

Industry Approach to Addressing Fukushima Near Term Task Force Recommendation 7.1 Spent Fuel Pool Instrumentation

December 15, 2011

Industry Goal

- Apply the lessons-learned from the Fukushima accident to enhance the safety of the U.S. reactor fleet
- Implement an integrated and effective approach for Tier 1 recommendations
 - Achieve safety benefit in a shorter time

NRC Staff Recommendation (SECY-11-0137)

The staff recommends that the NRC, as a near term action, undertake regulatory activities to:

1. Engage stakeholders to inform the determination of (1) what constitutes reliable (potentially safety-related) [Spent Fuel Pool] SFP instrumentation, (2) what conditions the instrumentation must withstand to fulfill its function, (3) which SFP parameters should be monitored (e.g., water level, temperature, and area radiation levels), (4) what makeup strategies could be implemented, and (5) where indications are needed (e.g., control room and/or remote location).
2. Develop and issue order to licensees to provide reliable SFP instrumentation.

Problem Statement

Ensure that nuclear power plant operating crews have the information needed about spent fuel pool conditions during severe events involving loss of AC power such that they react appropriately to maintain pool temperature and water levels to avoid fuel damage.

Diverse & Flexible Mitigation Capability (FLEX)

- Reliably address extended loss of all AC power and loss of ultimate heat sink resulting from a variety of causes, including beyond design basis natural phenomena.
- Diverse set of portable equipment that can be connected at diverse locations to maintain core and SFP cooling
- Sequence and implement Tier 1 in a manner that provides the greatest safety benefit

