Clean Nuclear, Safety First!

APR1400
Safe, Reliable Technology

OECD/NEA Workshop on
Innovations in Water-cooled Reactor Technology

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Presented by Shin Whan Kim

KEPCO E&C NSSS Division

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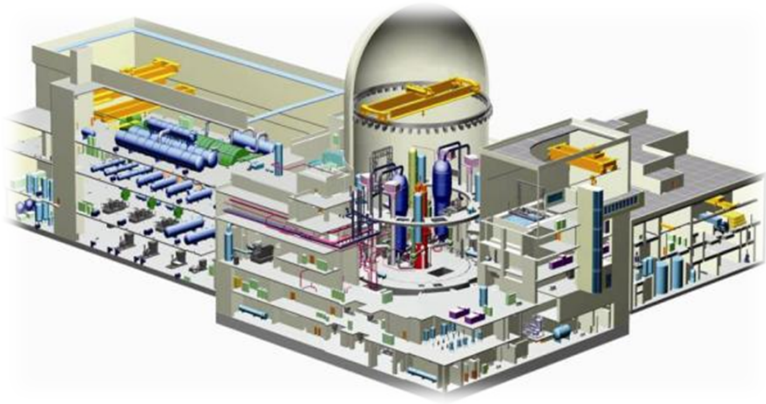
Technology Overview

Evolutionary Advanced Light Water Reactor Technology

- Offering significant advances in safety and economics
- Design addresses the expectation of utilities for ALWR
- Design complies with up-to-date regulatory requirements of Korea and US and IAEA requirements
- Severe accident mitigation design features
- Eight units, four in Korea and another four in the UAE, currently under construction

