

# Enhancing the Safety of Nuclear Installations after the Fukushima Accidents

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**Joon-Eon YANG**

**Korea Atomic Energy Research Institute**

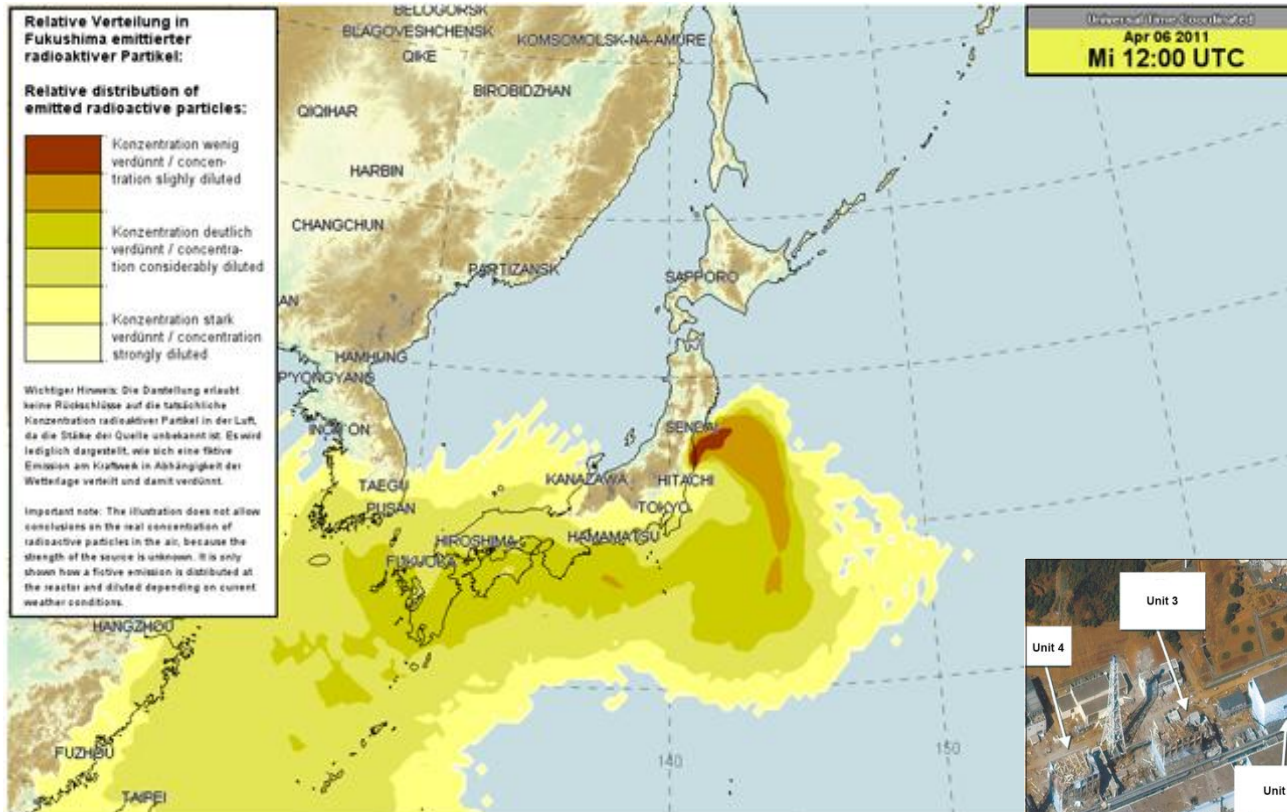


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- Special **Safety Inspection & Action Items** after the Fukushima Accidents
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# Fukushima Accident (11 Mar. 2011)



