



BHARATIYA NABHIKIYA VIDYUT NIGAM LIMITED
(BHAVINI)

(A Government of India Enterprise)
Department of Atomic Energy (DAE)



Prototype Fast Breeder Reactor
(PFBR)



PROPOSED ACTIVITIES AT PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

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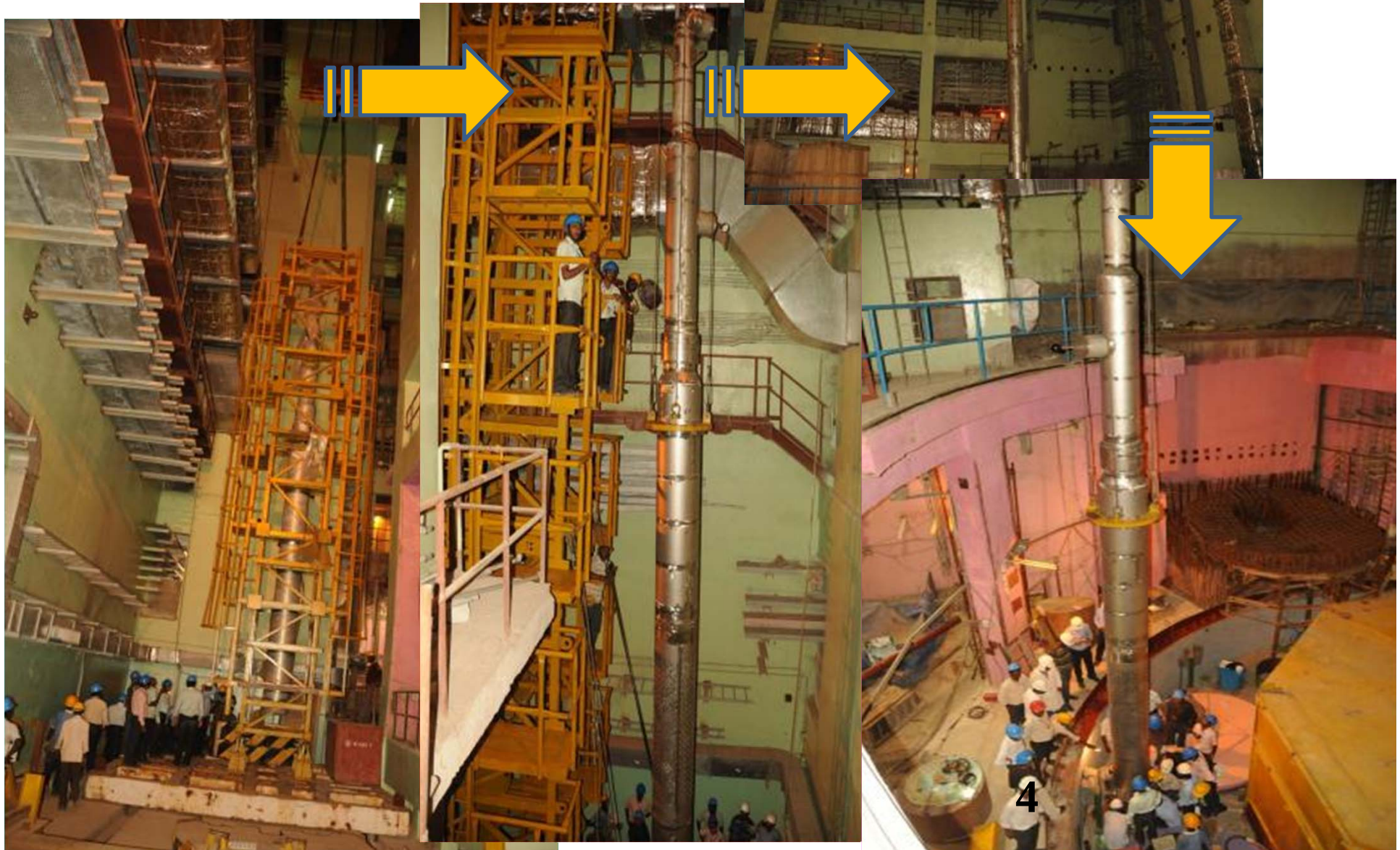
Sodium Piping



