Discussion on Grid Voltage Adequacy Issues

Industry-NRC Meeting

May 18, 2000

Rockville, MD

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Meeting Objective

- Respond to NRC request contained in March 2 letter to NEI
- Gain better appreciation of NRC concerns and planned actions
- Present current industry activities related to ensuring adequate grid voltage

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Discussion Topics

- Regulatory requirements and bases
- What are the issues?
- Industry experience and activities
  - Callaway experience
  - PJM Nuclear Generation Owners/Operators
  - California Model
  - INPO SOER 99-01

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Regulatory Requirements

- 10CFR 50, Appendix A, GDC 17
- Station Blackout Rule, 50.63
- Technical Specifications and Bases
- FSAR Safety Design Basis

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What are the Issues?

Electric industry changes placing increasing demands on grid have resulted in need for:

- Adequate understanding of plant electrical design requirements
- Better monitoring and notification of degrading grid conditions
- Clear operating agreements
- Improved organizational interfaces

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Callaway experience

- Wider switchyard voltage range due to
  - FERC mandated transmission system open access; increased power wheeling
  - Increased service territory load

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Callaway solutions

- Developed Transmission Provider Agreement clarifying responsibilities and requirements
- Enhanced Transmission Provider operator's real-time contingency analysis computer to effectively monitor switchyard voltage for loss of unit, and trigger appropriate communication to Plant
- Engineered creative transmission system configurations to better control switchyard voltage (immediate response)

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Callaway solutions (cont'd)

- Engineered plant modifications to accommodate a wider switchyard voltage range (in progress)
- Incorporated specific tests and sensitivities in Transmission Provider planning analyses
- Refreshed training of Plant and Transmission Provider System operators

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PJM Interconnection Nuclear Generation Owners/Operators (NGO) User Group

Glenn Miller, PPL

PJM NGO Users Group Chairman

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PJM NGO Charter

- Nuclear Operating License holders within PJM control area have formed a "User Group".
- In this new deregulated environment certain NRC licensing and related technical issues need to be addressed by Nuclear Operating License owners, with the PJM ISO, NAERO and MAAC reliability council, PJM Transmission Owners, and other PJM entities.
- The need exists for certain PJM entities to maintain familiarity with NRC regulatory issues surrounding nuclear plant operation, each plant's transmission design basis, and performance.
- There are many planning design and operational issues that are unique to nuclear generation which must be well understood. For these reasons, the entities that hold a Nuclear Operating License initiated the formation a PJM Users Group, as permitted by the FERC approved tariffs.

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PJM NGO Charter (cont'd)

- Define and implement the required relationship between the ISO, NAERO/MAAC, nuclear Operating License Holder, and transmission owner/local control centers relative to issues such as (but not limited to); reliable operation, black start, plant Final Safety Analysis Report (FSAR) issues, and design/control of the Bulk electric system.
- Include all Nuclear Operating License Holders within the PJM control area as official User Group voting Members in the development, review of procedures and protocols to ensure that issues are adequately addressed.

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PJM NGO Charter (cont'd)

- Reconcile and amend PJM/MAAC design and operations policy with each plant's Final Safety Analysis Report (FSAR). Work with PJM ISO, NAERO/MAAC, PJM Transmission Owners, and other appropriate parties to gain a common understanding of the changes required. With sufficient advance notice to obtain timely approvals, propose modifications to each FSAR as necessary or propose PJM/MAAC design or operations policy modifications as necessary.
- Emerging nationwide nuclear/ISO policy issues, actions and recommendations shall be discussed and coordinated with the Nuclear Energy Institute (NEI).

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PJM NGO Charter (cont'd)

- Operating License holders shall be proactive and participate in this new world of ISOs, FERC regulations, and NAERO/MAAC grid reliability standards. . The User Group shall address two key issues -- a) monitoring as-built Transmission system reliability, and b) consistency and timing of transmission grid modification approvals with FSAR design basis modifications (as deemed necessary).
- Provide the necessary communication infrastructure, an open PJM forum for discussion, and means to proactively resolve such issues.

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PJM NGO Members

Six Generation Companies, Thirteen Nuclear Units:

- **AmerGen - Three Mile Island 1**
- **BG&E - Calvert Cliffs 1 & 2**
- **GPU - Oyster Creek**
- **PECON - Peach Bottom 2 & 3, Limerick 1 & 2**
- **PPL - Susquehanna Units 1 & 2**
- **PSEG - Hope Creek & Salem Units 1 & 2**

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PJM NGO Activities

- PJM System Voltage Operating Criteria
  - Incorporates nuclear plant's normal and emergency high and low voltage limits into PJM's Emergency Management System
  - Real time actual and post contingency voltage analysis which considers nuclear plant trips
  - Actions taken to reconfigure system based on pre- and post-contingency analyses
  - PJM will re-dispatch system generation to stay within both pre- and post-contingency voltage limits
  - Actions to be incorporated into PJM operating procedures
- INPO SOER 99-01, Loss of Grid
- NRC IN 2000-06, Offsite Power Voltage Inadequacies

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PJM NGO Activities

- Root Cause Analysis of July 1999 PJM Low Voltage Condition
- Plant Severe Weather/Ambient Operating Restrictions
- NERC Planning and Operating Standards
- PJM Generator Standards Manual
- Communications Protocol Training Module
- Regional Transmission Expansion Planning
- Compensation for Reactive Power Generation

