



# AP-1000 Reactor

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An Introduction to the:  
Westinghouse Pressure Water  
AP-1000 Nuclear Power Plant

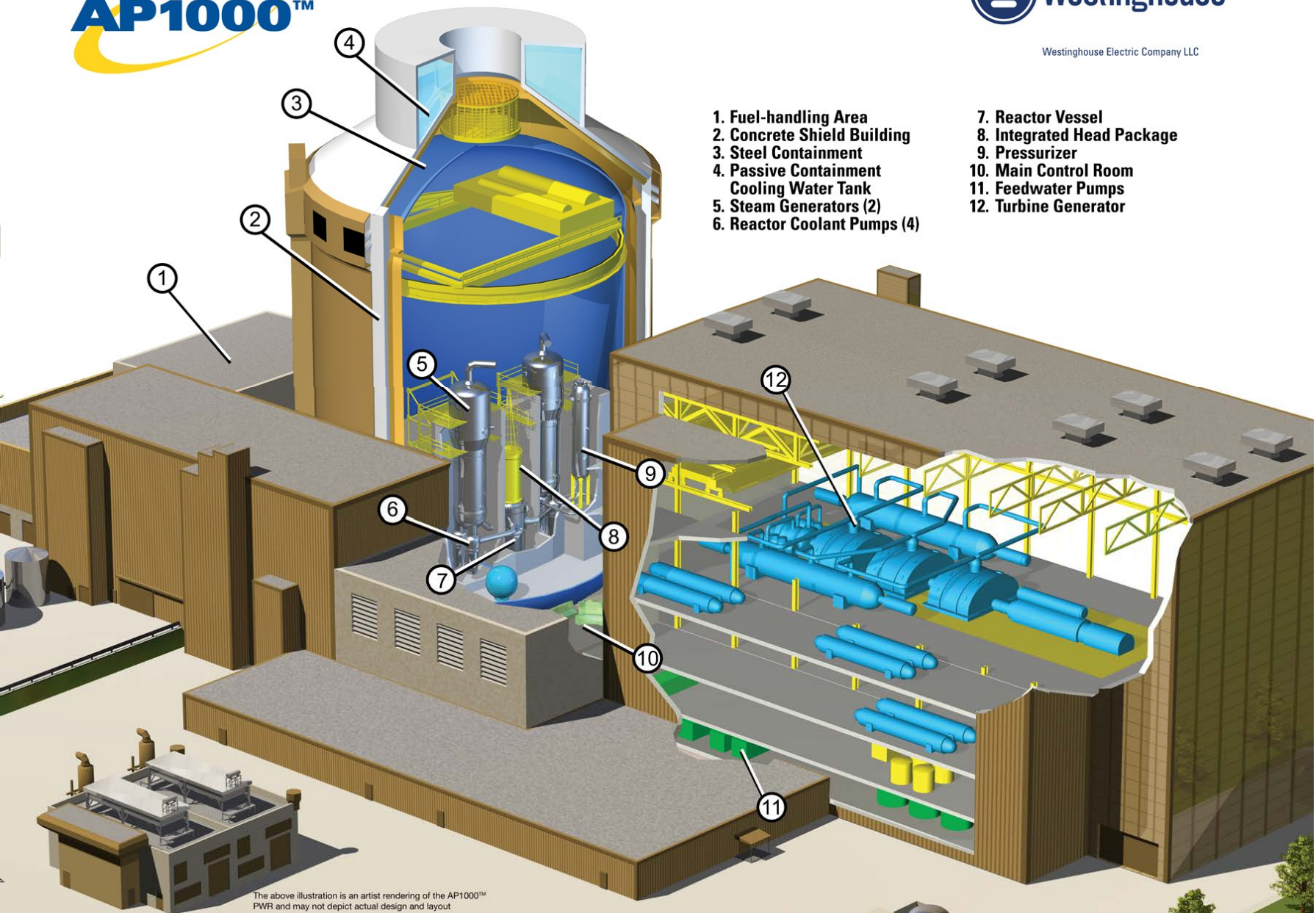
Developed for Nuclear Technologies, Inc.

By: Joseph D. Fournier B.Sc.E.E., M.Sc.E.E.

# AP1000 Plant Layout



Westinghouse Electric Company LLC



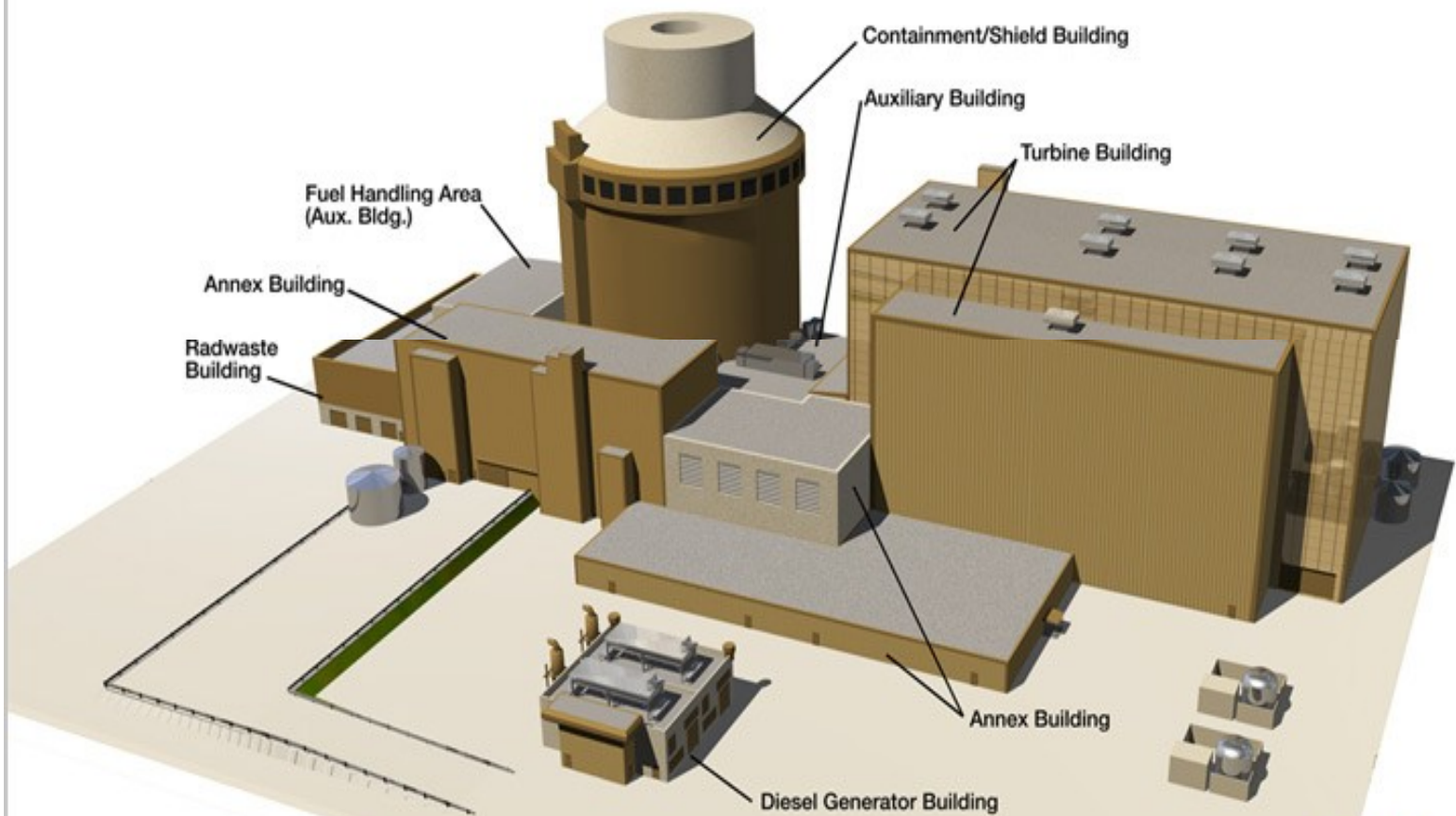
1. Fuel-handling Area
2. Concrete Shield Building
3. Steel Containment
4. Passive Containment Cooling Water Tank
5. Steam Generators (2)
6. Reactor Coolant Pumps (4)

7. Reactor Vessel
8. Integrated Head Package
9. Pressurizer
10. Main Control Room
11. Feedwater Pumps
12. Turbine Generator

The above illustration is an artist rendering of the AP1000™ PWR and may not depict actual design and layout.

