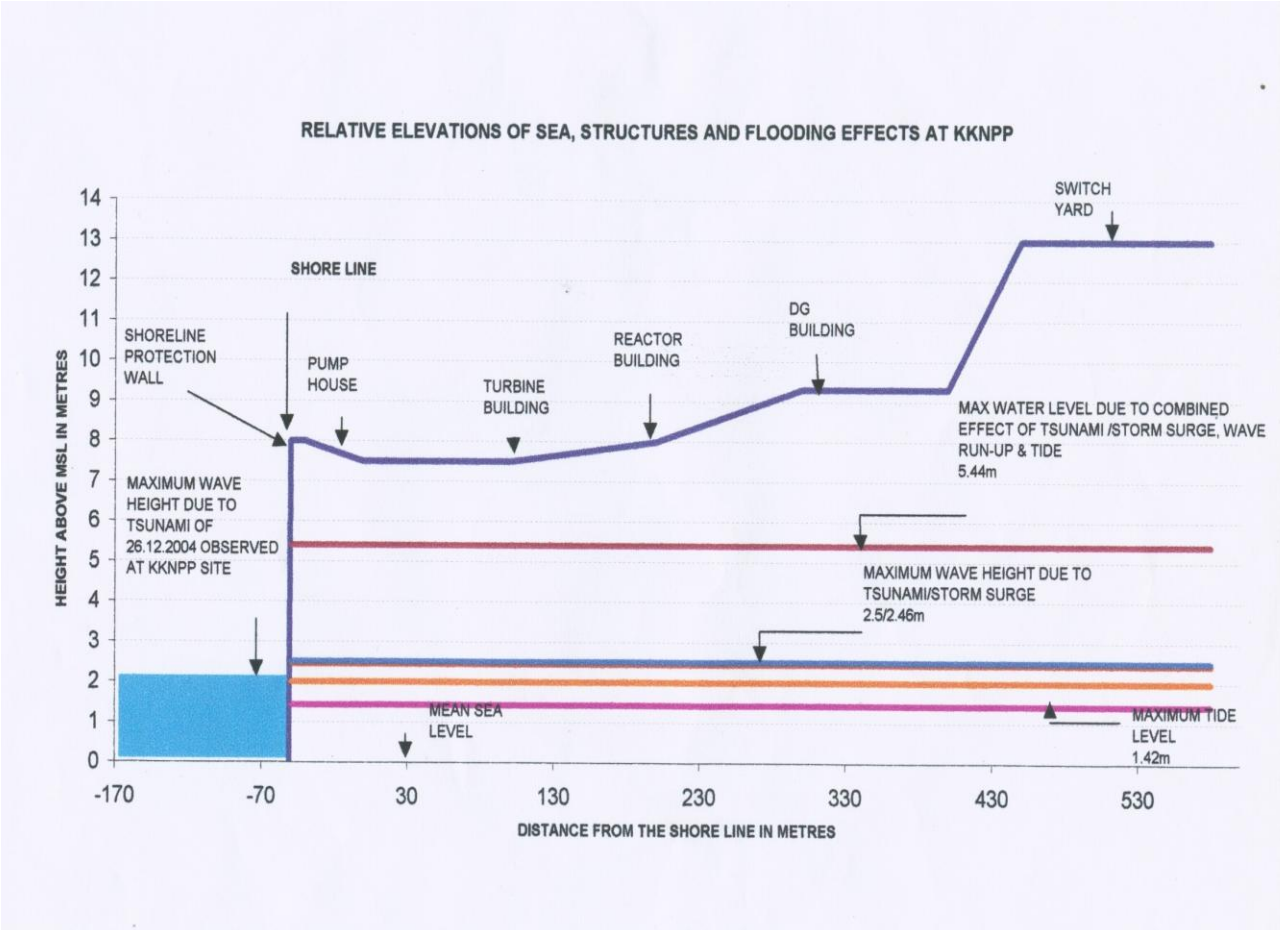

Table- Important Elevations for KKNPP

Description	Elevations in meters above MSL	Margin available Meters from DFL
Reactor Building ground floor	+8.7 m	3.26
Spent fuel pool - bottom	+12.5 m from RB floor (+21.2m above MSL)	15.76
Spent fuel pool - normal water level	+30.85 m from RB floor (+39.55 above MSL)	33.41
Safety DG sets (4 per unit) in UKD building(sealed building)	+9.3 m	3.86
Reliable PS DG sets (common for both units) (sealed building)	+8.2 m	2.76
Diesel day tanks in DG building , 15 m^3 , 8 Hrs FL capacity in UKD building (sealed building)	+14.1 m	8.66
Group-II switch gear of safety trains in UKD building (sealed building)	+9.3 m	3.86
Group-I Battery Bank for 2 hrs (sealed building)	+12.9 m	7.46
Group-I Battery Bank for 24 hrs (SBO Batteries) (sealed building)	+16.5 m	11.06
Group-I switch gear of safety trains in UKD building (sealed building)	+9.3m	3.86
Safety trains control instruments room in UKD (sealed building)	+16.5m	11.06
PHRS Heat exchangers	+ 51.8m	46.31
Main control room in UKC	+ 29.7 m	24.26
Supplementary Control room(shielded and sealed)	+9.7m	4.26

In addition to location at higher elevations, all the safety related buildings are closed with double gasket leak tight doors. Hence water entry into these buildings is extremely remote even in case of sea water level surge reaching upto their elevations.

3.9 Existing On Site Water Inventory:

Source of water for the plant operations is an onsite sea water desalination plant. This plant has the capacity (3x100 m^3/Hr) to meet the total requirement for plant operation and domestic water of unit 1&2. Water from the desalination plant is further de-ionized at the De-Mineralized (DM) plant before using in the main plant. Water produced at the desalination plant/DM plant is stored at various tanks as shown in the table.

Sr. No.	Description	Capacity (m^3)	Location
1	DM water storage tanks in DM Plant	630x2=1260 160x2=320 (1580) (common to Unit 1 &2)	+8.5m in DM Plant
2	DM water storage tank LCP near TB	1000 per unit	+8.1 near TB
3	Deaerator	250	Inside TB
4	Emergency water storage in SFP	500	Inside RB(SSE qualified)
5	ECCS tank stage-1	4x60=240	-do-
6	ECCS tank stage-2	8x120=960	Inside RB(SSE

Sr. No.	Description	Capacity (m^3)	Location
			qualified)
7	Distillate storage tanks KBC	160x2=320 630x2=1260 (Total 1580)	Inside RAB(OBE qualified)
8	Boric acid tanks KBD	160x2=320	Inside RAB(OBEqualified)
9	SFP filling tanks	400x2=800	Inside RAB(OBEqualified)
10	Firewater tank	1000x2=2000	+8.1m near Fire station
