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U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

NEW REACTORS AND SMALL MODULAR REACTORS

Presented by

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Objectives

- NRC's Goals
- Operating Reactors
- New Reactor Licensing (Part 52)
- Small Modular Reactors
- Questions

NRC's Strategic Goals

- *Safety: Ensure adequate protection of public health and safety and the environment.*
- *Security: Ensure adequate protection in the secure use and management of radioactive materials.*

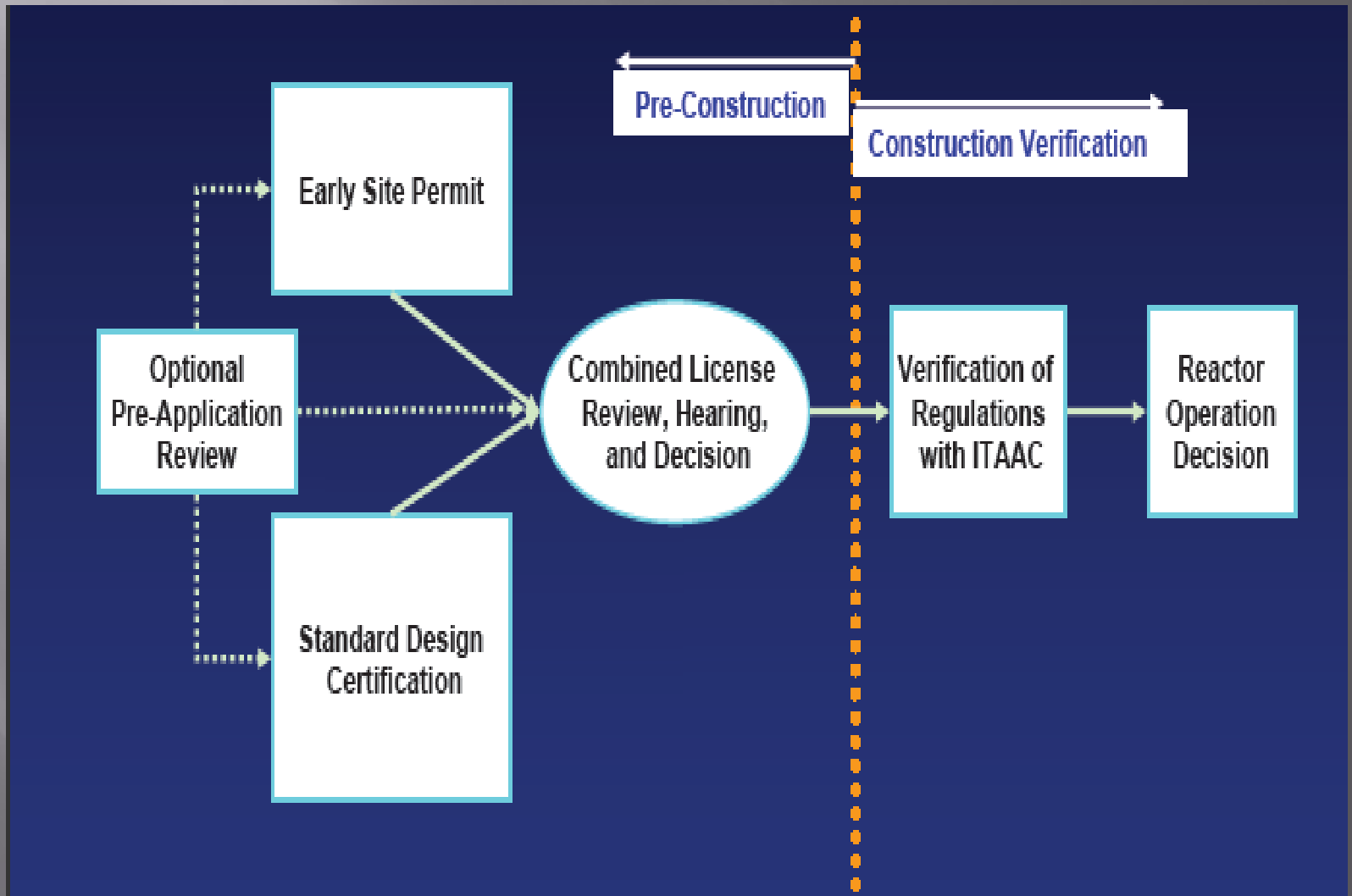
(Information Digest, NUREG-1350, Volume 23)

