ASME

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National Board of Boiler & Pressure Vessel Inspectors

ASME Response to March 11, 2011 Events in Japan

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Opryland Hotel – Nashville, Tennessee

May 14, 2012

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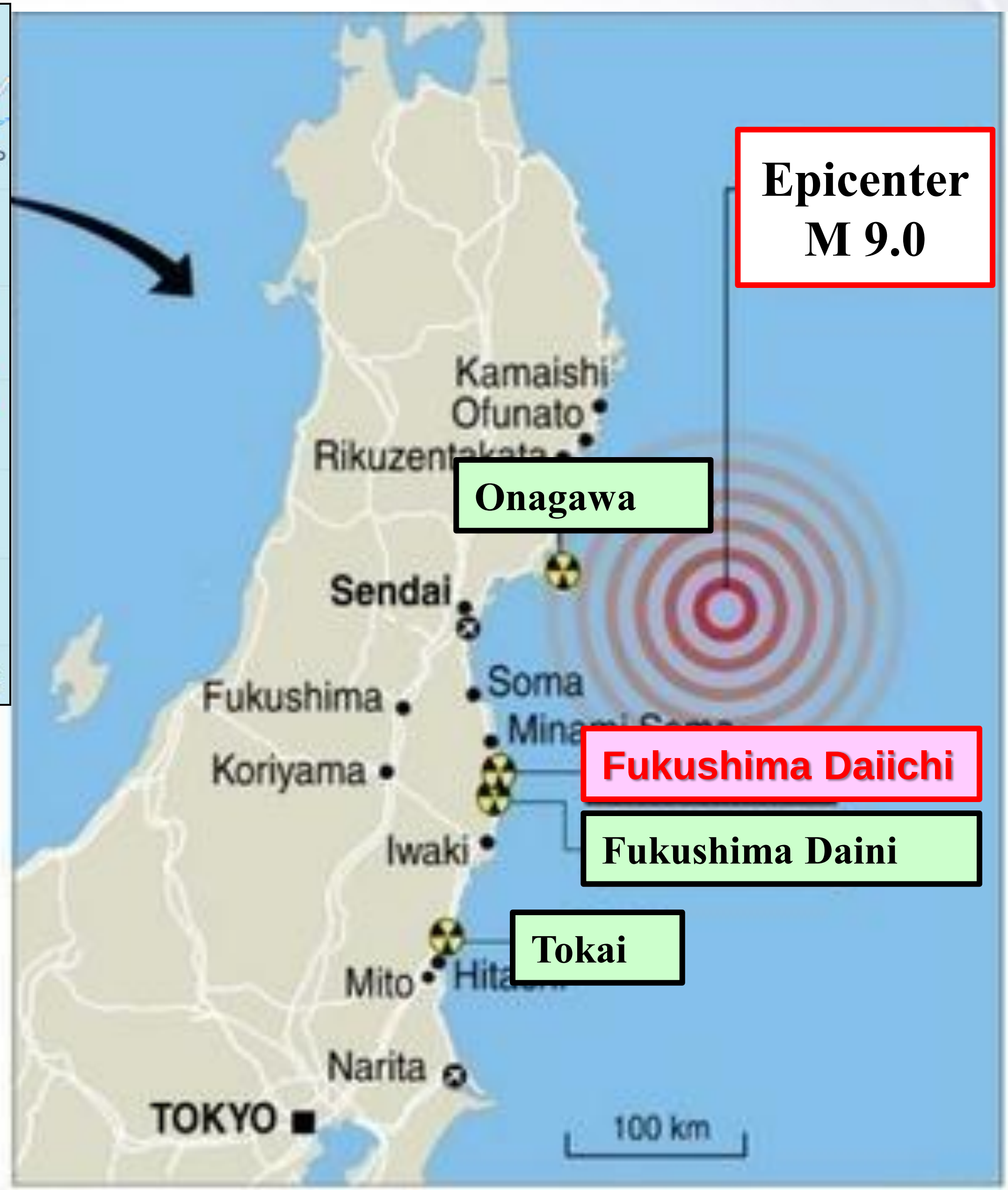
ASME Response to March 11, 2011 Events in Japan

- Overview of March 11, 2011 Events in Japan
- ASME Board on Nuclear Codes and Standards Task Force on Design Basis and Response to Severe Accidents
- ASME Presidential Task Force on Response to Japan Nuclear Power Plant Events
- Looking to the Future

