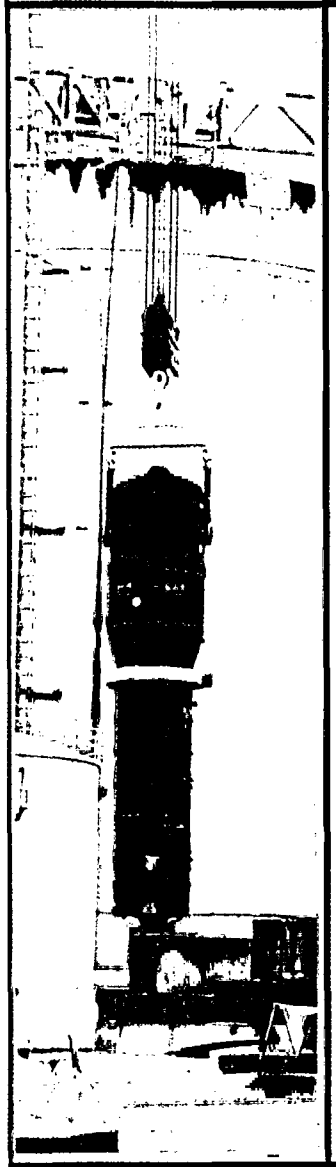
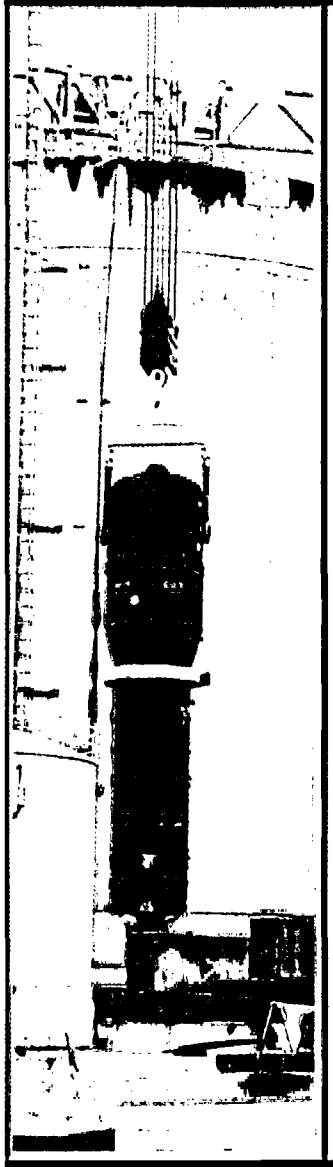
Watts Bar Nuclear Plant



