

Influence of MDEP interactions on reactor designs safety

APR1400 safety design features and the influence of MDEP interaction

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History of the APR1400 Development



Status of the APR1400

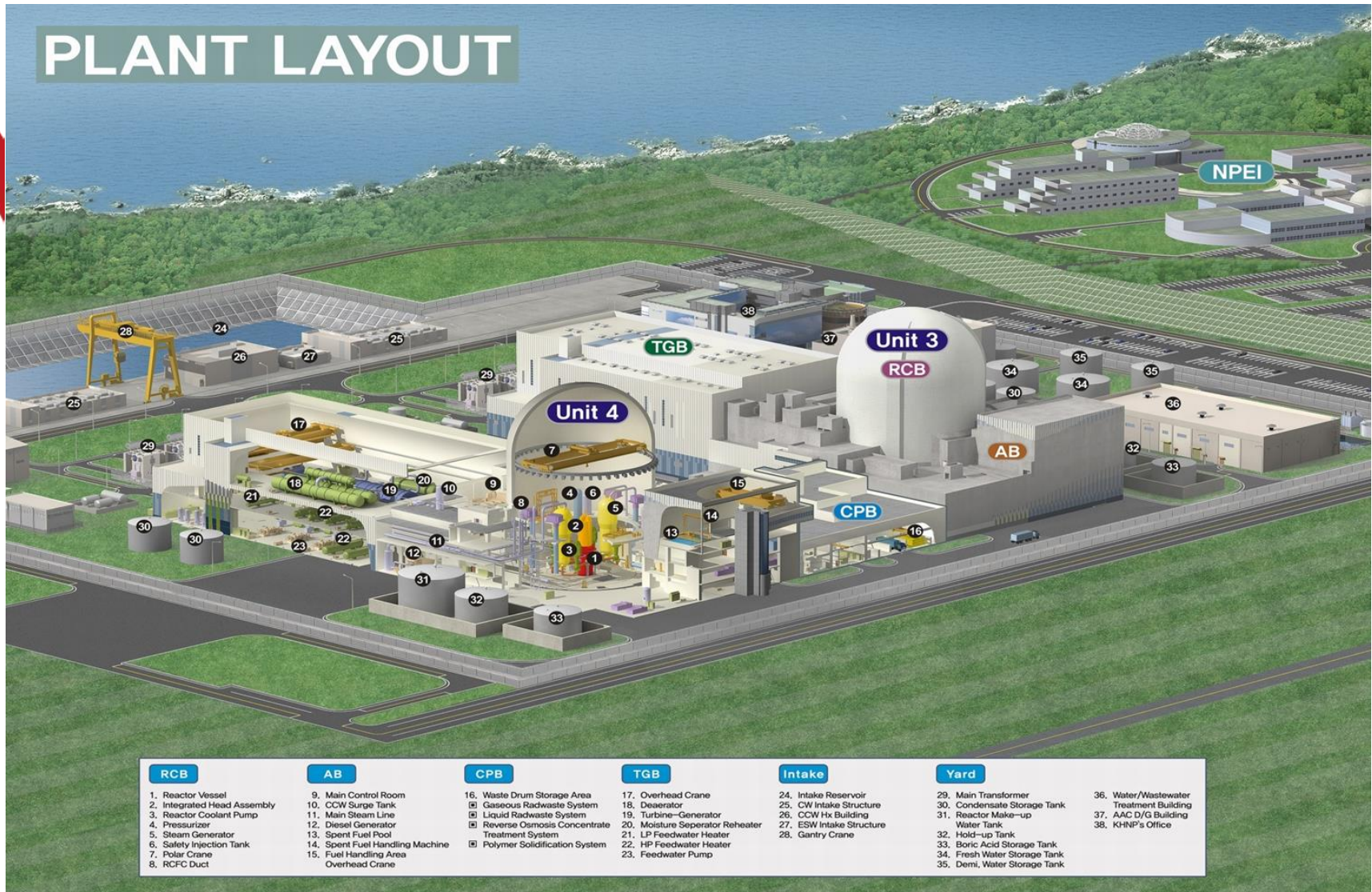
- In Korea and worldwide

- Construction completed in Korea (SKN 3&4)
 - OL for Unit 3 issued on October, 2015
 - Unit 3 commercial operation began on December, 2016
 - Unit 4 under pre-operation tests
- Under-construction in UAE (Barakah 1 ~ 4)
 - Commercial operation for Unit 1 scheduled on 2018
- Design certification in USA
 - NRC design review in phase 4 out of 6 phases



