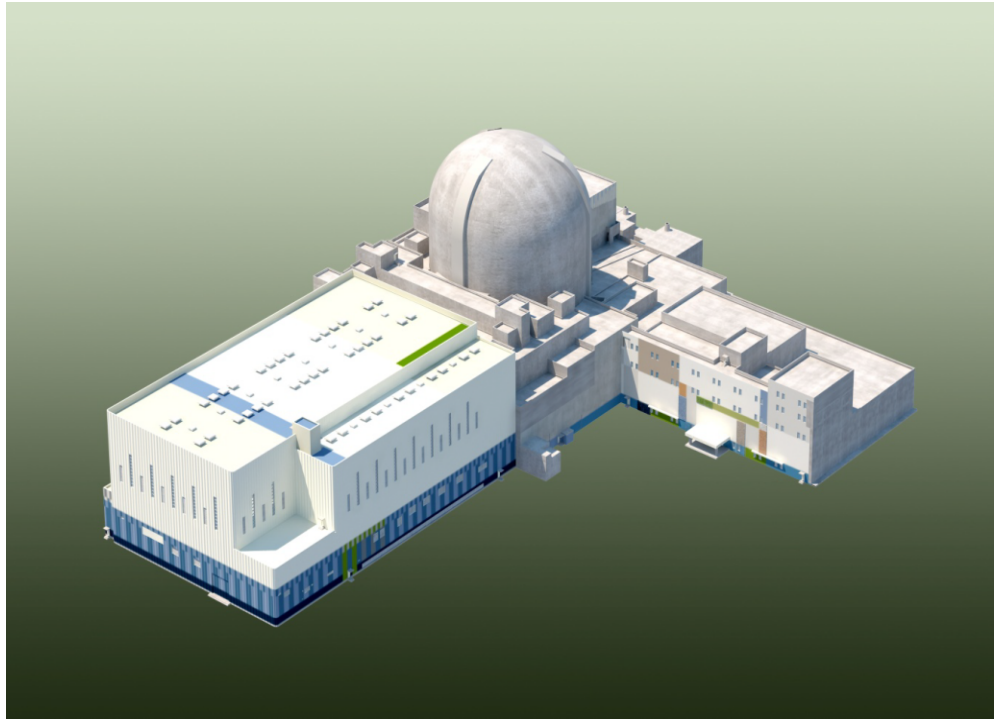
Overview of the APR1400 DC Project



KEPCO/KHNP

Apr. 20~21, 2016

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Nuclear Power Plants in Korea

In Operation	24 Units	21,716 MW
Under Construction	4 Units	5,600 MW
Planning	6 Units	8,600 MW

Hanul 1,2,3,4,5,6

Shin-Hanul 1,2
Shin-Hanul 3,4

Wolsong 1,2,3,4
(PHWR)

