January 22, 1992

Docket No. 50-395

LICENSEE: SOUTH CAROLINA ELECTRIC & GAS COMPANY

FACILITY: VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

SUBJECT: MEETING SUMMARY - STEAM GENERATOR REPLACEMENT

On January 9, 1992, the staff met with representatives of South Carolina Electric & Gas Company (SCE&G or the licensee) in Rockville Maryland, to discuss the licensee's proposed steam generator replacement program.

A meeting summary is provided as Enclosure 1, a list of those in attendance is provided as Enclosure 2, and a copy of the licensee's handout used at the meeting is provided as Enclosure 3.

/S/

George F. Wunder, Project Manager
Project Directorate II-1
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Meeting Summary
2. Attendance List
3. Meeting Handout

cc w/enclosures:
See next page

OFC	:PM:PD21:DRPE	:D:PD21:DRPE
NAME	:GWunder:sl	:EAdensam
DATE	:01/21/92	:01/22/92

cc:

Mr. R. J. White
Nuclear Coordinator
S.C. Public Service Authority
c/o Virgil C. Summer Nuclear Station
P. O. Box 88 (Mail Code 802)
Jenkinsville, South Carolina 29065

J. B. Knotts, Jr., Esq.
Bishop, Cook, Purcell
and Reynolds
1400 L Street, N.W.
Washington, D. C. 20005-3502

Resident Inspector/Summer NPS
c/o U.S. Nuclear Regulatory Commission
Route 1, Box 64
Jenkinsville, South Carolina 29065

Regional Administrator, Region II
U.S. Nuclear Regulatory Commission,
101 Marietta Street, N.W., Suite 2900
Atlanta, Georgia 30323

Chairman, Fairfield County Council
P. O. Box 293
Winnsboro, South Carolina 29180

Mr. Heyward G. Shealy, Chief
Bureau of Radiological Health
South Carolina Department of Health
and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

South Carolina Electric & Gas Company
Mr. A. R. Koon, Jr., Manager
Nuclear Licensing
Virgil C. Summer Nuclear Station
P. O. Box 88
Jenkinsville, South Carolina 29065

DISTRIBUTION

Docket File
NRC & Local PDRs
PDII-1 Reading File
T. Murley/F. Miraglia
J. Partlow
S. Varga
G. Lainas
E. Adensam
G. Wunder
P. Anderson
OGC
E. Jordan
ACRS (10)
J. Wechselberger, EDO2

ENCLOSURE 1

MEETING SUMMARY

VIRGIL C. SUMMER STATION, UNIT NO. 1

A meeting was held with South Carolina Electric & Gas Company (SCE&G or the licensee) on January 9, 1992, in Rockville Maryland. The purpose of the meeting was to discuss replacing the steam generators at Summer Station. The licensee has been having trouble with tube degradation in the Westinghouse D3 steam generators for several years. The amount of plugging in the three steam generators ranges from 8.5 to 14 percent.

The licensee had originally intended to replace the generators during the 1996 refueling outage, but accelerating deterioration has caused them to consider replacement as early as 1994. The steam generator replacement will result in a larger primary system; therefore, certain parameters associated with the primary and reactor protection systems will have to be changed, and certain Technical Specifications modified.

SCE&G is conducting an evaluation to determine whether the re-analysis of the accidents described in Chapter 15 of the Final Safety Analysis Report can be done under the provisions of 10 CFR 50.59 which allows licensees to make changes to their facilities as long as these changes do not involve either a change to the Technical Specifications or an unreviewed safety question.

The licensee also discussed the possibility for an increase in licensed power. After a discussion of the scope of the review that would be required before the power uprate was approved, the staff gave its opinion that it would be unlikely that we would be able to complete such a review by 1994. It was decided, therefore, to pursue the steam generator replacement and the power uprate as two separate issues.

