Salem Hope Creek
GENERATING STATIONS

# Hope Creek Extended Power Uprate

**NRC/PSEG Nuclear Pre-Application Meeting**

**Rockville, Maryland**

**March 15, 2005**

## Introduction

**Hope Creek Generating Station**

- GE BWR 4 Operating License in 1986 – 3293 MWt
- 2000 – Uprated to 3339 MWt
- Requested Uprate to 3840 MWt

**Project Submittal**

- Technical Rigor
- Industry Lessons Learned Addressed
- Current Issues Understood
- Thorough and Encompassing

## Objectives

- Inform NRC staff of PSEG's plans for EPU LCR (115% of CLTP)
- Discuss the NRC staff's expectations regarding the content of the EPU application

# Agenda

- Licensing Approach
- Project Status
- Reactor Systems
- Containment
- Mechanical & Materials Engineering
- Probabilistic Safety Assessment
- Environmental

# Licensing Approach

**Constant Reactor Pressure**

**Based on CPPU LTR**

**ELTR1 & ELTR2 for Fuel Dependent Topics**

- Supplemented with Mixed Core Evaluations

# Hope Creek EPU Project Status

**Alternative Source Term – approved**

- Amendments 134 & 146

**P/T Limits – approved**

- Amendment 157

**GE14 Fuel Transition – approved**

- Amendment 158

**ARTS/MELLLA – submitted**

**Plant Modifications**

# Hope Creek EPU Project Status

## MELLLA/MELLLA+

- MELLLA
  - Prerequisite for EPU per CPPU LTR
  - Submitted 06/07/04
  - Mixed Core Evaluations Submitted 02/18/05
  - Implementation during Current Cycle 13 (on-line)
- MELLLA+
  - Not a Prerequisite for EPU (115% CLTP)
  - Not Currently Being Pursued

# Hope Creek EPU Project Status

## Plant Modifications

- Designed to Maintain Plant Design and Operational Margin in Selected Areas:
  - Main Turbine Replacement
    - Includes new DEHC and TSI system
  - Main Transformer Replacements
  - Moisture Separator Internals Upgrade
  - Generator Stator Cooling System Upgrade
  - GE-14 Fuel Design
  - Switchyard Upgrades
  - Cooling Tower Upgrades
  - Iso-Phase Bus Cooling Upgrade
  - MELLLA Implementation
  - Moisture Separator Relief Valve Upgrades
  - Steam Jet Air Ejector Modification
  - FWH 2/3 Dump Valve Replacements
  - EPU Implementation

## Reactor Systems Topics

**Mixed Core Analyses**

- Fuel Transition:  Cycle 13 CLTP ELLLA
- ARTS/MELLLA Implementation: Cycle 13 CLTP
- EPU Implementation: 115% CLTP

**NSSS Codes & Methods**

**Large Transient Testing**

# Reactor Systems Topics

## Mixed Core Analyses

- GE14 Fuel Transition:  Cycle 13, ELLLA, GNF Methods
  - Mixed Core Analysis Report
  - Stability
    - Backup Stability Protection Report – report provided
    - DIVOM Report
    - Option III Setpoint Report
  - ECCS/LOCA – report provided
  - Fuel Transition Report
- Fuel dependent evaluations applicable to CLTP condition
- Forms solid basis for change assessment of EPU impact on fuel & core

# Mixed Core Analyses

- ARTS/MELLLA: Cycle 13, CLTP
  - ARTS/MELLLA Safety Analysis Report, Rev. 2
    - Submitted 02/18/05
    - Addresses Plant and Fuel Requirements
    - Documents Bases and Changes Due to Introduction of ARTS/MELLLA at CLTP
      - » Mixed Core (GE14 / SVEA-96+) through Full Core of GE14
    - Tied to Reactor Systems EPU Technical Review

## Mixed Core Analyses

- EPU Implementation: 115% CLTP
  - Power Uprate Safety Analysis Report
    - Addresses plant and fuel requirements
    - Documents bases and changes due to EPU with equilibrium core of GE14 fuel
  - Fuel Supplemental Reports
    - Mixed Core (GE14 / SVEA-96+)
      - » Fuel dependent evaluations applicable to EPU condition
      - » Based on Assumed Energy Plan
      - » GNF Reload Methodology/Process Controls
    - Mixed Core Analysis Report
    - Stability Reports
      - » Backup Stability Protection (BSP)
      - » DIVOM
      - » OPRM Option III Setpoint
    - ECCS/LOCA
    - Fuel Transition Report

## NSSS Codes & Methods

- SRXB – Applicability of Codes & Methods in EPU Condition
- GE Proposed “Methods Interim Process”
- NRC Requested GE to Docket Process
- PSEG to Review Resolution
- LCR to Refer to “Methods Interim Process”

## Large Transient Testing

- CLTR is the Basis for Hope Creek CPPU Power Ascension and Test Program
- CLTR Test Program Accepted by NRC Staff, Except for the Recommendation to Eliminate Large Transient Testing of ELTR1 (i.e. MSIV Closure/Generator Load Reject)
- Guidance for Justification of Large Transient Test Program Provided in Draft SRP 14.2.1

