February 10, 2000

LICENSEE: Entergy Operations, Inc.

FACILITY: Arkansas Nuclear One, Unit 2

SUBJECT: SUMMARY OF JANUARY 18, 2000, MEETING TO DISCUSS REPLACEMENT STEAM GENERATOR-RELATED APPLICATIONS

On January 18, 2000, representatives of the Nuclear Regulatory Commission (NRC) met with Entergy Operations, Inc. (Entergy or the licensee) to discuss several license amendment applications associated with the Replacement Steam Generators (RSGs). These applications have already been submitted on the docket. Enclosure 1 is a list of meeting attendees. Enclosures 2 and 3 are the licensee's handouts used during the meeting.

The licensee's presentation served as an introduction to several of the RSG-related license amendment requests to facilitate the NRC's review. The license amendment requests discussed were: (1) an unreviewed safety question on potential steam generator drop scenarios, (2) steam generator inspection requirements, (3) reactor protection system and engineered safety features actuation system setpoint changes and high linear power trip setpoint changes, and (4) relocation of the steam generator high-level trip setpoints. The RSGs are scheduled to be installed during the fall 2000 refueling outage (2R14, scheduled to begin on September 15, 2000).

In addition, the licensee briefly mentioned the containment uprate license amendment request (this application was previously discussed with the NRC in a meeting on November 9, 1999), and provided an overview of their planned 7.5 percent power uprate application. The power uprate application is scheduled to be submitted during the 3rd quarter of 2000 and approval will be requested by March 2002 (one cycle after the RSGs are installed).

During the licensee's presentation, the NRC identified a few areas needing clarification or follow-up that will be the subject of future telephone calls between the NRC and the licensee. In addition, as the NRC's review of the applications progress, the NRC will engage the licensee as needed to resolve any issues identified.

/RA/

Thomas W. Alexion, Project Manager, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-368

Enclosures: As stated (3)

cc w/encls: See next page

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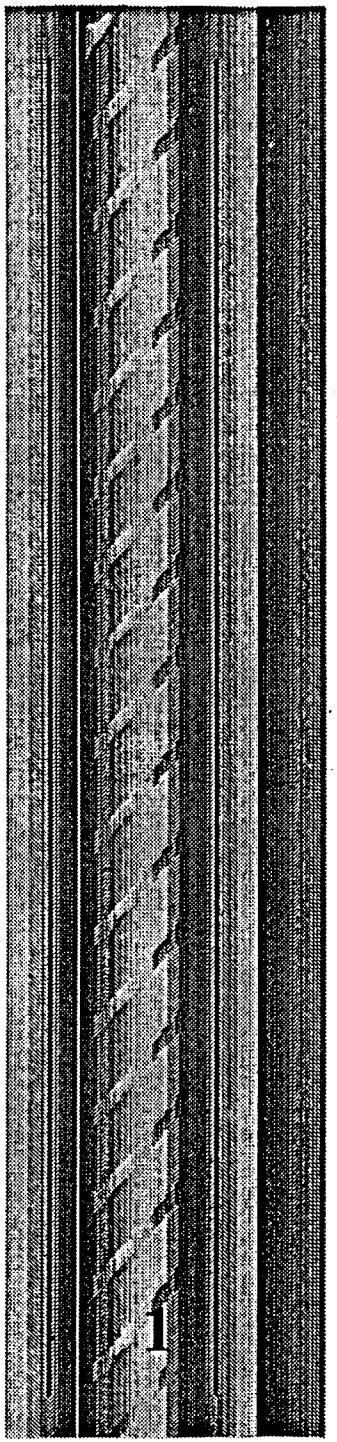
ATTENDANCE LIST

PUBLIC MEETING HELD ON JANUARY 18, 2000

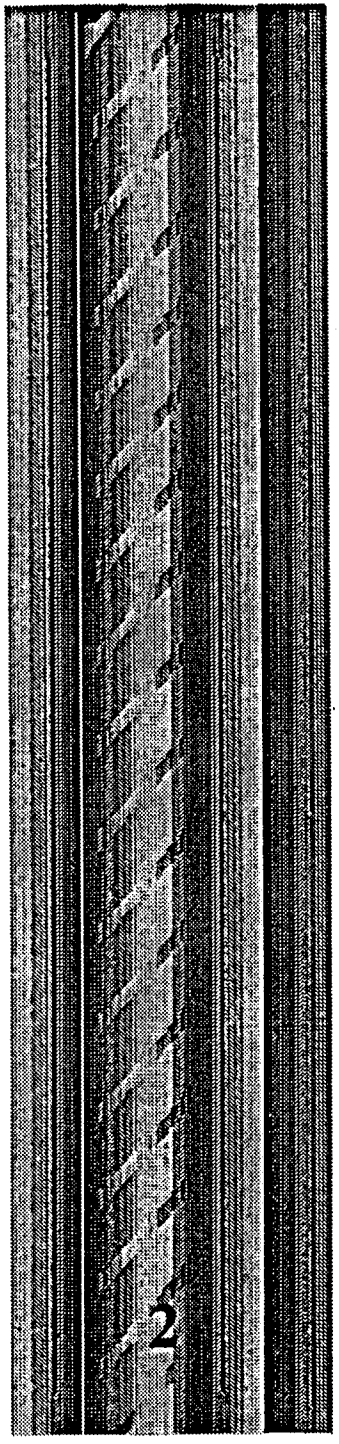
Name	Organization
S. McWilliams	Entergy
D. James	Entergy
L. Humphrey	Entergy
D. Bice	Entergy
B. Daiber	Entergy
D. Nilius	Entergy
R. Wilson	Entergy
S. Kline	Bechtel
C. Reid	Bechtel
M. Golbabai	ABB-CE
R. Surman	Westinghouse
R. Bernier	Ariz. Public Service
C. Nolan	NRC
S. Athavale	NRC
J. Tsao	NRC
C. Liang	NRC
S. Richards	NRC
F. Orr	NRC
F. Akstulewicz	NRC
P. Milano	NRC
S. LaVie	NRC
R. Lobel	NRC
H. Garg	NRC
B. Thomas	NRC
T. Alexion	NRC

Enclosure 1



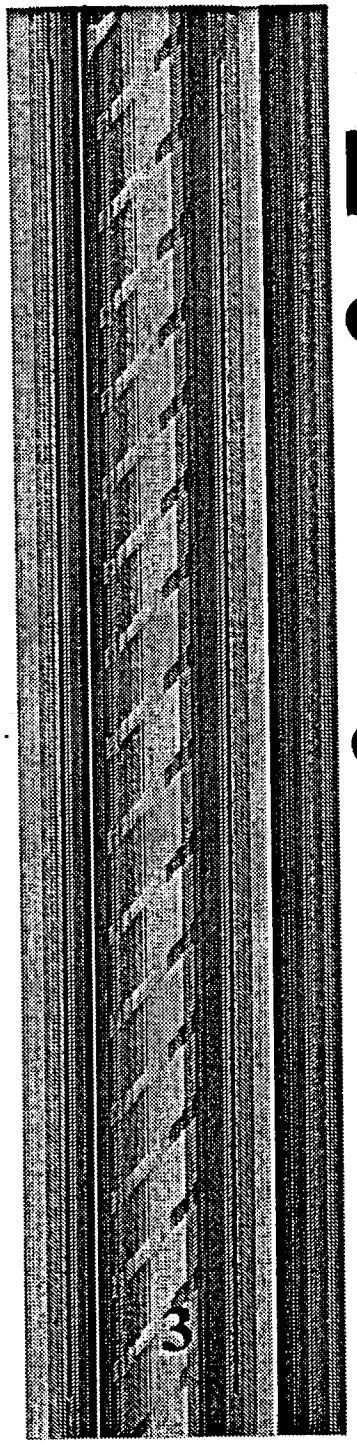
Meeting with NRR to Discuss Replacement Steam Generator Submittals

January 18, 2000



Introduction

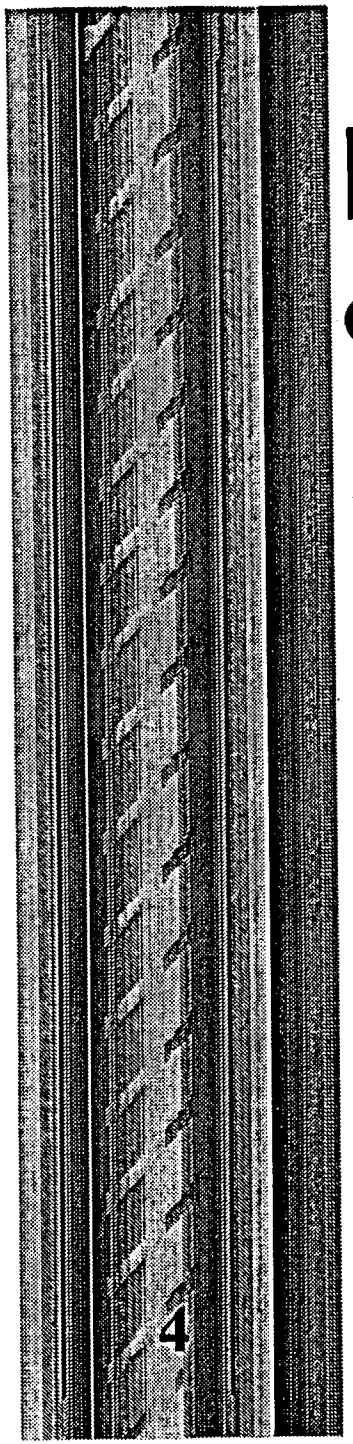
Larry Humphrey



Introduction

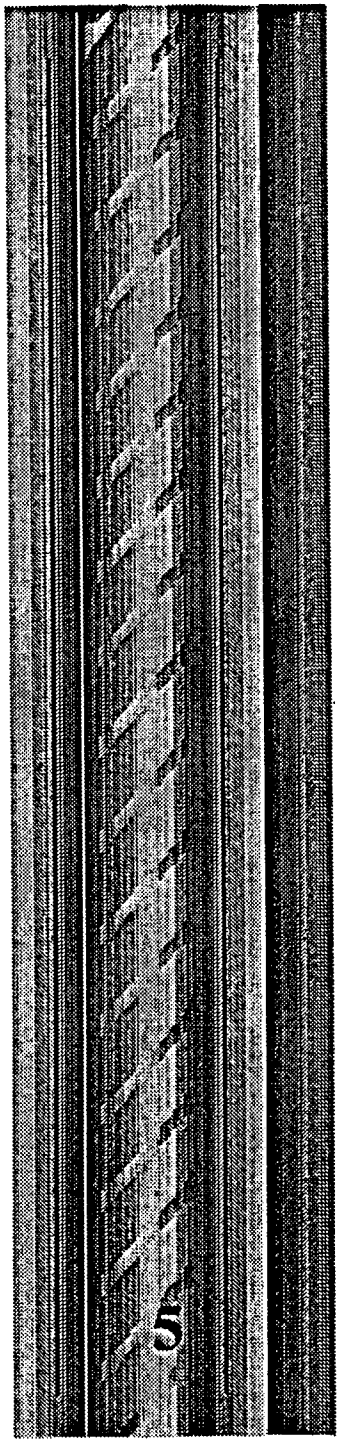
- **Meeting purpose**
  - **1) discuss SG replacement submittal packages**
  - **2) present power uprate overview**
- **Agenda**

• Introduction	Larry Humphrey
• Potential steam generator drop scenarios	Jim McWilliams
• SG inspection requirements	Dale James
• RPS setpoints & SG high level trip	Bryan Daiber
• Power uprate overview	Roger Wilson



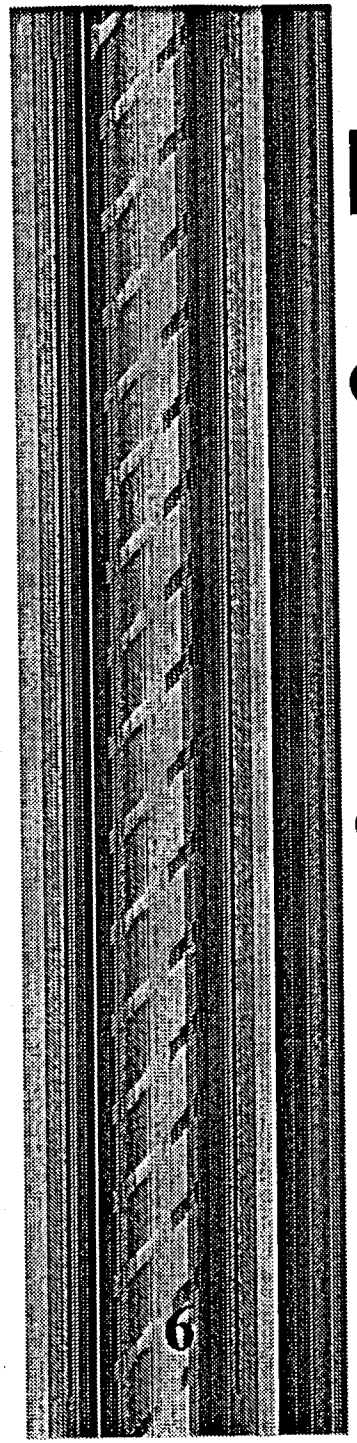
Introduction

- **Previous Meetings with NRC Staff**
  - **October 15, 1997**
    - **project overview**
    - **design comparison of SGs**
  - **July 28, 1998**
    - **project overview**
    - **design comparison of SGs**
    - **safety/structural analysis**
    - **licensing aspects**
  - **November 9, 1999**
    - **containment uprate from 54 to 59 psig**



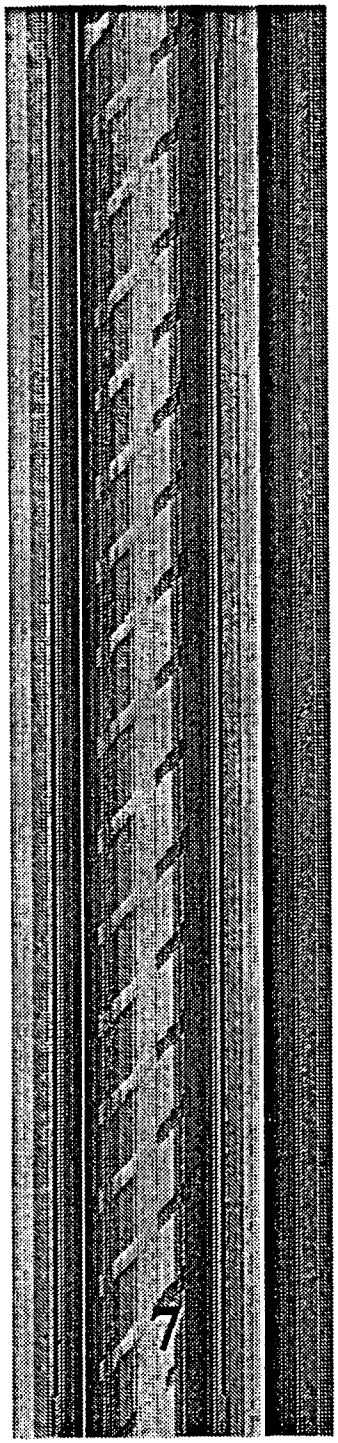
Introduction

- **List of Key Replacement Steam Generator (RSG) Submittals for NRC Approval**
  - **09/09/98 request to use ASME Code Cases**
  - **08/18/99 SG inspection requirements**
  - **09/17/99 SG drop scenarios (USQ)**
  - **11/03/99 containment uprate (USQ)**
  - **11/29/99 RPS setpoint changes (USQ)**
  - **11/29/99 SG high level trip setpoints**



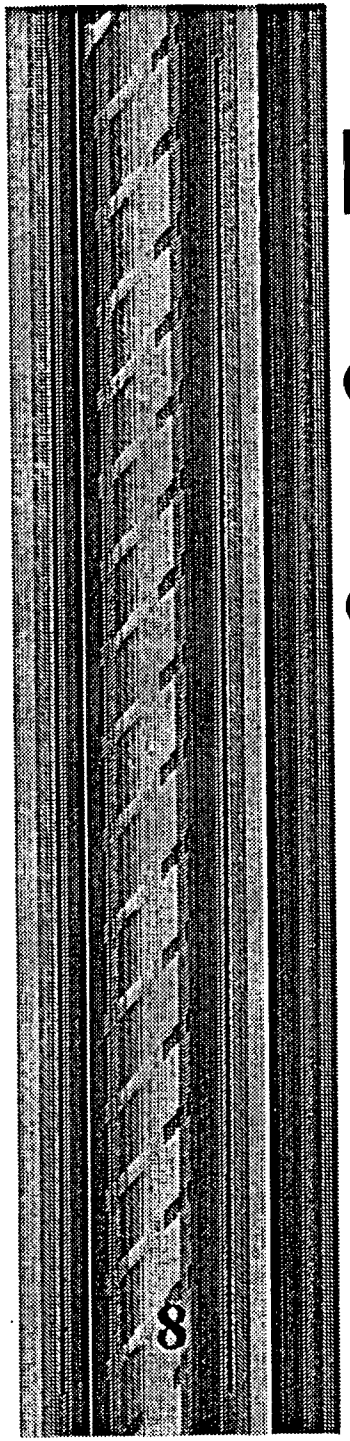
Introduction

- **RSGs**
  - **supplier - Westinghouse**
  - **safety analysis - ABB-CE**
  - **changeout services - Bechtel**
- **Schedule**
  - **replacement during RFO 2R14; September 15, 2000**



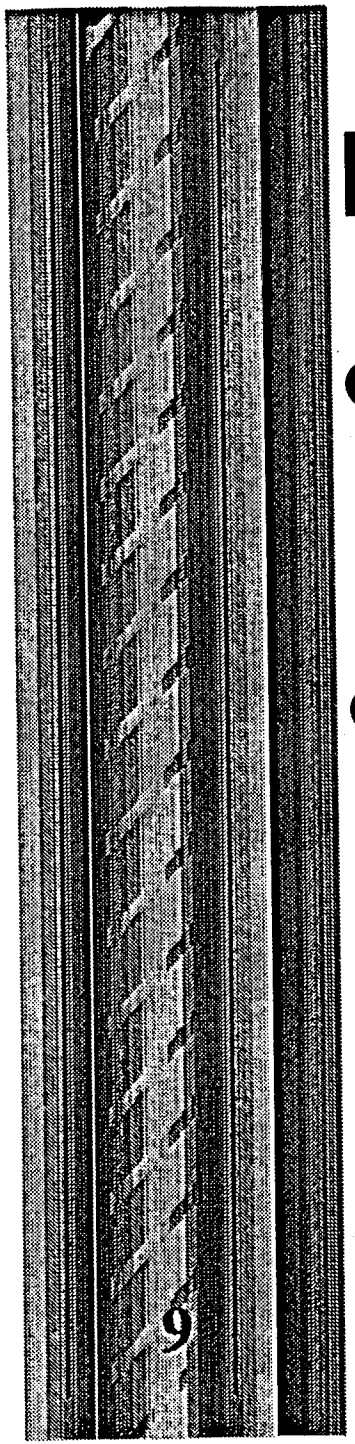
Introduction

- **RSGs**
  - **increased mass and volume**
  - **increased heat transfer area**
- **Access for SG replacement will be via a temporary opening in the containment building wall above the equipment hatch**
  - **approx 52 ft above ground elevation**
  - **approx 21 ft wide by 28 feet high**



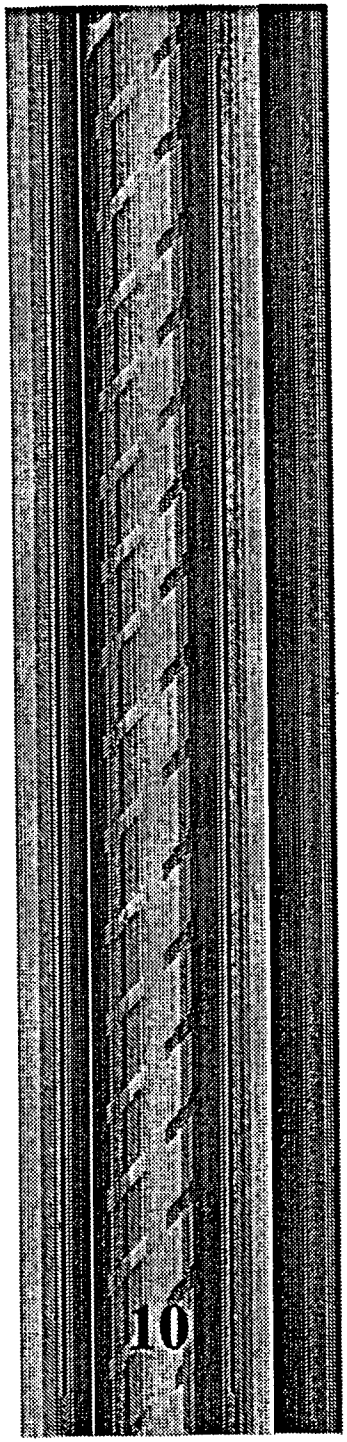
Introduction

- **Install the RSGs in Accordance with 10CFR50.59**
- **Tech Spec changes and USQs Submitted to the NRC for Review and Approval**



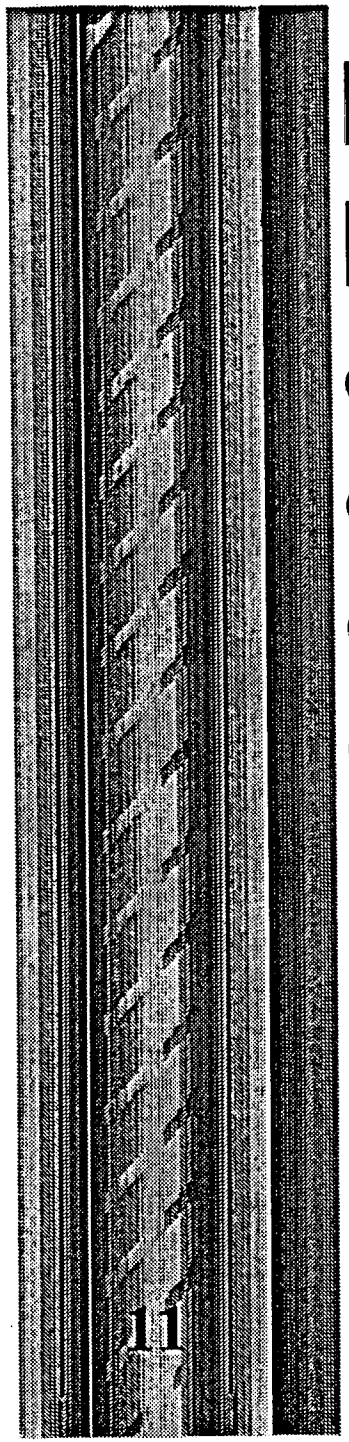
Introduction

- **Operate One Cycle at Current Licensed Power Level Following 2R14**
- **Power Uprate (7.5 %)**
  - **objective during design/analysis of RSGs**
  - **2R15 (Spring 2002)**



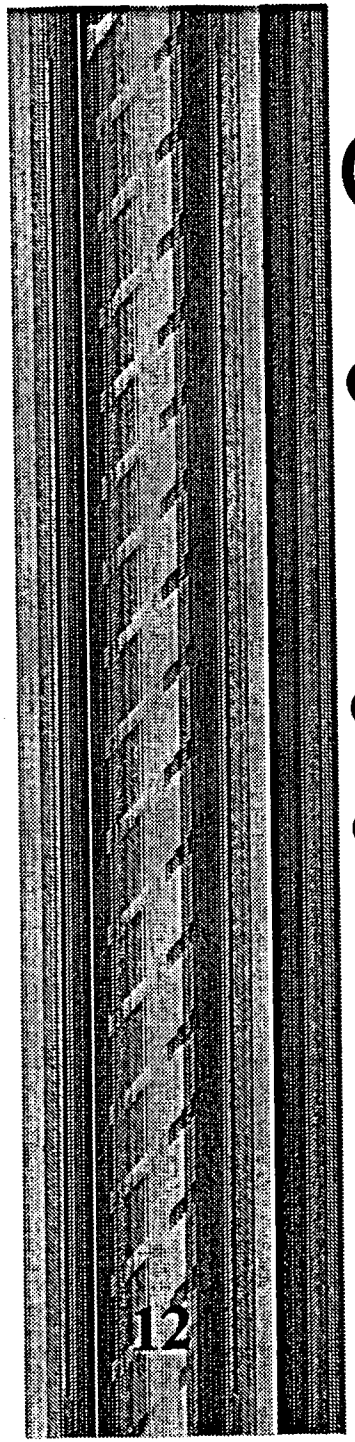
USQ Regarding ANO-1 Potential Steam Generator Drop Scenarios