ENCLOSURE 2

MEETING WITH SCE&G

January 9, 1992

Name	Organization
E. Adensam	NRR/PDII-1
G. Wunder	NRR/PDII-1
R. Jones	NRR/SRXB
H. Abelson	NRR/SRXB
R. Hermann	NRR/EMCB
C. Wu	NRR/EMEB
F. Cantrell	RII
A. Koon	SCE&G
L. Cartin	SCE&G
R. Clary	SCE&G
J. Barth	Bechtel

SCE&G
V C SUMMER STATION
STEAM GENERATOR
REPLACEMENT
PROJECT

PRESENTATION

TO

NRC

SCE&G Attendees:

Lou Cartin

Ron Clary

Al Koon

JANUARY 9, 1992

STEAM GENERATOR REPLACEMENT PROJECT

- Existing D-3 S/G Conditions

- S/G Replacement/Stretch Power Activities:

  Modifications
  Evaluations
  Licensing Impacts
  Schedules

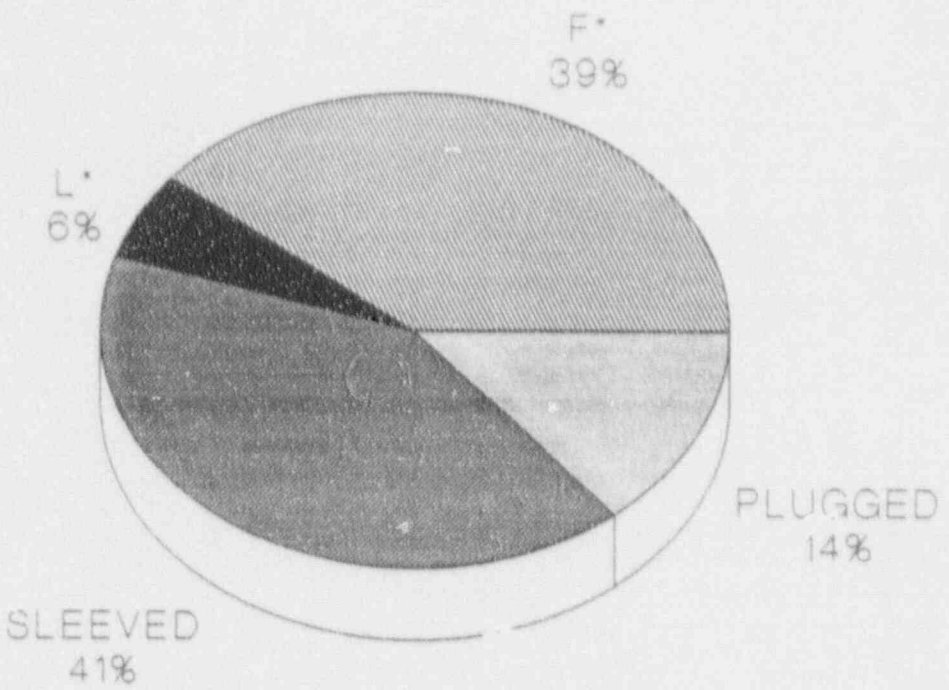
- Discussion on Licensing Options & NRC Schedule Impact

STEAM GENERATOR TUBE STATUS

DECEMBER 1991

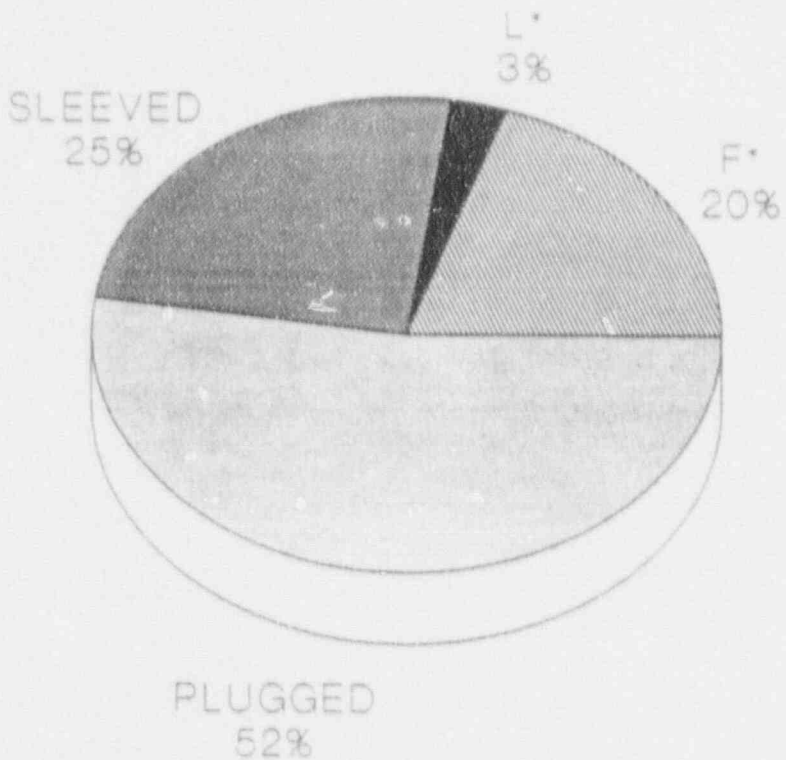
	NUMBER	%
PLUGGED PRIOR TO REFUEL 6	1370	9.8
SLEEVED PRIOR TO REFUEL 6	125	0.9
TOTAL EFFECTIVE PLUGGED	1377	9.82
PLUGGED IN REFUEL 6	203	1.4
SLEEVED IN REFUEL 6	612	4.4
TOTAL EFFECTIVE PLUGGED-RF6	234	1.6
TOTAL EFFECTIVE PLUGGED	1611	11.5
TOTAL NOW PLUGGED - (a)	1573	11.2
TOTAL NOW SLEEVED - (b)	735	5.2
TOTAL F*/L* TUBES - (c)	671	4.8
TOTAL DEFECTIVE TUBES (a+b+c)	2979	21.2

