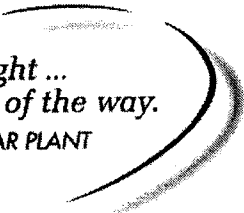


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COOK NUCLEAR PLANT



American Electric Power

Meeting with Nuclear Regulatory Commission

Discussion of MOV Operability with Degraded Voltage

Restarting D. C. Cook
March 24, 2000



Agenda

- | | |
|--|---------------|
| ■ Agenda/Opening Remarks | Mike Rencheck |
| ■ MOV Requirements | Mike Finissi |
| ■ Degraded Voltage Protection
Licensing Basis | Robert Godley |
| ■ MOV Degraded Voltage Design
Basis and Operability | Scot Greenlee |
| ■ 89-10 Program MOVs | Mike Finissi |
| ■ Closing Remarks | Mike Rencheck |

MOV Requirements

- **Ensure Operation in Accordance with Design Basis (DB)**

- **MOV DB Considerations Include:**
 - Flow, pressure and temperature
 - Torque, thrust, and valve capabilities
 - Environmental qualification/HELB
 - Voltage

- **MOV DB Voltage:**
 - Must be adequate to operate equipment

Degraded Voltage Protection Licensing Basis

- **Millstone Event, July 20, 1976**
 - Degraded grid results in motor failure

- **NRC Generic Letter dated August 13, 1976**
 - Offsite power configuration
 - Loss of voltage design (incl. setpoints)

- **AEP Response dated November 17, 1976**
 - Provided analysis results
 - Proposed 2nd level UV at 94% of 34.5 kV

Degraded Voltage Protection Licensing Basis (cont.)

- **NRC Generic Letter (GL), June 3, 1977**
 - **Voltage/time setpoints analysis at all distribution levels**
 - **Protection to include coincident logic**
 - **Time delay not to exceed accident analysis**
 - **Include setpoints in Tech Specs**

Degraded Voltage Protection Licensing Basis (cont.)

- **AEP Response to GL June 3, 1977, dated July 22, 1977**
 - **1st Level UV**
 - » 60%
 - » 8 cycle TD
 - **2nd Level UV**
 - » 94% @ 34.5 KV side of transformers
 - » 2 sec TD compatible with accident analysis
 - **Tech Specs under development**

Degraded Voltage Protection Licensing Basis (cont.)

- **ANO Event**

- **NRC GL, dated August 8, 1979**
 - Avoid spurious separation during S/U, normal ops, & when S/D
 - Provided sample Tech Specs

- **NRC RAI, dated August 15, 1979**
 - AEP response, dated October 5, 1979

Degraded Voltage Protection Licensing Basis (cont.)

■ AEP Response to GL August 8, 1979, dated December 17, 1979

– Proposal

- » 1st level UV increased to 79.9% with 2 sec TD
- » 2nd level UV 89.9% @ 4 KV buss with 2 min TD
- » 2nd level UV alarm only when on main generator

– Basis

- » Theoretical load flow study
- » Safety busses volt range for normal ops & starting of safety loads is adequate
- » Original proposal could cause spurious tripping
- » Will accommodate short voltage dips
- » Will avoid spurious separation from offsite power

Degraded Voltage Protection Licensing Basis (cont.)

- **Tech Spec submitted February 22, 1980**
- **Unit 2 amendment 22 issued July 10, 1980**
Unit 1 amendment 39 issued July 25, 1980
 - **Modifications will protect class 1E equipment**
 - **Complies with staff positions**
 - **Provides for adequate testing**
- **Later Tech Spec Changes Made Minor Shifts in Setpoints**

Degraded Voltage Protection Licensing Basis (cont.)

■ Approval Based on:

- Maintaining previously analyzed time delays and minimum allowable setpoints
- Adequate margin existed between the maximum allowable setpoint and worst case anticipated degraded grid voltage
- Preclude spurious separation from grid

Degraded Voltage Protection Licensing Basis (Summary)

■ Summary

- Original proposal supported accident analysis
- TS proposal moved setpoint below analyzed degraded voltage under accident conditions
- Operability based on load flow study
- Believed setpoint voltages acceptable for continuous duty motors

■ Conclusion

- Accident functions protected by depth & rigor of analysis

MOV Degraded Voltage Background

- **Electrical Distribution System Design Basis
Reconstitution Efforts**

- **Operability Based on Grid and Load Flow Analyses**

- **LER 99-022 Documents Degraded Voltage Findings**
 - **Load flow calculation issues**
 - **Grid profiles changed**

MOV Design Input

- **Load Flow Analysis Establishes “Analytical Limit” for 4kV Buses**
 - Limiting accident conditions used in analysis
 - Modeling goes to equipment terminals

- **Operation > Analytical Limit Ensures Equipment Can Operate**

- **Analytical Limit Used to Determine MOV Low Voltage and Performance**

MOV Design Input (cont.)