Jim McWilliams



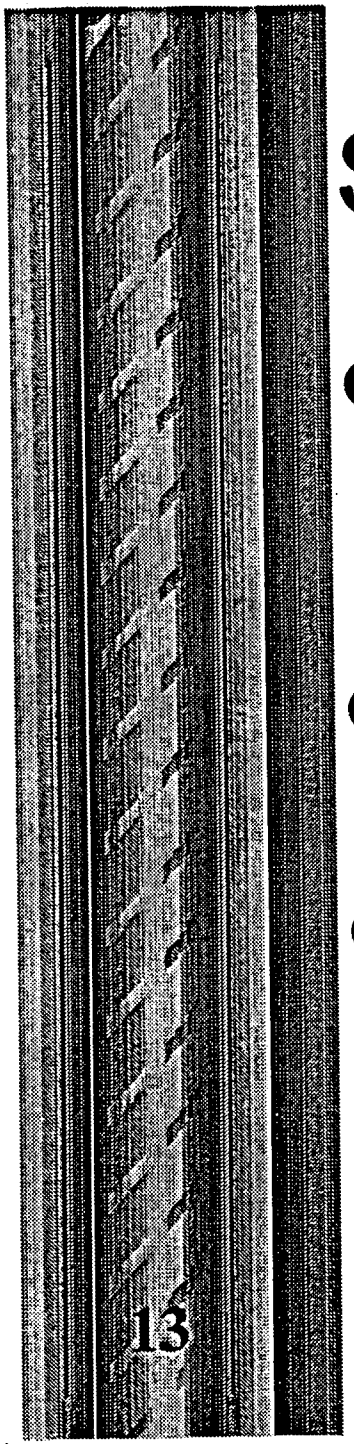
Potential Steam Generator Drop Outline

- **Overview of USQ for ANO-1 EDGs**
- **S/G Load Path Evaluation**
- **Load Handling Equipment**
- **Load Drop Scenarios**
- **System level effects of a load drop**
- **Contingency planning and compensatory measures**
- **USQ for potential loss of both EDGs for ANO-1**



Overview of S/G Drop USQ

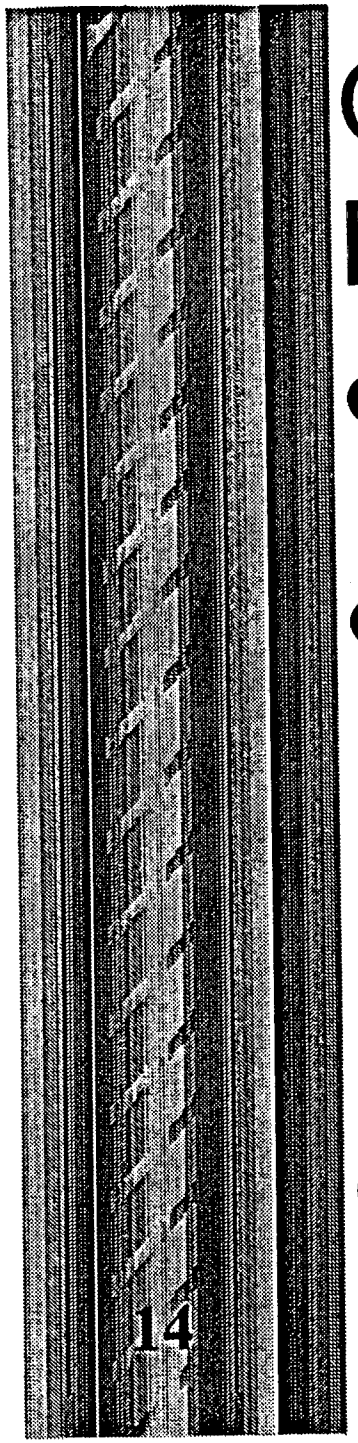
- **S/G Load Path Evaluation and Movement of S/Gs results in an Unreviewed Safety Question**
- **Potential for a dropped S/G exists**
- **S/G drop could affect multiple systems or trains for ANO-1 and/or ANO-2**
- **Effects of a drop have been evaluated and compensatory measures defined**



S/G Load Path Evaluation

- **Evaluated the S/G route from barge to containment to storage facility for potential impacts to both units**
- **Addressed grade, compaction, and effects on buried system piping**
- **Resolved impacts**

  -Circ Water, Natural Gas lines, culverts, manholes, etc
- **Identified ANO-1 EDG USQ**

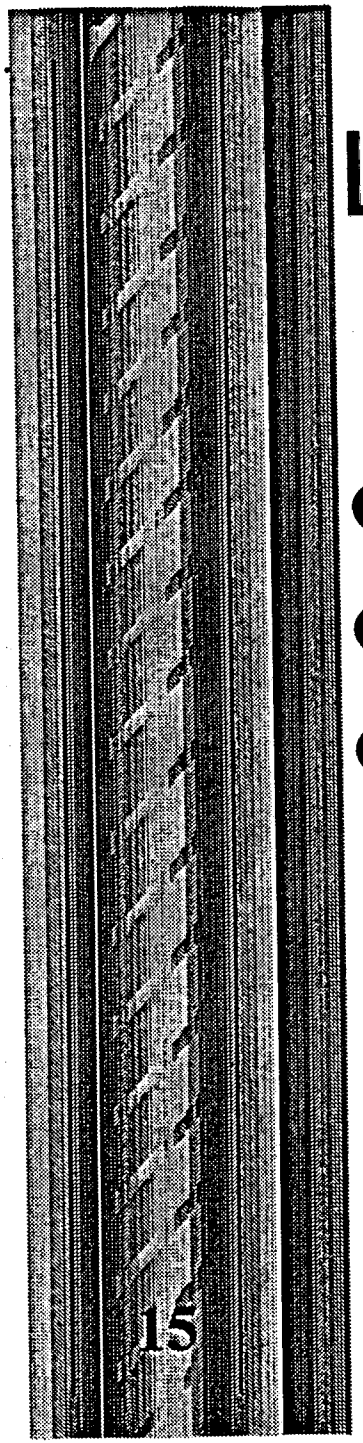


Overview Of Load Handling Equipment

- **Runway beam support system (RBSS)**
- **Outside lift system (OLS)**

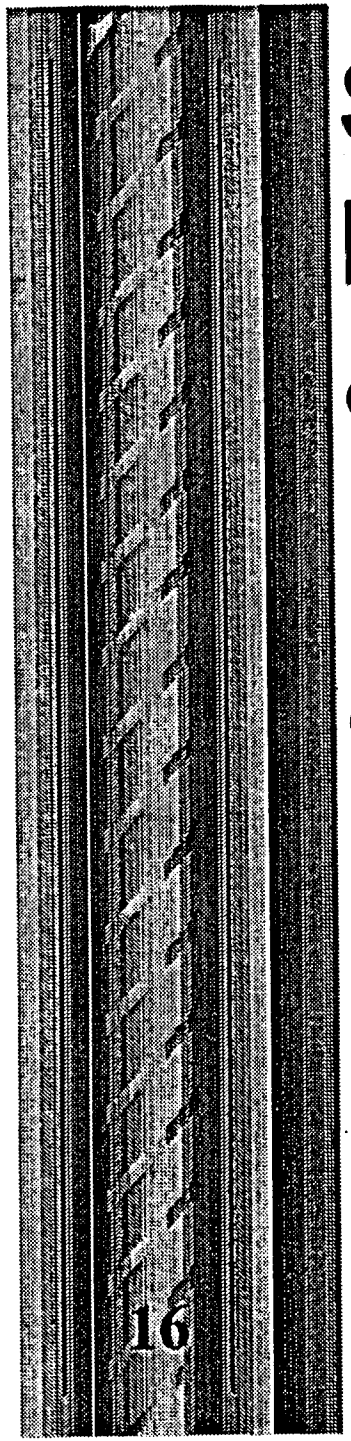
  -Seismic II/I and wind/tornado loading requirements satisfied (unloaded configuration)

  -Load testing after assembly
- **Transporter**



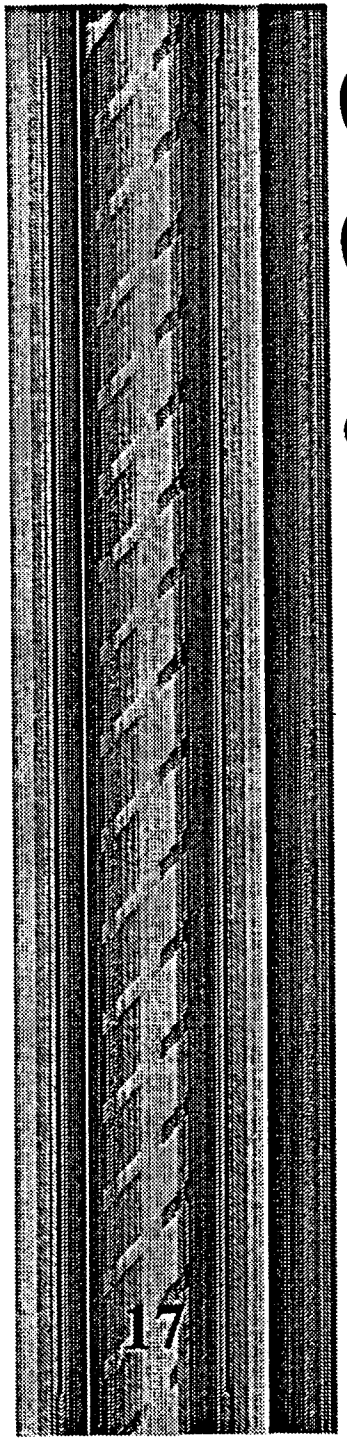
Load Drop Scenarios

- **Load drop from RBSS/OLS**
- **Load drop from transporter**
- **Failure postulated due to**
  - **-Seismic event**
  - **-High winds**
  - **-Failure of load handling equipment**



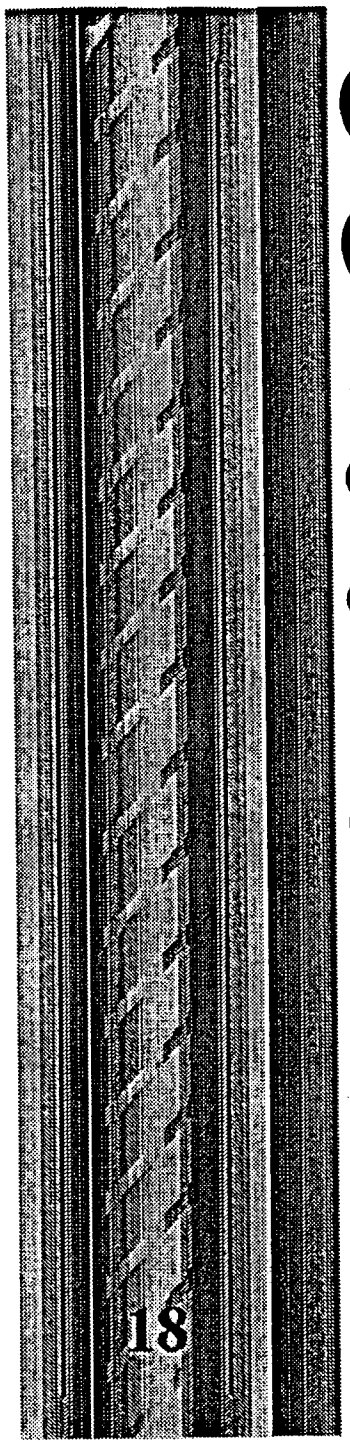
System Level Effects Of A Load Drop

- **ANO-1 Red & Green Trains of EDG Fuel Oil Storage and Transfer System (USQ)**
- **ANO-2 Red & Green Trains of EDG Fuel Oil Storage and Transfer System**
- **ANO-1 Service Water Emergency Cooling Pond Return Line**
- **Fire Water System**



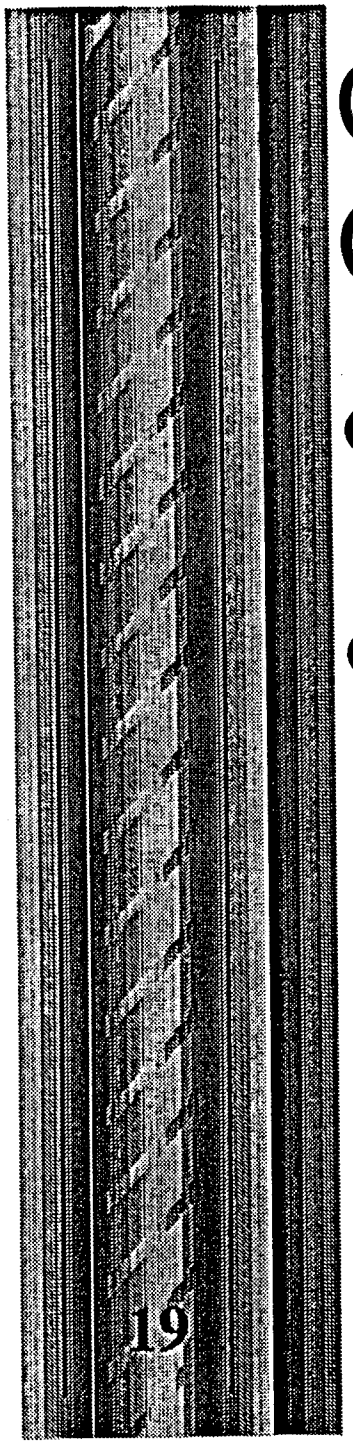
Contingency Planning and Compensatory Measures

- **Special Work Plan will control compensatory measures**
  - **Dedicated S/G Drop Team personnel available during potential times**
  - **Materials staged for FO piping and transfer pump power supply**
  - **S/G Drop Team personnel trained and dry run on compensatory measures performed**



Contingency Planning and Compensatory Measures

- **EDG Day tanks completely full**
- **Power one train of control room cooling from ANO-1**
- **ANO-1 Service Water remains aligned to the lake, not ECP**
- **Confirm SBO diesel operable**
- **Transporter at minimum height**

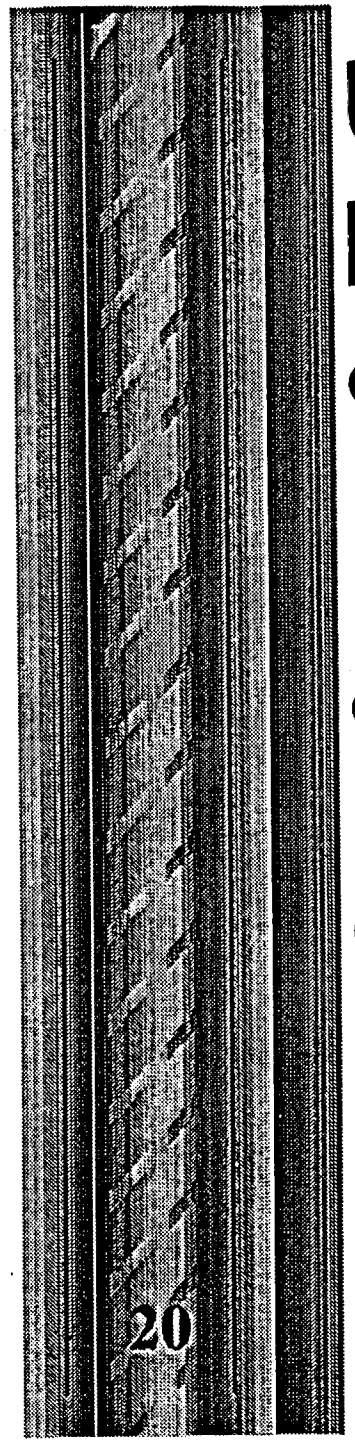


Contingency Planning and Compensatory Measures

- **ANO-1 SW procedure change to supply ANO-2 Spent Fuel Pool**
- **ANO-1 enters TS 3.0.3 for EDGs if S/G is dropped (T.S. 3.7.1.C)**

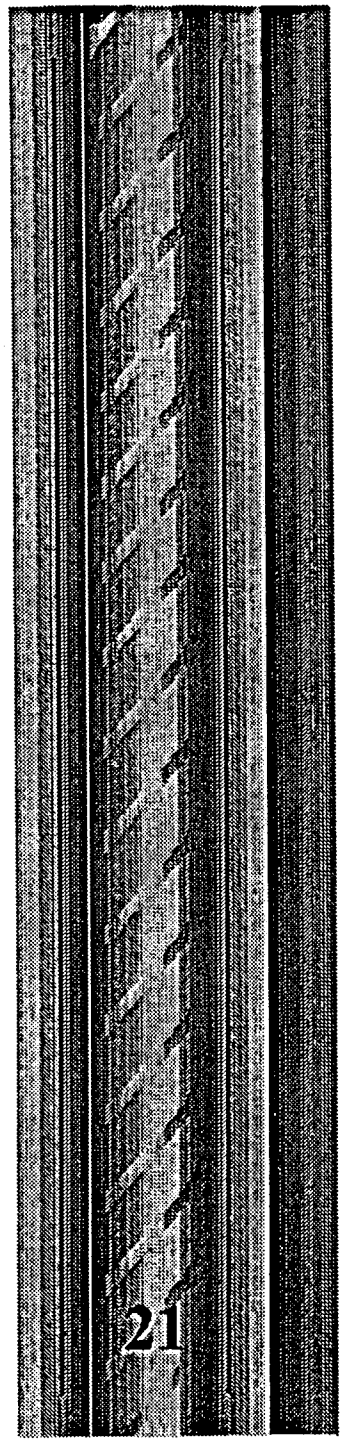
  -EDGs remain available to start and supply power

  -EDGs inoperable due to loss of diesel fuel oil transfer capability



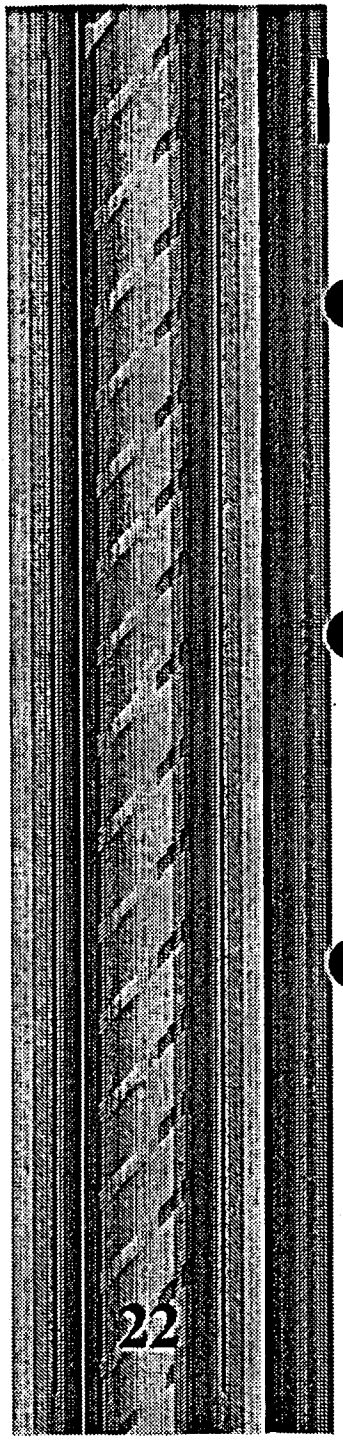
USQ on Potential Loss of Both ANO-1 EDGs

- **Based upon ANO evaluations and specified compensatory measures in place for drop S/G**
- **Determined No Significant Hazards Exist for Drop S/G**
- **No significant increases in amounts of effluents released off-site**
- **No significant increase in individual or cumulative occupational radiation exposure**



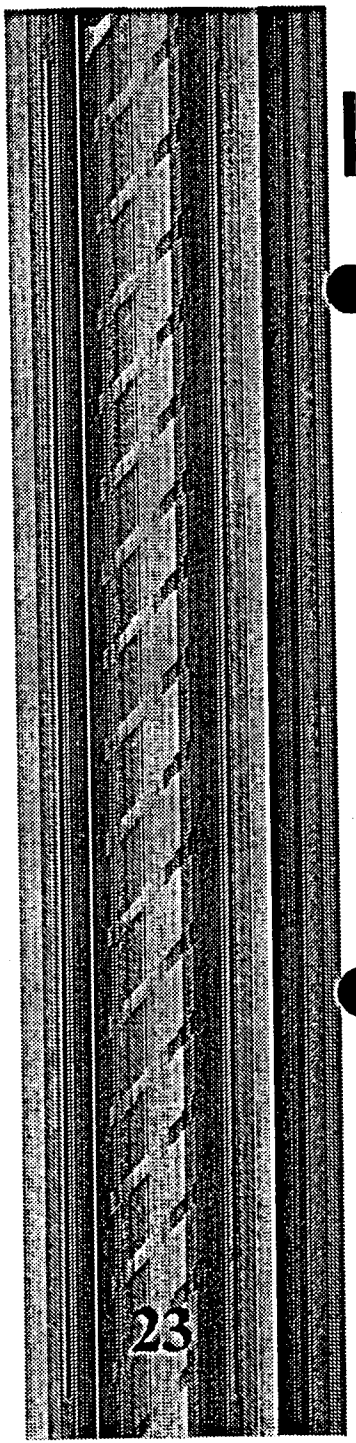
Steam Generator Inspection Requirements

Dale James



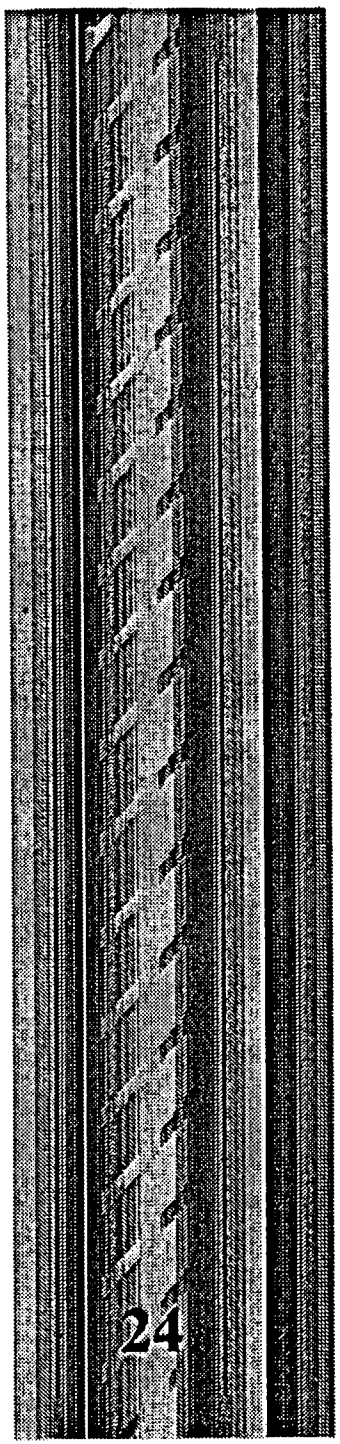
Inspection Requirements

- **Preservice Inspection (PSI) to be Performed after Shop Hydrotest**
  - **Original PSI followed field hydrotest**
- **No Inservice Inspection (ISI) during Replacement Outage**
  - **PSI performed prior to outage**
- **Removed Tube Repair Requirements**
  - **Sleeving techniques qualified for specific SGs & not applicable to RSG**



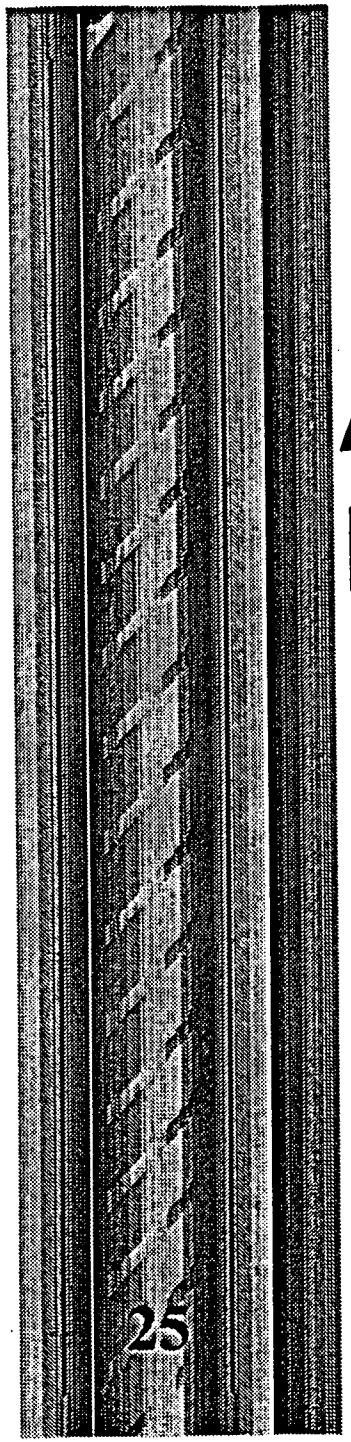
Inspection Requirements

- **Inspection Interval Maximum of Once per 40 Months**
  - **Allowed if results of first ISI are Category C-1**
  - **Allowed if two consecutive inspections show previous degradation no longer occurring**
- **Bases Changes**
  - **Removed reference to wastage**
  - **Removed requirement for 20% detection limit**



