



# A NEWCOMER'S REGULATORY RESPONSE to the FUKUSHIMA ACCIDENT

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# Presentation Outline

- Introduction
  - Construction License Application
- Fukushima Lessons Learned Action: FANR
  - Strengthening Safety and Emergency preparedness
- ENEC Approach
- FANR Evaluation Findings

# Construction Licence Application





# Construction Licence Application

- Construction License Application (CLA) received December 2010
  - Preliminary Safety Analysis Report (9000+ pages)
  - Physical Protection Plan for construction
  - Preliminary Safeguards Plan
  - Preliminary Probabilistic Safety Assessment Report summary
  - Severe Accident Analysis Report
  - Aircraft Impact Assessment
- Less than 3 months into the CLA review, Fukushima accident



# Post-Fukushima Action

- 30 March 2011, FANR requested ENEC to develop a plan to evaluate and apply lessons
- Approach is largely based on actions taken by international organizations, e.g., USNRC, ENSREG, WENRA; Korean actions reviewed
- ENEC and KEPCO formed a Safety Review Task Force (*SRTF*)
- FANR Established a Fukushima Lesson Learned Task Force to support ongoing national and international activities



# FANR Requirements

- **Siting and design Issues**– external hazards, e.g., earthquakes, floods, tsunami, sand storms, oil spills
  - **Potential impact** of loss of large areas of the facility due to fires and explosions
  - Robustness of the design
- **Severe accident** sequences, consequences and mitigation – SAMG, mobile equipment
  - Command and Control - Organization (personnel, procedures, etc.)
- **Consequential Loss of Safety Functions; SBO, UHS**
  - Enhancement of power system against **CCF**
  - **Multiunit site**-sharing items important to safety



# ENEC Fukushima Report

- Fukushima lessons learned addressed in supplementary report; provided to FANR, 31 December 2011.
- The report has been reviewed by FANR as a part of ENEC CLA for Barakah NPP 1&2
- Make margin-enhancement-focused changes consistent with reference plant in South Korea
- Use design changes to limit analytical justifications



# Earthquake Assessment

- Barakah site PGA is 0.14g
- Barakah NPP design PGA/SSE is 0.3g
- Margin evaluation is ongoing to determine the seismic capacity of SSCs
  - *High Confidence Low Probability of Failure [HCLPF]*
- Provisions to increase plant robustness
  - Seismically qualified display in MCR
  - Enhanced seismic qualification of AAC building to PGA of 0.14g being considered (FSAR)





# Flooding Assessment

- Barakah site is designed to be a dry site
- Elevations are selected to protect against surge waves, tsunami, and plausible combinations
- Provisions to increase plant robustness
  - Watertight doors/gates for entrances, penetrations, and openings of the auxiliary building
  - Protection of outdoor tanks (barriers)
  - Mobilization of additional diesel fuel (FSAR)



# Sand Storms

- Sand and dust storms, dust events, and dust haze are considered for the design of the Barakah plants
- Examples of design/procedural features *under consideration (FSAR)*:
  - Outside penetrations at > 6.0 m above site grade
  - Mainly indoor switchyard
  - Debris filter
  - Protection of out door electrical and electronic devices
  - Additional operational procedures



# Oil Slick Assessment

- Distance from potential spill locations
  - Shallow coastal waters of Gulf prevent large ships from approaching and provide time for alerting and response
- Cooling water intakes draw from deep water below floating products
- Very low water velocity in the intake channel
- Use of oil absorbent material, oil booms, air bubblers and skimmers are *under consideration (FSAR)*



# SFP Inventory and Cooling

- Time to reach the top of fuel in the SFP is:
  - > 20 hours assuming a pipe break
  - > 35 hours with no pipe break
- Provisions for increased robustness
  - External SFP fill line
  - Safety-related redundant SFP temperature instrument
  - PAR(s) in SFP building



## Severe Accident Management Improvements

- Operating procedures, EOPs and SAMGs will be developed. Fukushima lessons learned will be incorporated (FSAR)
- Decisions on supply/storage & use of external equipment, such as fire engines, pumps, mobile DGs, etc. (FSAR)
- Emergency Plan lessons learned will be incorporated (FSAR)



# Key Committed Design Enhancements Summary

- Waterproof doors to protect plant from extreme flood
- Enhancement to emergency electrical power supplies
- Unit cross tie design of EDGs and AAC DG for emergency Power Supply
- Battery Duty Extension
- Class 1E power backup for communication system
- External water injection for: Steam Generators, Reactor Coolant System, Spent Fuel Pool
- PARs in Spent Fuel Pool
- Spent Fuel Pool instrumentation
- Severe accident and emergency management procedures



## Concluding Remarks

- FANR review concluded that the Barakah 1 & 2 Fukushima lessons learned assessment report provides reasonable assurance of the plant capabilities to cope with challenges posed by extreme natural and man-made events – CL stage
- FANR will continue to assess lessons learned as they become available and review additional submittals during the construction phase and as part of the operating license review