# Large Transient Testing

- Evaluation in Progress Using Guidance in Draft SRP 14.2.1
  - Operating Experience and Documented Events/Transients
  - Transient Evaluations for CPPU
  - Event/Evaluation Comparisons (Margins & Conservatisms)
  - Simulator Capabilities/Operator Preparation
  - Safety Significance of Potential Testing Benefits (latent defects) versus Undesirable Transient Cycle

# Large Transient Testing

- LCR Attachment Will Be Submitted to Supplement PUSAR Testing Information
  - Focuses on MSIV Closure and Generator Load Rejection Events
  - Addresses Aggregate Impact of Post-modification Testing

## Containment Overpressure

- Not Required for EPU
- ECCS NPSH Still Meets RG 1.1

## B Reactor Recirculation Pump Vibration Monitoring – Cycle 13

- Drywell - Main Steam, Reactor Recirculation, Feedwater, Branch Lines
  - 30 Channels of Data From Accelerometers Installed on the Main Steam (18 Accelerometers) and Feedwater (12 Accelerometers) Piping Inside the Drywell
  - 58 Accelerometers Installed on the Recirculation Piping, RHR Piping, Pump Motor, and 3 Proximity Probes Installed on 3 Valves
- Turbine Building – Main Steam, Feedwater, Extraction Steam
  - 34 Channels of Data from Sensors Installed on the Main Steam Piping (10 Accelerometers and 10 Strain Gage Channels), Feedwater Piping (4 Accelerometers), and Extraction Steam Piping (10 Accelerometers)

## Vibration Monitoring – Cycle 13

- Data Taken at 10 Power Levels from 23% to 100% RTP
- Main Steam Line Vibration
  - Below the Stress Criteria of 7,692 PSI
- Feedwater Piping Vibration
  - Below the Stress Criteria of 7,692 PSI
- Recirculation System Vibration
  - Maximum Stresses for the Reactor Recirculation System Are Less Than 7,692 PSI for the Carbon Steel Portions and Less Than 10,880 PSI for the Stainless Steel Portions
  - Piping Vibrations an Order of Magnitude Higher Than FW or MS
  - Highest Vibration Levels on Branch and Instrument Lines

# HCGS Steam Dryer Condition

- Curved Hood Design
- Regular Inspections to BWRVIP Standards
  - Minimal Indications Observed – IGSCC
- Fall 2004 Inspections – Performed IAW SIL 644 Supp 1
  - Observed One Additional Indication
    - Center Support Ring – IGSCC
  - No Indications Observed on Most Susceptible Locations (Hoods, Cover Plates or End Plates)
  - No Vibration Induced Flaws Have Been Identified

## Analytical Methods for Determining Loads

- Computational Fluid Dynamics
  - To Determine Loads Caused by Flow Exiting the Dryer Circulating Within the Steam Dome up to the Point Where It Exits the Main Steam Nozzles
  - May Also Be Applied to Steam Lines
- Acoustic Loads Model
  - To Determine Loads Caused by Acoustic Phenomena in the Main Steam Lines
- Finite Element Analysis of Steam Dryer
  - OEM to develop acceptance criteria for dryer loads
- CFD and Acoustic Models Will Make Use of Data Collected from Main Steam Strain/Vibration Instrumentation

# Confirmation of Dryer Loads

- Validation of Analytical Methods
  - Data From an Instrumented Dryer Will be Utilized to Validate the Loads Models
- Instrumentation of Hope Creek Dryer
  - Contingency Will Be in Place Before Implementation
  - Will Identify Abnormal Vibration Levels if They Occur
  - Finite Element Analysis Used to Generate Acceptance Criteria for Dryer Stress

# RCPB Structural Evaluations

- Augmented Inspection Program
  - IGSCC Category A
    - Risk Informed ISI
  - Categories C & E
    - Continue IAW GL 88-01 and BWRVIP-75
- Flow Accelerated Corrosion

## PRA Scope & Quality

- HC EPU Model Based on Updated (2003) PRA
  - Generally Consistent with ASME Standard (Category II)
  - Internal Flooding PRA Included
  - Resolves 1999 Peer Review Level A and B F&Os
  - HRA Uses EPRI HRA Calculator
  - Robust CCF modeling based on ASME standard
  - Self-Assessment to Compare to ASME Standard
  - Suitable to Support PRA Applications that Require ASME PRA Capability Category II

# Environmental Assessment

- Updated Jan 2005 for EPU
- Scope
  - Socioeconomic
  - Non-Radiological Environmental
    - Terrestrial
    - Aquatic
    - Air Quality
    - Hydrology
  - Radiological Environmental
  - Alternatives

## Permit Status

- No Land Use Permits Required
- No Modifications to Groundwater, Surface Water, or NJPDES Permits Required
- Received Prevention of Significant Deterioration Non-Applicability from USEPA - March 2004
- Submitted Application for Modification of Air Emission Permit to NJDEP - February 2004
- Completed Required Emissions Modeling and Analyses for Increased Emissions Limitation - July 2004
- NJDEP Proposed Regulatory Rulemaking to Address Emissions - Pending

## Summary

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