U. S. Operating Reactors

- 104 commercial nuclear power reactors
- 4 different reactor vendors
- 26 operating companies
- 65 sites

Part 50 Licensing Process

The Part 52 Process



Part 52 Licensing Process

- Licensing Process:
  - –Early Site Permit (ESP)
  - –Design Certification (DC)
  - –Combined License (COL)
- Provide a predictable licensing process
- Resolve safety and environmental issues before authorizing construction
- Provide for timely & meaningful public participation
- Encourage standardization of nuclear plant designs
- Reduce financial risk to nuclear plant licensees

Early Site Permits

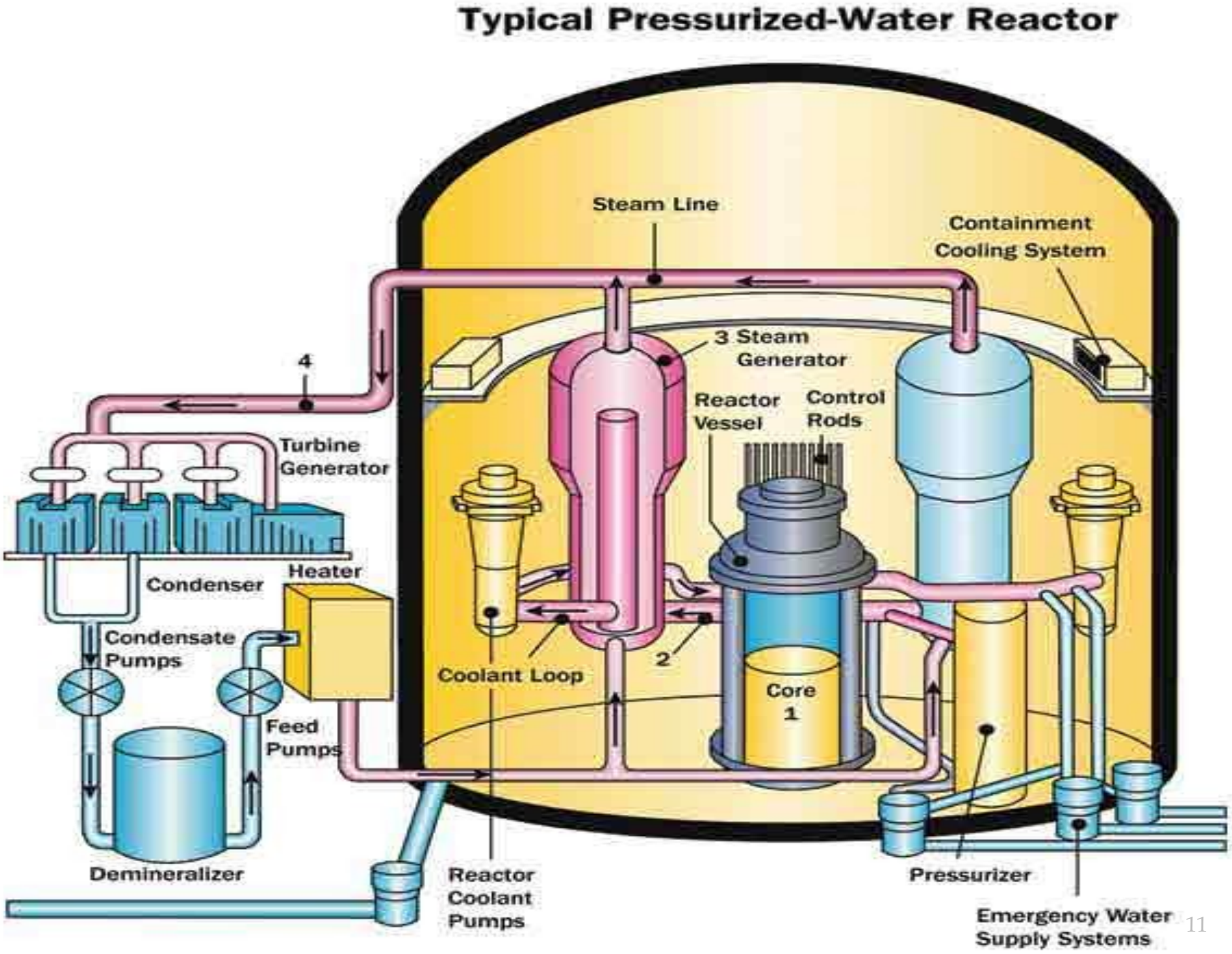
- Allows Early Resolution of Siting Issues and "Banking" of a Site for 10 –20 Years
- Review Areas Include:
  - Site safety
  - Environmental impact
  - Emergency preparedness