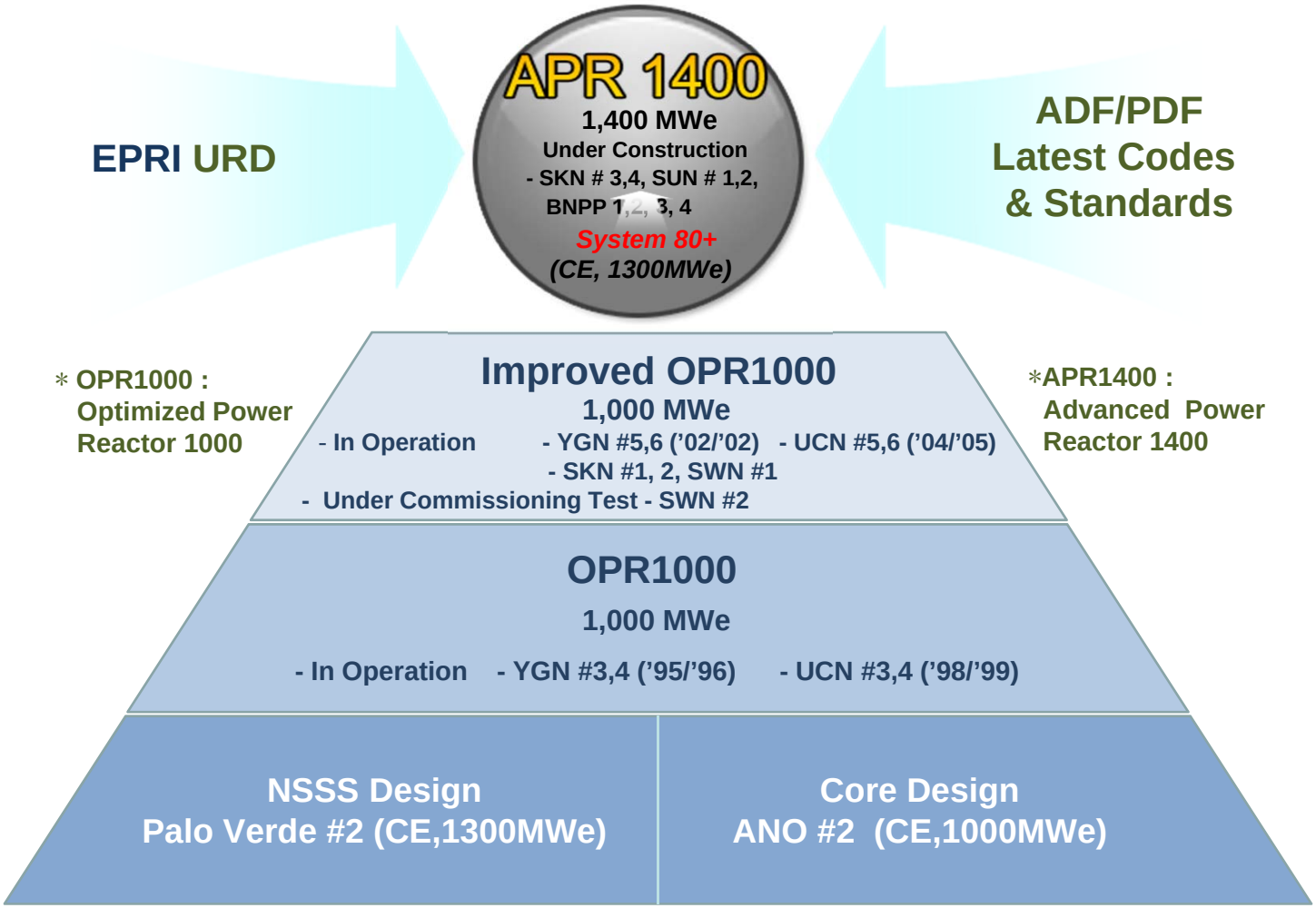


APR1400 Development

Strategy

- **Design adopting evolutionary improvement strategy based on proven standard/reference design**
- **Incorporate advanced design features to enhance safety and operational flexibility**
- **Optimize design for economic improvement**
- **Compliance with the Utility Design Requirements (domestic & world-wide)**
  - Proven Technology
  - Constructability
  - Regulatory Stabilization
  - Maintainability

Evolutionary Technology Development



Design Goals

❑ Safety

- Core Damage Frequency < $10E^{-5}$/RY
- Containment Failure Frequency < $10E^{-6}$/RY
- Seismic Design Basis : 0.3 g
- Occupational radiation exposure < 1 man·Sv/RY

❑ Performance

- Thermal Margin > 10 %
- Plant Availability > 90 %
- Unplanned Trip < 0.8/RY

❑ Economy

- Plant Capacity (Gross) : 1,455 MW_e
- Plant Lifetime : 60 years
- Refueling Cycle : ≥ 18 months
- Construction Period : 48 months (N-th Unit)