STEAM GENERATOR TUBE EXAMINATION RESULTS REFUEL - 6



PERCENT OF TUBES REQUIRING ACTION
(TOTAL TUBES REQUIRING ACTION - 1486)

ALL STEAM GENERATORS
DEFECTIVE TUBE STATUS
DECEMBER 1991



DISTRIBUTION OF DEFECTIVE TUBES

(TOTAL DEFECTIVE TUBES - 2979)

STEAM GENERATOR MAINTENANCE
REFUELING OUTAGE EXPOSURE/DURATION

	S/G MAINTENANCE WINDOW	MAN-REM
RF5-04/90	30 DAYS	95.8
RF6-10/91	37 DAYS	128.2
TECH. SPEC. REFUELING OUTAGE	7 DAYS	MINIMUM

- KEY FACTORS AFFECTING SG REPLACEMENT SCHEDULE

  - → Lengthy Outages
  - → ManRem Exposure
  - → Costly Repair Activities
  - → Industry Experience
  - → Minimize Risk

- IS 1994 REPLACEMENT ACHIEVABLE ?

Broad Applicability

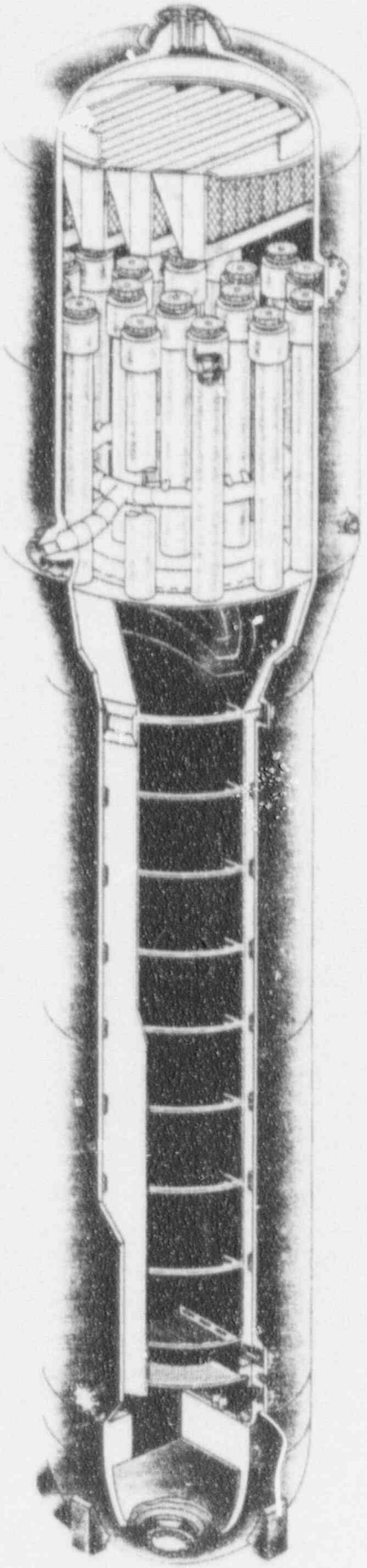
- Intended for new plant and replacement steam generator applications
- Identical shell size to the 51 Series, Model D, and Model F steam generators
- Exceeds the functional performance capabilities of existing steam generators

