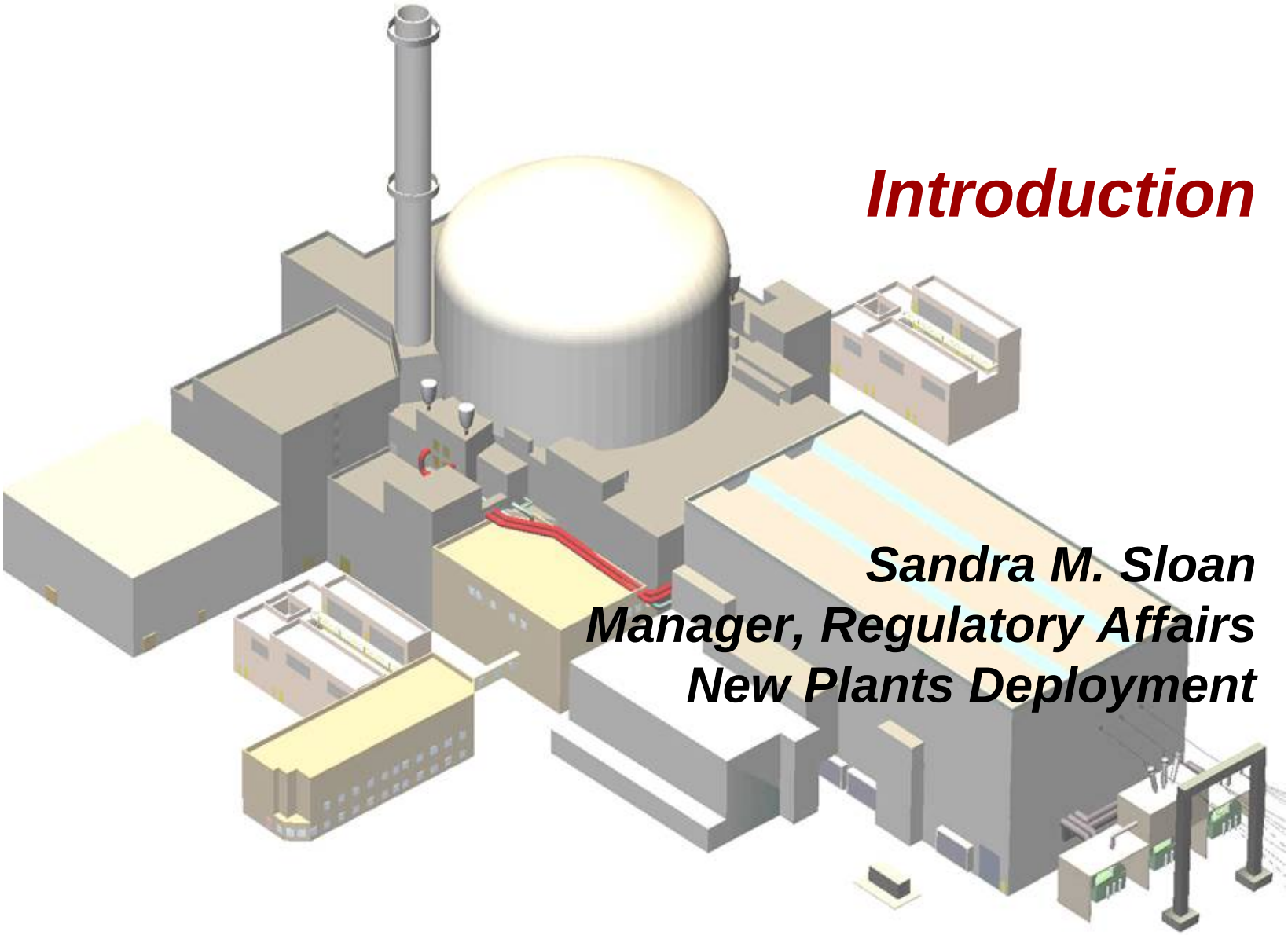
U.S. EPR Pre-Application Review Meeting: Overview of Generic Technical Specifications

AREVA NP Inc. and the NRC
May 31, 2006

Introduction



Sandra M. Sloan
Manager, Regulatory Affairs
New Plants Deployment

Meeting Objectives

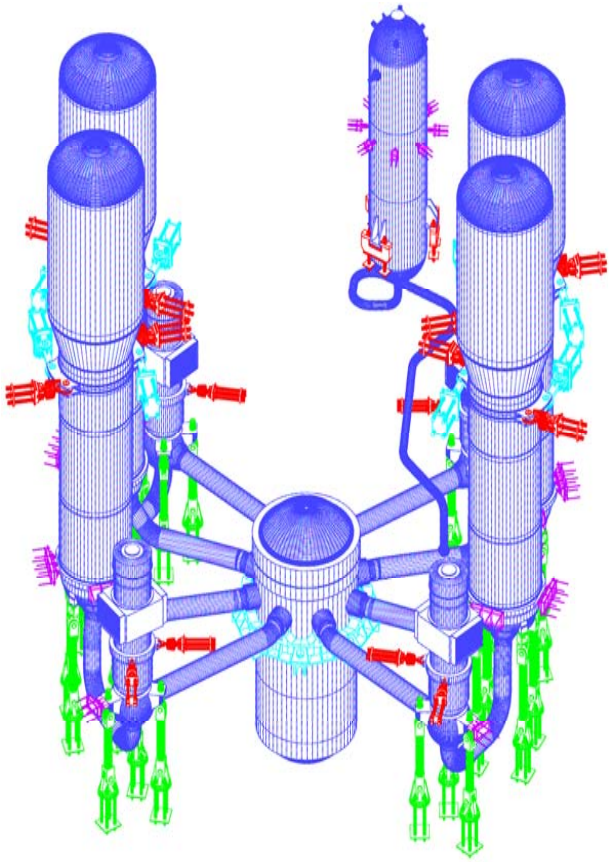
- **Provide an overview of plant design criteria and unique design features important to generic Technical Specifications (TS) development**
- **Provide an overview of U.S. EPR generic TS development process**
- **Obtain early NRC feedback associated with the U.S. EPR generic TS development plans**