# Present Status of Korean NPP Program




In operation

**23 units**



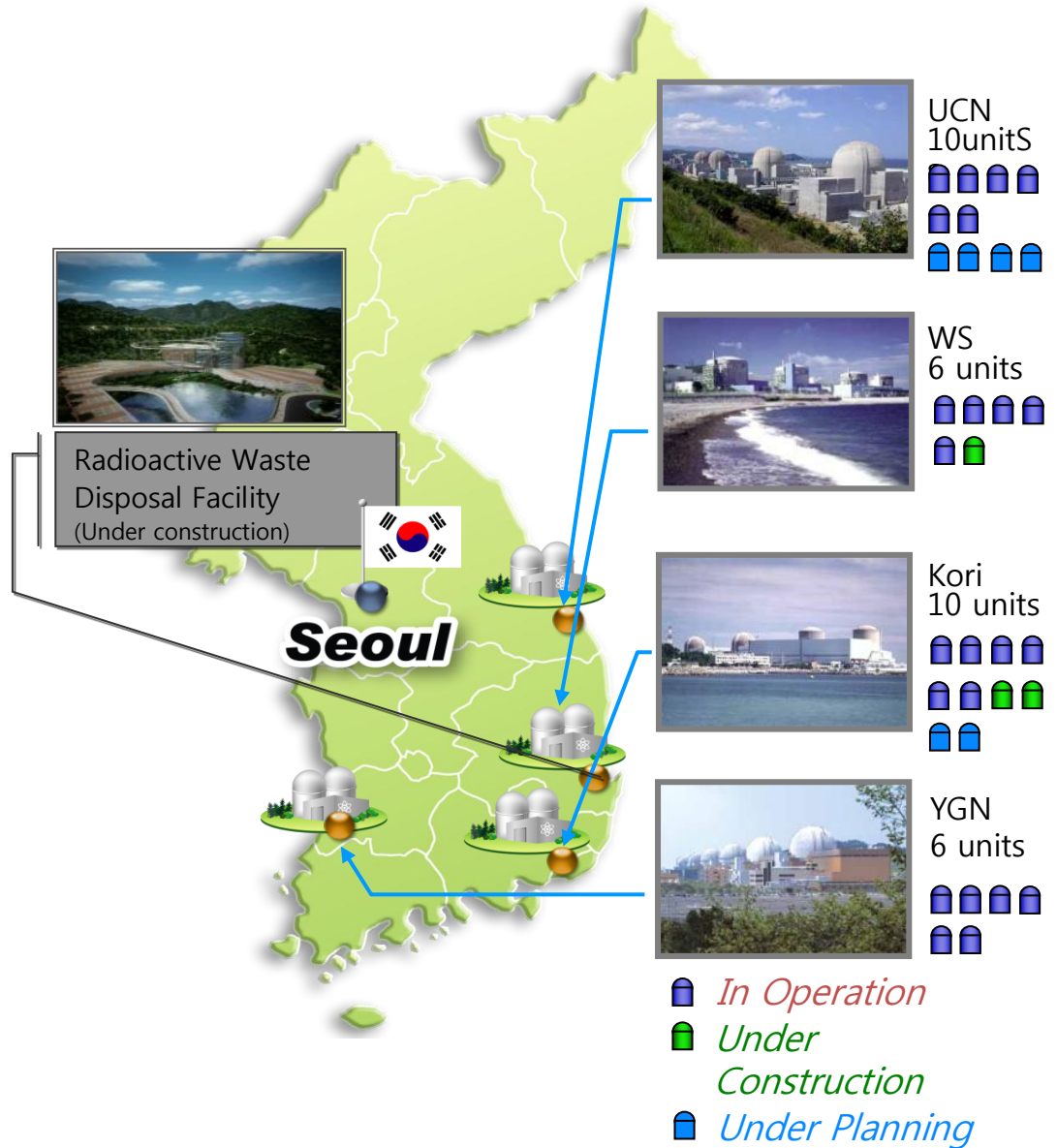
Under construction

**3 units**



Under planning

**6 units**



- Capacity: 18.5GW, 29.5%  
(Plan to increase 41% by 2030)
- Generation: 1,487GWh, 36%  
(Plan to increase 59% by 2030)

