

Palo Verde Steam Generator Replacement And Power Uprate Project

**Presentation
To The
Nuclear Regulatory Commission**

February 21, 2001



Palo Verde Steam Generator Replacement And Power Uprate Project

Project Update

**Carl Churchman
SGR Project Director**



Agenda

- | | |
|------------------------|----------------|
| ◆ Introduction | Carl Churchman |
| ◆ Project status | Carl Churchman |
| ◆ Licensing activities | Dick Bernier |
| ◆ Safety analyses | Paul Clifford |
| ◆ Risk evaluation | Gerry Sowers |
| ◆ CR habitability | Mo Karbassian |
| ◆ Modifications | Mo Karbassian |
| ◆ Weld issues | Mo Karbassian |
| ◆ Future activities | Carl Churchman |



Objectives

- ♦ **Provide status of SG replacement and power uprate project**
- ♦ **Overview of RSG transportation**
- ♦ **Overview of RSG installation**
- ♦ **Discuss power uprate submittal**
- ♦ **Proposed Technical Specification changes**

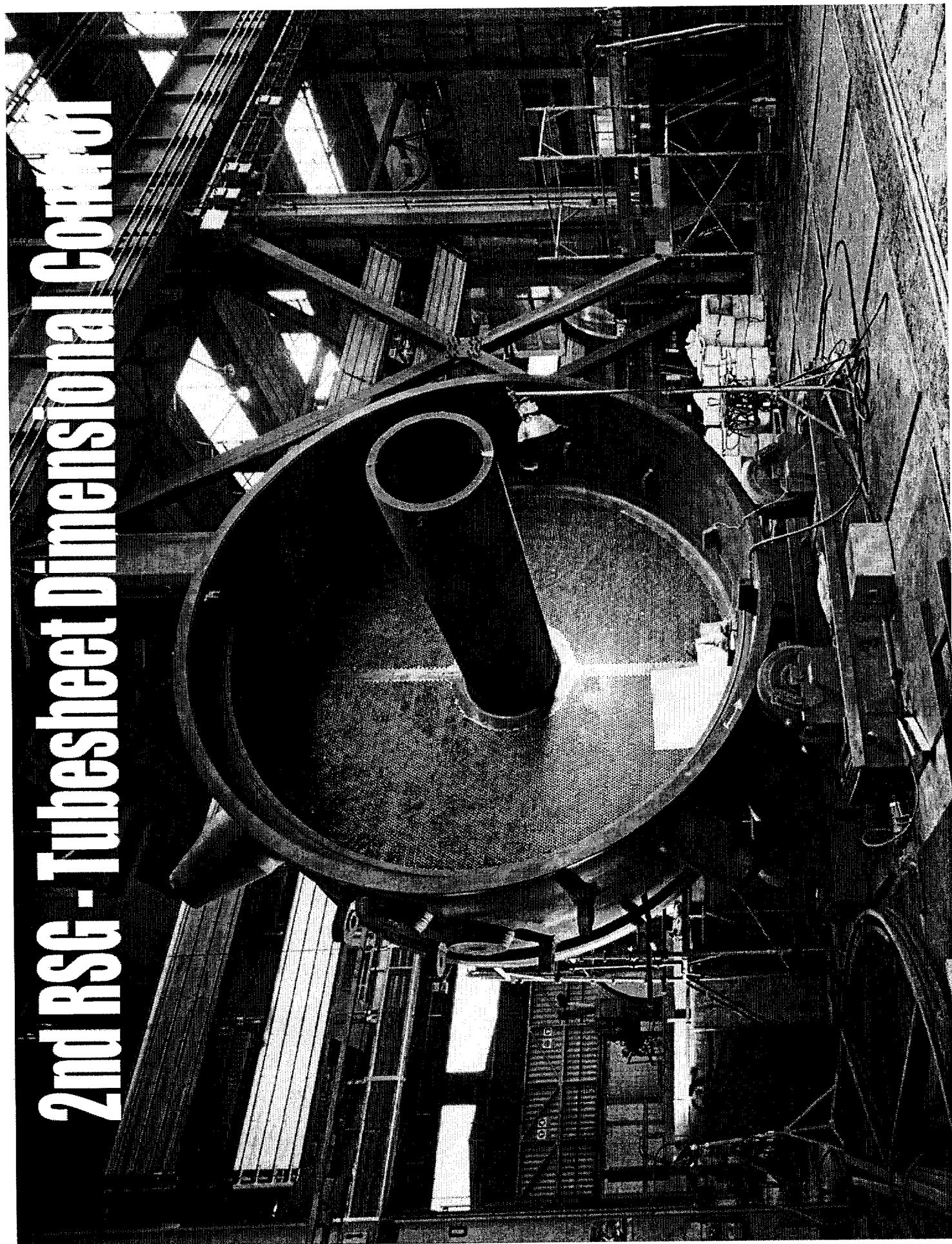


Objectives

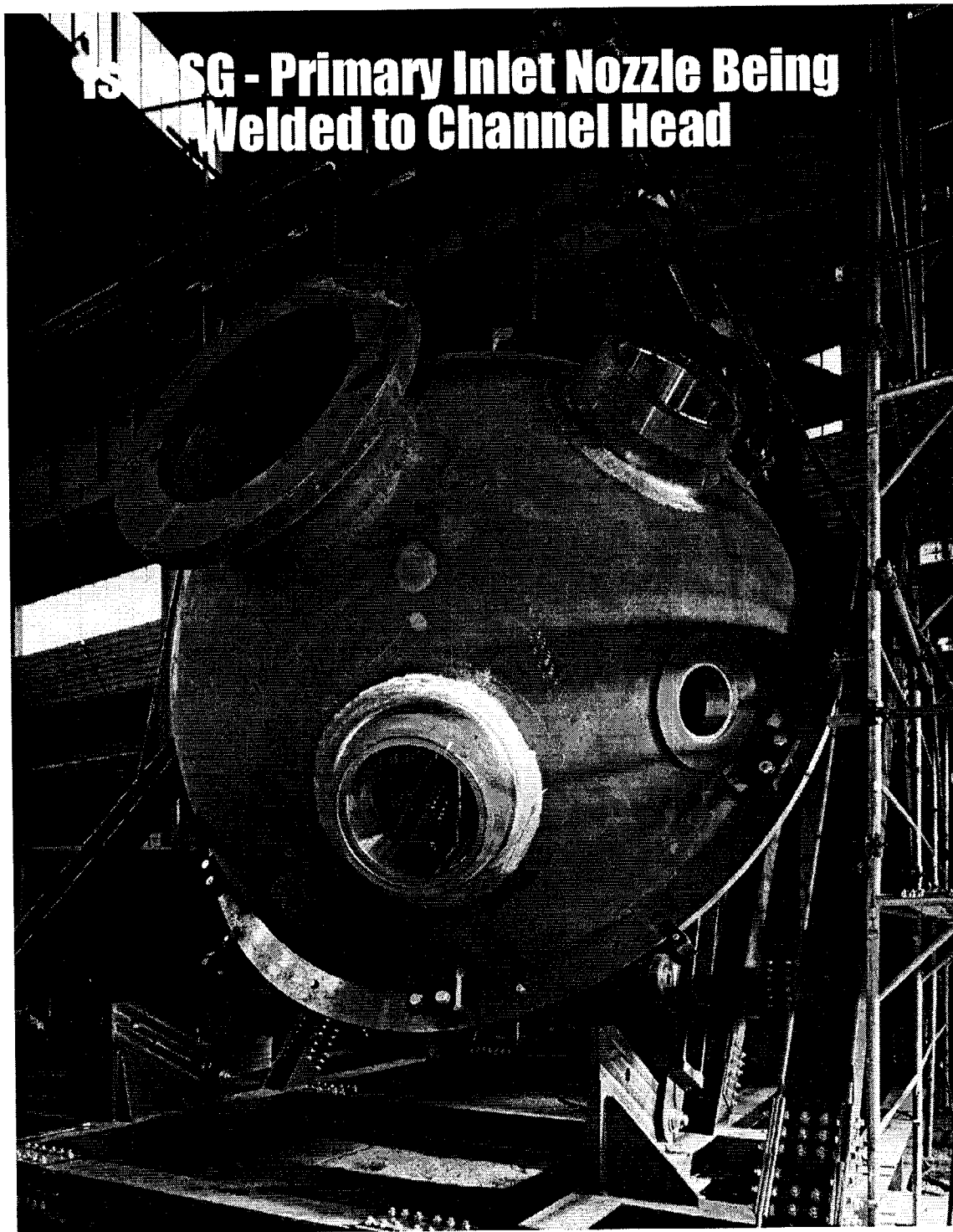
- ◆ **Required plant modifications**
- ◆ **Control room habitability**
- ◆ **RCS piping weld issue**
- ◆ **Provide an overview of upcoming activities**
- ◆ **Discuss integrated schedule**