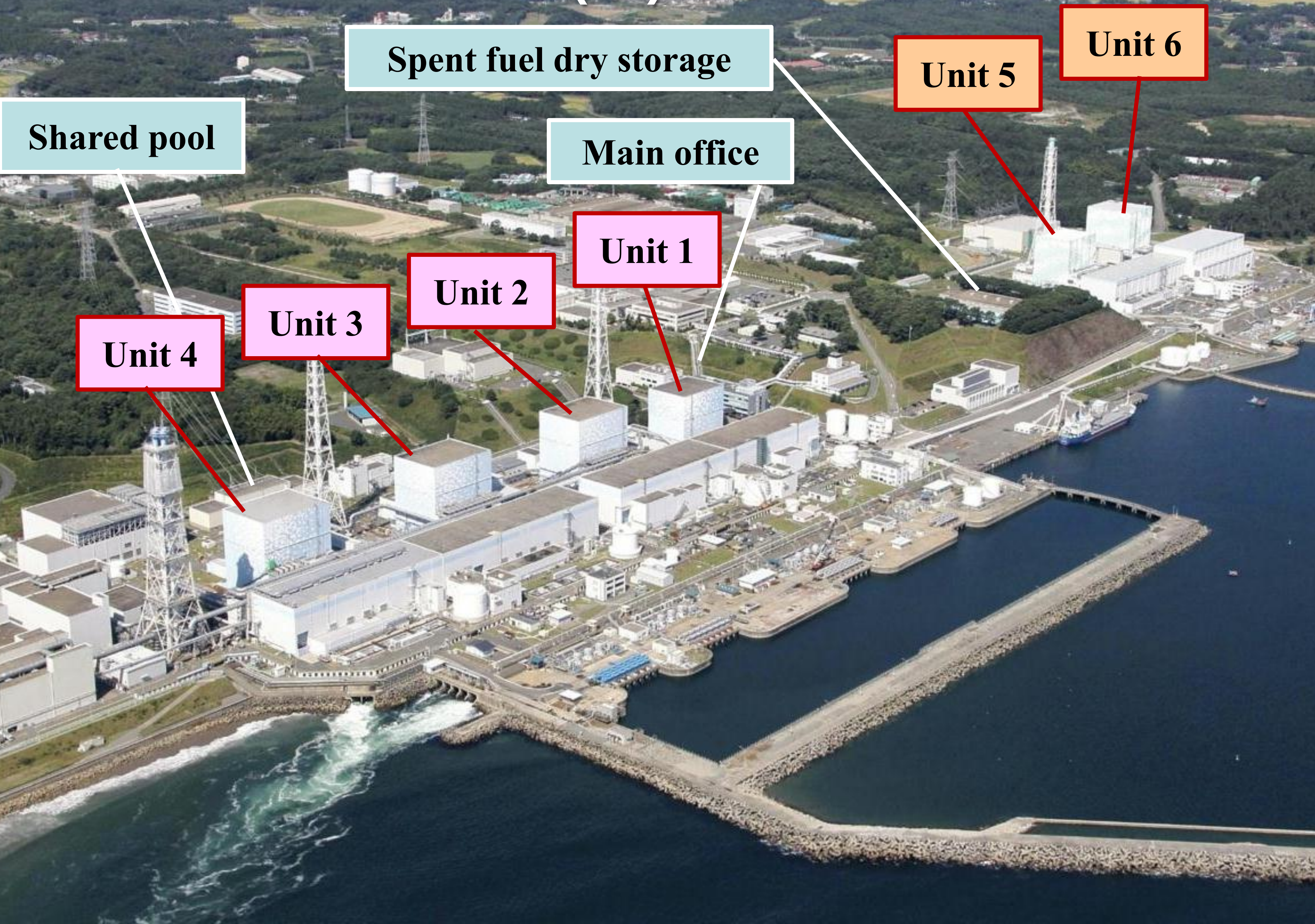
Affected by the earthquake:

