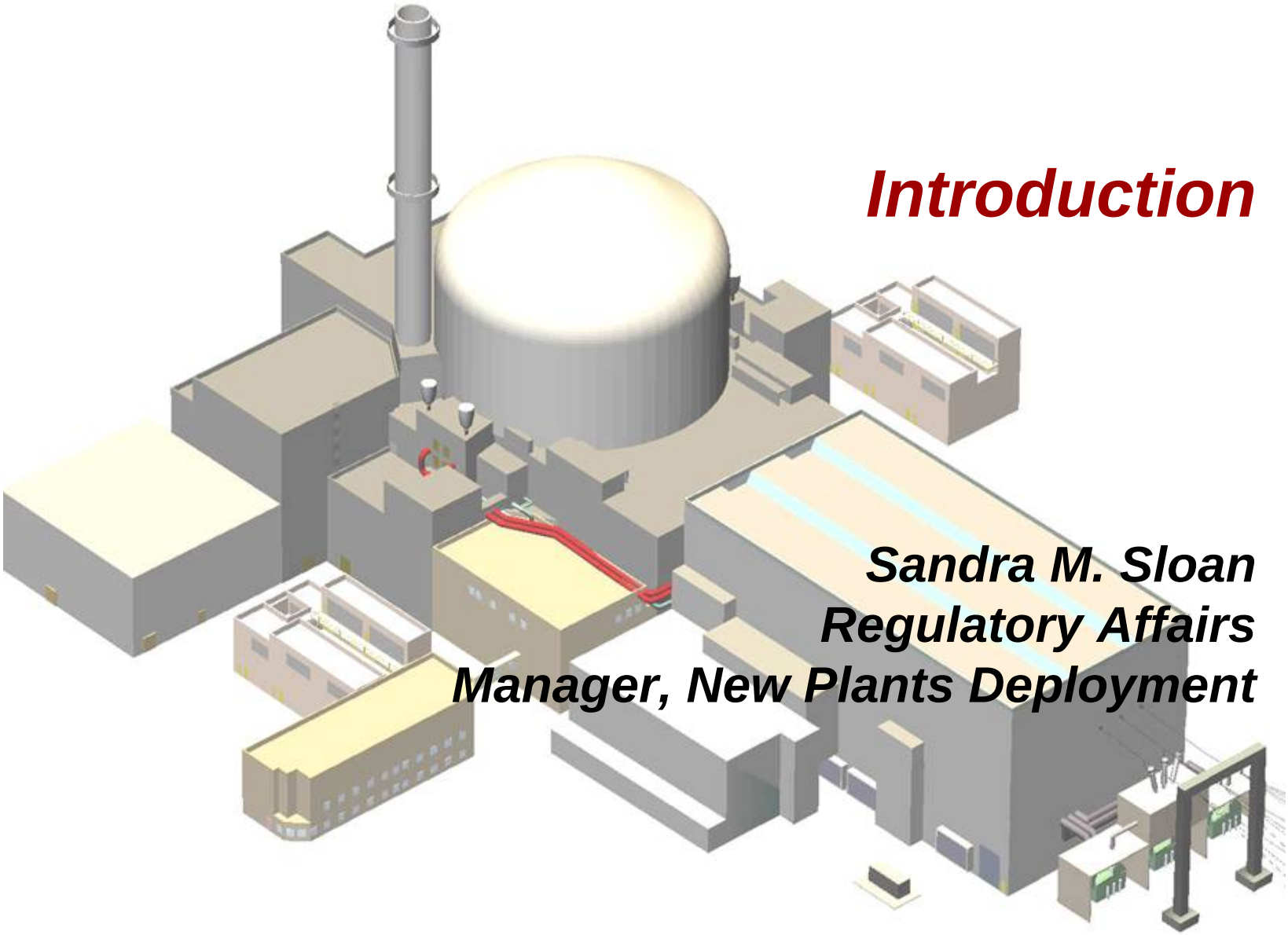
U.S. EPR Pre-Application Review Meeting: Equipment Qualification