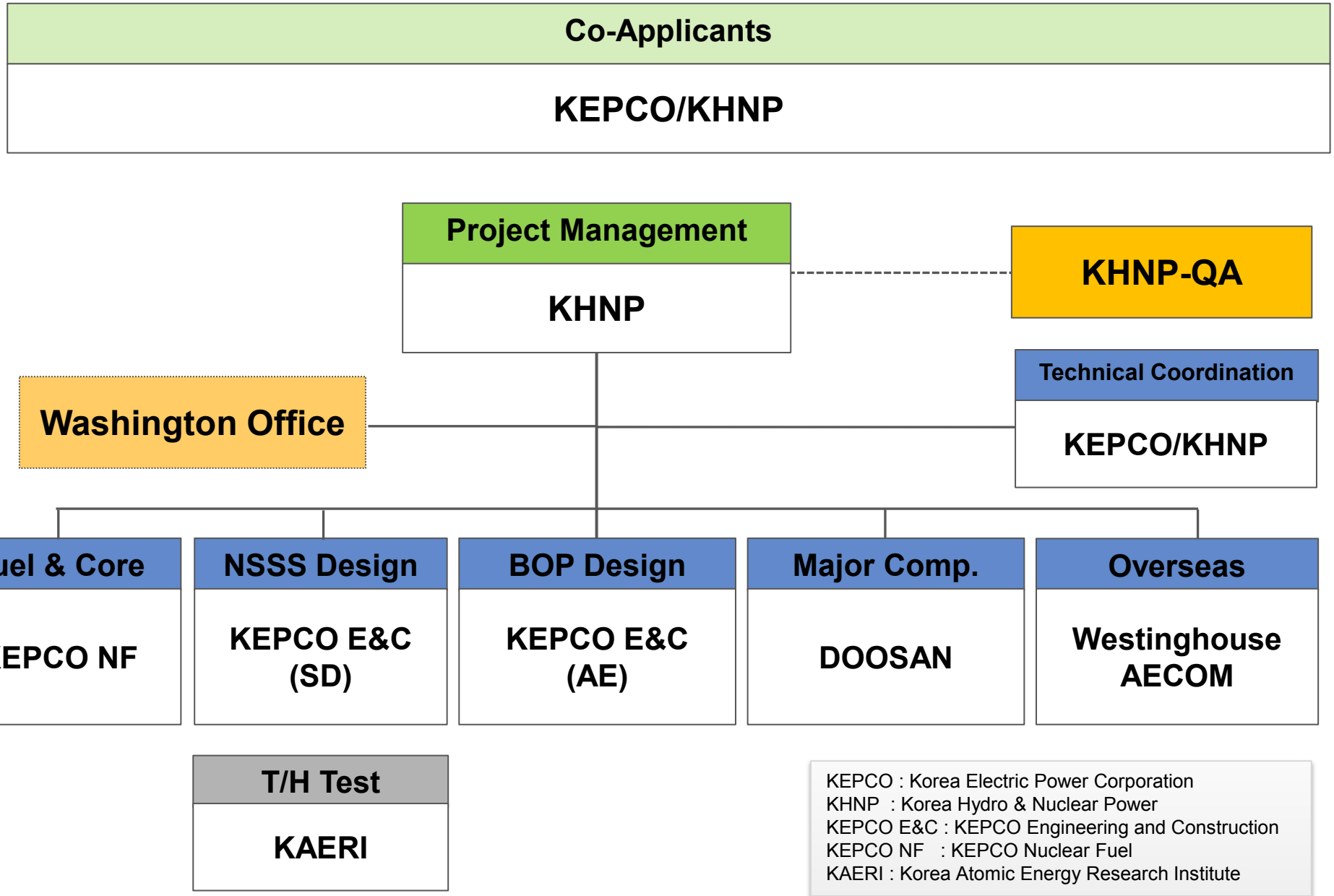
Shin -Wolsong 1,2

Hanbit 1, 2, 3, 4, 5, 6

Kori 1,2,3,4
Shin-Kori 1,2

Shin-Kori 3,4
Shin-Kori 5,6

Project Organization



KEPCO : Korea Electric Power Corporation
KHNP : Korea Hydro & Nuclear Power
KEPCO E&C : KEPCO Engineering and Construction
KEPCO NF : KEPCO Nuclear Fuel
KAERI : Korea Atomic Energy Research Institute

NON-PROPRIETARY

Project History and Progress

- [Mar. 2009] Submittal of the Intent of APR1400 DC Application to US NRC
- [Apr. 2010~Oct. 2014] Performed total 18 PARMs
- [Dec. 2014] Submittal of the APR1400 DC application to the US NRC
- [Mar. 2015] Receive the Docketing letter of APR1400 DC application
- [Apr. 2015] Receive the First RAIs[Ch. 2 & 3]
- [Jan. 2016] Finished Phase I Review

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NRC NEWS
Office of Public Affairs, Headquarters
Washington, DC. 20555-0001
www.nrc.gov ▪ opa.resource@nrc.gov

No: 15-012
CONTACT: Scott Burnell, 301-415-8200

March 4, 2015

NRC To Begin Full Certification Review of APR1400 Reactor

The Nuclear Regulatory Commission has docketed for review Korea Electric Power Corp. and Korea Hydro and Nuclear Power's application to certify the APR1400 reactor design for use in the United States.