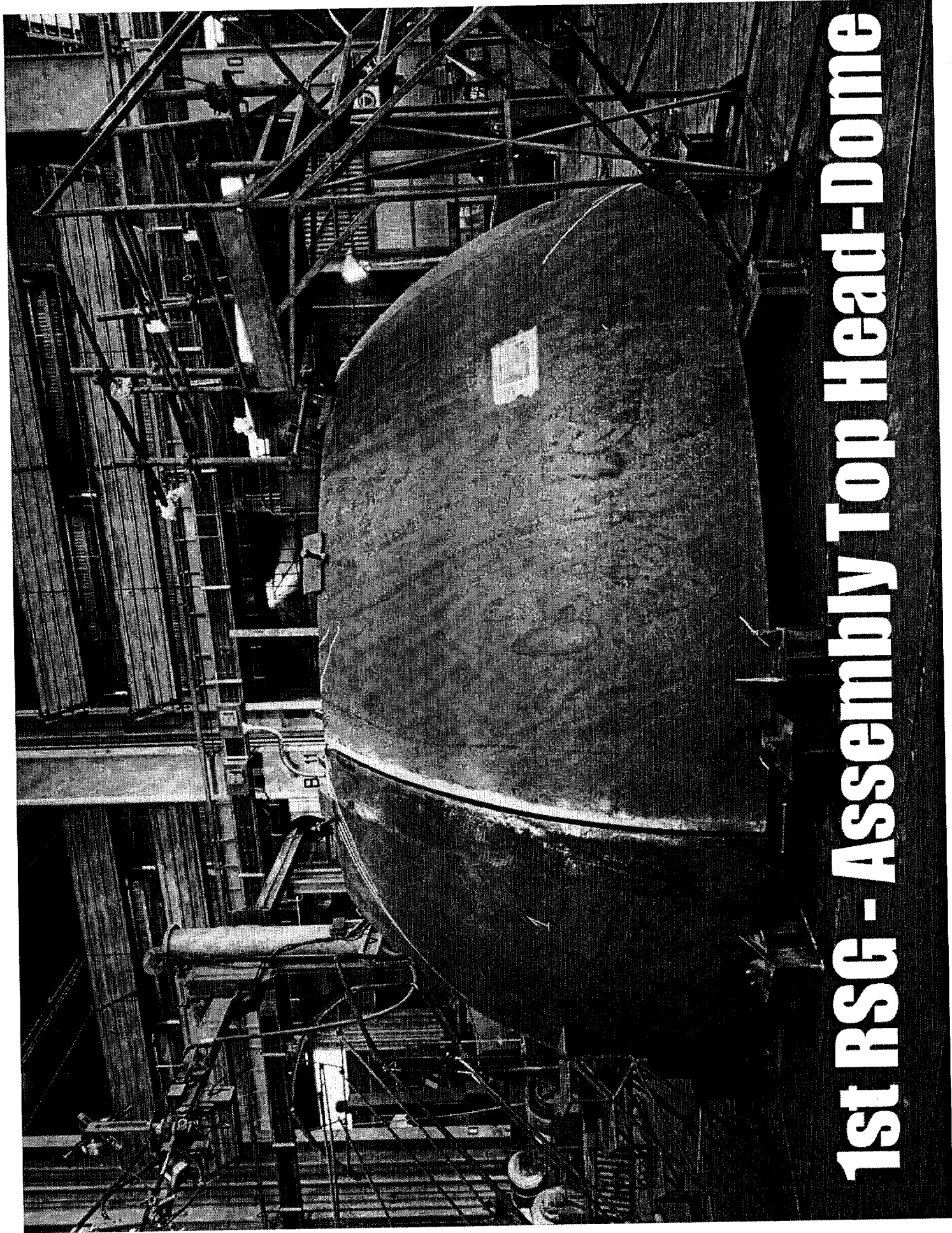


2nd RSG - Tubesheet Dimensional Control



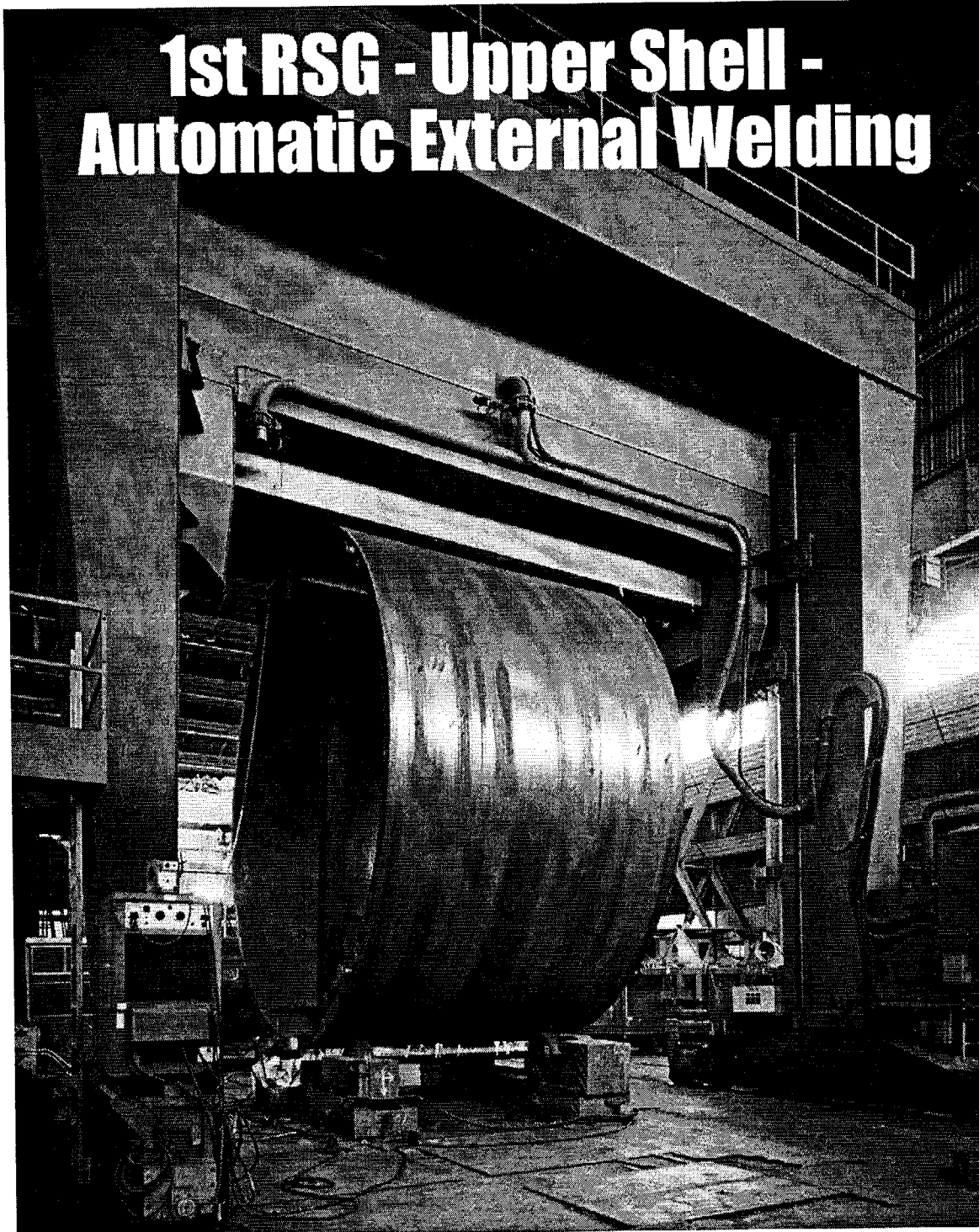
Is SG - Primary Inlet Nozzle Being Welded to Channel Head