AREVA NP and the NRC
November 29, 2006

Introduction



Sandra M. Sloan
Regulatory Affairs
Manager, New Plants Deployment

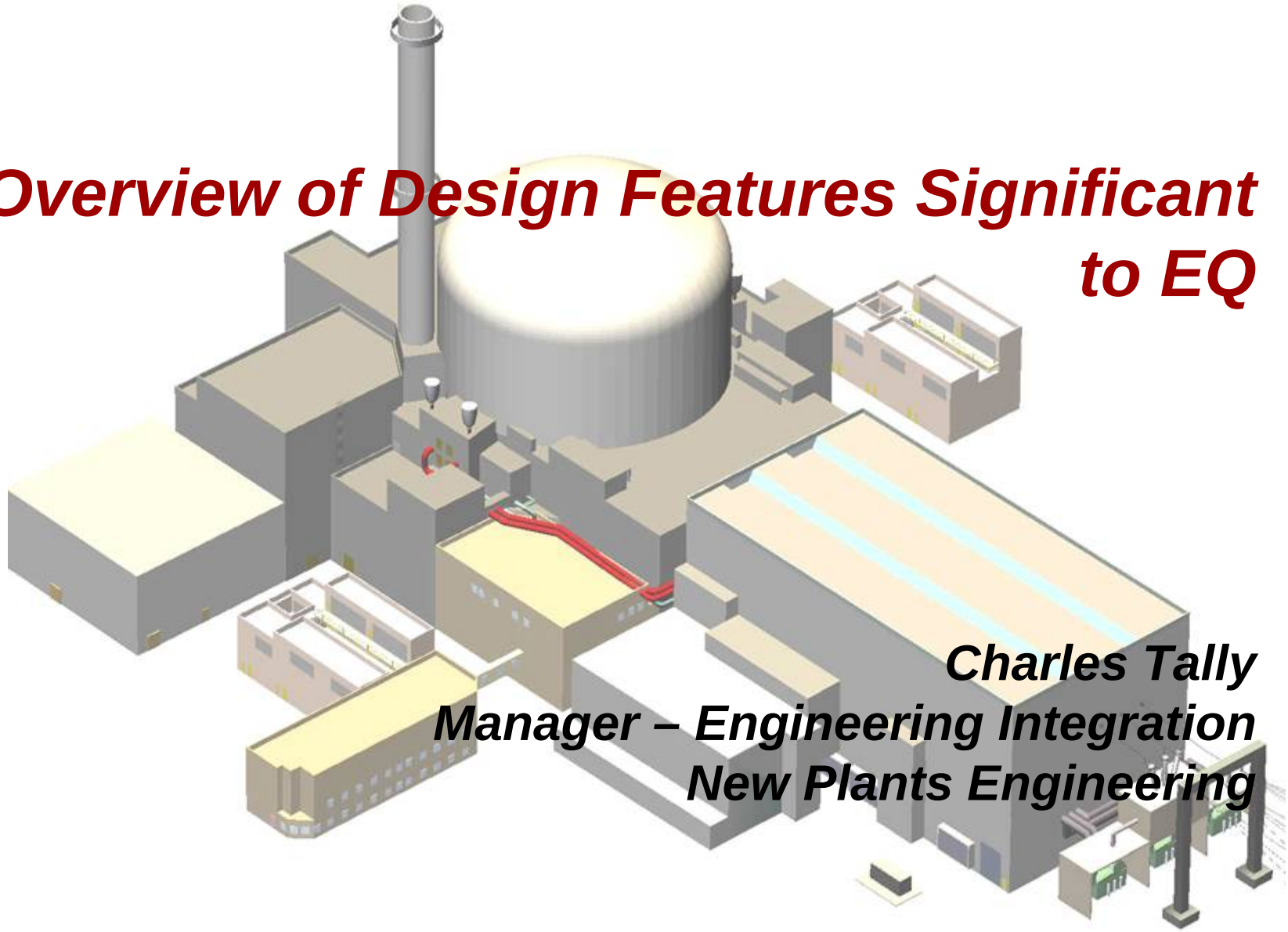
Meeting Objectives

- Provide an overview of U.S. EPR design features significant to equipment qualification (EQ)
- Describe AREVA NP's approach to EQ
- Discuss the scope and content of the EQ program report (to be submitted in December)
- Provide an opportunity for early NRC feedback on AREVA NP's approach

Outline

- Overview of design features significant to EQ (C. Tally)
- Conformance to U.S. regulatory requirements (P. Salas)
  - Qualification to the latest U.S. industry standards
  - Selection of source term
  - Treatment of Regulatory Guide (RG) 1.97
  - Mechanical equipment
- EQ program report content (P. Salas)
- Summary and next steps (S. Sloan)

Overview of Design Features Significant to EQ



Charles Tally
Manager – Engineering Integration
New Plants Engineering

Topics

- Four-train concept
- Simplified design
- Use of radiation zones
- Physical separation and compartmentalization

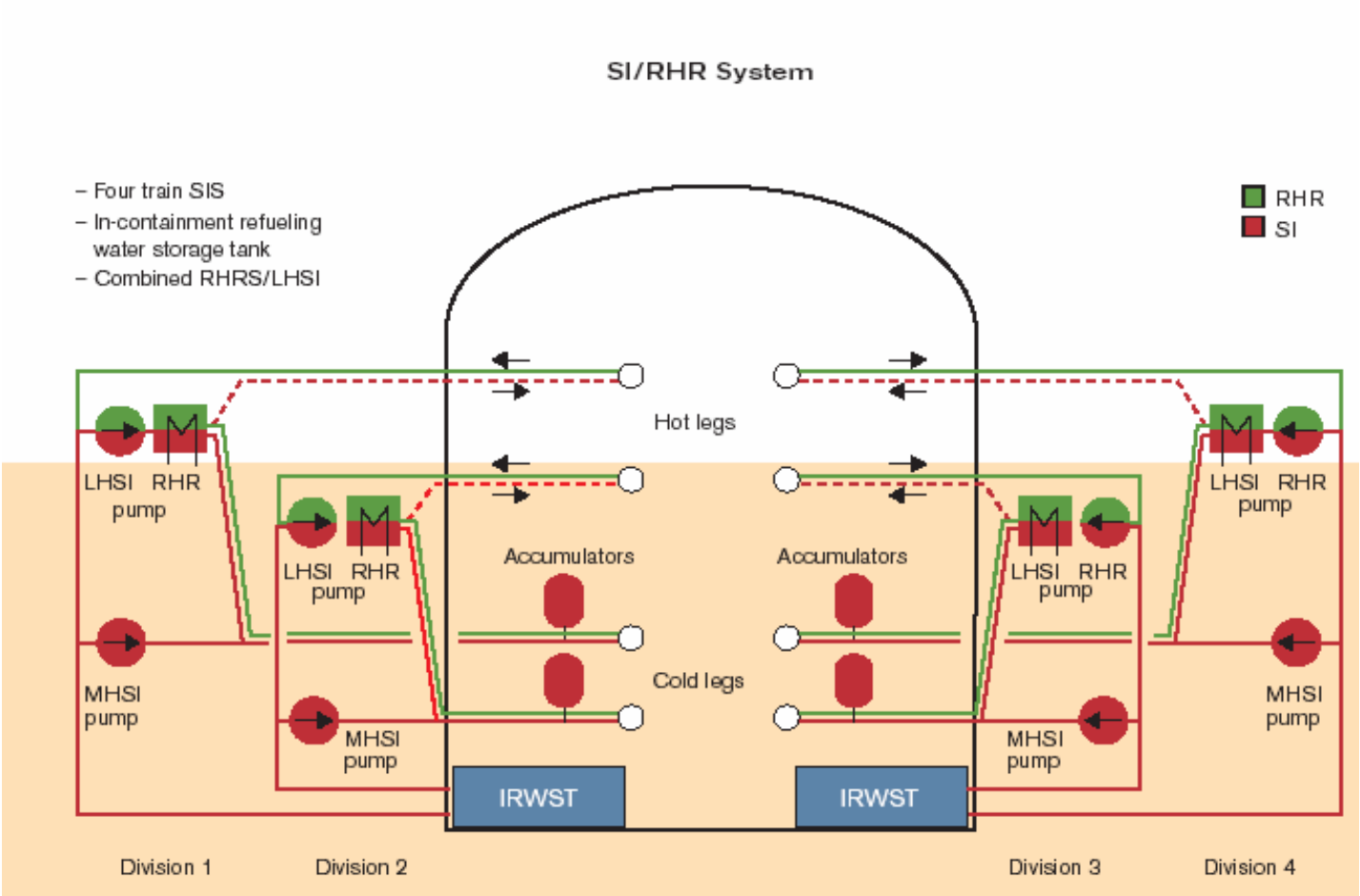
Overview

- Four independent safety trains in separate buildings
- Physical separation against internal & external hazards
- Because of large separate areas, internal hazards results in loss of only one division
- Shield building extends airplane crash and external hazard protection to two safeguard buildings and fuel building

