Safety Culture and the AP1000 Plant Design

IEEE Meeting

August 28, 2007

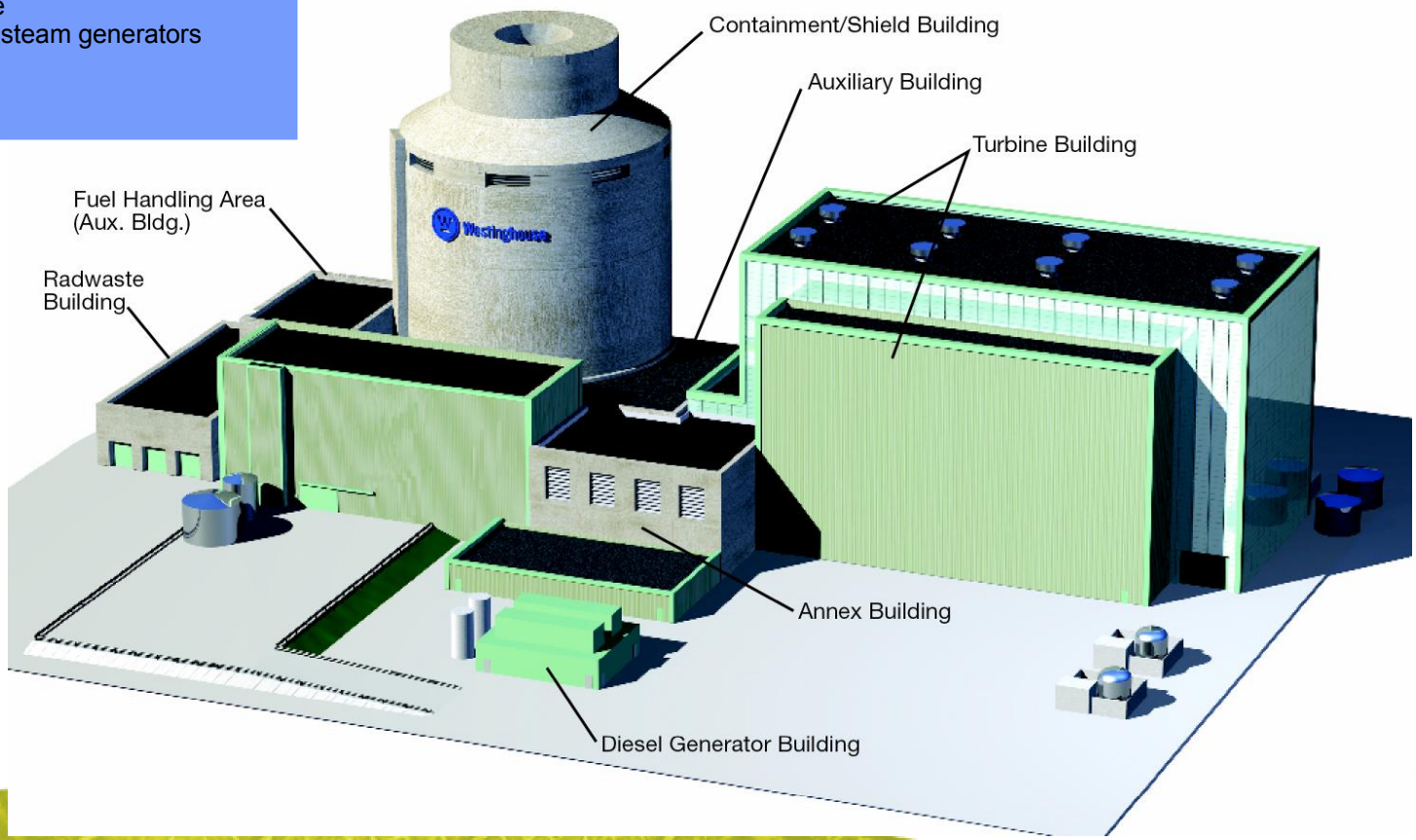
Attributes of a Strong Safety Culture

- Safety is a clearly recognized value
- Leadership for safety is clear
- Accountability for safety is clear
- Safety is integrated into all activities
- Safety is learning driven

The following is a look at how these attributes are evident in the AP1000 plant design and design processes.