Outline

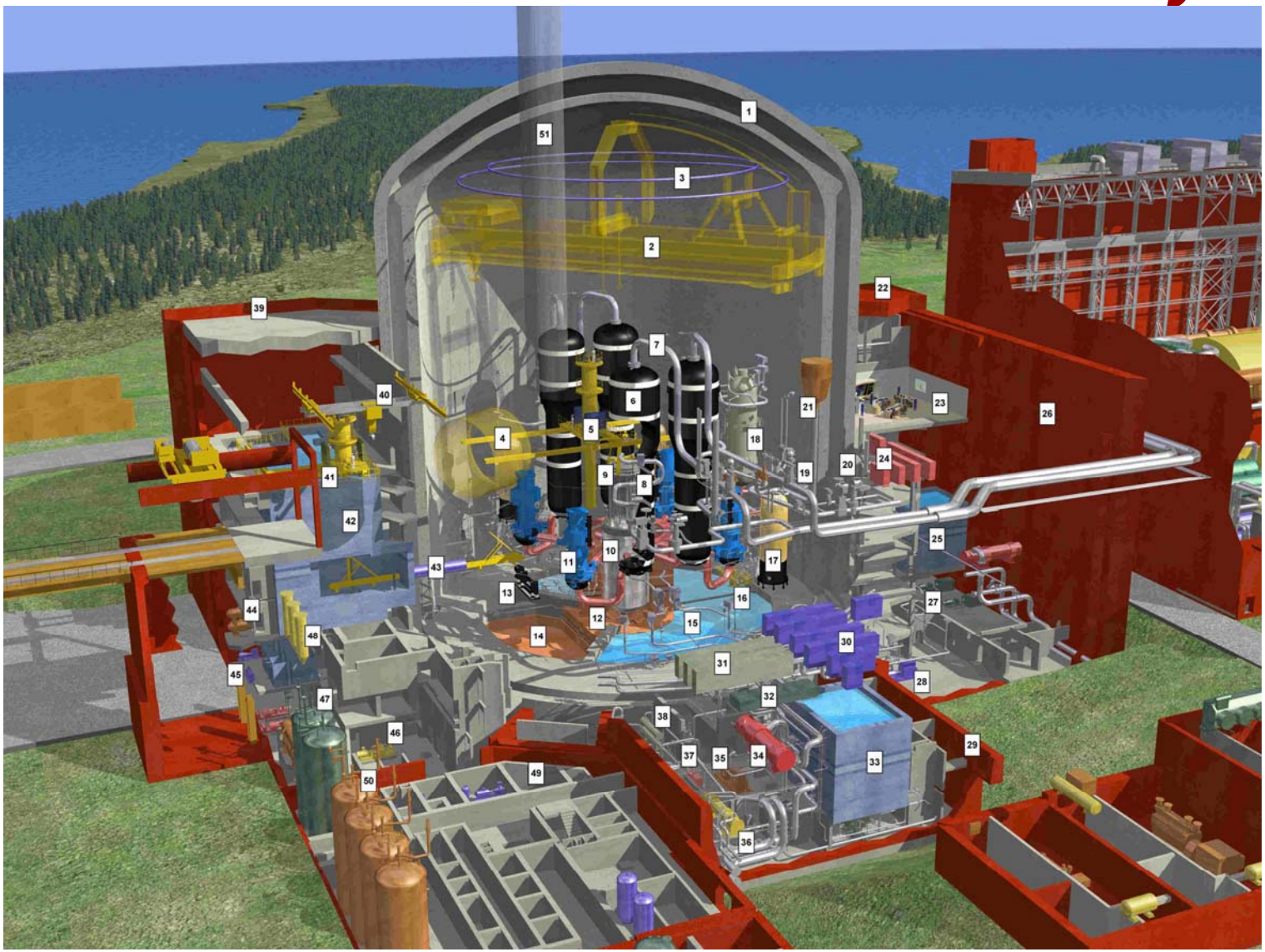
- U.S. EPR plant background (Sloan)
- Plant design criteria and unique design features important to generic TS development (Burzynski)
- U.S. EPR generic TS development process (Sharpe)
- Summary and next steps (Sloan)

U.S. EPR Plant Summary

- Evolutionary 4-loop PWR design proven by decades of design, licensing and operating experience
- Rated power level is 1600 MWe (~4590 MWt)
- Main components enlarged to increase operating margin in many transients and accidents
- Four-train safety systems
- Shield building and steel-lined pre-stressed concrete containment