Four-Train Concept

- On-line maintenance without entering action statements
- Radial arrangement simplifies layout and reduces piping
- Reduced component sizes
- Separate safeguards buildings
  - Physical separation
  - Improved hazards mitigation – fire, flood, external events

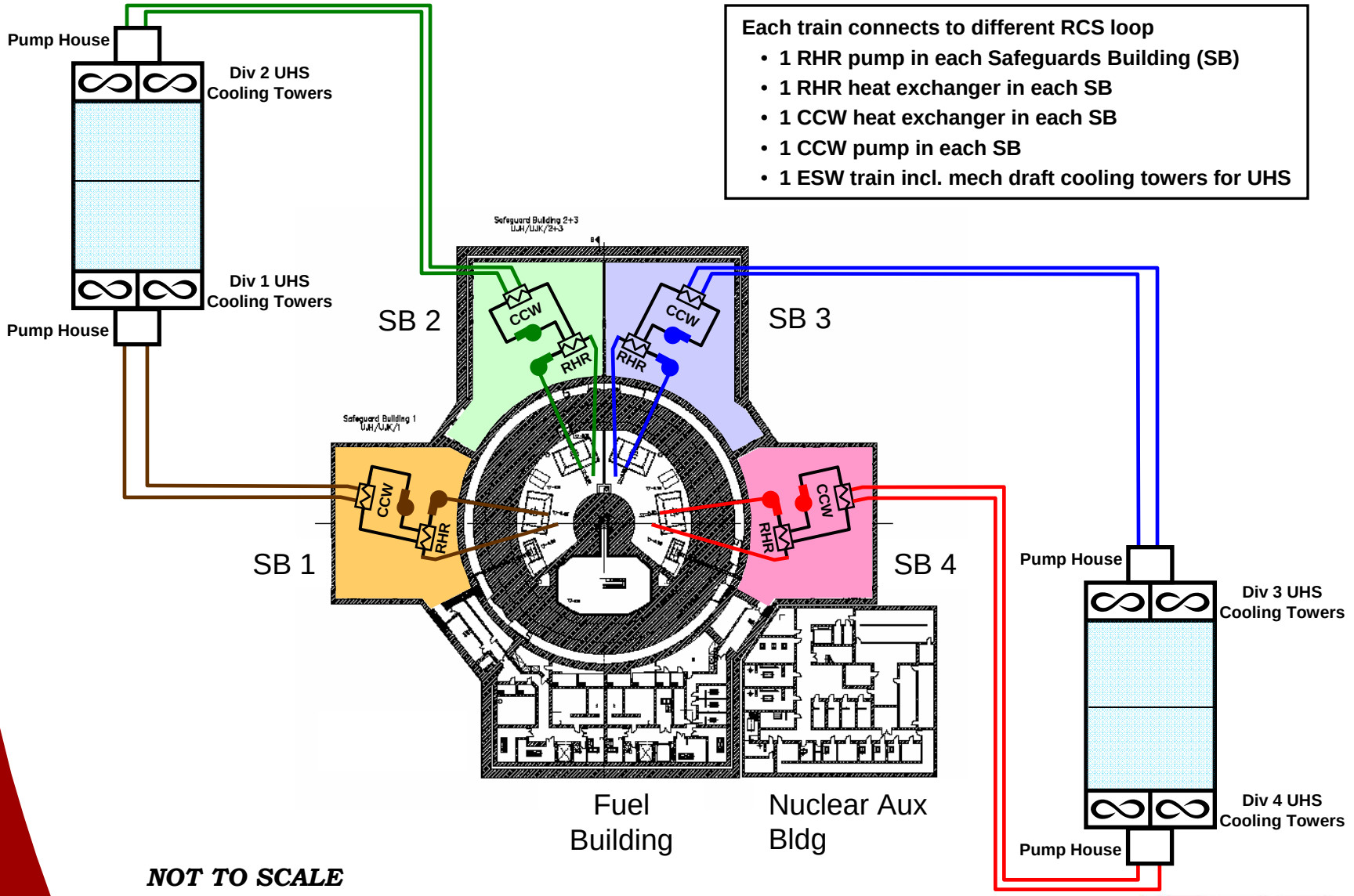
SIS/RHR Systems



Decay Heat Removal Systems

Each train connects to different RCS loop

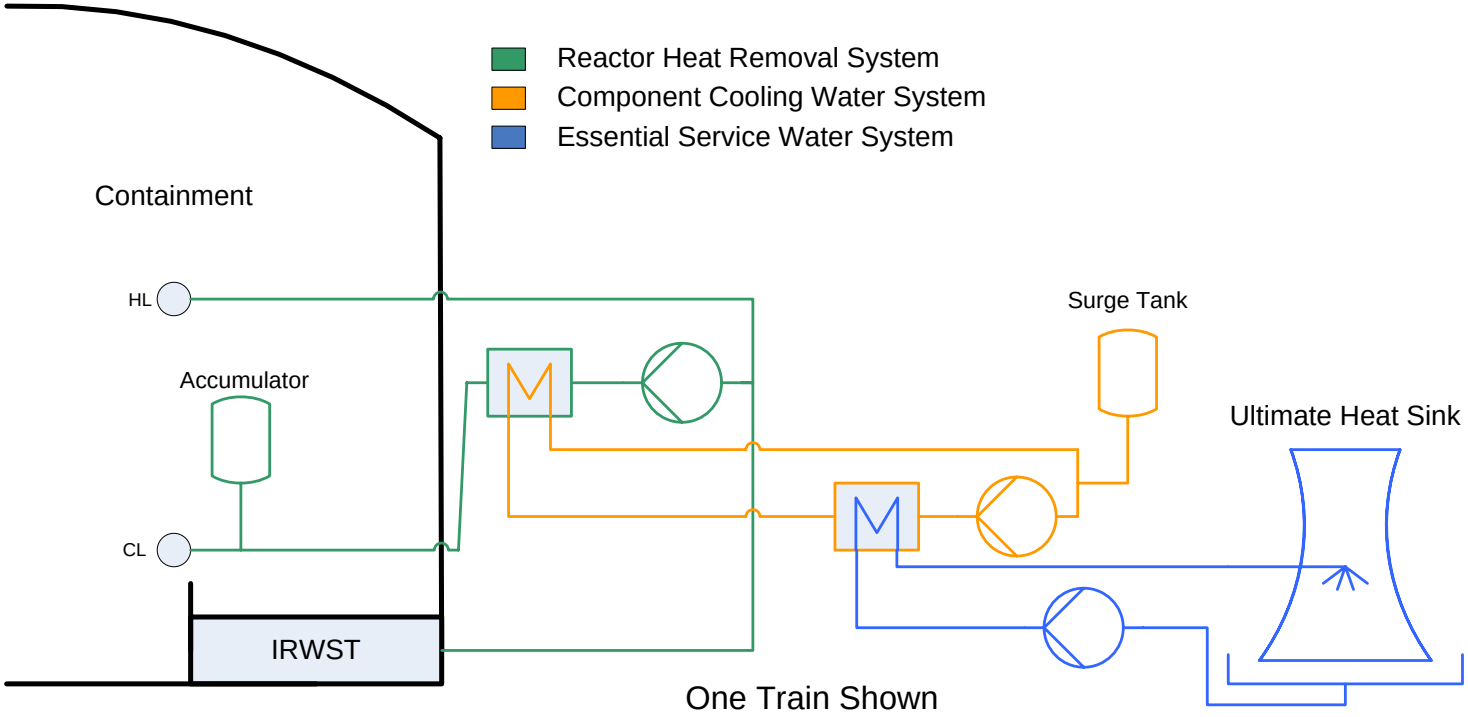
- **1 RHR pump in each Safeguards Building (SB)**
- **1 RHR heat exchanger in each SB**
- **1 CCW heat exchanger in each SB**
- **1 CCW pump in each SB**
- **1 ESW train incl. mech draft cooling towers for UHS**