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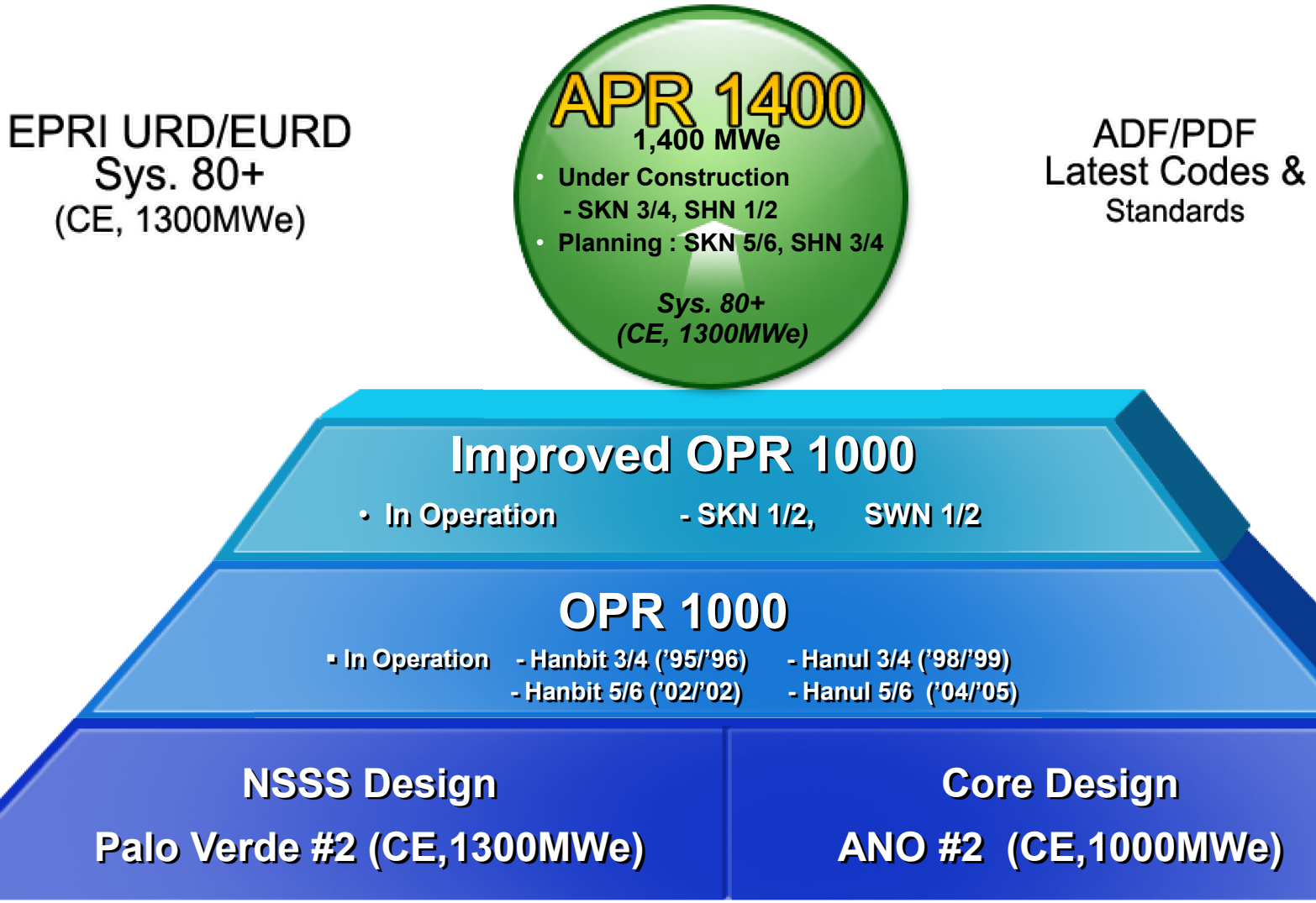
Development history of APR1400

- Development of Advanced Power Reactor 1400 (1992~2002)
- Licensing agreement with ABB-CE