- Assurance of Operation > Analytical Limit Provided by Grid Study

- Grid Study
 - Loss of a nearby generating unit
 - Loss of critical transmission grid element
 - CNP units down
 - » One unit in shutdown
 - » One unit in LOCA
 - Transmission system heavily loaded

MOV Degraded Voltage Design Modifications and Enhancements

- **Grid Study Results:**
 - Do not expect to reach analytical value

- **Restart Modifications to Ensure 4kV Bus Analytical Limit Maintained**
 - New switchyard breaker
 - Transformer tap changes

- **New Working Agreement Between CNP and AEP System Operations to Monitor Grid Voltages and Failure Scenarios**

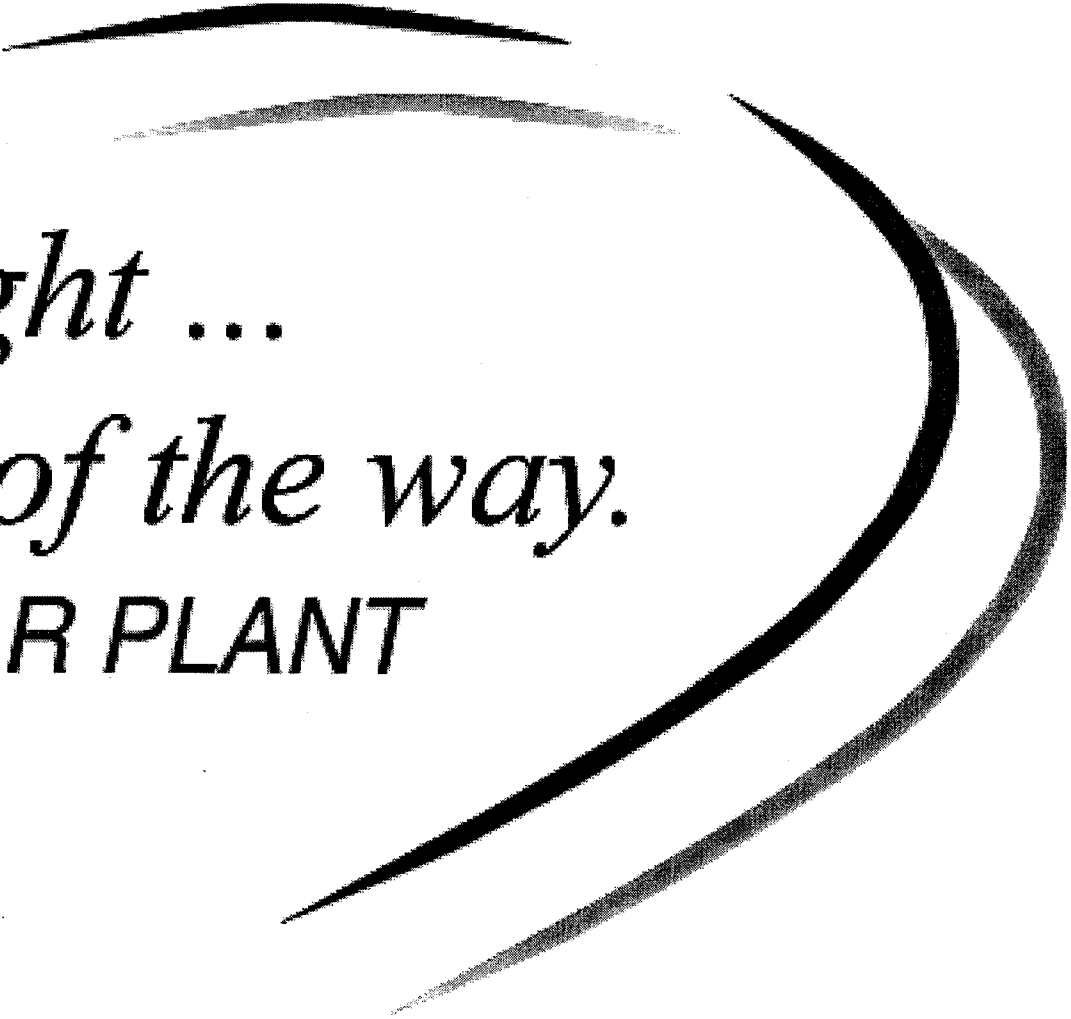
- **Long-term: Evaluating Additional Options**

89-10 Program MOVs

- **Demonstrating that CNP MOVs will Operate as Designed**
- **Using Conservative Methodology in MOV Program**

Conclusion

- **Analytical Limit is Based on Load Flow Analyses**
- **Ensures Adequate Voltage for Safety Related Loads**
- **89-10 MOVs Operable at Restart**
- **Analysis in Progress to Guide Our Future Actions**



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cc w/encls: A. C. Bakken III, Site Vice President
J. Pollock, Plant Manager
M. Rencheck, Vice President, Nuclear Engineering
R. Whale, Michigan Public Service Commission
Michigan Department of Environmental Quality
Emergency Management Division
MI Department of State Police
D. Lochbaum, Union of Concerned Scientists

ADAMS Distribution:

RRB1

RPC

Project Mgr., NRR

J. Caldwell, RIII

B. Clayton, RIII

SRI D. C. Cook

DRP

DRS

RIII PRR

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