# AP1000 Site Layout

## The Westinghouse AP1000<sup>TM</sup>



# AP1000 Plant Layout





# AP-1000 Reactor

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## **PRESSURIZED WATER REACTOR**

- ❑ A **pressurized water reactor (PWR)** is a light-water nuclear reactor type.
- ❑ PWRs constitute the large majority of the world's nuclear power plants.
- ❑ In a PWR, the primary coolant (water) is pumped under high pressure to the reactor core where it is heated by the energy released by the fission of atoms.
- ❑ The heated, high pressure water then flows to a steam generator, where it transfers its thermal energy to lower pressure water of a secondary system where steam is generated.
- ❑ The steam then drives turbines, which spin an electric generator.



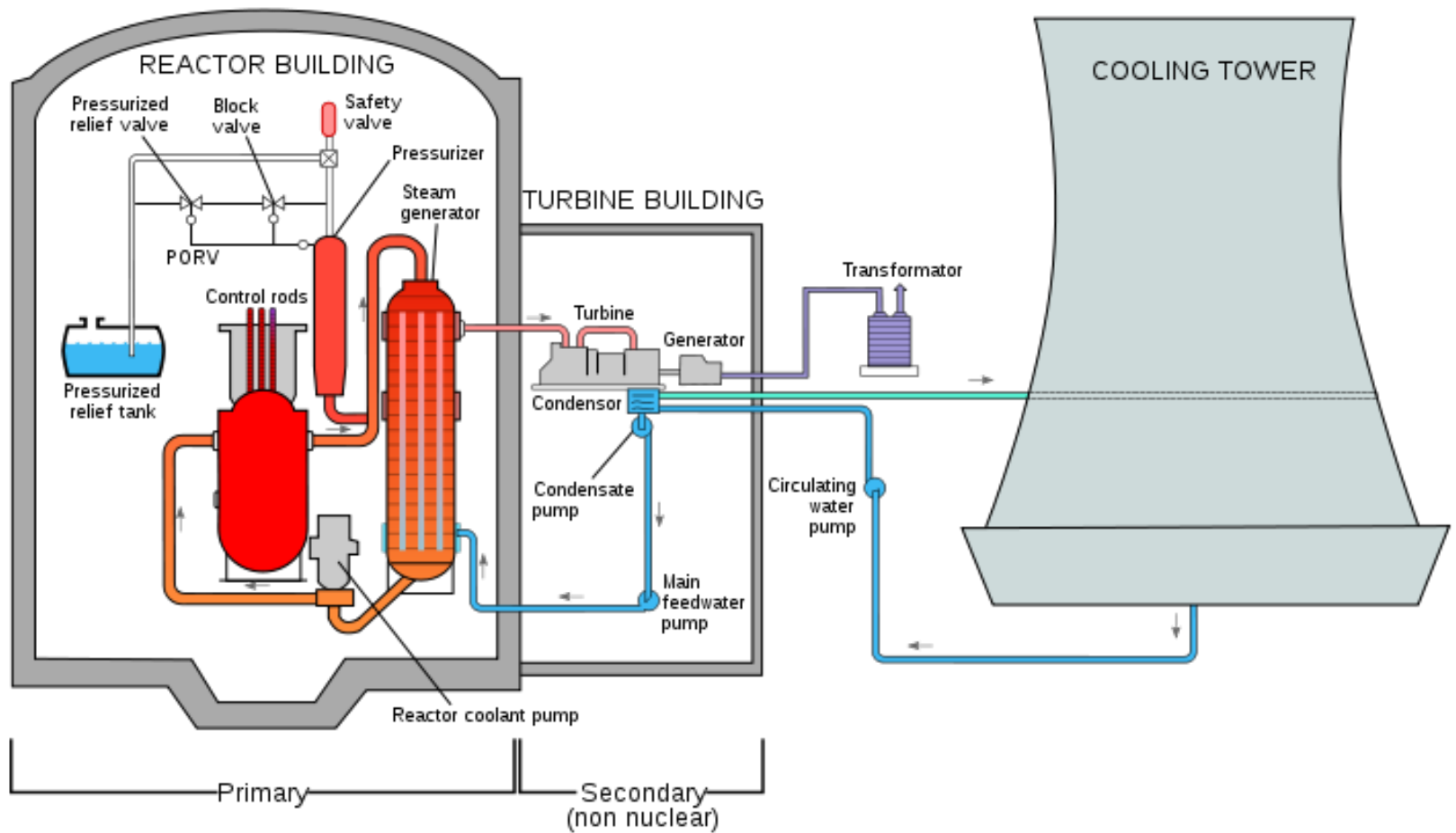
# AP-1000 Reactor



## **PRESSURIZED WATER REACTOR OPERATION**

- The reactor core transfers the fission energy, primarily kinetic energy created by recoil of the fission fragments in the fuel rods into thermal energy of the water which is both the moderator and the cooling agent in a Light Water Reactor
- Pressurized-water in the primary coolant loop carries the heat to the steam generator.
- Inside the steam generator heat from the primary coolant loop vaporizes the water in the secondary loop producing steam.
- The steam line directs the steam to the main turbine causing it to turn the turbine which is connected to the generator to create electrical power.
- The unused steam is condensed into water.
- The resulting water is pumped out of the condenser with a series of pumps, reheated and pumped back to the steam generator.

# Pressure Water Nuclear Power Plant





# AP-1000 Reactor

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## Steam Supply System

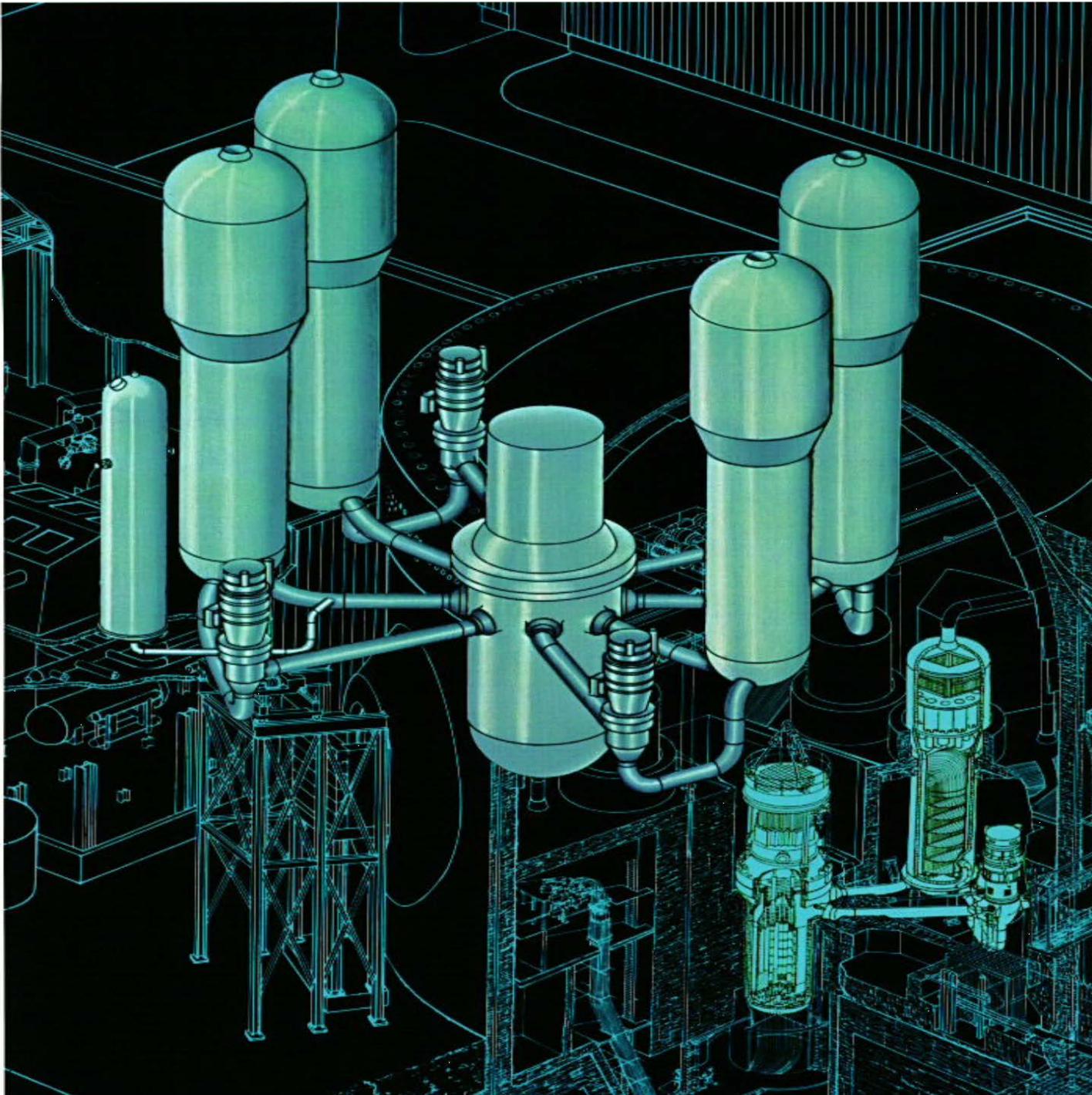
The Steam Cycle of the AP-1000 consists of:

- Reactor Assembly (Pressure Vessel)
- Steam Generators
- Pressurizers
- Heat-Transport System



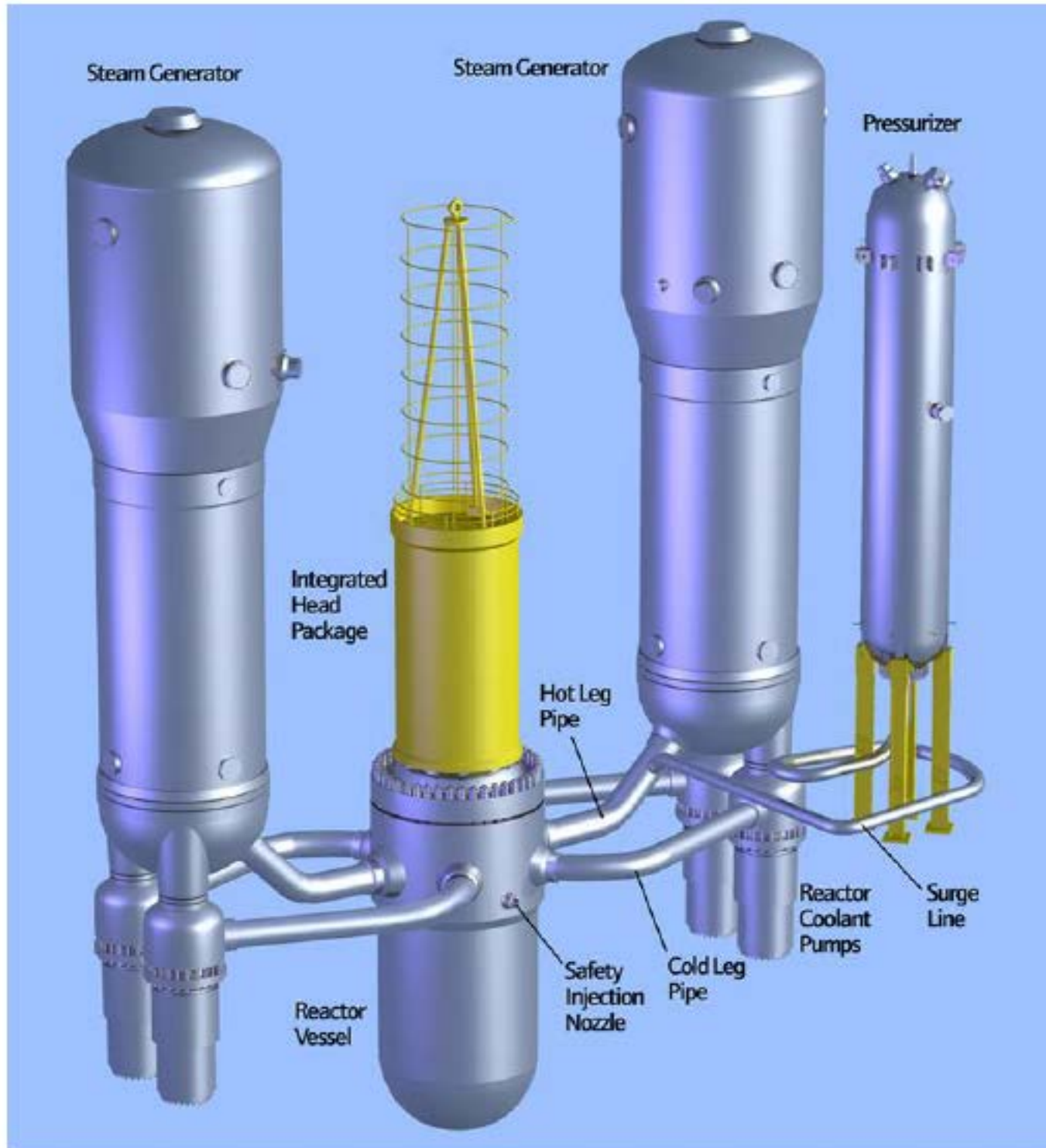
AP1000

# Steam Supply System

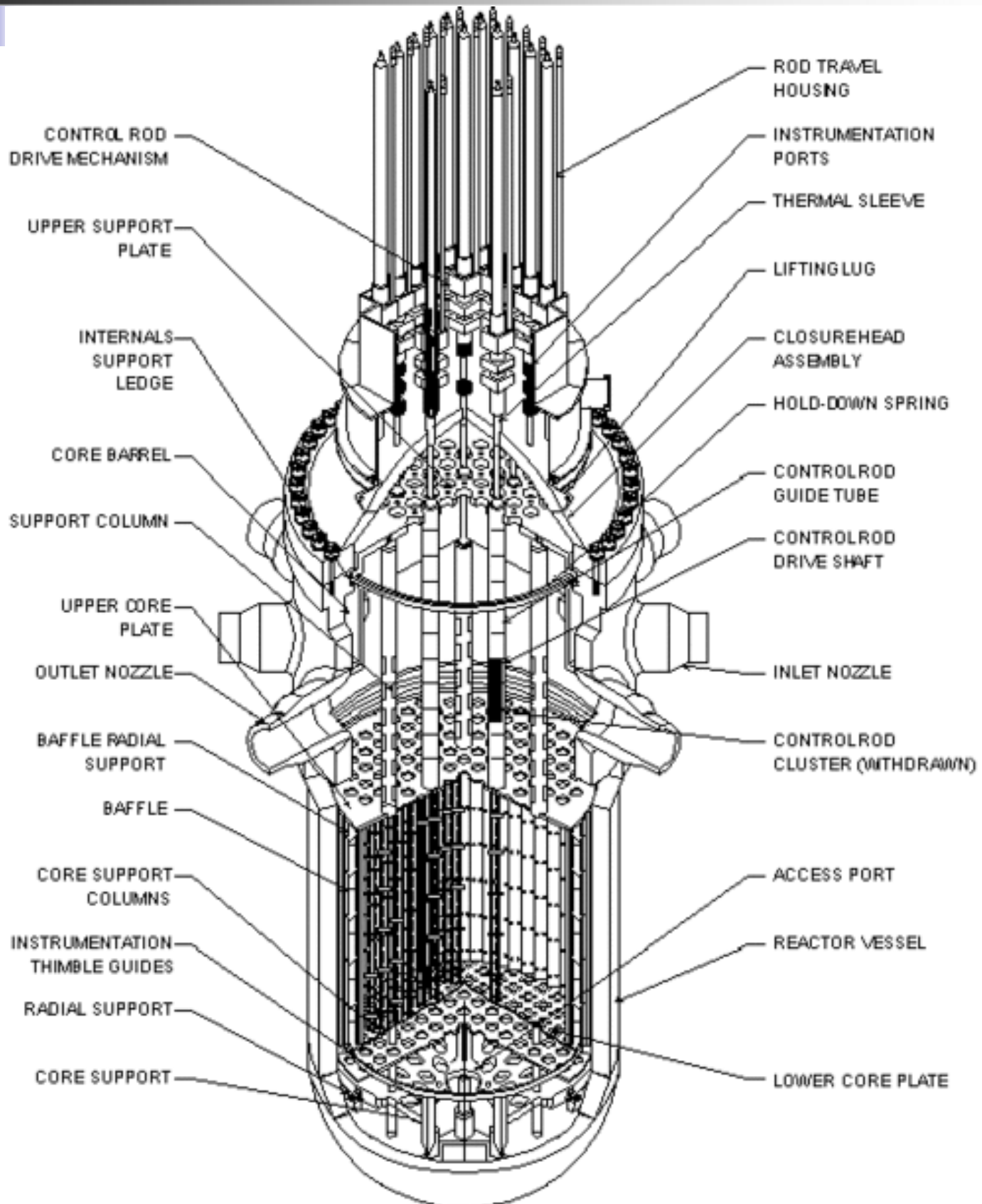