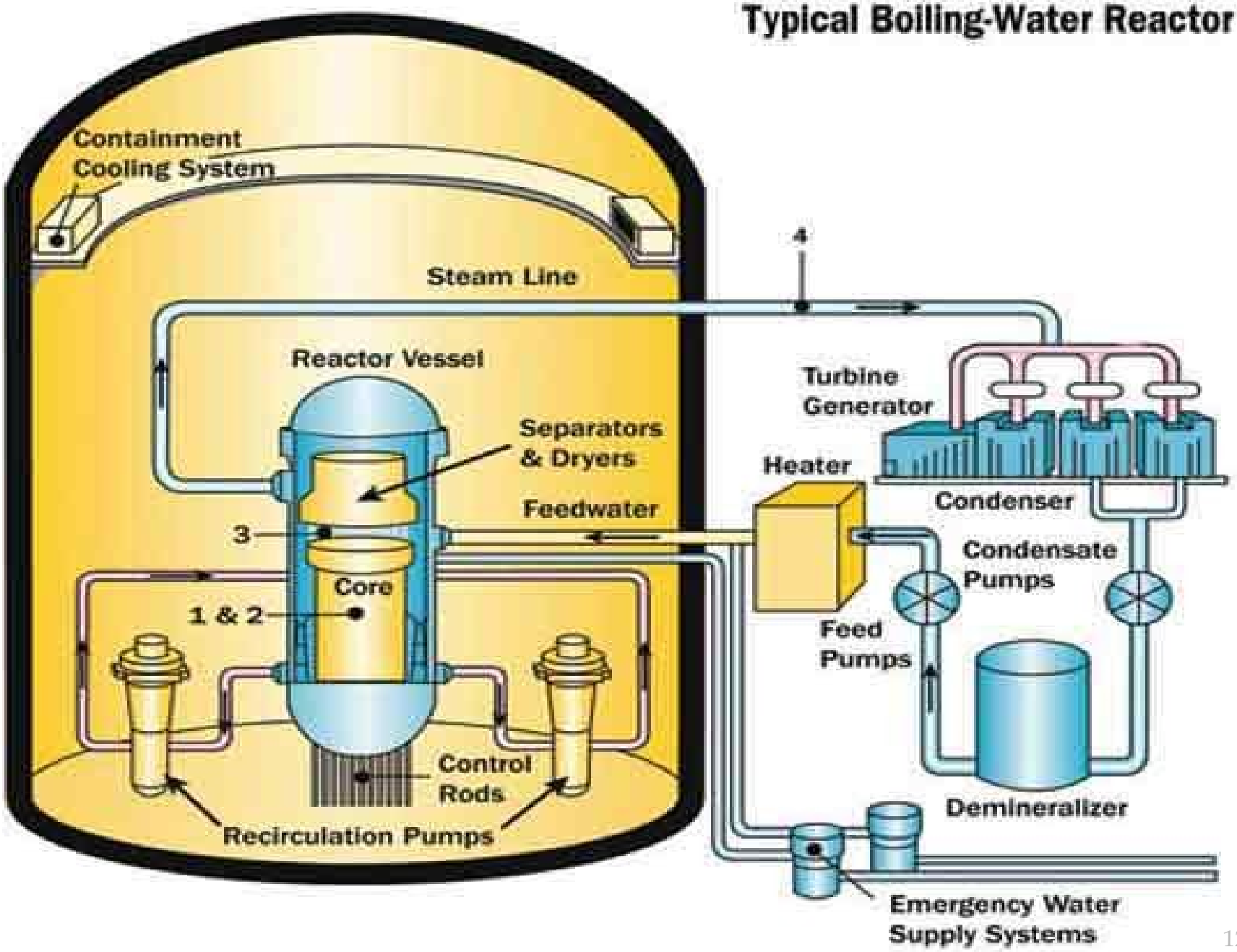
Design Certifications (DC)

