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Overview of Mitigation Strategies (FLEX) for Beyond-Design-Basis External Events

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Mitigation Strategies for Beyond Design Basis External Events

Agenda

- Regulatory Background & Specific Actions
- Objectives
- Mitigation Strategies
- Relationship with Other Tier 1 Recommendations
- Execution Approach
- Schedule
- Q & A

Mitigation Strategies for Beyond Design Basis External Events

Regulatory Background

- Near Term Task Force (NTTF) Team's Recommendations SECY-11-0093
- Immediate Action without delay SECY-11-0124
- Prioritization of Recommended Action SECY-11-0137
- US NRC Issues Orders

Specific Actions - Tier 1

- Seismic Analysis (NTTF 2.1)
- Seismic Walkdowns (NTTF 2.2)
- Flooding Analysis (NTTF 2.1)
- Flooding Walkdows (NTTF 2.3)
- ***Station Blackout / Mitigation Strategies (NTTF 4.1/4.2) for BDBEE***
- Hardened Vent (NTTF 5.1)
- Spent Fuel Pool Instrumentation (NTTF 7.1)
- Emergency Procedures / Emergency Response (NTTF 8.0 / 9.3)

Mitigation Strategies for Beyond Design Basis External Events

Objectives

- Consequences of Beyond Design Basis External Event:
  - extended loss of AC power (ELAP)
  - loss of core cooling & ultimate heat sink
  - challenge to containment integrity
  - spent pool cooling
- **FLEX** – Diverse & Flexible Mitigation Strategy
  - Increase defense-in-depth approach to address ELAP
  - Provides an indefinite coping capability to prevent fuel damage in core & spent fuel pool
  - Utilize “installed” equipment, new “onsite” portable equipment & pre-staged “offsite” resources
  - FLEX addresses: loss of offsite power, emergency diesel generators and Alternate AC source;

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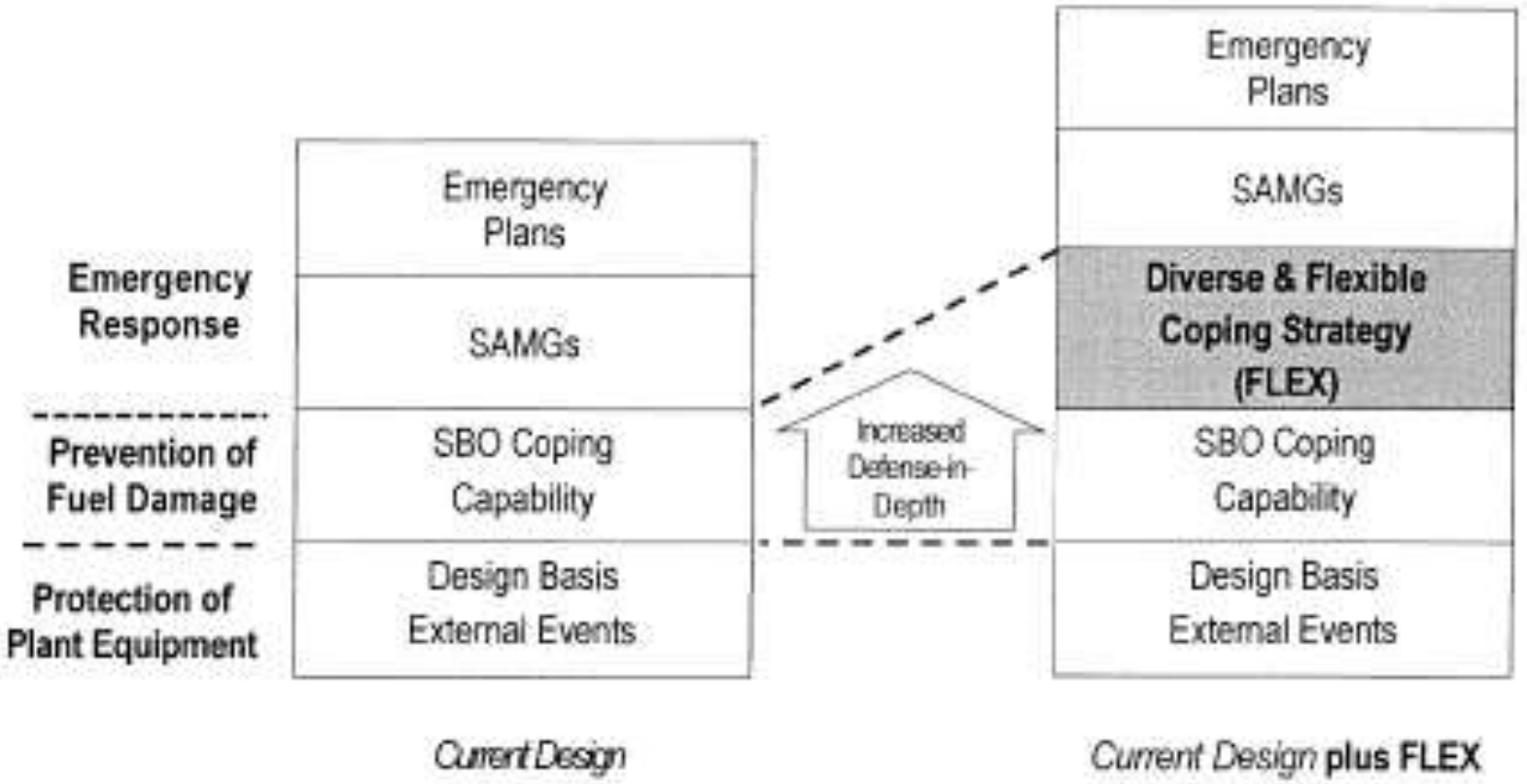
Figure 1: FLEX Enhances Defense-in-Depth (Ref. NEI 12-06)