EPR General Plant Layout



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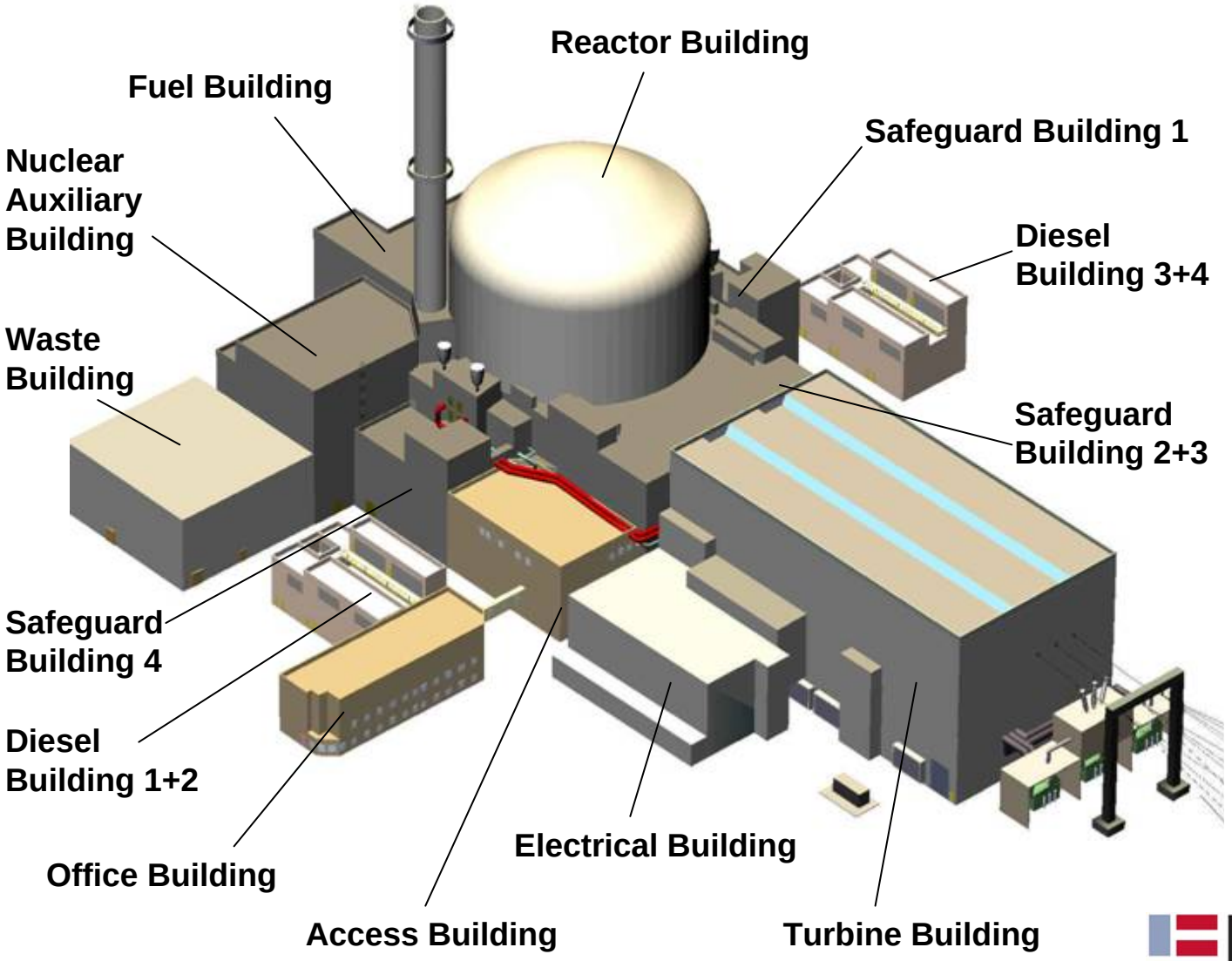
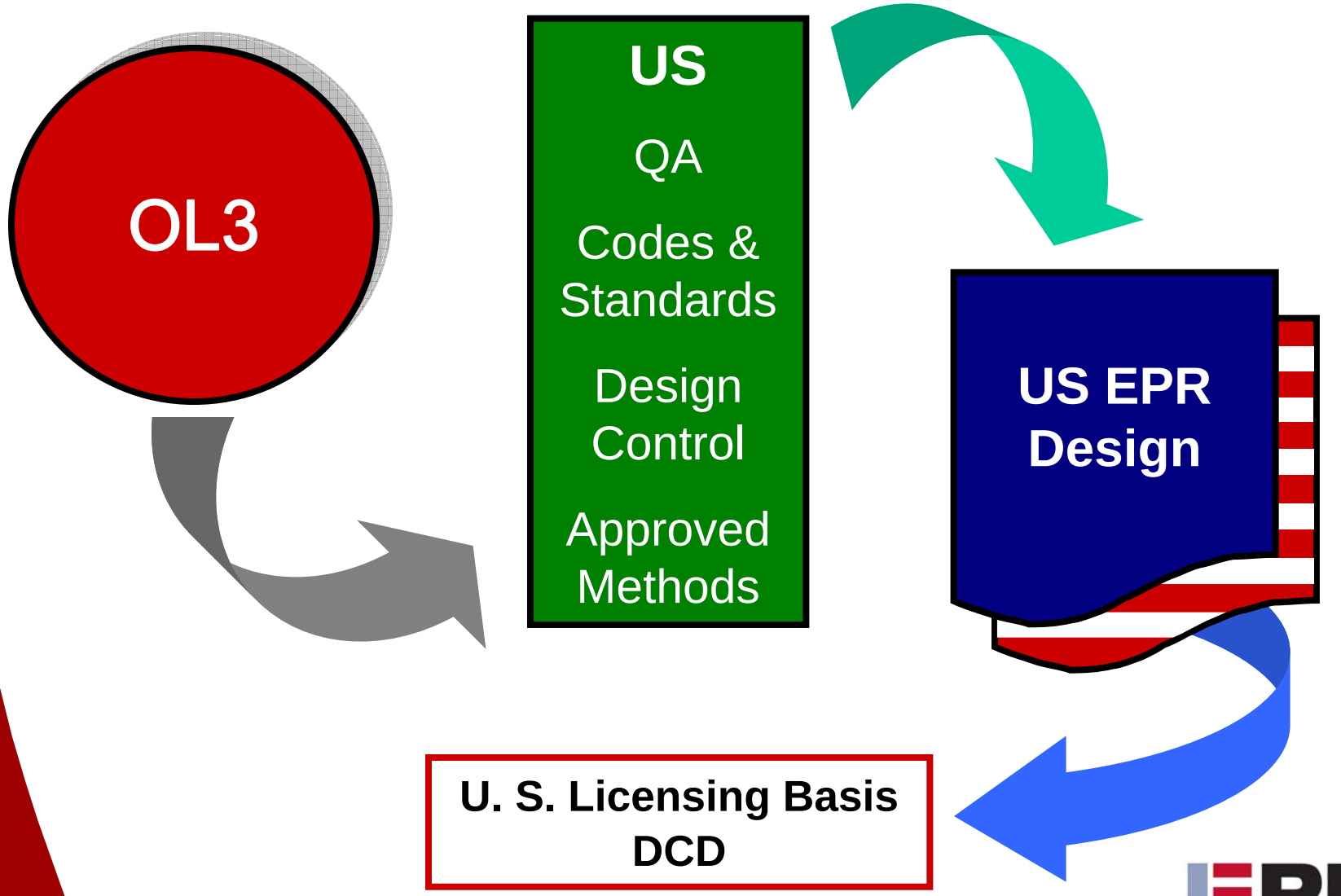


