DAEC
Power Uprate Program

- Project Status
- Planned Modifications
- Overview of Submittals
- Net Positive Suction Head for ECCS Pumps
- Alternate Source Term
- Environmental Report
- NRC Review Schedule and Insights

August 31,2000

ENCLOSURE 2

DAEC Power Uprate Project

Status

- Task Reports 80% complete
- HP Turbine construction on schedule
- Modifications identified and design stage commenced
- PUSAR submittal- 1st draft in review
- Stand alone submittals-nearing completion

DAEC
Power Uprate Project
Hardware
Modifications

RFO 17 (2001)

- High Pressure Turbine
- Partial Arc Admission
- GE14 Fuel
- Main Transformer Coolers
- Instrumentation

  MELLLA Cards

  MSL Flow Instruments

  S/U Testing Instruments

  Various Indicators

RFO 17 cont.

- Condensate Demineralizers
  Increased Septa Surface Area
- Main Generator Hydrogen Coolers
- General Service Water Piping
- Various BOP Electrical Protective Relaying
- Heat Exchangers (Feedwater,Lube Oil)
- AOV Upgrades/Tuning

RFO 18 (2003)

- Main Transformers
- Feedwater System Capacity Increase
- Isophase Bus Cooling/Capacity
- BOP Breakers, Load Transformers, Protective Relays
- Grid Stability Compensation (Cap. Banks, Static VAR Compensator)

DAEC
Power Uprate Project
Upcoming Licensing Submittals

Tony Browning
Sr. Licensing Engineer

Agenda

- Upcoming License Amendment Requests/Submittals
  - Extended Power Uprate (EPU)
  - GE-14 / Cycle 18 Startup
  - Refuel Outage Support
- Submittal Schedule
- Submittal Priority

Licensing Submittals for EPU

- Amendment Request to Increase Licensed Power Level
  - Power Uprate Safety Analysis Report (PUSAR)
  - Corresponding TS Changes
- Environmental Assessment
- 10CFR 50.67 Amendment Request to Apply Alternate Source Term (AST)
  - Corresponding TS Changes to Implement the AST
- License Amendment Request for New Fuel Pool Cooling Analysis

Licensing Submittals for Cycle 18 / GE-14 Fuel Introduction

- Cycle 18 Safety Limit MCPR TS Change
- Standby Liquid Control Concentration TS Change
- Thermal-hydraulic Stability Method Change (ODYSY) GE Licensing Topical Report Lead Plant Submittal
- [Linear Heat Generation Rate (LHGR) TS Change]

Licensing Submittals to Support Refuel Outage #17 (RFO 17)

- RPV Pressure / Temperature Limits Curve TS Change
- [Moving Irradiated Fuel w/o Secondary Containment and SGTS TS Change]

Submittal Schedule

- September 2000
  - Environmental Assessment
  - AST
  - Fuel Pool Cooling
  - SBLC Concentration
  - RPV P/T Limits

Submittal Schedule cont.

- October 2000
  - EPU / PUSAR
  - [Moving Fuel w/o 2nd Containment/SGTS]
- November 2000
  - [LHGR]
- January 2001
  - SLMCPR

Review Priorities

- Cycle 18 Startup (May 2001)
  - SLMCPR
  - SBLC Concentration
  - [LHGR]
- EPU Implementation
  - PUSAR / TS Changes
  - Environmental Assessment
  - AST
  - Fuel Pool Cooling
- [Moving Fuel w/o 2nd Containment/SGTS]
- RPV P/T Limits Curve

ECCS NPSH CALCULATIONS

Steve Huebsch
Duane Arnold Energy Center
Power Uprate Project

08/29/2000

Containment Analysis

- Assumptions consistent with containment analysis associated with NRC Bulletin 96-03
- Performed using GE computer code SHEX
- Expected increase in suppression pool temperatures and containment pressures occurred