1. Onagawa (3 BWRs)
2. **Fukushima Daiichi (6 BWRs)**
3. Fukushima Daini (4 BWRs)
4. Tokai (1 BWR)

Fukushima Daiichi was severely damaged by Tsunami

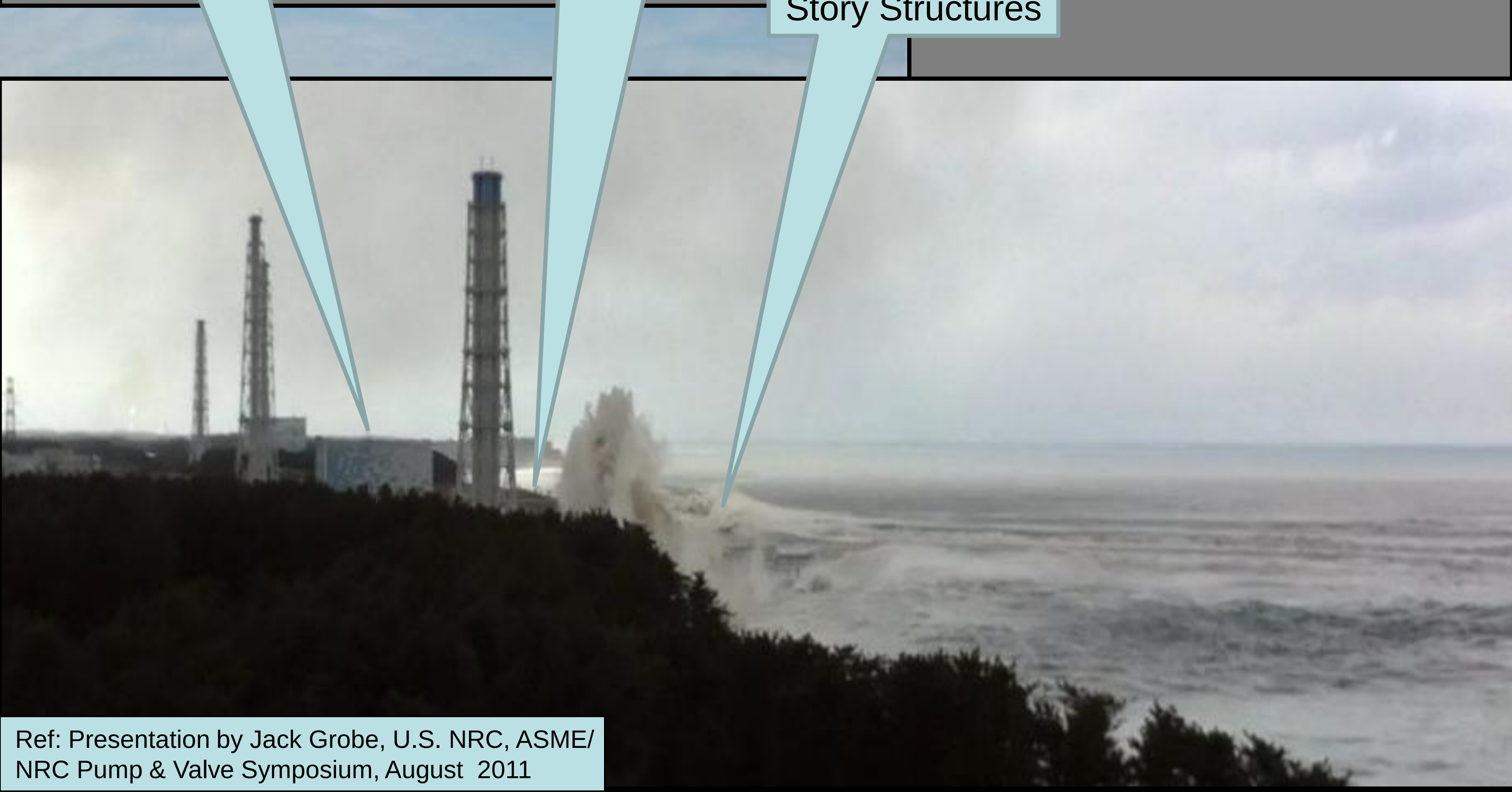


Fukushima Daiichi (1F) Nuclear Power Station



Ref: Presentation by Jack Grobe, U.S. NRC, ASME/
NRC Pump & Valve Symposium, August 2011