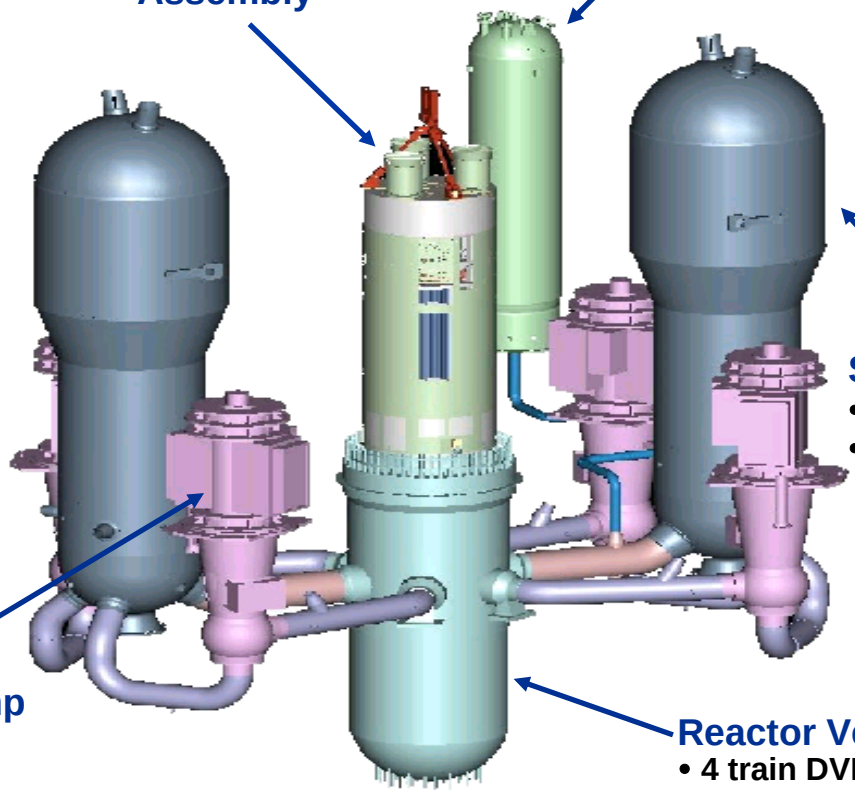
2. Major Safety Design Characteristics

- Improved Thermal Margin
- Advanced Fuel Technology
- Enhanced Reliability of Safety Systems
- Digital I&C System
- Severe Accident Mitigation
- Protection Against External Hazards

Improved Thermal Margin

Reactor Coolant System

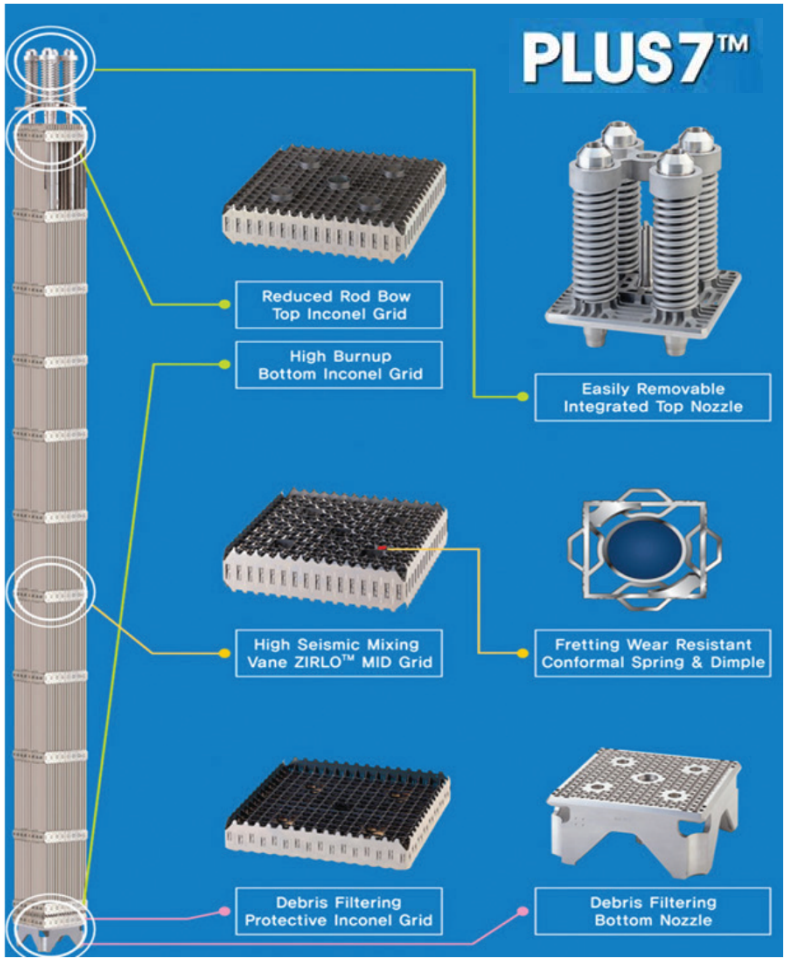
- Thermal Power: 4,000 MW
- Designed with increased thermal margin



Advanced Fuel Technology

Major Improvement

- ❑ Increased thermal margin of larger than 10 %
- ❑ High burnup of 55,000 MWD/MTU
- ❑ Improved neutron economy
- ❑ Improved seismic resistance
- ❑ Improved the resistance against fretting wear
- ❑ Debris-Filter Bottom Nozzle
- ❑ Improved Fuel Productivity