NOT TO SCALE

EPR

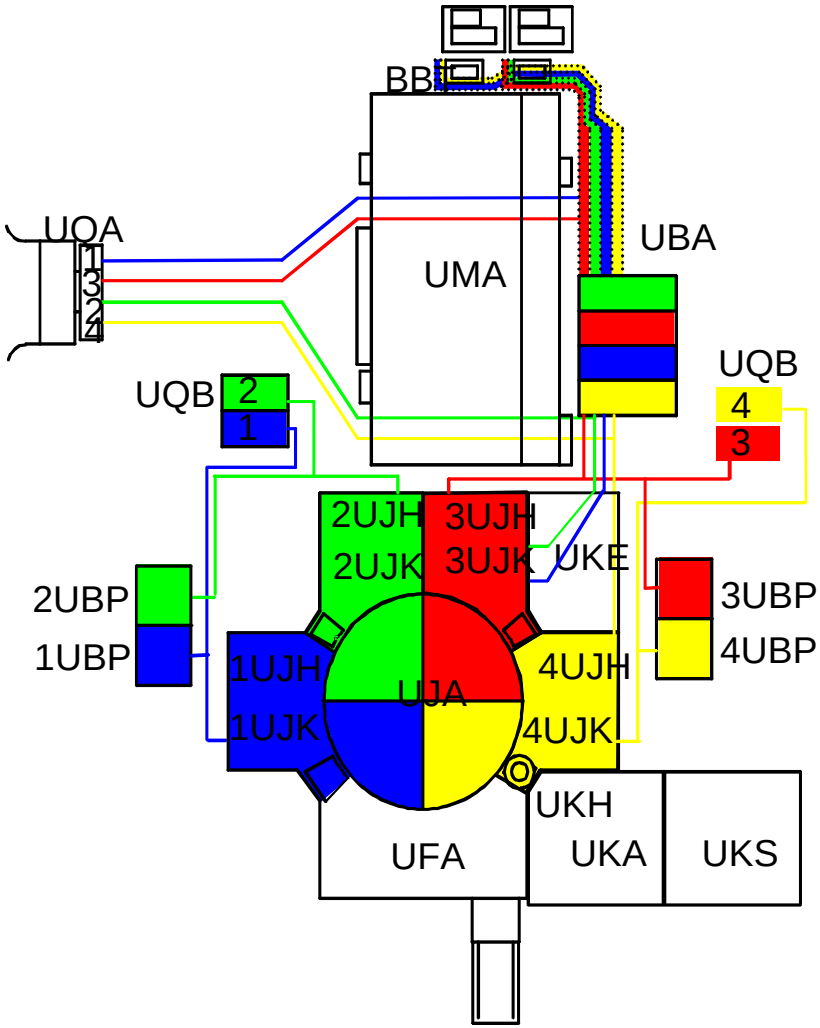
Decay Heat Removal Systems



- **4-train redundancy in Essential Service Water, Component Cooling Water, and Reactor Heat Removal Systems (including electrical supply)**
- **All pumps are electrically motor-driven**