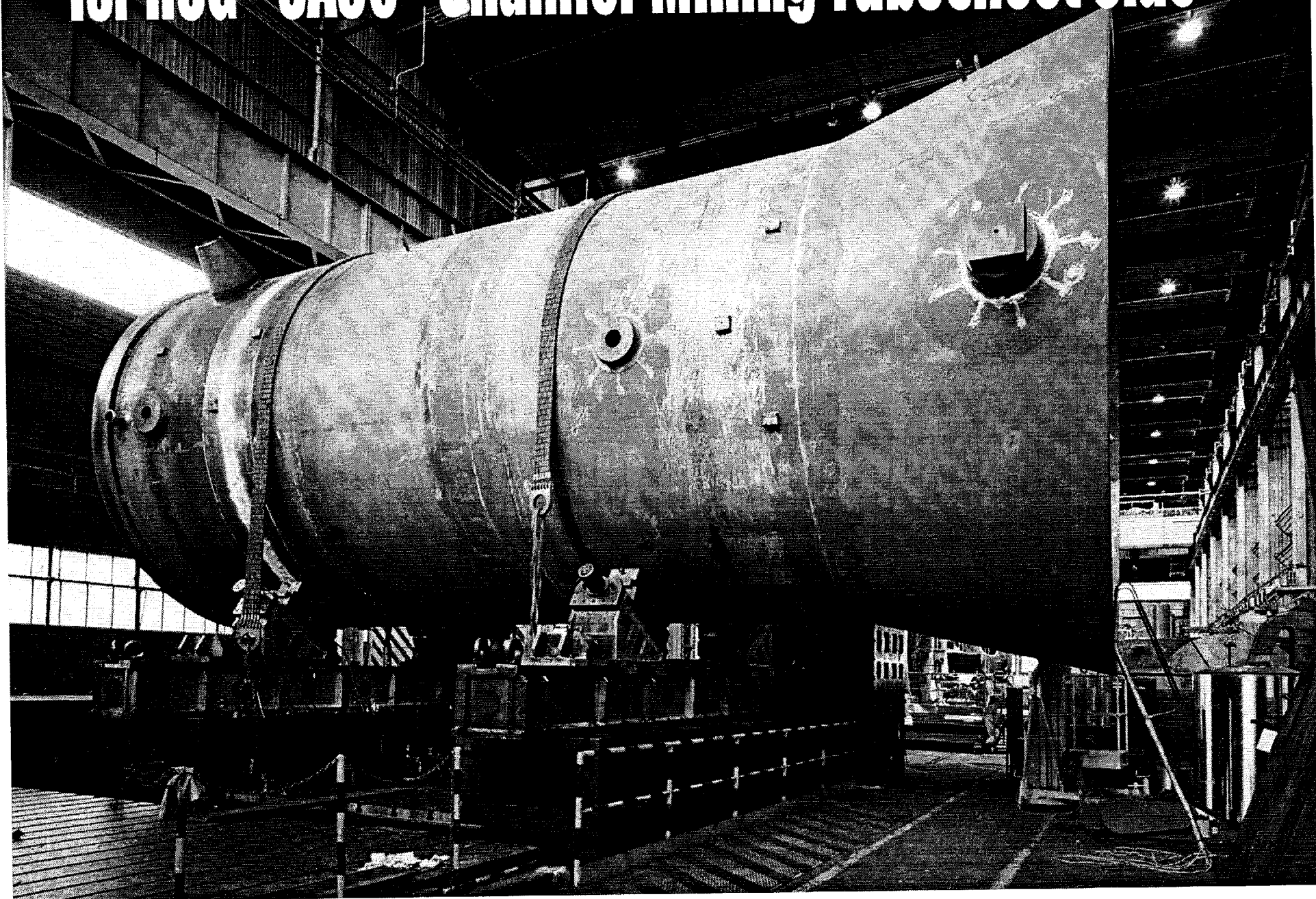


1st RSG - Assembly Top Head-Dome

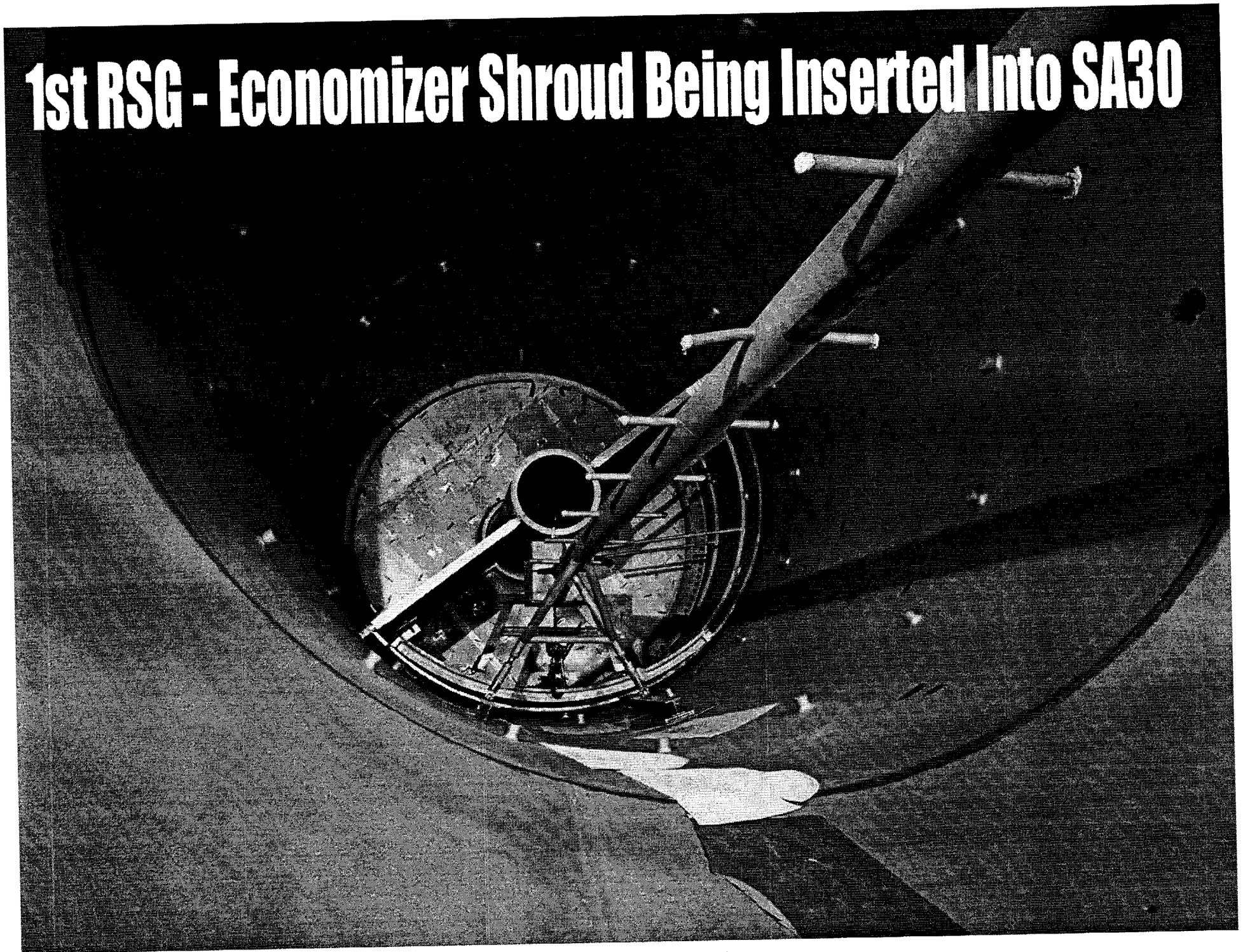
1st RSG - Upper Shell - Automatic External Welding