/http://www.knfc.co.kr/

Enhanced Reliability of Safety Systems

❑ Safety Injection System

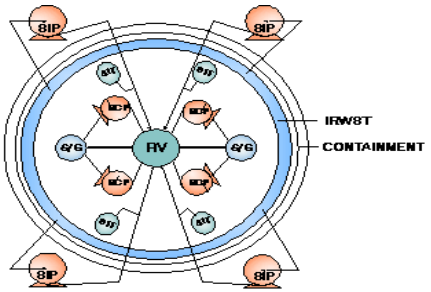
- 4 independent trains, Direct Vessel Injection
- Water source: In-containment Refueling Water Tank
- Fluidic Device for effective use of coolant

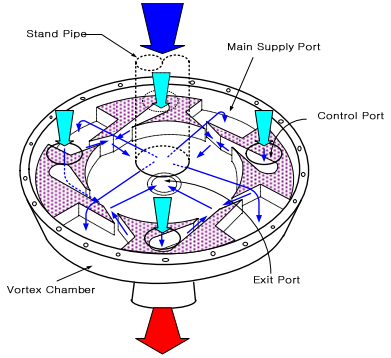
❑ Auxiliary Feedwater System

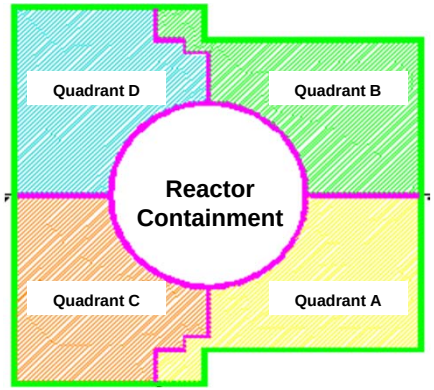
- Diversity in component design: turbine driven and motor driven pumps
- Turbine drive pump can provide cooling water without the supply of AC power