Steam Generator Replacement Project Status/Issues

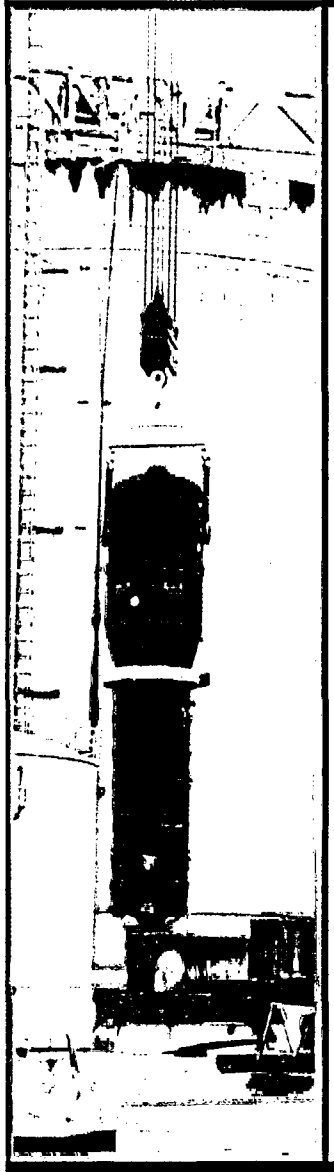
August 26, 2004

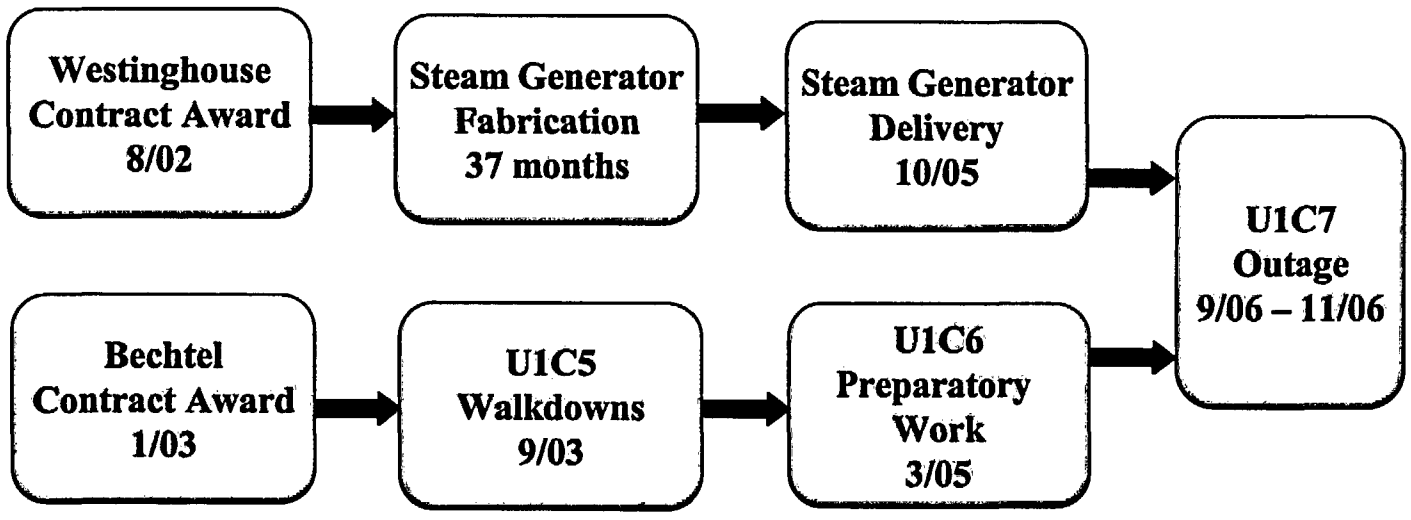
Introduction

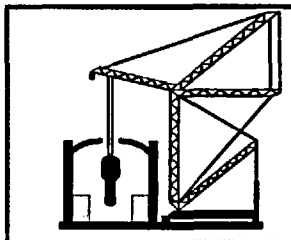


- Purpose
- Expectations

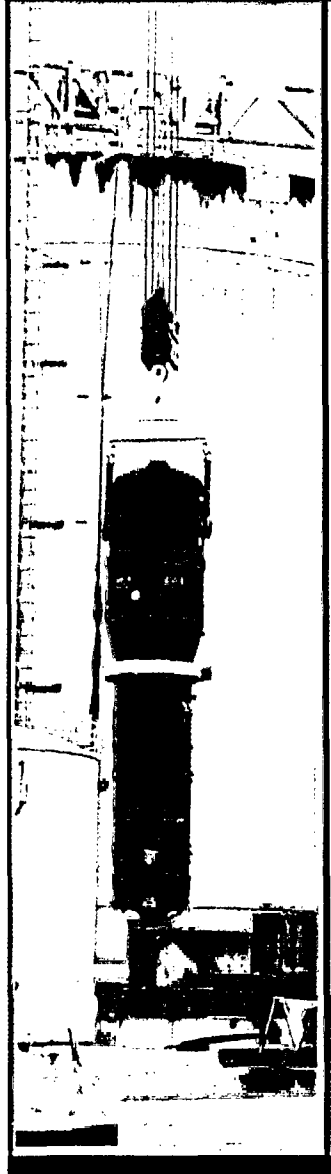
Project Overview





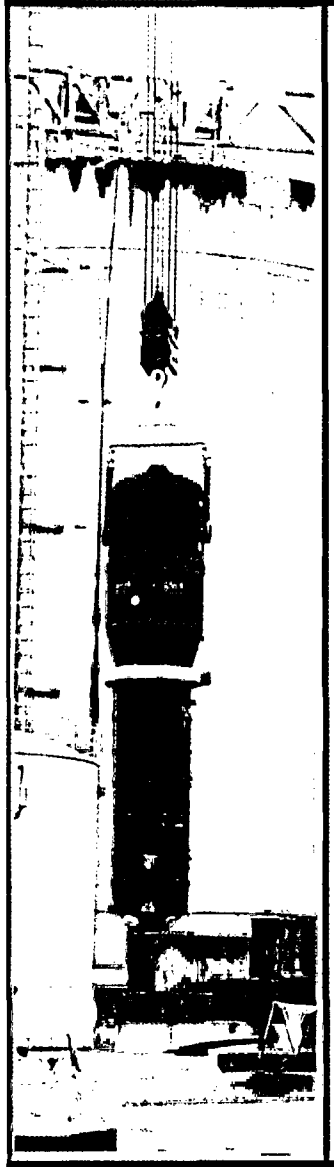


RSG Features – Same as SQN

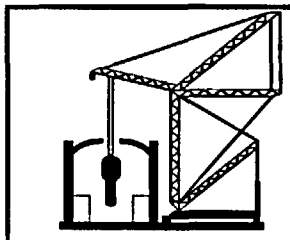


- Same physical size as old steam generators
- Increased tube surface area
- Integral loose parts strainer provided for FW/AFW
- Reduced moisture content at exit steam
- Advanced tube support grid to reduce contact length w/tubes
- Reduction of ASME welds/ISI
- Shellside recirculation nozzle and sparger for chemical cleaning
- Additional access handholes
- Snaplock Nozzle Dams provided for dose reduction
- Electro Polished Head Bowls for dose reduction