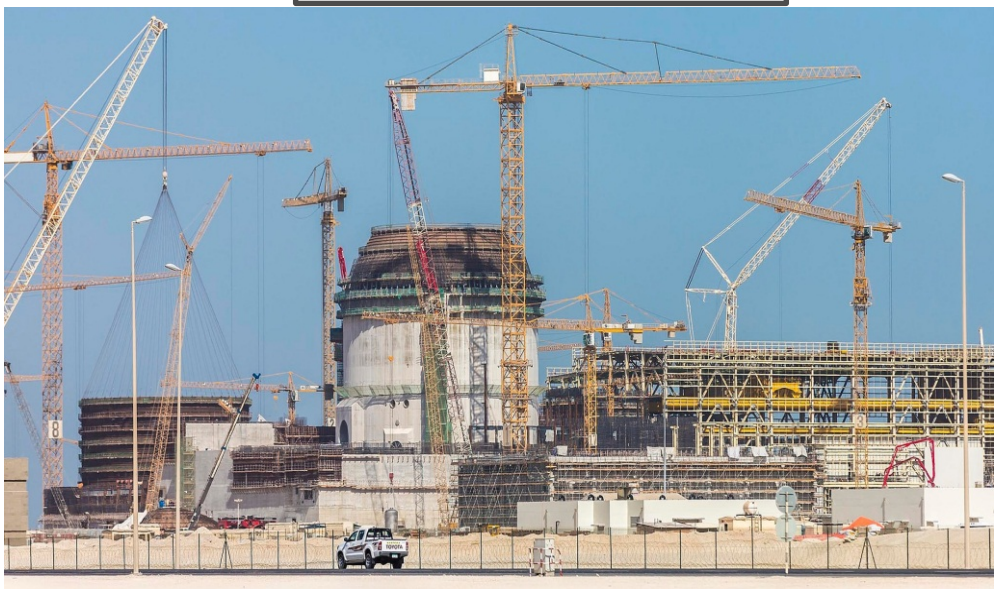


APR1400 Design Features

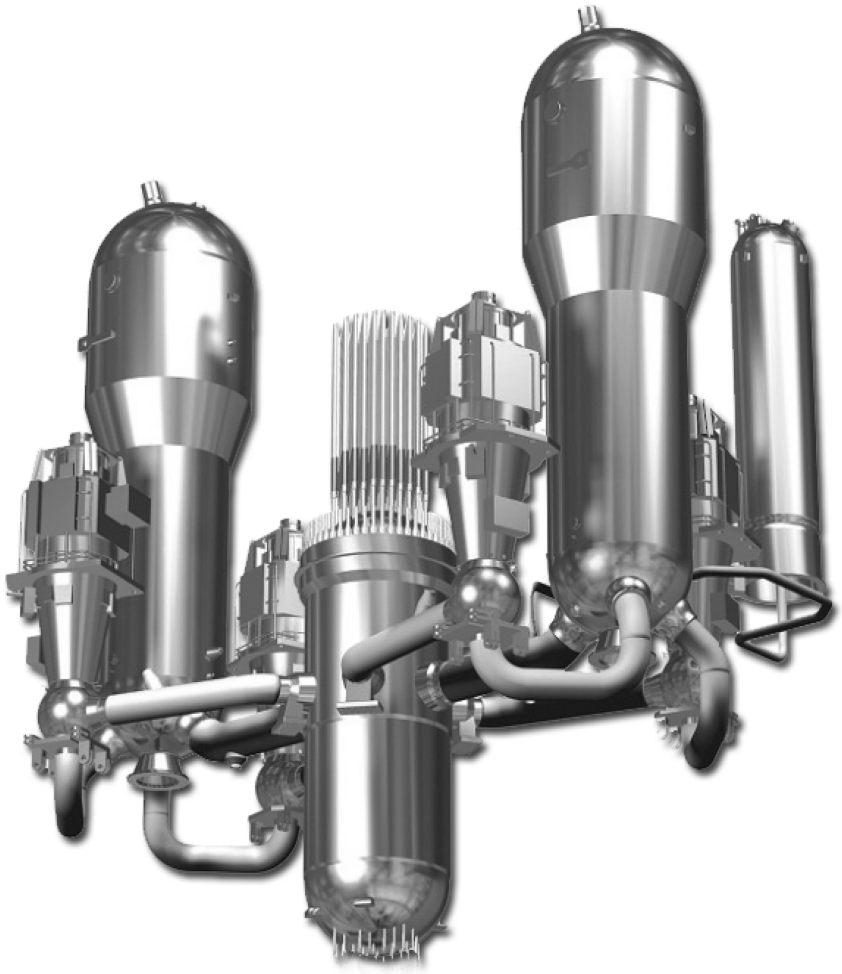
- **APR1400 referenced Shin Kori Units 3&4.**
- **APR1400 is an essentially complete design**
  - Construction completed in Korea (Shin Kori Units 3 & 4)
    - OL for Shin Kori Unit 3 issued on October 2015
    - Criticality reached on December 2015
  - Under-construction in UAE (Barakah Units 1 - 4)
    - OL for Barakah Unit 1 scheduled for October 2016

