



BEAVER VALLEY POWER STATION UNIT 2 CHARCOAL DELUGE EVENT

Dennis Adams, FENOC HVAC Program
Manager

Tom McGourty, BVPS System Engineer

Rick Beal, BVPS System Engineer

Plant Conditions

- Unit 1 Refueling/Steam Generator Replacement Shutdown
- Unit 2 100% power

EVENT CHART

- 4/11/06 0410 HRS Train A Supplementary Leak Collection and Release System (SLRCS) taken OOS for surveillance- charcoal sampling
- 4/11/06 0924, Multiple Fire Protection System Deluge Inadvertent valve actuations
 - Main Filter Banks (SLCRS)
 - Main Transformer
 - 2A/2B System Station Service Transformers
 - Condensate Bldg Charcoal Filter Unit
 - Decon Bldg Charcoal Filter Unit
- 4/11/06, 0924 Unit 2 entered Tech Spec 3.0.3
 - Initiate shutdown within 1 hr, 6 hrs to hot standby, 24 hrs to cold shutdown

Event Chart (cont)

- 1055 hrs, Commenced Normal Reactor Shutdown
- Requested Enforcement Discretion from TS 3.0.3
- 1520, NRC granted 48 hr ED on TS 3.0.3 for SLCRS filter units
 - 48 hrs to restore one train, 4/13/06, 1520 hrs
 - 7 days to restore both trains by 4/17/06, 0436 hrs
 - Note: NRC had previously approved removal of SLCRS from TS in next revision
- 4/12/06 Completed A Train SLCRS charcoal/HEPA changeout
- 4/13/06, 0945 A Train SLCRS OPERABLE
- 4/14/06, Completed B Train SLRCS charcoal/HEPA changeout
- 4/14/06, Train B SLCRS OPERABLE

Interim Observations

- No actual fire occurred
- Fire Deluge Logic well defined
- Ground induced actuation voltage surge occurred simultaneously
- Most probable cause was a ground
- 3 of 4 SLCRS filter housings flooded via automatic deluge system
- Other grounds previous in other systems
- Not all fire protection systems activated due to difference in trip circuit impedance to a surge on the bus
- 4 KV bus breaker testing in progress at the time of occurrence using site fabricated variacs

Interim Actions Taken

- Problem Solving Team Manned 24/7
- Unit 2 returned to 100% power from 19%
- Commenced Unit 2 charcoal/HEPA changeout A and B Train SLCRS
- Blank Flanges installed on Deluge lines
- Root Cause Team in progress

Cause of Event

- Root Cause-Indeterminate-ground cleared
- Most Probable Cause
 - Ground on 125vdc bus that propagated a surge to the other dc bus-Latent connection between 2-5 and 2-6 dc buses
 - 4KV bus breaker testing in progress
 - test equipment (Variac) inadequate design
 - Testing connected uncontrolled test equipment to the DC bus that powered two of the fire protection circuits actuated
 - procedure did not provide specific instructions for controlling the connections of the test equipment

Corrective Action Program

- Evaluate Hazards Analysis for internal flooding-Bounded
- MRFF review-No FF of FP, 125vdc or SLCRS
- Risk evaluation of event-very low
- BVPS Unit 2 LER 2006-002, NRC Itr dated 6/12/06
- Investigate common connection between DC buses 2-5 and 2-6
- Evaluate need to establish criteria for testing dc buses
- Evaluate potential mod to U2 FP deluge panel circuitry-sensitivity
- Changes to all Site Fabricated Variacs across the fleet
- Deluge System Modifications-Remove automatic deluge valve and replace with 2 ball valves with telltale drain

Variac Changes

- Replace power cord-use grommet to protect jacket
- Add in-line fuse to the input, sized to match the load
- Add a master power switch to front panel
- Replace the 3K ohm 10 watt resistor with 20 watt
- Locate fuse before the fuse and switch
- Replace the capacitor using 25uf 200 vdc, with a mounting bracket
- Add control knob to variac wiper
- Maintain Variac per Measuring and Test Equipment Calibration Program