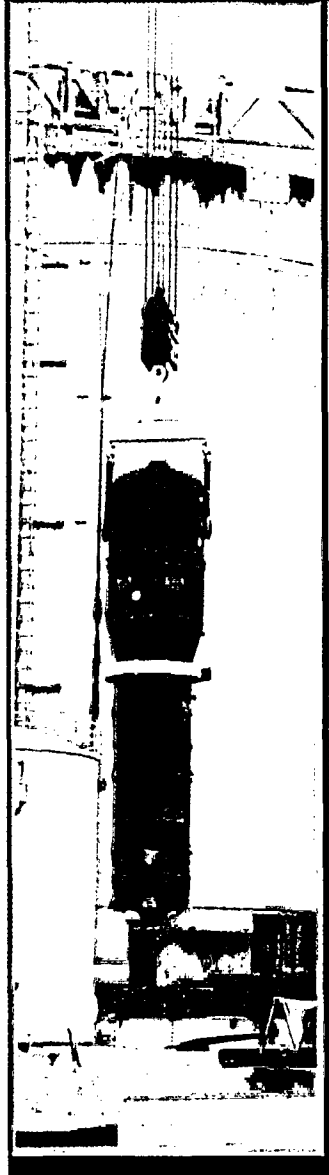
RSG Features – Different from SQN



- Uprate capability from 3475MWt to 3720MWt (future)
- Nozzles compatible with high chromium content piping
- Preheater designed to eliminate warmup during startup
- "Tempering Flow" for Aux FW nozzle warming eliminated
- Shellside blowdown from hot or cold side or combination
- Increased steam pressure of ~ 50 #
- 12% Tube plugging margin vs 8%-10%
- 50 year fatigue life

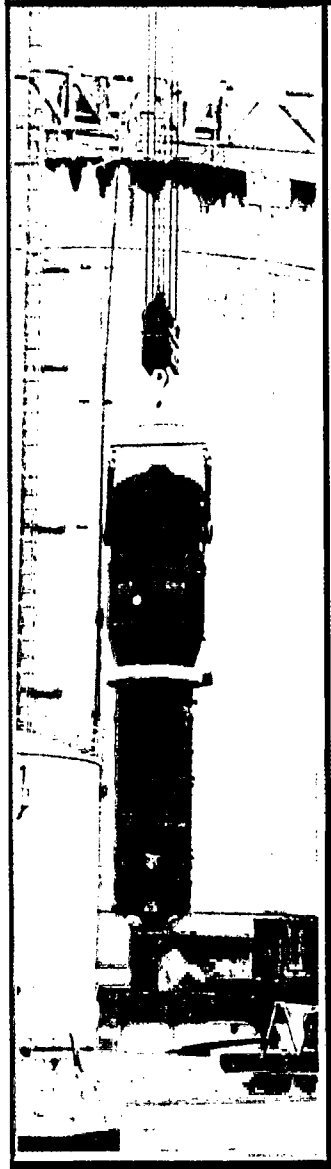


OSG/RSG Comparison

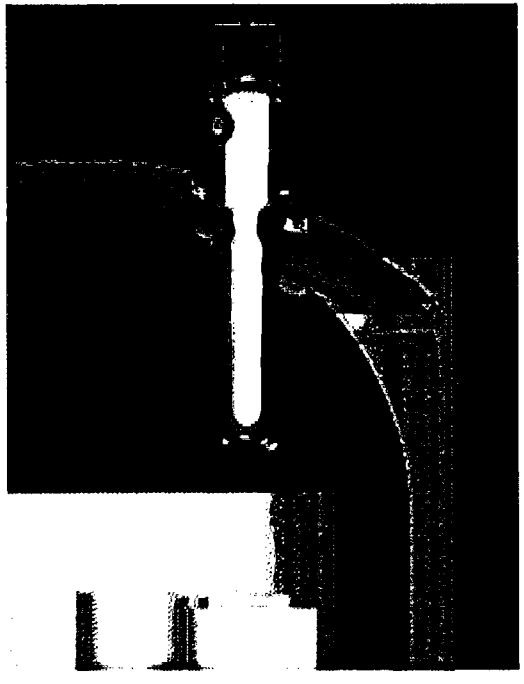


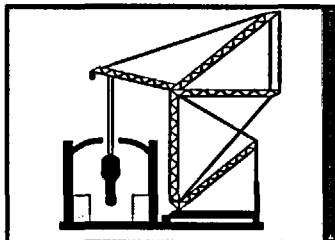
Parameter	OSG	RSG
Steam Pressure (Thermal Design)	980 psia	1030 psia
Max Moisture Carry Over	.25%	.10%
Nominal Tube OD	0.75 in.	0.75 in.
Tube Wall Thickness	0.43 in.	0.43 in.
Number of Tubes	4674	5128
Min. U-Bend Radius	2.25 in.	3.188 in.
Tube Bundle Length	27.39 ft.	37.04 ft.
Max Plug Level	10%	12%
Tube Material	I 600	Alloy 690
Secondary Side HT Area	48,000 sq. ft.	68,000 sq. ft.
Primary Side Volume / SG	935 cu. ft.	1193 cu. ft.
Secondary Side Volume / SG	5947 cu. ft.	5618 cu. ft.
Total RCS Volume	11,789 cu. ft.	12,821 cu. ft.
Dry Weight	352 tons	380 tons
Secondary Side Liquid Mass 100% Power	95,000 lbm	109,549 lbm
Secondary Side Steam Mass 100% Power	9,000 lbm	7,618 lbm