TEPCO Web Cam Images



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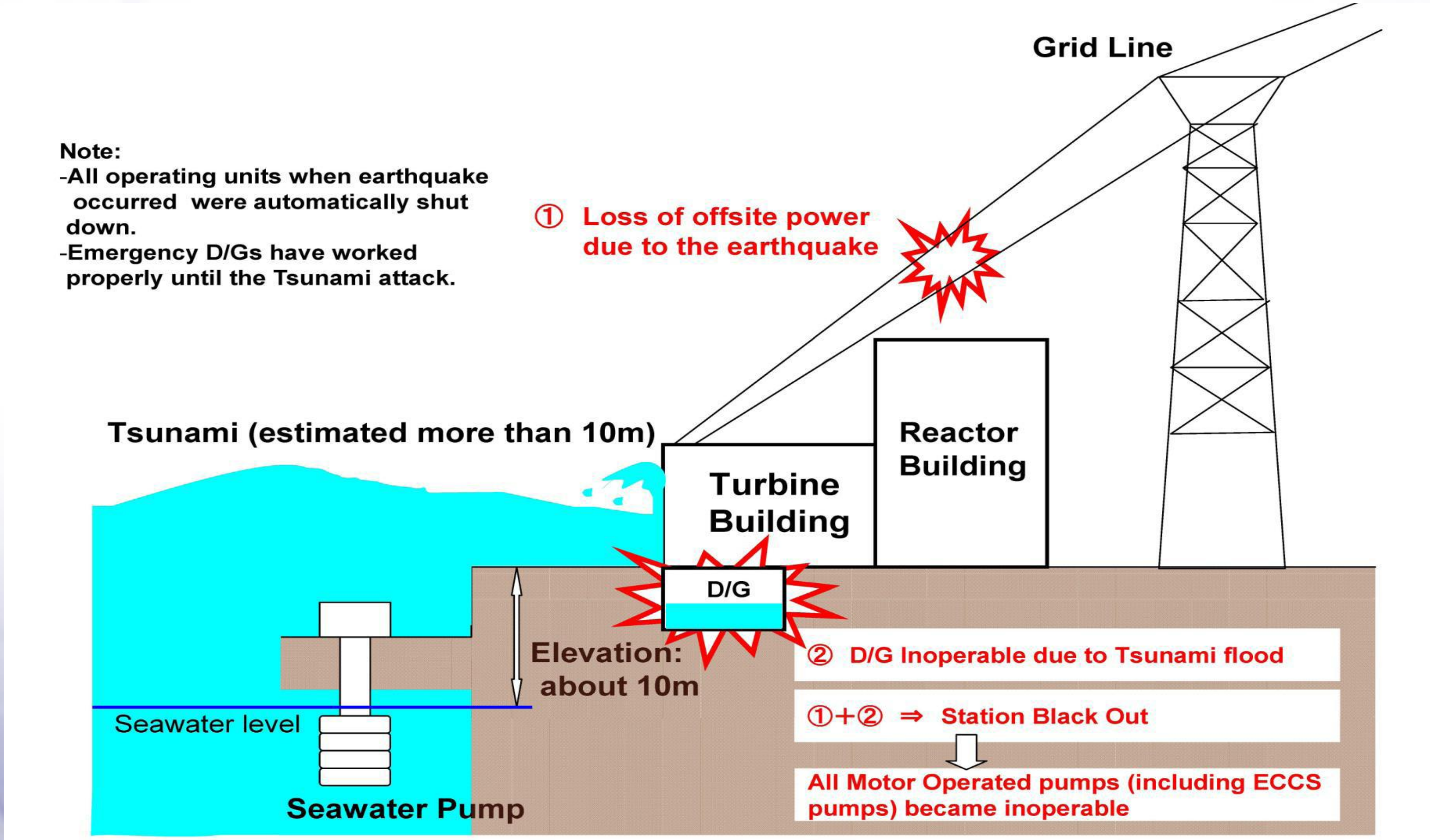
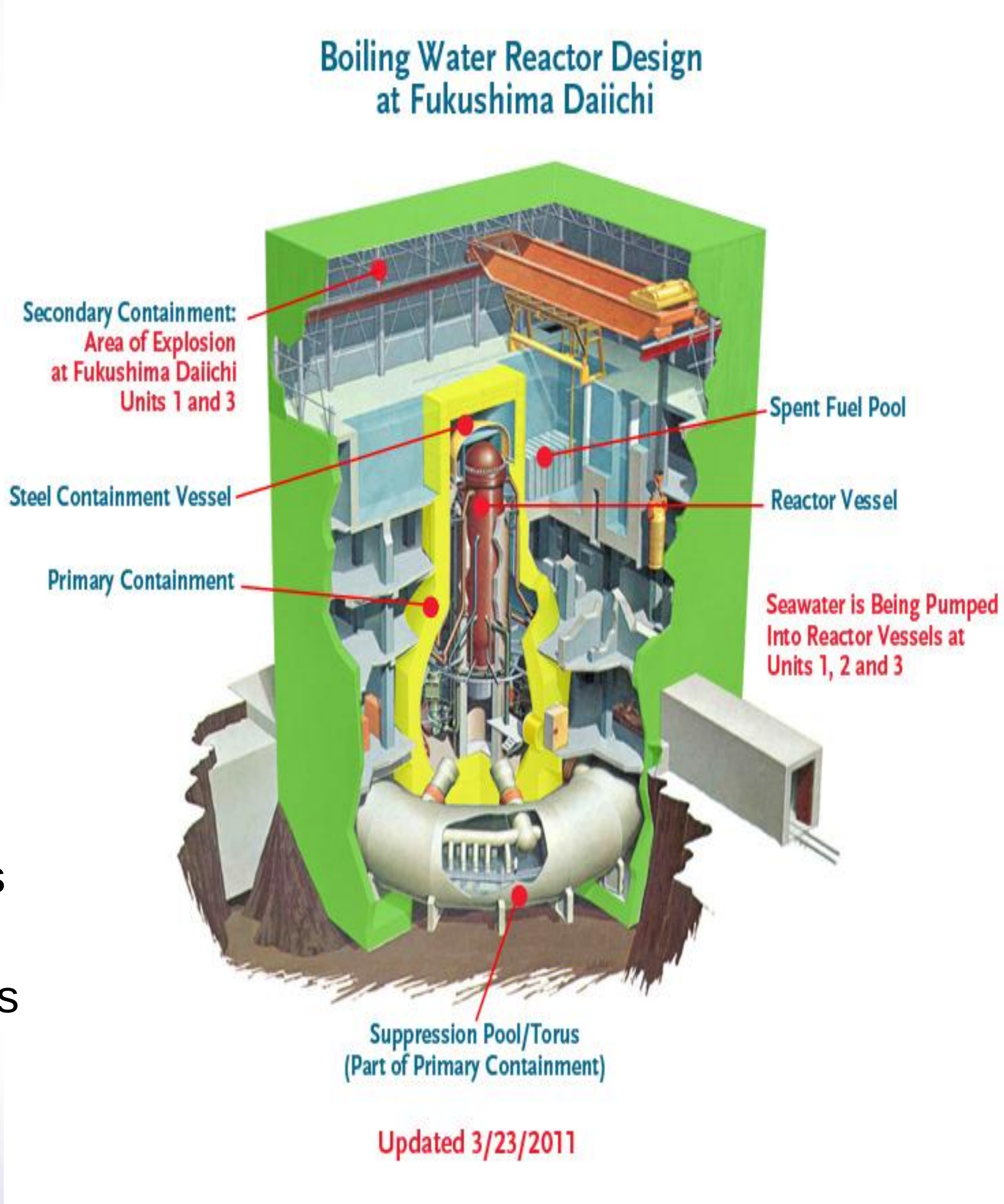
The March 11, 2011 Event at Fukushima Daiichi