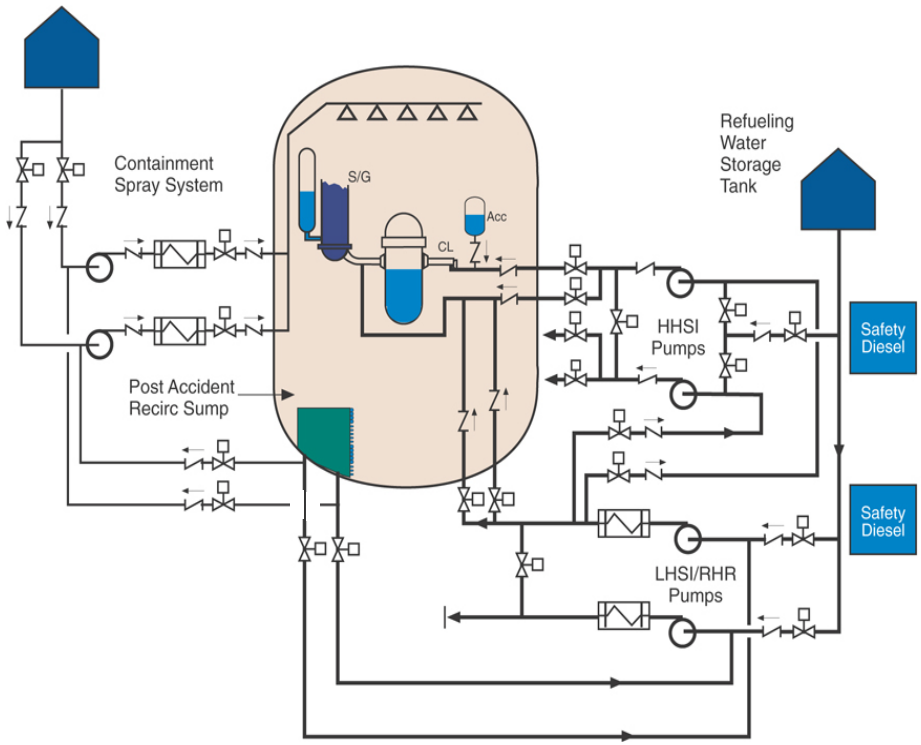
The Westinghouse AP1000

A compact station
- 3415 MWt, primary system
- 1117 MWe
- 2-loops, 2 steam generators