- Allows an applicant to obtain pre-approval of a standard nuclear plant design
- Essentially complete design
- Reduces licensing uncertainty by resolving design issues
- Facilitates standardization
- Higher degree of regulatory finality with design certification

Combined license (COL)

- Combined construction permit and operating license with conditions for a nuclear power facility
- May reference an early site permit, a standard design certification, both, or neither
- Objective is to resolve all safety & environmental issues before authorizing construction


Typical Pressurized-Water Reactor
Steam Line
Containment Cooling System
3 Steam Generator
4
Reactor Vessel
Control Rods
Turbine Generator
Condenser
Heater
Condensate Pumps
Coolant Loop
2
Core 1
Feed Pumps
Demineralizer
Reactor Coolant Pumps
Pressurizer
Emergency Water Supply Systems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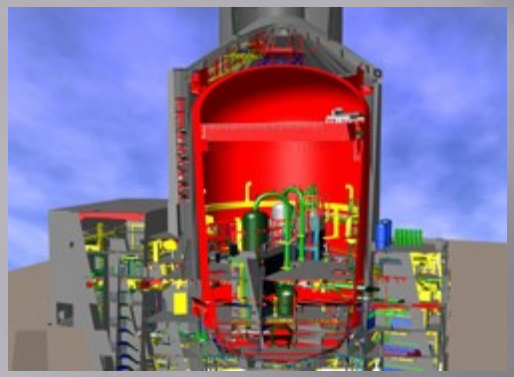
Reactor Vessel
Turbine
Generator
Separators
& Dryers
Heater
Feedwater
Condenser
3
Condensate
Pumps
Core
1 & 2
Feed
Pumps
Demineralizer
Control
Rods
Recirculation Pumps
Emergency Water
Supply Systems

New Reactor Designs

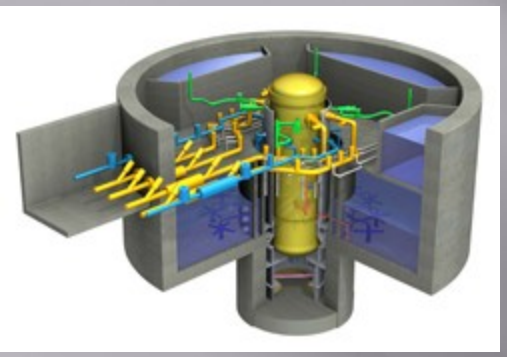
Issued Design Certification – Advanced Passive 1000 (AP1000), Rev. 15



Issued Design Certification – Advanced Boiling-Water Reactor (ABWR)

New Reactor Designs (cont.)