The Fukushima Dai-ichi Nuclear Power Station Accident, EDA, Inc.

The Event

- 9.1 Magnitude Earthquake
  - Plant Shutdown in Stable State
- Tsunami knocks out emergency power
- Steam-Turbine driven pumps provide temporary makeup to reactor
- Pumps stop; reactor temperature and pressure increase
  - Reactor cooling water begins to boil
- Water level decreases until core is exposed
- Fission products released & hydrogen generated
- Containment depressurization releases hydrogen



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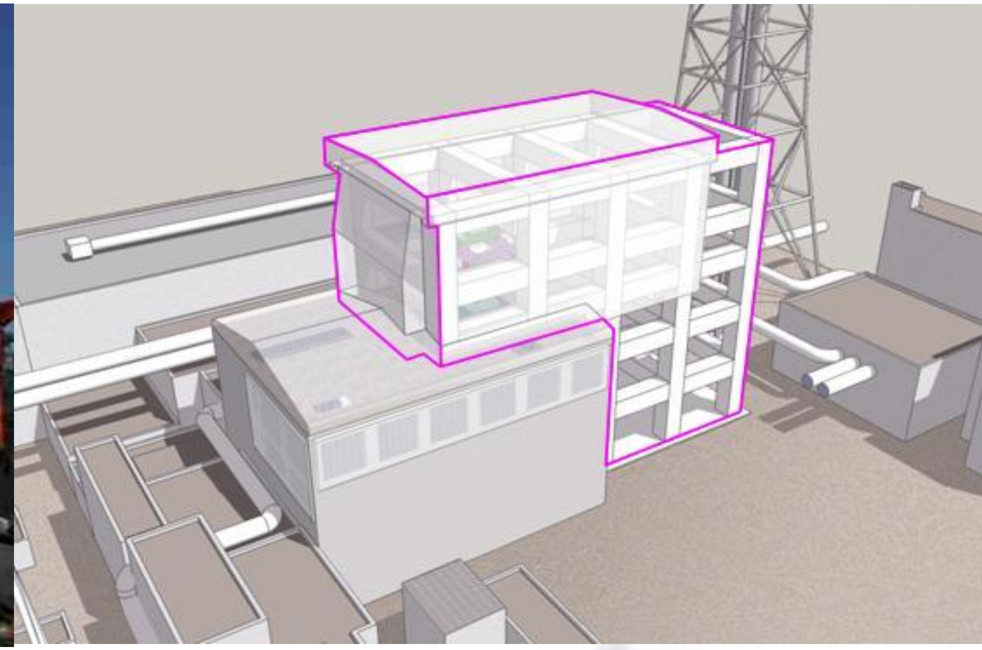
Ongoing Recovery Efforts

- Continue to cool and stabilize Fukushima Daiichi reactors 1-3
- Provide additional cooling water to used fuel storage pools in reactors 1-4
- Provide long-term cooling systems
- Process radioactive water
- Conduct detailed evaluation of event
- Decommission the site

Example of Recent Developments at Fukushima Daiichi



South View of Reactor Building Unit 4 – April 16, 2012

General Plan and Start of Main Work of the Cover for Fuel Removal of Unit 4 – North View

Ref: Tokyo Electric Power Company Website - April 26, 2012 - http://photo.tepco.co.jp/en/date/2012/201204-e/120416-04e.html -

Impact of Fukushima Daiichi Event

- Four reactors destroyed
- 100,000 citizens evacuated
- Extensive land contamination in surrounding area
- 53 of the 54 reactors in Japan are now shutdown as of 4-27-2012
- Major economic impact on Japan
- Significant changes to nuclear programs throughout the world
- Increased reliance on fossil fuels in many countries (CO_2)

Units 1 – 4 after Event

Broader Impact of Earthquake & Tsunami on Japan

Fatalities 15,854
Injured 26,992
Missing 3,155
*** as of March 12, 2012**

Impact on Japan Infrastructure

- Energy
  - Nuclear, Thermal, Hydro, Oil Refining, Electric Power Grid
- Transportation
  - Roads, Highways, Rail Transport, Airport
- Manufacturing
  - Automobiles, Electronics, etc
- 125,000 Buildings Damaged or Destroyed
- More than 300,000 Refugees
- Food and Water Supply