EPSS

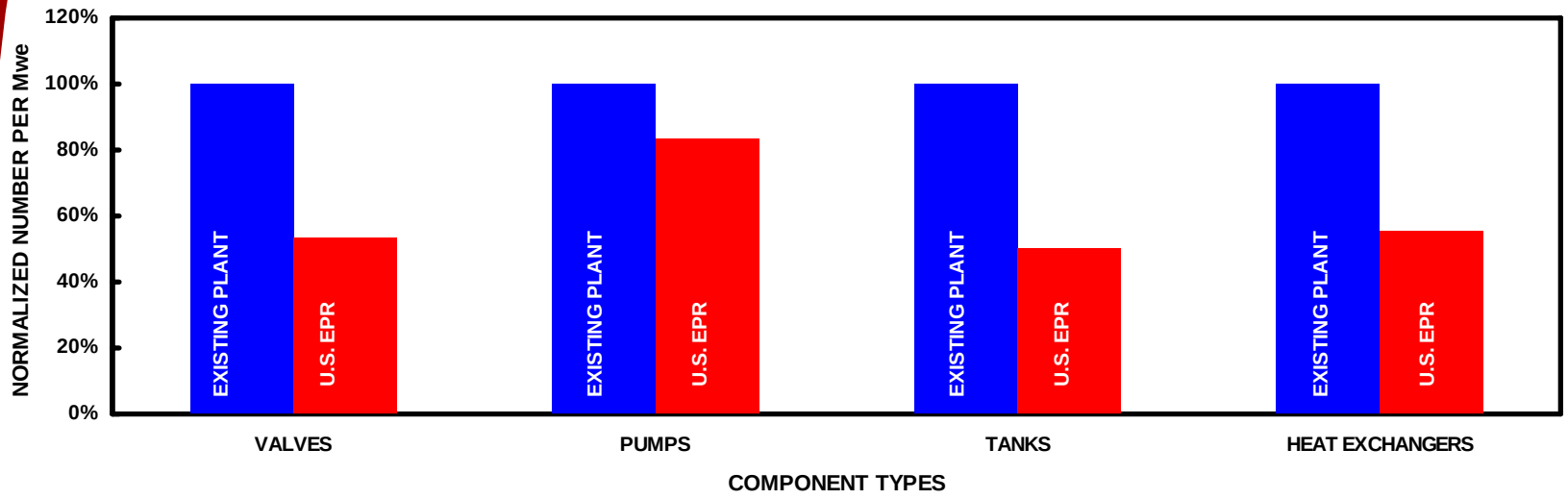
Electrical Distribution Systems



UBP	Emergency Diesel Generator Building
UFA	Fuel Pool Building
UJA	Reactor Building
UJH	Safeguard Building Mechanical Part
UJK	Safeguard Building Electrical Part
UKA	Nuclear Auxiliary Building
UKE	Access Building
UKH	Vent Stack
UKS	Radioactive Waste Processing Building
UQA	Circ Water Pump Building
UQB	Service Water Pump Building

Separation and redundancy

Simplified Design

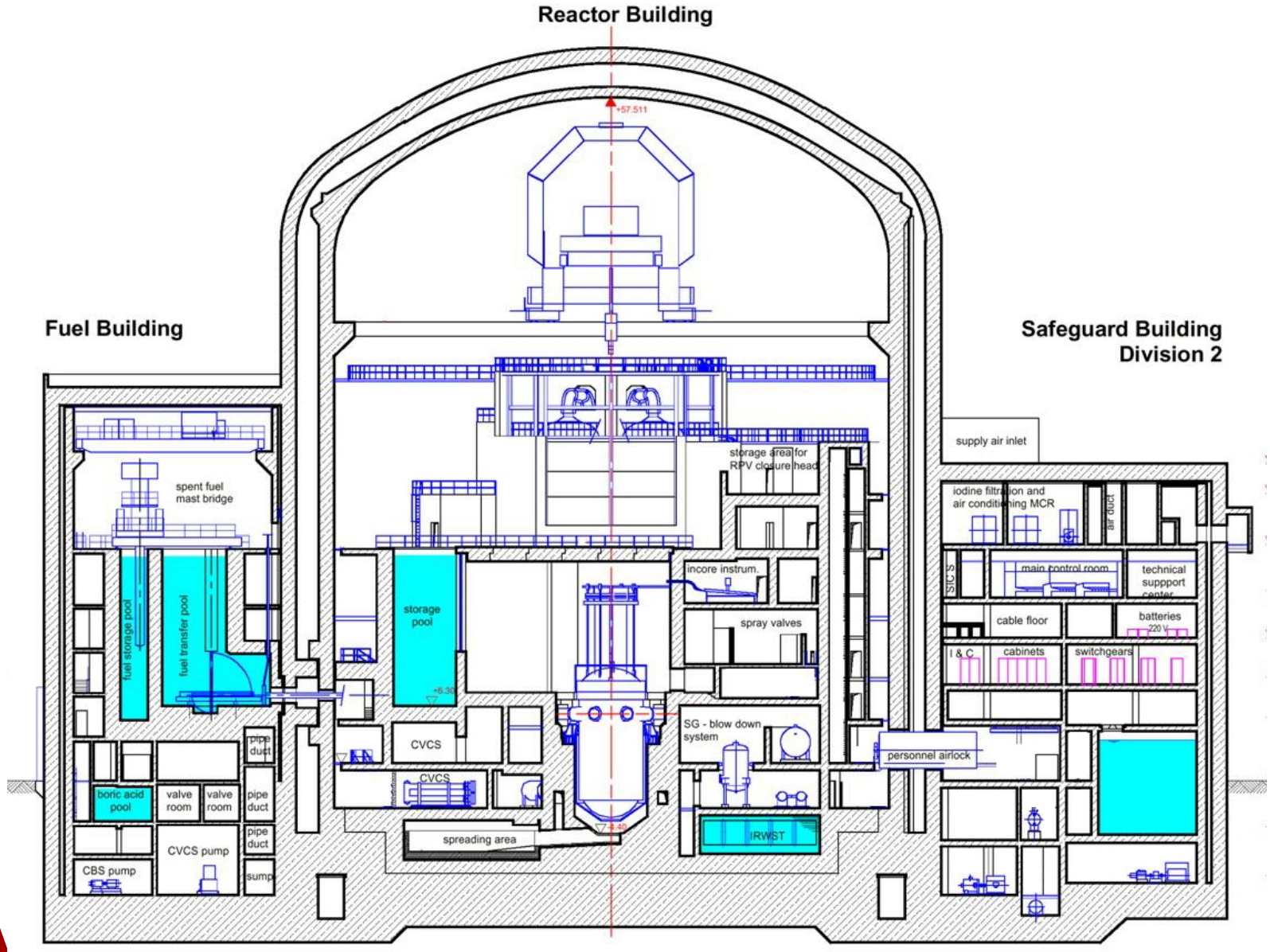


	U.S. EPR	4-Loop PWR	% Change (Absolute)	% Change (Count/MWe)
Pumps & Turbines	43	37	16	(16)
Heat Exchangers	34	44	(23)	(44)
Tanks	23	33	(30)	(50)
Valves	2,044	2,766	(26)	(47)