11	Domestic water tank	550 (O/H tank) 275x3=875 (U/G tank)	+44m Outside Operating Island
12	Desalination Plant	630x1 160x1	+8.5m Outside Operating Island

Out of the tanks mentioned against S.Nos. 1, 2 & 7 in the above table, except for two 160 m^3 capacity tanks at D.M. plant other tanks are designed for seismic category II (OBE). The other two 160 m^3 tanks are category III conforming to codel design.

3.10 Decay heat removal provisions:

Core cooling during loss of Group –III power supply

During loss of Group-III power conditions, reactor is shutdown automatically and core cooling is achieved by natural circulation of primary coolant system through steam generators. Heat removal from SG takes place initially through atmospheric discharge valves and PHRS. After starting of the DG sets, closed loop system of SGECD comes into operation. As both PHRS and SGECD are closed loop systems, there is no need of SG inventory replenishment. SGECD pumps are supplied with Group-II EPSS. However, auxiliary FW pumps powered from common station DG sets will be available for SG level makeup. Normal cool down rate of reactor using SGECD is 30 deg C/Hr and fast cooling can be done at 60 deg C/Hr. After cooling down of RCS to 120-130 deg C, further cooling of reactor coolant system is done using one train of emergency cool down system JNA.

If required primary make up can be done using following methods:

By using make up pumps when Gr-3/Gr-2 reliable supply is available.

By using high pressure emergency boron injection pumps when Gr-3/Gr-2 supply is available.

By using high pressure boron injection pumps at 6.5 MPa when Gr-3/Gr-2 supply is available.

By using 1st stage ECCS accumulators at 6.0 MPa when Gr-3/Gr-2 supply is not available.

By using 2nd stage ECCS accumulators at 1.5 MPa when Gr-3/Gr-2 supply not available.

Water makeup to steam generators can be done from deaerator storage tank when Gr-3/Gr-2 power is available.

3.11 Core cooling during SBO:

In case of simultaneous loss of Gr-III and Gr-II power supply reactor is shutdown automatically and core cooling is achieved by natural circulation of primary coolant system through steam generators. Heat removal from SG takes place initially through atmospheric discharge valves and PHRS. On sensing low level in SG closure of Fast Steam Isolating Valve (FSIV) will take place and SG cooling will continue using PHRS. As per the safety analysis reports, primary coolant temperature &pressure comes down to 165º C and 3.4 MPa after 24 hrs.