Proven Reliability

- Based on demonstrated strengths of the Model F steam generator
- Feedring design permits simplest tube bundle, maximizing tube reliability while providing additional operating margin
- 84 steam generators with similar features operating for an average of 6 years

Outstanding Design Features

- Uses thermally treated Alloy 690 tubing — the state-of-the-art tube material based on its corrosion resistance
- Triangular pitch tube array maximizes tube bundle surface area
- Full depth hydraulic expansion tube-to-tubesheet joints with minimal residual stress
- Stainless steel tube supports enhance corrosion resistance and reduce wear
- Broached tube supports enhance fluid flushing at the tube interface, to limit chemical concentration around the tube
- Tube supports and flow distribution baffle have flat surfaces where the tubes touch the supports to reduce dryout
- Three sets of U-bend supports with minimum gap construction enhance tube vibration and wear margins



Enhanced Margin

- Highest thermal capacity of any steam generator in this shell size
- Uprating compatibility up to 1050 MWt per steam generator
- Lowest T-hot capability provides excellent fuel efficiency and lower corrosion rates
- Additional core DNB margin
- Wide water level control span

Enhanced Operations and Maintenance

- Twelve access ports, including two primary manways and ten secondary side access ports
- Enhanced peripheral tube access from primary and secondary sides
- Studs, rather than bolts, on primary and secondary manways for faster installation and removal
- Forged shell boundaries eliminate longitudinal welds and help to reduce inservice inspection time
- Channel head cladding machined to a smooth surface finish to reduce deposition, thereby helping to reduce man-rem exposure
- Integral sludge collector to promote sludge deposition away from the tube bundle
- Capable of 3 percent continuous blowdown flow rates
- Moisture carryover no more than 0.10 percent at full power operation
- Wide water level control span helps to reduce the potential for trips during transient operation

STEAM GENERATOR
COMPARISON

	MODEL D-3	MODEL D-75
Type	Split Flow Preheater	Feedring
Weight (Tons)	340	358
Steam Flow (LBM/Hr/SG)	4.07×10^6	$4.07 \times 10^6 / 4.27 \times 10^6$ *
Tube Size (O.D.)	3/4	11/16
Heat Transfer Area	48,000	75,150
No. of Tubes (All 3 S/G)	14,022	18,921
RCS Flow (GPM)	100,700	102,600
S/G Tube Side Pressure Drop (PSI)	42	37.7
Primary Side Flow Area (Sq. In.)	4856	5484
Tube Material	I-600MA	I-690TT
Tube Support Material	CS	SS
Tube Support Type	Drilled Holes	Trifoil
Sec. Crevice Area (Sq. In./tube)	38.9	3.52

* - Data for Uprate Condition

STEAM GENERATOR PLANT MODIFICATIONS

- REPLACE STEAM GENERATORS
- REROUTE FEEDWATER PIPING
- REMOVE FORWARD/REVERSE FLUSH PIPING
- REPLACE MSR TUBE BUNDLES
- CONTAINMENT STRUCTURAL SUPPORT
- FACILITIES/BUILDINGS
- INSULATION
- ELECTRICAL & I&C SUPPORT MODIFICATIONS
- MECHANICAL & I&C MODIFICATIONS

Steam Generator Project
Safety Evaluations

	SGR	STRETCH POWER
1 - NSSS/BOP Parameters	✓	✓
2 - Fuel Design/Performance		✓
3 - Accident Analysis	✓	✓
4 - Design Transients	✓	✓
5 - Structural Evaluation	✓	✓
6 - Fluid & Control Systems	✓	✓
7 - Protection Systems	✓	✓
8 - Equipment Qualification	✓	✓