NPSH Analysis

- Performed at elevated suppression pool temperatures
- Identified need for additional containment overpressure of approximately 2 psia for Core Spray and < 1psia for RHR
- Analysis evaluated DBA LOCA, ATWS, Station Blackout, and runout analysis associated with GE SIL 151

Conservative Analysis

- Decay heat curve with 2σ adder
- 1 foot pool reduction and no credit for feedwater or vessel inventory
- RHR heat exchangers modeled with fouling factors
- Service water temperatures modeled at 95F
- Higher than required ECCS flow rates
- Significant debris generation requirements

Conclusions

- Containment and NPSH analysis are conservatively performed
- Adequate containment pressure exists to maintain NPSH margins
  - Calculated containment pressure maintains 8 psig margin > required pressure

Conclusions continued

- NPSH and containment analysis performed consistent with analysis performed for NRC Bulletin 96-03
- Original DAEC SER "required containment pressure margin of 2.7 psig" is maintained
- Minimum NPSH is maintained for the ECCS

DAEC
Power Uprate Project
Alternate Source Term
Implementation

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Overview

- RG 1.183
- Insights
- Changes
- Submittal

RG 1.183

- Core Inventory - ORIGEN 2
- Non-LOCA Fractions
  - used DG fractions
    - Conservative for all but alkali metals
    - Alkali Metals 10% vice 12%
  - Conservative Doses by about 1/3
- Timing - 2 minutes to Gap Release

RG 1.183 (cont)

- FHA Iodine Chemical Form
  - Used DG 99.75% elemental vice 99.85%
  - Results are Conservative due to larger allowed Pool DF for elemental iodine
  - No credit for ESF Filtration, Holdup or Deposition
  - TS Change to Relax Secondary Containment During Refueling *(Separate if it delays review)*

RG 1.183 (Cont)

- CRDA fuel melt iodine fraction
  - 50% (RG) vs. 25% (DG) Iodine
    - 1200 Fuel Pins perforated
    - 0.77% of damaged fuel melts
  - melt fraction produces about 10% of dose
    - Predicted Doses << 1 REM TEDE
    - Dose Limit 6.3 REM TEDE
  - Reanalysis Not Recommended

RG 1.183 (cont)

- MSLB
  - Instantaneous Release
  - Reanalysis in progress
  - Plan to Adopt Standard TS Iodine Concentration Limit (NUREG-1433)

Insights for DAEC LOCA

- Increased CR In-Leakage Lowers Doses After Positive Pressure Period
- Delayed Isolation of CR past PPP Lowers Doses
- Charcoal Filter Iodine Loading Less Limiting Due to Iodine Chemical Form
- HEPA Filter Loading and Heatup Evaluated and Within Design Capability

Clarification May Be Needed

- Links between DBA Radiological Consequences Analyses and EOPs, SAMGs Particularly in Regard to pH Control
- DAEC SAG already has SBLC Injection when Evidence of Core Damage
- Plan to Provide Training on pH and Iodine Reevolution
- No Changes Needed for EOPs, AOPs, OIs
- DBA is Not Expected to Result in Core Damage
- SBLC Design Basis Unchanged

EQ Radiological Evaluations

- TID Source Term Methods Used
- Used new 120% ORTP Fission Product Inventory
- Original Dose Integration Method Was Very Conservative
- Analysis Used More Accurate Integration Method
- Current DAEC EQ Dose Rates Using TID Source Term Remain Bounding at 120% Uprate
- Normal 40 Year Dose Increases Due to Uprate in Drywell and RWCU Addressed in EPU Submittal

DAEC TS Changes

- Coolant Iodine Concentration (Adopt Standard TS)
- Change to CR Isolation Radiation AV
- Relaxation of Secondary Containment During Refueling *(Separate if it delays review)*
- Definition Changes

Examples of DAEC AST-Related TS Bases Changes

- Positive Pressure Period (5 minutes)
- Delayed CR Isolation
- Increased CR In-Leakage
- ESF Leakage
- pH Control