# Special Safety Inspection (1/5)

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- **Activities of Regulatory Body**
  - **MEST, KINS organized the special safety inspection team**
    - From 28 Mar. to 3 May, 2011
    - For 21 operating NPPs and 1 research reactor
  - **Considered Scenario in Inspection**
    - Extreme natural hazard (earthquake + tsunami)
    - SBO
    - Severe Accident
  - **Conclusions of Regulatory Body**
    - No NPPs are exposed to imminent risk
    - But safety measures are need against potential risk

# Special Safety Inspection (2/5)

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- **Action Items based on DID**
  - **1<sup>st</sup> Barrier against extreme natural disaster**
    - Improve seismic resistance
    - Minimize potential risk of flooding
  - **2<sup>nd</sup> Barrier to ensure core cooling capability**
    - Make available A/C power at any anticipated events
    - Make available cooling water and path at any unlikely event
  - **3<sup>rd</sup> Barrier to ensure C/B integrity and to improve emergency response capability**
    - To eliminate the likelihood of severe accident and avoid hydrogen explosion
    - To address multi-unit disasters

# Special Safety Inspection (3/5)

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- **Activities of Industry Side**
  - Additional Special Inspection for **Kori-1 Units (Long-term operation related)**
  - Special Inspection of **NPPs under construction** (5 units)
  - Design Review of **New NPPs (APR+)** against Fukushima accident
  - Established integrated plant to enhance the safety of NPP (July 2011)

# Special Safety Inspection (4/5)

- **50 Action Items for 6 Areas**

- Structure, Component Integrity against Seismic, Tsunami
- Safety of Electrical/Cooling/Fire Protection System against Flooding
- Mitigation of Severe Accidents
- Emergency Responses
- Long Term Operation & New NPPs
- Research Reactors, Fuel Cycle Facilities & Medical Institute for Radiation Emergency



Group	Application Stage	# of Items
Design	Apply at the detailed design stage	12
Construction	Apply at the construction/test operation stage	13
Operation	Apply at the operation stage	7
Etc.s	For specific unit and/or NPP type	18
<b>Sum</b>		<b>50</b>



# Special Safety Inspection (5/5)

- **Some Example Items**

- Structure, Component Integrity for Seismic, Tsunami

- Automatic Seismic Trip System
- Seismic Design Criteria: 0.2g → 0.3g
- Water-proof door for Aux. & EDG Building

- Safety of Electrical/Cooling/Fire Protection System against the flooding

- Movable EDG Vehicle, Battery Connection Point to External Electric Source
- Water Injection Line to SFP from External Fire Car
- Dedicated Battery for Important Safety Systems
- Design Change of AAC DG