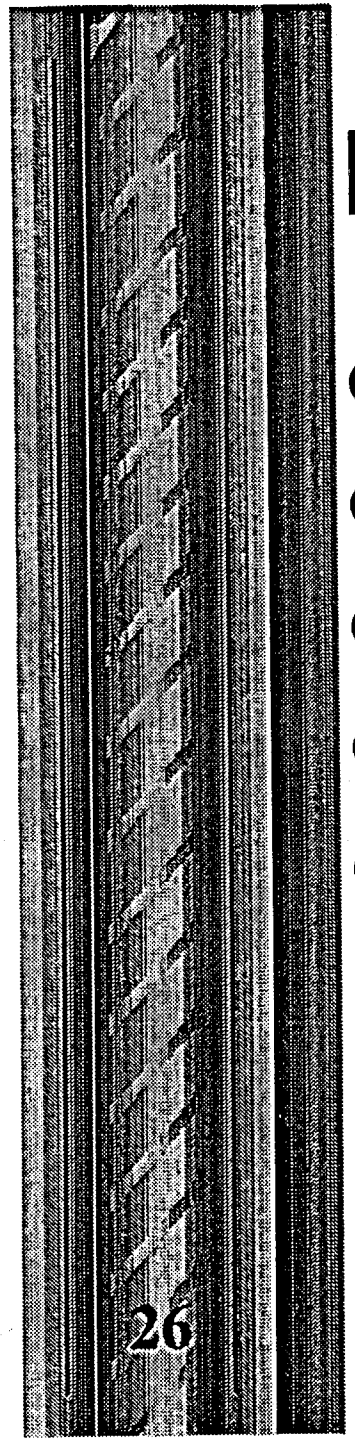
Inspection Requirements

- **Reporting Requirements**
  - **Changed reporting frequency to be consistent with NEI 97-06**
    - **12 month report in lieu of annual report due on March 1**
    - **Does not alter C-3 report**



ANO-2 RPS Setpoints & High Steam Generator Level

Bryan Daiber

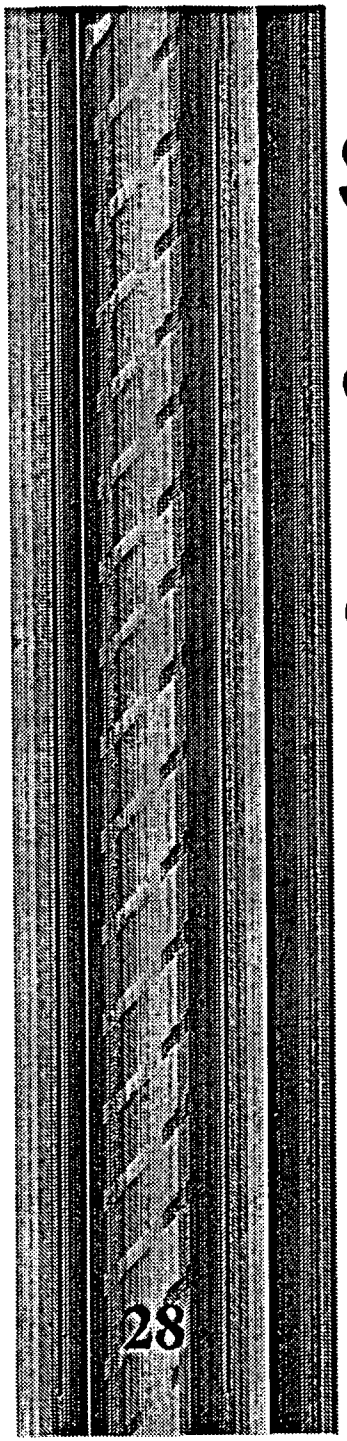


RSG Impacts

- Larger secondary volume
- Larger primary volume
- Restored RCS flow
- Increased heat transfer area
- Restored secondary pressure
- Flow limiting nozzle
- Level taps moved

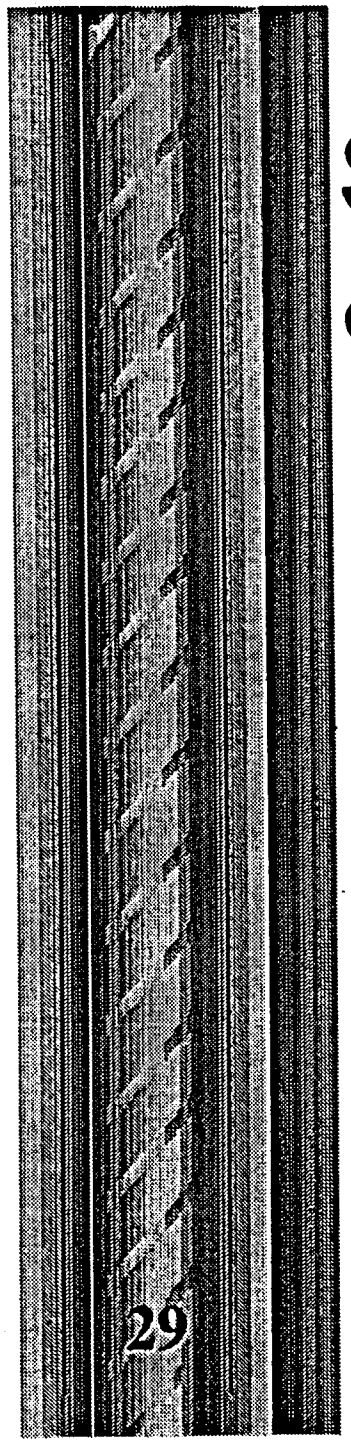
Summary of TS Changes

- Decrease Low Pzr Pressure RPS & ESFAS Setpoint
  - ≥ 1717.4 psia to ≥ 1675 psia
- Increase Low SG Pressure RPS & ESFAS Setpoint
  - ≥ 712 psia to ≥ 751 psia
- Decrease Low SG Level RPS & ESFAS Setpoint
  - ≥ 23% to ≥ 22.2%
- Power Ops with less than 4 RCPs



Summary of TS Changes

- **Increase RCS Flow**
  - **108.4x10^6 lbm/hr to 120.4x10^6 lbm/hr**
- **MS Safety Valves out of service**
  - **4 hrs vs. 12 hrs to reduce High Linear Power Trip (HLPT) setpoint & 4 hrs to reduce power (consistent with RSTS)**
  - **shutdown to mode 4 in 12 hrs vs. mode 5 in 30 hrs (consistent with RSTS)**
  - **separate mode 1&2 and mode 3 items**
  - **clean-up less than 4 RCP operation**

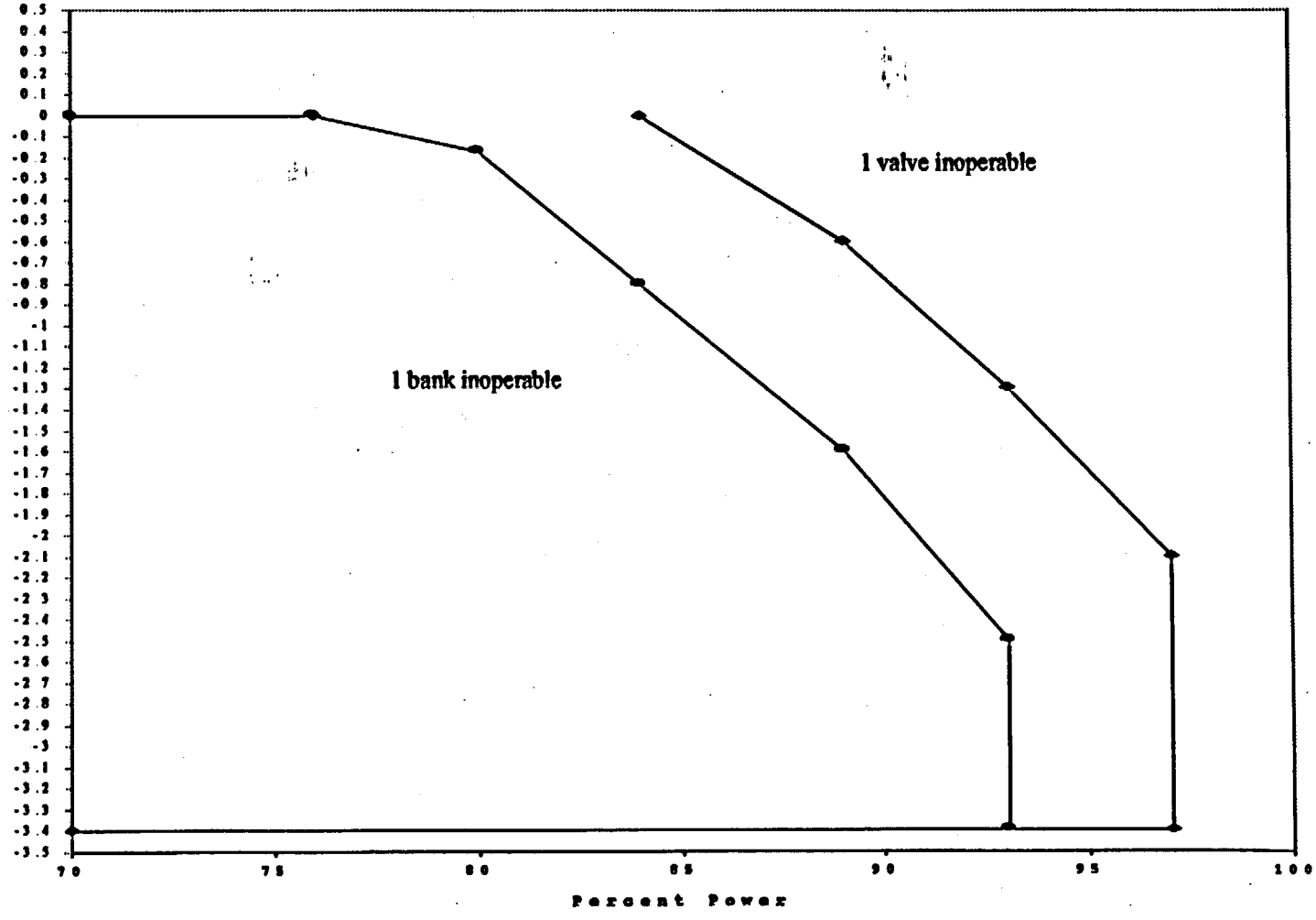


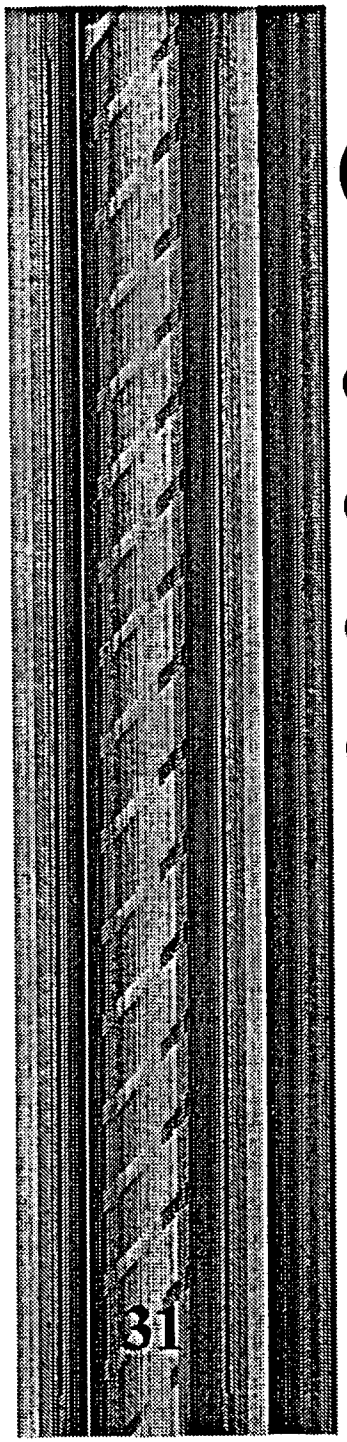
Summary of TS Changes

- **MSSVs out of service, cont.**
  - **Added 1 individual valve inop case**
  - **Added MTC vs. HLPT Setpoint curves**
    - **1 individual valve inoperable**
    - **1 valve per header inoperable**
  - **Reduced HLPT setpoint**
    - **2 valves per header inop 67.7 % to 43 %**
    - **3 valves per header inop 36 % to 25 %**
- **MSSVs out of service bases**
  - **LOCV limiting event**
  - **RSG 1100 psig vs. 1100 psia**

MTC vs. HLPT Setpoint

FIGURE 3.7-1



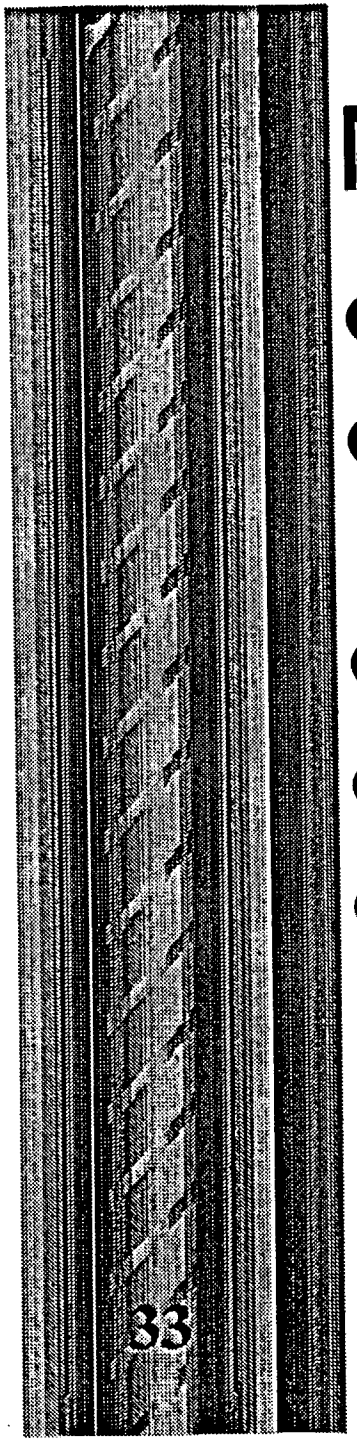


General Approach

- Use current approved methods
- Some changes in input methods
- Cover Tech Spec changes
- Cover RSG effects
- Cover power uprate if reanalysis
- Use bounding uprate physics
  - MTC, Doppler, scram curve, kinetics
- Cover miscellaneous input changes

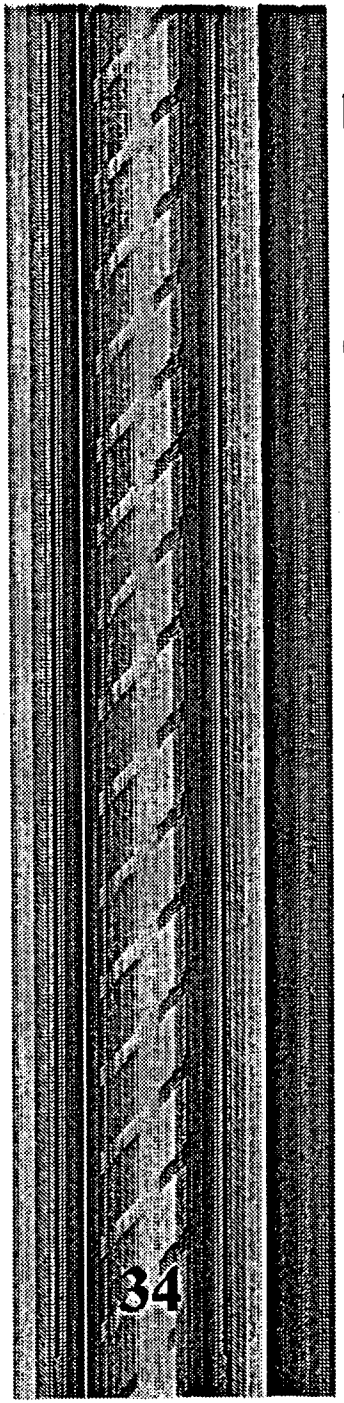
Other Input Changes

- Increased core power
- Reduced High Pressurizer Pressure Trip (HPPT) response time
- Increased MSIV and MFIV response times
- Reduced High Containment Pressure Trip (HCPT) response time
- Larger excess flow to main turbine
- Increase in maximum RCS flow



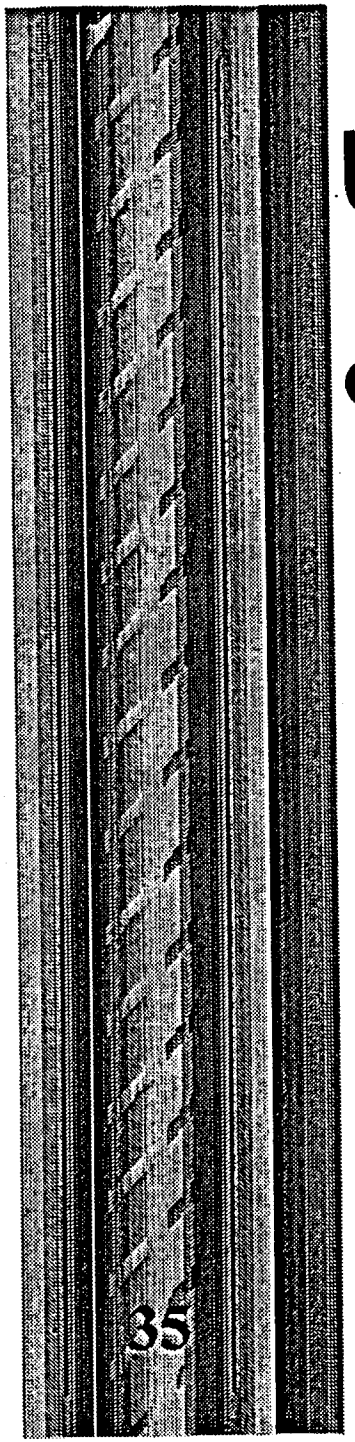
Methodology Changes

- **Credit HCPT for MSLB**
- **Credit Safety Injection Tanks for MSLB**
- **FWLB trip time logic**
- **Napier correction for PSV flow**
- **Instrument uncertainties**
  - **normal**
  - **abnormal**
  - **harsh**
- **Radiological dose calculation**



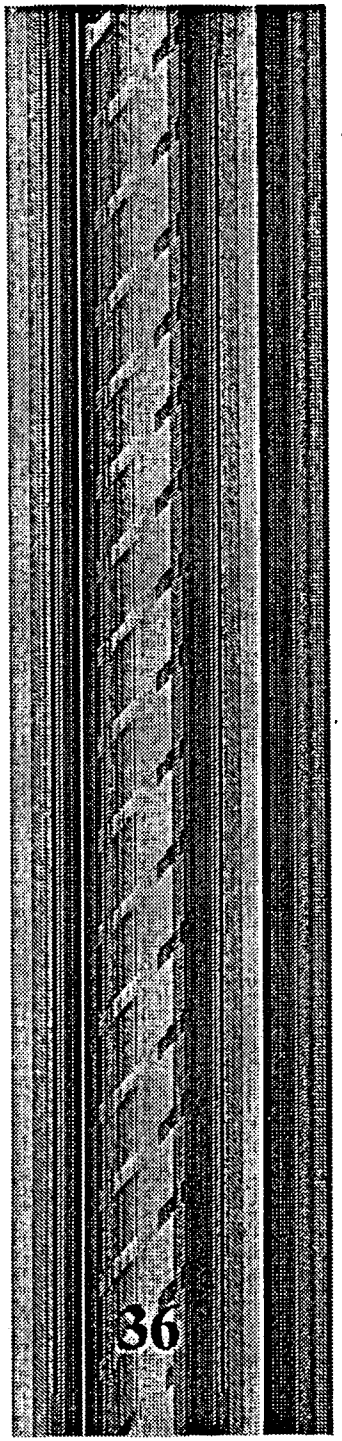
USQ Increase in Dose

- **RSG**
  - **larger secondary inventory**
  - **larger primary inventory**
  - **greater SG metal mass**



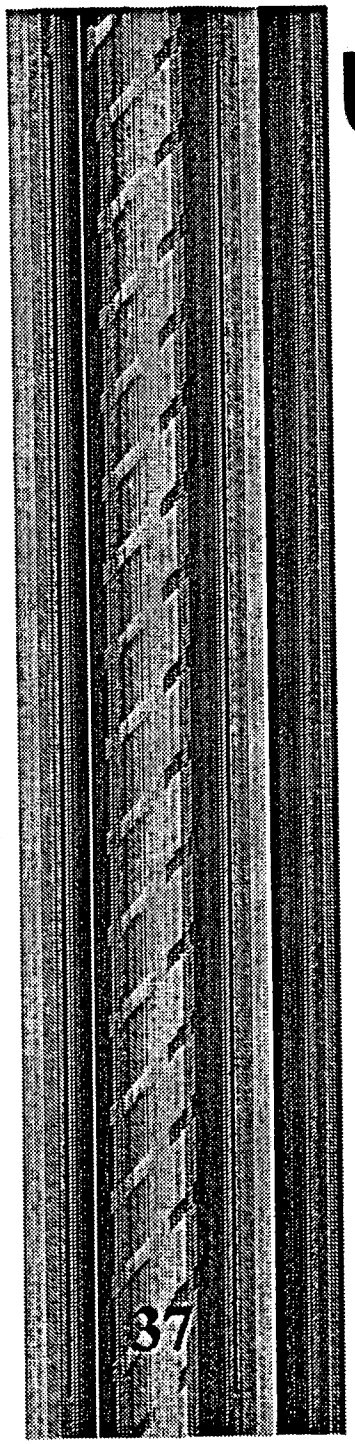
USQ Increase in Dose, cont.

- **Methodology**
  - essentially consistent with SRP and SER
  - primary & secondary activities
  - primary to secondary leakage
    - 150 gpd
    - 0.5 gpm for large pressure differential
  - ICRP-2 dose conversion factor no fuel failure
  - ICRP-30 dose conversion factor fuel failure
  - Decontamination factor of 100
  - pre-existing and generated Iodine spikes (PIS, GIS)
  - core power 3087 MWt
  - 2 hr and 8 hr cooldown
  - no condenser scrubbing



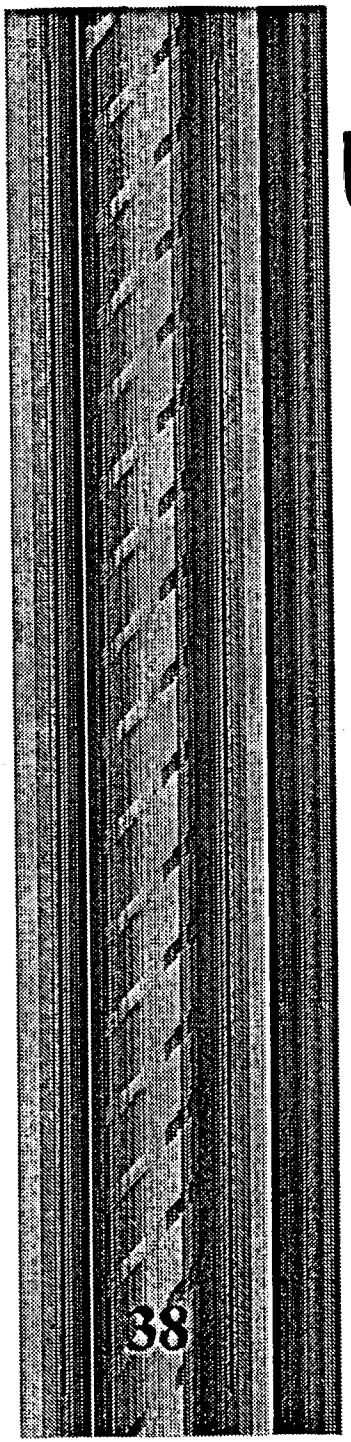
USQ Increase in Dose, cont.