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California Model

Doug Stickney, SCE

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Deregulation in California

- California ISO
  - ***grid reliability*** is the ISO's ***primary responsibility***
  - Operational control of the grid transferred on March 31, 1998

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Deregulation

- California Assembly Bill 1890 requirements:
  - *The ISO shall ensure efficient use and reliable operation of the transmission grid consistent with achievement of planning and operating reserve criteria no less stringent than those established by the Western Systems Coordinating Council (WSCC) and the North American Electric Reliability Council (NERC).*
  - *The ISO shall immediately participate in all relevant Federal Energy Regulatory Commission (FERC) proceedings.*

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Deregulation

- What's not in AB 1890:
  - The ISO shall meet SCE's specific requirements for reliability and operability of San Onofre's offsite power supply, including any requirements imposed by NRC regulations or specified in the NRC Operating Licenses
- San Onofre's challenge
  - Ensure that the essential plant specific requirements for offsite power at San Onofre are firmly established between SCE and the ISO (contractual basis).

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SONGS Offsite Power Specification ("grid spec")

- Transmission Lines
- Sufficient Capacity
- Minimum Voltage
- Normal Voltage
- Maximum Voltage
- Grid Operating Conditions
- System Studies
- Stability/Availability
- LOOP Priority
- Frequency
- Reliability Criteria
- Patrols
- Inspections/Washing
- Preventive Maintenance
- UFSAR Update

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Minimum Voltage

- The minimum grid voltage at the SONGS switchyard shall be maintained ***at or above 218 kV***. In the event of a system disturbance that can cause the voltage to dip below 218 kV, ***including the trip of a SONGS unit***, ...

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Grid Operating Conditions

- During certain critical transmission line outages with one SONGS unit off-line, ***maintain the offsite power system within specified power flows*** (as determined by system studies). Grid conditions which render the offsite power supply ***inoperable***, or are ***outside of analyzed conditions***, shall be ***immediately communicated*** to SCE for ***operability determination.***

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System Studies

- ***Assess system studies annually*** and update as needed to demonstrate capability to supply adequate offsite power.
- Study assessments and updates shall be transmitted to SCE.
- Grid operating procedure changes due to load growth and changes in local generation require ***prior review by SCE.***

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Stability/Availability

- The following initiating events ***shall not*** result in the loss of ***grid stability or availability***:
  - The ***loss of a San Onofre Unit*** (with other unit offline).
  - The loss of any generating unit on the SCE and SDG&E grids.
  - The loss of any major transmission circuit or intertie on the SCE and SDG&E grids.
  - The loss of any large load or block of load on the SCE and SDG&E grids.

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LOOP Priority

- ***Highest possible priority*** shall be given to restoring power to the ***San Onofre switchyard***. Procedures and training shall include several methods of transmitting power from black start units, including nearby gas turbine generators.
- Power restoration repairs for San Onofre shall be given the ***highest priority*** for manpower, equipment, and materials.

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Reliability Criteria

- Existing SCE and SDG&E reliability criteria shall be maintained. ***Proposed changes*** to reliability criteria shall be ***assessed*** to determine if grid reliability and availability are ***adversely impacted***.
- ***Changes in grid operation*** due to revised reliability criteria require ***prior review by SCE.***

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The Transmission Control Agreement (TCA)

- The TCA is a contract between SCE, SDG&E, PG&E, and the ISO. The TCA has been approved by FERC. The ISO is bound by FERC mandate to operate the grid in accordance with the TCA.
- The San Onofre and Diablo Canyon "grid specs" have been incorporated into the TCA (Appendix E of the TCA).
- Operation of the grid in accordance with the TCA ensures equivalent (or better) grid reliability and operability (with respect to San Onofre offsite power) as prior to deregulation.

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Significant Operating Experience Report (SOER) 99-1 "Loss of Grid"

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SOER 99-1 "Loss of Grid"

- SOER issued because of recent events (including US events) associated with loss of grid
- Intent of the SOER recommendations is to help ensure barriers that protect nuclear plants from grid loss or degradation are in place

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Recommendation 1 - establish appropriate interface with the grid operator

- plant coordination with grid maintenance and testing
- plant is made aware of grid status
- plant requirements and status are made known to grid operator
- grid operator is made aware that the plant is an important customer
- responsibilities for grid/switchyard equipment maintenance are clearly defined

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Recommendation 2 – verify procedure adequacy for loss or degraded grid

- actions in response to grid instability and degradation
- guidance for manual configuration of electrical buses if automatic transfers fail or manual alignment of emergency power when necessary
- guidance reflects timely resetting of safety system electrical sequencing
- immediate focus is to stabilize the plant rather than return to power

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Recommendation 3

- verify plant and switchyard high voltage grid distribution equipment under plant responsibility is in the plant preventive maintenance program

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Recommendation 4

- confirm grid reliability and stability design assumptions remain valid
- review trip setpoints – (Degraded grid voltage may result in unanticipated component trips prior to emergency power source automatic actuation.)

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Recommendation 5 – operator training

- **train on:**
  - degrade grid voltage
  - post loss of grid actions
  - manual electrical bus alignments

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The evaluation of SOER 99-1 implementation starts in June 2000

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