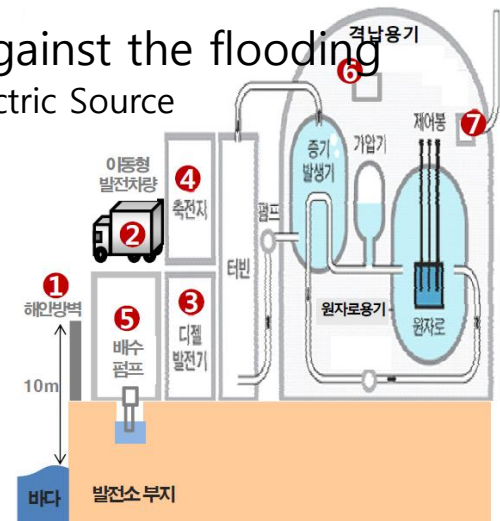
- Mitigation of Severe Accidents

- PAR for Hydrogen Removal
- Reactor Building Venting System

- Emergency Responses

- Critical Information Acquisition for Long Term SBO

- **The effectiveness of action items are evaluated by using the PSA**



# Changes of Regulatory Framework (1/2)

- **IRRS of IAEA to Korea**

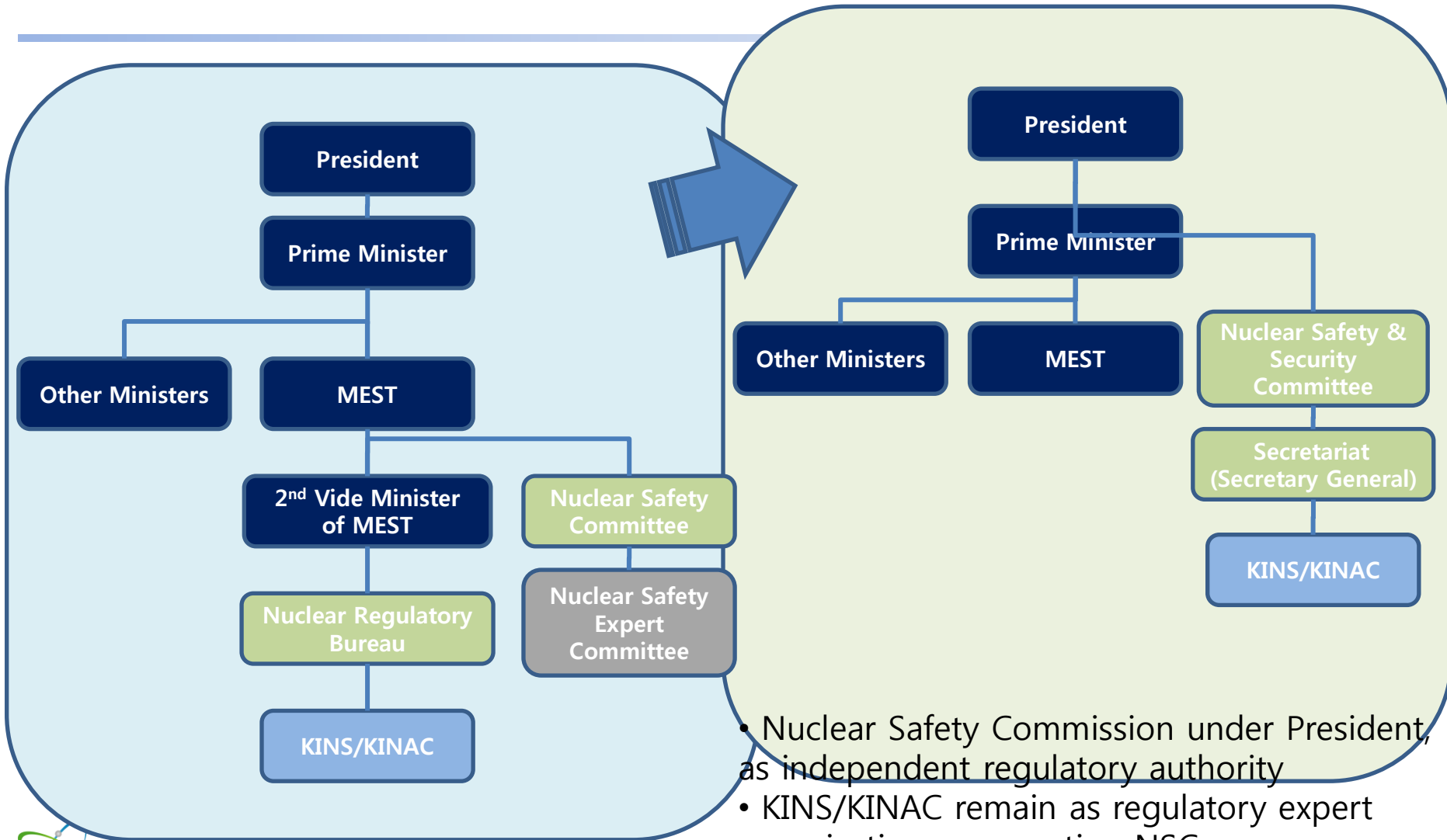
- 10 ~ 22 July, 2011
- First IRRS Mission after Fukushima
  - Fukushima aspects are included in each module review
- Summary of Mission
  - The Korean government, through the activities of MEST and KINS has implemented a technically capable and effective nuclear safety regulation program
  - Korea's response to the accident at Fukushima has been prompt & effective. Communications with the public, development of actions for improvement and coordination with international stakeholders was of high quality.