Event	SAR	RSG
Shaft Seizure		
Fuel Failure (%)	2	14
EAB (Rem)		
Thyroid	2.35×10^{-5}	5
Whole Body	2.97×10^{-5}	1
LPZ (Rem)		
Thyroid	-	3
Whole Body	-	0.1
Loss of External Load		
EAB (Rem)		
Thyroid	1.2×10^{-2}	-
Whole Body	5.4×10^{-4}	-
Loss of AC		
EAB (Rem)		
Thyroid	1.87×10^{-2}	-
Whole Body	5.06×10^{-2}	-



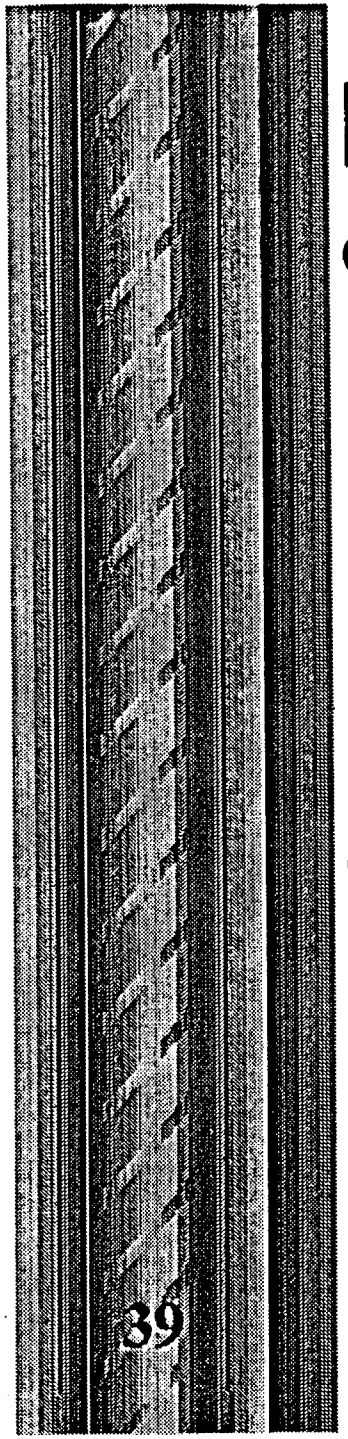
USQ Increase in Dose, cont.

Event	SAR	RSG
Main Steam Line Break		
No Spiking		
EAB (Rem)		
Thyroid	-	5
Whole Body	-	0.1
LPZ (Rem)		
Thyroid	-	0.3
Whole Body	-	0.1
GIS Spiking		
EAB (Rem)		
Thyroid	10	9
Whole Body	0.03	0.1
LPZ (Rem)		
Thyroid	5	3
Whole Body	0.01	0.1
PIS Spiking		
EAB (Rem)		
Thyroid	10	10
Whole Body	0.03	0.1
LPZ (Rem)		
Thyroid	5	2
Whole Body	0.01	0.1



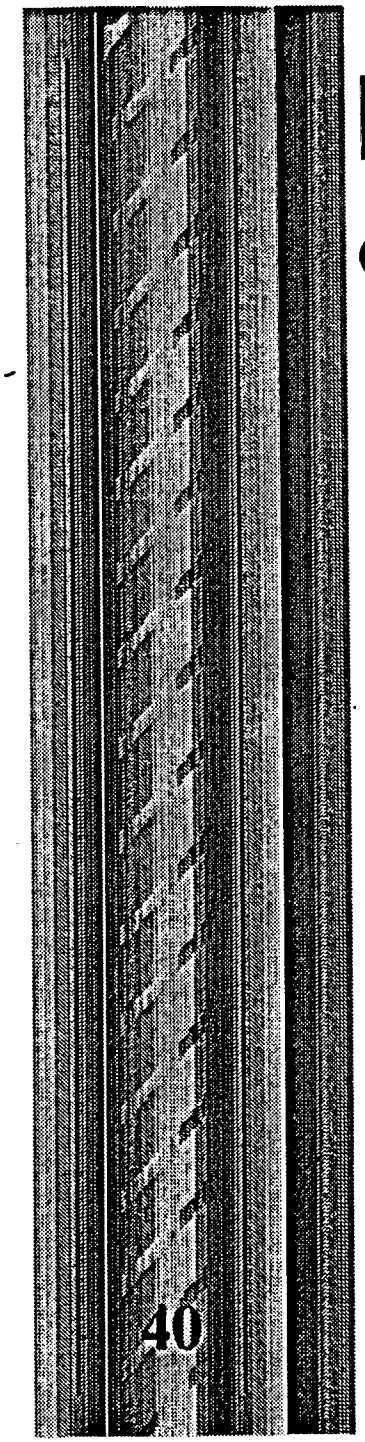
USQ Increase in Dose, cont.

Event	SAR	RSG
Feedwater Line Break		
EAB (Rem)		
Thyroid	1.87×10^{-2}	9
Whole Body	5.06×10^{-2}	0.1
LPZ (Rem)		
Thyroid	-	0.5
Whole Body	-	0.1



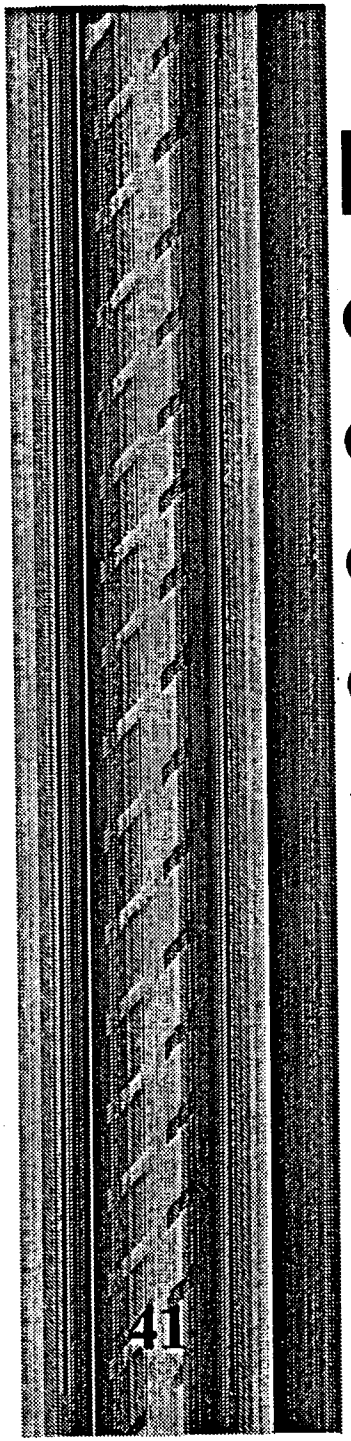
Instrument Uncertainty

- **High Pressurizer Pressure Trip**
  - **TS setpoint**
    - **2362 psia**
  - **Analytical setpoint**
    - **2392 psia - normal**
    - **2415 psia - harsh**
- **Low SG Pressure Trip**
  - **TS setpoint**
    - **751 psia**
  - **Analytical setpoint**
    - **693 psia - normal**
    - **658 psia - harsh**



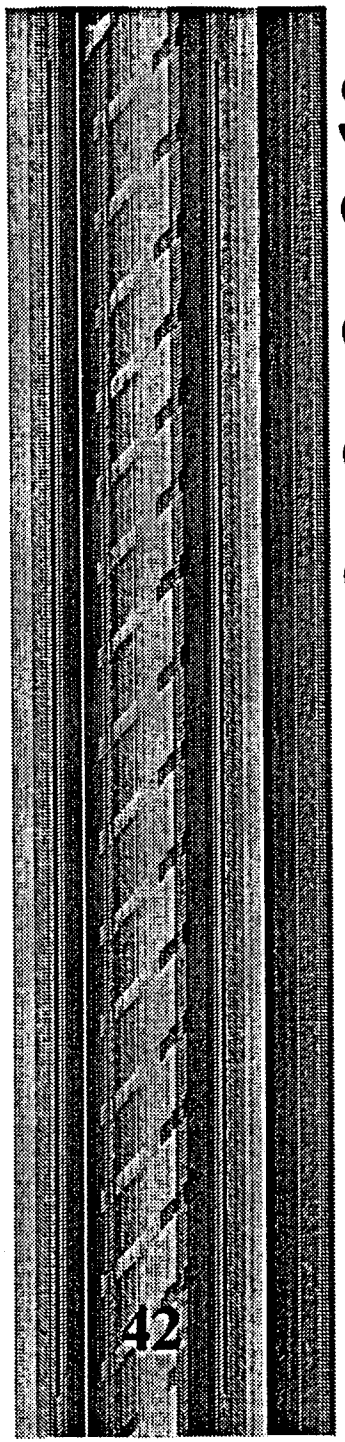
Instrument Uncertainty

- **Low Steam Generator Level**
  - **TS setpoint**
    - **22.2%**
  - **Analytical setpoint**
    - **9% normal**
    - **6% abnormal**
    - **0% harsh**
- **Low Pressurizer Pressure Trip**
  - **TS setpoint**
    - **1675 psia**
  - **Analytical setpoint**
    - **1400 psia**
    - **1600 psia - SGTR only**



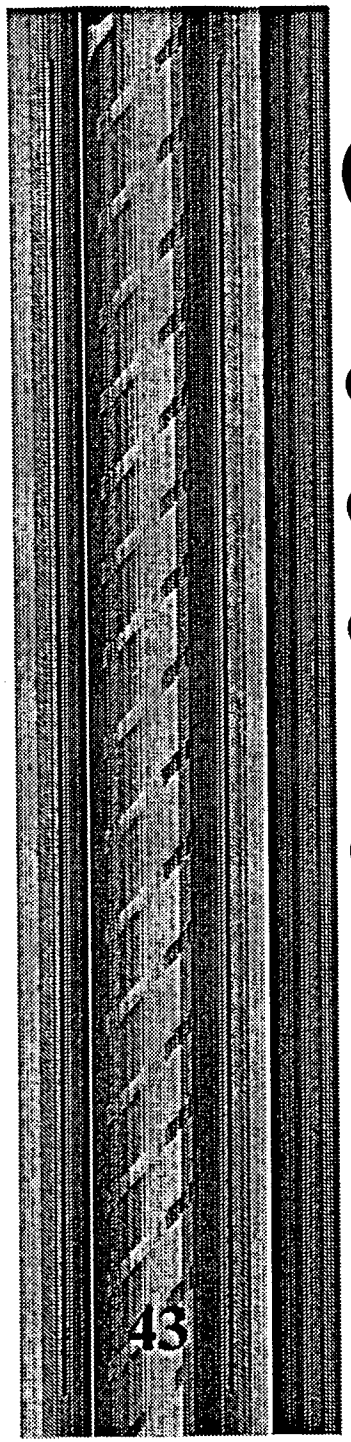
LBLOCA

- Reanalysis
- Limiting break (0.6 DEG/PD)
- June 1985 EM
- Inputs
  - RSG
  - Current power rating
  - 118×10^6 lbm/hr
  - 1400 psia pzr pressure setpoint
- Results
  - 2029 F



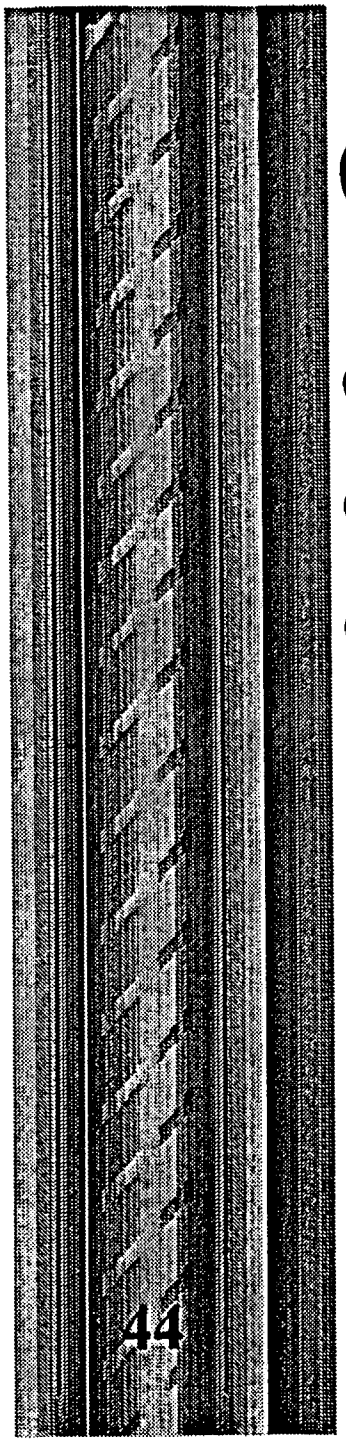
SBLOCA

- Reanalysis
- 0.03 ft^2, 0.04 ft^2, and 0.05 ft^2
- Supplement 2 EM
- Inputs
  - RSG
  - Current power rating
  - 118x10^6 lbm/hr
  - 1400 psia pzr pressure setpoint
  - HPSI curve
- Results
  - limiting break size 0.04 ft^2
  - 1905 F



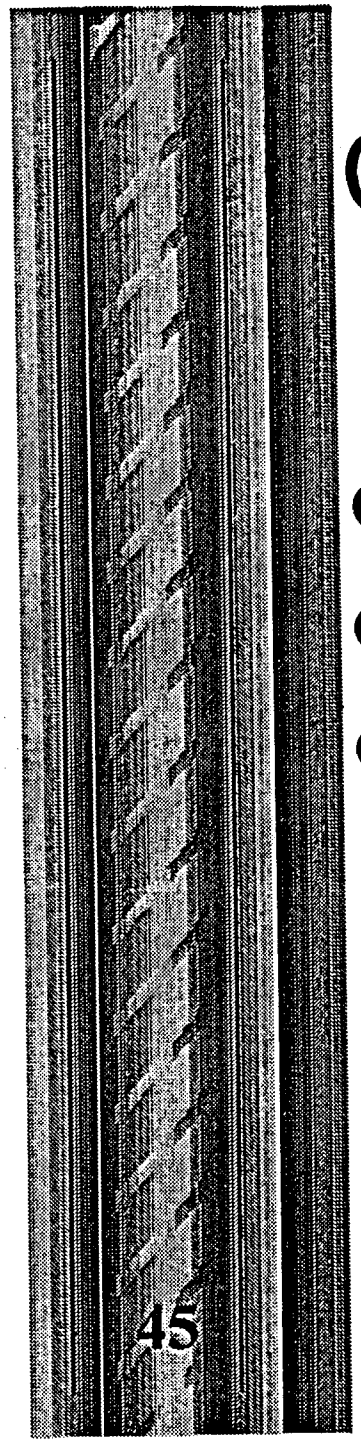
CEA Withdrawal - Subcritical

- **Evaluation**
- **RSG - no impact**
- **RCS flow increase - small beneficial impact**
- **Core physics, reactivity insertion rate (RIR), kinetics, Doppler, MTC**
- **High log power trip**



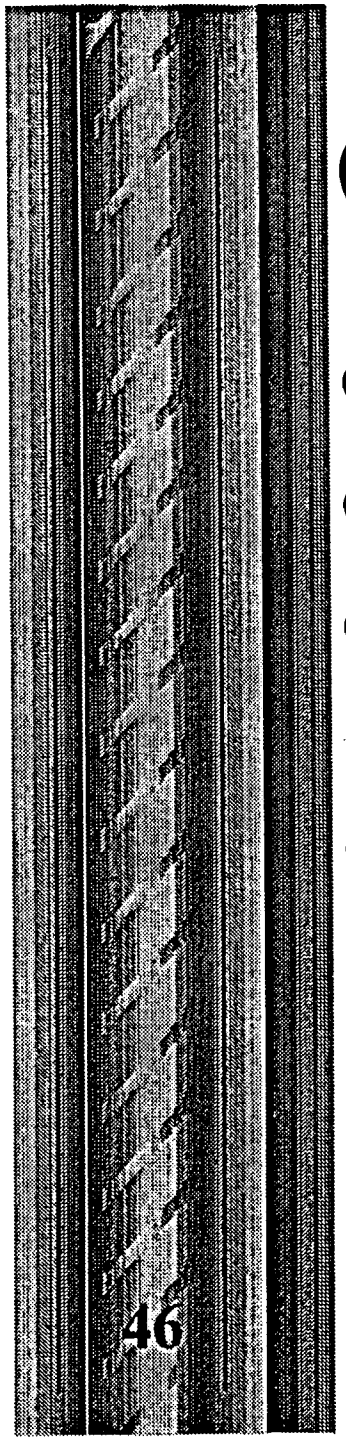
CEA Withdrawal - Critical

- **Evaluation**
- **RSG - no impact**
- **RCS flow increase**
  - **small beneficial impact - Hot Zero Pwr**
  - **maximum flow conservative - Hot FP**
- **Core physics, RIR, kinetics, Doppler, MTC**
- **CPC DNBR trip, variable overpower trip (VOPT), CPC dynamic compensation filters**



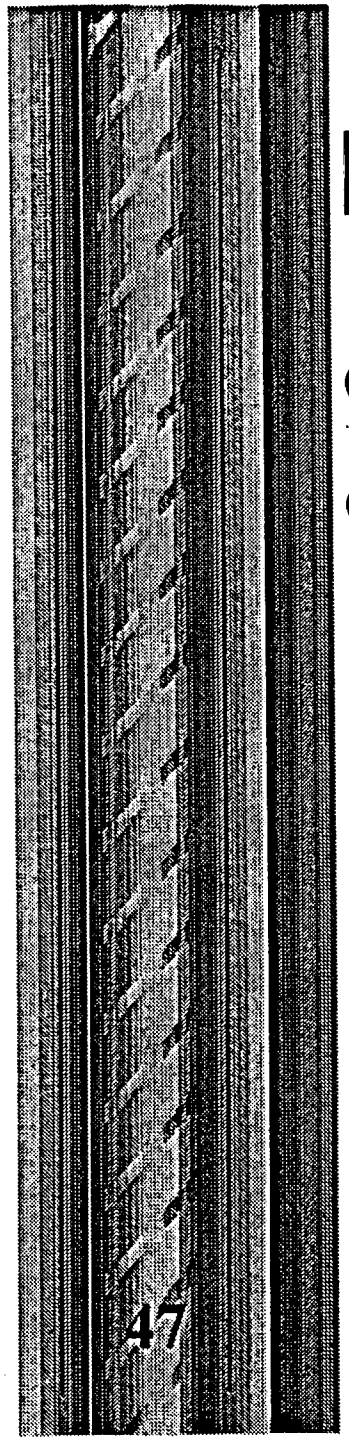
CEA Misoperation

- **Evaluation**
- **RSG - no impact**
- **Core physics, CEA worths, radial distortion, kinetics, Doppler, MTC**



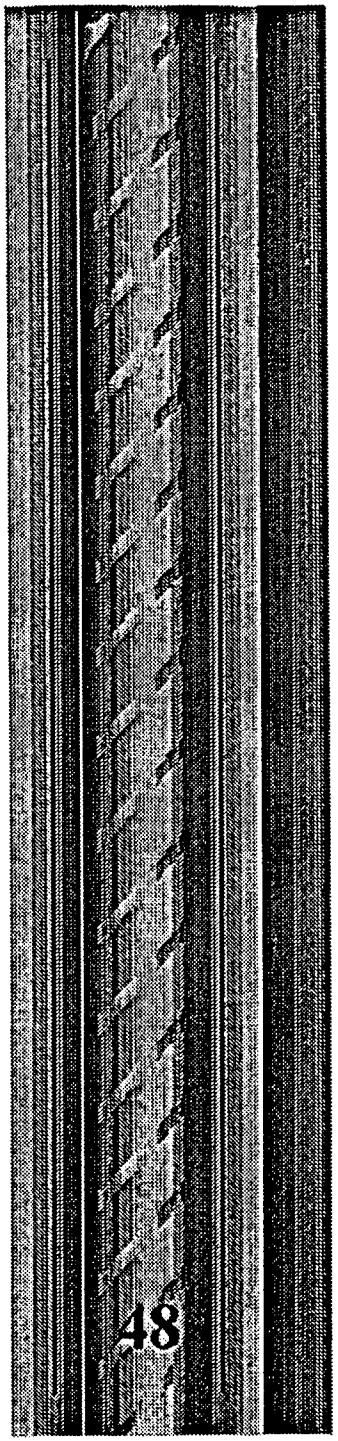
Control Element Ejection

- **Evaluation**
- **RSG - no impact**
- **RCS flow increase - small beneficial impact**
- **Core physics, kinetics, Doppler, MTC, ejected worths and 3-D peaks**
- **VOPT, HLPT**



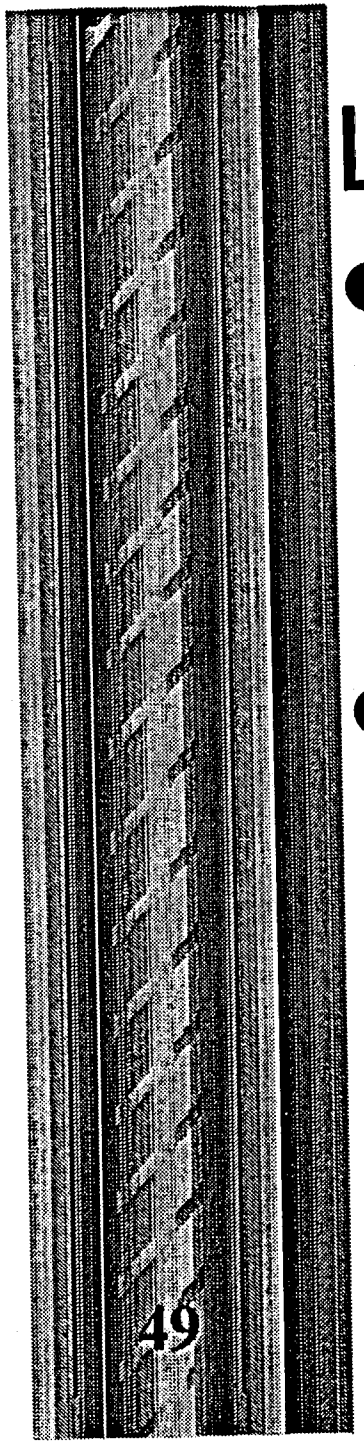
Boron Dilution

- **Evaluation**
- **Boron concentration, inverse boron worth, shutdown margin, RCS mass, and charging flow**
- **Increased RCS mass from RSG**
  - **increased dilution time constant**
  - **increases operator time**



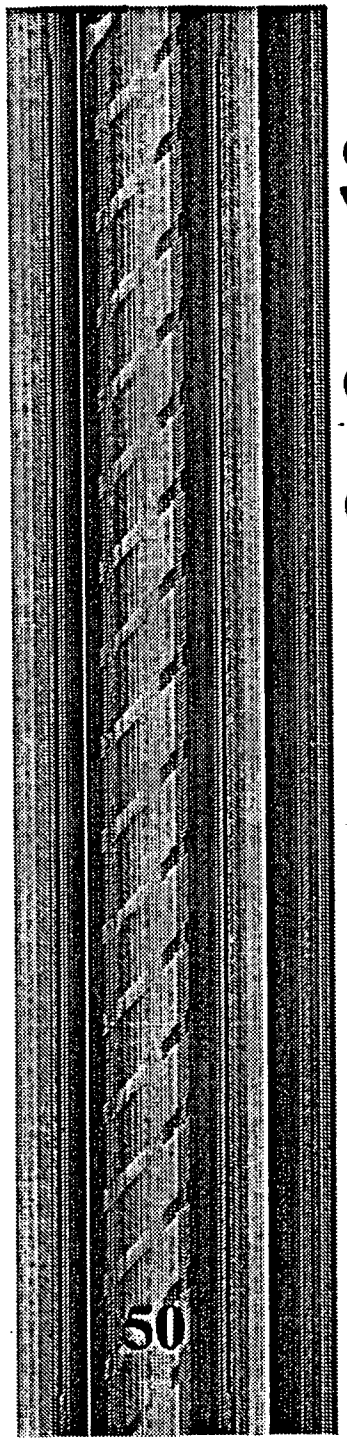
Loss of Flow

- **Evaluation**
- **RSG Impacts**
  - **increased maximum RCS flow**
    - **355,200 gpm to 386,400 gpm**
  - **reduced resistance**
    - **same effective coastdown**
    - **initial conditions more bounding (temp & pressure) - slightly more rapid coastdown**
- **Other Impacts**
  - **longer CPC response time**
    - **0.3 sec to 0.4 sec**
  - **least negative Doppler curve**



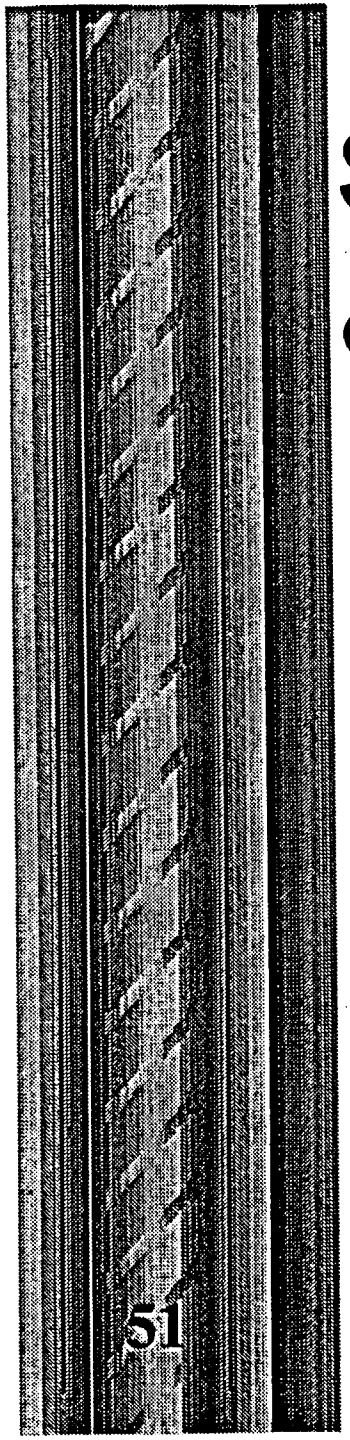
Loss of Flow, Cont.

