



# Implementation of Safety Upgrades in Korea Following the Assessment of Vulnerabilities of Nuclear Power Plants

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# Strategy for Regulatory Actions

## 1<sup>st</sup> phase

- Issuance of Action Items by performing Special Safety Inspection
- Preparation of action plan for the implementation \*

## 2<sup>nd</sup> phase

- Implementation of Action Plans for all Operating Plants \*
- Feedback of Selected Action Items to Plants under Construction
- Issuance of Additional Action Items considering Lessons Learned from International Communities \*

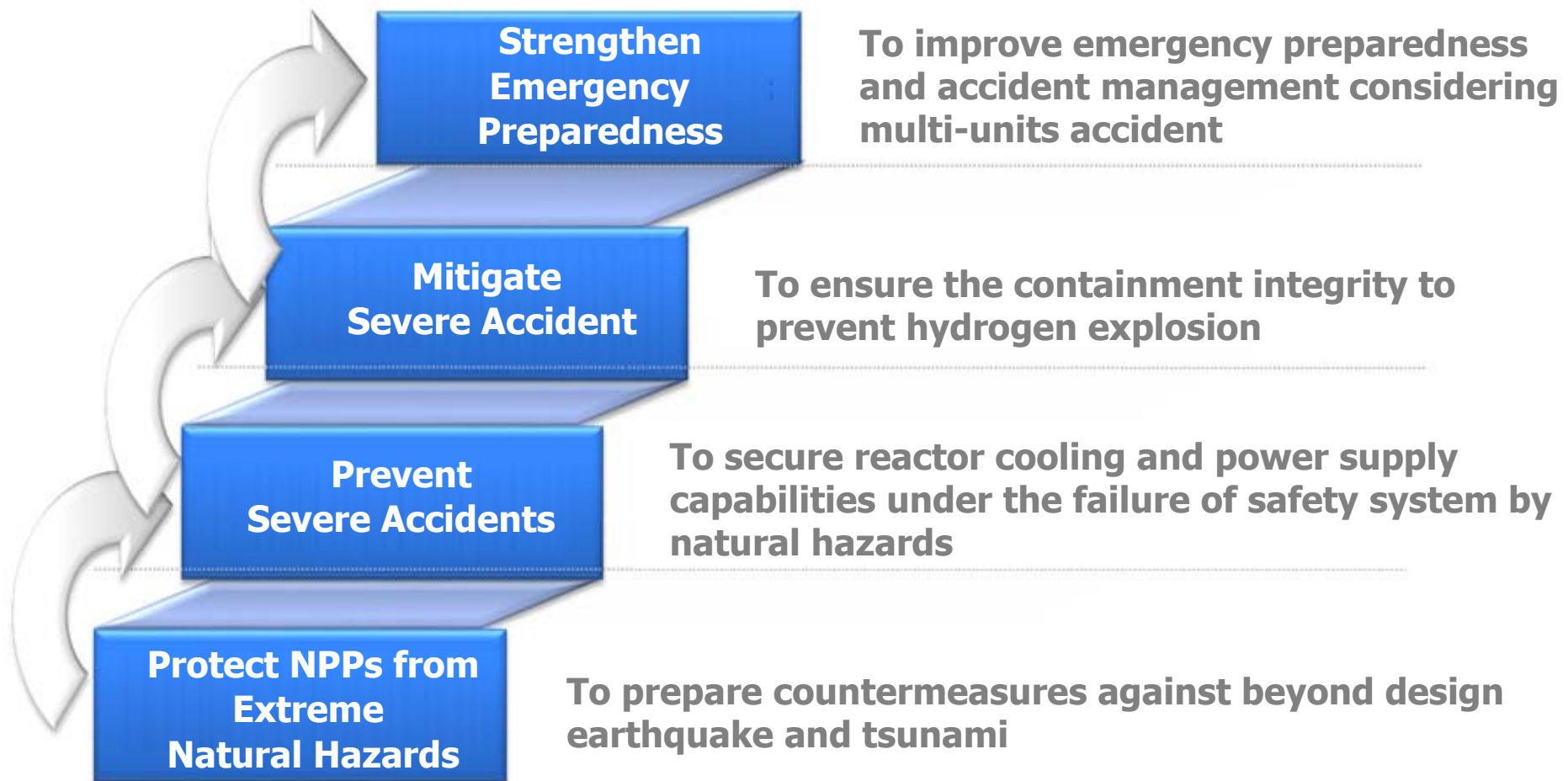
## 3<sup>rd</sup> phase

- Update the Action Items considering Lessons Learned from International Communities. \*
- Evaluation of the Effectiveness of the Action Items by using Stress Test and/or PSA \*
- Modification of Safety Objective and Goal, and Regulations and Guides considering Beyond DBA.