NSSS/BOP/Fuel Performance Parameters

NSSS Power, MWt	2912
Pump Power, MWt	12
Mechanical Design Flow, gpm/loop	107,100
Best EstimateFlow, gpm/loop	102,600
Thermal Design Flow, gpm/loop	92,600
Core Bypass Flow, %	8.9
RCS Design Temp., ° F	650
RCS T-avg., ° F	572-587.4
Zero Load Temp., ° F	557
RCS Design Pressure, psia	2500
Normal Operating Pressure, psia	2250
Feedwater Temp., ° F	440
Moisture Carryover, %	0.1
Fuel Design	Vantage +
LOCA F_Q/ $F_{\Delta H}$	2.50/1.68
Non-LOCA F_Q/ $F_{\Delta H}$	2.50/1.68
PMTC, pcm/ °F	+7
Maximum Lead Rod Burnup Limit, MWD/MTU	60,000 *
Region Avg. Burnup Limit, MWD/MTU	48,000 *

* Source Terms to Cover Higher BU Limits

Accident Analyses

	SGR	STRETCH POWER
SB LOCA Analysis	✓	✓
LB LOCA Analysis (Note 1)	✓	✓
SG Tube Rupture	✓	✓
Non-LOCA Accidents	✓	✓
Short Term LOCA Mass & Energy (Note 2)	✓	✓
Long Term LOCA Mass & Energy (Note 3)	✓	✓
SLB Mass & Energy Release	✓	✓
FWLB Mass & Energy Release	✓	✓
LOCA Hydraulic Forcing Functions (Note 2)	✓	✓
LOCA RB Pressure & Temperature	✓	✓
SLB RB Pressure & Temperature	✓	✓
High Energy Line Break outside RB	✓	✓
Source Terms		✓
Dose Asssessment	✓	✓

Note 1: To Use Best Estimate LOCA Analysis
Note 2: To Use Leak Before Break Analysis
Note 3: To Use Improved 1979 Model

Design Transients

- Modify Design Transients to Cover Full Range of Operating Conditions

	Current	@ Stretch Power
T-hot (°F)	611.9-618.7	604.1-619.9
T-cold (°F)	549.8-555.8	539.6-557.2
T-steam (°F)	533.3-540.2	526.3-548.5
P-steam (psia)	906 - 964	857 - 1033

- Lower T_{avg} Operating Conditions is Primary reason for Design Transient Re-Analysis

- Two Transient sets, One for High and One for Low T_{avg} Conditions, will be Developed to Provide Bounding Inputs to Stress/Fatigue Analysis

Fluid & Control Systems

Performance of Components

	SGR	STRETCH POWER
Pressurizer Safety Valves		✓
Pressurizer PORV		✓
Pressurizer Spray		✓
Pressurizer Heater		✓
Secondary Safety Valves		✓
Steam Dump		✓

Fluid & Control Systems

NSSS Control Systems

	SGR	STRETCH POWER
Reactor		✓
Pressurizer Pressure		✓
Pressurizer Level		✓
Steam Dump		✓
Steam Generator Level	✓	✓