U. S. EPR Plant Design Process Overview

- Systematic process is being applied to prepare the design for U.S. deployment
  - Olkiluoto 3 (OL3) design under construction in Finland
  - Conversion to U.S. design codes and standards
  - Compliance with NRC regulations and QA requirements
- Address U.S. operating experience
- Use of AREVA's world-wide experience in design development and standardization
- On track for December 2007 design certification submittal

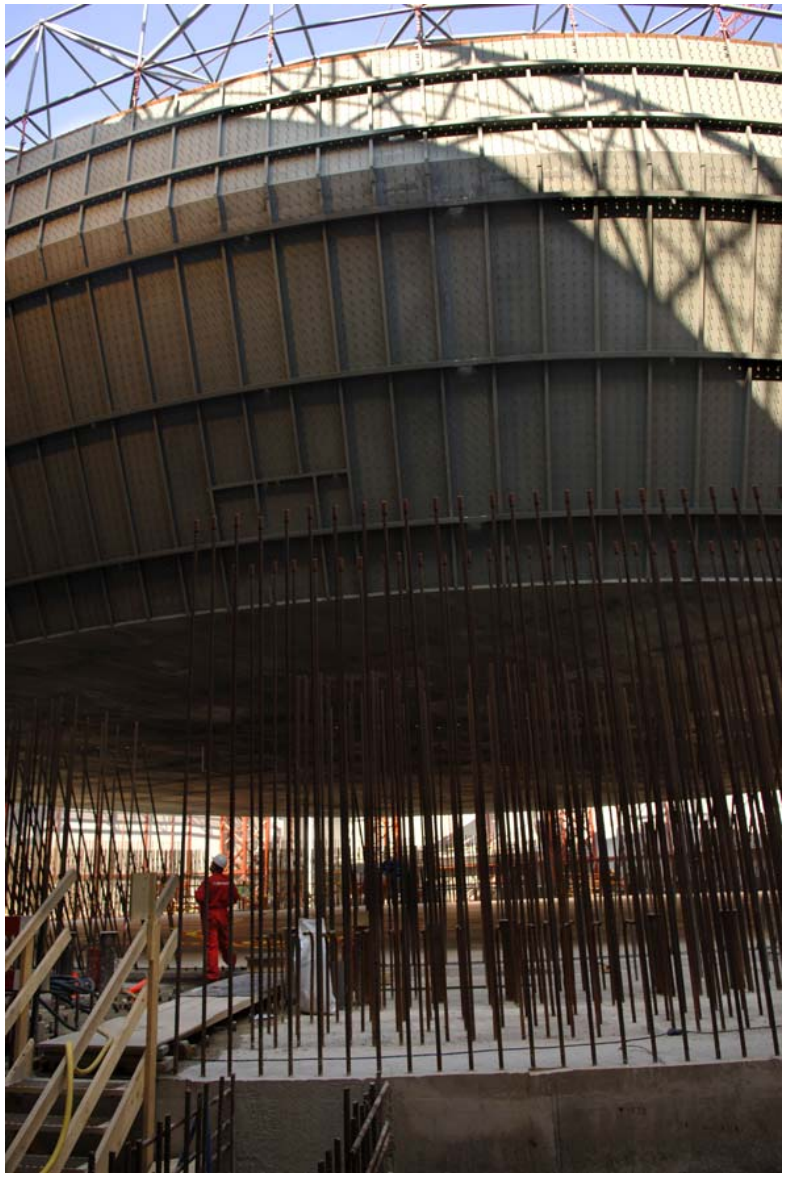
EPR Design Conversion



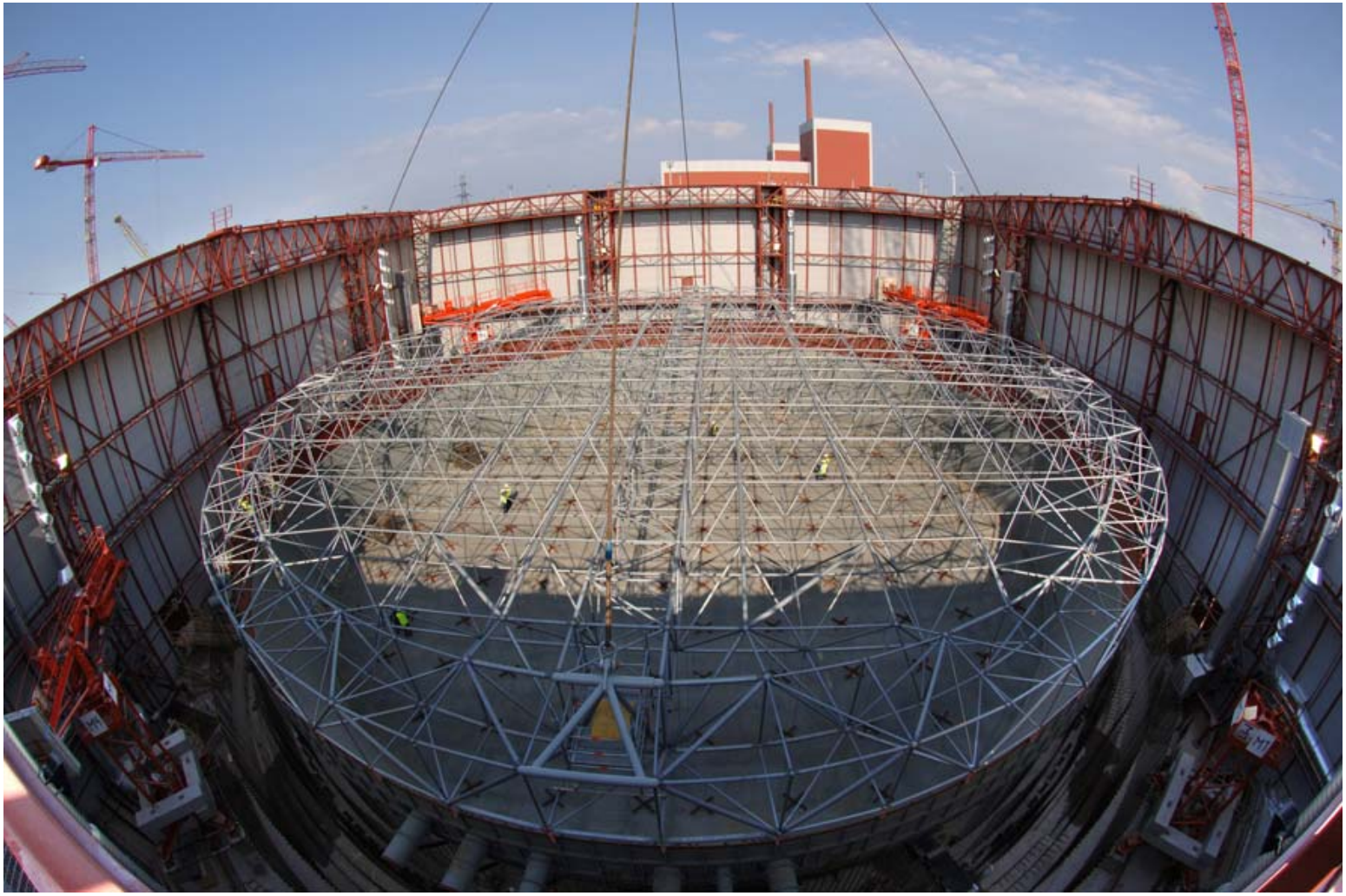
General Overview of the OL3 Site

Lifting of OL3 Containment Liner Cup (1/3)

Lifting of OL3 Containment Liner Cup (2/3)



Lifting of OL3 Containment Liner Cup (3/3)



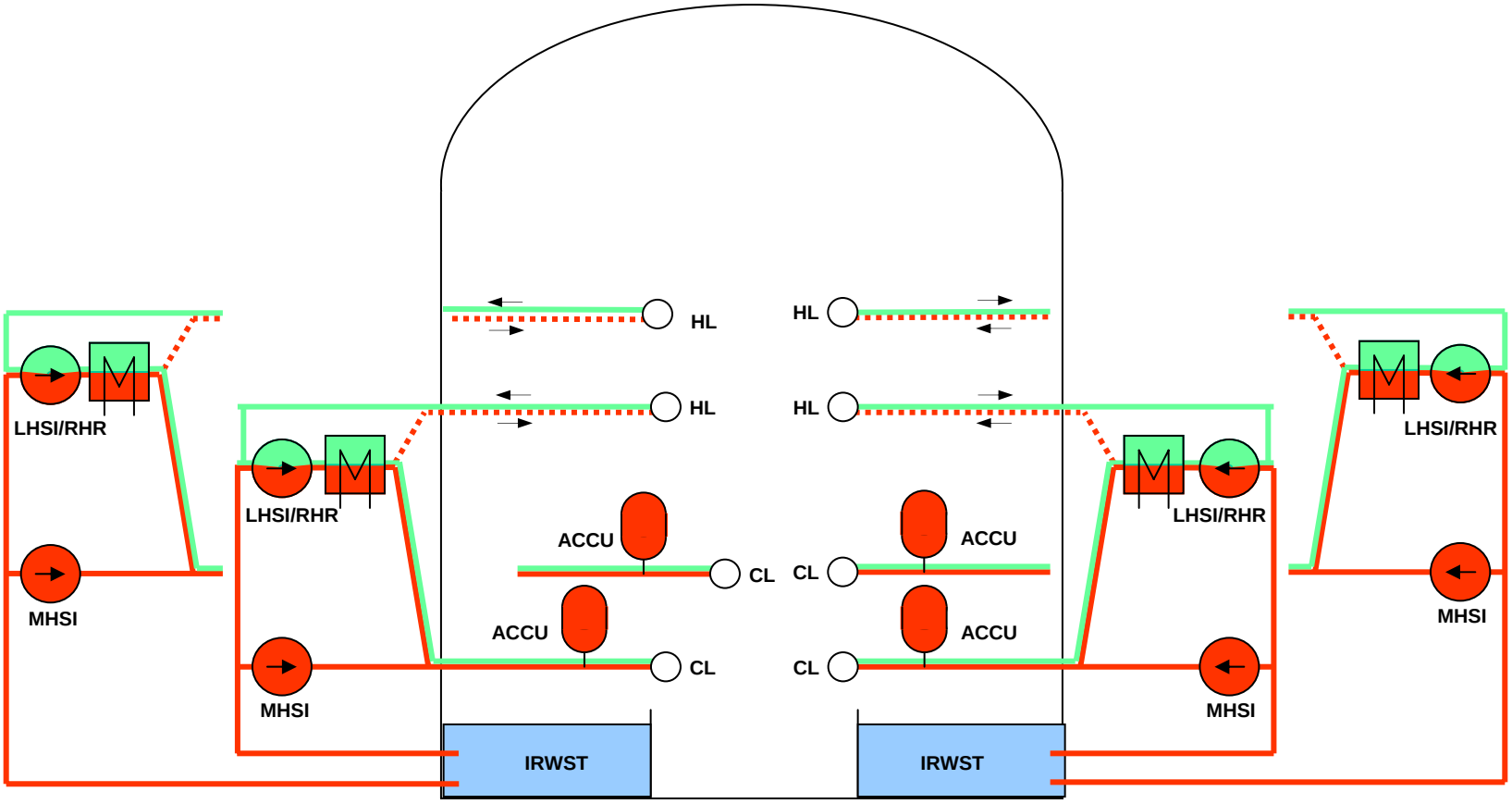
U.S. EPR Plant Design Criteria and Unique Design Features Important to Generic Technical Specification Development