Design Certification Applications Currently Under NRC Review



Economic Simplified Boiling-Water Reactor (ESBWR)

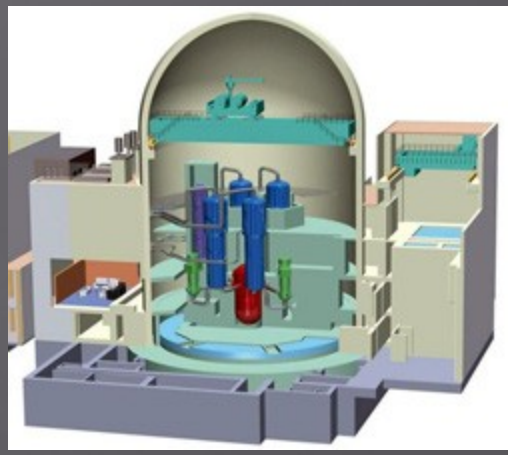
Who: GE-Hitachi Nuclear Energy (GEH)

What: Application for a Standard Design Certification for the Economic Simplified Boiling-Water Reactor (ESBWR), a 4,500 MWt reactor, which uses natural circulation for normal operation and has passive safety features.

U.S. Evolutionary Power Reactor (U.S. EPR)

Who: AREVA Nuclear Power

What: Application for Standard Design Certification for the U.S. Evolutionary Power Reactor (U.S. EPR), a 4500-MWt pressurized-water reactor



U.S. Advanced Pressurized-Water Reactor (US-APWR)

Who: Mitsubishi Heavy Industries, Ltd.

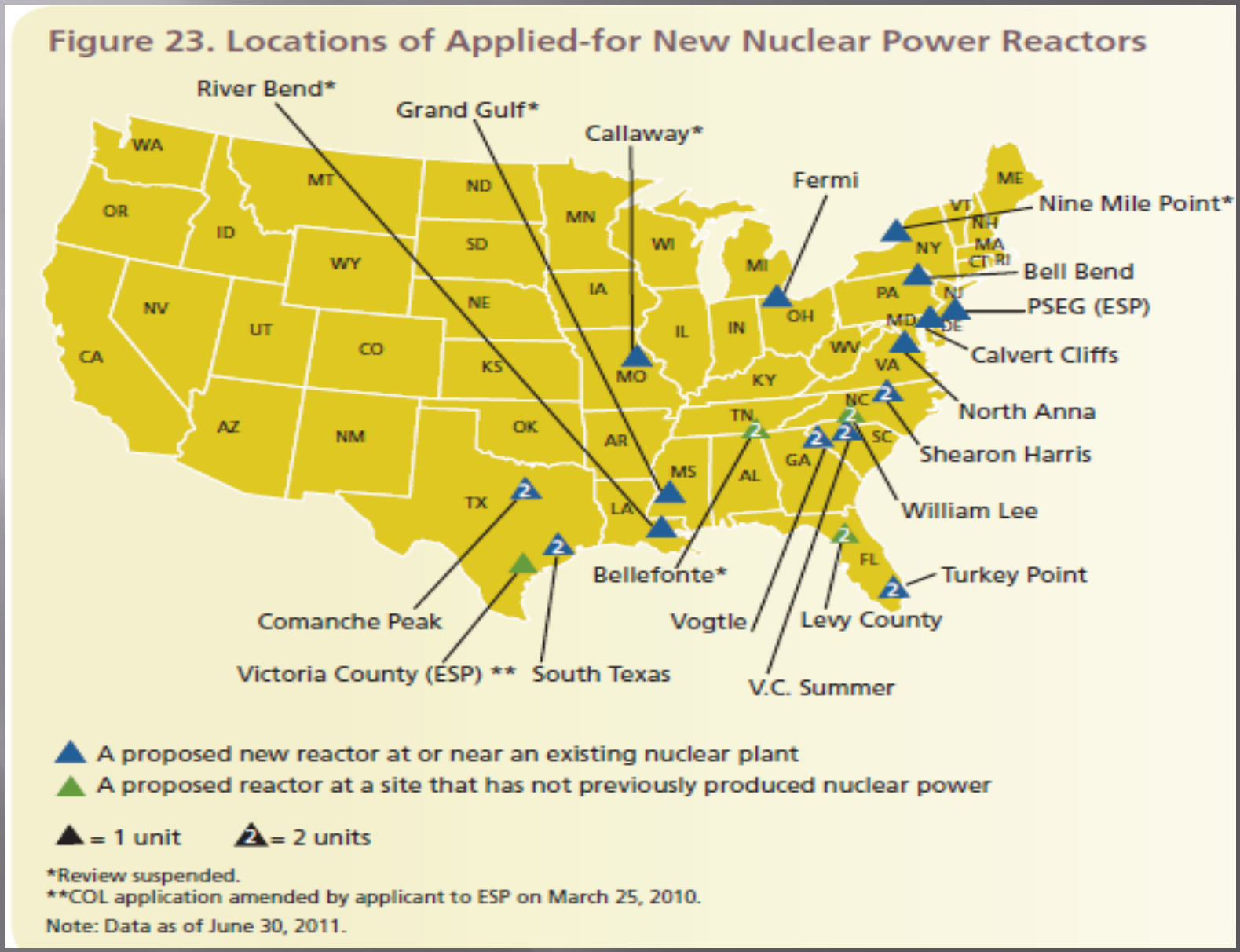
What: Application for Standard Design Certification for the U.S. Advanced Pressurized-Water Reactor (US-APWR), a 4,451-MWt pressurized-water reactor (PWR)