❑ Enhanced Physical Separation

- Four-quadrant arrangement of safety systems



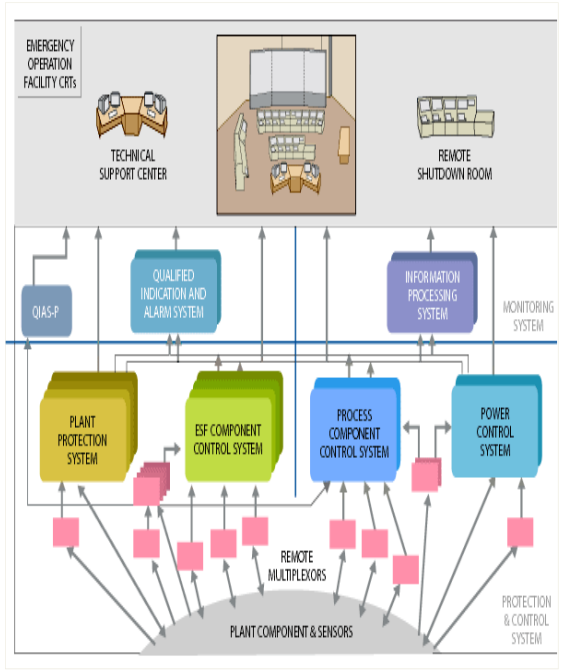




Digital I&C System

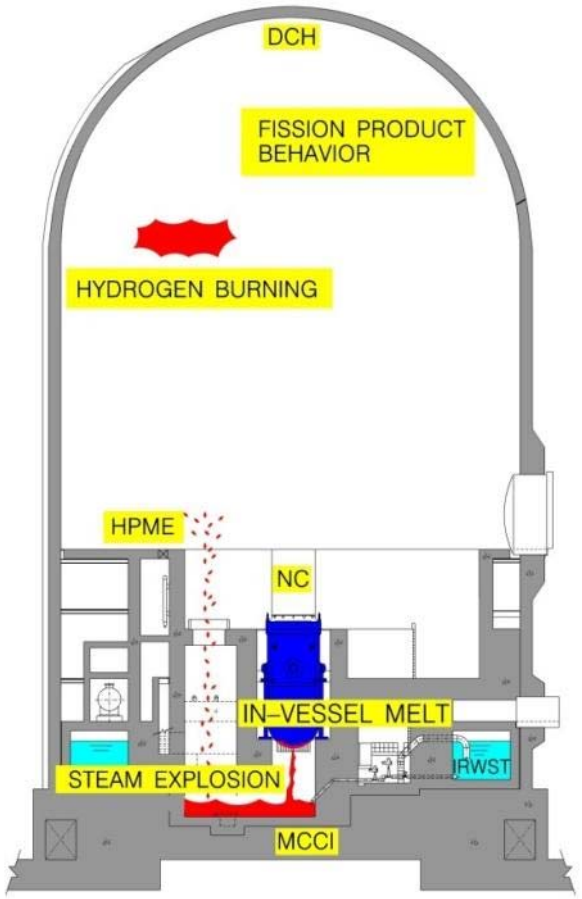
MMIS and I&C System

- **Digital technology & data communication network**
- **Proven, Open & standard architecture**
- **Defense against common mode failure**
  - Diversity between DCS and PLC
  - Reactor trip : PPS, DPS, Manual PPS Actuation
  - ESF-CCS : PPS, Manual by soft control, Hard wired Manual ESF Actuation
  - Alarm & Indications : IPS, QIAS-N, Diverse Indication
- **Operability & Maintenance**
  - Auto test, Self-diagnosis
- **Computerized Procedure System**
- **V&V for Human Factors Engineering Design**



Severe Accident Mitigation

- **Advanced design features for the prevention and mitigation of severe accidents**
  - Safety Depressurization & Vent System
  - Hydrogen Control System
  - Large reactor cavity & corium chamber
  - Cavity Flooding System
  - In-Vessel Retention & Ex-Reactor Vessel Cooling System
  - Emergency Containment Spray Backup System
  - Equipment survivability assessment



Protection against External Hazard

❑ Design consideration for external hazards

- Natural disasters: earthquake, floods and site specific conditions
- Man-made hazards: aircraft crash, fire, etc.

❑ Post-Fukushima safety enhancement

- Installation of an Automatic Seismic Trip System
- Reinforcement of waterproof functions
- Reinforcing design basis of the emergency diesel generator and AAC
- Countermeasures to address loss of cooling in the spent fuel pool
- Installation of an external injection flow path for emergency cooling
- Securing mobile generator and batteries

3. Summary

- APR1400: Safe, Reliable Technology
- ALWR Technology Development in Korea

APR1400, Safe and Reliable Technology

- **APR1400, Evolutionary ALWR**
  - Advanced design features for safety enhancement
  - Design features for severe accident mitigation
  - Enhanced economics via uprated power, longer design life, longer fuel cycle, performance improvement and enhanced constructability
  - 4 units currently under construction in Korea and another four units in the UAE
- **Proven technology minimizes technical and licensing uncertainties**
  - Proven by operation of reference technology
  - Proven by licensing approval
  - Proven by R&D programs
- **Technology development is continuously underway for further safety improvement.**

ALWR Technology Development in Korea

ALWR Technology Development with Safety Improvement

Reactor Model	OPR1000	APR1400	APR+	PPP
				**Premier Power Reactor**
First Commercial Operation	1995	2015	~ 2025	~
Size	1000 MWe	1400 MWe	1500 MWe	1000~1500 MWe
Design Life	40 yrs	60 yrs	60 yrs	80 yrs
CDF CFF	$< 1\times10^{-4}$/RY $< 1\times10^{-5}$/RY	$< 1\times10^{-5}$/RY $< 1\times10^{-6}$/RY	$< 1\times10^{-6}$/RY $< 1\times10^{-7}$/RY	"Zero" Severe Accident
Main Safety Systems	Active	Active	Active + Passive	Fully Passive

Thank you!