Mark Burzynski
Regulatory Affairs

N+2 Design Philosophy for Fluid Systems

- Required accident mitigation (N)
  - One train injects to mitigate an accident
  - Injection from a second train is assumed lost due to initiating event
- Single failure criterion (N+1)
  - A third train is lost to an assumed single failure
- U.S. EPR design (N+2)
  - A fourth train can be removed from service without affecting safety functions
- Examples include the safety injection, emergency feedwater, component cooling water, and essential service water systems

Typical N+2 Fluid System



Four independent 100% trains for fluid systems with each injecting into a single RCS loop

Safety Systems in Four Redundant Buildings

Each safety train is independent and located within a physically separate building

N+2 Design Philosophy for Ventilation Systems

- **Required accident mitigation (N)**
  - **Two trains (2 x 50% capability) required to mitigate an accident**
- **Single failure criterion (N+1)**
  - **A third train is lost to an assumed single failure**
- **U. S. EPR design (N+2)**
  - **A fourth train can be removed from service without affecting safety functions**
- **Example systems include main control room air conditioning system and safeguards building controlled area ventilation system**

N+2 Design Philosophy for Electrical System

- **Required accident mitigation (N)**
  - **One train to power each of the two trains of pumps required to support ECCS injection train**
- **Single failure criterion (N+1)**
  - **A third train is lost due to an assumed single failure**
- **U. S. EPR design (N+2)**
  - **A fourth train can be removed from service without affecting safety functions**
  - **Power for instrumentation and containment isolation valves provided via redundant power feeds to the low voltage load centers, which preserve sufficient train independence and separation**

N+2 Design Philosophy for Protection (I&C) System

- **Required protection actuation (N)**
  - Actuation signals in two channels are required for protective function
- **Single failure criterion (N+1)**
  - A third channel is lost to an assumed single failure
- **U. S. EPR design (N+2)**
  - A fourth channel can be removed from service without affecting safety functions

Current Plans for Treatment of N+2 Systems in U.S. EPR Generic Technical Specifications

- **LCOs for four train (N+2) systems based on three required safety trains (N+1)**
- **Requirements for a fourth train not planned for inclusion**
- **Reliability and availability of a fourth train to be controlled by Maintenance Rule (10 CFR 50.65)**

N+2 design allows one train to be removed from service without affecting safety functions

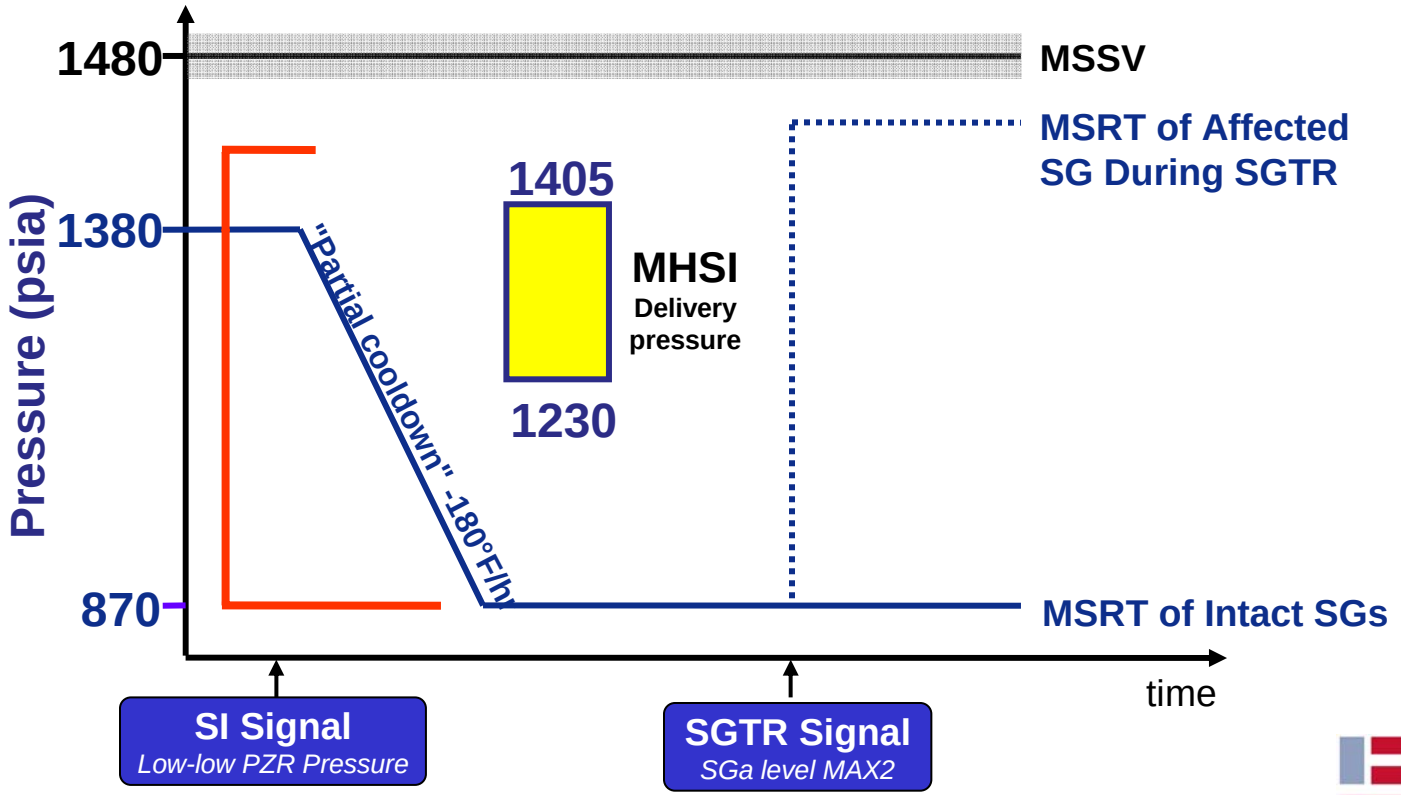
Current Plans for Treatment of Severe Accident Mitigation Features

