

Safety Assessment of Indian NPPs in the light of Fukushima Accident

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Indian Response to Fukushima Event

- **The Government called for a thorough technical review of safety of NPPs vis-a-vis impact of large natural disasters.**
- **AERB constituted a national level committee to review all related aspects.**
- **NPCIL has initiated in-house review and evaluation of Indian NPPs.**

Regulatory Actions

- **AERB committee was tasked to review:**
 - ✓ **capability of Indian Nuclear Power Plants to withstand earthquakes and other external events such as tsunamis, cyclones, floods, etc., and**
 - ✓ **adequacy of provisions available to ensure safety in case of such events, both within and beyond design basis.**
- **The Committee consists of experts in:**
 - **NPP operation, design and safety analysis**
 - **external events – seismology, meteorology, hydrodynamics and earthquake engineering.**

AERB Committee - Review Approach

- **AERB Committee has sought plant specific details from the utility including available safety provisions to handle external events, and their consequences.**
- **These details are undergoing critical review by working groups constituted by the Committee for specific areas of safety and for specific plant types.**
- **The findings of these groups will be examined in the Committee to arrive at final recommendations.**

AERB Committee - Review Areas Identified (1/5)

- **Review of existing requirements regarding design basis external events. Do they require any revision ?**
- **Re-assessment of individual plants to ascertain their capability to withstand currently defined design basis external events.
(Results of such exercises conducted during PSRs to be re-visited).**
- **Assessment of available margins beyond design basis flood and design basis earthquake, at which safety functions can still be performed.**
- **To evolve guidelines for required margins or magnitudes to be considered for such beyond design basis external events.**

AERB Committee - Review Areas (2/5)

- **In the re-assessment of plants to withstand external events (both design basis and beyond), adequacy of design provisions for the following to be checked.**

(a) Capability to shutdown the reactor and maintain it in guaranteed shutdown state.

(b) Capability to maintain reactor containment integrity.

(c) Capability to adequately cool the reactor core on a sustained basis:

Availability of :

- ✓ **class 1,2 and 3 power supplies**
- ✓ **relevant equipment and components like DGs, pumps, piping and valves**
- ✓ **control and instrumentation items**
- ✓ **water in required quantities for heat removal and for replenishing losses**
- ✓ **ultimate heat sink**

AERB Committee - Review Areas (3/5)

- **Examination of capability to cool the reactor core and spent fuel pools under**
 - (a) station blackout condition of extended duration.**
 - (b) loss of normal heat sink for extended duration.**

Utility Proposals:

- Additional provisions involving schemes to hook-up external mobile power packs, pumping systems, water inventories/sources.

Plant specific utility proposals will be assessed by AERB

AERB Committee - Review Areas (4/5)

- **Review of Severe Accident Management Provisions & Guidelines**
 - Existing provisions and guidelines; any augmentations required?
 - Evolve methodologies for testing of SAMGs
 - Implementability of EOPs and SAMGs under adverse environmental conditions including large scale contamination.
 - Provisions for handling large quantities of contaminated water.

AERB Committee - Review Areas (5/5)

Other review areas:

- **Irradiated fuel in spent fuel storage pools and in 'away from reactor' storage facilities (both wet and dry storage).**
- **Other facilities at NPP site with potential for release of radioactivity like the near surface radioactive waste disposal facilities and heavy water up grading plants.**
- **Facilities in the vicinity that can threaten NPP safety e.g. H₂S based heavy water production plant and heavy water cleanup facility.**

Additional Areas for Review/consideration

- **PSAs for external events to identify cliff edge effects.**
- **Considerations for common cause failures at multiunit sites.**
- **Considerations for the use of offsite resources for managing crisis at plant, when offsite conditions themselves may be unfavourable.**

Utility Actions

- **NPCIL has constituted task forces to look into the safety of all NPPs in light of the Fukushima accidents.**
- **These task forces have completed preliminary safety assessments of all operating NPPs.**
- **The safety assessment work carried out by these task forces would form an important input in the deliberations of the AERB Committee.**

Utility Reviews: Key Preliminary findings

- **Current methods of defining design basis earthquake for NPPs are conservative.**
- **Design Basis floods in all new plants consider maximum storm surge or tsunami, or upstream dam breach, as applicable.**
- **Capability for safely handling SBO exists.**
- **Water inventory in spent fuel pools enough for 7 to 30 days cooling.**
- **Additional provisions identified for**
 - **Handling extended SBO and/or loss of UHS**
 - **Tsunami protection for old plants**
 - **Upgradation of EOPs / SAMGs**

Other areas

- **Emergency Planning in public domain**
 - **Involvement of National Disaster Management Agency (NDMA)**
- **Communication with Public**
- **Safety Culture ; Leadership in Management**

Thank You