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**Power Uprate Program
At
Laguna Verde Station**

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Power Uprate Program

What Is Power Uprate and Types of Power Uprates

- Power uprate is a method to increase the licensed thermal power level of a plant from the 'original' power rating to a higher value.
- US NRC classifies power uprates into three types:
 - Measurement Uncertainty Recapture (MUR) power uprates: Up to 2% additional output above original power level
 - Stretch Power Uprates (SPU): 5 to 7% above original power level
 - Extended Power Uprates (EPU): Up to 20% above original power level
- US NRC approved / pending power uprates:
 - Approved: MUR: 38; SPU: 61; EPU: 19 [Total MW_e 5263]
 - Pending / Future Applications: 9 / 27 [Total MW_e 2800]

Power Uprate Program

- Phases of Power Uprate Program
 - Feasibility study
 - Licensing phase
 - Implementation phase
- Feasibility study
 - Assess Technical Impact
 - Perform reviews: NSSS performance & safety margin impact
 - BOP systems and turbine generator performance capability
 - Identify “pinch” points
 - Assess Commercial Impact
 - Develop cost profiles for “pinch” points identified in technical reviews
 - Recommend optimum power uprate level and implementation approach
- Licensing phase
 - Based on feasibility study, perform detailed technical evaluations for the NSSS and BOP systems, fuel, and other special analysis / programmatic items
 - Develop licensing submittal consistent with US NRC requirements (Ref: RS 001)
- Implementation phase

Power Uprate Program

- Lessons learned from past power uprates
 - Dedicated power uprate “team”
 - Proper data identification and data analysis
 - Clear scope definition and division of responsibilities between all parties involved
 - Benefit from past histories at other power uprate programs
 - Technical evaluations consider operating data and system / equipment health
 - Plan the work *and* work the plan for all phases of power program
 - Plant configuration must be maintained
 - Integrated level 3 schedule
 - Early “buy-in” of the station
 - Separate “existing plant issues and power uprate issues
 - Margin management

Laguna Verde Nuclear Station – EPU Project

- Owner and Operator: Comision Federal de Electricidad, Mexico
- LVNPP site has 2 Units
- Each originally designed for 656 MW_e
- BWR/5, Mark II Containment, with Mitsubishi Turbine and Once-thru-cooling (sea water)
- Original AE of Record and Constructor: URS, Washington Division (formerly, EBASCO part of URS, Washington Division)

Laguna Verde Nuclear Station – EPU Project - Power Levels

Cases	% OLTP	MW_{th}
Original Licensed Thermal Power (OLTP)	100	1931
Current Licensed Thermal Power (CLTP)	105	2027
EPU Thermal Power Level	120	2327

Laguna Verde Nuclear Station— Project Approach for EPU

- Utilize US NRC approved constant pressure power uprate (CPPU) methodology
- Maintain the original licensing and design bases
- Utilize the conclusions from the EPU feasibility study performed in Year 2003
- In conjunction with EPU project, address the existing plant issues pertaining to design, engineering, operations, and maintenance (Rehabilitation Project)
- Embark on the EPU Licensing Phase and perform detailed engineering and design analysis for preparing Power Urate Safety Analysis Report (PUSAR)
- For EPU Licensing Phase – Select General Electric for NSSS evaluations and URS, Washington Division for BOP technical evaluations
- Periodically interact with Mexican licensing authority (CNSNS)
- For EPU Implementation Phase—Select vendor based on process prescribed by Mexican Govt (global tender)
- Implement EPU in four outages—two outages for each Laguna Verde unit
- CFE perform all project management activities for the EPU Project

Laguna Verde Nuclear Station EPU Project - Licensing Phase

- At the outset, established a clear understanding of the division of responsibility between CFE, General Electric and URS, Washington Division for performing the detailed technical evaluation / analysis
- Established a process for:
 - Design input & data collection
 - Preparation of technical reports
 - PUSAR preparation
 - All reviews and approvals by CFE
- Total of 120 reports were prepared addressing the following areas:
 - NSSS Technical Evaluations
 - Reactor heat balance
 - Reactor pressure vessel & internals
 - Core and fuel capability
 - Containment performance
 - NSS systems and piping
 - Radiological consequences
 - Plant life
 - Plant transients

Laguna Verde Nuclear Station - EPU Project Licensing Phase *(Cont'd)*

- Balance of Plant (BOP) Technical Evaluations

- Power conversion systems
- Main condenser & circulating water systems
- Turbine generator & its auxiliaries
- Water systems (closed & open)
- Condensate demineralizers
- Piping
- Radwaste systems
- On-site AC and DC power systems
- Power dependent HVAC

- Current Project Status – Licensing Phase

Power Uprate Safety Analysis Report (PUSAR) scheduled to be completed in July 2008 and submitted to Licensing Authority of Mexico (CNSNS)

Laguna Verde Nuclear Station – EPU Project Implementation Phase

- CFE awarded turnkey contract to IBERDROLA (Spain) to execute the Implementation Phase for Laguna Verde Units 1 and 2
- Based on the Licensing Phase and existing plant problems, the following major BOP equipment/components will be replenished and/or replaced:
 - High pressure & low pressure turbine rotors
 - HP and LP turbine auxiliaries
 - Main generator & its foundation
 - Isophase bus
 - Turbine generator controls
 - Moisture/separators reheater
 - Condenser re-tubing
 - Feedwater heaters
 - Condensate pumps
 - Condensate booster pumps
 - Reactor feedwater pumps
 - Turbine bypass valves
 - Addition of condensate demin vessels
 - Circulating water pump impeller change
 - Heater drain level control valves

Laguna Verde Nuclear Station EPU Project Implementation Phase *(Cont'd)*

- Other features for EPU implementation
 - Fuel: GE14 fuel introduction will occur in future refueling cycle (currently using GE12 fuel)
- Implementation Schedule:
 - Unit 1: 2008 and 2010 outages
 - Unit 2: 2009 and 2010 outages
- EPU Project Cost: Over 600 million USD for two units

Laguna Verde Nuclear Station - EPU Project

- **Q&A**