1sr RSG - SA30 - Chamfer Milling Tubesheet Side



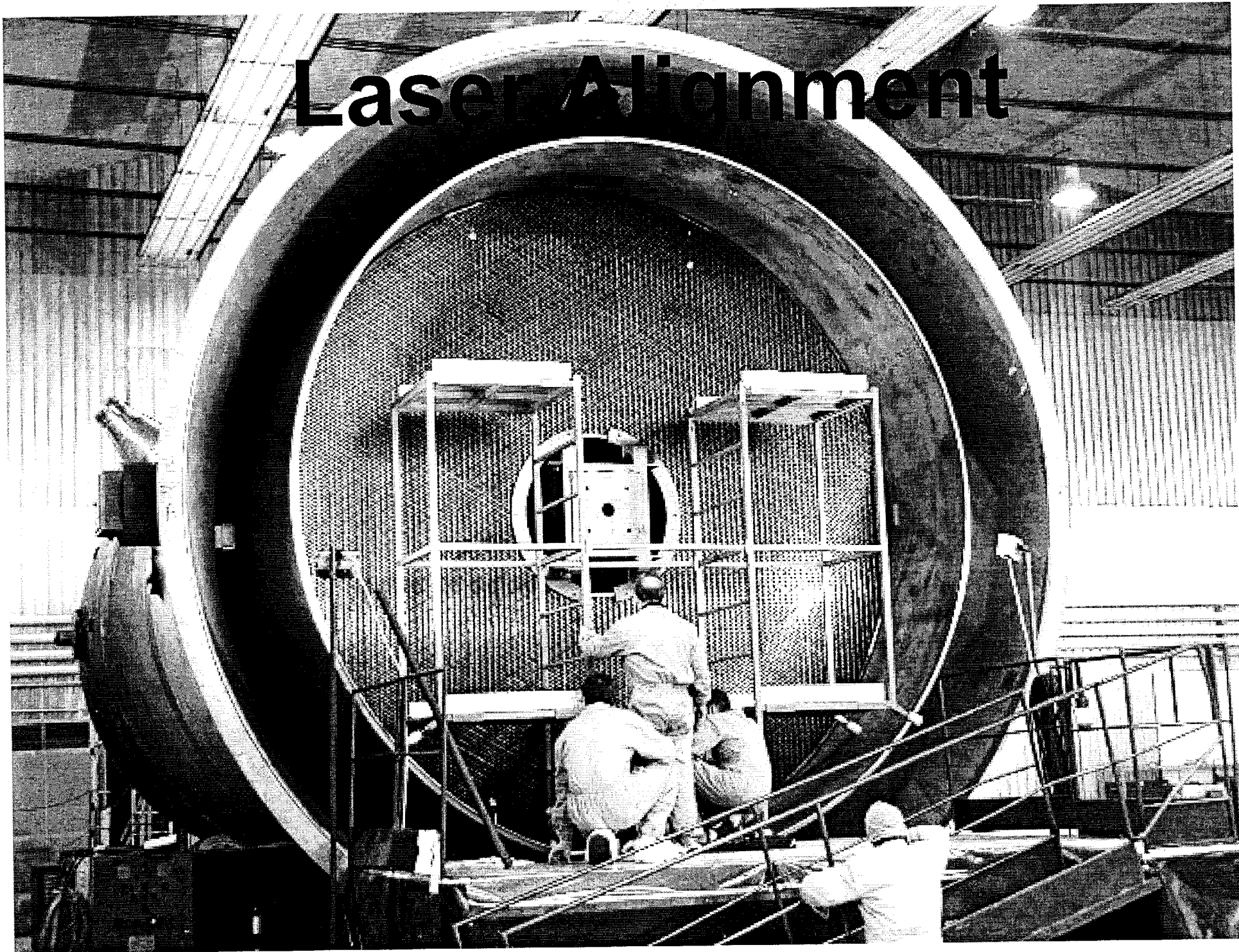
1st RSG - Economizer Shroud Being Inserted Into SA30



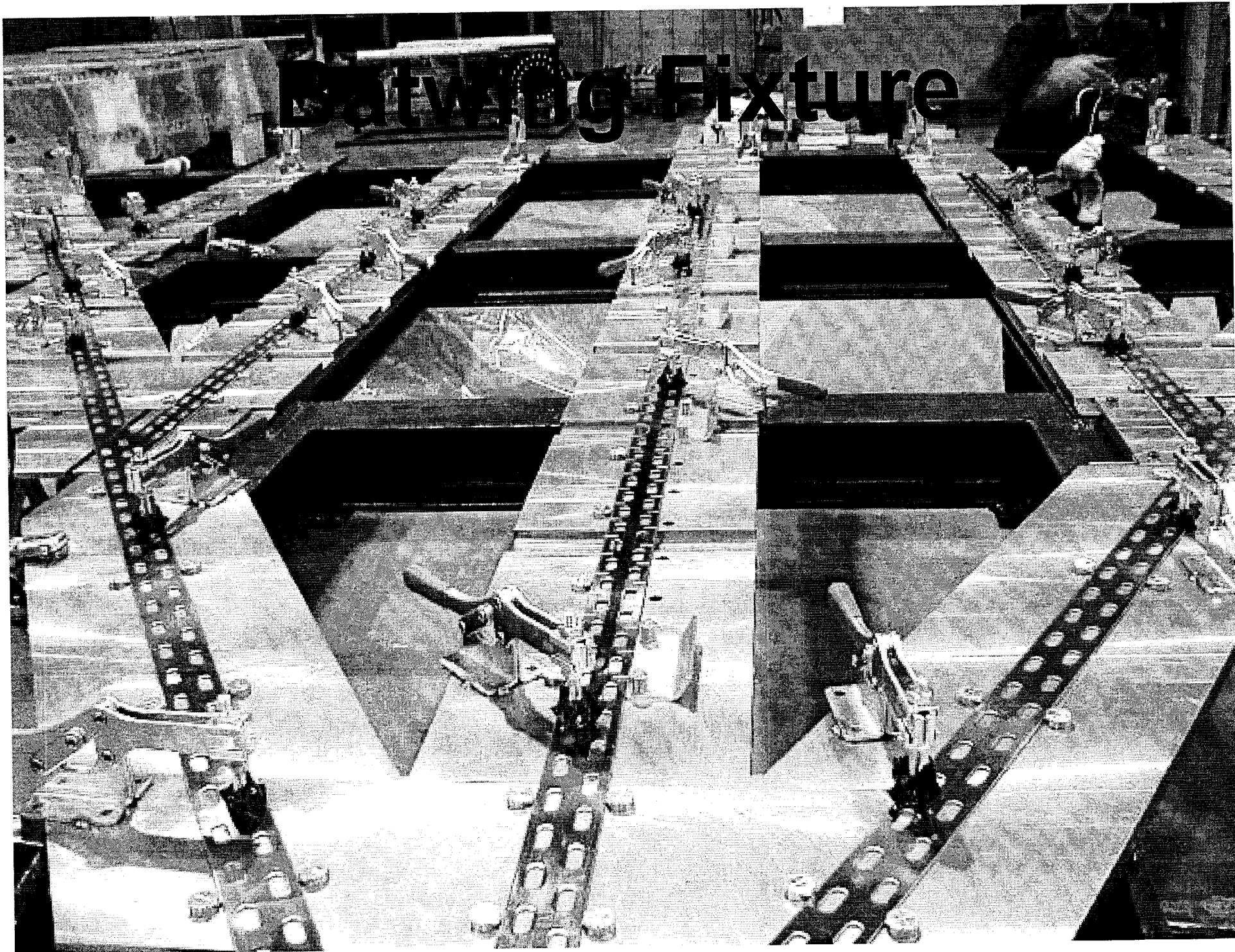
1st RSG - Shroud Assembly



Laser Alignment



Batwing Fixture



RSG Transportation

- ◆ **Status of transportation plan**
- ◆ **Status of permits**
- ◆ **Status of infrastructure improvements**



Installation Activities

- ♦ **U2R9 (fall 2000) (Complete)**
 - Laser templating of piping in containment
 - Design walkdowns in containment
 - Polar crane inspections
 - No major rework required
- ♦ **U2C10 (winter 2000 - spring 2002)**
 - Personnel access and north side sally port



Installation Activities

♦ U2R10 (spring 2002)

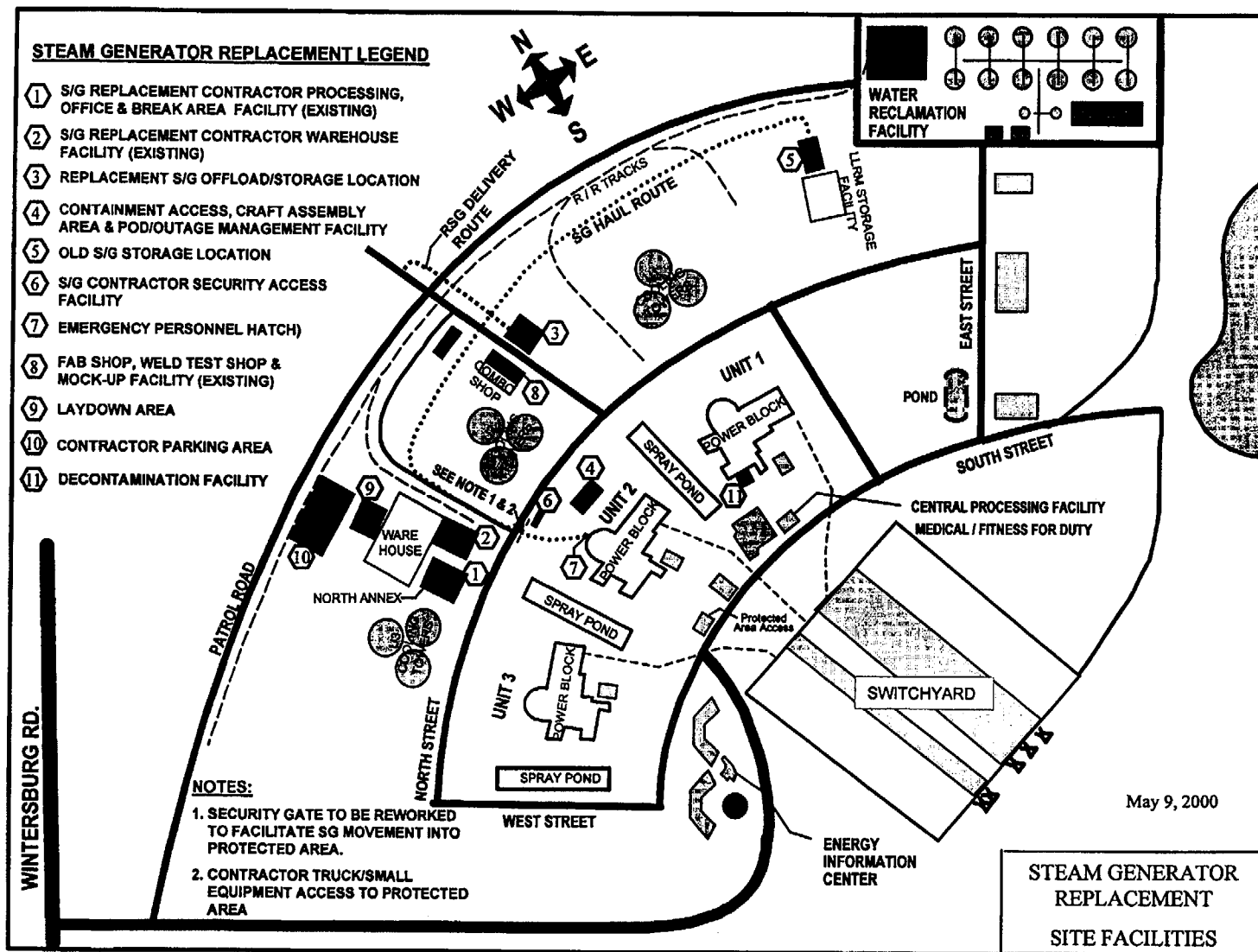
- Remove/relocate interfering commodities from bioshield wall
- Polar crane preparations (based on U2R9 inspection)
- SG2 auxiliary crane supports



