

***D. C. Cook Nuclear Plant
Degraded Voltage Protection
May 10, 2006***



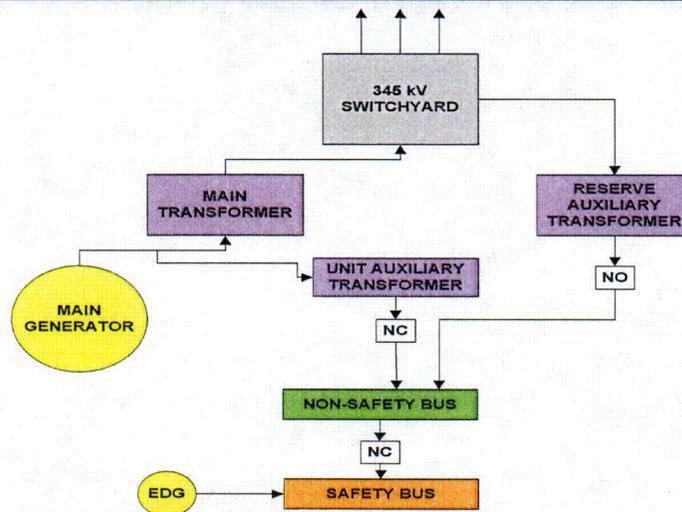
Purpose of Meeting

- Discuss technical and schedule considerations associated with implementation of the degraded voltage protection backfit.

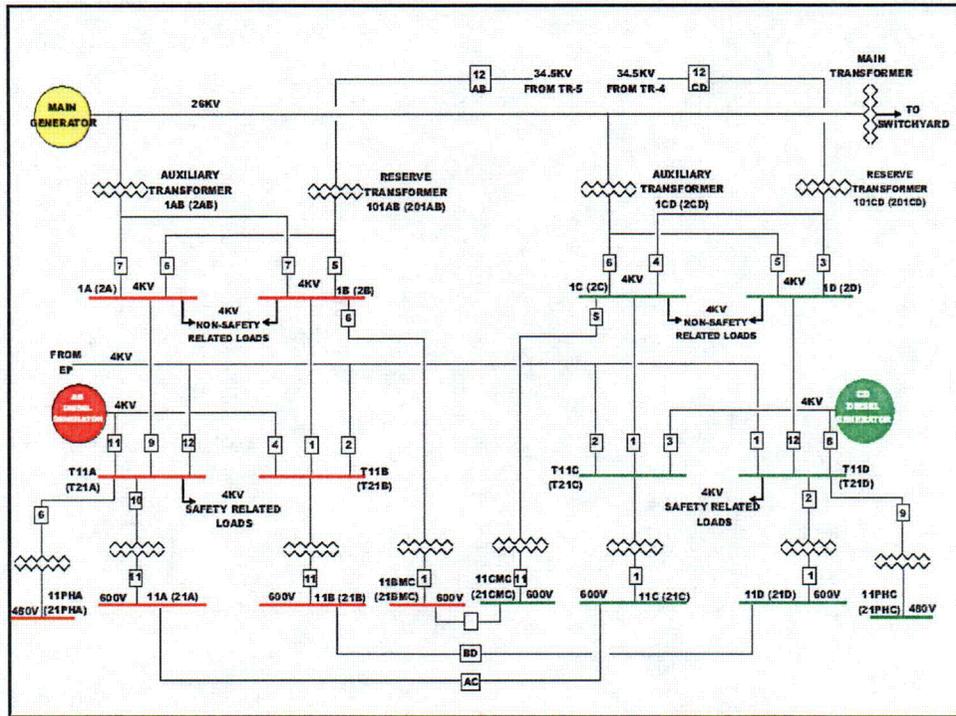
Agenda

- Current Cook Nuclear Plant (CNP) Design
- Backfit requirements
- Technical Considerations
- Design options for implementing backfit
- Schedule considerations

CNP Electrical System Arrangement



COI



Current Design

Normal Operation:

- Power to 4 kV buses is provided by main generator via UATs.
- Non-safety 4 kV buses fed from UATs.
- Safety buses fed from non-safety buses during normal operation.
- First level backup from Reserve Auxiliary Transformers.
- Second level backup from EDGs.
- Voltage is monitored at 4 kV and 600 V levels. Bus voltages reliant on generator voltage and under the control of the operator.