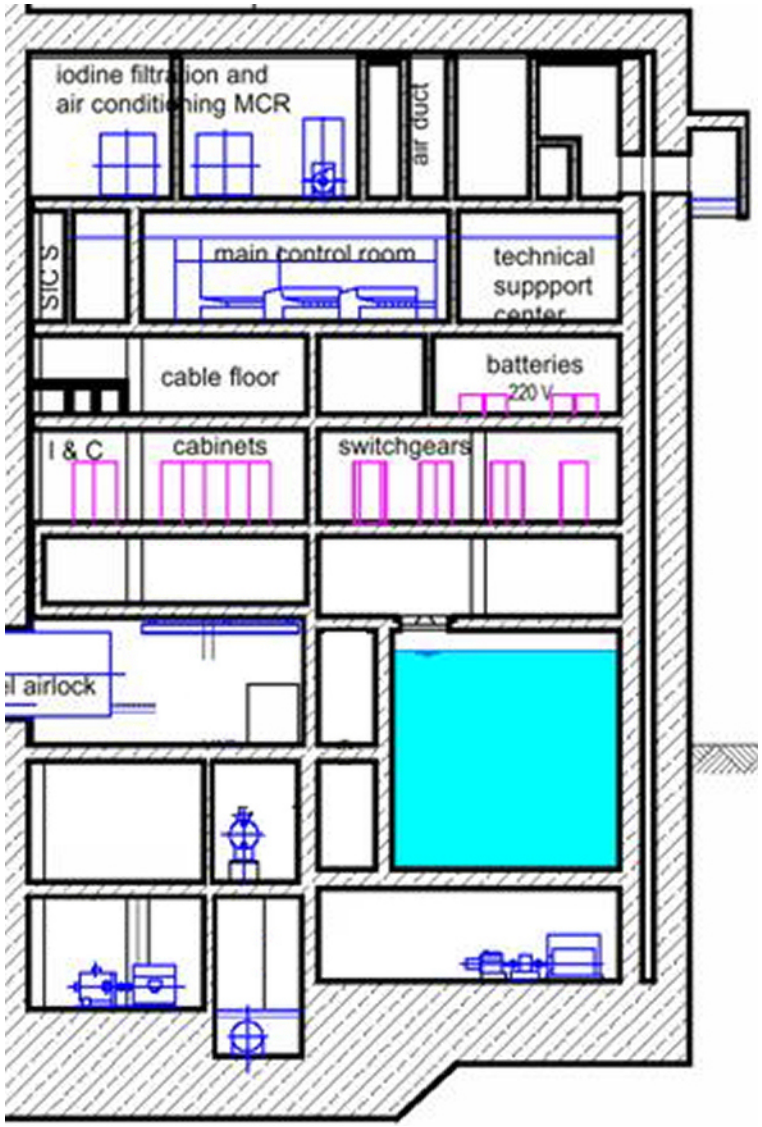
** Information based on AREVA study of modern 4-loop facility*

Simplified plant design

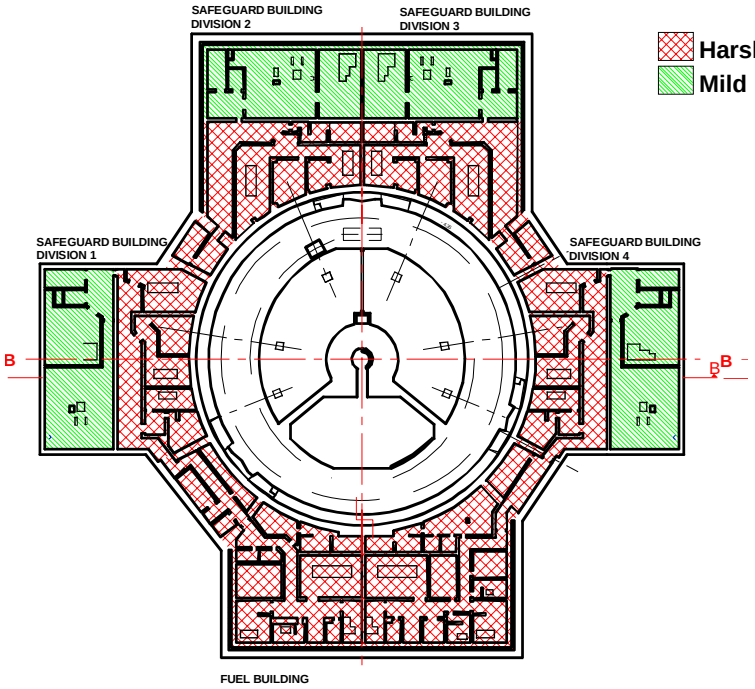
Section View



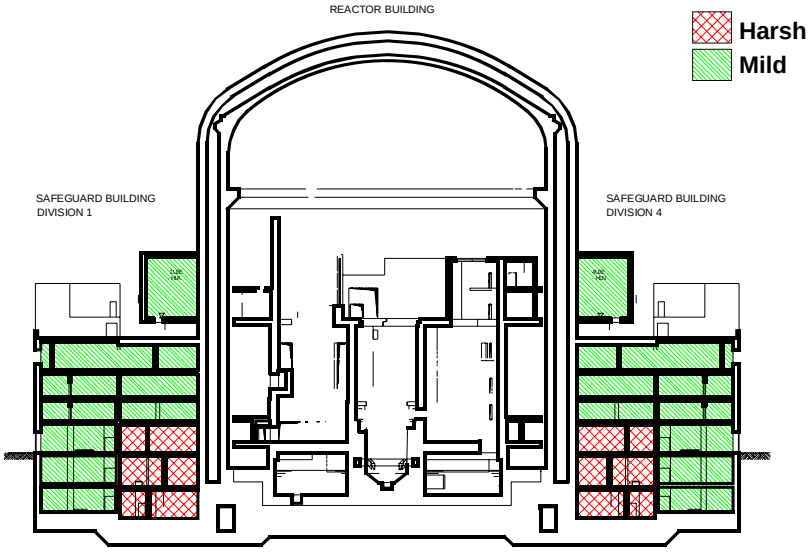
Typical Safeguards Building Cross Section