Design Feature of the APR1400

PLANT LAYOUT



RCB

1. Reactor Vessel
2. Integrated Head Assembly
3. Reactor Coolant Pump
4. Pressurizer
5. Steam Generator
6. Safety Injection Tank
7. Polar Crane
8. RCFC Duct

AB

9. Main Control Room
10. CCW Surge Tank
11. Main Steam Line
12. Diesel Generator
13. Spent Fuel Pool
14. Spent Fuel Handling Machine
15. Fuel Handling Area Overhead Crane

CPB

16. Waste Drum Storage Area
17. Gaseous Radwaste System
18. Liquid Radwaste System
19. Reverse Osmosis Concentrate Treatment System
20. Polymer Solidification System

TGB

17. Overhead Crane
18. Deserator
19. Turbine-Generator
20. Moisture Separator Reheater
21. LP Feedwater Heater
22. HP Feedwater Heater
23. Feedwater Pump

Intake

24. Intake Reservoir
25. CW Intake Structure
26. CCW Hx Building
27. ESW Intake Structure
28. Gantry Crane

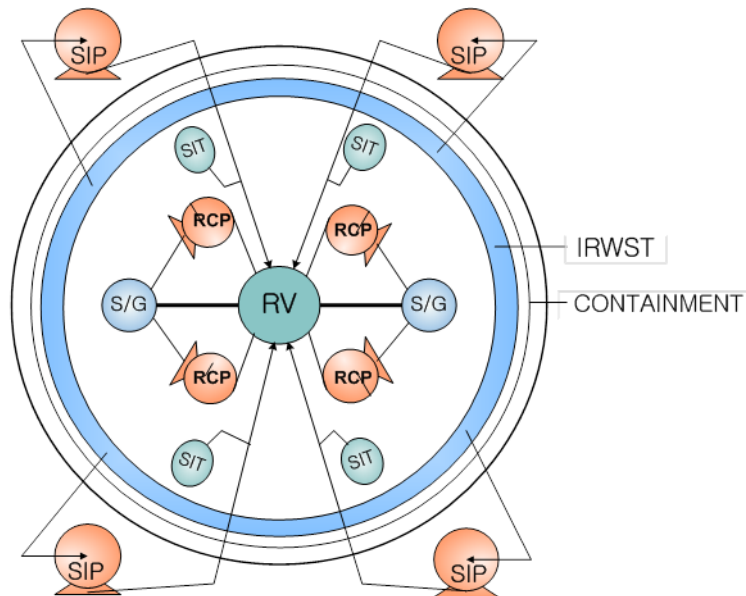
Yard

29. Main Transformer
30. Condensate Storage Tank
31. Reactor Make-up Water Tank
32. Hold-up Tank
33. Boric Acid Storage Tank
34. Fresh Water Storage Tank
35. Demi. Water Storage Tank
36. Water/Wastewater Treatment Building
37. AAC D/G Building
38. KHNP's Office

Design Feature of the APR1400

● Safety Injection System

- Four independent trains through Direct Vessel Injection nozzle
- Safety Injection Tanks(SIT) with Fluidic Device
- Safety Injection Pumps(SIP) from In-containment Refueling Water Storage Tank(IRWST)



Full scale
SIT &
Fluidic
Device test
facility

Design Feature of the APR1400

● Containment System

- Containment is prestressed and has sufficient peak pressure margin
- Containment Spray System consists of two 100% division
- Emergency Containment Spray Backup System(ECSBS) dedicated for severe accident management
- Controls hydrogen concentration ; PAR and Igniters