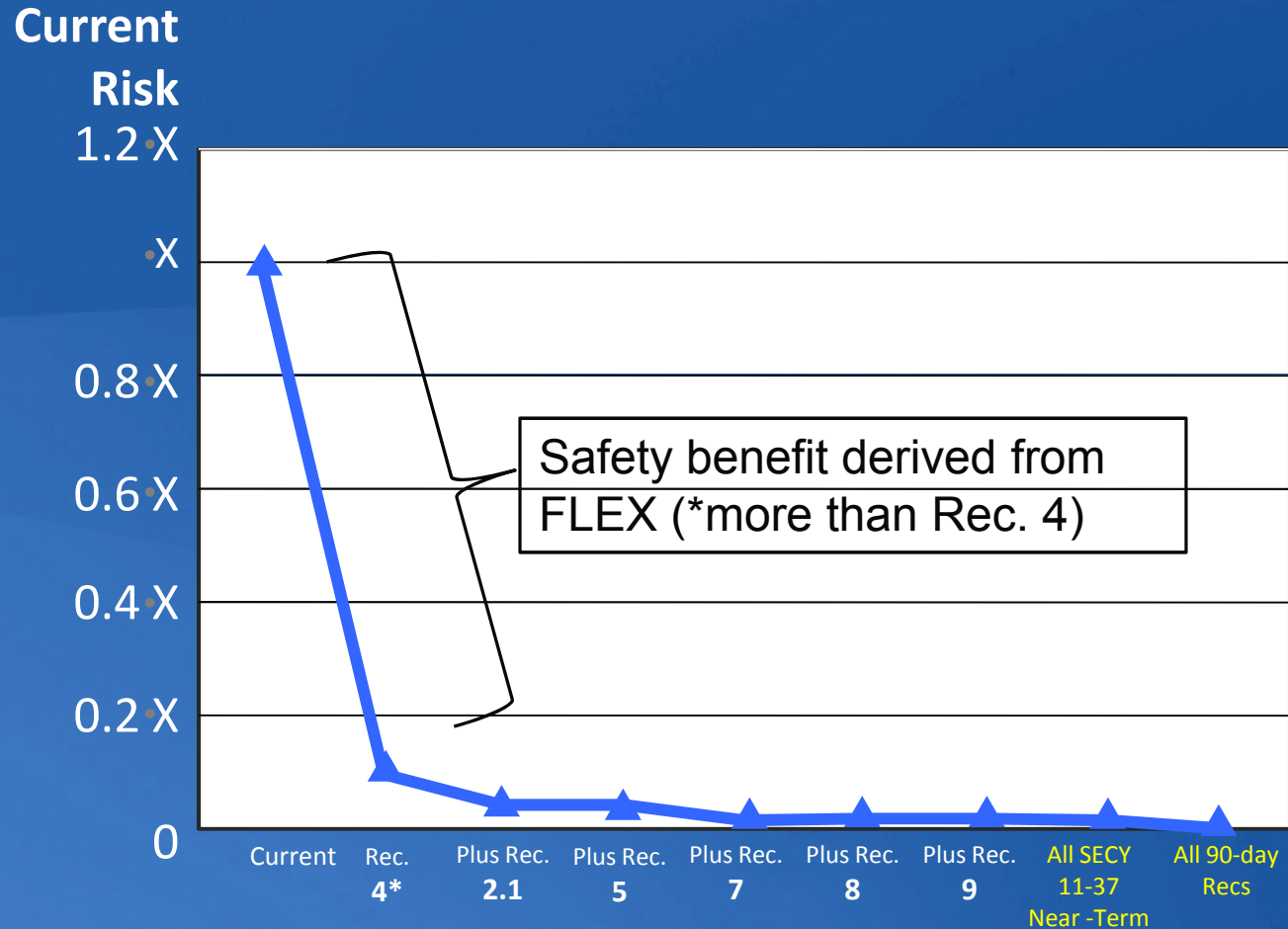
Potential FLEX Equipment Scope

- Equipment and structures
 - Portable and prestaged pumps, generators, batteries, compressors, hoses, couplings, tools, debris clearing equipment, temporary flood protection equipment and consumables
 - Located in structures at diverse locations to protect against external events per commercial standards
- Guidelines and procedures/instructions
 - Coordination with severe accident management guidelines

Safety Benefit – SECY 11-0137

Collective Risk Reduction -- Sequentially Applied

(Mean Values Only – Linear)



Validated using BWR and PWR PRAs

INPO SFP Requirements

- Enhanced capability to protect SFPs against extreme external events
 - IER L1* 11-2; 4/25/11
- Operators required to know time available until pool reaches 200°F in the event of a loss of SFP cooling
- When less than 72 hours, must protect systems and equipment required to maintain functions of SFP decay heat removal and water inventory control
- Level instruments will provide SFP level data during station blackout (SBO) so operators can take actions to assure maintaining safe conditions



*Institute of Nuclear Power Operations
Event Report Level 1

Considerations for Developing SFP Instrumentation Requirements

- Key parameters operating crews need to know
- Other parameters to consider
- Existing SFP instrumentation
- Diversity and reliability of SFP instrumentation
- Value of safety-related pedigree for beyond design-basis events
- Environmental qualifications
- Available instrumentation technology

Parameters

- SFP water level is key parameter
 - Defines need to add water
 - Time available due to slow nature of event
- Other parameters to consider
 - Area radiation (access)
 - Temperature (bulk or pool surface)
 - Not particularly informative

Current Instrumentation

- Varies among plants
- Generally:
 - Pool Level
 - installed visual indication (some remote indication in control room)
 - level point alarm switch
 - Area and airborne radiation monitoring
 - Temperature of water in SFP cooling system

Diversity and Reliability

- One permanently installed level monitoring device used as needed (momentary power).
- One portable level monitoring device provided by FLEX
- Indications in a plant habitable area
- Reliable power supply during SBO
 - Installed device could use long-lived battery or a portable battery pack
 - Portable power (for either installed or portable device) provided as part of FLEX

Safety-related Instruments and Power

- Making instrumentation safety-related does not improve safety margins in this instance
 - At Fukushima, safety systems were lost during SBO
- Quality assurance requirements will be addressed consistent with FLEX
 - Quality requirements for installed device and portable device might be different

Environmental Qualifications

- Portable equipment stored per FLEX requirements thus eliminating need for installed device to be seismic
- Designed for appropriate temperature and humidity associated with pool evaporation and boiling

Available Instrumentation Technology

- NRC should specify requirements, not instruments
- Utilities will select site-appropriate approach
- Some examples of current technology
 - Thermal dispersion level monitoring
 - Conventional D/P level instruments
 - Sonar/microwave
 - Infrared surface monitoring
 - Conventional area radiation monitors
 - Cameras to view pool

Next Steps

- Additional public discussions on SFP instrumentation
- Industry further developing FLEX concept
 - Identify appropriate “regulatory footprint”