Mitigation Strategies for Beyond Design Basis External Events

Flex Strategy

- Employs a three-phase approach:
  - Initially cope by relying on “installed” equipment
  - Transition from “installed” equipment to new “on-site” FLEX equipment
  - Obtain additional capability & redundancy from “offsite” until power, water and injection systems are restored at the site
- Perform plant specific copying analysis to establish the durations for each phase
- FLEX does not address “recovery” aspect if the plant is damaged

Plant Specific Analysis

Step 1: Perform Coping Analysis

Initial Boundary Conditions

- BDBEE occurs affecting all units at the site
- All reactors initially operating at full power
- Each reactor is successfully shutdown (no ATWS, all rods inserted)
- Staff available onsite & consider minimum shift staffing levels
- No other independent, concurrent event (e.g., no security threat)
- Spent Fuel in dry storage outside of FLEX

Extended Loss of AC Power (ELAP)

Initial Plant Conditions are:

- No specific initiating event. LOOP to all units for many days
- All installed sources of emergency onsite AC power and SBO Alternate AC power are assumed to be not available and not imminently recoverable
- Cooling & makeup water inventories contained in systems or structures with 'robust' design are available
- UHS heat sink water inventory remains available
- Diesel fuel oil storage stored in robust structures remains available
- Portable equipment that is protected and has predetermined hookups can be used
- Installed electrical distribution system remains available

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Perform Baseline Coping Capability

Utilize the guidance provided in NUMARC 87-00 and build of the response provided on IER 11-4 to address the following:

- Reactor core cooling
- Spent fuel cooling
- Containment integrity and isolation
- Battery evaluation
- Loss of ventilation

- Plant procedures
- 'New' Portable FLEX equipment must satisfy N+1 set of 'onsite' portable equipment & portable equipment must have primary & alternate connection points to achieve stable plant conditions.

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Step 2: External Hazards (Events), the following should be considered:

- The site assessment process involves the evaluation of the external hazards that are credible to a particular site, such as:
  - Seismic event
  - External Flooding
  - Storms (high winds, tornados, hurricanes)
  - Snow, Ice and cold conditions
  - Extreme heat
- Each plant should evaluate the applicability of these hazards and address the implementation considering the following:
  - Protection of FLEX equipment
  - Storage of FLEX equipment
  - Deployment of FLEX equipment
  - Procedural interfaces
  - Utilization of offsite resources.

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Step 3: Implementation Plan & Programmatic Controls, should consider:

- Quality attributes
- Equipment design specifications & procurement
- Equipment storage
- Plant Procedures
- Maintenance & testing
- Training
- Configuration Control

Relationship with Other Tier 1 Recommendations

- **Seismic walk downs (NTTF 2.3)** – provide basis for plant's capability to successfully respond to seismic events, which is a foundation for FLEX strategy
- **Flood walk downs (NTTF 2.3)** – provide basis for plant's capability to successfully respond to flood events, which is a foundation for FLEX strategy
- **Boiling Water Reactor (BWR) Mark I and II Reliable Hardened Vents (NTTF 5.1)** – BWR Containment venting will be a required function to cope with an ELAP and/or Loss of UHS event.
- **SFP level instrumentation (NTTF 7.1)** – the enhanced SFP instrumentation will support the implementation of FLEX strategies for maintaining SFP water level to prevent fuel damage.
- **EOP/SAMG activities (NTTF 8)** – implementation of FLEX will require coordination with plant EOPs.
- **Emergency Response Organization (ERO) staffing and communications (NTTF 9.3)** – implementation of FLEX will utilize the enhanced on-site and off-site communication capabilities, and ERO staff will support deployment of FLEX strategies in responding to the events postulated to affect all units on a site.

Mitigation Strategies for Beyond Design Basis External Events

➢ FLEX Execution / Approach

- Part 1: Performance of Gap Analysis
- Part 2: Preparation of Conceptual Designs & Plant Modification Packages

Part 1:

- Identify the difference between the “current” design & the “new” requirements per the Order to ensure coping safety functions (core cooling, containment integrity & SFP cooling)
- Minimize operator actions and station staff needs
- The coping strategy deployment will confirm the Station’s response to IER 11-4
- The temporary equipment procured for each site to meet 10CFR50.54(hh)(2), [commonly called B.5.b per NEI 06-12] will be reviewed for its application to this FLEX mitigation strategies.
- ***Gap Analysis will confirm either these equipment are sufficient for the FLEX Strategies OR identify functional gaps and recommend solutions.***
- This evaluation will form the basis for relying on ‘installed’ equipment to address the Initial Phase of the coping time.
- Identification of the ‘onsite’ plant modifications to address the ‘Transition’ Phase of the coping time. This work will address the new portable equipment, its connections to the plant systems / structures / components (both primary and alternate connections), availability of source of power, water, etc.
- Identification of “Offsite” equipment necessary for mitigation is ‘later’ per NRC schedule

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- The Part 2 - Implementation Phase
  - Prepare conceptual design and plant modifications per existing plant procedures

Mitigation Strategies for Beyond Design Basis External Events

- **Schedule for FLEX** (US operating plants)
  - NRC Order Issued on March 12, 2012
  - NEI Guidance (Draft Rev B1) Issued
  - Industry Workshops, Webinars & Public Meetings are Ongoing
  - NRC Interim Staff Guidance Issued on May 31, 2012 for public comments
  - 180 day Plan Response date is March 2013
  - Implementation by 2016 with 6 months updates

Question ???