If required primary make up can be done using following methods:

By using 1st stage ECCS accumulators at 6.0 MPa when Gr-3/Gr-2 supply not available.

By using 2nd stage ECCS accumulators at 1.5 MPa when Gr-3/Gr-2 supply not available.

3.12 Design Basis Accident (DBA):

Safety analysis of various design basis accidents have been carried out including loss of coolant accidents (LOCA) covering a spectrum of primary coolant pipe break size from 100mm to 850mm. Results of these analysis have proved that acceptance criteria is met for all the conditions.

Containment spray system is available for post accident depressurization provided with Group II power. (JMN 40). After containment pressure reduces, provision for controlled post accident purification through filters and purge to stack, using fans having Group II power supply, is also available.

3.13 Beyond Design Basis Accidents (BDBA):

Safety analysis of various beyond design basis accidents have been carried out including loss of coolant accidents (LOCA) with Station Black Out (SBO) for 24 hrs and Anticipated Transient Without Scram (ATWS). Results of these analyses have proved that acceptance criteria are met for all the conditions.

Monitoring of all the important parameters for core, radiation monitoring, reactor coolant system and containment are available through Group-1 Emergency Power Supply System (EPSS) i.e. 24hr SBO batteries.

4.0 Severe Natural Events for Which Plant Systems are studied in this report:

Even though sufficient margins have been built in, above DBFL, extended station blackout has been studied deterministically.

In case of water inundation upto 7.65m height there will not be any impact on the station as pump house grade level is 7.65m and all other buildings are above this level. Hence, reactor can be safely shutdown and long term core cooling can be ensured using the designed systems in this scenario.

In case of water inundation of above 7.65m height the pump house and heat removal from the normal route will be affected. Turbine will trip on low vacuum following loss of condenser cooling water and the plant has to be brought to shutdown condition immediately.

In a realistic scenario, there will be about 2 to 3 hours time available from tsunami alert to shut down and cool down the reactors in a normal manner. Also, the leak tightness of the buildings which houses safety system pumps, DG's, EPSS, safety train building (UKA) will prevent the safety systems from getting submerged.

Possible Tsunami occurrence can be known from:-

- ✓ Tsunami and earth quake alerts from agencies and proposed earthquake alert system.
- ✓ Recording of seismic activity by the instruments > 0.025g
- ✓ Pump house bay level showing unexpected changes

Event progression in different scenarios up to a maximum of postulated event scenario brought out above with mitigating actions:

4.1 Event progression if Group-III power is not available:

As the water start rising above 7.65 m pump house will be submerged and all the pumps like CCW, PGB, will be affected. As the DG building is not submerged, Group II power will be available. The Essential Load cooling water pump house is a sealed structure and is expected to be operable.

Cooling to condenser will be lost leading to fall in condenser vacuum and subsequently TG will trip on low condenser vacuum.

Reactor should be tripped manually if not tripped already and Quick boron injection should be initiated;

- ✓ Fast Steam Isolating Valves (FSIV) will close on SG low level.
- ✓ Start cooling of the reactor using PHRS and borated water addition to RCS has to be started using Emergency Boron Injection System (EBIS) -.
- ✓ Primary system inventory make up by 1st stage accumulators.
- ✓ Reactor Auxiliary and Spent fuel pool cooling will be affected.

- ✓ Break the condenser vacuum and vent out hydrogen from generator.

4.2 Event progression if Group-II Power becomes unavailable

For this to occur, water should inundate up to 9.3 meter elevation and if no credit is taken for the leak tightness of the buildings entire Group-III and Group-II power supplies will be lost.

- ✓ TG will trip, CCW pumps, FW pumps, RCPs will also trip.
- ✓ SG pressure will start rising resulting in opening of atmospheric dump valves BRU-A.
- ✓ Due to fall in SG level, Steam isolation valves will close.
- ✓ Cool down should be initiated immediately using all four channels of PHRS.
- ✓ Primary system inventory make up by 1st stage accumulators.
- ✓ Reactor Auxiliary and Spent fuel pool cooling will be affected.
- ✓ Break the condenser vacuum and vent out hydrogen from generator.
- ✓ As per the safety analysis carried out, primary pressure is expected to reach 3.5 MPa and 165 deg C by 24 hours.