SKN 3&4, Korea

Barakah 1&2, UAE



Design Features of the APR1400



- Design Life Time : 60 Years for Class 1 Major Equipment
- Power : 4000MWth / 1400MWe
- Two-Loop : 2 HLs, 2 SGs, 4 RCPs, 4 CLs, 1 Pzr
- Primary Operating condition:
  - Pressure : 2250psia
  - HL/CL Temp. : 615/555 °F
- Secondary Operating condition:
  - Pressure : 1000psia
  - MF/MS Temp. : 450/545 °F
- Pzr Free volume : 2400 ft^3
- SG U-tube : 13102/SG, I690

APR1400 for NRC DC(1/2)

Basic approach of design change for NRC DC

- **Retain reference plant design (SKN 3&4)**
  - To take advantage of proven safety and performance
- **Meet US NRC Regulation Guidance effective on Aug. 2014**
  - Six month before the target docketing date

APR1400 for NRC DC(2/2)

Special Design Considerations for NRC DC

- **Enhance SBO coping capability**
  - Gas turbine generator for AAC source, 16 hr battery(Train C/D), FLEX implementation
- **Improve the tolerance to the beyond design basis**
  - Analysis of aircraft impact by 10CFR50.150
  - Application of LOLA (loss of large area) design requirement
  - Application of physical security requirement
- **Robust design for the design base accidents**
  - GSI-191 for LBLOCA
  - Diverse reactor protection systems for common cause failures
  - Application of FEM model to seismic design

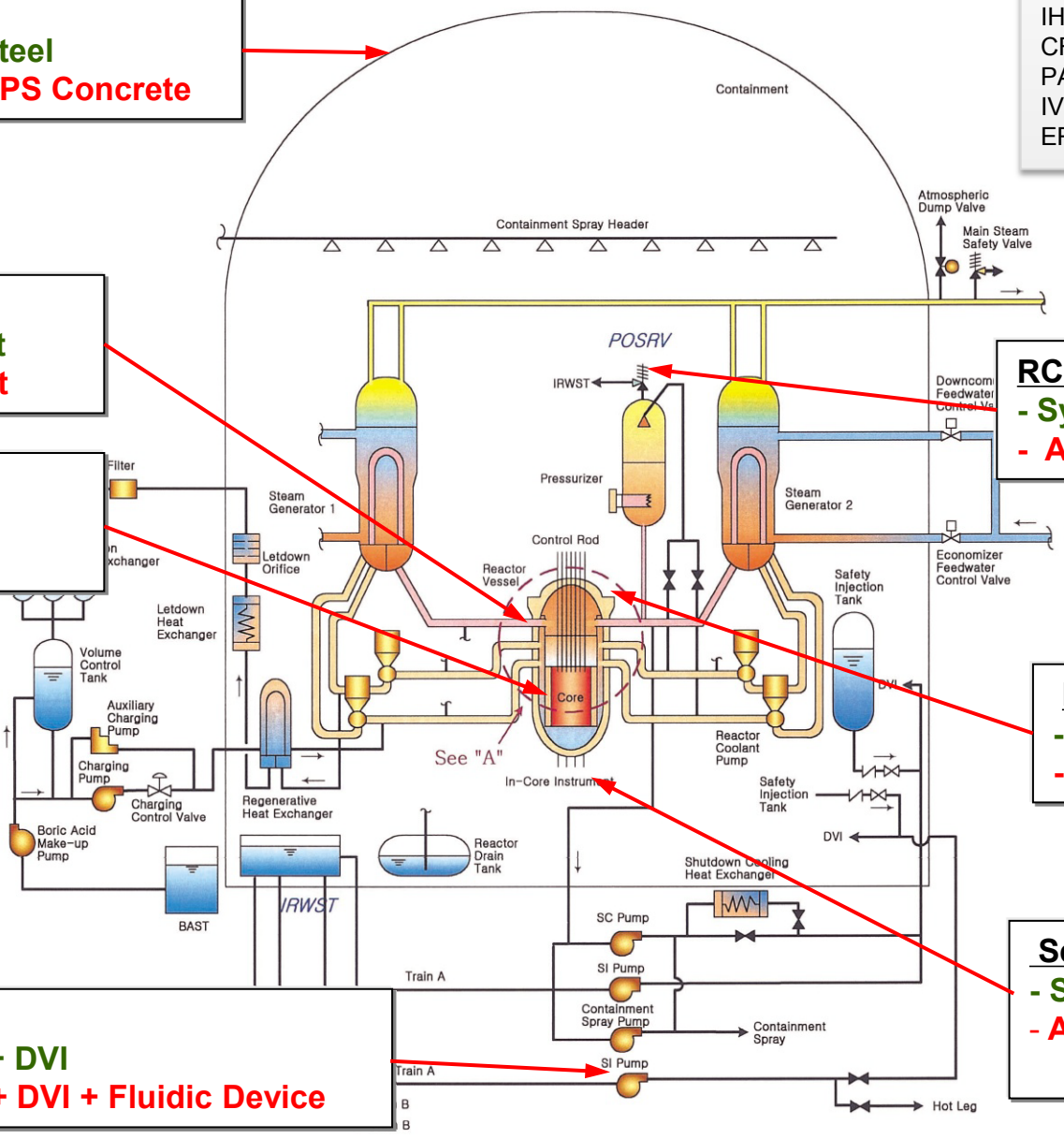
Design Differences between APR1400 and System 80+