Fluid & Control Systems

Auxiliary Systems/Components

	SGR	STRETCH POWER
RHR		✓
CVCS		✓
MFW	✓	✓
EFW	✓	✓
CCW		✓
SWS		✓
ECCS		✓

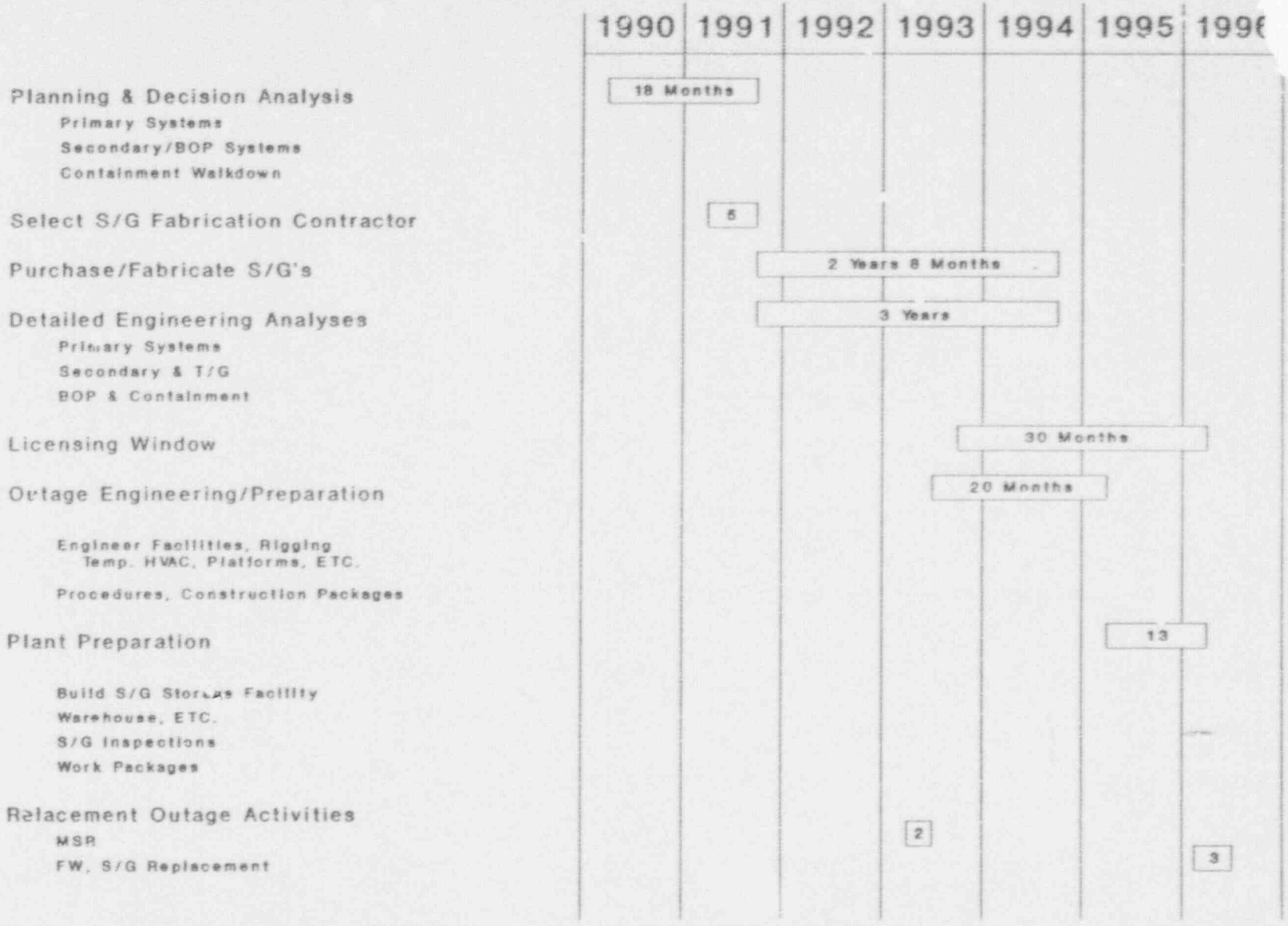
Structural Evaluations

	SGR	STRETCH POWER
Reactor Vessel		✓
Reactor Internals		✓
CRDM		✓
RCS Piping	✓	✓
Equipment Supports	✓	✓
Pressurizer		✓
Steam Generator	✓	✓
RC Pumps		✓
All Pressure Boundary Comp.	✓	✓
Steam/Feedwater Piping	✓	✓