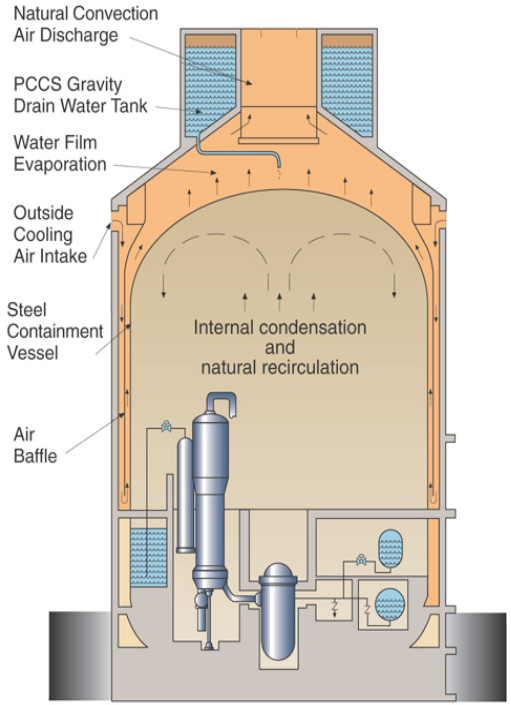


AP1000 Passive Safety Systems

Standard PWR



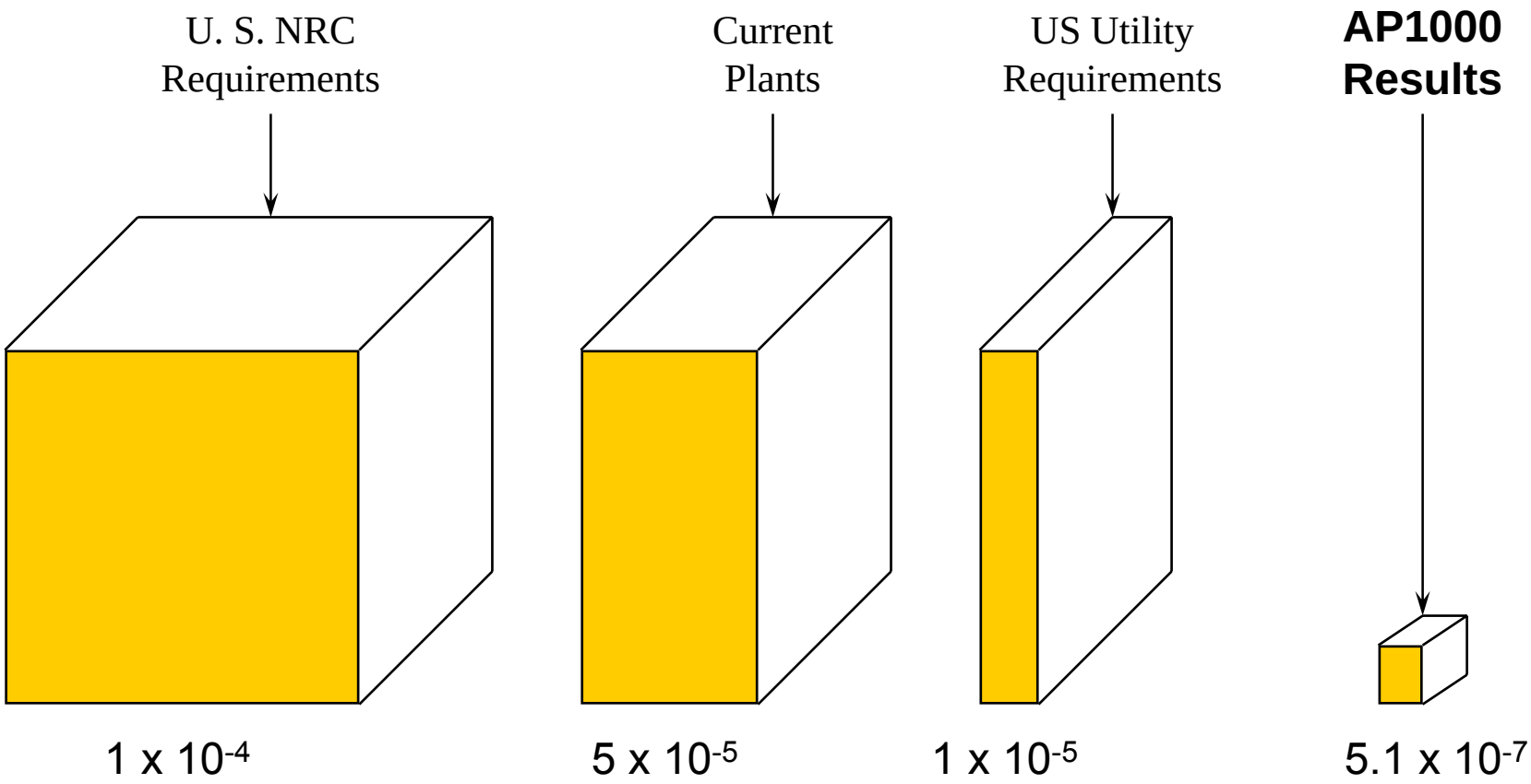
AP1000



AP1000 Development Timeline

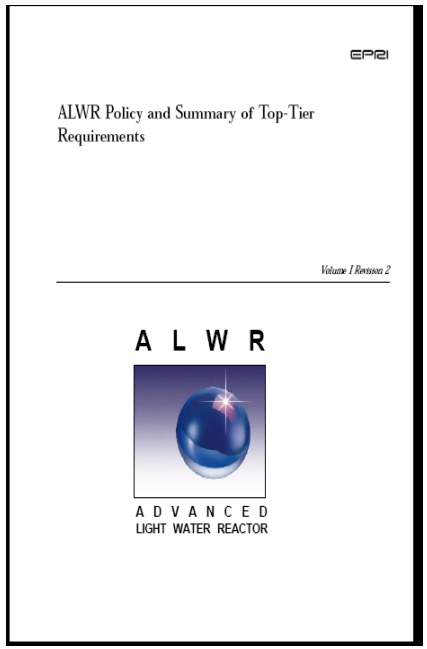
- 1985 -1990
  - Industry program led by EPRI to establish utility requirements for Advanced Light Water Reactors
  - Early AP600 Design and Testing Activities
  - NRC adopts Part 52 licensing process
- 1990 - 1999
  - AP600 Development and Design Certification
    - Utility / DOE program for first of a kind engineering
    - Extensive testing of passive safety features
    - SSAR and PRA reports submitted to NRC
    - Design Certification granted by NRC
- 2000 - present
  - AP600 uprated to AP1000 – design / analysis / testing
  - Design Certification granted by NRC at end of 2005
  - Combined License applications using AP1000 technology

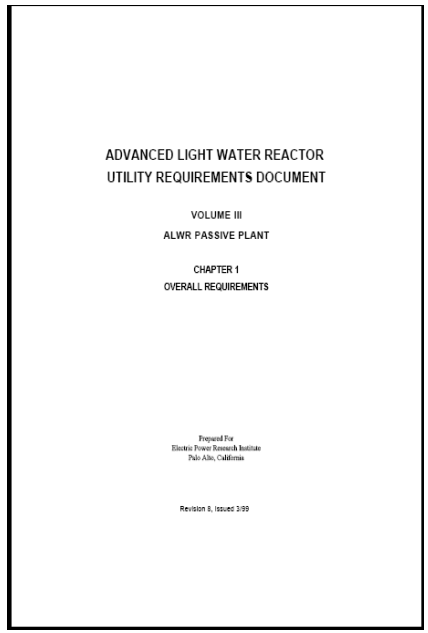
Safety is a clearly recognized value



Leadership for safety is clear

