

NERC Lessons Learned:

“Inadvertent CVT Fuse Removal on a Live Circuit”

“RAS Unexpected Operation”

“Loss of Monitoring or Control Capability due to Power Supply Failure”

“Breaker Failure due to Multiple Reclose Attempts”

Donnie Bielak
Reliability Engineering

- **Title**
 - Inadvertent CVT Fuse Removal on a Live Circuit
- **Source of Lesson Learned**
 - Northeast Power Coordinating Council (NPCC)
- **Date Published**
 - August 1, 2019

- During a planned outage, switching was required to transfer load from one circuit to another parallel circuit
- After the load transfer, the switching crew skipped a pre-isolation switching procedure to familiarize with station equipment
- The crew inadvertently pulled the CVT fuses from the circuit carrying load
- Resulted in line protection relay operation and loss of 382MW
- Circuit was later energized and load restored

- Enhance labeling differences between similar nearby or parallel equipment
- Ensure all staff positively identify the equipment associated with their job
- Have training and documentation which clearly details the roles and responsibilities of every staff member
- Be cognizant on the effect of long wait times
- Do not skip procedures due to familiarity
- Periodically conduct refresher training courses for all staff

- **Title**
 - RAS Unexpected Operation
- **Source of Lesson Learned**
 - Northeast Power Coordinating Council (NPCC)
- **Date Published**
 - August 1, 2019

- In accordance with work plan, a technician physically removed the control unit that commands the RAS in order to conduct test plans
- After the test, control unit was returned and system restored to normal operation
- Technician noticed an incorrect label on one of the control unit cards
- Technician attempted to change card label with the control unit in place
- Cards were not secured with screws as required, therefore slight motion triggered RAS
- RAS rejected generation and triggered load shedding

- Ensure installation of equipment follows supplier's design recommendations
- Ensure RAS cards are firmly screwed to avoid RAS activation due to card movement
- No matter how small the job, work plan procedures and their review should be detailed and precise to ensure all steps are completed appropriately
- Equipment assembly procedures should include reminders to avoid omission of equipment pieces

- **Title**
 - Loss of Monitoring or Control Capability due to Power Supply Failure
- **Source of Lesson Learned**
 - North American Electric Reliability Corporation (NERC)
- **Date Published**
 - August 1, 2019

- Several entities have experienced energy management system (EMS) outages from power supply failure
- Outages due to the instability and insecurity of normal power supplies and the failure of standby power supplies
- 7 cases were reported and investigated during scheduled and unplanned power outages
- In 1 case, system operator failed to notice an EMS alarm indicating lack of communication between CC & substation

- Routines should be created for monthly testing and maintenance running of backup generators
- UPS battery life, charge cycle and size should be assessed as part of risk analysis
- Periodic maintenance and monitoring of any UPS system beneficial
- Devices should be balanced between PDUs to prevent overloading
- Ensure input ratings of the PDU are in harmony with the outlet ratings and that they have the required functions
- The power supplies of the switches should be connected into the different UPS circuits

- A redundant sealed valve regulated lead acid battery string on each parallel UPS is recommended
- Communication between work groups or departments is vital to maintaining situational awareness of the bulk power system
- Mandatory operator response to alarms should be reinforced

- **Title**
 - Breaker Failure due to Multiple Reclose Attempts
- **Source of Lesson Learned**
 - Western Electricity Coordinating Council (WECC)
- **Date Published**
 - August 13, 2019

- A tree fell into a 115 kV line, breaking the C-phase conductor
- C-phase conductor fell and made permanent contact with the grounded transmission tower
- Breakers cleared fault and then initiated a re-close
- One of the breakers malfunctioned and improperly self-initiated re-closures into the faulted line seven more times
- During the final reclose attempt, the breaker failed to interrupt the fault and eventually faulted internally on the C-phase
- The main bus differential lockout relay opened all breakers on the 115 kV bus.

- It was found that there was an insufficient gap between the top of the close-coil plunger and the close lever in the breaker's closing mechanism
- Breakers do not come from the manufacture this way and was a result of improper maintenance
- After performing work on breakers, ensure the reassembly of equipment follows manufacturer's recommendations
- Include a step to verify the gap parameters in breaker diagnostic checklists that are used during maintenance activities
- Lesson learned includes steps for visual inspection to determine if condition exists on other breakers

- https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/20190803_Inadvertent_CVT_fuse_removal_on_live_circuit.pdf
- https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/20190802_RAS_Unexpected_Operation.pdf
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