Installation Activities

- ◆ **U2C11 (summer 2002 - fall 2003)**
 - **Craft access facility**
 - **Outside lift system**
 - **Haul route**
 - **RSG preparations**
- ◆ **U2R11 (fall 2003)**
 - **Bioshield wall modifications**
 - **Replace steam generators**





Licensing Activities

- ◆ Submittal is being reviewed by a cross-disciplinary team including members from another utility
- ◆ Final safety analysis results are within criteria defined at the outset of the project



Licensing Activities

- ♦ **APS will provide submittal to NRC in June 2001**
- ♦ **Request approval in June 2002**
- ♦ **U2C12 fuel design to commence in September 2002 based on SER from NRC**



Technical Specification Changes

- ◆ Definition of rated thermal power
- ◆ Low SG pressure reactor trip setpoint
- ◆ Low SG pressure MSIS setpoint
- ◆ Peak containment pressure
- ◆ Operating range for cold leg temperature at 100 percent power
- ◆ Allowable power vs. operable MSSVs



Safety Analyses

- ◆ **UFSAR Chapter 15 Transient Analysis**
 - **CENTS code**
 - **Analytical limits**
 - **Methodology changes**
 - **Sample from uprate submittal**



Safety Analyses

- ♦ **CENTS will replace CESEC-III as the primary tool for Chapter 15 non-LOCA transient analysis.**
- ♦ **Implementation of CENTS targeted for Unit 2 Cycle 11 in accordance with GL 83-11 Supplement 1 guidelines.**
- ♦ **CENTS will be used to predict global changes in RCS pressure during the CEA ejection event. STRIKIN-II will continue to be used to predict local conditions (i.e. fuel enthalpy and DNBR).**



Safety Analyses

Initial conditions at full power

Values Include appropriate uncertainties

Power	= 4070 MWt (3990 + uncertainty)
Inlet temperature	= 548 to 566°F
Pressurizer pressure	= 2100 to 2325 psia
RCS mass flow rate	= 95% to 116% of design
Pressurizer level	= 24% to 59%
SG level	= 4% to 92% NR
Axial power distribution	= -0.20 to +0.20 ASI
MTC	= -0.20 to -4.0 E-4 delta-rho/°F
Primary to secondary leakage	= 720 gpd / SG



Safety Analyses

◆ Methodology changes

- The following methods/assumptions changes will be applied to both the current plant configuration (Units 1/3) and Unit 2 RSG/uprate
 - Dose calculations will assume a decontamination factor of 100 (partition factor of 0.01) for the intact SG
 - Post-trip MSLB will employ a more detailed reactivity calculation, including moderator density feedback in the hot channel



Safety Analyses

♦ Methodology changes (cont.)

- Single RCP sheared shaft with LOP will assume that, at 90 minutes, the operator will re-establish level in the affected SG
- SGTR+LOP will credit EOP-based isolation of affected SG



Safety Analyses

- ◆ **Sample from uprate submittal**
 - **Outline and contents of the safety analysis portion of the submittal is based on a composite of the PVNGS UFSAR and the Farley uprate submittal**



Safety Analyses

- ◆ **Sample from uprate submittal (cont.)**
 - **Inadvertent opening of a SGADV**
 - **Identification of causes and event description**
 - **Acceptance criteria**
 - **Description of analysis**
 - **Input parameters, initial conditions, and assumptions**
 - **Results**
 - **Conclusions**