Steam Generator Replacement

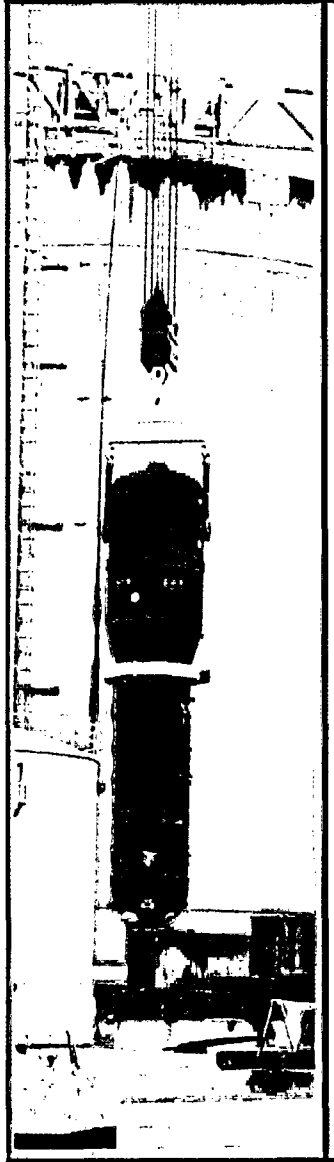


- **One Piece Replacement like SQN**
- **Major Activities Involved:**
  - Obtain & Assemble Large Crane
  - Build Support Facilities
  - Defuel Reactor
  - Cut holes in Shield Building, Steel Containment Vessel (SCV), and SG Compartment Roofs
  - Remove Old SGs
  - Install Replacement SGs
  - Restore SG Compartments, SCV, and Shield Building
  - Refuel Reactor
  - Pressure Test to Demonstrate Restored Containment Integrity

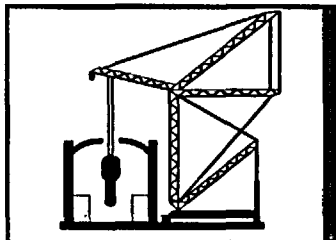




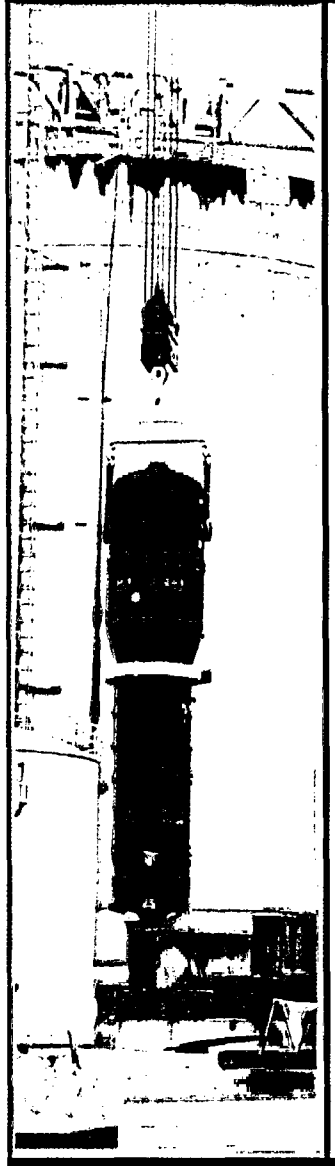
Current Project Status



- Shield Building, SCV and SG Compartment Modifications are Similar to SQN and Will Use Same Methodology
- Safe Load Paths and Load Drop Analysis for Crane Components, Steam Generators, and Other Heavy Loads under Development
- Using Lessons Learned From SQN
  - Movement of Material to SCV Dome
- N-1 Design Packages - Issued or in final review to issue
- SGRO Design Packages - Several reaching 10% Status
- Coordinating with Security to maintain compliance with DBT Security Order