*\* required to Licensee also.*

# Defense-in-Depth Approach

To prepare appropriate counter measures for each stage of postulated accident scenario



# Post-Fukushima Actions

- ❑ **PFA-1 Enhancing Capabilities to Respond to Initiating Events caused by Natural Disasters such as Earthquake and Tsunami**
- ❑ **PFA-2 Improving Safety Functions and Accident Management Capabilities**
  - ❖ **2-1 Enhancing the Reliability of Electric Power System**
  - ❖ **2-2 Improving Reactor Core Cooling Function**
  - ❖ **2-3 Improving Spent Fuel Pool Cooling Function**
  - ❖ **2-4 Securing Cooling and Fire Fighting Water Sources**
  - ❖ **2-5 Securing the Integrity of Containment Building and Mitigating the Release of Effluent Radioactive Material into the Environment**
  - ❖ **2-6 Reinforcing Fire Fighting Capability**
  - ❖ **2-7 Strengthening Capabilities to Manage Severe Accidents and Extensive Damage**
- ❑ **PFA-3 Improving Emergency Preparedness and Emergency Medical System**

## **PFA-1 Enhancing Capabilities to Respond to Initiating Events caused by Natural Disasters such as Earthquake and Tsunami**

- ❑ Investigation and assessment of the maximum potential earthquake for the nuclear sites**
- ❑ Investigating and researching the design basis sea water level of the nuclear power sites**
- ❑ Improvement of seismic capacity of the safe shutdown system**
- ❑ Improvement of seismic capacity of the seismic alarm window in the main control room**
- ❑ Improvement of seismic capacity of the entrance bridge at Wolsong site**
- ❑ Evaluation of seismic performance of water pipeline (from purifying plant to treatment plant)**
- ❑ Building up the coastal barrier for Kori site**
- ❑ Installing an automatic seismic trip system (ASTS)**

## **PFA-1 Enhancing Capabilities to Respond to Initiating Events caused by Natural Disasters such as Earthquake and Tsunami**

- ❑ Installing waterproof doors and discharge pumps**
- ❑ Reinforcing the intake capability for cooling water and improving facilities to prepare against a tsunami**
- ❑ Plan to prevent damages to outdoor tanks**

## **PFA-2 Improving Safety Functions and Accident Management Capabilities**

### **2-1 Enhancing the Reliability of Electric Power System**

- ❑ Securing mobile electric power generators and batteries**
- ❑ Improving the design basis of AAC DG**
- ❑ Fastening down the standby transformers with anchor bolts and improving the fuel injection port mechanism of Wolsong NPP's emergency power supply system**
- ❑ Improving the management for switchyard facilities**
- ❑ Improving the reliability of on-site power supply system**
- ❑ Securing emergency power supply for Wolsong Unit 1 local air cooler (LAC)**

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## **PFA-2 Improving Safety Functions and Accident Management Capabilities**

### **2-2 Improving Reactor Core Cooling Function**

- ❑ Installing of reactor injection flow paths for emergency cooling water injection from external sources**
- ❑ Preparing a plan to prevent the inundation of main steam safety valve room and emergency feed water pump room**
- ❑ Preparing a plan to prevent and restore from inundation of ultimate heat sink (UHS)**
- ❑ Installing additional auxiliary feed water storage tanks at Hanul Unit 1**

## **PFA-2 Improving Safety Functions and Accident Management Capabilities**

### **2-3 Improving Spent Fuel Pool Cooling Function**

- Preparing countermeasures against the loss of spent fuel pool cooling**
- Installing safety-class instruments to monitor water level, temperature and radiation level.**
- Revising technical specifications related to securing emergency power for spent fuel pool**