- **Analysis Overview**
  - **CENTS coastdown rerun with RSG**
  - **HERMITE RSG not modeled, evaluated based on sensitivities studies**
- **Results**
  - **coastdown 0.15% Required Over Power Margin (ROPM)**
  - **flow 0.2% ROPM**
  - **CPC response time 0.55% ROPM**
  - **Doppler - negligible**
- **Less than 1% ROPM increase**



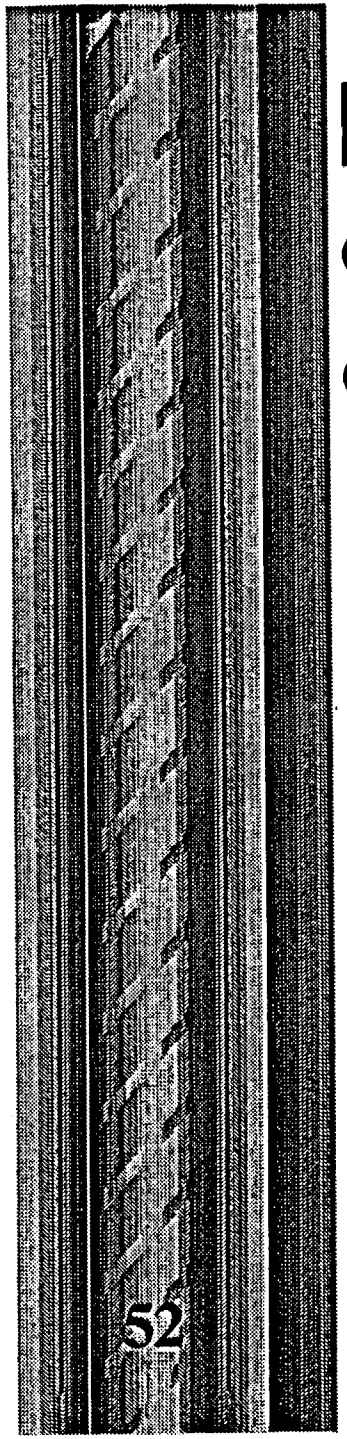
Shaft Seizure

- **Evaluation**
- **RSG Impacts**
  - **increased maximum RCS flow**
    - **355,200 gpm to 386,400 gpm**
  - **reduced resistance**
  - **increased primary and secondary inventory - dose impact**
- **Analysis Overview**
  - **CENTS coastdown rerun with RSG**
  - **new offsite dose calculation**



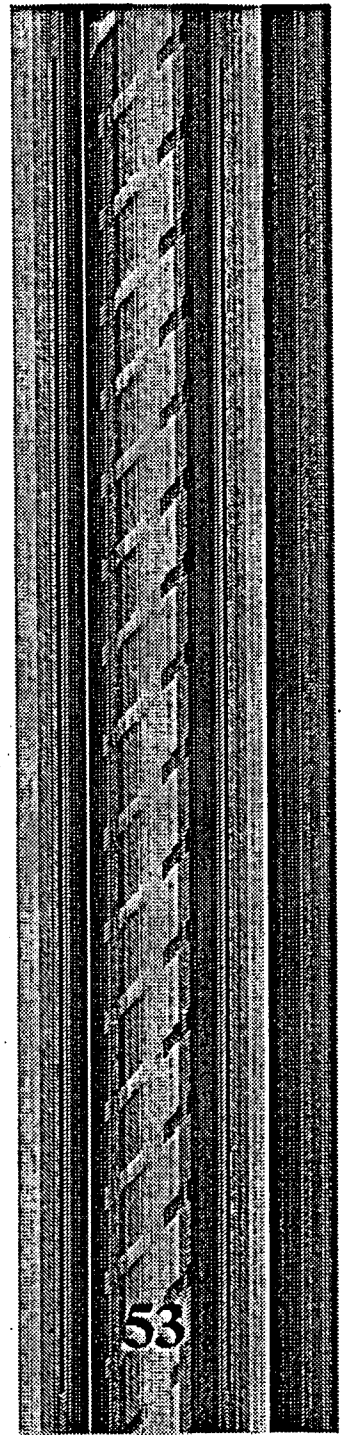
Shaft Seizure, Cont.

- **Results**
  - **transient**
    - **coastdown asymptotic flow 0.6% decrease**
    - **RCS flow range covered**
    - **results in 1% penalty in cycle 15 design**
  - **dose**
    - **RSG inventory small impact**
    - **addressed power uprate**
    - **credited 150 gpd primary to secondary**
    - **14% fuel failure within 10% of 10CFR 100**
      - **EAB Thyroid 5 rem, WB 1 rem**
      - **LPZ Thyroid 3 rem, WB 0.1 rem**



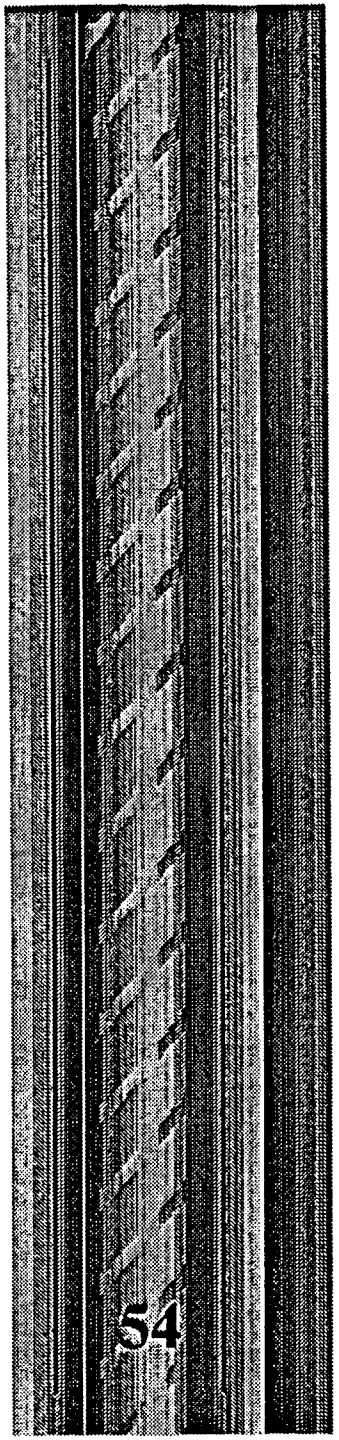
Loss of Load / LOCV

- **Reanalysis**
- **RSG Impacts**
  - **increase in RCS flow**
    - **386,400 gpm - peak RCS pressure**
    - **315,560 gpm - MSSVs out of service**
  - **RSG heat transfer area & SG pressure**
    - **reduces peak RCS pressure**
  - **integrated RSG impact on MSSV out of service cases**
  - **LSGL Trip setpoint and tap span - 9%**
  - **increased primary and secondary inventory - dose impact**



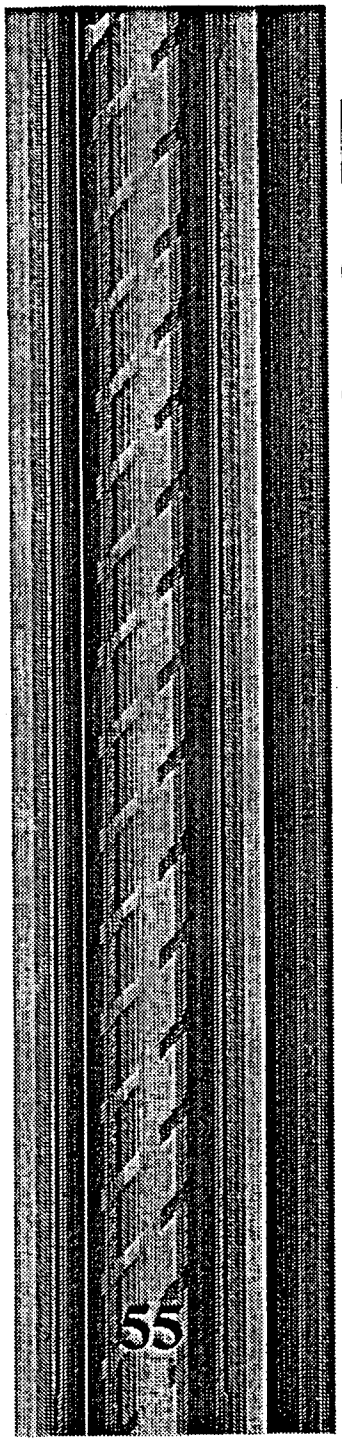
Loss of Load / LOCV, cont.

- **Other Impacts**
  - **HPPT setpoint - 2392 psia**
  - **HPPT response time - 0.65 sec**
  - **rated power - 3026 MWt**
  - **LSGL Trip response time - 1.3 sec**
- **Analysis Overview**
  - **CENTS - consistent with AOR**
    - **Peak primary and secondary cases**
    - **1 MSSV and 1 MSSV bank - MTC study**
    - **2 MSSV banks and 3 MSSV banks**



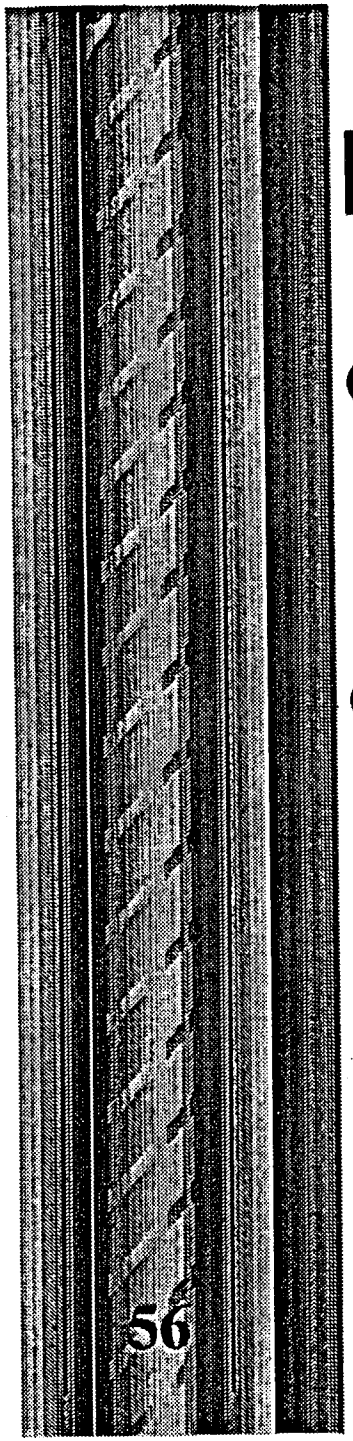
Loss of Load / LOCV, cont.

- **Results**
  - **transient**
    - **peak RCS pressure - 2688 psia**
    - **peak RSG pressure - 1209 psia**
  - **MSSVs out of service**
    - **1 valve - 84% - MTC curve**
    - **1 bank - 76% - MTC curve**
    - **2 banks - 43%**
    - **3 banks - 25%**
  - **dose**
    - **acceptable due to MSLB & FWLB results**



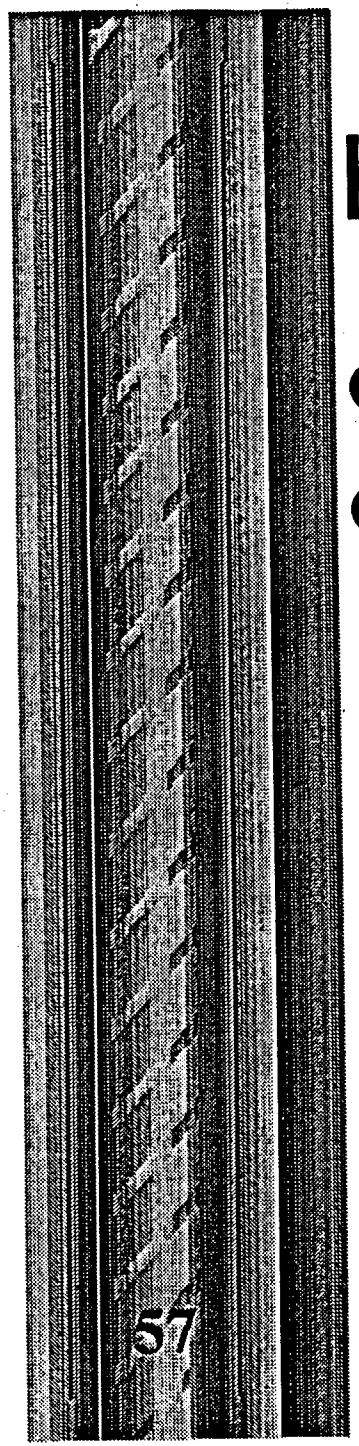
Loss of Feedwater

- **Reanalysis**
- **RSG Impacts**
  - **increase in minimum RCS flow**
    - **315,560 gpm**
  - **RSG heat transfer area & SG pressure**
  - **LSGL Trip and Emer FW Actuation Signal (EFAS) s/p and tap span - 9%**
- **Other Impacts**
  - **rated power - 3026 MWt**
  - **LSGL Trip response time - 1.3 sec**
  - **more negative MTC -3.8×10^{-4} $\Delta\rho/°F$**



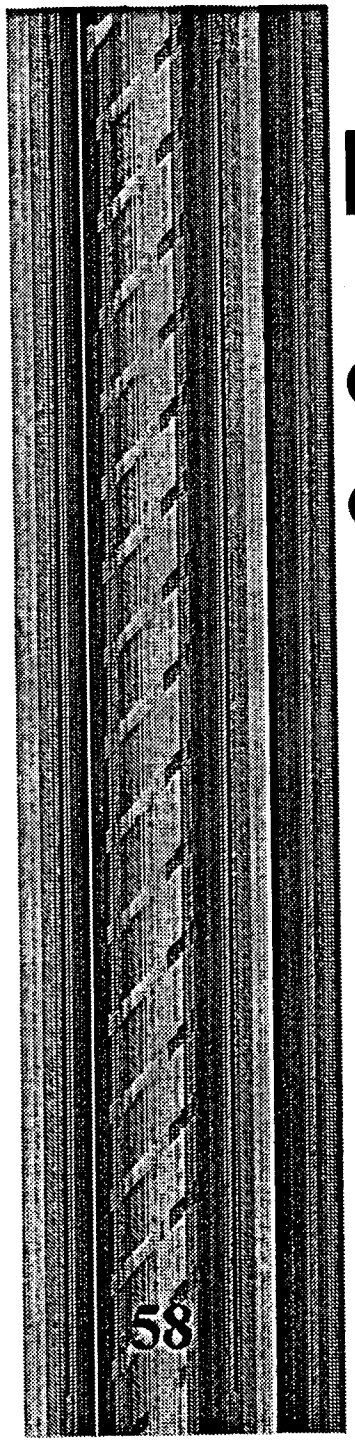
Loss of Feedwater, cont.

- **Analysis Overview**
  - **CENTS - consistent with analysis of record (AOR)**
- **Results**
  - **secondary heat sink maintained - no dryout**



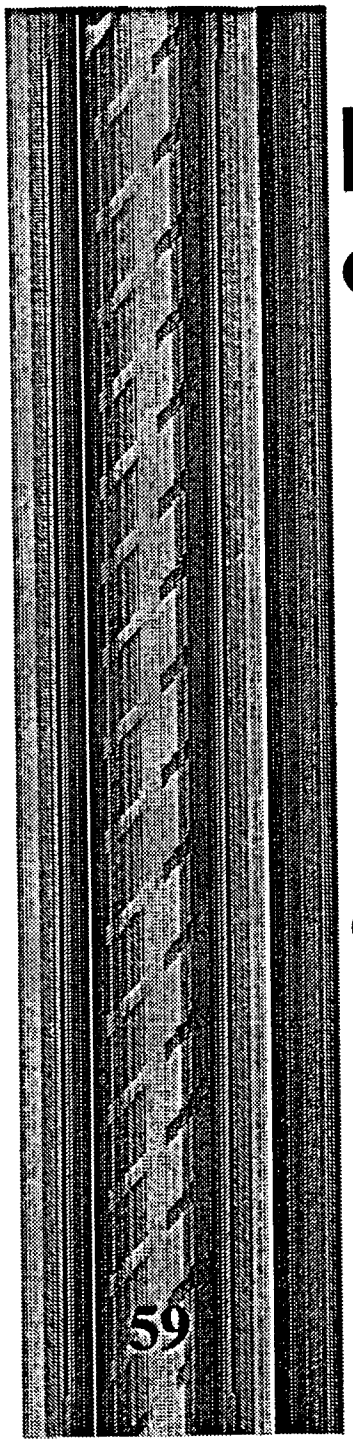
Loss of AC Power

- **Evaluation**
- **Other events verified to bound**
  - **loss of flow analysis covers departure from nucleate boiling (DNB)**
  - **Loss of Condenser Vacuum (LOCV) covers secondary pressure**
  - **LOCV covers RCS pressure**
  - **acceptable MSLB & FWLB doses**



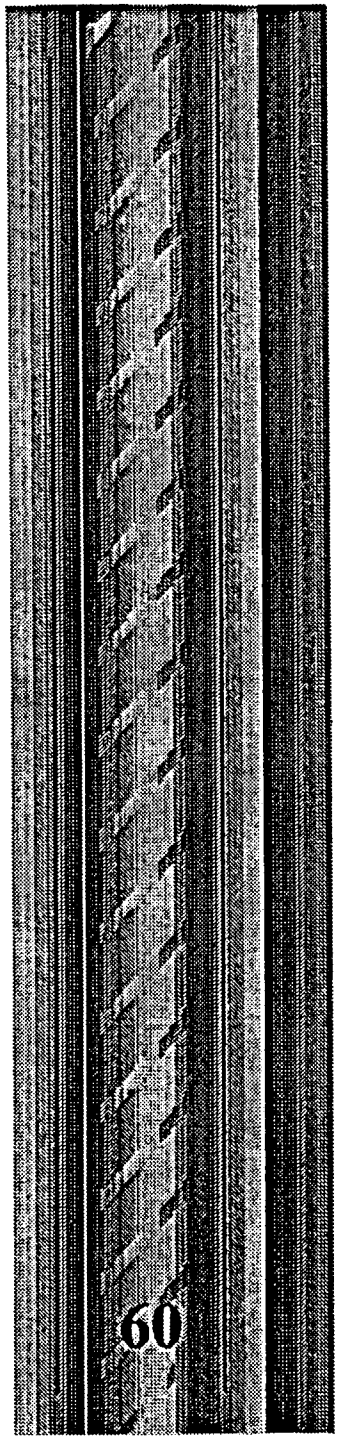
Feedwater Line Break

- **Reanalysis**
- **RSG Impacts**
  - **increase in RCS flow**
    - **315,560 gpm**
  - **RSG heat transfer area & SG pressure**
    - **reduces peak RCS pressure**
  - **LSGL Trip setpoint and tap span - 6%**
  - **LSGL EFAS setpoint - 0%**
  - **LSGP MSIS - 658 psia**
  - **increased primary and secondary inventory - dose impact**



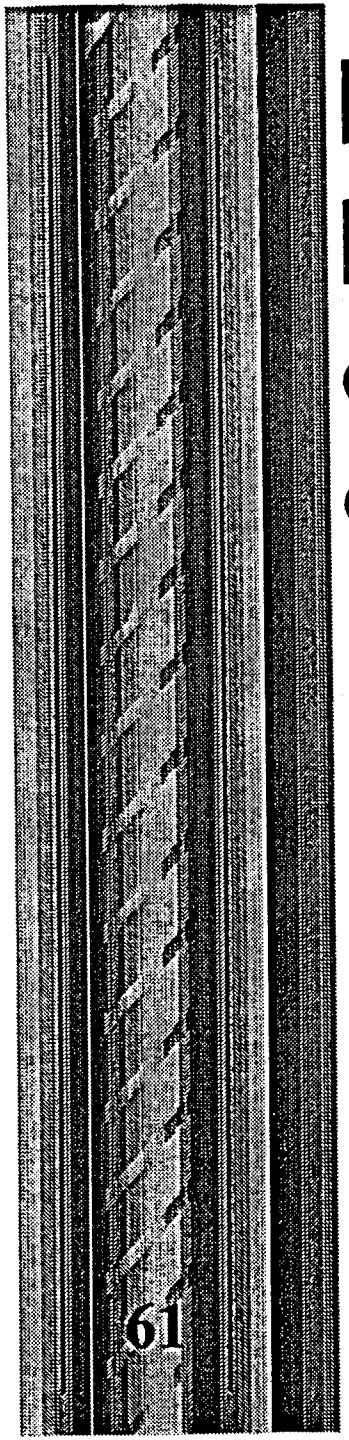
Feedwater Line Break, cont.

- **Other Impacts**
  - HPPT setpoint - 2415 psia
  - HPPT response time - 0.65 sec
  - rated power - 2815 MWt
  - LSGL Trip response time - 1.3 sec
  - MSIV stroke time - 3.5 sec
- **Analysis Overview**
  - CENTS - consistent with AOR
  - HPPT coincident with LSGL Trip
  - parametric on break size - 0.1798 ft^2
  - new dose calculation



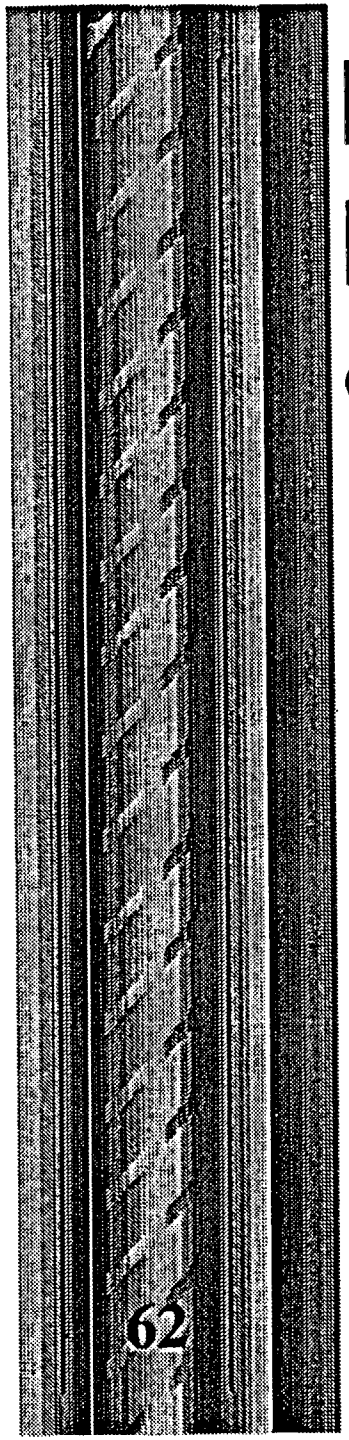
Feedwater Line Break, cont.