# AP1000

## Steam Supply System



# Pressure Vessel-One



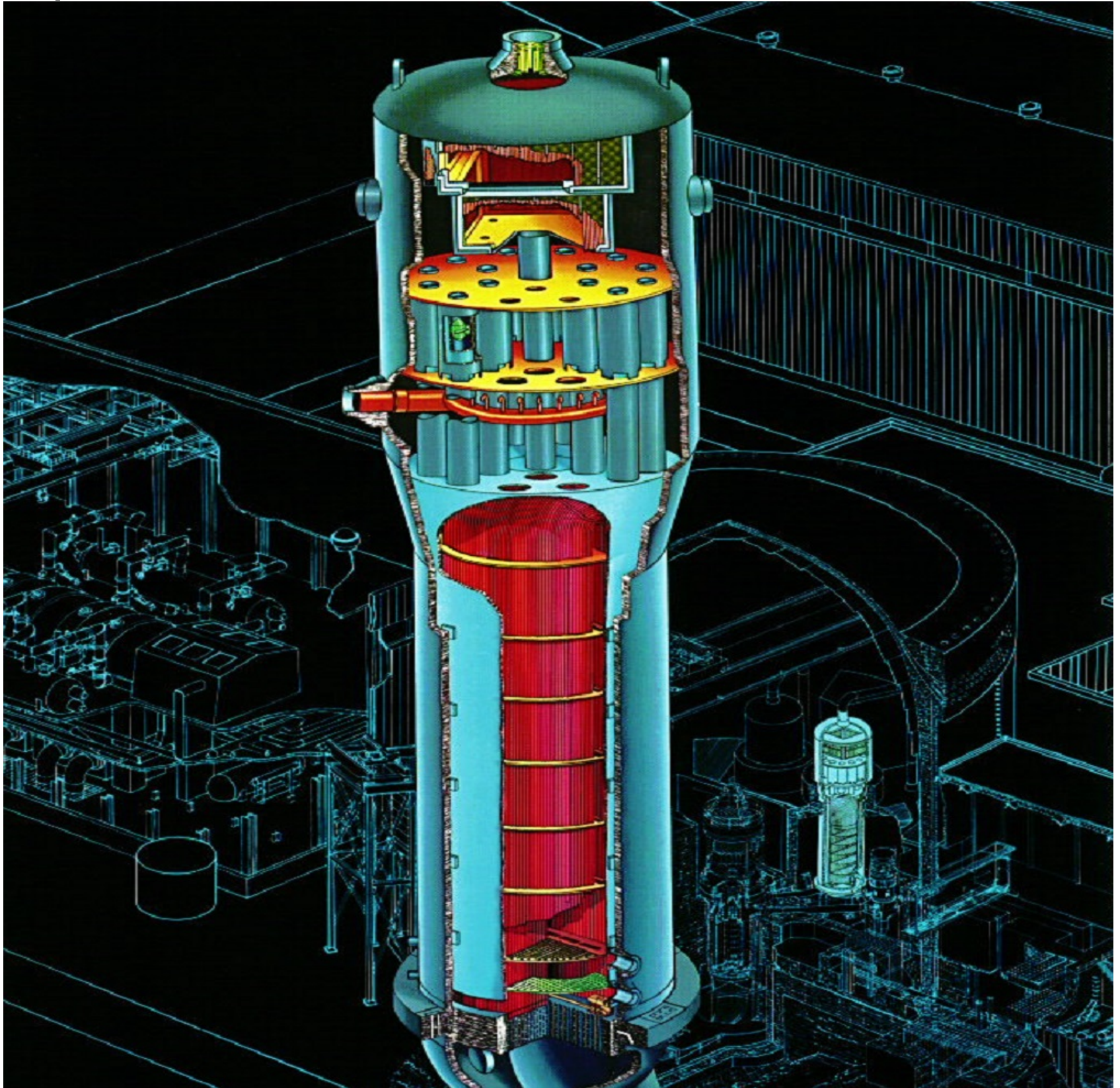
# Pressure Vessel-Two



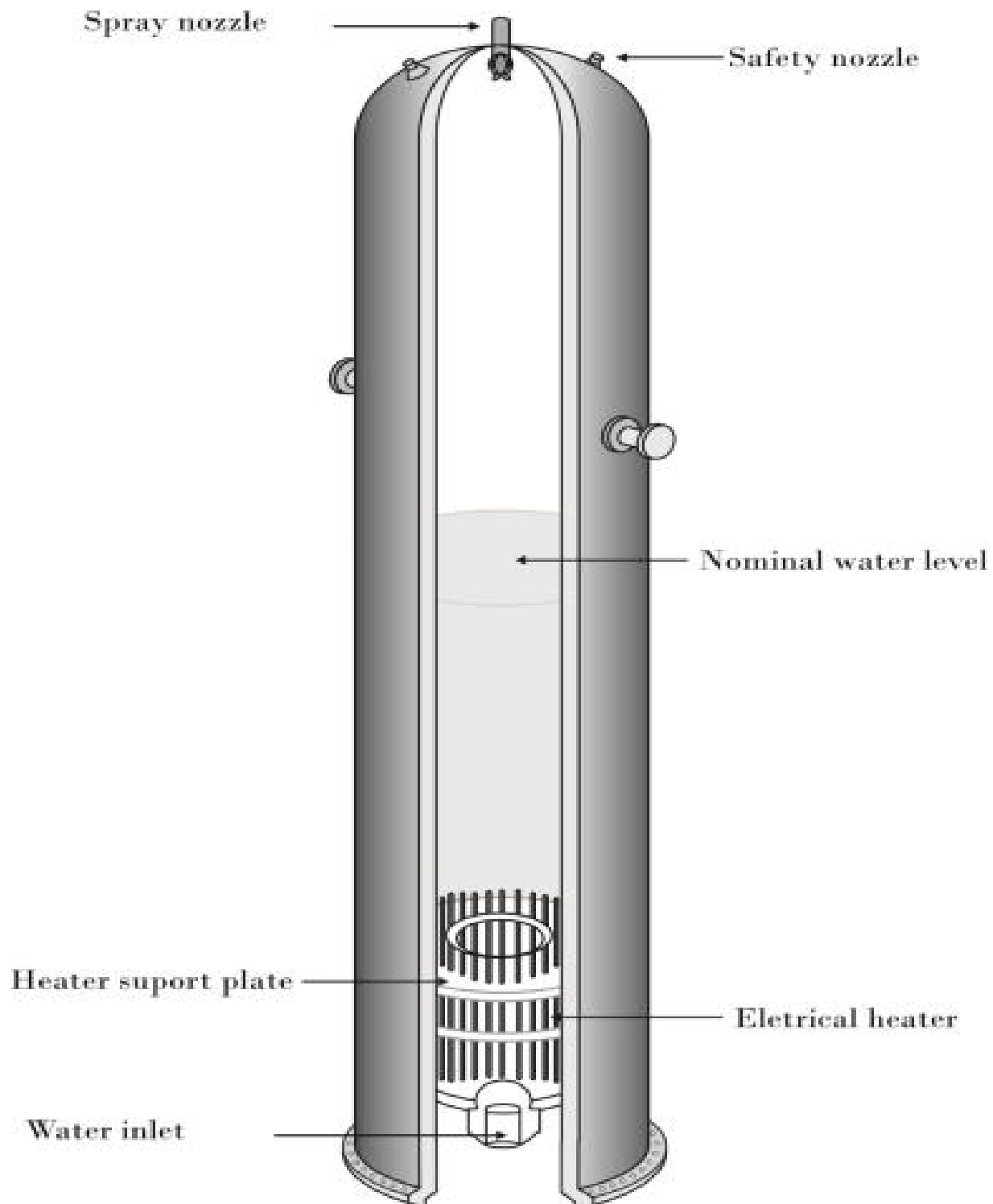