SIS: safe injection system
DVI: direct vessel injection
POSRV: pilot operated safety relief valve
IHA: integrated head assembly
CFS: core flooding system
PAR: passive autocatalytic recombiner
IVR: in-vessel retention
ERVC: external reactor vessel cooling

Containment
- System80+ : Spherical Steel
- APR1400 : Cylindrical PS Concrete

Thermal Power
- System80+ : 3,931 MWt
- APR1400 : 4,000 MWt

Hot-leg Temp.
- System80+ : 621F
- APR1400 : 615F



RCS OPP / RD System
- System80+ : 4 PSV + 2 SDS
- APR1400 : 4 POSRV

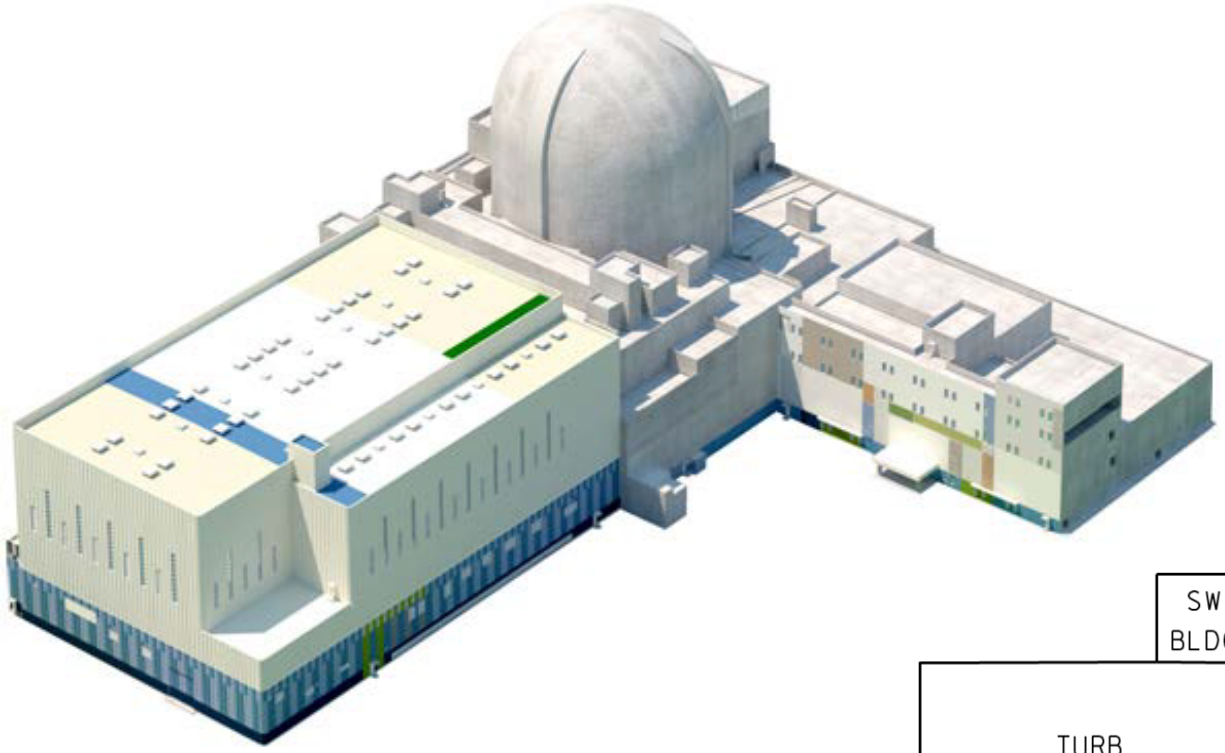
RV Upper Structure
- System80+ : Conventional
- APR1400 : IHA