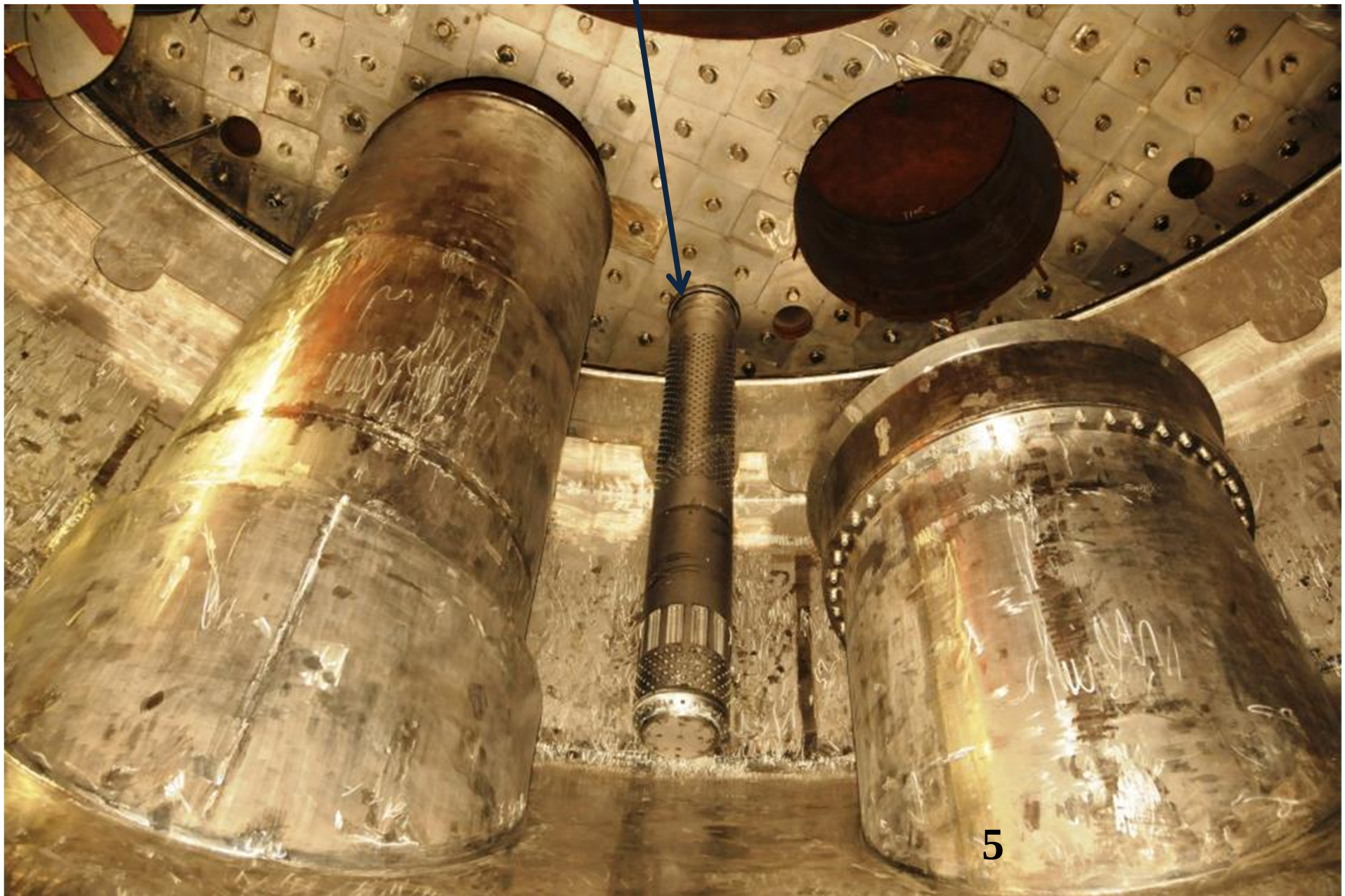
Sodium piping – Bellow fit up & welding



DHX erection sequence



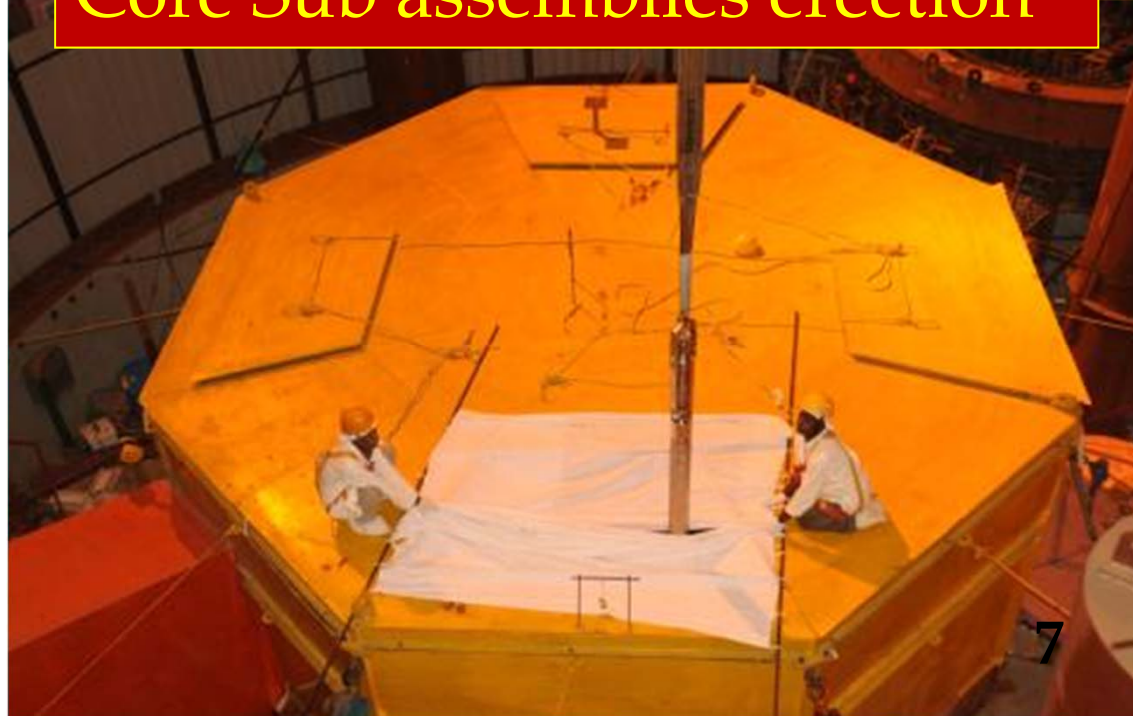
DHX after erection (View from Grid Plate)







Core Sub assemblies erection



Core Sub Assemblies (SAs) erection over the Grid plate

Outer B4C Sub Assemblies : 188 / 417
Steel Shielding SAs : 192 / 609

PR & PTM erection sequence





7th Steam Generator (SG) erected at its location in SGB-2 building.



7 nos. of steam generators erected at site.