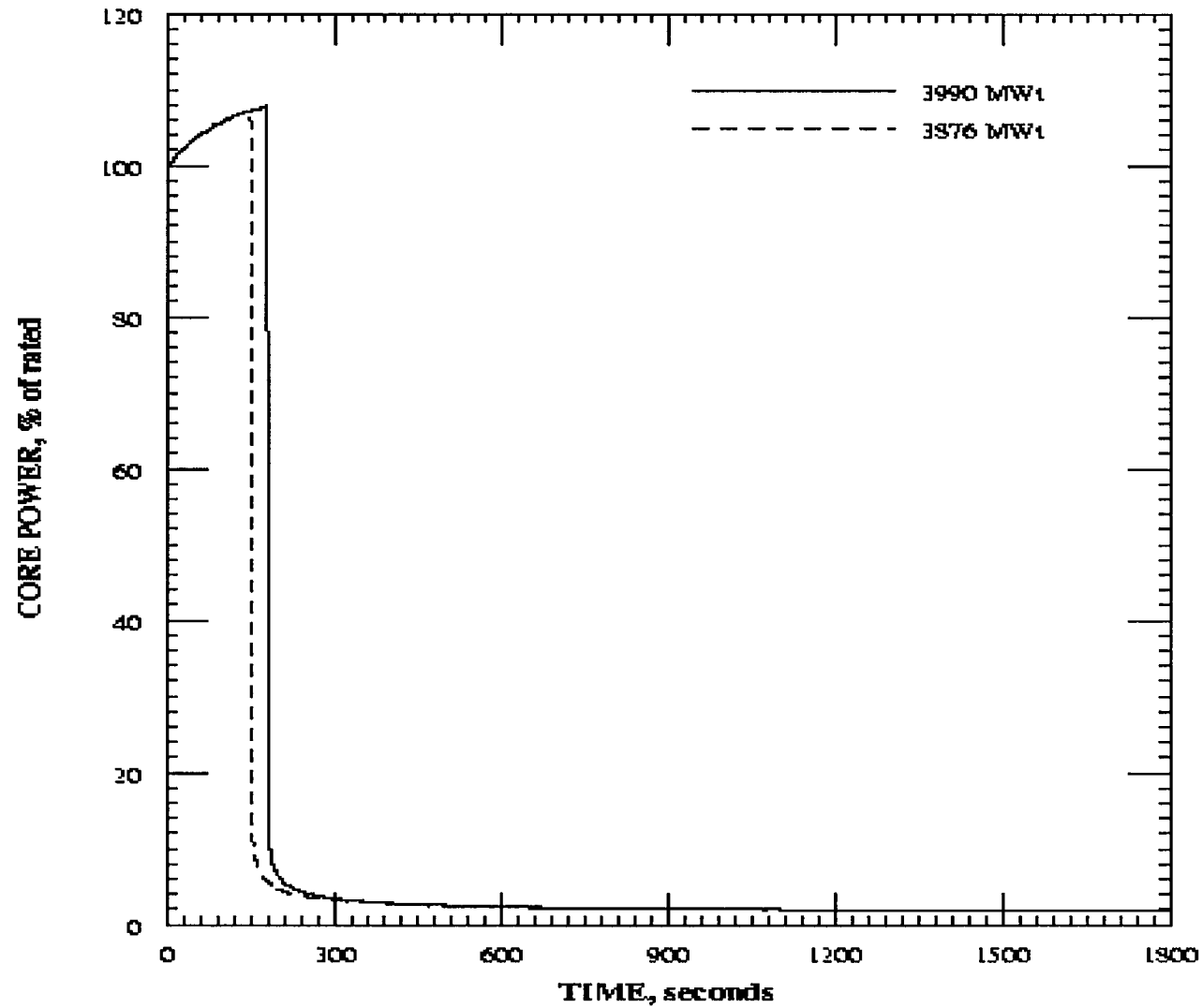
Safety Analyses

Table 6.3-8: Sequence of Events for IOSGADV+LOP Event

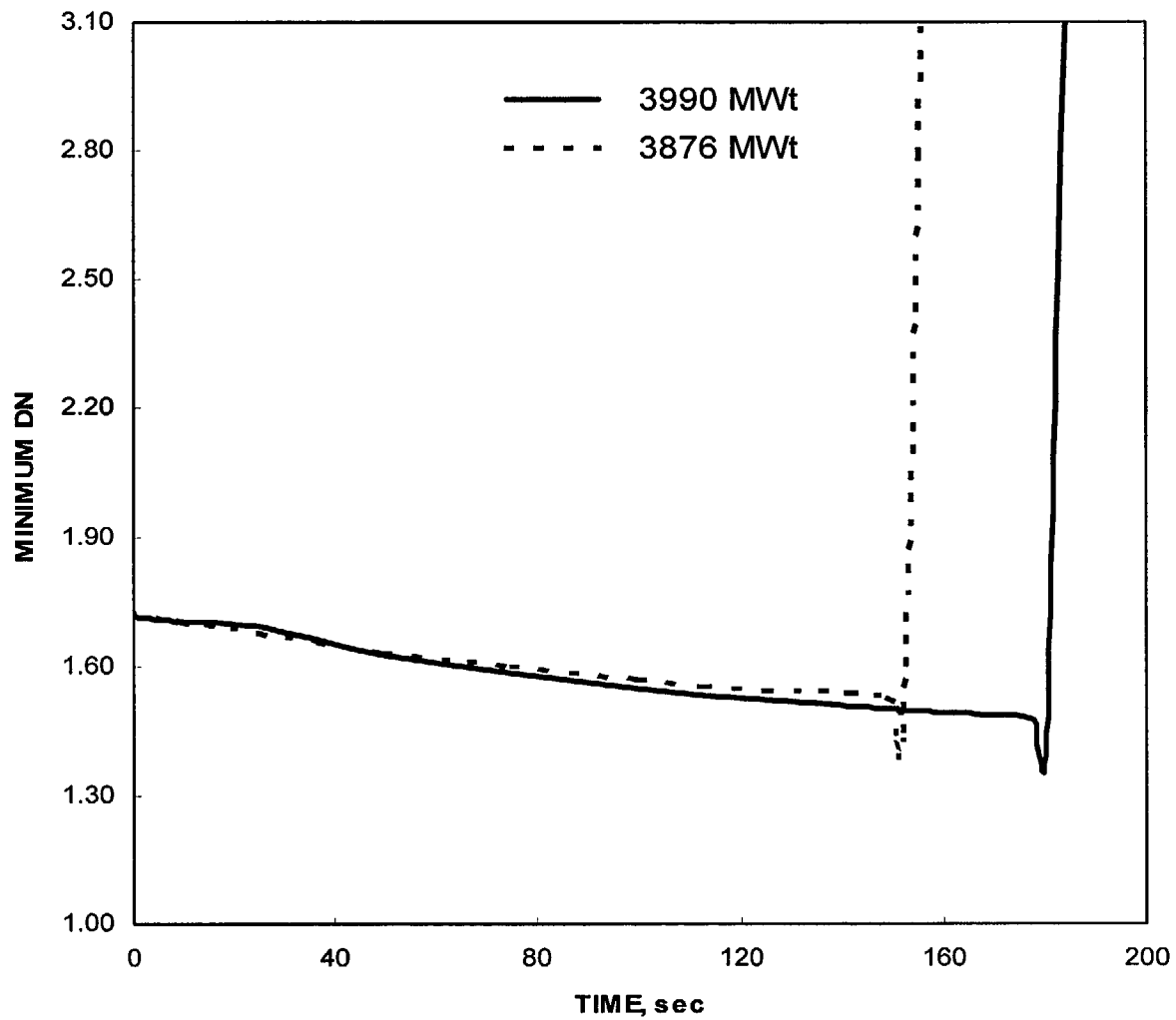
Time (sec)		Event	Value	
3876 MWt	3990 MWt		3876 MWt	3990 MWt
0.00	0.00	Inadvertent opening of SG#1 ADV	---	---
0.00	0.00	Hot Channel Minimum DNBR	1.72	1.72
147.9	176.5	SG pressure reaches MSIS/Trip setpoint (psia)	850	915
149.1	177.7	Reactor/Turbine trip Loss of Offsite Power	---	---
149.7	178.3	Scram CEAs begin falling	---	---
151.2	179.7	Minimum DNBR	> SAFDL	> SAFDL
153.5	182.1	MSIVs Closed	---	---
352.7	329.3	SG#2 MSSV Bank 1 Open (psia) Begin Oscillating	1303	1303
463.9	428.3	RCS pressure reaches SIAS setpoint (psia)	1750	1750
919	1005	SG#1 Empties	---	---
1800	1800	Operators manually close SG#1 ADV	---	---
1800	1800	Operators initiate cooldown (min)	30	30



