

NERC Lessons Learned:

“Inadequate Battery Configuration Management Damaged a Generating Station and Tripped an HVDC Conversion Station”

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- Progressive voltage drops between a multiunit generating station and an AC-DC conversion station for a major intertie
- Loss of DC supply at generating station
 - All units were without monitoring
 - Half of the units were running without control and protection

- Two main batteries to supply the control and protection of the units
 - In the normal configuration, each of the batteries supply the protection and control of half of the units
 - One battery can supply the protection and control for all the units when the other battery is out-of-service for maintenance

- Technicians performing maintenance on the batteries
- After maintenance on Battery #2, operator did not close CB to supply power from battery
- Opened CB for Battery #1, which had been supplying power
 - No power for monitoring of all units and the control and protection of half of the units
- Monitoring for the entire generating station was lost
 - No alarms seen by the operator nor at the control center
 - Panel remained out of service for about an hour and a half

- Approximately an hour after the loss of power, progressive voltage drops occurred on the transmission lines connecting the generating station to the AC-DC conversion station
- Cascade effect due to the response of the AC-DC substation to the initial voltage drop (in/out service of filters) and the lack of regulation at the generating station with loss of the DC supply
- Resulted in damage to the generating units that were left without protection due to the loss of DC power
- Power transfer for the DC tie lost for over three hours

- When the generating station operator failed to close CB, he had technical instructions in-hand but did not have the switching plan
 - Technical instructions included actions to perform on specific equipment
 - Switching plan contained all actions to be performed, including confirmation steps
- Following the event, it was noted that many operators have been only following the technical instructions

- Ensure operators have all necessary procedures and technical documentation in-hand when performing switching operations
- Confirm that actual engineering practices that apply to maintenance of any power that supplies protection, regulation, control, monitoring, or telecontrol systems are suitable
- Evaluate the power supply of the control and protection systems of all strategic generating stations and, if necessary, modify the power supply systems

- Improve generating station operator awareness regarding the risks encountered by the loss of DC supply in generating stations and stress the importance of communication with the control center operators
- Establish clear procedures for when the DC supply of some or all units are lost (for example: stop the units)

- Establish internal controls on maintenance activities for critical work
- Ensure that the criticality of the work, including the configuration of the network at the time of the work, is understood
- Emphasize the importance of clear and prompt communication
- Improve operator awareness regarding the risks posed by the loss of DC supply in generating stations
- Further stress the importance of communication by specifically adding it into written procedures

- If there is no battery back-up:
 - When in-service battery maintenance is performed, ensure that redundant supplies (such as mobile battery carts or permanently installed “swing batteries” connected in parallel) exist to supply power to essential protection and controls plus monitoring tools
 - If those methods are not feasible, consider delaying maintenance on the batteries until units are off-line