New vs. Operating Reactors

What makes these new designs better?

- The new designs reflect evolutionary and advanced features and enhancements as compared to the designs of currently operating reactors.
- The designs are expected to increase plant availability, operating capacity, safety, and reliability.
- Some designs contain passive safety systems, simplified system designs, and redundant systems.

Locations for New Reactors



Advanced Reactors

- Reactor designers are developing a number of small light-water reactor (LWR) and non-LWR designs employing innovative solutions to technical nuclear power issues.
- These designs could be used for generating electricity in isolated areas or producing high-temperature process heat for industrial purposes.

Advanced Reactors (cont.)

- The NRC has developed its current regulations on the basis of experience gained over the past 40 years from the design and operation of light-water reactor (LWR) facilities.
- To facilitate the licensing of new reactor designs that differ from the current generation of large LWR facilities, the NRC staff seeks to resolve key safety and licensing issues and develop a regulatory infrastructure to support licensing review of these unique reactor designs.

Small Modular Reactors (SMRs)

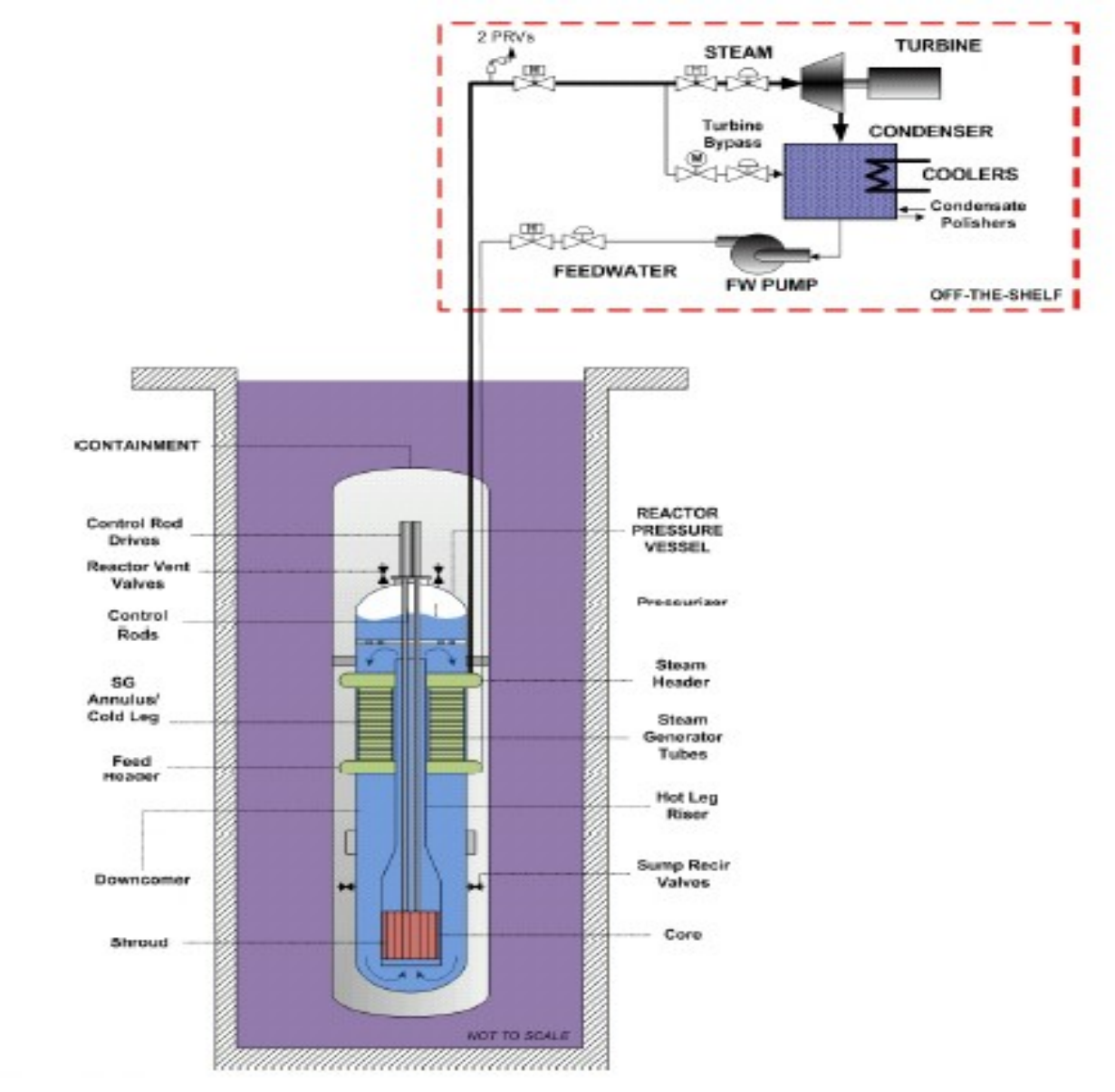
- Small Light-Water Reactor (LWR)
- Non-LWR
- Used for generating electricity in isolated areas or producing high-temperature process heat for industrial purposes.

NuScale Power Inc.

The NRC is working with NuScale in the pre-application phase for activities associated with the NuScale Small modular reactor (SMR) design. More specifically, NuScale is:

- An integral pressurized-water reactor (iPWR)
- Designed by NuScale Power, Inc.
- Based on MASLWR (Multi-Application Small Light Water Reactor).
- A natural circulation LWR with the reactor core and helical coil steam generator located in a common reactor vessel in a cylindrical steel containment.
- The reactor building is located below grade and is designed to hold 12 SMRs.
- Each NuScale SMR has a rated thermal output of 160 MWt and electrical output of 45 MWe, yielding a total capacity of 540 MWe for 12 SMRs.