- **AP1000 Was Developed To Meet Advanced Light Water Reactor Utility Requirements (ALWR URD)**
  - **Issues were discussed with EPRI ALWR Staff and Utility Staff**
  - **All issues were resolved**
    - **Sometimes the design was changed**
    - **Sometimes URD requirements were changed**

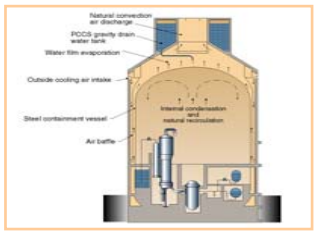




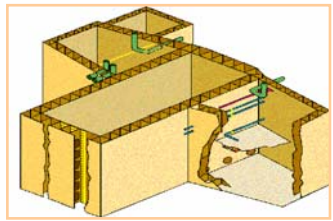
Accountability for safety is clear

U.S. NRC Review of AP600 and AP1000		
	AP1000	**AP600**
Level of review	Final Design Approval	Final Design Approval
Material submitted for review • Safety Analysis Report • Probabilistic Risk Assessment Report	 ~ 6500 pages ~ 4500 pages	 ~ 6500 pages ~ 4500 pages
Dates of review	2 1/2 years (3/02 – 9/04)	6+ years (6/92 – 9/98)
U.S. NRC review effort • Formal written questions • U.S. NRC meetings • ACRS meetings • U.S. NRC independent safety analysis • U.S. NRC independent tests	31 man-years 820 23 20 yes yes	110 man-years 7400 380 43 yes yes
U.S. NRC Safety Evaluation Report	NUREG-1793, 9/04 (~2400 pages)	NUREG-1512, 9/98 (~2700 pages)