Fire at the Cosmo Oil Refinery in Ichihara

Dam Failure at Fujinuma

Train Washed Away from Onagawa Station

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ASME Board on Nuclear Codes & Standards (BNCS) Task Force on Design Basis and Response to Severe Accidents

Goals

- Develop a data dissemination system on the damage resulting from the incident in each of the focus areas
- Form teams of experts to review the data and make recommendations on potential code and standards development initiatives
- Provide the recommendation to the responsible standards committees for their consideration
- Communicate and coordinate these initiatives with the U.S. Nuclear Regulatory Commission (NRC), the Nuclear Energy Institute (NEI) and other industry stakeholders
- Communicate with international stakeholders

ASME BNCS Task Force
Design Basis and Response to Severe Accidents

ASME BNCS Task Force

- **Design Basis External Events**
  - Design Basis for External Events
- **Component Integrity**
  - Pressure Boundary Integrity
  - Containment Integrity
- **Safety System Response**
  - Station Blackout
  - Hydrogen Control
  - Fuel Pool Integrity
- **Severe Accident Mitigation and Response**
  - Severe Accident Response and Recovery

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ASME BNCS Task Force Members

- Bryan Erler – Task Force Chair, ASME Board on Nuclear Codes and Standards
- Don Spellman – American Nuclear Society
- Stuart Richards – U.S. Nuclear Regulatory Commission
- Alex Marion – Nuclear Energy Institute
- Masaki Morishita – Japan Society of Mechanical Engineers (JSME)
- Chris Sanna – ASME Staff

Current Actions

- Comments provided to JSME on their severe accident management guidelines
- Establish leaders and populate Subgroups
- Provide support for future JSME's tasks as requested
- Develop U.S. standards development organizational contacts
- Meetings with JSME in Japan several times since the March 11, 2011 event

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ASME Presidential Task Force on Response to Japan Nuclear Power Plant Events –

"Forging a New Nuclear Safety Construct"

ASME Presidential Task Force

- Charter includes:
  - Assessing lessons learned and not learned from over 50 years of power reactor operations
  - Reviewing the events at the Fukushima Dai-ichi nuclear plant, as well as pertinent events and activities in the U.S., Japan and elsewhere
  - Identifying ASME's role in addressing issues and developing lessons learned
  - Disseminating ASME's perspective on the impact of these events on the future direction of the world-wide nuclear power industry

Ref: Presentation by Dr. Nils Diaz, U.S. NRC Regulatory Information Conference, March 14, 2012

ASME Presidential Task Force Members

Chair - Nils Diaz

Vice Chair - Regis Matzie

Kenneth Balkey
John Bendo
Jack Devine
Romney Duffey
Robert Evans
Thomas Hafera
James Lake
David Leaver
Robert Lutz
Roger Mattson
Joseph Miller
Richard Schultz
Robert Sims
Doug True
Jack Tuohy

Ref: Presentation by Dr. Nils Diaz, U.S. NRC Regulatory Information Conference, March 14, 2012

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ASME Presidential Task Force Deliverables

- Main deliverable is a comprehensive report summarizing the findings and recommendations of the Task Force (peer review underway)
- Future ASME actions will be conducted with other responsible stakeholders (in progress)
- Additional deliverables will likely include:
  - Public workshops
  - Government/congressional briefings
  - Visual and audio media
  - Summary white papers
  - Inclusion of findings and recommendations in Standards, as appropriate

Ref: Presentation by Dr. Nils Diaz, U.S. NRC Regulatory Information Conference, March 14, 2012

ASME Presidential Task Force
- Areas That Are Being Addressed -

- Historical safety perspective of major reactor accidents and other major safety-related events
- Design basis, adequate protection, and beyond
- Human performance and decision making
- Accident management
- Emergency preparedness
- Supporting activities: enhancing communications, securing public trust, and potential updating and expanding ASME codes & standards
- The Lesson Learned

Ref: Presentation by Dr. Nils Diaz, U.S. NRC Regulatory Information Conference, March 14, 2012