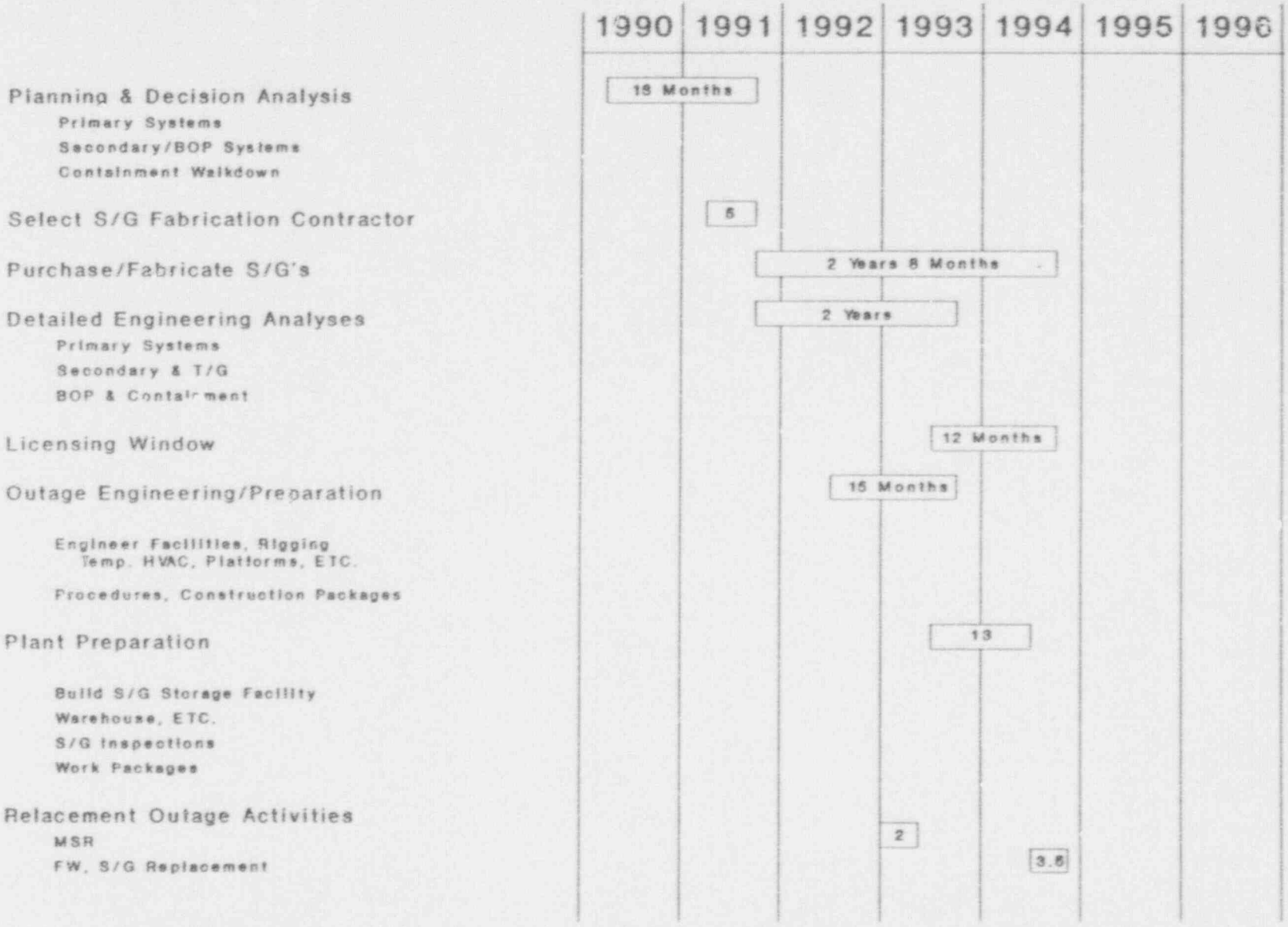
STEAM GENERATOR PROJECT
LICENSING PACKAGES

	SGR	STRETCH POWER
● TECH. SPEC. CHANGES		
Def.of Rated Thermal Pwr. - 1.25		✓
Safety Limit Curve-Fig 2.1-1	✓	✓
Rx Trip System Inst. Trip	✓	✓
Setpoints - Tab 2.2-1		
a. SGWL	✓	
b. OP△T		✓
c. OT△T		✓
d. RCS Flow	✓	✓
e. Negative Flux Rate Trip	–	–
Safety Limit Basis - B 2-1	✓	✓
Shutdown Margin Curve - Fig. 3.1-3	✓	✓
Steam Generator - 3/4 4.5	✓	
Charging Pump Flow-3/4 5.2		✓
MSSV Setpoints-Table 3.7-3		✓
EFW Flow - 3/4 7.1.2		✓
RCS Volume - 5.4.2	✓	
Best Estimate LOCA - 6.9.1.11		✓
● OPERATING LICENSE		
D-3 ⟶ D-75	✓	
2912 MWT		✓
● CORE OPERATING LIMIT REPORT	✓	✓

1996 Steam Generator Replacement Schedule



1994 Steam Generator Replacement Schedule



DISCUSSIONS

- Licensing Package Options

- NRC Schedule Impact