Use of Radiation Zones



Safeguard Buildings Harsh/Mild Separation



Safeguard Buildings Harsh/Mild Separation

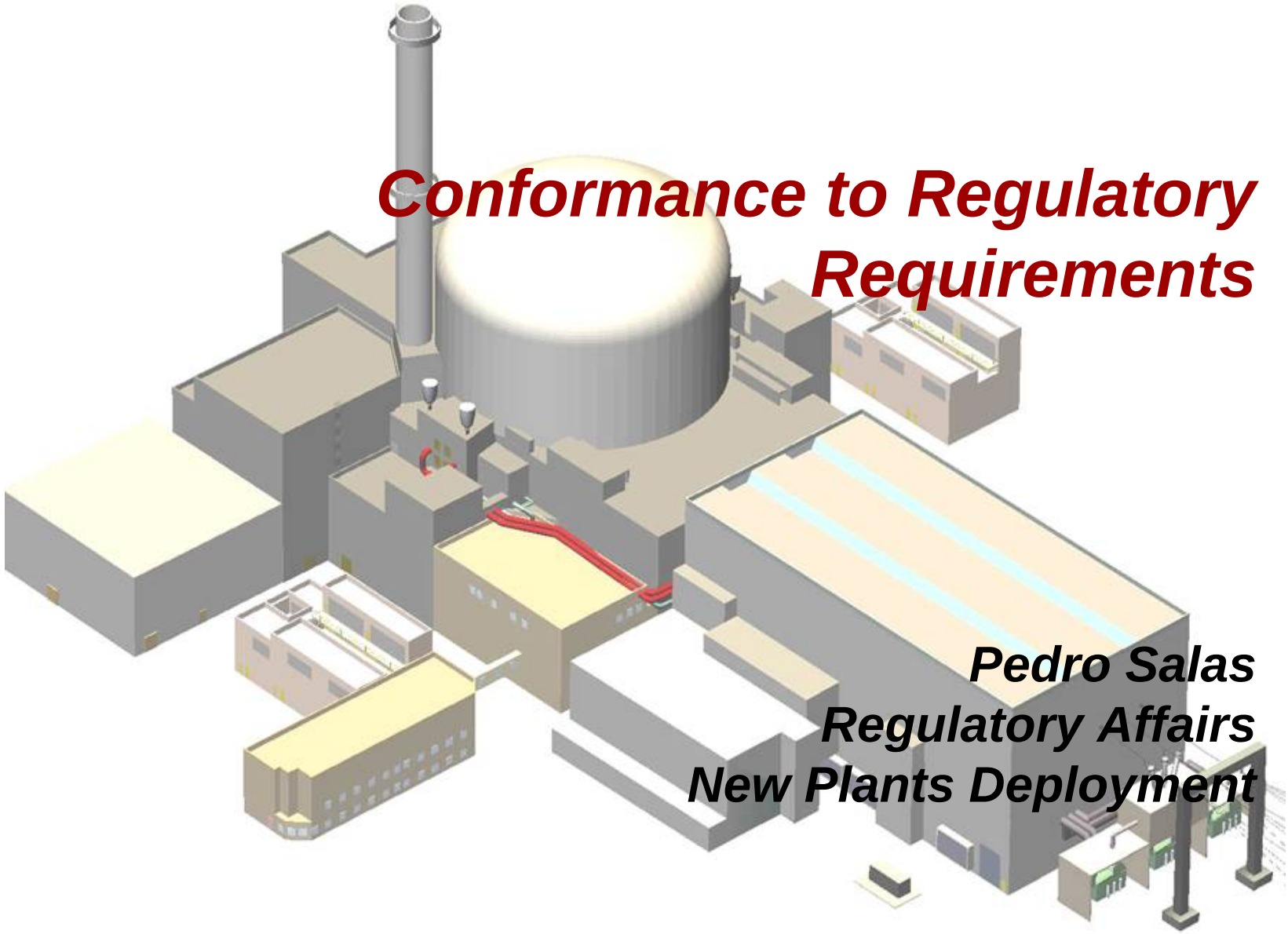
Physical Separation and Compartmentalization

- Four-train layout physically separates each division of safety related systems outside containment
- No steam or main feedwater lines pass through safeguards buildings
- Vertical layout minimizes exposure of electrical and I&C equipment to radiation fields from lower floors
- Safeguards buildings will not experience harsh environmental conditions except in regard to radiation in selected areas
- At normal operating conditions, no potential for high energy line breaks within safeguards building

Physical Separation & Compartmentalization

- **Accident considerations**
  - **Treatment of pipe breaks in the reactor building consistent with current plants (temperature, pressure, and radiation)**
  - **A pipe break in a safeguard building will result in a loss of the entire division**
    - **No need to qualify equipment assumed to be lost**
  - **Remaining three trains will not experience elevated temperatures and pressures**
  - **Radiation will enter other safeguard buildings as process fluids in piping and through leakage**
  - **Only equipment exposed to direct shine from pipes will be affected**
  - **Shielding and compartmentalization minimize the number of electrical components exposed to harsh environments**

Conformance to Regulatory Requirements



Pedro Salas
Regulatory Affairs
New Plants Deployment

Topics

- Qualification to latest industry standards
- RG 1.89 - Selection of Source Term
- Treatment of RG 1.97
- Mechanical equipment

Industry Standards

- AREVA NP's objective is to qualify equipment to the latest industry standards
- AREVA NP anticipating revision to Standard Review Plan Section 3.11 in December 2006 to assess endorsement of these standards
- Will adopt endorsed version of standards or justify deviations

Regulatory Guides

- **Key RGs that govern compliance of the EQ program**
  - **RG 1.89 – Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants**
  - **RG 1.97 – Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants**

RG 1.89 Regulatory Considerations

- **RG 1.89 describes acceptable methods for compliance with 10 CFR 50.49**
- **Revision 1, dated June 1984, is the latest version**
- **If not updated, two exceptions will be required**
  - **Compliance with IEEE Std 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Generating Stations"**
  - **Radiation source term assumptions**

RG 1.89 Regulatory Considerations

- **IEEE Standard 323**
  - **The latest version is IEEE 323-2003**
  - **If SRP 3.11 does not endorse IEEE 323-2003, the design certification application will justify the deviation from the standard specified in RG 1.89**
  - **If SRP 3.11 endorses IEEE 323-2003, the application will identify that this is an NRC approved exception to the standard specified in RG 1.89**

RG 1.89 Regulatory Considerations

- **Radiation source term**
  - **RG 1.89, Revision 1 recommends specific source term assumptions**
  - **The RG recognized that ongoing investigation could lead to modifications to the source term**
  - **The U.S. EPR will conform to the NRC approved "Alternate Source Term"**
  - **If the RG is not updated, the design certification application will identify that this is an NRC approved deviation from RG 1.89**
  - **SRP 3.11, Draft Revision 3 (April 1986), anticipates this deviation as a possibility**

RG 1.97 Regulatory Considerations

- **The text of 10 CFR 50.49 specifically references RG 1.97 Revision 2 in the text of the rule**
- **SRP 3.11 Draft Revision 3 recognizes that the latest version of RG 1.97 may be more appropriate**

  "For new applications the staff may accept an exemption from the requirement of 10 CFR 50.49(b)(3) to qualify certain types of post-accident monitoring equipment in accordance with Revision 2 to RG 1.97, if the applicant commits to conformance with the latest revision of RG 1.97, which meets the underlying purpose of the 10 CFR 50.49 rule"
- **AREVA NP will apply for such an exemption to use RG 1.97 Revision 4**

Mechanical Equipment

- Ensure acceptability of mechanical equipment consistent with the methods adopted by operating reactors in the 1990's
- Qualification method reviewed and approved by the NRC for the South Texas Project
- AREVA NP's EQ program will be consistent with this basis

U.S. EPR EQ approach for mechanical equipment consistent with methods accepted by the NRC for operating plants

Mechanical Equipment (Continued)