- **Consistent with treatment of similar systems for operating plants, 'Beyond Design Basis' mitigation features not included in U.S. EPR Generic TS unless specifically required by 10 CFR 50.36 Criterion 4**
  - **Examples include SBO diesel generators, containment spray system, and extra boration system**
- **Reliability and availability of severe accident management systems will be controlled by Maintenance Rule**
- **RTNSS only required for passive designs**

Severe accident management systems not expected to be included in Technical Specifications

Partial Cooldown System for SBLOCA and SGTR

- N+2 safety-related system
- Depressurizes SGs to reduce T_{sat} at 180°F/hr
- Ensures adequate MHSI flow for SBLOCA and SGTR
- Meets 10 CFR 50.36 Criterion 3



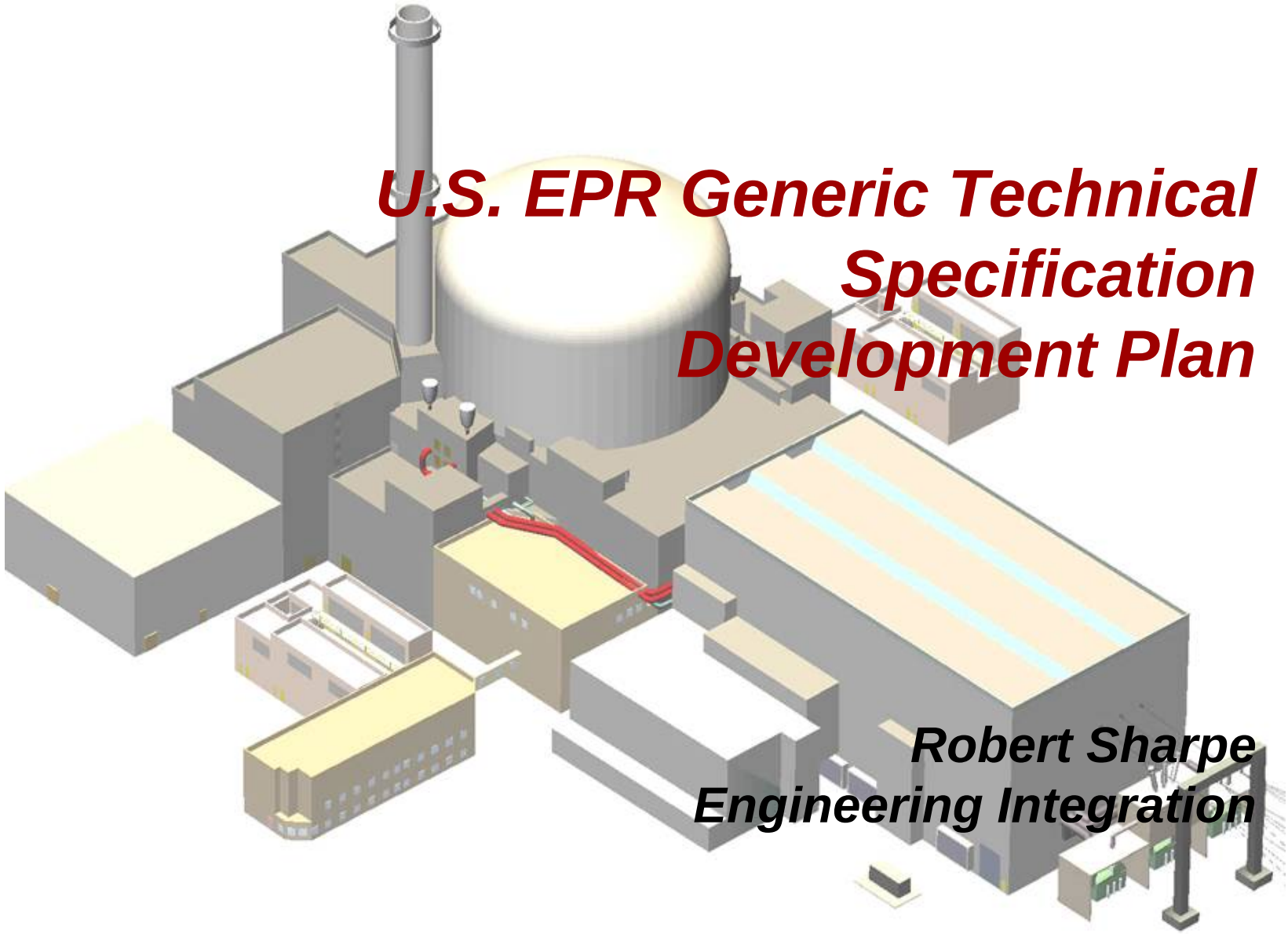
Partial Trip for Operational Transients

- **Symmetric group of rods dropped into core for fast power reductions for plant operational transients where rapid runback is desired to avoid reactor trip**
- **Partial trip function is not safety-related (does not meet 10 CFR 50.36 Criterion 3)**
  - **Instead, impact on actions statements for Criterion 2 parameters (e.g., rod alignment and power distribution) will be assessed**