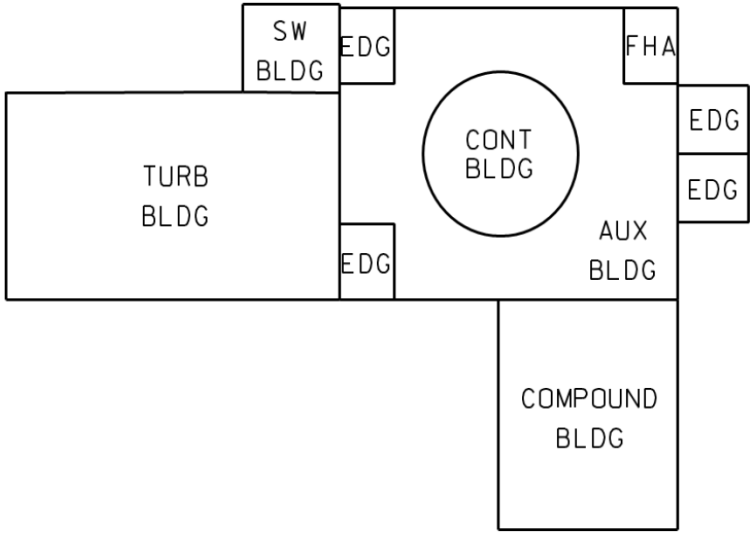
Severe Accident
- System80+ : CFS
- APR1400 : CFS + PAR, IVR/ERVC

Safety Injection System
- System80+ : 4 train SIS + DVI
- APR1400 : 4 train SIS + DVI + Fluidic Device

General Arrangement (1/4)