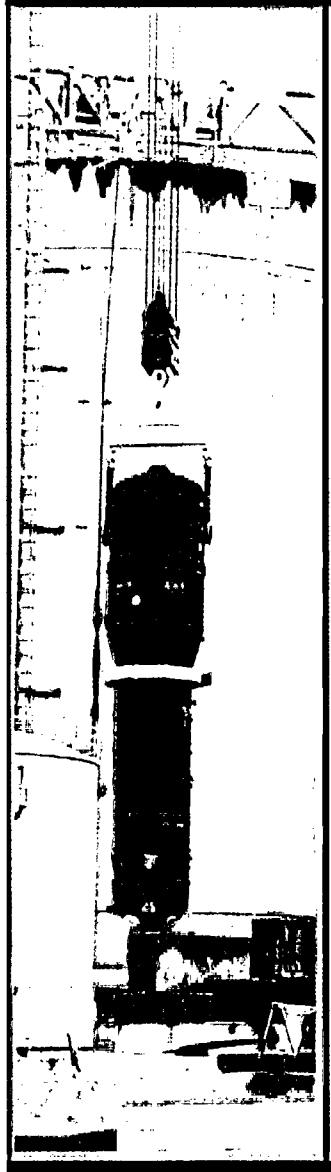


Current Project Status (continued)

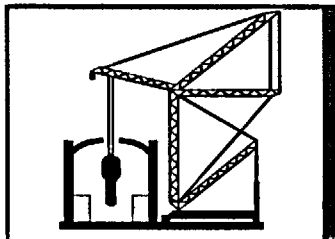


- **Westinghouse NSSS Analyses Being Performed**
  - RSG with 2 ° F T-Avg Reduction
  - Input Parameters
    - Primary Reactor Operating Conditions for 0%, 12% SG Tube Plugging
    - Best Estimate Steam Parameters for Turbine/BOP Cycle
  - Safety
    - LOCA
    - Transient Analysis (FSAR Chapter 15 non-LOCA events)
    - LOCA Mass & Energy/Containment Integrity
    - MSLB Mass &Energy/Containment Integrity
    - SG Tube Rupture
    - Steam Releases for Dose Analysis
  - Control Systems
    - Margin to Trip Analysis
    - Low Temp Over Pressure Protection System
    - RCS and Steam Pressure Control Systems
  - Components
    - NSSS and Auxiliary Systems Design Transients
    - Component Reviews
      - Pumps, Valves, Tanks, Heat Exchangers
      - Fuel Design
      - Reactor Coolant Loop Piping
  - Systems
    - Fluid Systems
    - NSSS/BOP Interface Review

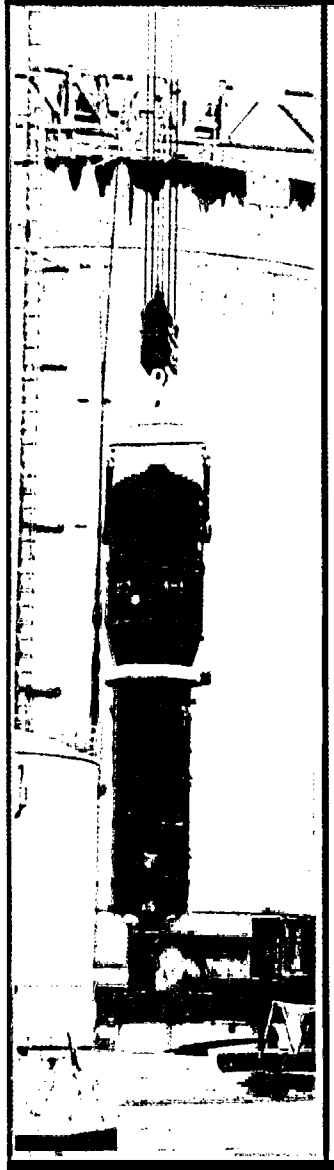
NRC Involvement



- Steam Generator Component Replacement Performed via 10 CFR 50.59
  - Plan to demonstrate original and replacement SG equivalence and compliance w/existing NRC acceptance criteria
- Design Changes Related to RSGs Performed via 10 CFR 50.59
  - NSSS Reactor Coolant Loop Reanalysis
    - Seismic Spectra B+C used per UFSAR
    - Use coupled analysis of interior concrete structure & NSSS loop
  - 2 ° F Tavg Reduction
  - 2% Increase in Pressurizer Level Operating Range
  - SG FW Operational Changes
- NRC ROP Oversight of 10 CFR 50.59 Evaluations

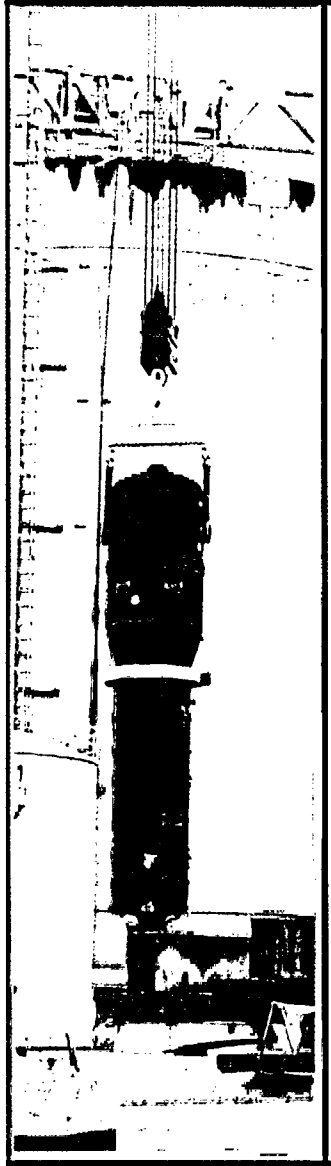


NRC Involvement (continued)