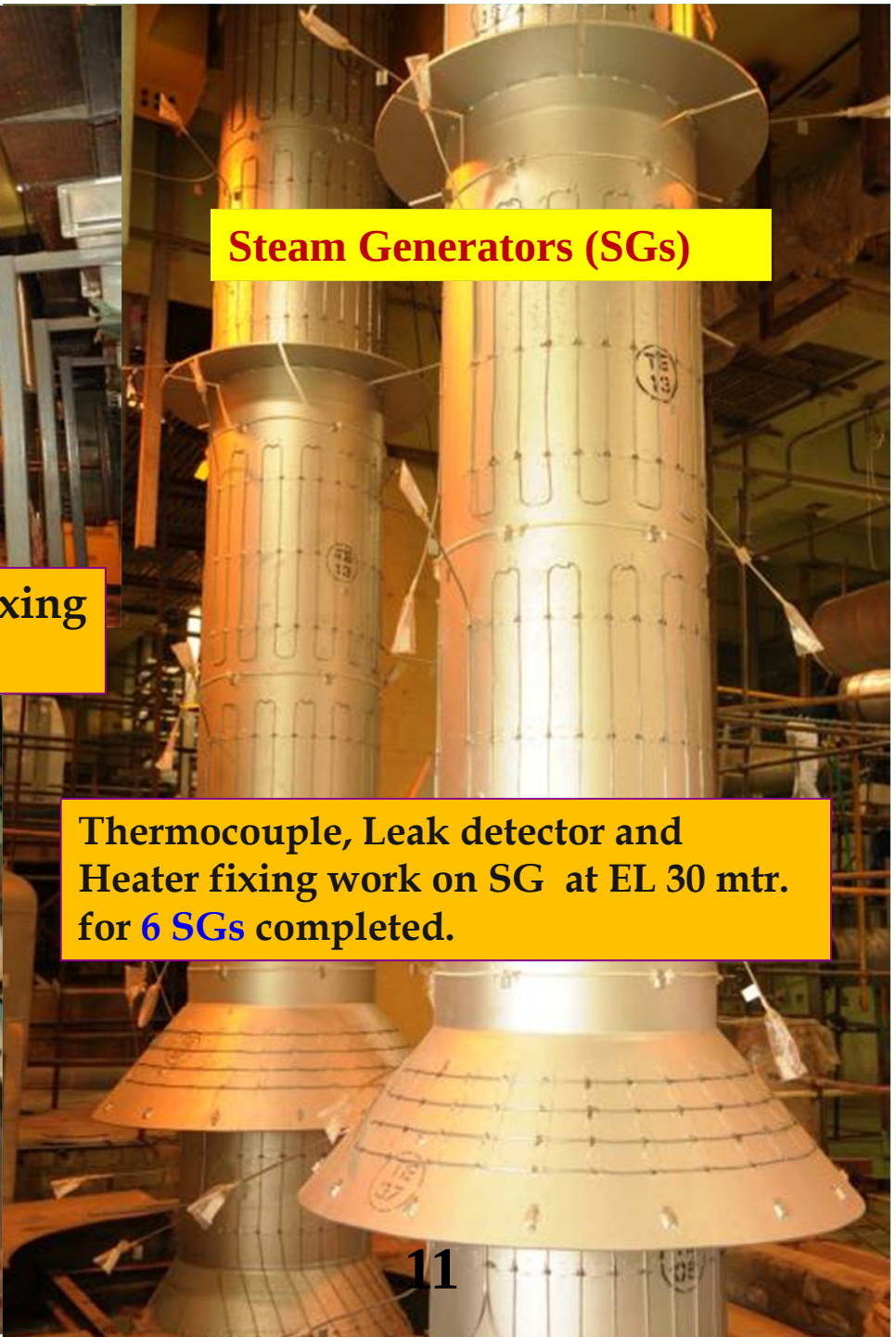


Thermocouple, Leak detector and Heater fixing work on SG at EL 37.5 mtr. is in progress.



Steam Generators (SGs)

Thermocouple, Leak detector and Heater fixing work on SG at EL 30 mtr. for 6 SGs completed.



Frozen seal valves erected at site



Sodium Piping Installation





Sodium Piping



Bellow fit up & welding



Un-presidented

- **Common mode**
- **Multi unit**
- **Impaired Cooling**
- **Four hydrogen explosions (3 RBs and in one Wet well**
- **Sufficient release in public domain**
- **Evacuation**
- **Restriction of food consumption**
- **Long time to cool the reactor**

POST FUKUSHIMA

- **Design adequacy**
- **Design extension**
- **Accident management**

Design adequacy

- ✓ **Capability to shut down**
- ✓ **Capability to cool**
- ✓ **Capability to maintain power supply**
- ✓ **Capability to know the status of the reactor**

Design Extension

- ✓ Leak tight doors
- ✓ Leak tight penetration
- ✓ Leak tight DGBs
- ✓ Additional Batteries
- ✓ Additional Diesel Generators
- ✓ Additional Borewells
- ✓ Extension of fire water to SF SB

Design Extension

- ✓ **Extension of Tsunami wall height and coverage**
- ✓ **Bathymetry, shore contour and shore protection**
- ✓ **Additional stores**
- ✓ **Additional approach**
- ✓ **Hydrogen management**