- **Key elements for demonstrating acceptability of mechanical equipment**
  - **Utilize the procurement, maintenance, and surveillance programs to establish that mechanical equipment will remain operable in applicable harsh and normal environmental conditions**
  - **Documentation**
    - Design specifications
    - Vendor certifications (Certificate of Compliance)
    - Design and purchase specifications for replacement parts
    - Material evaluations for replacement parts

Mechanical Equipment (Continued)

- **Justification for this approach:**
  - **Mechanical equipment (pumps and valves) is inherently more rugged than electrical equipment**
  - **The operating internal pressures and temperatures of mechanical equipment are much higher compared to electrical equipment and do not significantly change post accident**
  - **Radiation sensitivity can be effectively considered through design and procurement**
  - **Preventive maintenance, surveillance testing, local leak rate tests, valve stroke tests, in-service tests, and component monitoring provide reasonable assurance of detection of aging mechanisms**

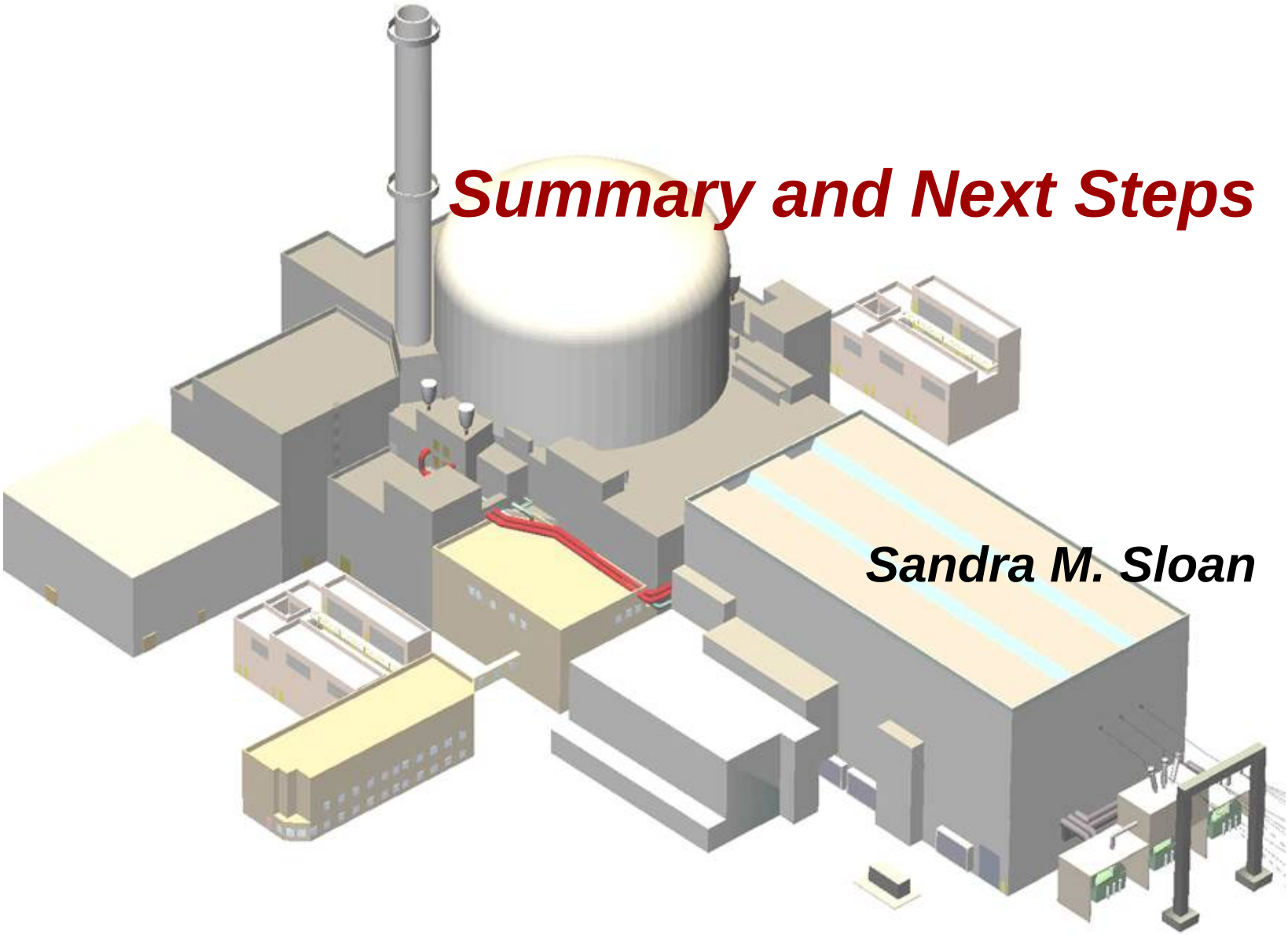
EQ Program Report Content

- Regulatory requirements and licensing basis
  - 10 CFR 50.49
  - RG 1.89, Rev. 1
  - RG 1.100, Rev. 2
  - RG 1.97, Rev. 4
  - Standard Review Plan
  - IEEE Standards endorsed by RG
  - IEEE Standards not endorsed by RG
- Programmatic elements
  - Nuclear island (NSSS)
  - Balance of plant and turbine island
  - Electrical
  - Mechanical
  - Seismic sequence methodology
  - Instrumentation and control

EQ Program Report Content

- **Scope of work**
  - Criteria for the 50.49 list
  - Identification of equipment location
  - Identification of service conditions
  - Procurement of qualified equipment
  - Documentation of qualification
  - Design Control Document (DCD) programmatic aspects
- **Summary of activities for U.S. EPR design**
  - Development of Chapter 3.11
  - Development of the Master Equipment List
  - Development of Appendix 3D
  - Development of equipment service conditions
  - Development of EQ data package format
  - Development of aging program
  - Development of low level radiation threshold
  - Development of aging parameters
  - Development of seismic sequence methodology

Summary and Next Steps



Sandra M. Sloan

Summary

- **The U.S. EPR is uniquely designed with spatial separation to minimize equipment exposed to, and qualified for, harsh environments**
- **AREVA NP's EQ approach for mechanical equipment consistent with methods accepted by the NRC for currently operating plants**
- **Will use endorsed standards or justify exceptions**

Next Steps

- **AREVA NP will submit a report that details the principles contained in this presentation (December 2006)**
- **Next meetings:**
  - **December 7, 2006: Human factors program pre-submittal meeting**
  - **AREVA NP proposes Spring 2007 EQ post-submittal meeting**