NuScale SMR Design

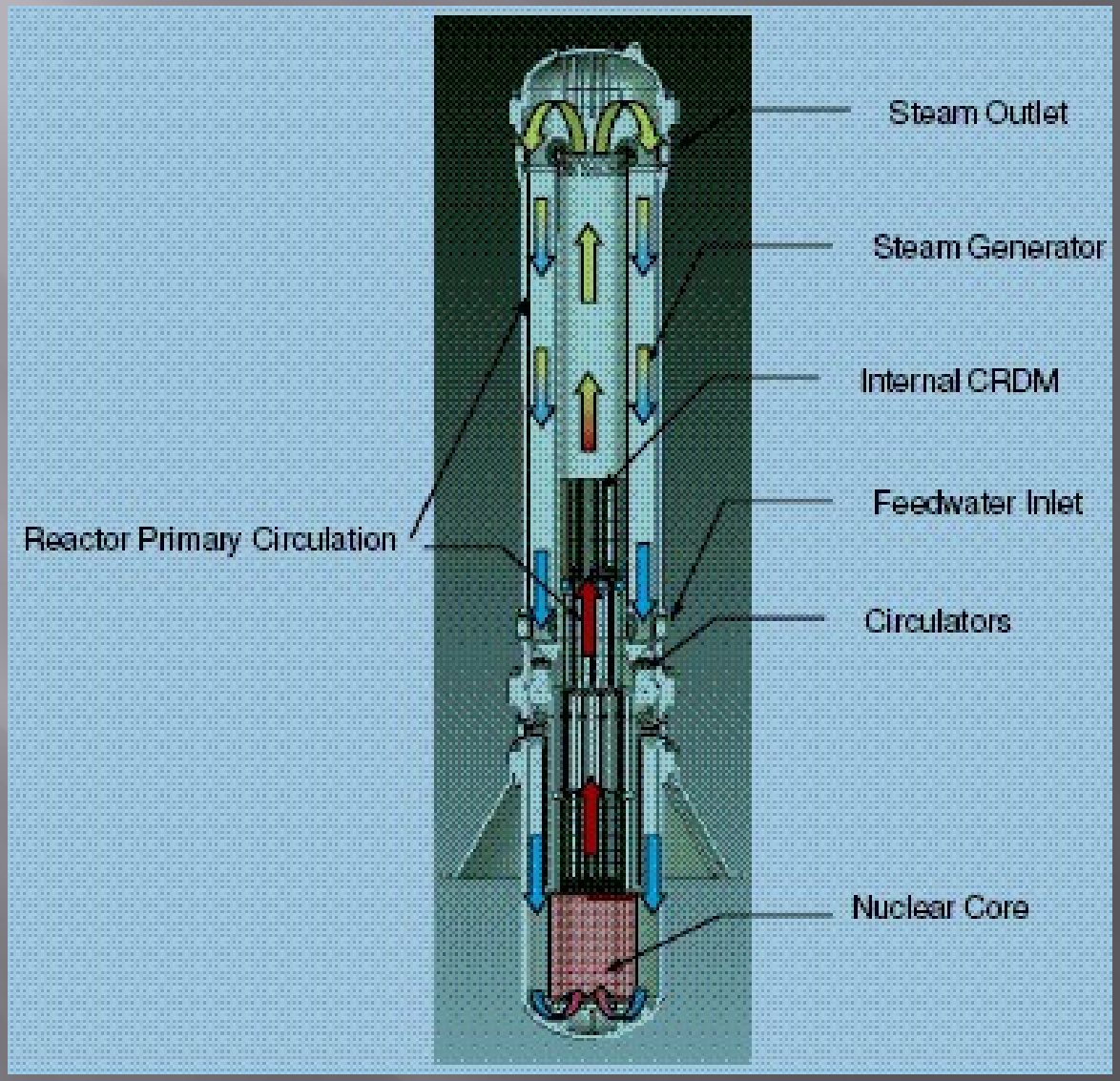


Babcock & Wilcox Company (B&W)

The NRC is engaged in pre-application activities on the mPower small modular reactor design. A few specifics about mPower include:

- An integral pressurized-water reactor (iPWR)
- Designed by the Babcock & Wilcox Company
- Light water reactor
- Rated thermal output of 400 MWt
- Electrical output of 125 MWe

B&W mPower Design



QUESTIONS?

For more information, please visit the NRC's website at www.nrc.gov.