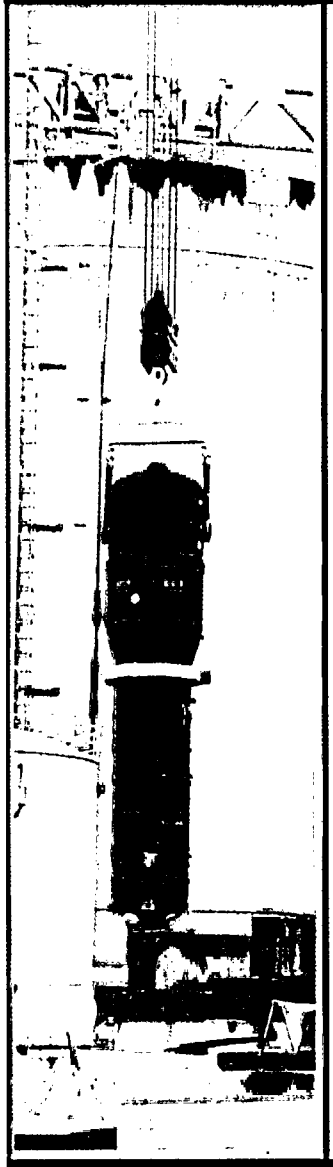
- Known License Amendment/Relief Requests
  - Use of Bar-Lock Mechanical Couplers instead of Cadwelds for Rebar Splicing during Shield Building Restoration
  - Opening of Penetrations in Shield Building Dome during Modes 1-4 for Material Handling
  - SGTR Operator Action to Prevent Overfill
  - Additional Ice Bed Total Weight (Ice Bed Tech Spec)
  - SG Water Level Setpoints
    - Steam Generator Water Level- Low Low (RTS Tech Spec)
    - Steam Generator Water Level- High High (RTS and ESFAS Tech Specs)
    - Steam Generator Water Level- (RCS Loops- Mode 3, RCS Loops- Mode 4, and RCS Loops- Mode 5, Loops Filled Tech Specs)
  - Revise APC Specifications
  - Use of Pressure Test rather than CILRT for PMT of restored Steel Containment Vessel like SQN

NRC Involvement (continued)



- Potential License Amendment Requests
  - Compensatory Measures due to Load Drop
    - WBN evaluating whether a license amendment and compensatory measures for rigging and transport of steam generators are needed
- SQN License Amendment Requests Not Required for WBN
  - SG Compartment Restoration
    - License amendment for a code change not required, since existing WBN design is more robust compared to SQN
    - Will use design similar to SQN

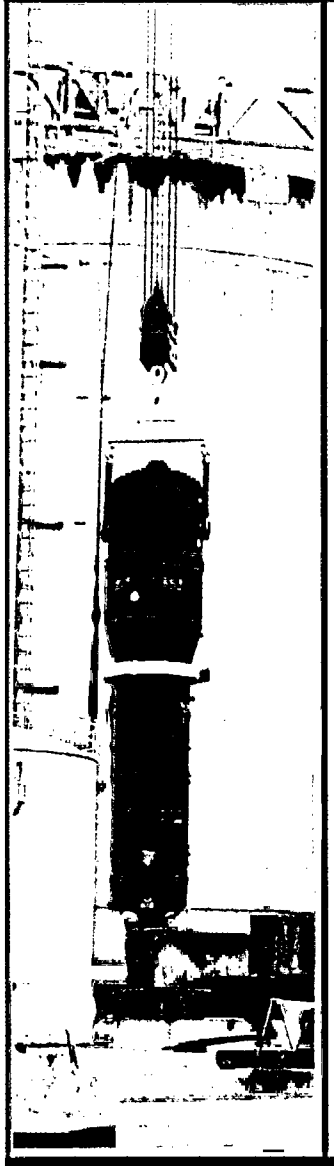
NRC Involvement (continued)



Items Of Note

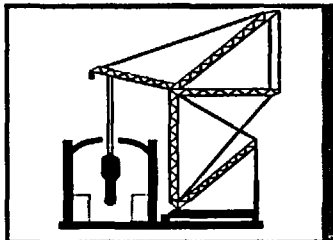
1. **Use of Bar-Lock Mechanical Couplers instead of Cadwelds for Rebar Splicing during Shield Building Restoration**
   - Propose not performing pre-use qualification testing
     - Same application as NRC approved for SQN
     - Couplers purchased from same vendor and dedicated same as SQN
     - Material, process and QA program are same
     - Sister splice testing will verify adequacy of installed couplers

NRC Involvement (continued)

