Need to revisit safety regulation of Nuclear Power Plants - Post Fukushima

S. Duraisamy

Atomic Energy Regulatory Board

India

OUTLINE

- Indian response to Fukushima event
  - Existing Provisions
  - Review Findings and Further Safety Enhancement
  - Revision of regulatory documents
- Lessons learnt
  - Technical
  - Regulatory
  - Cultural
- Some challenges & Parting Thoughts

Response to Fukushima event

- Detailed safety reviews were taken up to assess the capability of Indian NPPs to withstand such external events and their possible effect
- Objective was to utilise the lessons learnt towards safety improvements in design, operation as well as in management of safety.
- Reviews by utility & regulatory board
- Regulatory initiatives-
  - All plants asked to report on adequacy of relevant plant features that are existing
  - Focused regulatory inspections
  - Constitution of High-level Committee to recommend further actions

Existing provisions for NPPs in the context of Fukushima

- Siting requirements
  - Disqualification criteria
    - Zones of high seismicity (Zone V)
    - Capable fault within 5km radius
  - NPPs designed to withstand maximum earthquake and maximum flood potential determined rigorously for a site
- Station Black Out (SBO) as design basis
- Periodic re-assessment of site parameters & Plant design as part of 10 yearly PSR

Review Findings and Further Safety Enhancement

- Re-confirmation of capability to withstand currently defined site specific review basis levels of external events for individual plants
- Margin assessment for Extreme External Events
- Measures to strengthen mechanism for extended SBO and loss of UHS
- Enhancing severe accident management program
- Enhance capabilities to treat large quantities of liquid waste
- Review of off-site emergency preparedness

Revision of AERB regulatory documents (1/2)

- Revision of siting code
  1. Re-look on the return periods of external events & plausible combination of events
  2. Accounting for uncertainties in evaluation of hazard due to external events
  3. Need for safety margins w.r.to external events
  4. Assessment of vulnerability to cliff edge effects
  5. Emergency preparedness program to include assessment of scenarios involving multiple facilities, possible isolation of site, etc

Revision of AERB regulatory documents (2/2)

- Currently identified areas in Design code

1. Provision for handling extended loss of power and extended loss of heat sink
2. Review and strengthening of severe accident management provisions and guidelines
3. Classification and qualification aspects of the structures and systems for severe accident/extreme events
4. Issue of sharing of systems for severe accident / extreme events
5. Any additional requirements that may arise from further reviews of Fukushima

Lessons Learnt

- Technical aspects
- Regulatory aspects
- Philosophical / cultural aspects

Technical aspects

- Improved defense in depth in design-To achieve robustness in Electrical power supply, Core cooling & Containment systems.
  - Passive, Diverse, Independent / Physical separation, External hazard and their combinations
- Capability to withstand prolonged SBO & loss of UHS-To enable longer autonomy to NPPs
- Management of SA under adverse conditions
  - Containment issues, Human resources, Communication capabilities, Development of EDMG.
  - Multiunit considerations
- Environmentally hardened response centre to deal with emergencies
- Transparency and urgency in communication at local, national, regional and international level.

Regulatory aspects

- Conservative consideration of external events
  - ➢ additional requirements for external events that exceed the design basis, international harmonization of standards for new reactors.
- Periodic reviews and implementation of necessary safety upgrades
- Safety objective for new NPPs - avoid off-site long term contamination in case of a severe accident
- Stricter, meticulous and timely implementation of regulatory stipulations & recommendations
- Enhance regulatory effectiveness

Philosophical/Cultural Aspects

"This cannot happen here" syndrome

- Complacency
- Commercial obligation
- Safety culture

Some challenges

- Margins for external events in beyond design basis domain

  10% - 20% - 50%---- How much is sufficient
- Acceptance criteria of SSC
  - Extreme external events
  - Severe accident management
- Enhancing exchange of safety related information freely as accident any where challenges safety every where
- Balancing between radiation protection and Hardship & Trauma associated with displacement
- Utility-regulatory relationship----Double edged sword
- Addressing Public Concern

Parting Thoughts (1/2)

- Each of the three severe accidents (TMI, Chernobyl & Fukushima) have uncovered different vulnerabilities
- Fukushima challenged the current thinking
  - External cause
  - Reactor under shutdown
  - Multiple units
  - Loss of support infrastructure
- Lessons learnt –Have the root causes identified?

Parting Thoughts (2/2)

- *While it is the collective responsibility of all the Stakeholders to avoid the need for one more such fact finding mission ----*

- Can we rule out the next accident ?

Focus has to be on management of accident and containing activity so as to reduce off-site impact

Thank you