# Pressure Vessel-Three



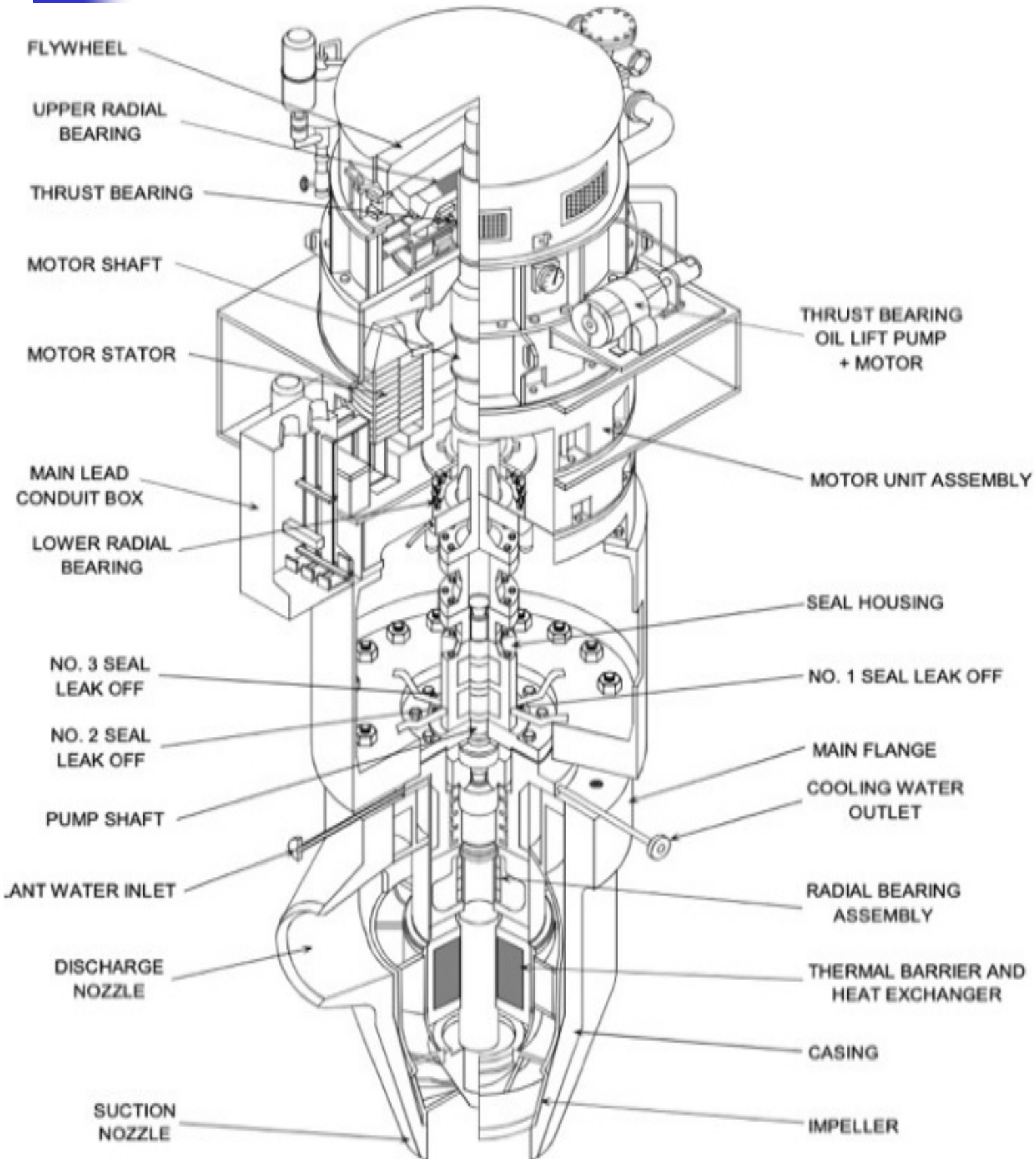
# AP1000-Steam Generator



# AP1000-Pressurizer

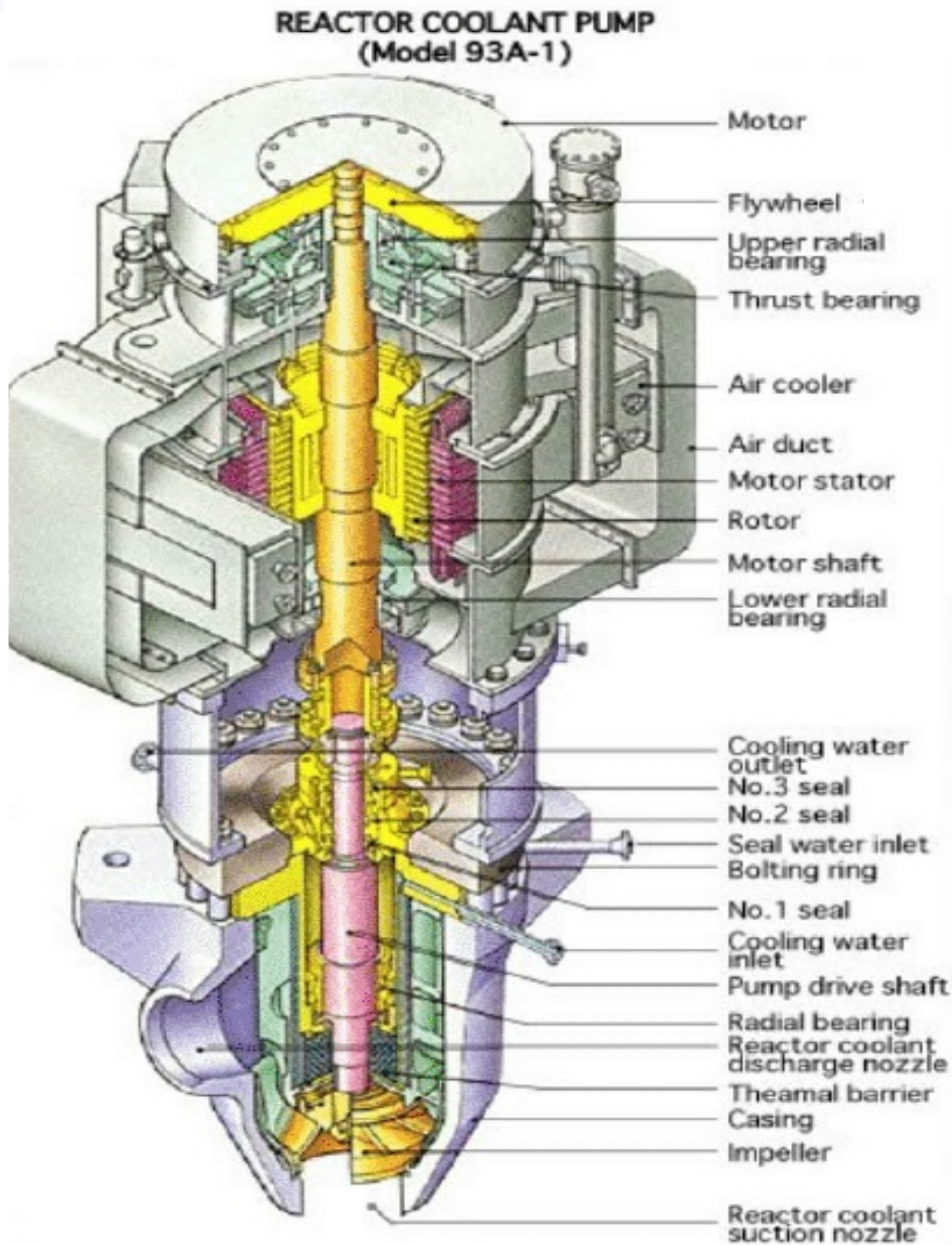