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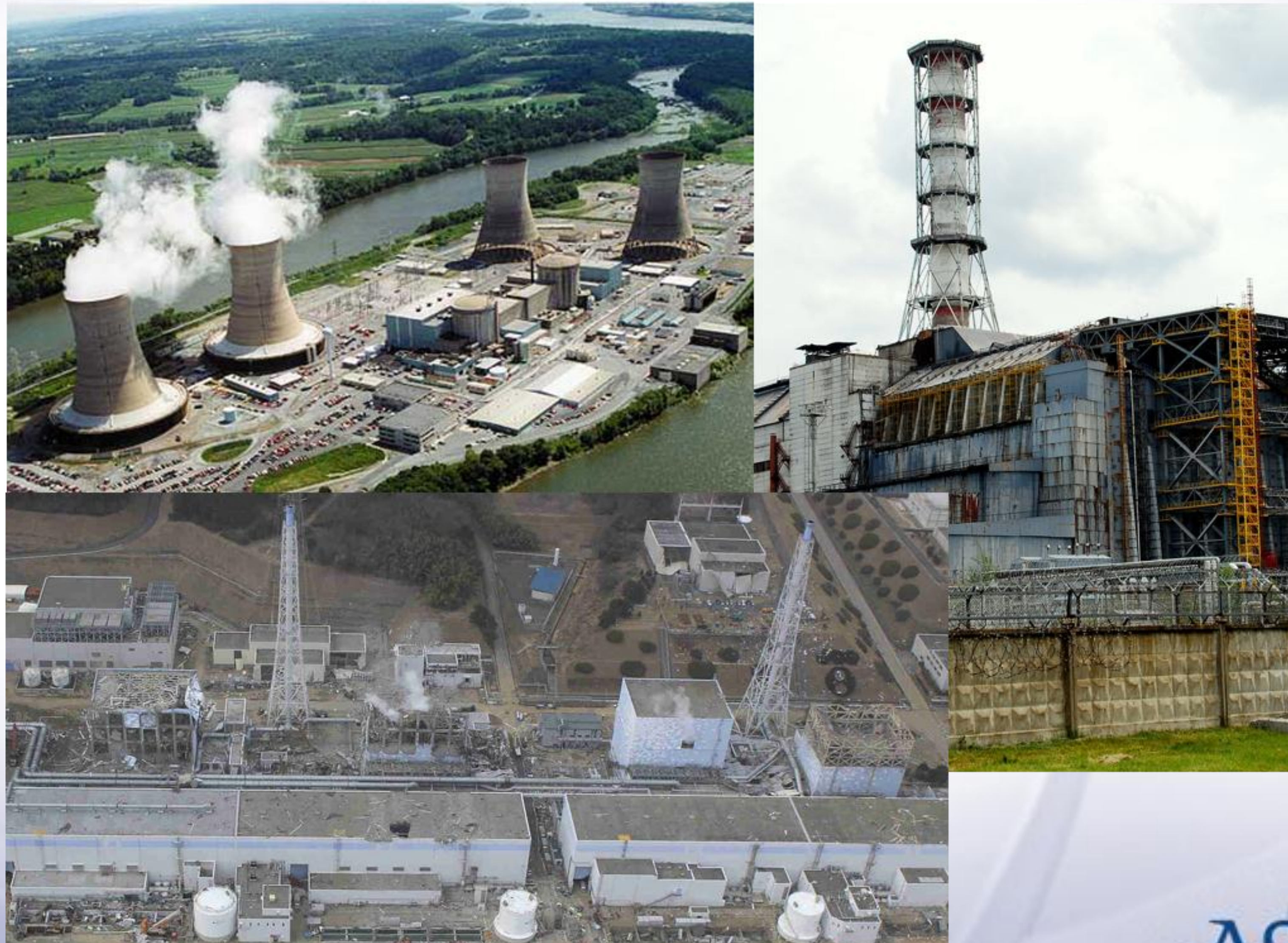
The Lesson Learned…



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Regulatory Information Conference, March 14, 2012

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Fukushima Dai-ichi Nuclear Accidents' Consequences

- The radiological public health consequences were managed, with no prompt fatalities and minimal delayed public health effects expected.
- Other very significant consequences included:
  - Radiological contamination of a populated area in Japan
  - The relocation of more than 100,000 persons for radiological protection purposes
  - The loss of economic productivity of the contaminated areas for some time to come
  - The wholesale curtailing of nuclear power generation across Japan (and impacts on other countries)
  - A very substantial economic impact, yet to be determined

Ref: Presentation by Dr. Nils Diaz, U.S. NRC Regulatory Information Conference, March 14, 2012

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The Lesson Learned

Protection of public health and safety from radiological releases has been and is the primary focus of reactor safety. The present body of knowledge, including severe reactor accidents, establishes the importance of maintaining that focus yet brings out a relevant fact:

The major consequences of severe nuclear accidents have been socio-political and economic disruptions inflicting enormous cost to society.