- **Results**
  - **transient**
    - **peak RCS pressure - 2694 psia**
    - **acceptable peak RSG pressure**
    - **pressurizer did not fill**
  - **dose**
    - **less than small fraction of 10CFR100**
      - **EAB Thyroid 9 rem, WB 0.1 rem**
      - **LPZ Thyroid 0.5 rem, WB 0.1 rem**



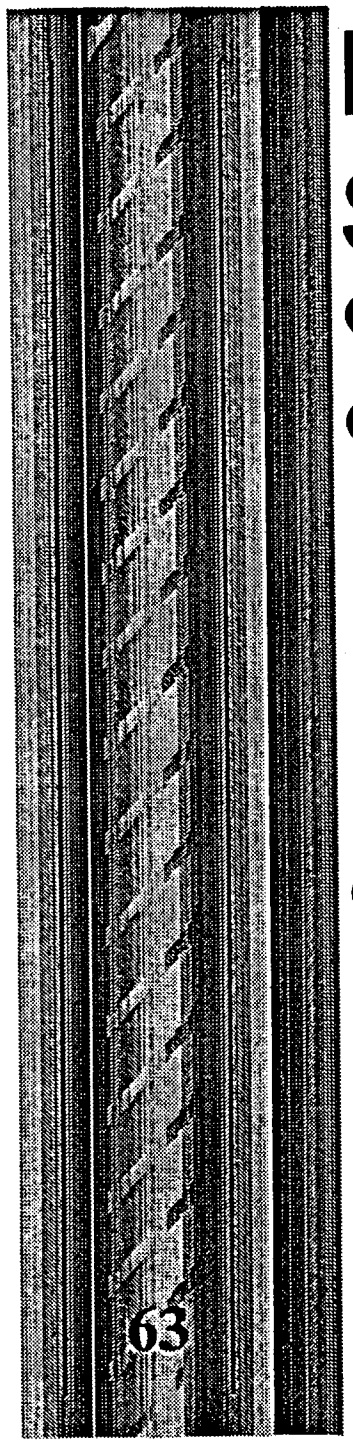
Excess Heat Removal - Feedwater

- **Reanalysis**
- **RSG Impacts**
  - **increase in RCS flow**
    - **315,560 gpm**
  - **RSG heat transfer area & SG pressure**
- **Other Impacts**
  - **rated power - 3026 MWt**
  - **CPC VOPT credited**
  - **more negative MTC -3.8×10^{-4} $\Delta\rho$/°F**



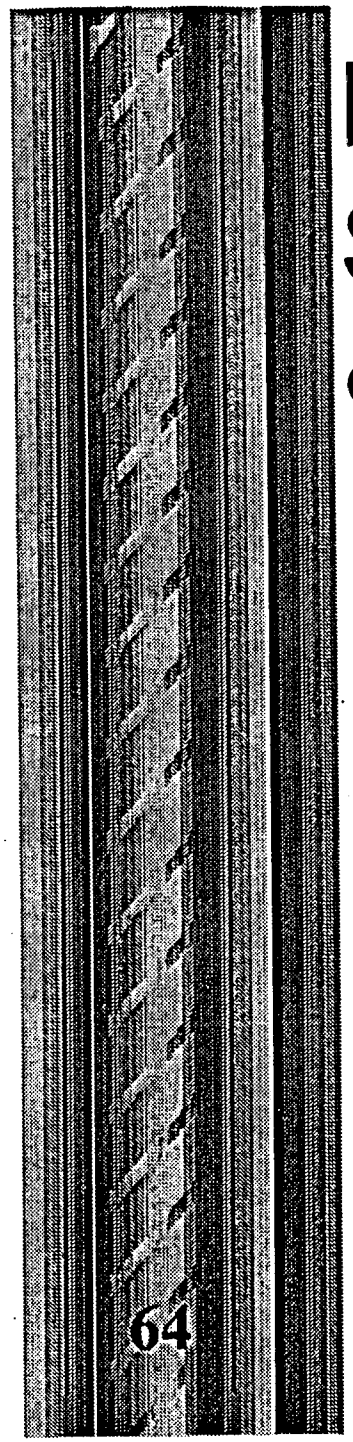
Excess Heat Removal - Feedwater, cont.

- **Analysis Overview**
  - **CENTS used versus CESEC Code**
  - **CETOP Code**
  - **160% of main feedwater flow**
- **Results**
  - **minimum DNBR greater than 1.25**
  - **peak linear heat rate less than 21 kW/ft**



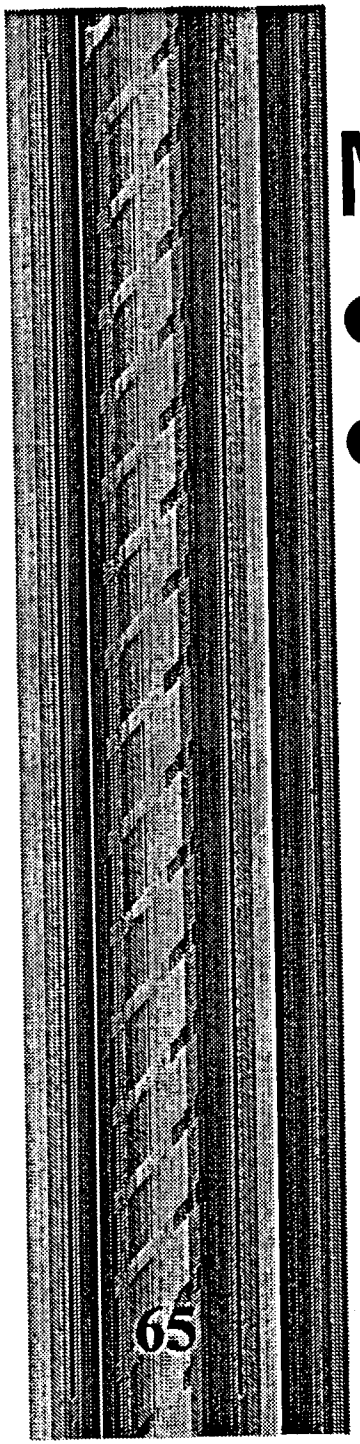
Excess Heat Removal - Steam System

- **Reanalysis**
- **RSG Impacts**
  - **increase in RCS flow - 315,560 gpm**
  - **RSG heat transfer area & SG pressure**
  - **LSGP MSIS - 693 psia**
  - **primary and secondary inventory dose impact**
- **Other Impacts**
  - **rated power - 3026 MWt**
  - **CPC VOPT credited**
  - **more negative MTC -3.8×10^{-4} $\Delta\rho$/°F**
  - **SIAS setpoint - 1400 psia**
  - **turbine valve inherent capacity**



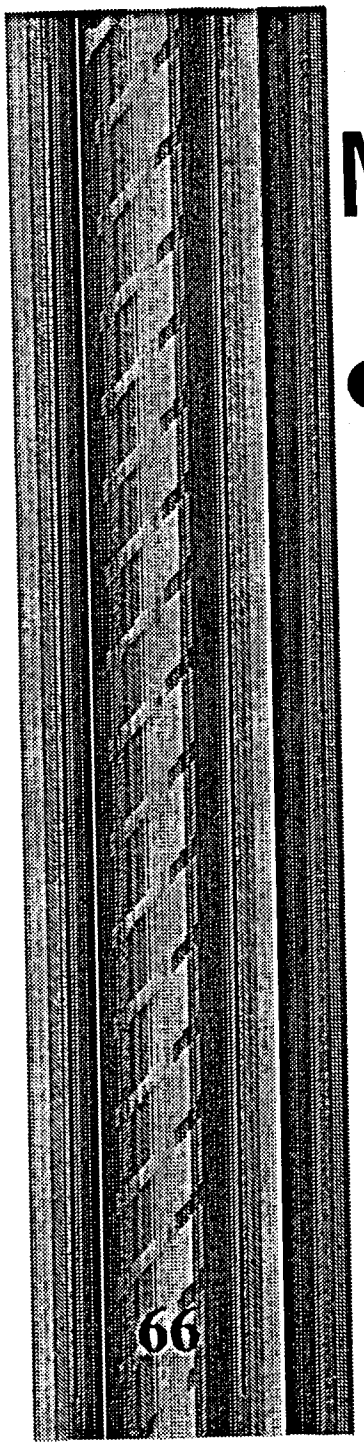
Excess Heat Removal - Steam System, cont.

- **Analysis Overview**
  - **CENTS used versus CESEC Code**
  - **CETOP Code**
  - **13% of uprated power steam flow**
  - **turbine valve capacity bounded by CPC filters analysis**
- **Results**
  - **minimum DNBR greater than 1.25**
  - **peak linear heat rate less than 21 kW/ft**
  - **acceptable MSLB doses**



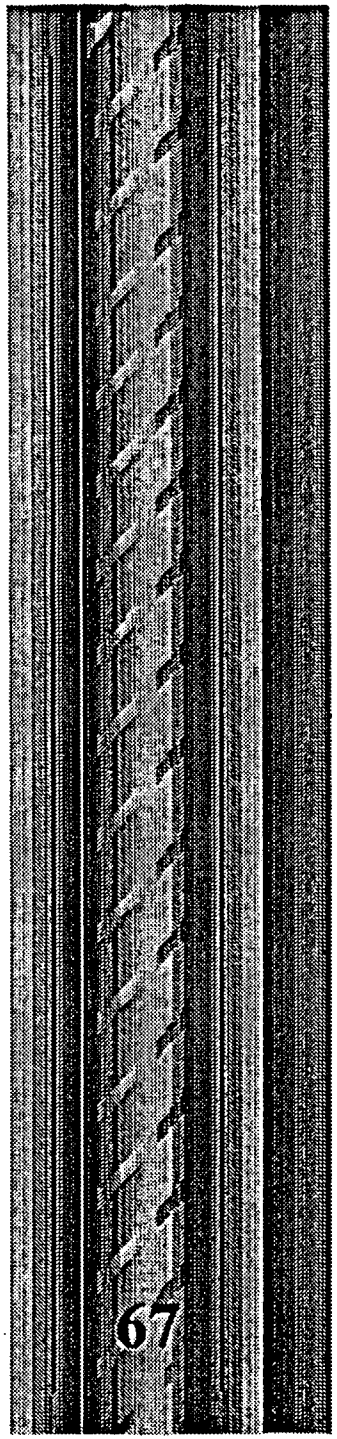
Main Steam Line Break

- **Reanalysis**
- **RSG Impacts**
  - **flow limiting nozzle - < 2 ft^2**
  - **increase in RCS flow - 315,560 gpm**
  - **RSG heat transfer area & SG pressure**
  - **LSGP Trip and MSIS -**
    - **658 psia inside containment**
    - **693 psia outside containment**
  - **secondary inventory**
  - **primary and secondary inventory dose impact**



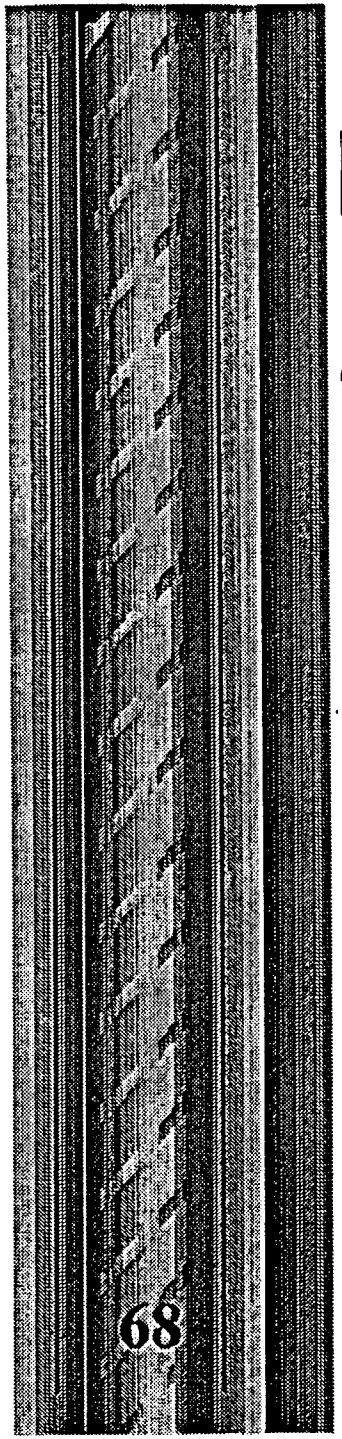
Main Steam Line Break, cont.

- **Other Impacts**
  - **rated power - 3026 MWt**
  - **more negative MTC -3.8x10^{-4} $\Delta\rho$/°F**
  - **SIAS setpoint - 1400 psia**
  - **credited safety injection tanks**
  - **credited HCPT and VOPT**
  - **increased MSIV and MFIV response times**
  - **RCP shaft speed trip - 0.95**
  - **no credit for CSAS**



Main Steam Line Break, cont.

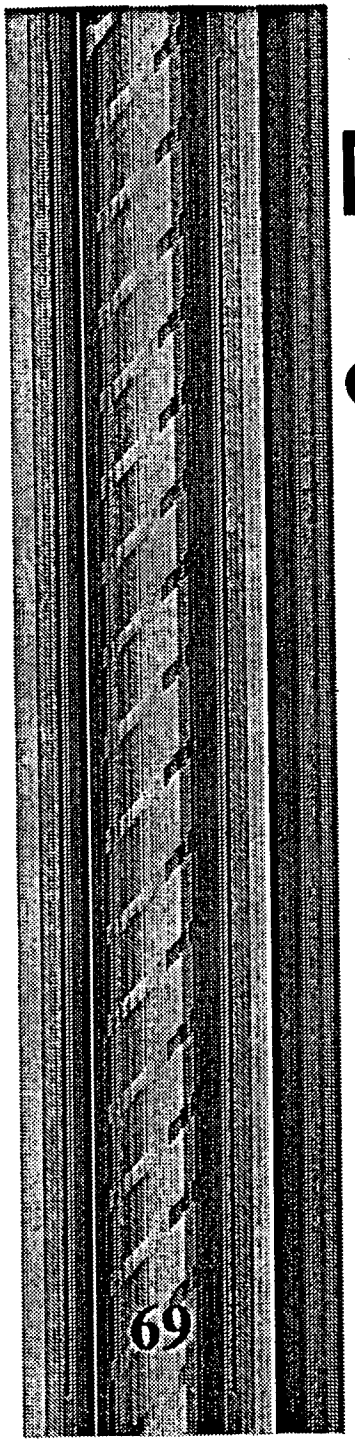
- **Analysis Overview**
  - **nozzle break**
    - **hot full power & hot zero power**
    - **inside and outside containment**
    - **with and without LOOP**
  - **methods consistent with AOR**
    - **CENTS, HRISE, RELAP5/MOD3.1, ROCS/HERMITE**
  - **single failure**
    - **EDG for LOOP cases**
    - **HFP no LOOP - bus fast transfer failure**
    - **HZP no LOOP - HPSI failure**
  - **new dose calculation**



Main Steam Line Break, cont.

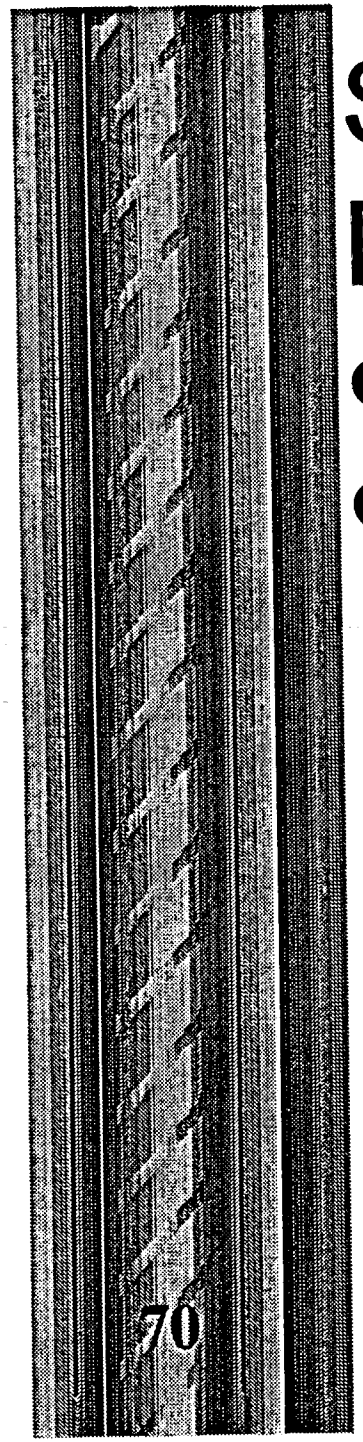
- **Results**
  - **transient**
    - **Cycle 15 and Cycle 16 analyzed**
    - **MacBeth DNBR > 1.3**
    - **linear heat rate less than 21 kW/ft**
    - **0.09 %Δρ margin in CEA worth**

	HFP IC LOOP	HFP IC	HZP IC LOOP	HZP OC
Reactivity, %Δρ	0.0211	-0.0218	0.206	-0.545
Power, %	3.39	4.26	0.15	0
DNBR	1.56	2.72	>10	>10



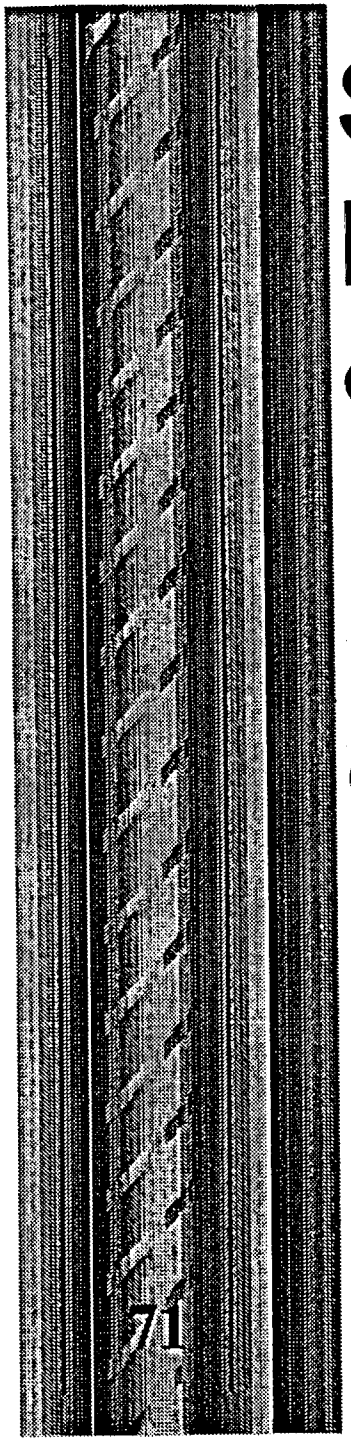
Main Steam Line Break, cont.

- **Results**
  - **dose**
    - **less than small fraction of 10CFR100**
      - **no spiking**
        - **EAB Thyroid 5 rem, WB 0.1 rem**
        - **LPZ Thyroid 0.3 rem, WB 0.1 rem**
      - **generated Iodine spike**
        - **EAB Thyroid 9 rem, WB 0.1 rem**
        - **LPZ Thyroid 3 rem, WB 0.1 rem**
      - **pre-existing Iodine spike**
        - **EAB Thyroid 10 rem, WB 0.1 rem**
        - **LPZ Thyroid 2 rem, WB 0.1 rem**



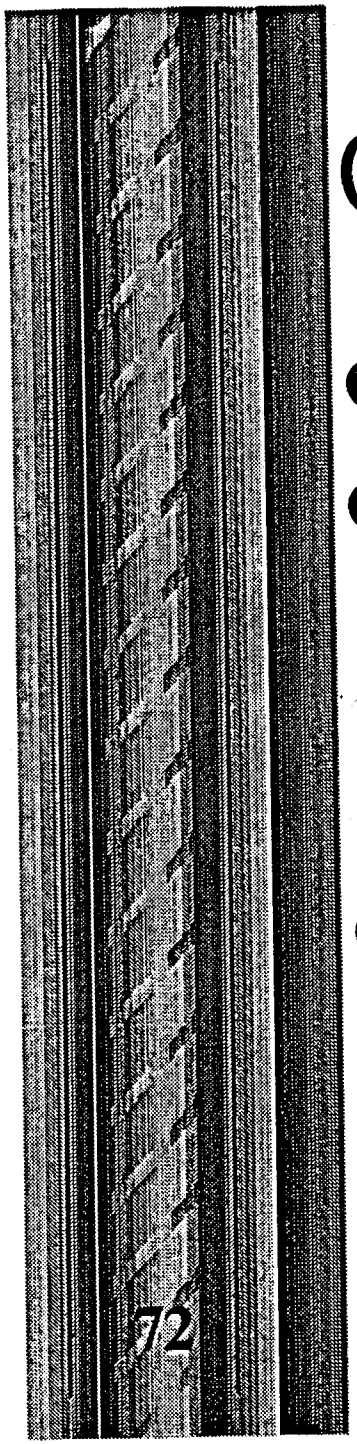
Steam Generator Tube Rupture

- **Evaluation**
- **RSG Impacts**
  - **larger secondary volume 8172 ft^3 vs 7957 ft^3**
  - **larger number of tubes 10,637 vs 8411**
  - **smaller tube diameter 0.608 in vs 0.654 in**
  - **different loss coefficient (longer tubes)**
  - **higher RSG operating pressure**



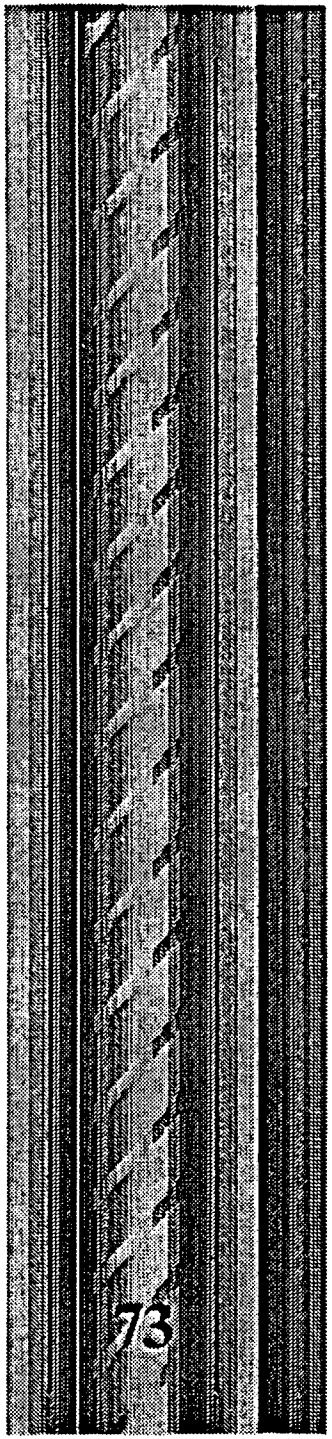
Steam Generator Tube Rupture, cont.

- **Analysis Overview**
  - **smaller diameter - reduces leak rate 13%**
  - **higher RSG pressure lower driving pressure**
  - **tube resistance - reduces leak rate 5%**
- **Results**
  - **offsite releases bounded by AOR**
  - **SIAS based on 1600 psia**



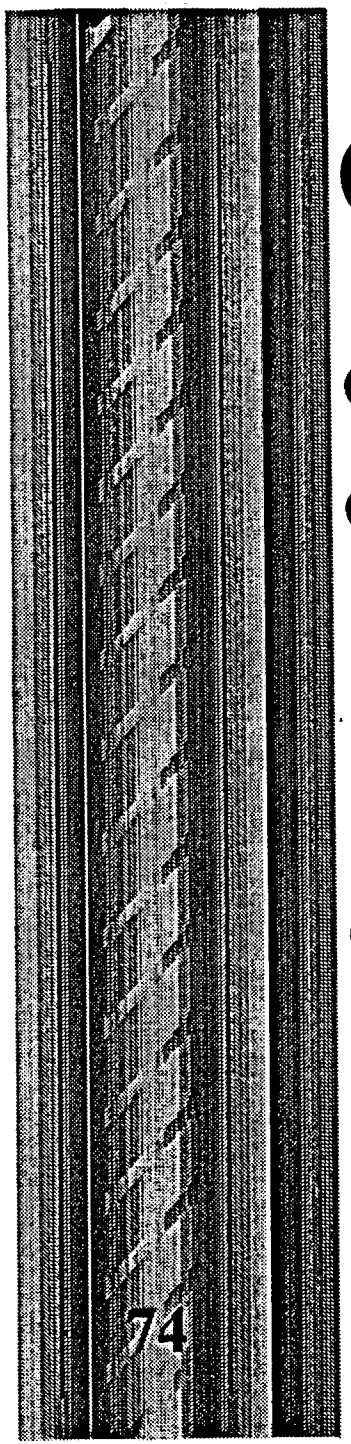
Closure of a MSIV

- **Reanalysis**
- **RSG Impacts**
  - **increase in RCS flow**
    - **315,560 gpm**
  - **RSG heat transfer area & SG pressure**
- **Other Impacts**
  - **rated power - 3026 MWt**
  - **more negative MTC -3.8×10^{-4} $\Delta\rho$/°F**



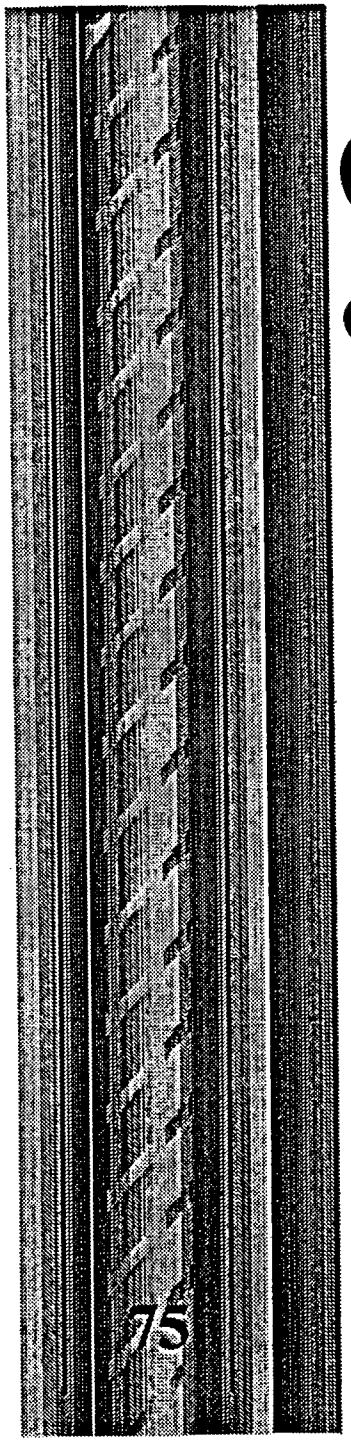
Closure of a MSIV, cont.