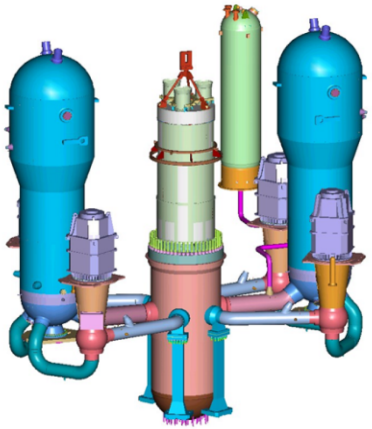
Plant General Arrangement





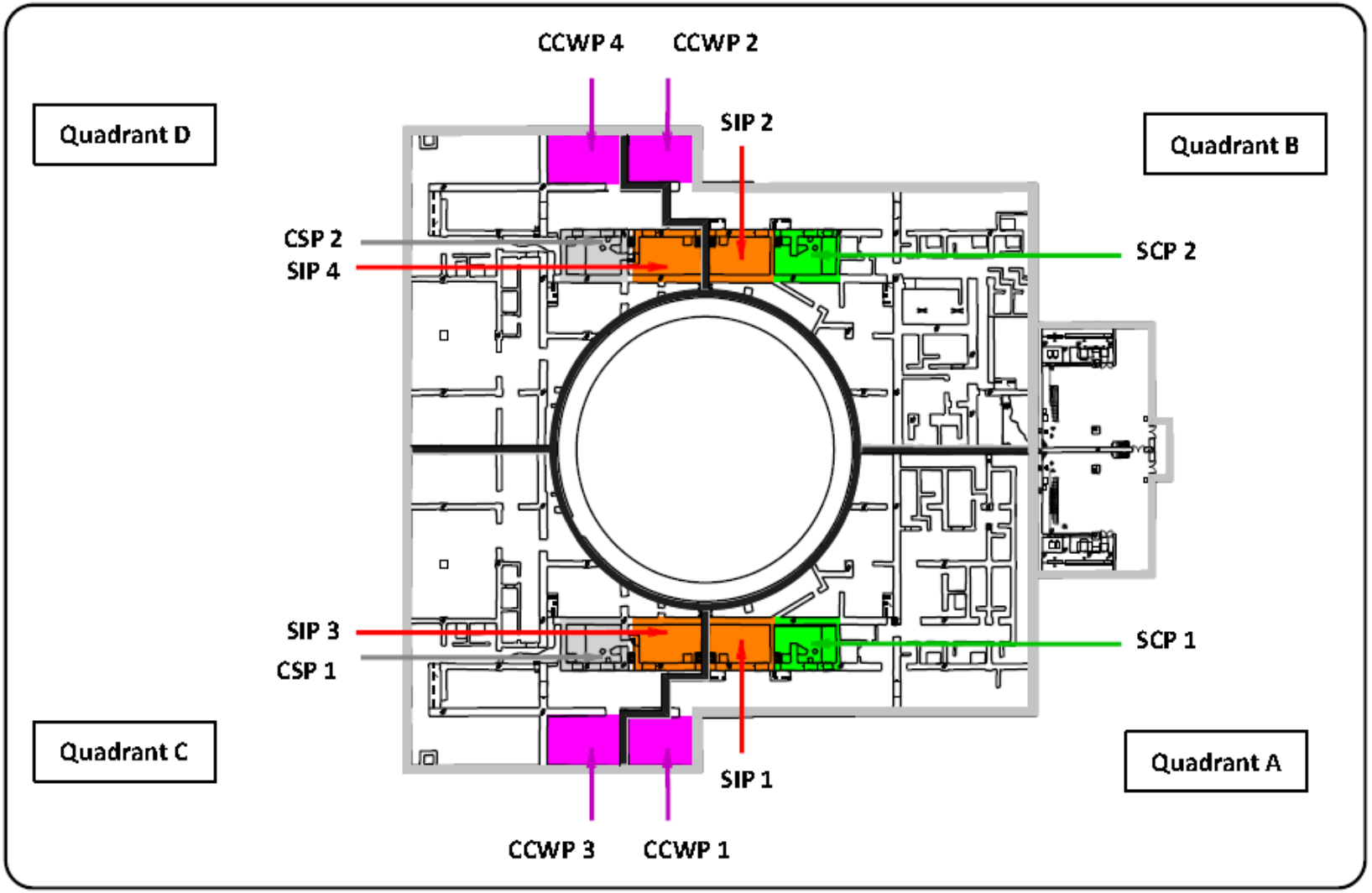
General Arrangement (3/4)

RCS Arrangement Plane



General Arrangement (4/4)

Quadrant Arrangement of Aux. Building



SIP : Safety Injection Pump
SCP : Shutdown Cooling Pump
CSP : Containment Spray Pump
CCWP : Component Cooling Water Pump

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Design Review Status

Task	Description	Target Date
Phase Ⅰ	PSER and RAI Completed	Feb. 2016 Jan. 29 2016
Phase Ⅱ	SER with Open Items	Nov. 2016
Phase Ⅲ	ACRS Review of SER with Open Items	Jun. 2017
Phase Ⅳ	Advanced SER with No Open Items	Dec. 2017
Phase Ⅴ	ACRS Review of Advanced SER with No Open Items	Jun. 2018
Phase Ⅵ	Final SER with No Open Items	Sep. 2018

Interaction with NRC

- **Regular meeting**
  - ✓ Bi-Weekly PM Conference Call
  - ✓ Bi-Weekly Conference Call for PRA Issues
  - ✓ Bi-Weekly Conference Call for Ch.3 Issues
  - ✓ Bi-Weekly Conference Call for Ch.15
  - ✓ Bi-Weekly Conference Call for Ch.9
- **Clarification meeting**
  - ✓ Phone call or face-to-face meeting frequently
- **Drop-in meeting**
  - ✓ Staff in WDCC visits NRC to coordinate issues
- **Audit**
  - ✓ Design documents, Piping, Computer code V/V. etc.
- **QA inspection**
  - ✓ GSI-191 issue : 4 findings
  - ✓ Computer codes : 4 observations

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Summaries

- **The APR1400 adopted proven technologies from the operation of OPR1000.**
- **The APR1400 used safety analysis codes and methodologies of the certified System 80+.**
- **The APR1400 standard design approval was issued by Korean regulatory authority in 2002.**
  - The first two units of the APR1400, Shin-Kori Units 3 & 4, are being constructed and their commercial operations are under preparation.
- **The APR1400 is an essentially complete design.**

Thank you