- **New Items for PSR**

- From 50-SG-012 (1994, 11 items) to NS-G-2.10 (2003, 14 items)
- PSA, Hazard Analysis, Plant Design

# Changes of Regulatory Framework (2/2)



- Nuclear Safety Commission under President, as independent regulatory authority
- KINS/KINAC remain as regulatory expert organizations, supporting NSC

# Mid-&-Long Term Research Plan after the Fukushima

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- **Two Research Programs**
  - Being planned by MEST & MKE
  - Some research items are focused on the ways to overcome the Fukushima accident
    - **Extreme Hazard**
    - **Multi-unit Risk**
    - **Severe Accidents**
    - **SFP Safety, Nuclear Chemistry during accident**
  - The research for New NPP is focusing on the **Passive Safety System**

# Some Generic Research Topics

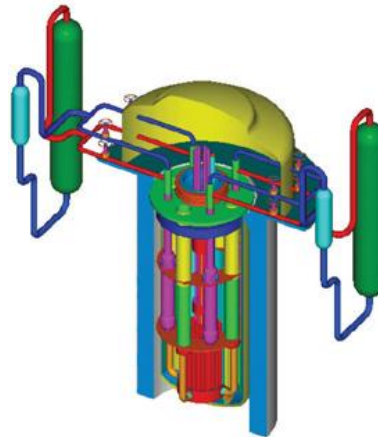
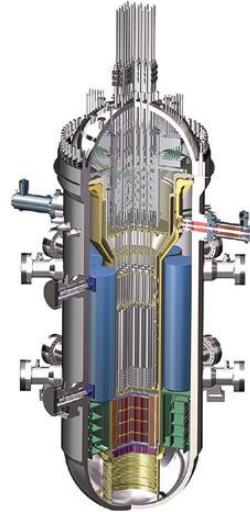
- External Hazard
  - Strong earthquake & Tsunami Risk Assessment
  - Airplane Crash Risk Assessment
  - Another site specific extreme external hazards
- Multi-unit
  - Site Risk Assessment & Accident Management including SFP
- Severe Accidents
  - ATLAS: SBO Experiment
    - Investigation of ECCS Performance of PWRs
    - Establishment of DB for Evaluation of Safety Margin
  - TROI: OECD/SERENA Steam Explosion
  - VESTA Corium-Structure Interaction
  - New Experiment Facility: Investigate Integrity of Containment during SA
- Etc.
  - Development of Wide Range Radiation Dispersion Model



# Research for New Reactors

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- Development of New Light Water Reactor Design
  - Full Passive Safety Systems
  - Longer Operator Available Time
- Small Modular Reactor
  - DC of SMART (2012.7)
- Gen-IV Reactor
  - Built-in safety (RSWG of GIF)
  - Sodium Fast Reactor
  - VHTR



# Summary of Korean Efforts

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- Change of **Regulation System**
  - Enhance the independency
- Enhance the **Safety of Operating NPPs**
  - 50 Action items
  - Additional items will be derived continuously
- Enhance the **Safety of New Reactors**
  - New safety concept & systems (passive systems)
- **International Cooperation**
  - Nuclear accident is an international issue
- A report on the Fukushima accident is being prepared by Korean Nuclear Society

# 감사합니다



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Any Questions??



한국원자력연구원  
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