Under the postulated scenario following systems become unavailable:

- ✓ Group -III and Group-II power Supply Systems
- ✓ All active safety systems
- ✓ Sea water cooling system
- ✓ Chemical and volume Control System (CVCS)
- ✓ Spent Fuel Pool Cooling

- ✓ Electric Fire Water Pumps
- ✓ Normal and Emergency Ventilation System

Under the postulated scenario following systems will be available;

- ✓ Reactor Trip and CPSAR position Indication
- ✓ Passive Heat Removal System (PHRS)
- ✓ ECCS 1st Stage Hydro accumulators
- ✓ ECCS 2nd Stage Hydro accumulators
- ✓ Containment Isolation
- ✓ Hydrogen Recombiners
- ✓ Quick Boron Injection System (QBIS)

Under the postulated scenario following Indication will be available for 24 hrs through SBO Batteries:

- ✓ Neutron Flux
- ✓ Pressure above the core
- ✓ Containment Pressure
- ✓ Coolant Temperature
- ✓ Hydrogen Concentration Inside the Containment
- ✓ Reactor Coolant Level
- ✓ Reactor Sump Level
- ✓ Radiation Inside the Central Hall
- ✓ Pressure Vessel Level
- ✓ Coolant temp in hot and cold legs

- ✓ Boiler water level
- ✓ Temperature inside the Containment

Core cooling will be available using PHRS provided sufficient water inventory in SG is maintained. In case of leakages from the secondary side of SGs if the inventory starts coming down provision is to be made make up the secondary from outside the containment through hook up provisions to feed water line.

During this phase, Reactor Coolant inventory makeup is possible from 1st stage accumulators and then from 2nd stage accumulators whenever pressure falls below 1.5 MPa.

Considering a leak rate from the RCS as $5m^3$ per day and volume shrinkage due to cooling as $100m^3$, inventories in 1st stage accumulator ($4x60\ m^3$) alone is sufficient for more than 20 days.

Further make up of RCS from 2nd stage accumulators ($8x120\ m^3$) is available.

Approximately 800 m^3 of borated water is available above the level of spent fuel assembly in the fuel pool for emergency core cooling. Once the fuel pool cooling is not available water loss from the fuel pool will take place due to evaporation.

4.2.1. Aspects to be addressed under the scenario of Station Blackout concurrent with severe natural event

After detailed discussions, the minimum requirements to be addressed for core safety and spent fuel safety for SBO condition extended beyond 24 hours has been arrived at

a) Provision for Makeup of water on secondary side of Steam Generators

b) Provision for Make up of Borated water to Spent Fuel Pool

c) Provision for Injection of borated water in the Reactor Coolant System at required pressure in case any leakage develops and the existing substantial back up inventories are exhausted.

d) Hook up provisions from outside the Reactor Building for the above water addition requirements from alternate sources other than the designed water routes.

e) Augmentation of onsite water resources/storage designed to be intact following tsunamis/earth quake (with suitable capacity).

f) Mobile pumping equipment/other methods that do not require on site or offsite power

g) Alternate Power sources for the mobile pumping equipment

h) Monitoring of important parameters (under item 4.2 above) using portable power packs at suitable pre identified wiring terminals.

4.3 Preparation of EOPs and training of operators:

It is seen that draft version of EOP for tsunami, SBO and other BDBAs covered in design are prepared. They have to be finalized and training of operators on these EOPs is to be done.

5.0 Long term Recommendations:

i. Provision of solar powered lighting for different buildings.

ii. Study the feasibility of using wind power generator already available at KKNPP site as a backup power.

6.0 Conclusion:

Review of the core cooling capability of the KKNPP during a postulated beyond design basis scenario of tsunami resulting in incapacitation of motive power and the designed water supply route was carried out. It is seen that KKNPP design has incorporated sufficient passive systems to ensure core cooling and radio activity confinement even in the case of an extended unavailability of electric power and the designed water supply route. Hydrogen management and molten core long term cooling systems are also available to ensure the integrity of the containment systems. Grade levels of all the main buildings have sufficient margins from the design basis flood level which is conservatively arrived at.

However, as a means to further enhance the level of safety and to build more defense in depth the committee recommends the implementation of the measures outlined to cope up with unanticipated and rare severe and multiple natural events having very low probability like the one that took place at Fukushima Nuclear Plants in Sendai prefecture of Japan.

The engineering details of these additional measures are being worked out. The schedule (short term and long term) of implementation will be submitted along with engineering details by end August 2011.