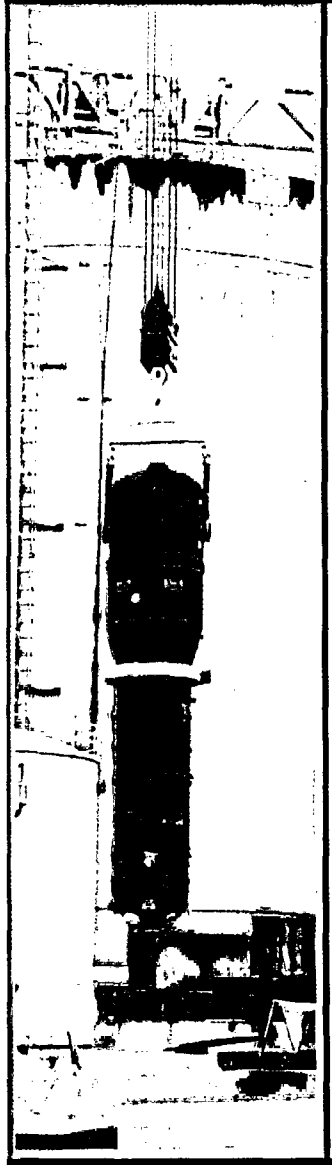


2. Opening of Penetrations in Shield Building Dome during Modes 1-4 for Material Handling

- One-time change to Tech Spec 3.6.15 (Shield Building) required during Cycle 6
- Allows material movement to SCV dome through Shield Building dome versus through Auxiliary Building and up ladder in annulus
- Will reduce time spent in annulus and minimize personnel dose
- Will reduce congestion and delays at annulus ladder
- Will reduce potential for damage of SSCs along path through Auxiliary Building and annulus
- Offsite Dose Impacts
- Mission Dose Impacts



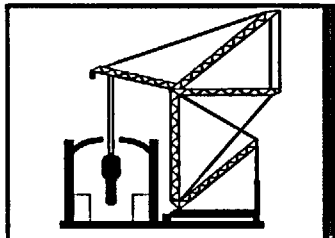
NRC Involvement (continued)



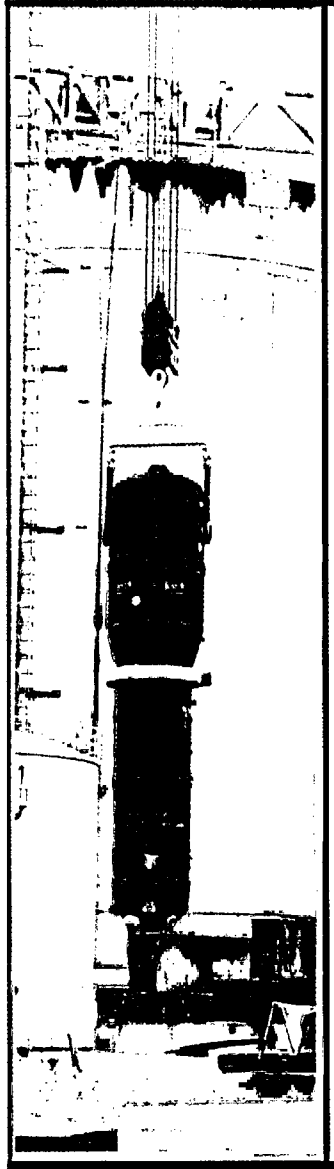
3. NSSS Reactor Coolant Loop Reanalysis

Replacement Steam Generator (increase in mass and change in stiffness) constitutes a modification to Reactor Coolant Loop reanalysis. For New/Modification of items, UFSAR requires use of Seismic Spectra Set B+C rather than previous Spectra Set A evaluated to Spectra B.

- Couple Interior Containment Structure (ICS) with the Reactor Coolant Loop (RCL)
  - Original:
    - 4-Loop RCL/supports model (uncoupled)
    - Set A Amplified Response Spectra (ARS) input at highest loop support location
  - Reanalysis:
    - 4-Loop RCL/supports coupled with ICS
    - Set B+C ARS input at basemat elevation

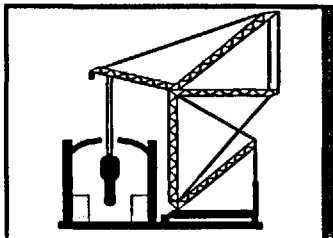


NRC Involvement (continued)