Reactor Control, Surveillance and Limitation System

- Implements automatic functions, manual actions, and monitoring functions to control and limit the reactor and nuclear steam supply system parameters:
  - Core related parameters (i.e., reactor power, power density, reactivity)
  - RCS parameters (i.e., RCS pressure, pressurizer level, RCS temperature, RCS loop level)
  - Nuclear steam supply system parameters (steam generator level)
- RCSL system does not meet 10 CFR 50.36 Criterion 3
  - Instead, RCSL will be used in lieu of specific manual surveillances for criterion 2 parameters in TS Sections 3.1 (Reactivity Control) and 3.2 (Power Distribution)
  - Alternate surveillances will be defined when RCSL is out of service

U.S. EPR Generic Technical Specification Development Plan



Robert Sharpe
Engineering Integration

Use of Standard Industry Templates

- **NUREG 1431 Rev. 3.1,** *Standard Technical Specifications for Westinghouse Plants*
  - **Most appropriate template**
  - **Largest experience base**
  - **Most relevant content**
  - **Modified to reflect U.S. EPR-specific design and analyses**
- **NUREG 1432 Rev. 3.1,** *Standard Technical Specifications for Combustion Engineering Plants (Digital)*
  - **Digital instrumentation in reactivity control (3.1), power distribution (3.2), and protection instrumentation (3.3)**
- **Industry Standard Writer's Guide**
  - **TSTF-GG-05-01,** *Writer's Guide for Plant-Specific Improved Technical Specifications*

U.S. EPR TS development plan is based on standard industry guidance documents

Current Plans for Use of Industry Experience with ITS

- **Incorporate additional TSTF travelers approved by NRC that are available six months prior to DCD submittal**
  - **Correction of errors and ambiguous language**
  - **Incorporation of operating improvements**
  - **Resolution of regulatory issues**
  - **Industry risk-informed TS initiatives**

Development Process

- **Modify applicable NUREG TS and Bases to be consistent with U.S. EPR design and analyses**
- **Apply 10 CFR 50.36 criteria to U.S. EPR SSCs/parameters**
  - **Safety-related systems generally included**
  - **Non-safety systems generally not included**
- **Apply existing completion times and surveillance frequencies as applicable**
- **Incorporate U.S. EPR specific accident analysis and PRA assumptions**
- **Incorporate applicable approved TSTFs**
- **Maintain awareness of other ALWR TS reviews**
- **If we choose to pursue risk based TS, will use methodology in Regulatory Guide 1.177,** *An Approach for Plant-Specific, Risk-Informed Decision-Making: Technical Specifications*

Supporting Documentation for DCD Chapter 16

- 10 CFR 50.36(c)(2)(ii) Application Summary
  - Description of methodology
  - Table of results showing U.S. EPR systems and applicable 10 CFR 50.36 criteria and applicable TS reference
  - Accident and transient analysis review summary
    - Table of results showing analyses and key initial conditions, resulting safety limits, credited mitigation systems, applicable 10 CFR 50.36 criteria and applicable TS reference
- NUREG Roadmap
  - Marked up copies of NUREG templates
  - Summary justification for each change
- Bracketed Information Summary
  - Table identifying bracketed items, responsibilities for completion, and expected completion milestone

Collaboration on Olkiluoto 3: Supporting Technical Specification Development

- **Areas of current collaboration**
  - Selection of standard TS NUREG templates
  - Development of writer's guides
  - Comparison of screening results using 10 CFR 50.36 criteria
  - Common development of administrative requirements
- **Areas of future collaboration**
  - Development of technical requirements for systems

U. S. EPR Technical Specifications are being developed in coordination with OL3 for consistency

Summary and Next Steps

Sandra M. Sloan
Manager, Regulatory Affairs
New Plants Deployment

Summary

- LCOs for four train (N+2) systems in U.S. EPR Generic TS planned to be based on three required safety trains (N+1)
  - N+2 design allows one train to be removed from service without affecting safety functions
- U. S. EPR Generic TS development plan is based on standard industry guidance documents
- U. S. EPR Generic TS development plan incorporates available TSTF travelers
- Sufficient information will be provided in DCD Chapter 16 and supporting documentation to facilitate NRC review of U.S. EPR Generic Technical Specifications

Next Steps

- **Next meeting**
  - **June 20 2006: Fire Protection and Train Separation Criteria, Electrical System Design**

U.S. EPR Acronyms

> ACCU	Accumulator
> ALWR	Advanced Light-Water Reactor
> ECCS	Emergency Core Cooling System
> EDG	Emergency Diesel Generator
> I&C	Instrumentation and Controls
> IRWST	In-containment Refueling Water Storage Tank
> ITS	Improved Technical Specifications
> LHSI	Low Head Safety Injection
> MHSI	Medium Head Safety Injection
> MSRT	Main Steam Relief Train
> MSSV	Main Steam Safety Valve
> PZR	Pressurizer
> RCS	Reactor Coolant System
> RHRS	Residual Heat Removal System
> RTNSS	Regulatory Treatment of Non-Safety Systems
> RCSL	Reactor Control, Surveillance and Limitation System
> SBLOCA	Small Break Loss of Coolant Accident
> SBO	Station Blackout
> SGTR	Steam Generator Tube Rupture
> SI	Safety Injection
> STI	Surveillance Test Interval
> TS	Technical Specifications