Safety is integrated into all activities

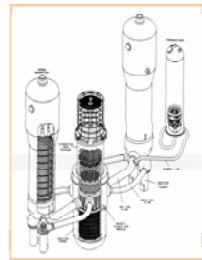


Passive Safety Systems

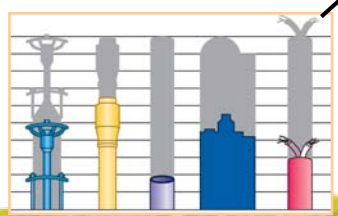


Modular Construction

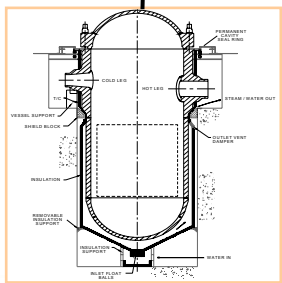
US Licensing Approval



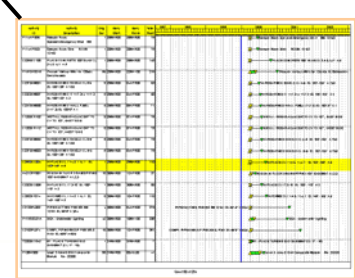
Advanced Design Features



Reduced Components & Commodity Components



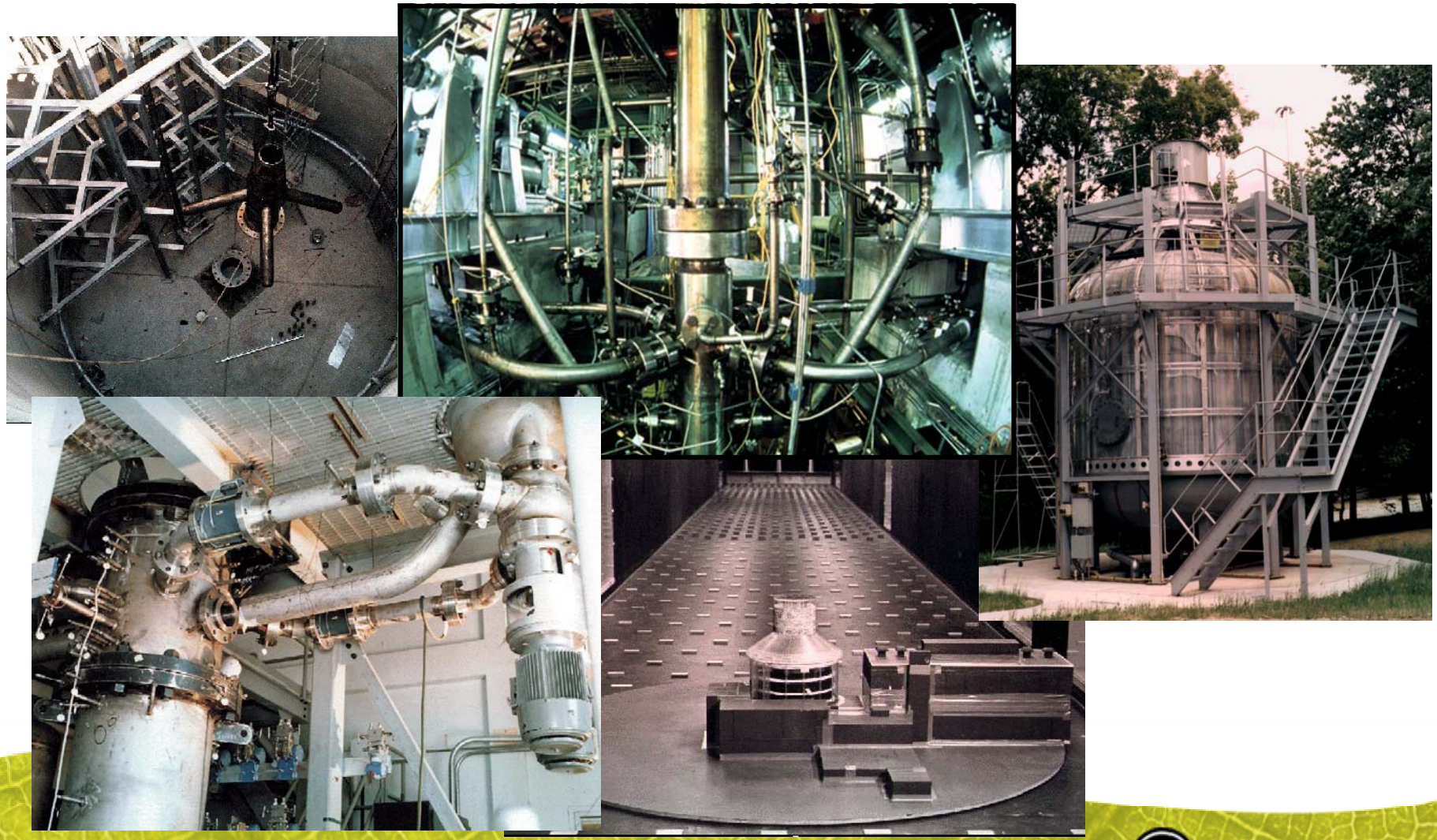
Severe Accidents Mitigation Features



Short Engineering and Construction Schedule

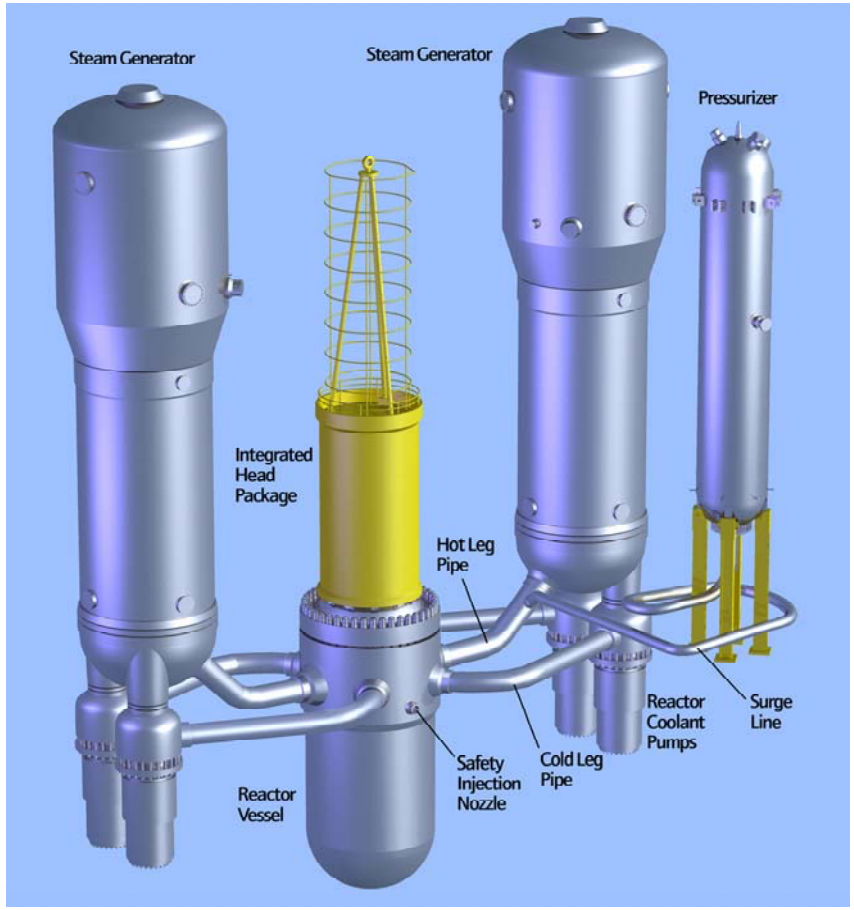
Safety is learning driven

AP1000 Design is based on extensive testing



Safety is learning driven

- **Reactor Vessel**
  - Materials lessons learned
  - No bottom-mounted instrumentation
- **Steam Generators**
  - Inconel 690 TT tubes
  - Stainless steel support plates
- **Reactor Coolant Pumps**
  - Canned motor pumps, no shaft seals
- **Pressurizer**
  - About 50% larger than operating plants
- **Simplified Main Loop**
  - Reduces welds 50%, supports 80%
  - All piping above reactor core



Leadership for safety is clear

AP1000 Design Certification Received From NRC 12/30/05

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Conclusion – there is ample evidence that the strong nuclear industry safety culture has served the AP1000 design development process well.