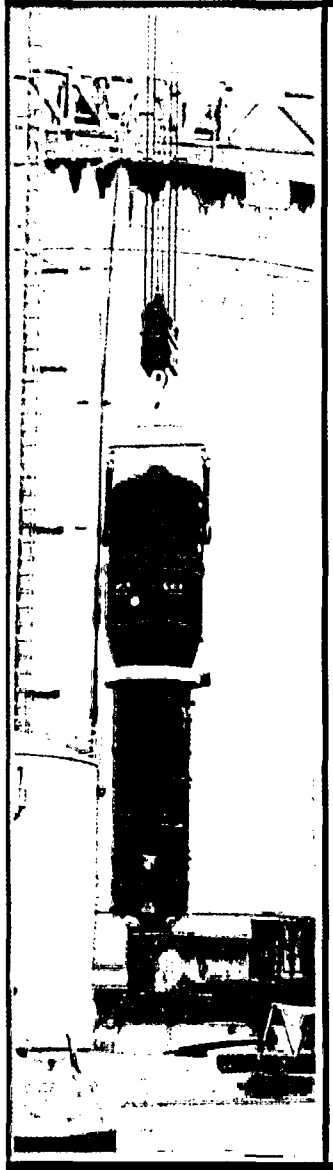


- Coupled ICS and RCL model used for WBN to generate ARS for SSC attachments to Shield Building SCV and ICS in accordance with UFSAR
- Similar model used by Westinghouse in other applications for RCL reanalysis for steam generator snubber elimination and/or SG replacement (Wolf Creek, Callaway, Farley, McGuire, Catawba)

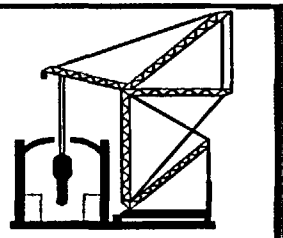
– 3-D Seismic Analysis Methodology
  - Original: 2-D input/combination methodology per original FSAR
  - Reanalysis: 3-D input/combination methodology per UFSAR
  - WBN piping and supports analyzed using 3-D method for Sets B and C Seismic Input.
  - UFSAR specifies 3-D for new design and modification analyses
  - Consistent with SRP 3.7.2



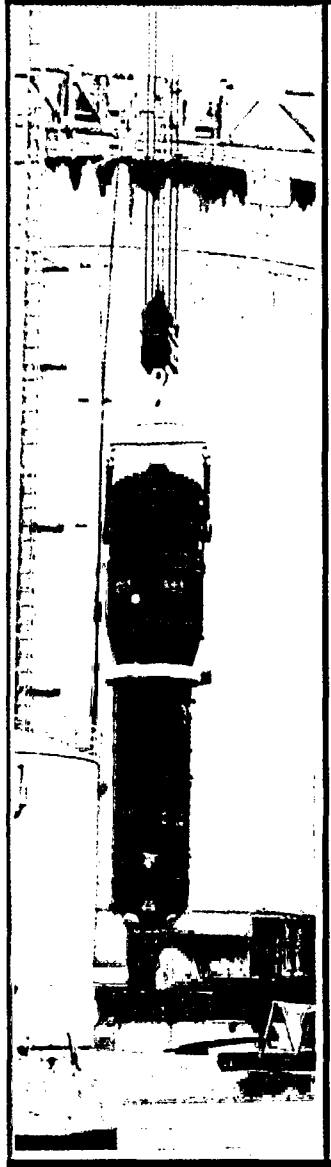
NRC Involvement (continued)



- PIPESTRESS Computer Code used for RCL Reanalysis
  - Original; WESTDYN-7
  - Reanalysis: PIPESTRESS
  - Approved for analysis of AP600 piping systems.

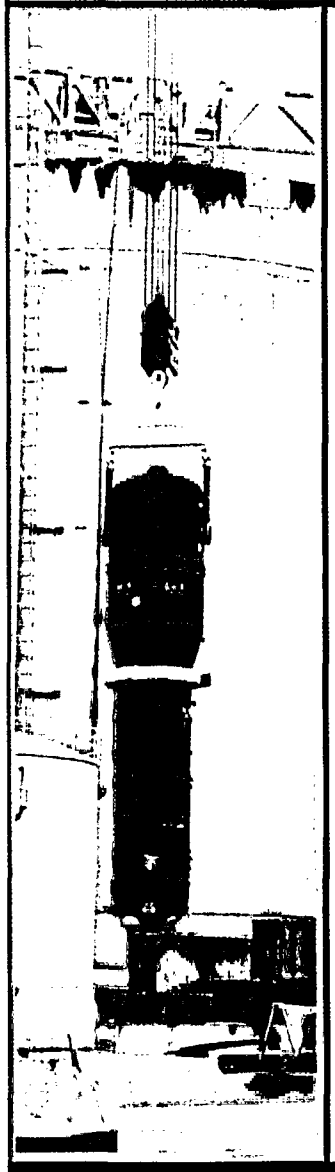


NRC Involvement (continued)



- **License Amendment Submittal Schedule**
  - Open Temporary Holes in Shield Building Dome – 11/04
  - SGTR Operator Action to Prevent Overfill – 12/04
  - Load Drop Compensatory Measures (if required) – 5/05
  - Additional Ice Mass – 7/05
  - SG Water Level Setpoints – 8/05
  - Revise APC Specifications – 8/05
  - Use of Pressure Test rather than CILRT – 8/05

Summary



- Implementing SQN Lessons Learned and Best Practices
- Addressing Licensing/Design Basis differences with SQN
- Plan is to provide minimum of 1 year staff review time