### **2-4 Securing Cooling and Fire Fighting Water Sources**

- Installing a branch pipe on the service water supply pipe line in the water purification plant**
- Securing movable diesel driven pumps**
- Securing long hoses for emergency water injection**

## **PFA-2 Improving Safety Functions and Accident Management Capabilities**

### **2-5 Securing the Integrity of Containment Building and Mitigating the Release of Effluent Radioactive Material into the Environment**

- Installing passive hydrogen removal equipment**
- Installation of filtered vent system or depressurizing facilities in the containment buildings**

### **2-6 Reinforcing Fire Fighting Capability**

- Improving the fire fighting plan and coordination with public fire departments**
- Improving the fire fighting capability of the site fire brigade**
- Introducing a performance based fire fighting design**

## **PFA-2 Improving Safety Functions and Accident Management Capabilities**

### **2-7 Strengthening Capabilities to Manage Severe Accidents and Extensive Damage**

- Reinforcing education and training on severe accident**
- Revision of the Severe Accident Management Guidelines to enhance effectiveness**
- Development of Low-Power Shutdown SAMG**
- Developing a Extensive Damage Mitigation Guide (EDMG)**
- Developing an integrated EOP-SAMG procedure.**

## **PFA-3 Improving Emergency Preparedness and Emergency Medical System**

- Securing additional radiation protection supplies for protecting residents near a nuclear power plant**
- Amending the radiological emergency plan to include simultaneous emergency at multiple units**
- Securing additional equipment to prepare for a prolonged emergency**
- Increasing the equipment of emergency medical treatment institutions**
- Reinforcing radiation emergency exercise**
- Securing vital information in case of a prolonged loss of electrical power**
- Improving the emergency response facilities**
- Securing countermeasures to protect emergency workers and reinforcing emergency preparedness training**

## **PFA-3 Improving Emergency Preparedness and Emergency Medical System**

- Amending the information disclosure procedure in the event of a radiological emergency**
- Evaluating protective measures for residents who live beyond the emergency planning zone (EPZ)**
  - ❖ **EPZ (8~10km) is now under consideration for expansion up to 30 km and reflecting PAZ (Precautionary Action Zone) and UPZ (Urgent protective Action planning Zone) to reflect the lessons learned from the Fukushima accident (reflect the IAEA GS-G-2.1)**
- Reinforcing the performance of emergency notifying system**

### **Some additional action items identified by Licensee**

- Improving a cooperation with relevant emergency organizations**
- Operating an assessment program for public protective actions**
- Environment Monitoring**
- Protective Measures for Residents**

## Future Works on Post Fukushima Action - Phase 3

**Action Items will be updated considering lessons learned from international communities**

- ❑ IAEA, OECD/NEA, EU(Stress Test), France, USA, Canada, Germany, Japan, China, and Russia**
- ❑ International cooperation is very important to get information and insight against Fukushima accident**

**The effectiveness of the action items will be evaluated by using various methodologies**

- ❑ Stress test with cliff edge evaluation will be performed for all operating plants in Korea**
- ❑ PSA may give us some insight to estimate the effectiveness**

## **Future Works on Post Fukushima Action - Phase 3**

### **Review and Modification of Safety Objective and Safety Goal considering Extreme Natural Hazard**

- ❑ External events could exceed the assumptions used in the design and licensing of a plant, as demonstrated by the Fukushima Daiichi Accident**

### **Review and Modification of Regulations and Guides considering beyond DBA**

- ❑ Air crash, Design Extension Condition, etc.**
- ❑ Periodic update safety requirements for natural hazards**



## Concluding Remarks (1/2)

- **As of March 2014, the licensee is in the process of implementation as planned. The regulatory body has set regulatory requirements for each action item and checked the adequacy of actions implemented**
- **Since fully understanding the causes and progress of the Fukushima Daiichi accident requires continuous effort, the regulatory body is developing a national-level process to incorporate the lessons learned from the Fukushima Daiichi accident into the operation of Korean NPPs**

## Concluding Remarks (2/2)

- **The process will cover gathering, analyzing, and evaluating operating experience; preparing action plans at operator and regulator levels; and establishing regulatory requirements to improve the safety of nuclear power plants**
- **In accordance with the process, action plans for construction and operation areas will also be in the works**



***Thanks for your attention***