PAR

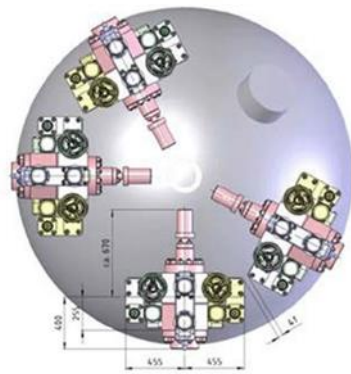


Hydrogen Igniter

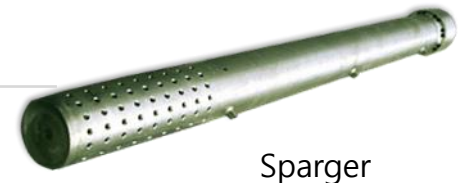
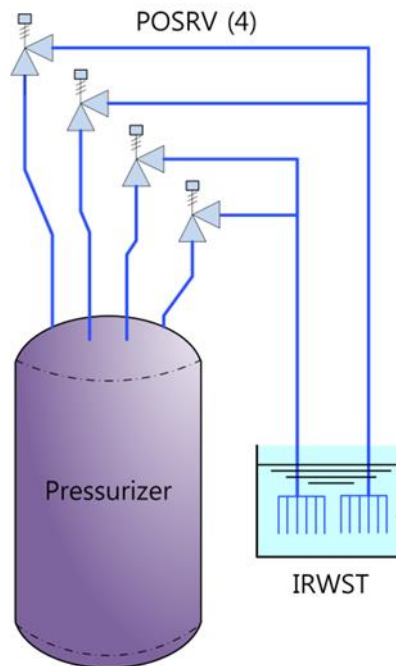
Design Feature of the APR1400

- **Overpressure protection**

- Maintain the RCS pressure below 110% design pressure
- Four Pilot Operated Safety Relief Valves (POSRV) , Main Steam Safety Valve(MSSV) and Reactor Protection System(RPS)
- The IRWST is used as the pressurizer relief tank



Bird view of Pressurizer

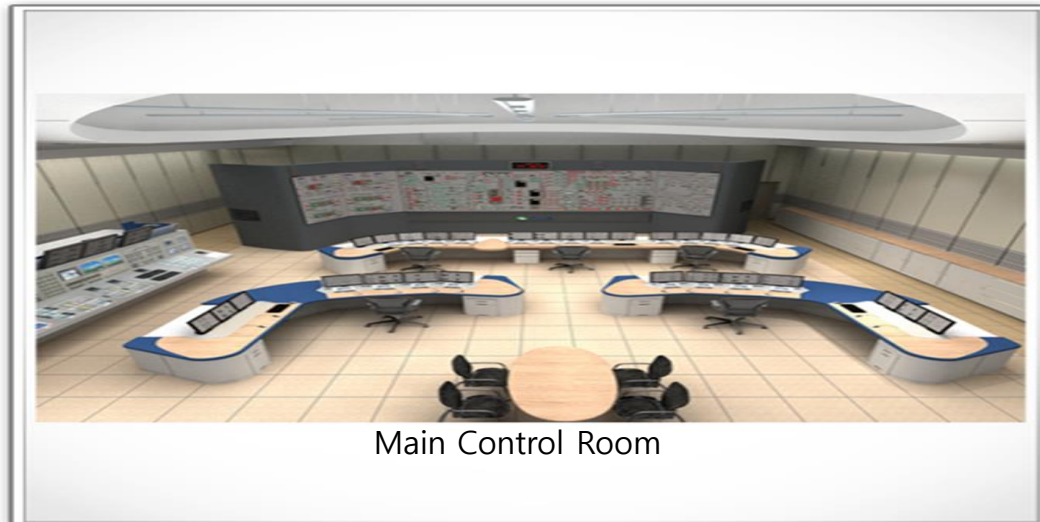


Sparger

Design Feature of the APR1400

● I&C System

- Fully digitalized I&C system with diverse platforms
 - Safety system : Programmable Logic Controller
 - Non-safety system : Distributed Control System
 - Diverse actuation system : FPGA-based Logic Controller
- Data communication systems maintain independence between safety system and non-safety system
- Remote Shutdown Room available when MCR uninhabitable



Design Feature of the APR1400

- Other design features

- Aircraft impact assessment to show core cooling capability and spent fuel pool integrity
- Loss of Power
 - Four EDGs are provided for LOOP
 - AAC GTG is provided for SBO
 - Onsite and offsite mobile DGs are provided for FLEX
- FLEX design
 - RCS makeup and core cooling using FLEX pumps
 - SFP makeup and spray using FLEX pumps
 - Power supply using mobile DGs(onsite and offsite)
 - SFP level instrumentations

Conclusion

- The APR1400 design is maturing through the accumulated experience from construction, pre-operation tests and operation
- Information exchange among regulators will help safe design of nuclear power plants
- KHNP is supporting MDEP to enhance safety of global nuclear industry