# AP1000-Cooling Pump-One





# AP1000-Cooling Pump-Two



# AP1000-Cooling Pump-Three

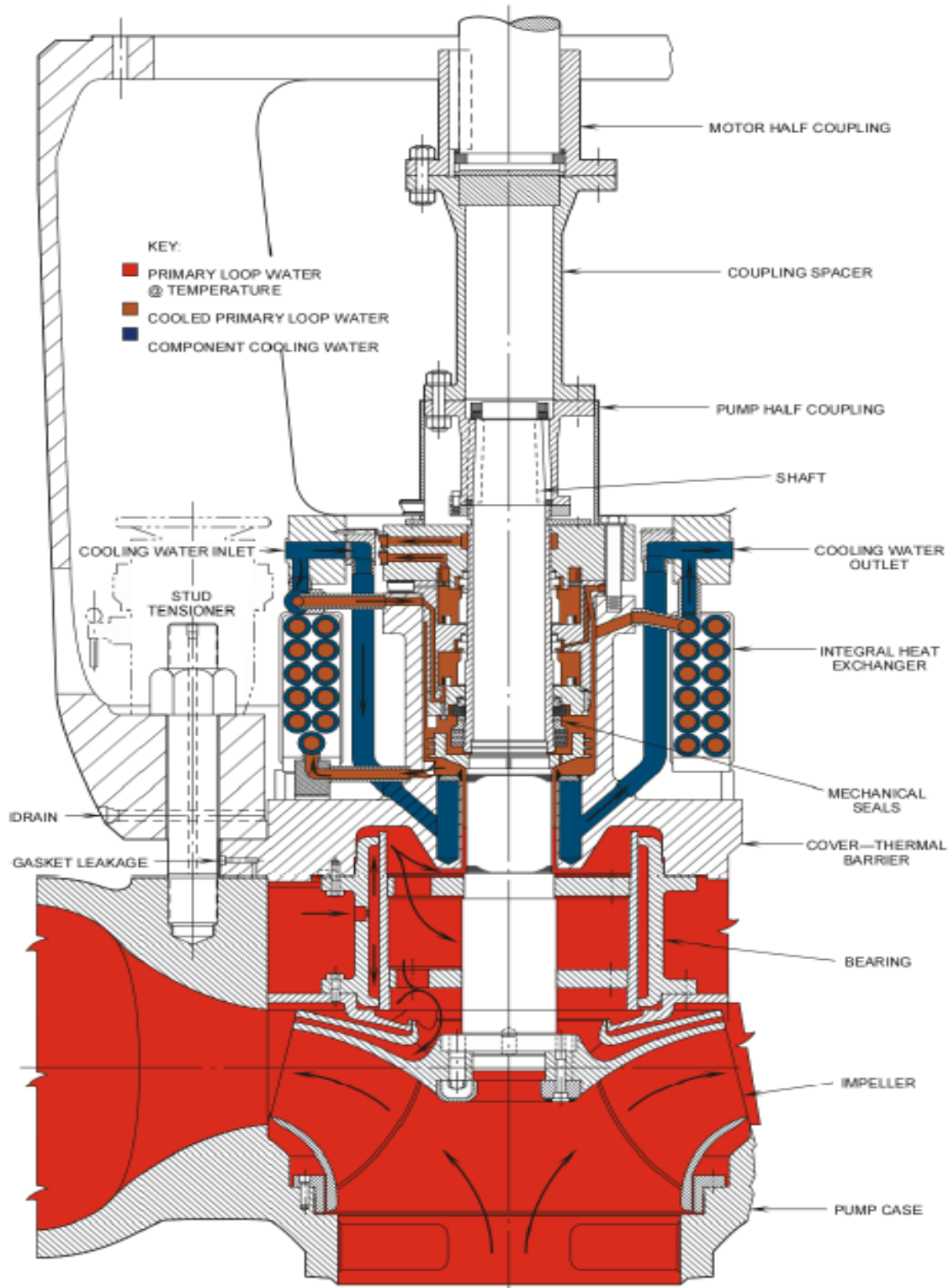
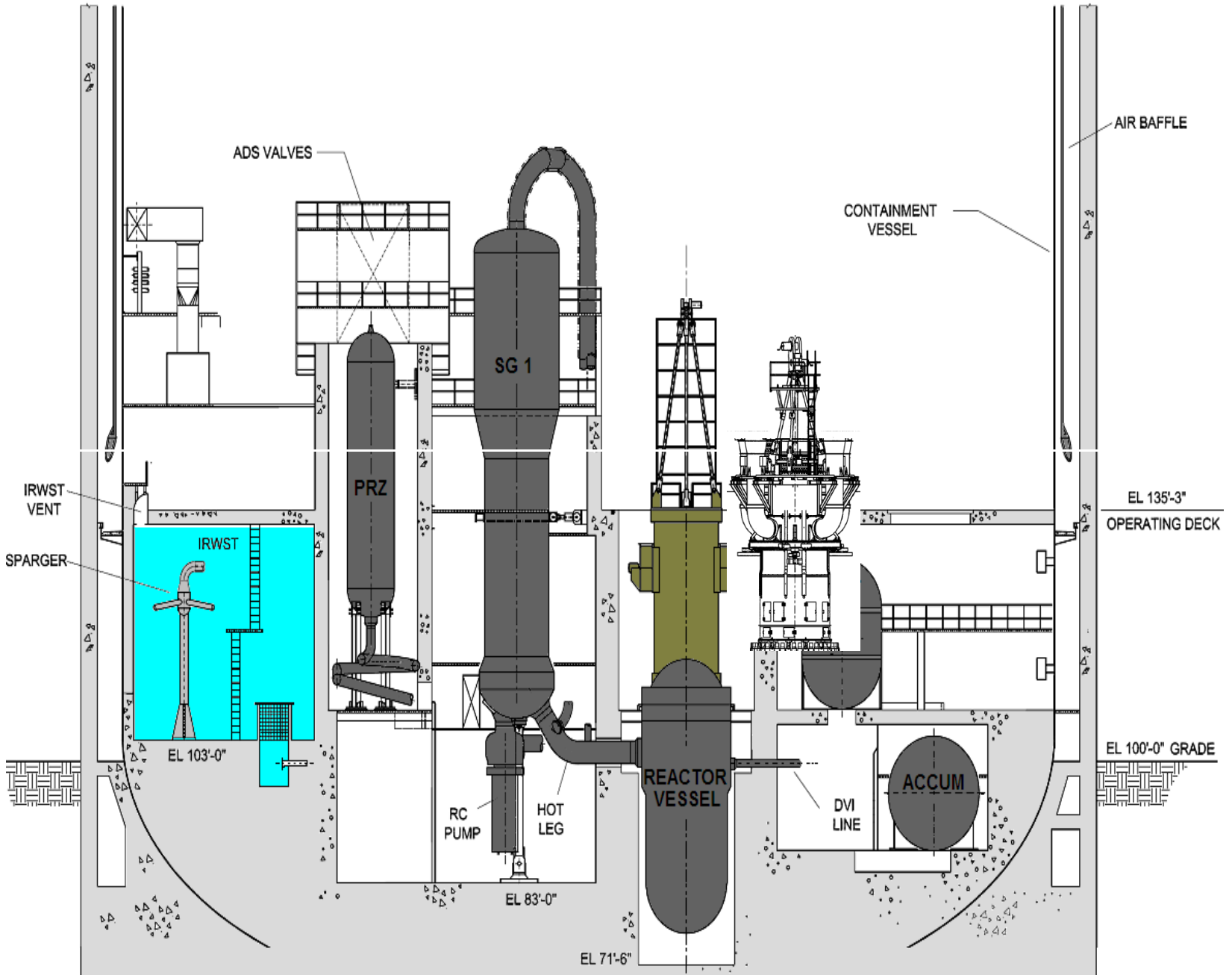
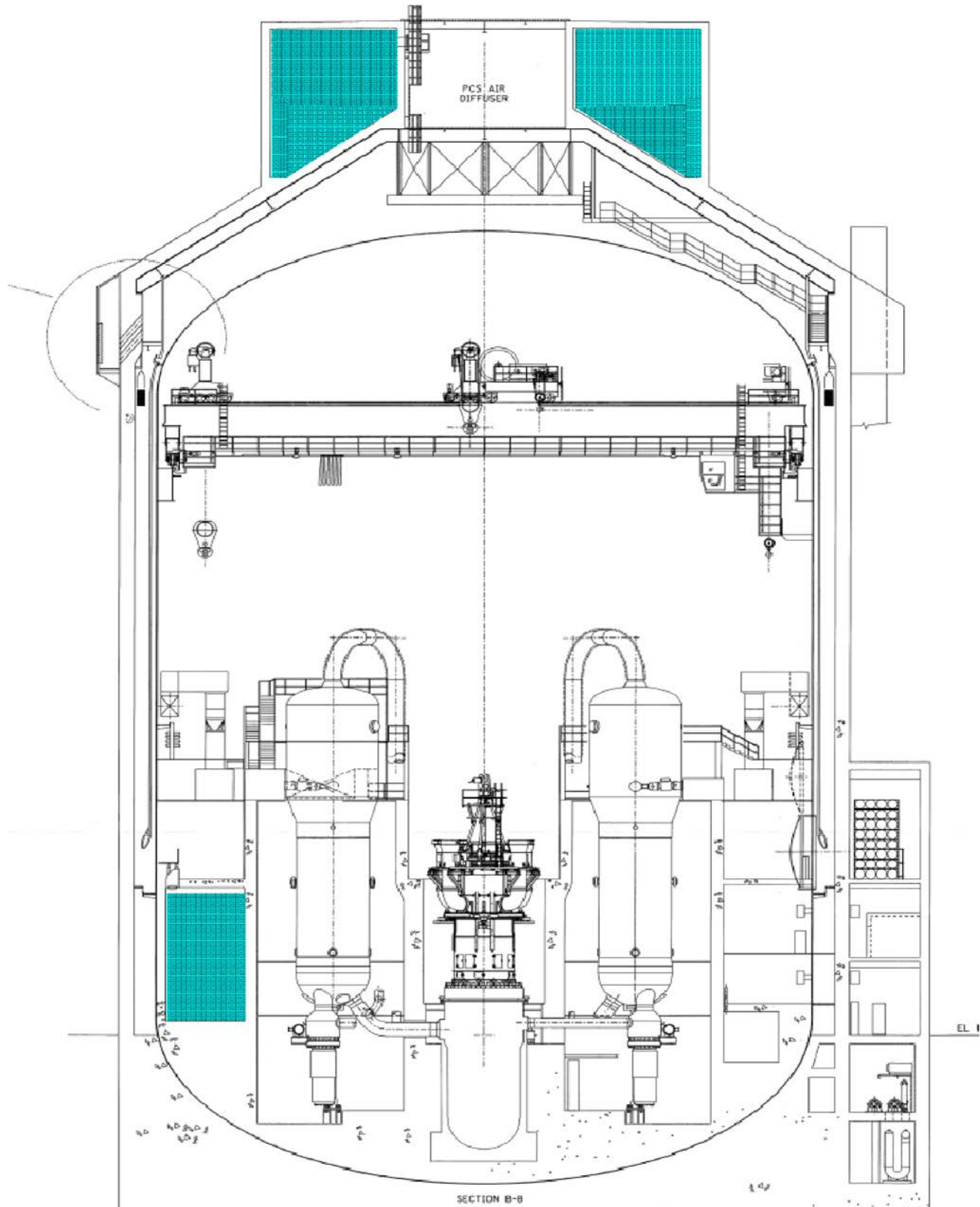