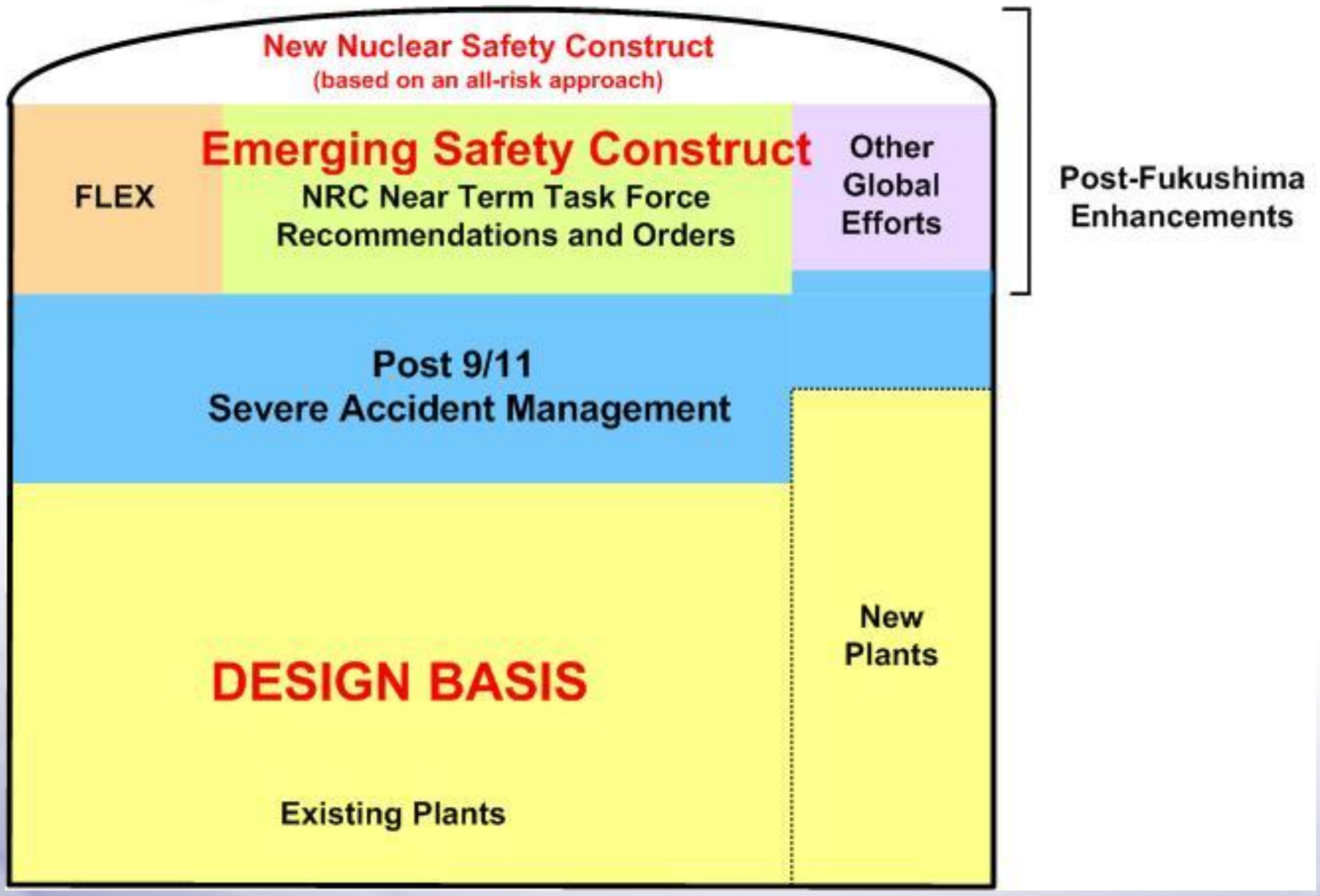
Ref: Presentation by Dr. Nils Diaz, U.S. NRC Regulatory Information Conference, March 14, 2012

The Lesson Learned

An accident resulting in a large uncontrolled release of radioactivity, disrupting the socio-economic fabric of society, including permanent displacement of large numbers of people and enormous costs, should not be an acceptable outcome for an accident at a nuclear power plant, even when there are no discernible radiological public health effects.

Ref: Presentation by Dr. Nils Diaz, U.S. NRC Regulatory Information Conference, March 14, 2012

Forging a New Nuclear Safety Construct



Key Elements
- •Core Cooling
- •Maintain reactor pressure boundary integrity
- •Containment Cooling & Integrity
- •Spent Fuel Pool Cooling & Integrity
- •Human Performance
- •Accident Management
- •Emergency Preparedness

Cross-Cutting Issues
- •Command and Control
- •Adequate resources
- •Public Trust
- •Enhance Communications
- •Upgraded codes & Standards

Ref: Presentation by Dr. Nils Diaz, U.S. NRC
Regulatory Information Conference, March 14, 2012

Looking to the Future

- There are now 7 billion people on the planet with projections of reaching 9 billion people by 2050
- Nations around the globe are striving to maintain and, in many cases, improve the quality of life for their people – thereby ever increasing the demand for electrical generation
- Nuclear power is by far the largest provider of steady, base load emission-free electricity with a small footprint as compared to other similar sources
- ***Forging a New Nuclear Safety Construct*** would ensure that nuclear power is utilized in a safe, environmentally sound manner to meet the above global challenge

Ref: Presentation by Dr. Nils Diaz, U.S. NRC Regulatory Information Conference, March 14, 2012

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