Accident Management

- ✓ **Emergency preparedness**
- ✓ **Emergency response center**
- ✓ **Public perception and public acceptance**
- ✓ **NDMA**
- ✓ **NDRF**
- ✓ **Emergency shelters**
- ✓ **Emergency health monitoring and treatment**

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

- **Subsequent to Fukushima**
 - **Direction of Atomic Energy Regulatory Board (AERB).**
- **Task Force PFBR against external events.**
- **Task Force carried out an in-depth review by forming various Working groups.**

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

- *Accident Management strategy and Emergency Preparedness :*
 - Availability of **DG beyond design basis scenario.**
 - Possibility of **hooking up** back up supply in the event of DG not available.
 - Adequacy of **approach to plant** to handle emergency scenario following DBA.
 - Formation of **emergency crew** to handle emergency situations and the training.

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

PROPOSED ACTION PLANS :

Automatic *reactor trip on seismic* event

- PFBR Site Seismic Values:
 - OBE : 0.078 g (Horizontal direction)
: 0.052 g (Vertical direction)
 - SSE : 0.156 g (Horizontal direction)
: 0.104 g (Vertical direction)

It is planned to have reactor trip when the threshold values corresponding to OBE level are exceeded.

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

Spent Fuel Storage Facility :

- It is planned to have provision to source **fire water from the terminals of locations identified near the Spent fuel storage pool.**
- At least 4 numbers of **bore wells in between the Fuel Building and the Service Building** are proposed. These bore wells will have a pump room with power supply from **Diesel Generators.**
- Sufficient numbers of **diesel operated portable pumps** are proposed to be positioned at safe locations in the plant. Provisions will be made to connect these pumps in place of fire water pumps and bore well pumps.

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

- It is planned to have **additional diverse instrumentation for level and temperature measurements** of Spent fuel storage pool, independent to the main plant instrumentation system will be provided.
- Planned to **lock the EOT cranes** in Fuel Building in safe parking locations when not in use.

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

Sealing of entries and openings in the plant buildings:

- It is planned to have *water seal tight doors* at all the major openings of Nuclear Inter Connected Building (NICB) , Emergency Diesel Generator Buildings & Power Island.
- The Steam Generator Buildings have got sodium lines. Hence, the existing shutters of the Steam Generator Buildings are planned to be replaced by *water leak-proof doors*.

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

- All the electrical and instrument cable joints and the junction boxes are planned to have *proper sealing to prevent water entry*.
- All the *cable terminal boxes/junction* boxes located in NICB & Power Island will be *sealed against the splash* water head with proper sealing compounds /sheaths.
- The *openings* for the Electrical and Instrumentation *cables'* *entry to the buildings will be sealed* to achieve the leak tightness to prevent water entry.

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

- Construction of an **alternate route/** road to site from the BHAVINI Township.
- Provision of an Additional Diesel Generator (ADG)(capacity :**1 MVA ; Air cooled ; location at a higher elevation**) to provide power supply to critical equipment's.
- Also, provision for **hooking up** the power supply for the battery chargers from the ADG.
- To have provision of **solar powered lighting** in critical areas of the plant.

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

- **During a natural calamity, diesel oil transfer from bulk oil storage tank to the EDG day tanks may not be possible.**
- **Hence it is planned to enhance the day tank capacity by augmenting with additional diesel oil day tank for each EDG.**

PROPOSED ACTIVITIES IN PFBR IN THE WAKE OF FUKUSHIMA ACCIDENT

Increase the Tsunami bund height and length:

Present Status:

- ***Tsunami protection bund*** made out of engineered boulders stacked at a height of 5.4 Meters above MSL (the top of the tsunami protection bund is at 11.5 m RL) is provided for about 240m north coastal line of the plant site. The balance 270 m coastal lines also planned to have Tsunami bund.
- ***Shore protection, sand dune and vegetation*** will also be created along the coast.

Tsunami bund



Shore protection



Emergency Response

Creation of an Emergency Facility (**Emergency Control Centre**) at PFBR site which will be :

- seismically qualified,
- having adequate radiation shielding and
- provisions of communication with outside agencies.

This facility will have all *emergency equipment* required to handle the situation, where persons can *stay for about one week with provision for food water etc.,*

Preparedness *Training of Personals* for handling Emergency situations due to any Natural calamities.



Thank You