Figure 2.2-2 Reactor Coolant Pump Assembly

# Containment Layout-I



# Containment Layout-II

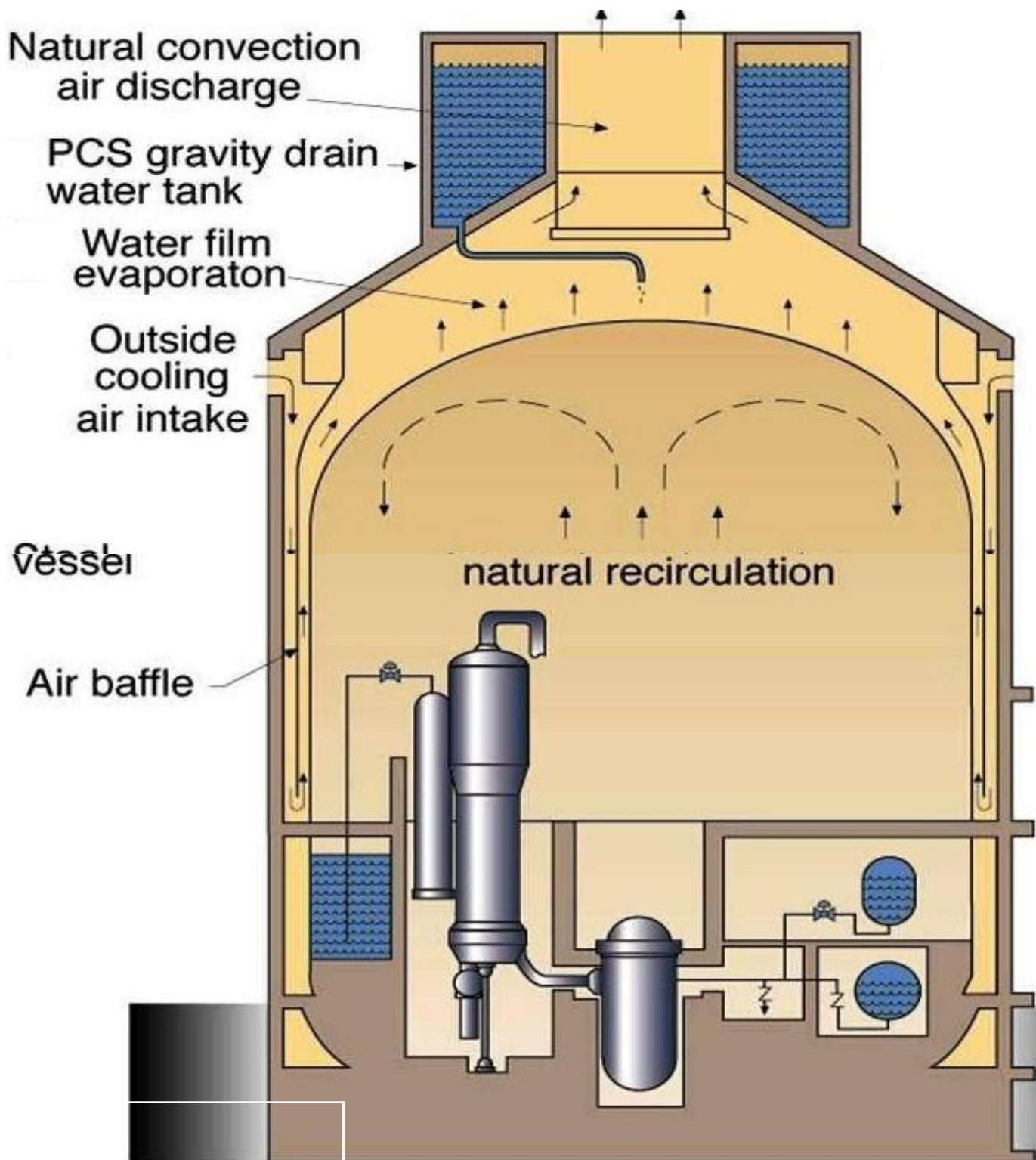


## Passive Containment Cooling System (PCS)

- Steel containment vessel is part of passive safety system.
- PCS transfers heat from the shell to the environment.
- Water from Passive Containment Cooling Water Storage Tank (PCCWST) wets outer shell for 72 hours.
- Natural convection air flow through containment annulus provides additional cooling.