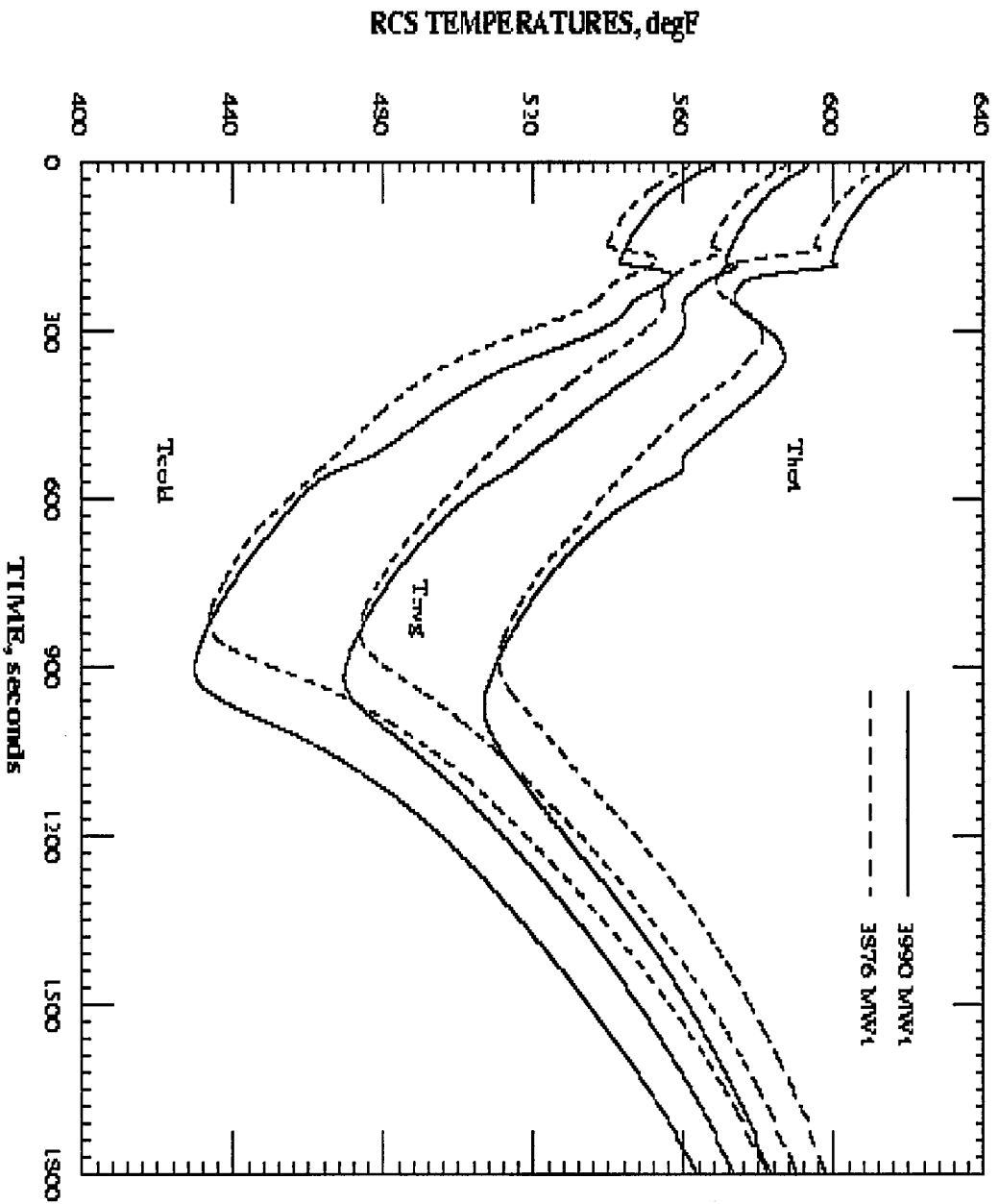
Safety Analyses



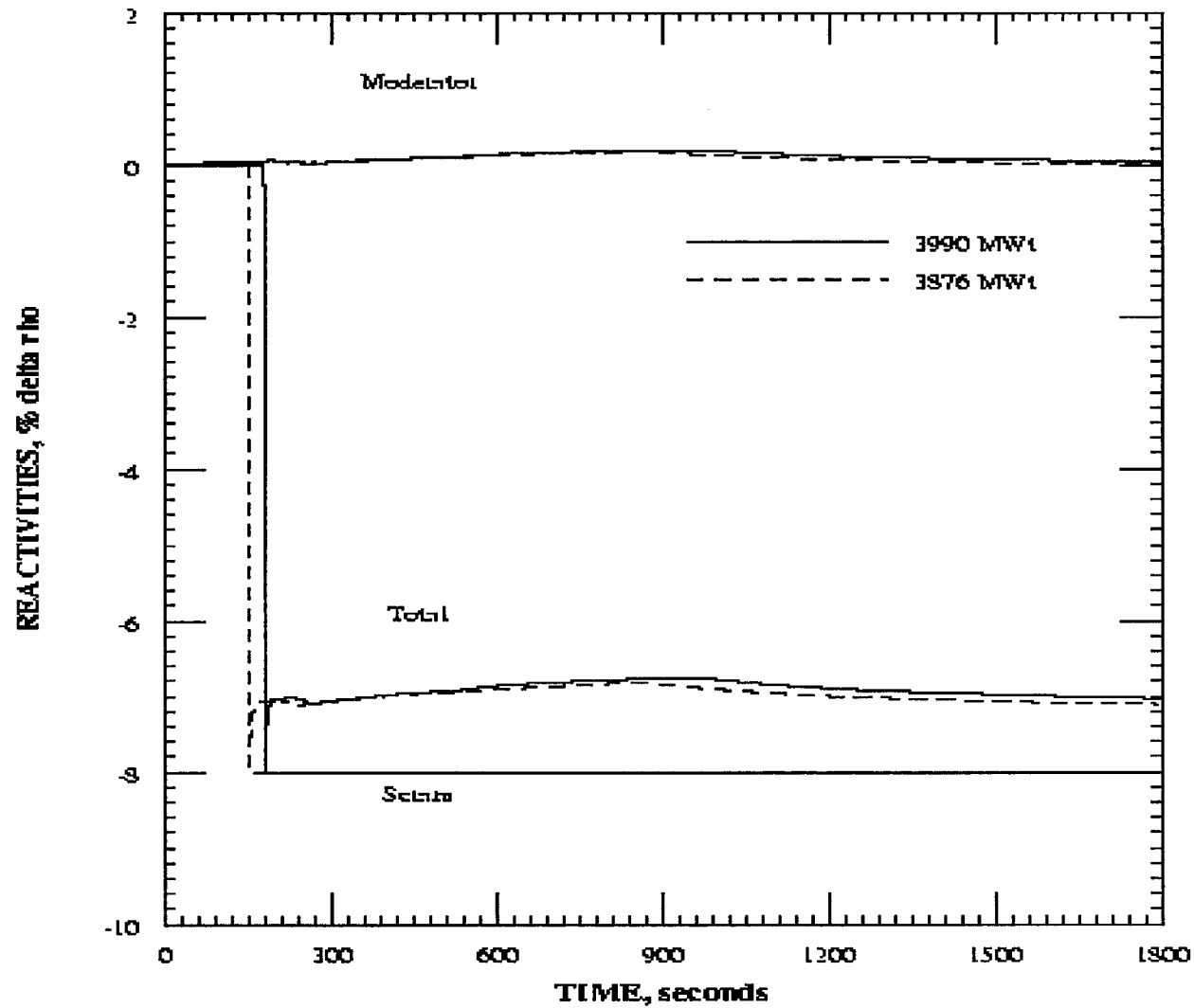
Safety Analyses



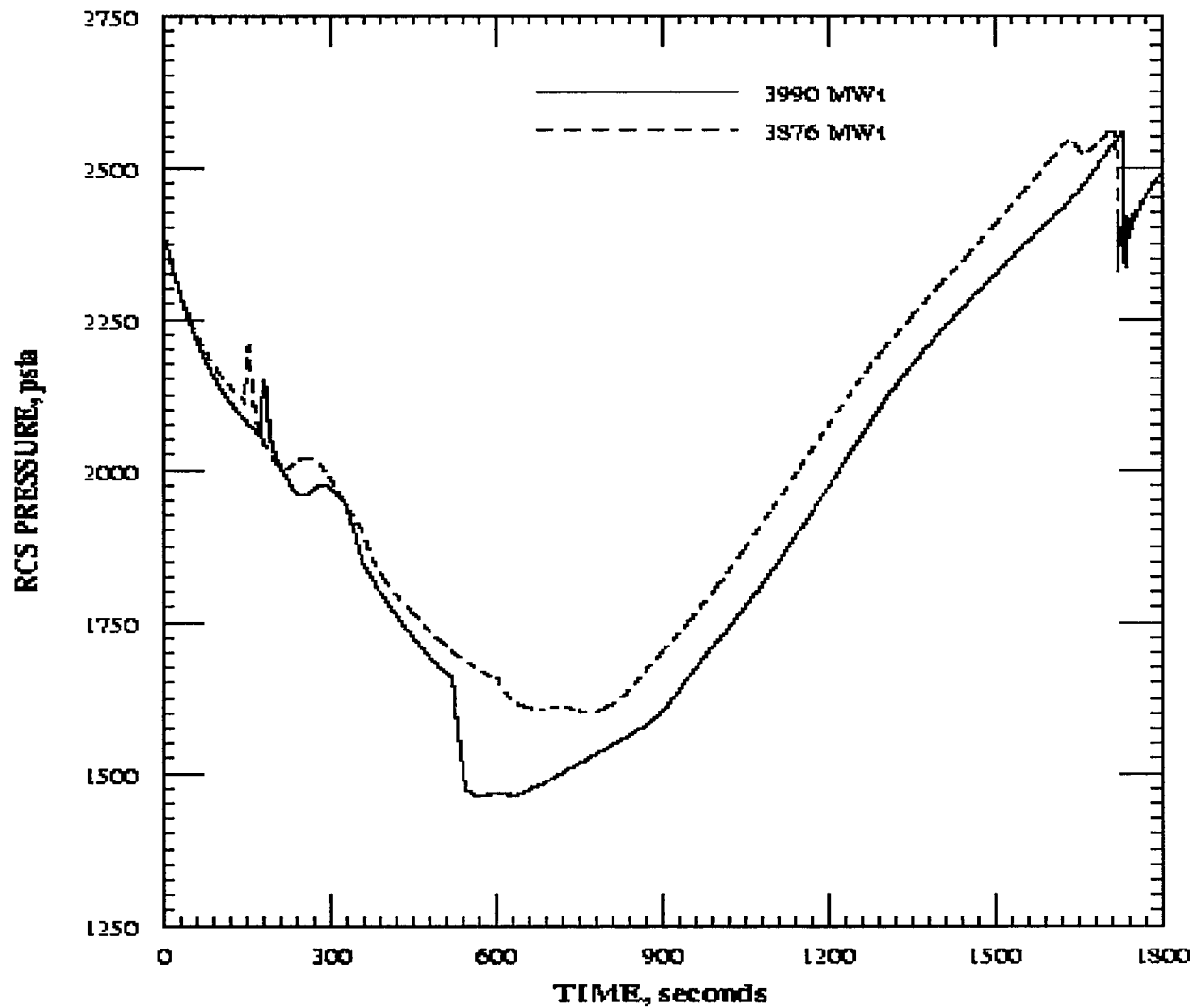
Safety Analyses



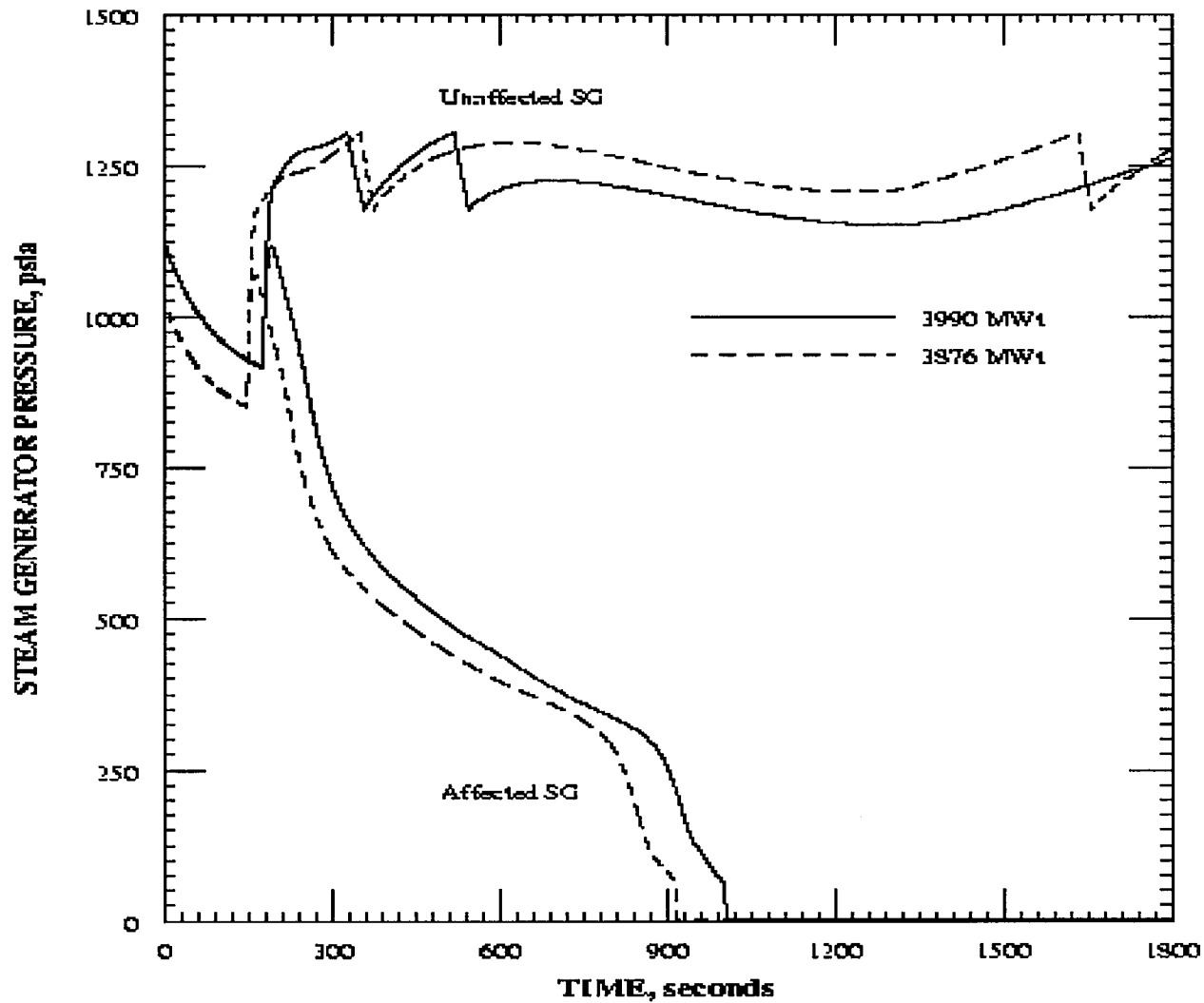
Safety Analyses



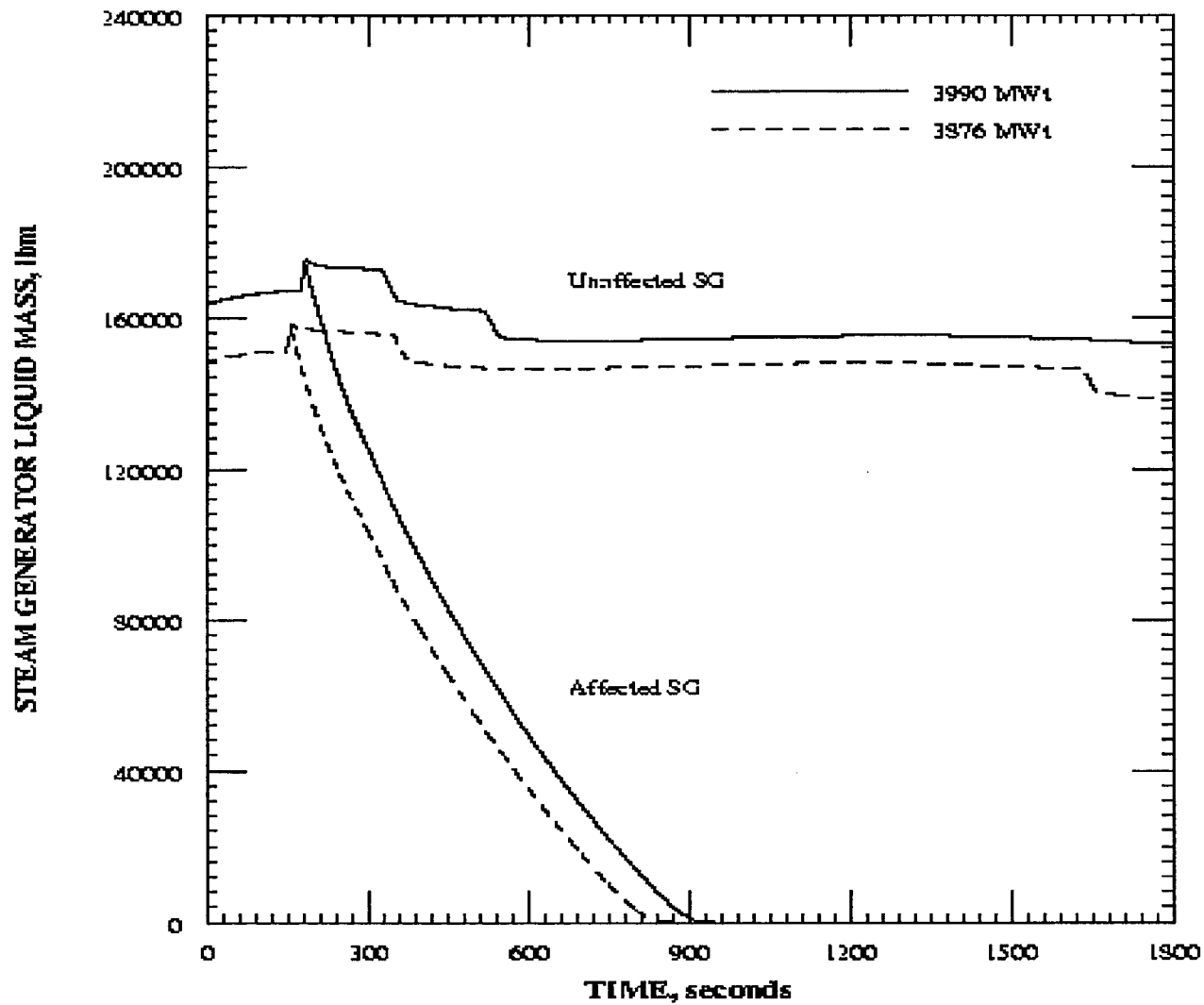
Safety Analyses



Safety Analyses



Safety Analyses



Safety Analyses

- ◆ **Sample from uprate submittal (cont.)**
 - **Conclusion**
 - **For the IOSGADV+LOP event, all of the acceptance criteria are met. The peak primary and secondary pressures remain below 110 percent of design at all times, thus ensuring the integrity of the RCS and main steam systems. The minimum hot channel DNBR remains above the SAFDL, thus ensuring fuel cladding integrity. Offsite radiological consequences remain within a small fraction of 10 CFR 100 guidelines.**



Risk Evaluation

- ◆ **Submittal will not be made as a risk-informed licensing amendment**
- ◆ **Power uprate is not large and no substantial change in risk expected**
- ◆ **PRA will be updated to reflect changes due to uprate**



Control Room Habitability

- ♦ **Revise design/licensing basis for allowable unfiltered in-leakage**
- ♦ **Validate allowable in-leakage with baseline testing**
- ♦ **Expect good results from testing due to CR ventilation system design and previous pressure testing**
- ♦ **PVNGS will have contingency plan ready if test results are unsatisfactory**



Required Plant Modifications

- ◆ **Spray pond temperature monitoring equipment**
- ◆ **Remove containment spray flow orifices and install Annubar flow elements**
- ◆ **Change steam admission to HP turbine from partial arc to full arc**



RCS Piping Weld Issue

- ♦ **PVNGS has reviewed construction records for RCS welds**
- ♦ **Records recovered to date indicate that welds were completed according to procedure**
- ♦ **Structural analysis for the RCS reflects those procedures**



Future Activities

- ◆ **RSG will be moved from Milan to Montfalcone for final welding later this year**
- ◆ **Meeting to discuss power uprate submittal a few weeks after receipt by NRC**
- ◆ **Point of contact for questions on submittal**



PVNGS Unit 2 Steam Generator Replacement Project / Integrated Level One Schedule for RSG & Power Up