- **Analysis Overview**
  - **CPC asymmetric SG trip (cold leg temperature differential)**
  - **CENTS and CETOP**
- **Results**
  - **minimum DNBR > 1.25**
  - **peak LHR < 21 kW/ft**
  - **non-limit COLSS ROPM event**



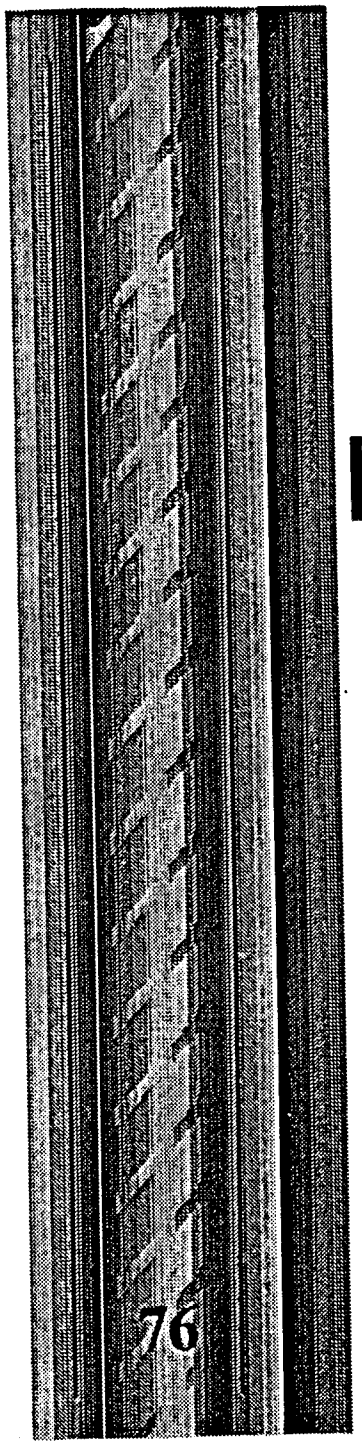
CPC Dynamic Filters

- **Reanalysis**
- **RSG Impacts**
  - **increase in RCS flow**
    - **315,560 gpm**
  - **RSG heat transfer area & SG pressure**
- **Other Impacts**
  - **rated power - 3026 MWt**
  - **more negative MTC -3.8×10^{-4} $\Delta\rho$/°F**

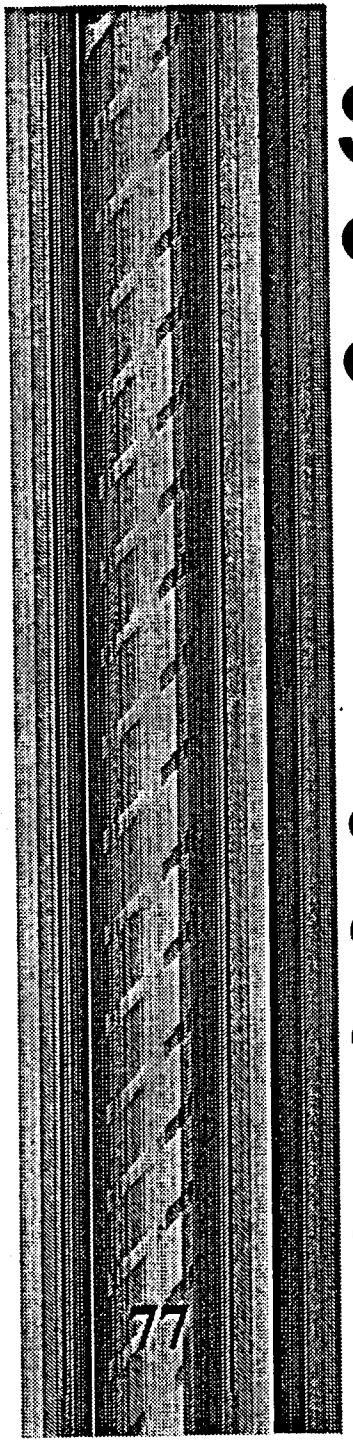


CPC Dynamic Filters, cont.

- **Analysis Overview**
  - **Increasing power - CEA withdrawal**
    - **CPC core average heat flux conservative**
  - **Increasing temperature - loss of load**
    - **T_{cmin} and T_{cmax} conservative**
  - **Decreasing temperature - excess load**
    - **T_{cmin} and T_{cmax} conservative**
    - **turbine demand from 80% to 125%**
    - **turbine demand from 80% to 110%**
- **Results**
  - **CPCs verified to be conservative**

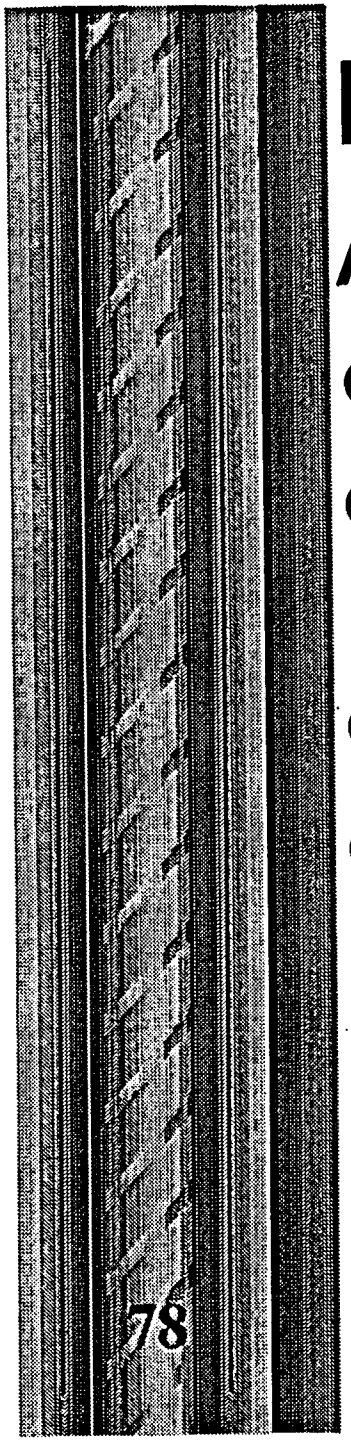


High Steam Generator Level



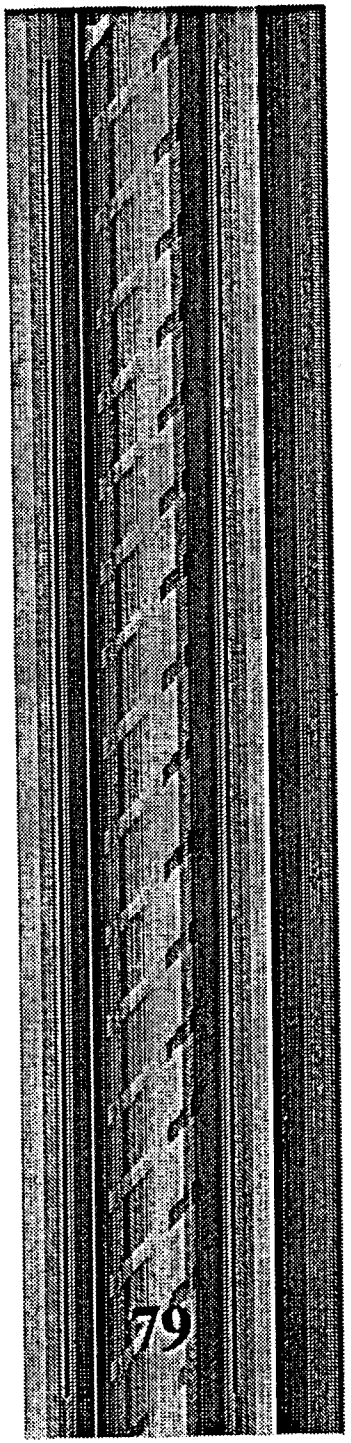
SG High Level Submittal

- **Move SG level high to TRM**
- **RSG effects - setpoint change**
  - **40 in. greater level span**
  - **normal operating level 436 in. vs. 410 in. above tubesheet**
  - **internal design differences**
- **Not credited in safety analyses**
- **Consistent with 10CFR50.36**
- **Bases to prevent excessive moisture carryover**
- **Similar to the Turbine Overspeed Protection System**



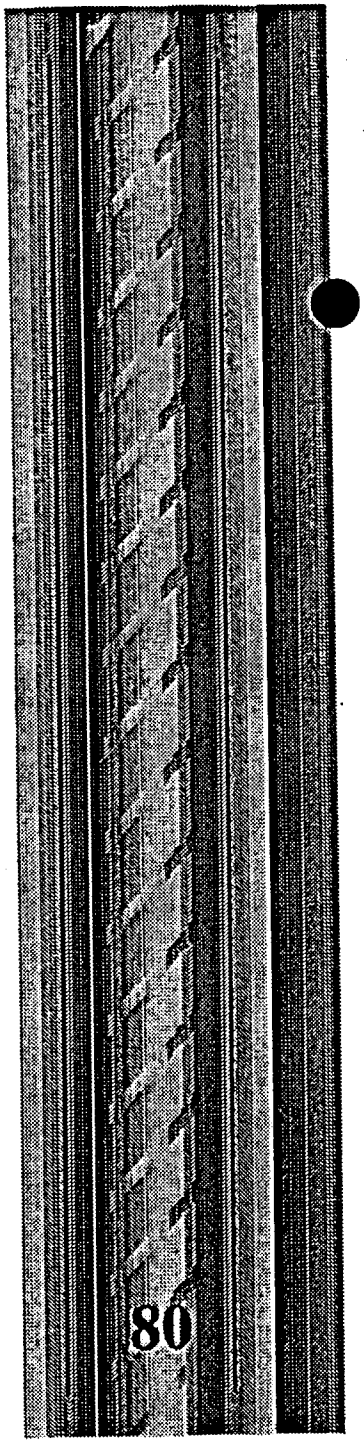
Leak Before Break Application

- October 30, 1990 SER on CEN-367
- Sept. 16, 1994 ANO-2 request for application on permanent seal plate
- June 18, 1996 SER on application
- October 2, 1998 notify use on RSG
  - RSG internal
  - RCS loop and RV internals
  - SG and RV subcompartments



ANO-2 Power Uprate

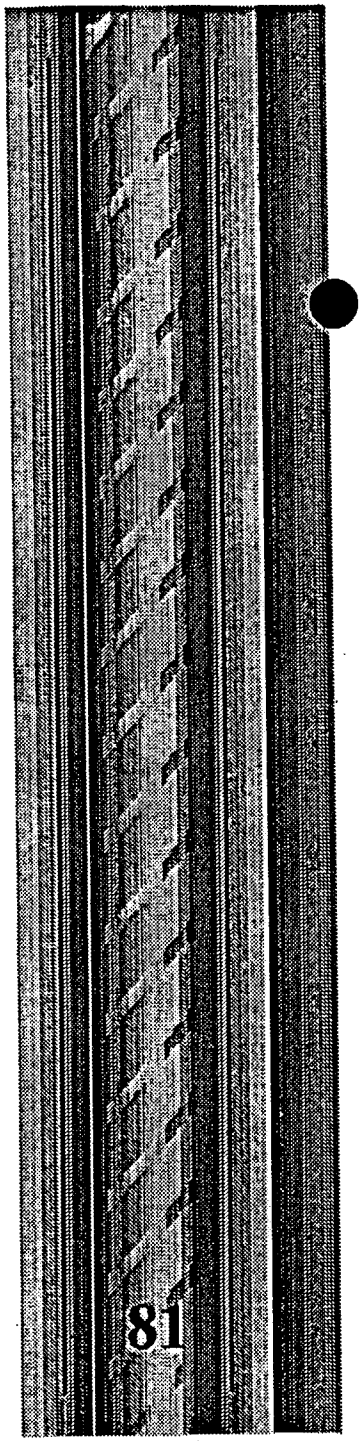
Roger Wilson



ANO-2 Power Uprate

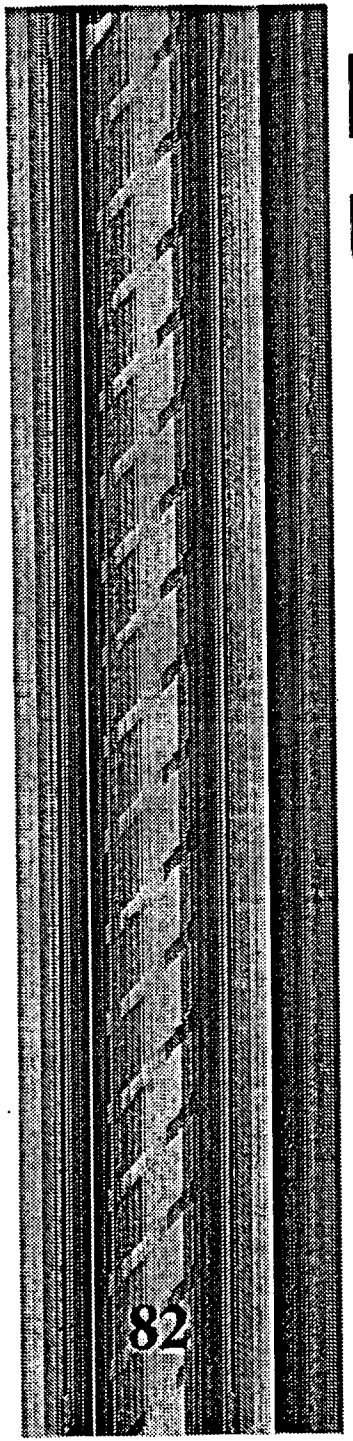
- **Overview**
  - **Power Uprate**
    - **One cycle after steam generators replaced during 2R14**
    - **2R15 scheduled to start March 15, 2002**
  - **7.5% Power Uprate, MWt**

• current licensed power	2815
• uprated power	3026



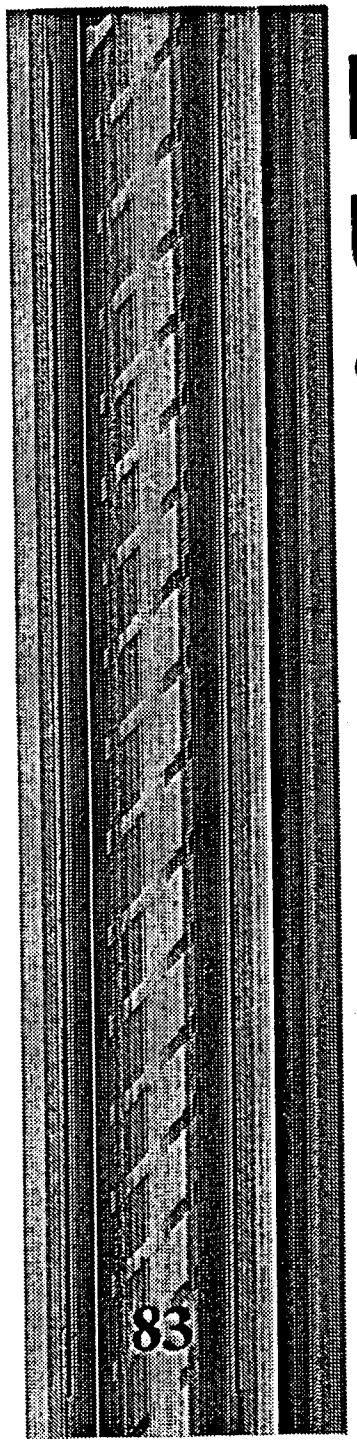
ANO-2 Power Uprate

- Overview
  - Power Uprate Submittal Format
    - tentative
    - ANO and Arizona Public Service personnel are meeting to discuss standardized format
    - format will draw heavily from GE format for its BWR uprates
    - two part submittal



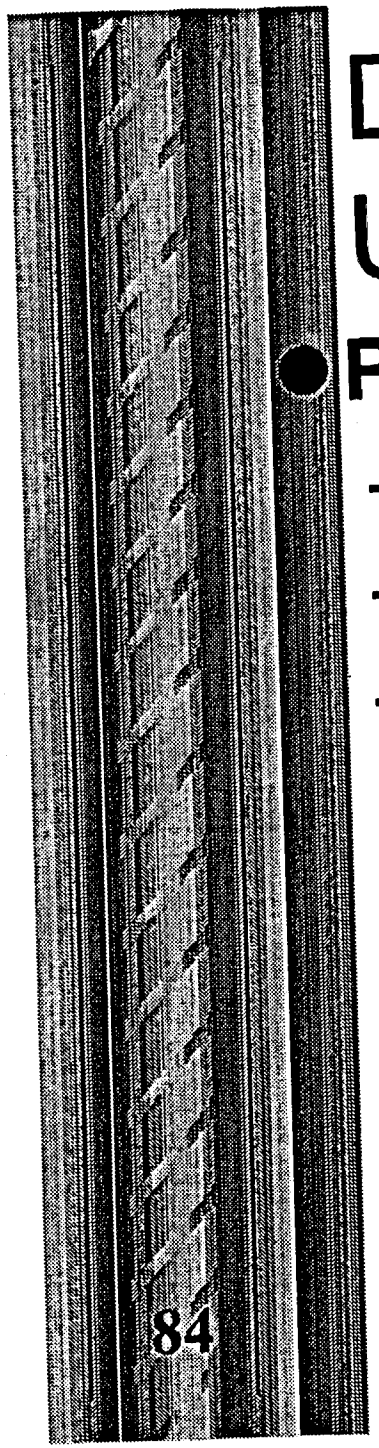
Draft Format for Power Uprate Submittal

- **Part 1**
  - **Cover letter with attachment**
  - **Enclosures**
    - **related TSs already submitted**
    - **proposed TS changes**
    - **safety analysis impacts**
    - **containment response**
    - **radiological consequences**
    - **NSSS components**
    - **NSSS systems**
    - **proposed SAR changes**



Draft Format for Power Uprate Submittal

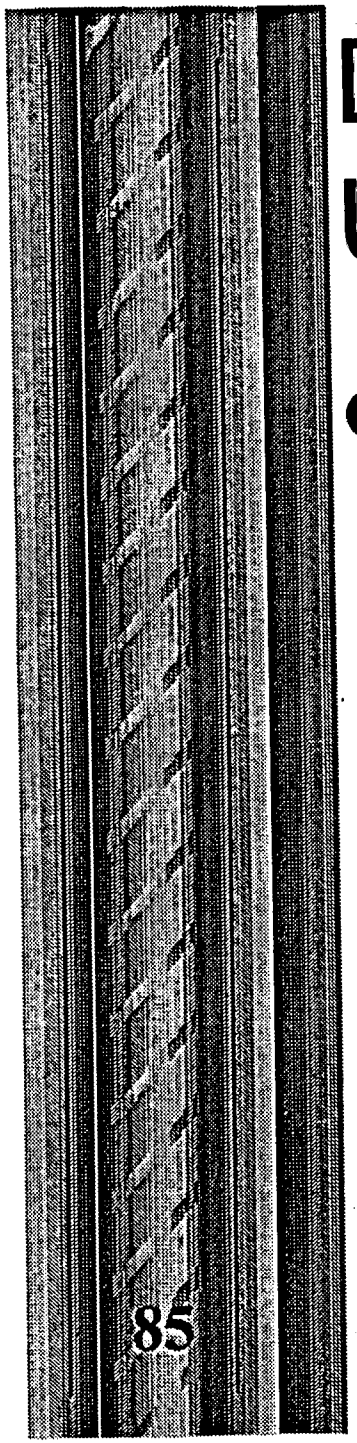
- **Part 1**
  - **Most significant part to NRC reviewers**
  - **3rd quarter 2000 submittal date**



Draft Format for Power Uprate Submittal

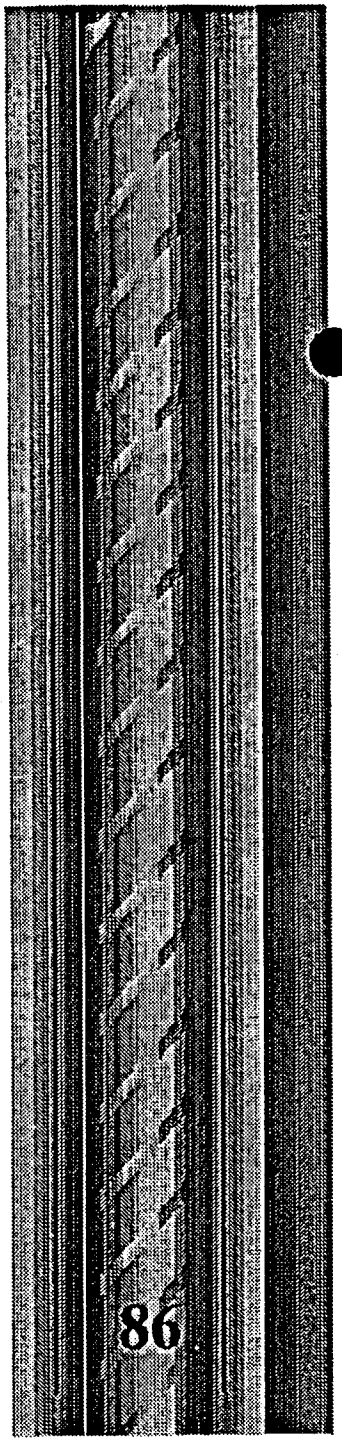
Part 2

- Submitted after Part 1
- Cover letter with attachment
- Enclosures
  - balance of plant systems, structures, components and topics
  - control and instrumentation setpoints
  - environmental impacts
  - miscellaneous



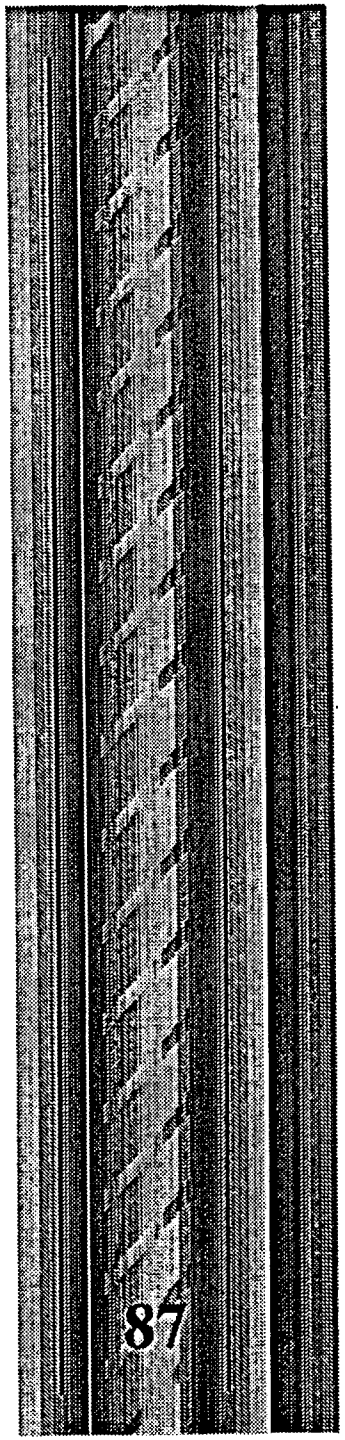
Draft Format for Power Uprate Submittal

- **Part 1 enclosure 1**
  - **Related Technical Specifications already submitted**
    - **containment building design pressure increase (2CAN119903)**
    - **RPS setpoints (2CAN119901)**



