U.S. DEPARTMENT OF ENERGY | Nuclear Energy

Summary of the Current Status of Lessons Learned From Fukushima Accident

Kemal Pasamehmetoglu

OECD/NEA Workshop on International Fuels

Paris, France (December 10-12, 2012)

Introduction

- On March 11, 2011, earthquake and tsunami-initiated events led to the Fukushima nuclear accident in Japan.

- Today we recognize that the traditional approach to management of reactor safety and communication to the public may no longer be adequate.

U.S. DEPARTMENT OF ENERGY
Nuclear Energy

Decay heat removal challenges are highlighted by Fukushima

- Basic Mitigation Scheme

  Upon detection of an accident initiator, shutdown the reactor

  Remove the decay heat through accident progression

- For GW class LWR's decay heat removal requires effective flow of water through the assemblies

  Flow must be maintained or re-established before a critical temperature is reached in fuel/cladding

- The circumstances in Fukushima made it difficult to reestablish decay heat removal flow in a timely basis before considerable fuel damage has occurred

- Advanced fuel/cladding concepts may enable additional time to re-establish flow or may require lower flow rates

  Function of reactor type and design evolution.

U.S. DEPARTMENT OF ENERGY
Nuclear Energy

Fukushima – In Context

Ref. ASME President's Task Force on "Forging a New Nuclear Safety Construct

- First accident with catastrophic core degradation caused by severe external events, first to involve multiple units, and first LWR with large release of radioactivity to the environment
- Other 10 reactors in the region survived.
  - Inadequacy in plant design basis for tsunami, flooding and accident management
- No prompt fatalities – low probability of long term health effects
- **The major consequences of severe accidents at nuclear power plants have been sociopolitical and economic disruptions inflicting enormous cost to society.**

A New Nuclear Safety Construct

The set of planned, coordinated, and implemented systems ensuring that nuclear plants are designed, constructed, operated, and managed to prevent extensive societal disruption caused by radioactive releases from accidents, using an all-risk approach.

Major Challenge

A globally embraced safety construct.

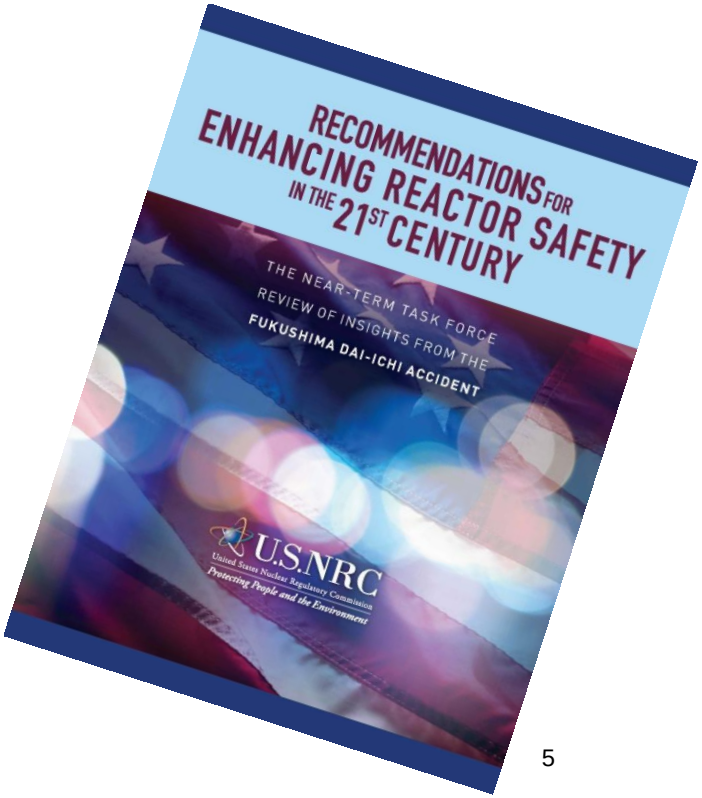
Principal is **building global consensus on its principles, details, and implementation.**

NRC Near-Term Task Force Recommendations

- Recommendation # 1:

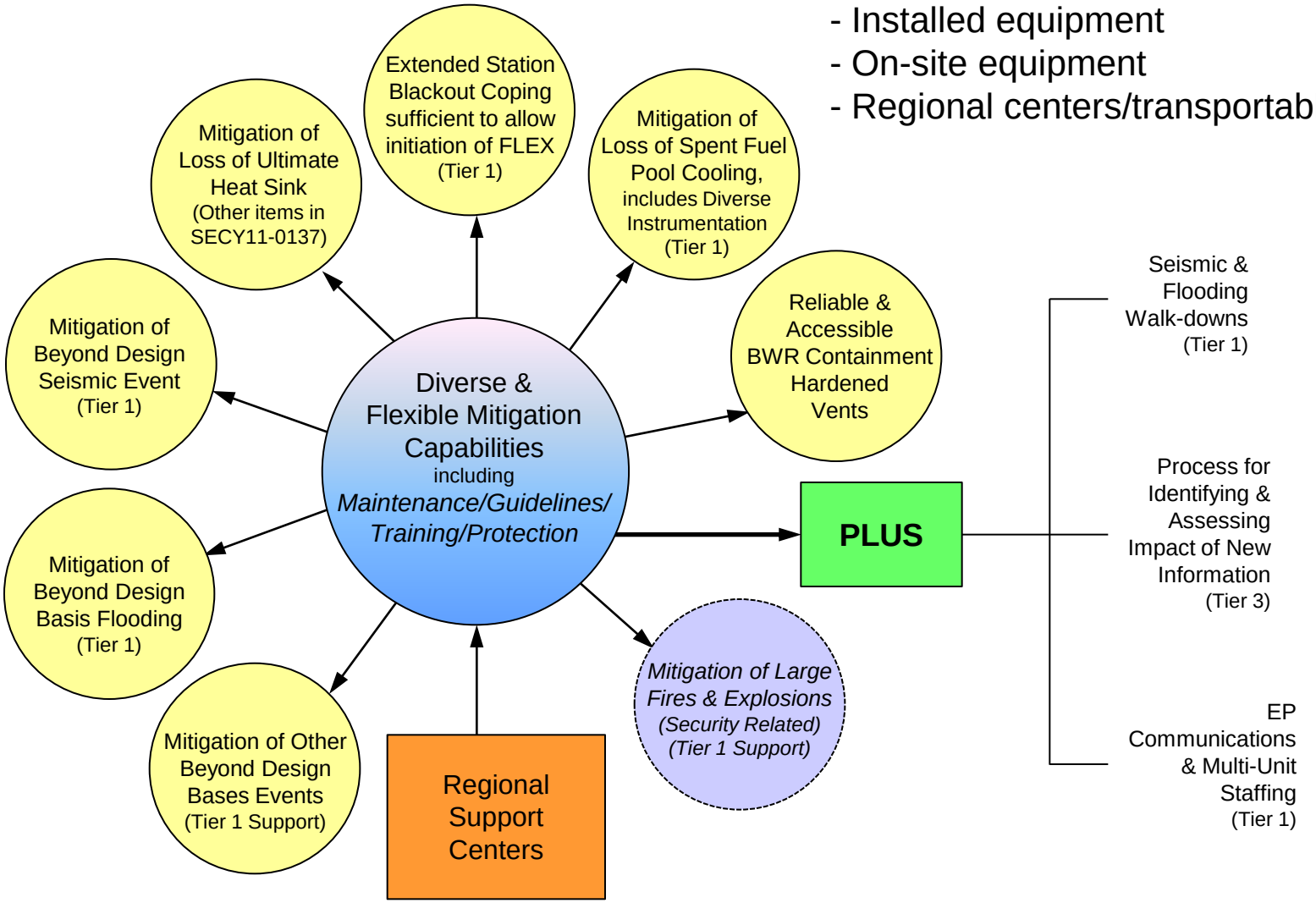
"Establish a logical, systematic, and coherent regulatory framework for adequate protection that appropriately balances defense-in-depth and risk considerations."

- **Other Recommendations:**
  2) seismic and flooding analyses;
  3) seismically induced fires and internal floods;
  4) prolonged station blackout;
  5) BWR (Mark I & II) hardened vent designs;
  6) containment (and other buildings) hydrogen control and mitigation;
  7) spent fuel instrumentation;
  8) onsite emergency response capabilities;
  9) prolonged SBO and multiunit events;



FLEX: The Industry Strategy to Enhance Safety

- Installed equipment
- On-site equipment
- Regional centers/transportable equipment



An Integrated, Safety-Focused Approach for Implementing Lessons Learned from Fukushima