Current Design

Normal Operation (cont.):

- If contingency analyses program shows CNP trip would cause unacceptable grid voltage, offsite power is declared inoperable.
- Control room alarm actuates if 600 V or 4 kV voltage low.
- Per alarm response procedures, operators raise main generator output voltage and trip reactor if voltage not recoverable in reasonable timeframe.
- No automatic DV protection.

Current Design

Accident operation:

- Reactor/turbine trip at $T=0$.
- Main generator trip at $T = 30$ sec.
- 4 kV buses are transferred from UATs to RATs at $T = 30$ sec.
- Fast transfer from UATs to RATs does not cause loads to trip.

Current Design

Accident operation (continued):

- Auto Load Tap Changing RATs provide voltage regulation to 4kV buses and mitigate the impact of any post-trip grid voltage reduction.
- Automatic DV protection is enabled when 4 kV buses are aligned to grid via RATs.



Current Design

While on RATs:

- Voltage on 4 kV safety buses is monitored.
- If voltage reaches DV set point:
 - Breakers from RCP buses open.
 - Safety bus voltage = 0.
 - EDG starts due to bus voltage = 0 or Si.
 - EDG breakers close - energize safety buses.
 - Safety loads sequenced on safety buses.



Backfit Requirement

- “The automatic degraded voltage protection shall not be bypassed during normal operation.”

Backfit Details

- Staff position MPA B-23 focuses on having degraded voltage (DV) relays in place to provide automatic protection for degraded voltage conditions regardless of the power sources for the safety buses.

Backfit Details

- Therefore, in addition to automatic DV protection while on Reserve Feed, CNP will provide automatic DV protection while auxiliary systems are powered from UATs
- CNP does not intend to provide DV protection for Emergency Power (EP) source (69kV) since EP is a partial capacity source, only used if normal power, reserve feed and one or both EDGs lost.

Technical Considerations

- Limited margin between normal bus operating voltage and DV setpoint.
- Pump starts (e.g., condensate booster, hotwell, heater drain pumps) could cause DV relay actuation.
- Design options to increase margin need to be considered.

Design Options for Backfit Compliance

- UAT replacement and removal of interlocks.
- Evaluate logic to transfer from the UATs to the RATS if degraded voltage occurs during non-accident situations (would require LAR since it deviates from the requirements described in the backfit letter).

Design Options for Backfit Compliance

- Unit 2 Generator Step Up (GSU) transformer replacement to recover margin to the degraded voltage setpoint (i.e., different winding rating/turns ratio).

Design Options for Backfit Compliance

- Voltage Regulation (both Units UAT no-load taps are set at maximum boost) – create margin in Unit 2 between relay setpoints and normal bus operating voltages.
 - Replace UATs with transformers having automatic load tap changers.
 - Install voltage regulator banks on 26kV or 4kV level.
 - Install voltage regulators on the 600V level.
 - Install static VAR compensators.

Major Project Approach

- Three phases:
 - Study – evaluate design options and recommend solution; conceptual design; project plan and schedule; financial development.
 - Design – develop modification package; complete installation planning; project plan schedule and financial development.
 - Implementation – physical installation; project turnover; closeout.

Schedule Considerations

- Request for proposals to complete study were issued to vendors (January, 2006)
- Proposals were received 1/31/06 and evaluated.
- Study funding was received from the Plant Health Committee (PHC) in March.
- Contract for study has been awarded and study phase kickoff meeting was held week of 4/10/06.
- Approximate time to complete study is 10 weeks, including time for AEP review (Design Review Board) and approval of the study.
- PHC review and approval (scope, schedule, funding) will follow.
- Project schedule will consider modification development, material procurement and outage preparation milestones.

Schedule Considerations

- Applicable milestones for upcoming outages:
- U1C21 commences in September, 2006. Milestones for issuing major modifications has passed.
- U2C17 major modification ID milestone (was 9/30/05; issue modifications by 9/30/06; outage starts 9/22/07).
- U1C22 major modification ID milestone (was 3/31/06; issue modifications by 3/31/07; outage starts 3/15/08).

Schedule Considerations

- The resolution of the backfit letter has been added to both the U2C17 (Fall 2007) and U1C22 (Spring 2008) outage modification lists, however, until the project scope and modification development schedule implications are understood, it is not possible to determine if these modifications can actually be installed during these outages.

Conclusion

- CNP intends to comply with the backfit letter in a timely manner.
- Study to examine options and select optimal solution is underway and expected to complete in July, 2006 (including PHC approval).
- Project schedule will consider modification development, material procurement and outage preparation milestones.
- CNP intends to provide the NRC staff with periodic updates as the project progresses.