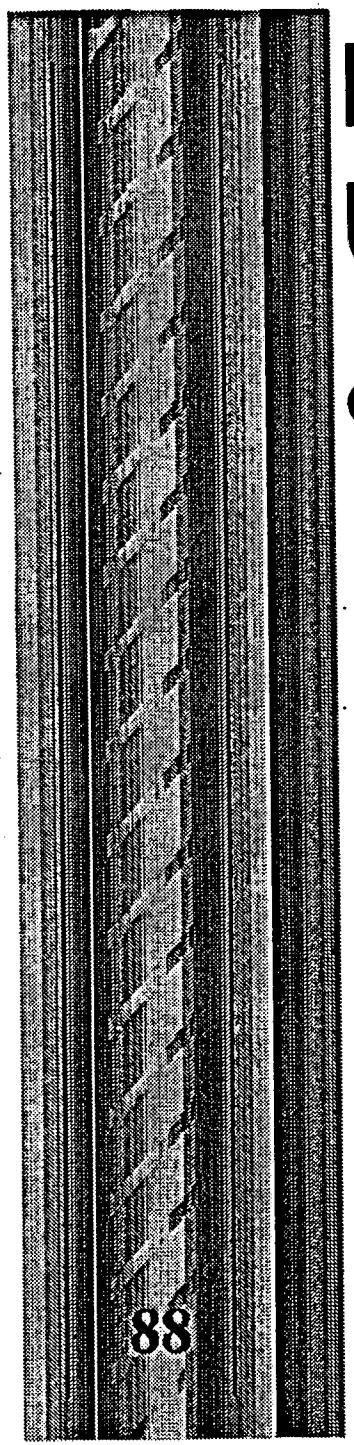
ANO-2 Power Uprate Technical Specification Changes/Submittals

- **Part 1 enclosure 2**
  - **Proposed Technical Specification changes**
    - **1.3 Definitions**
    - **3.1.2.7 Borated Water Sources Shutdown**
    - **3.1.3.1 CEA Position**
    - **3.4.9.1 Table 4.4-5 Reactor Vessel Material Irradiation Surveillance Schedule**



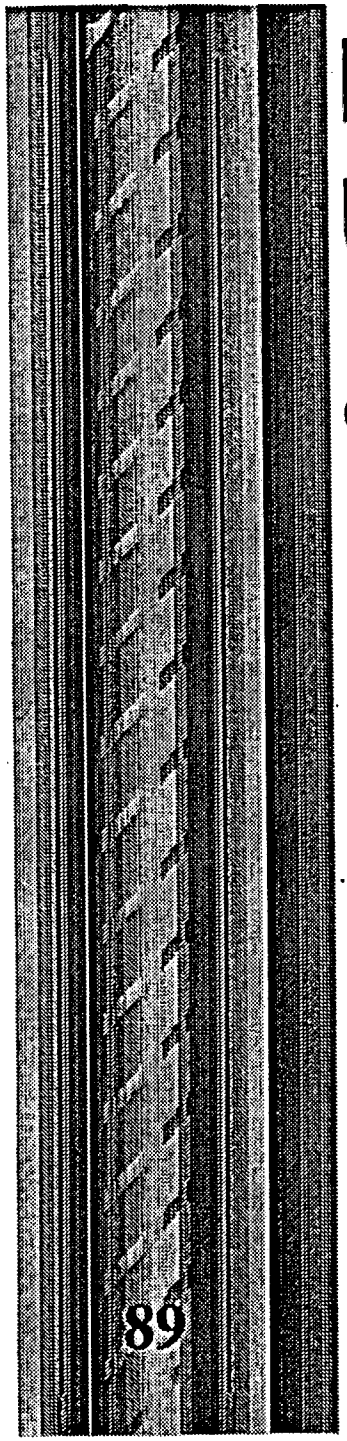
ANO-2 Power Uprate Technical Specification Changes/Submittals

- **Part 1 enclosure 2**
  - **Proposed Technical Specification changes (continued)**
    - **3.7.1.1 MSSV Setpoints**
    - **6.9.5.1 COLR References**



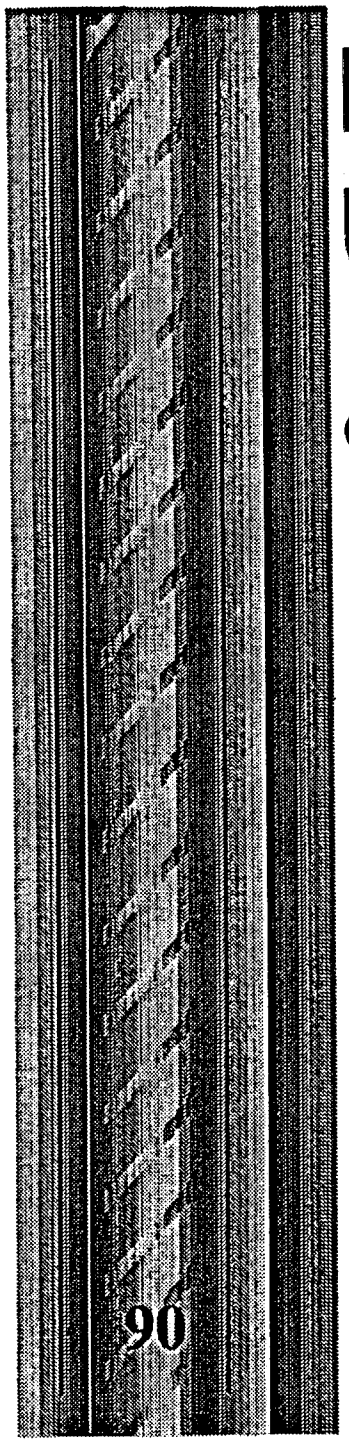
Draft Format for Power Uprate Submittal

- **Part 1 enclosure 3**
  - **Safety Analysis Impacts**
    - **uses approved methods with exception of: (ABB LBLOCA 1999 Evaluation Methodology - - approval pending)**
    - **switched integral burnable absorber from Gadolinia to Erbium**
    - **containment analysis performed at uprated conditions**
    - **most RPS setpoint analyses for RSG cover uprate**



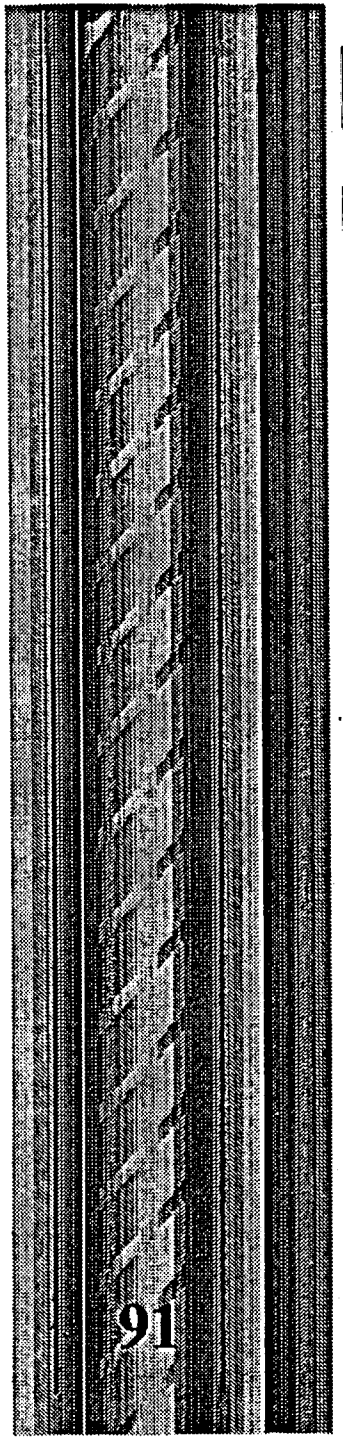
Draft Format for Power Uprate Submittal

- **Enclosure 5**
  - **Radiological Consequences**
    - **methods consistent with RSG**
    - **maintain acceptance criteria**



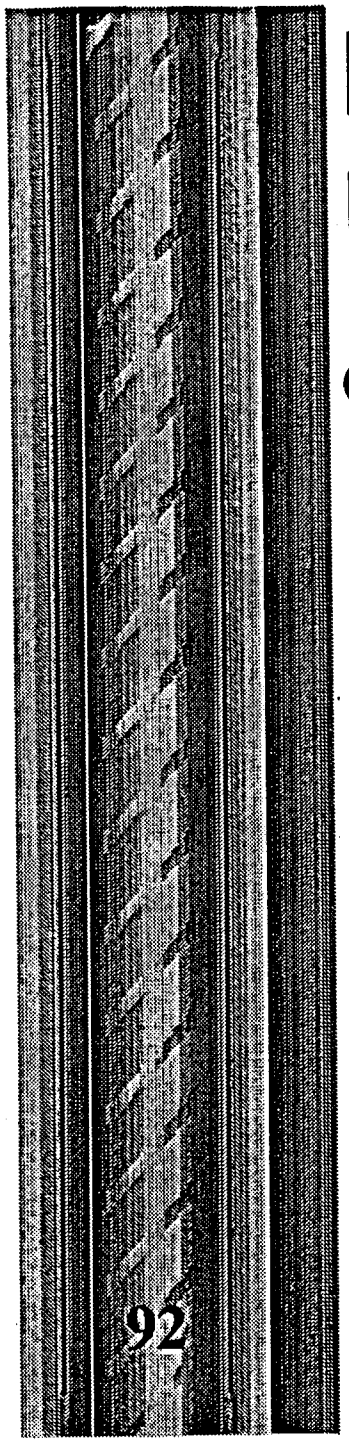
Draft Format for Power Uprate Submittal

- **Part 2 enclosure 1**
  - **Balance of plant systems, structures, components and topics**
    - **> 200 Engineering Requests issued for power uprate and containment uprate**
    - **Nine modifications**
    - **MSRs and Condensers already replaced - no copper, uprated**
    - **Topics**
      - **Alloy 600 issues**
      - **MOVs, AOVs, SOVs**



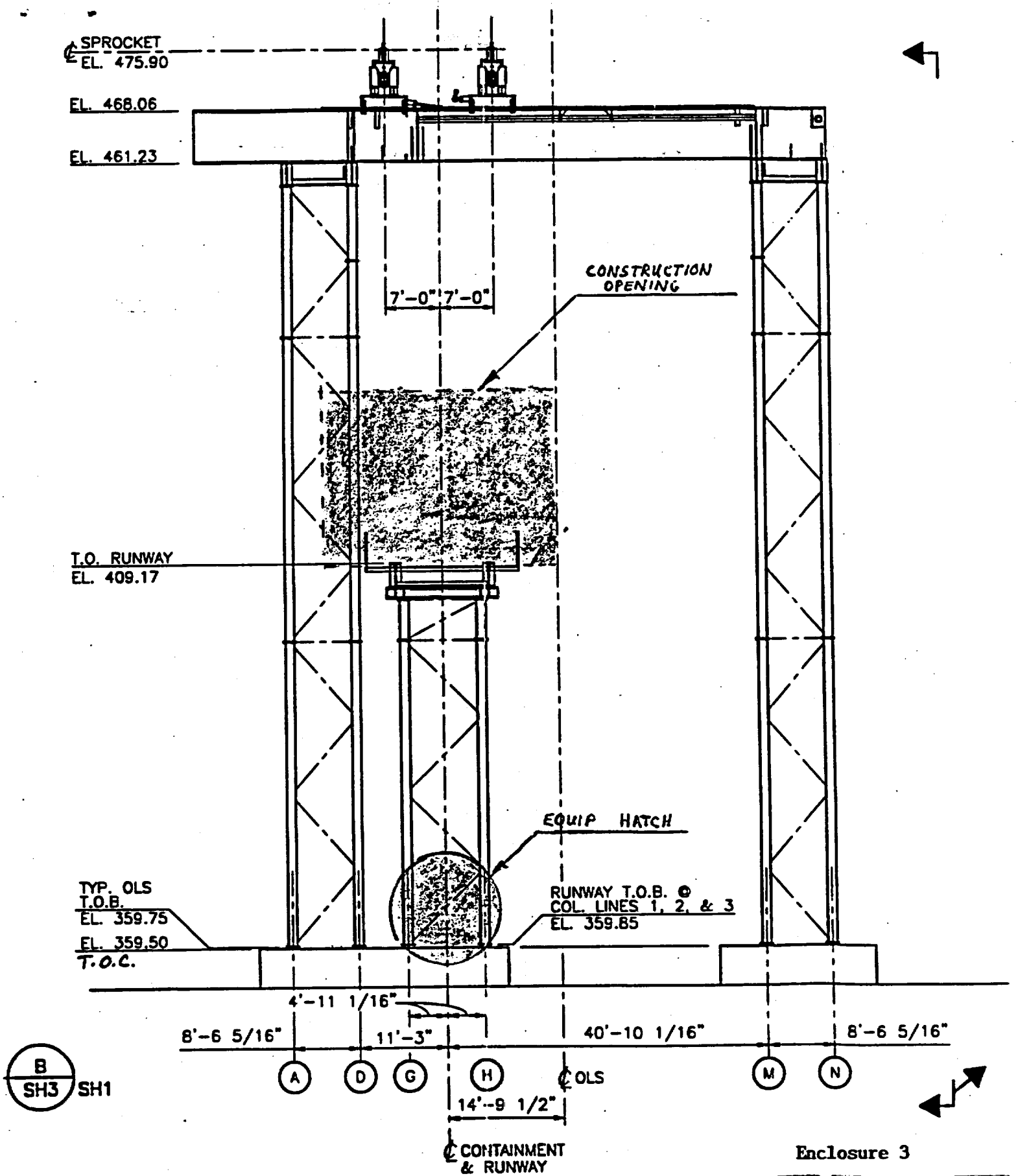
Draft Format for Power Uprate Submittal

- **Part 2 enclosure 1**
  - **BOP SSCs and topics**
    - **Nine Modifications**
      - **high (and low) pressure turbine**
      - **heater drain pump motors and impellers**
      - **steam dump and bypass system**
      - **feedwater heater safety valves**
      - **service water and ACW modifications to stator water coolers**
      - **stator and hydrogen coolers**
      - **iso-phase bus coolers**
      - **main, auxiliary and startup/standby transformer coolers**
      - **instrument range and setpoints**



Draft Format for Power Uprate Submittal

- **Part 2 enclosure 4**
  - **Miscellaneous**
    - **EQ**
    - **EOPs**
    - **Appendix R**
    - **HELB**
    - **station blackout**
    - **operator training**
    - **age related degradation of equipment operating under higher loads**
    - **power uprate testing**



Enclosure 3

		DRAWN	CHECKED	APPROVED
0	ORIGINAL ISSUE	05/26/99 TDC		5/27/99

ENTERGY ARKANSAS, INC.
ARKANSAS NUCLEAR ONE – UNIT 2
STEAM GENERATOR REPLACEMENT

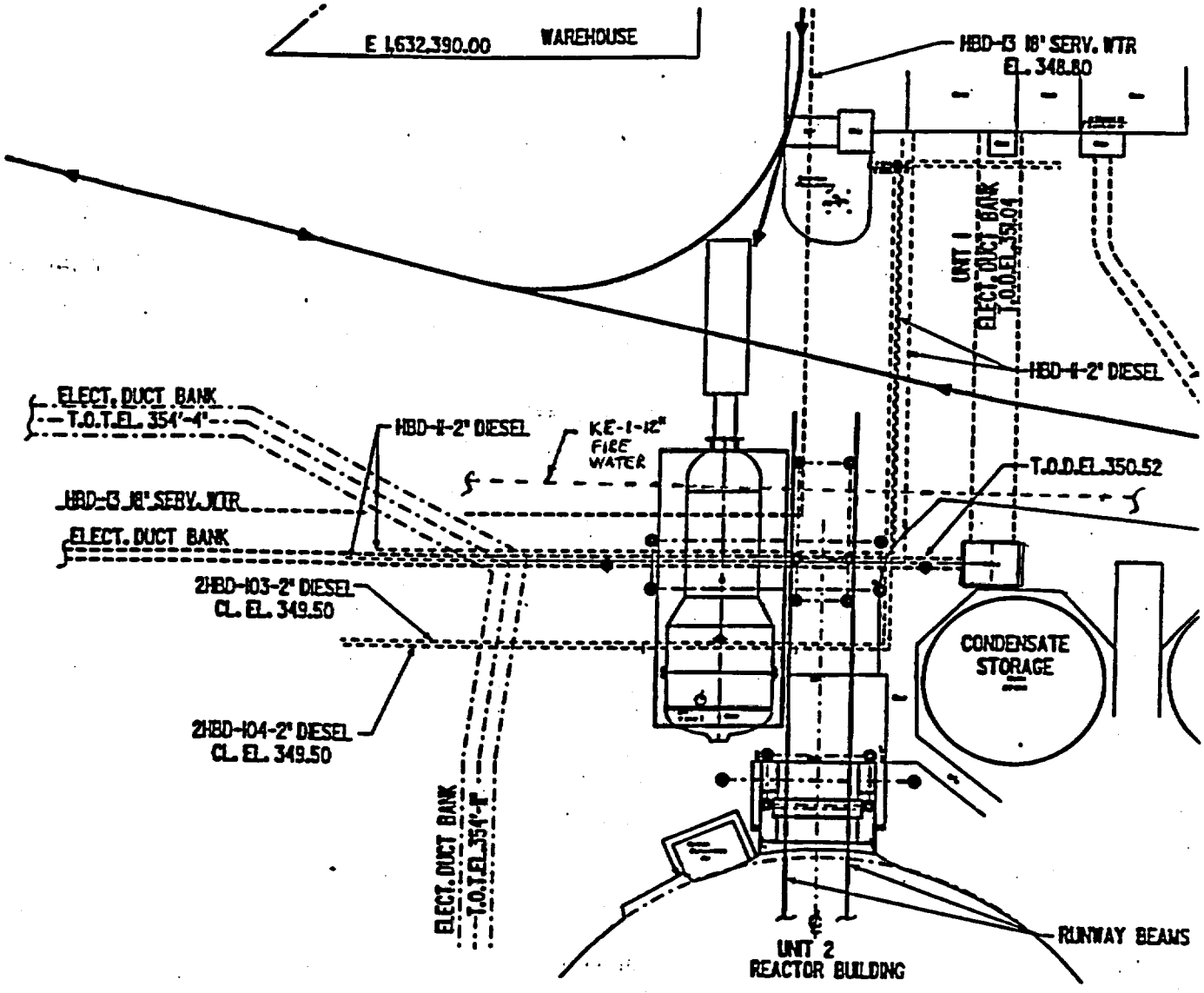
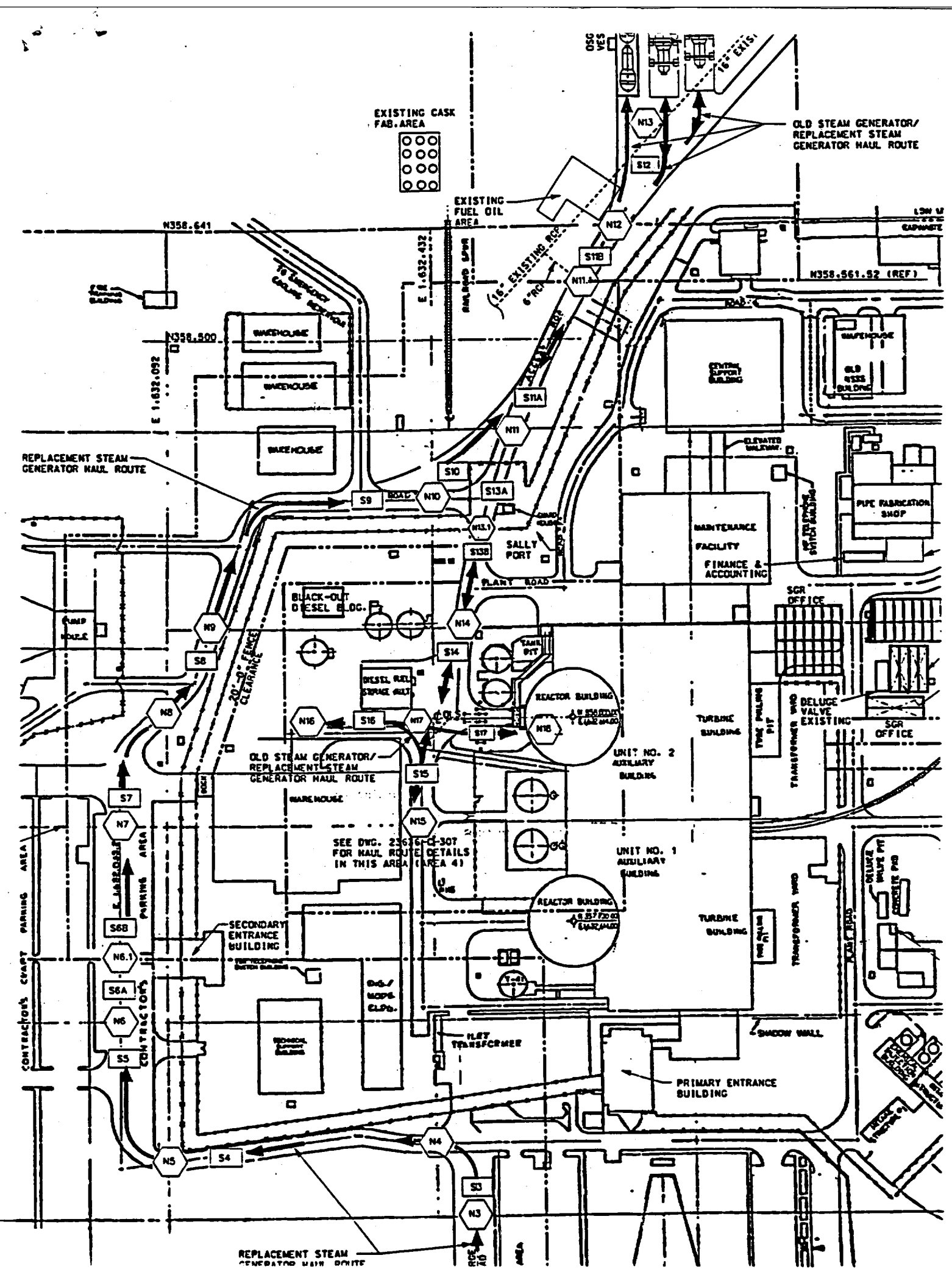


FIGURE 1 – UNDERGROUND SSC LOCATIONS RELATIVE TO RBSS/OLS AND SG HAUL ROUTE


EXISTING CASK FAB. AREA
EXISTING FUEL OIL AREA
OLD STEAM GENERATOR/ REPLACEMENT STEAM GENERATOR HAUL ROUTE
REPLACEMENT STEAM GENERATOR HAUL ROUTE
N358.641
N358.500
N358.561.52 (REF)
E 1,632,432
E 1,632,092
WAREHOUSE
WAREHOUSE
WAREHOUSE
CENTRAL SUPPORT BUILDING
MAINTENANCE FACILITY
FINANCE & ACCOUNTING
PIPE FABRICATION SHOP
SALLY PORT
PLANT ROAD
BLACK-OUT DIESEL BLDG.
PUMP HOUSE
20'-0" FENCE CLEARANCE
DIESEL FUEL STORAGE VAULT
TANK PIT
REACTOR BUILDING
TURBINE BUILDING
UNIT NO. 2 AUXILIARY BUILDING
UNIT NO. 1 AUXILIARY BUILDING
TRANSFORMER YARD
DELUGE VALVE EXISTING
SCR OFFICE
SECONDARY ENTRANCE BUILDING
PRIMARY ENTRANCE BUILDING
SHOW WALL
SEE DWG. 23616-C-307 FOR HAUL ROUTE DETAILS IN THIS AREA (AREA 4)
CONTRACTOR'S PARKING AREA
CONTRACTOR'S PARKING AREA
REPLACEMENT STEAM GENERATOR HAUL ROUTE
N1
N2
N3
N4
N5
N6
N6.1
N7
N8
N9
N10
N11
N11.1
N12
N13
N13.1
N14
N15
N16
N17
N18
S1
S2
S3
S4
S5
S6A
S6B
S7
S8
S9
S10
S11A
S11B
S12
S13A
S13B
S14
S15
S16
S17
S18