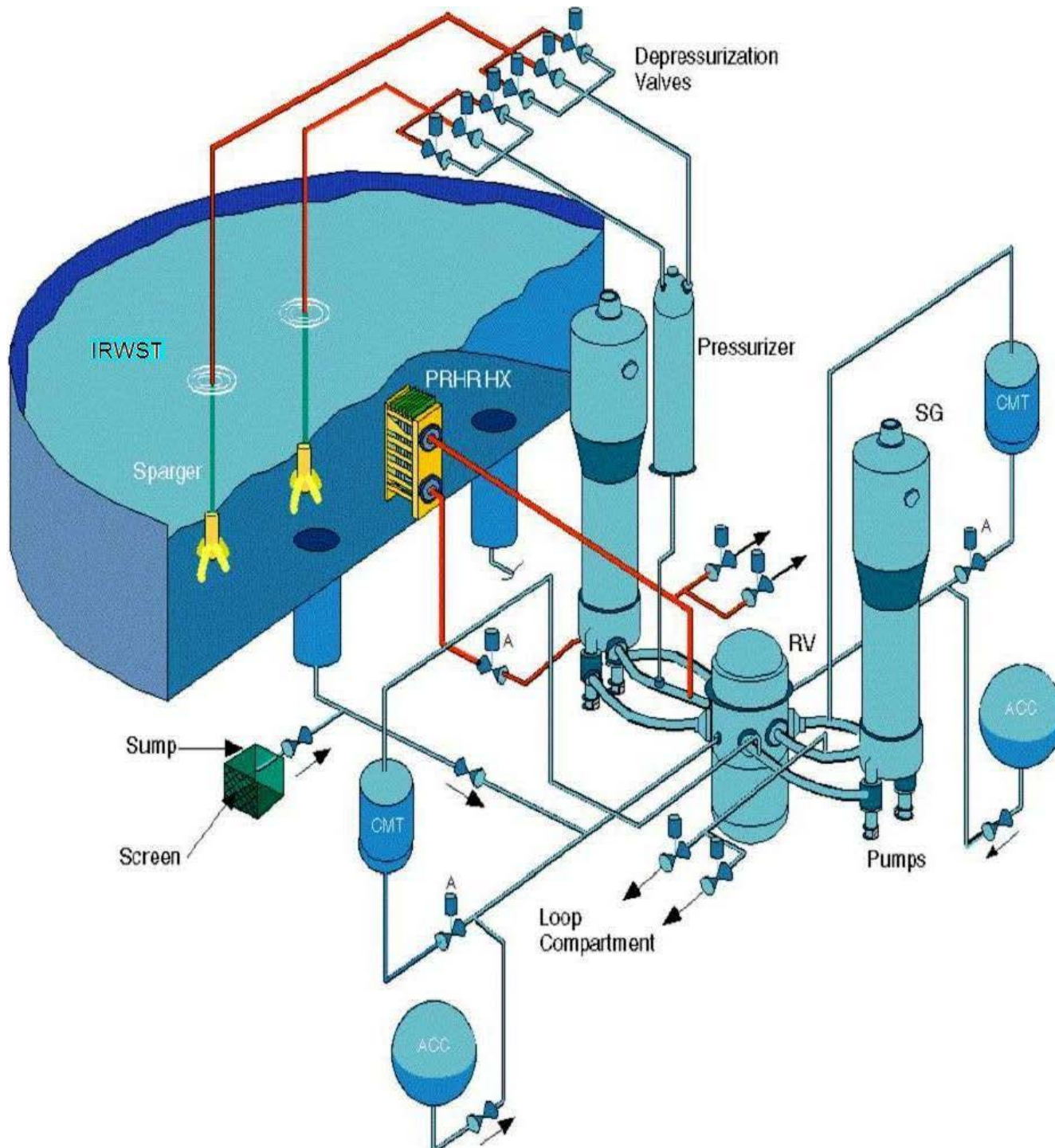
# Containment Layout-IV

## Passive Containment Cooling System (PCS)



# Containment Layout-V

## Passive Containment Cooling System (PCS)





# Passive Safety Features



- Passive Residual Heat Removal Heat Exchanger (PRHRHX)
  - Natural circulation HX connected to RCS
- Passive Safety Injection (PXS)
  - Core Makeup Tanks (CMTs)
  - N<sub>2</sub> pressurized accumulators
  - In-Containment Refueling Water Storage Tank (IRWST)
  - Automatic Depressurization System (ADS) valves, Pzr & HLs
- Passive Containment Cooling System (PCS)
  - Natural circulation of air / evaporation of water on outside surface of steel containment vessel



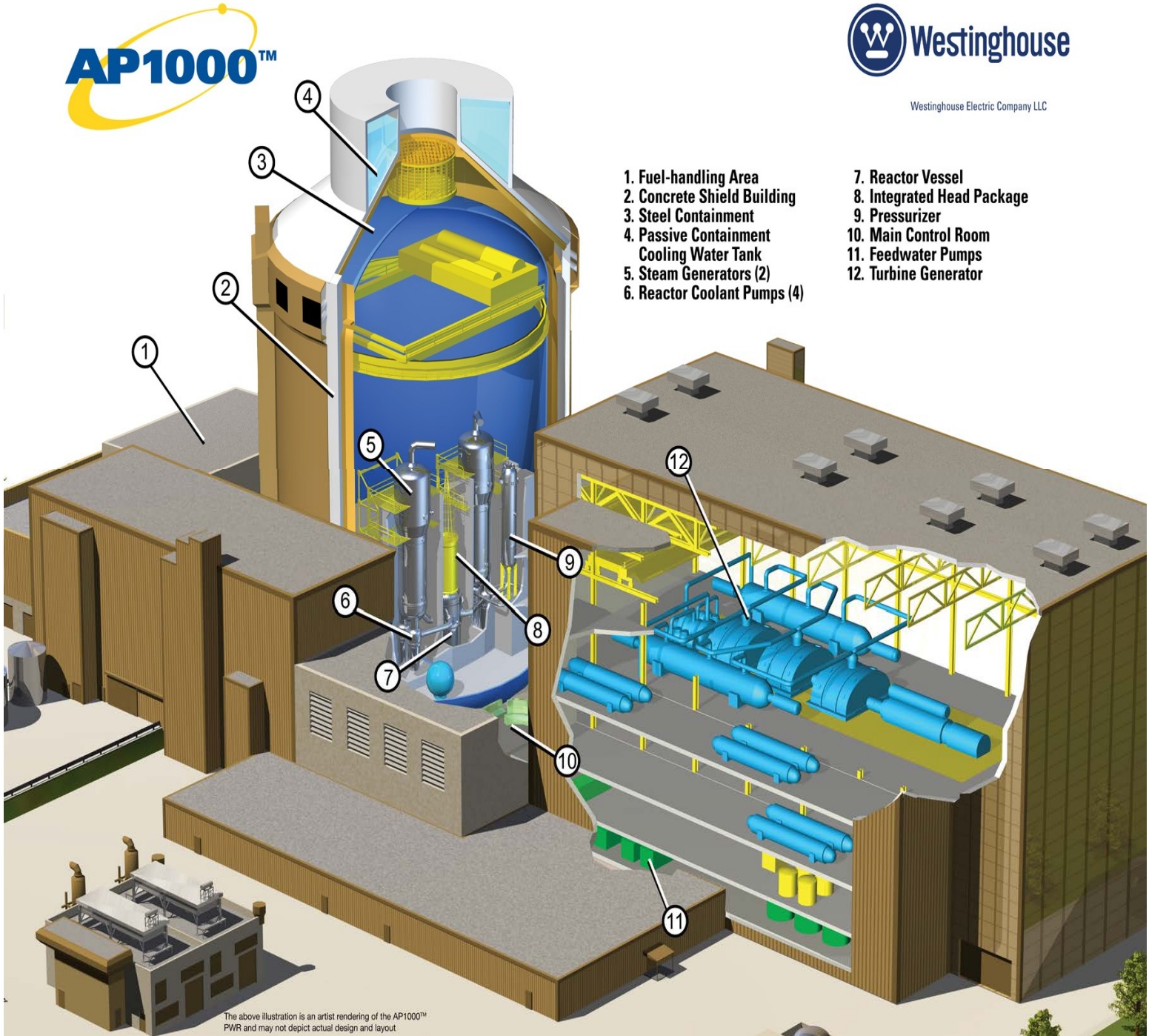
# AP1000 Plant Layout

AP1000<sup>TM</sup>



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