Submittal

- Impacted by RG 1.183 MSLB Rework
- Impact to EPU Submittal
  - Environmental Report
  - SBGTS, SFU, TSC Filters
  - EQ Evaluations
- Still Working to September Schedule

Discussion/Questions

- Analysis for NRC Review
  - Dispersion Factors
  - pH
  - EQ
  - NUREG-0737
  - DBAs
- Relaxations Submittals After Uprate

Environmental Impact of Power Uprate

Increase of 254 MWth

Methodology

Comparison of Projections to:

* Environmental Impact Statement
* Environmental Report
* UFSAR Information
* State Permits
* Federal Limits

Non Radiological Impacts

Cooling Tower Evaporation

Water Usage

Cooling Tower Discharge

Non Radiological Impacts: Cooling Tower Evaporation

Evaporation Rate

- Tower Flow: no change
- Evaporation Rate: increase from 2.25 to 2.99%

Fogging Rate

- Normal: 240 hours per year
- Environmental Report: 3.2 hours per year
- Power Uprate: or 4.3 hours per year

Non Radiological Impacts: Water Usage

Ground Water

- No change in usage

Surface Water

IDNR Limits vs Actual River Water Usage

	Flow (gpm)	Annual Usage (MGY)
IDNR Permit	24,000	12,575
Four Year Average	5,680	3,000
Uprate Average	6,700	3,540
Four Year Maximum	11,020	3,030
Uprate Maximum	13,000	3,580

Non Radiological Impacts: Cooling Tower Discharge

Discharges vs NPDES Permit

Parameter (Units)	Period	Effluent Limit		Nominal Values	
		Conc.	Mass	Conc.	Mass
Flow (MGD)	30 Day Ave	7.84		2.62	
	Daily Max	8.77		6.62	
Chlorine (mg/l and lbs/day)	30 Day Ave	0.21	13.0	<0.05	<0.93
	Daily Max	0.31	20.0	<0.05	<2.54
Chromium (mg/l and lbs/day)	30 Day Ave	0.20	13.0	0.023	0.41
	Daily Max	0.20	13.0	0.046	0.84
Zinc (mg/l and lbs/day)	30 Day Ave	1.0	65.0	0.59	10.6
	Daily Max	1.0	65.0	0.99	18.1

Non Radiological Impacts: Cooling Tower Discharge

Temperature

	January			Aug			Aug
	EIS	Typical	Uprate	EIS	Typical	Uprate	1989
Discharge Flow (cfs)	8.9	3.3	3.9	8.9	3.6	4.2	3.3
Discharge Temp (°F)	72.2	35.8	37.4	91.5	78.7	80.3	80.1
River Flow (cfs)	300	1252	1252	380	1435	1435	326
River Temp (°F)	34.1	34.1	34.1	76.6	76.6	76.6	77.0

Radiological Impacts

Waste Streams

- Solid
- Gaseous

Radiation Levels

- Onsite
- Offsite

Radiological Impacts:
Waste Streams

Solids

Resin Volumes
(cubic meters per year)

1981	210
1991	67
Current	27
Uprate	30

Radiological Impacts:
Waste Streams

Gaseous

DAEC Gaseous Effluents
(Curies per year)

	Noble Gas	Iodine
EIS	33,000	0.6
Typical	48	0.0009

Radiological Impacts:
Radiation Levels

Onsite

- N-16
- Co-60

Offsite

Annual Radiological Effluent Doses

	Nominal Values	Uprate Values	Appendix I Limits
Noble Gas Gamma Air Dose(mrad)	0.0022	0.0026	10
Noble Gas Beta Air Dose (mrad)	0.013	0.016	20
Particulates & Iodine Thyroid Dose (mrem)	0.0057	0.0068	15

Conclusions

- The parameters and assumptions of the Environmental Report and Environmental Impact Statement are extremely conservative when compared to typical operating conditions and projected uprate conditions.

- The original Environmental Impact Statement still bounds the impact the DAEC will have on the environment at 1912 MWth.