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Exhibit L

Reliability Engineering
Root Cause Analysis

CONFIDENTIAL – NON-PUBLIC INFORMATION

Document Date:	02/25/2022
To:	Manny Zeringue
From:	Bob Lerch
CC:	

Event Location:	Comanche Unit 3			
Event Date/Time:	01/28/2022, 9:17 AM and 3:41 PM			
Event Description:	Unit 3 Turbine Generator Motoring Event and Unit 1 Trip			
Strategic Measures Impacted:	☐	Safety	☒	Internal/External Customer Relationships
	☒	Reliability	☐	Environmental Stewardship
	☒	Rates/cost	☐	Improved Communication
KPI Impacted:	☒	EFOR	☒	$/MWh
	☒	EAF	☐	Other:
	☐	PEA		
Estimated Event Cost:	Material / Services Cost: $6,400,000			

Executive Summary:

On January 28, 2022 one pole of the Comanche 3 345 kV generator breaker was closed during breaker troubleshooting activities. The electrical protection circuits for the generator breaker were isolated and the disconnect switches that isolate the generator breaker from the electrical system were closed at the time. As a result, the Comanche 3 generator was significantly damaged, several generating units in the region experienced momentary outages, and multiple major transmission lines were opened.

Timeline / Technical Summary

01/27/2022:

- Approximately 10:30 am, COM3 control room received a "Generator Breaker Low Spring Energy" alarm. Generator Breaker 7013 is the affected breaker located in the COM3 substation yard north of the unit (see Fig. 1 and Fig. 2).

Fig. 1: Comanche 3 Generator Breaker 7013

Fig. 2: Affected "A"-Phase of 7013 Breaker

- Approximately 1:30 pm, Plant Director and Engineering discussed the potential of Breaker 7013 opening relative to this alarm that could result in COM3 tripping.
    - Engineer visual examination of 7013 indicated the unit was not at high risk of tripping; however, if the unit did trip for other reasons, 7013 may not open. If it did open, it may not re-close due to a concern with the hydraulic mechanism which keeps the spring charged in the closed position that should be examined further.
    - If 7013 did not open under that scenario, upstream line-side breakers 7014 and 7019 would open to prevent impact to the unit turbine generator.
    - Engineering continued with determining availability of parts and OEM service providers. All parts were to be on site before bringing unit down for breaker service.
    - The spring assists with opening and closing of the breaker through the hydraulic section of the charging assembly or mechanism (see Fig. 3). Breaker contacts are manipulated by a hydraulic plunger (or drive piston) that is moved by porting hydraulic fluid to the plunger (closed contact) or bled from the plunger (open contact) based upon the position of a pilot control valve that directs flow of hydraulic fluid. The position of the pilot valve and plunger change with hydraulic pressure when breaker position commands are changed. This pressure (and breaker position) are held in place by spring tension.

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[redacted]

01/28/2022:

- Approximately 7:45 am, Plant Director and Engineering had Breaker 7013 update discussion. Plant electrical engineer (EE) indicated that Xcel substation personnel experience with this breaker was limited to replacing the nylon gear.
- EE was awaiting a call back from the breaker OEM (ABB, Inc.). Plant Director advised to check for other service providers as well.
- At 9:17 am, COM3 tripped. Plant Director and Engineering Manager proceeded to COM3 control room from the administration building. Several alarms and trends were examined with the plant controls engineer. The unit tripped on "Generator Breaker Closed" fault (which is the false statement in controls logic indicating the 7013 breaker opened). This was the result of 7013 auto-opening on low spring energy.
- Approximately 10:30 am, Plant Director and Engineering reviewed trip protection scheme for 7013 and identified a jumper which could have prevented the breaker from auto-opening due to low spring energy. This jumper, when installed, allows the breaker to auto-open when the spring energy falls below the spring setpoint of 40 mm. With the jumper removed, the breaker will not auto-open when the spring energy falls below the setpoint.
- The breaker spring appeared to be fully discharged (or below the auto-trip setpoint) when looking through the small viewing window on the breaker enclosure (maintaining the breaker in the closed position and assuming the jumper was removed).
- EE confirmed that the jumper was still in place and the spring not completely discharged.
- Approximately 1:30 pm, EE and relay technician performed breaker fail blocking on 7013 in preparation for OEM breaker repair work and testing on 01/31/22.
- Approximately 2:45 pm, Plant Director informed Engineering Manager that substation personnel have been on site working on 7013 to replace a gear. Plant personnel did not make a request for substation support. Both proceeded to the COM3 substation yard where relay technician, substation personnel, EE, plant electrical foreman were seen at generator breaker 7013.
- EE explained that substation personnel were in the process of replacing a nylon gear in the spring charging mechanism (see Fig. 4).

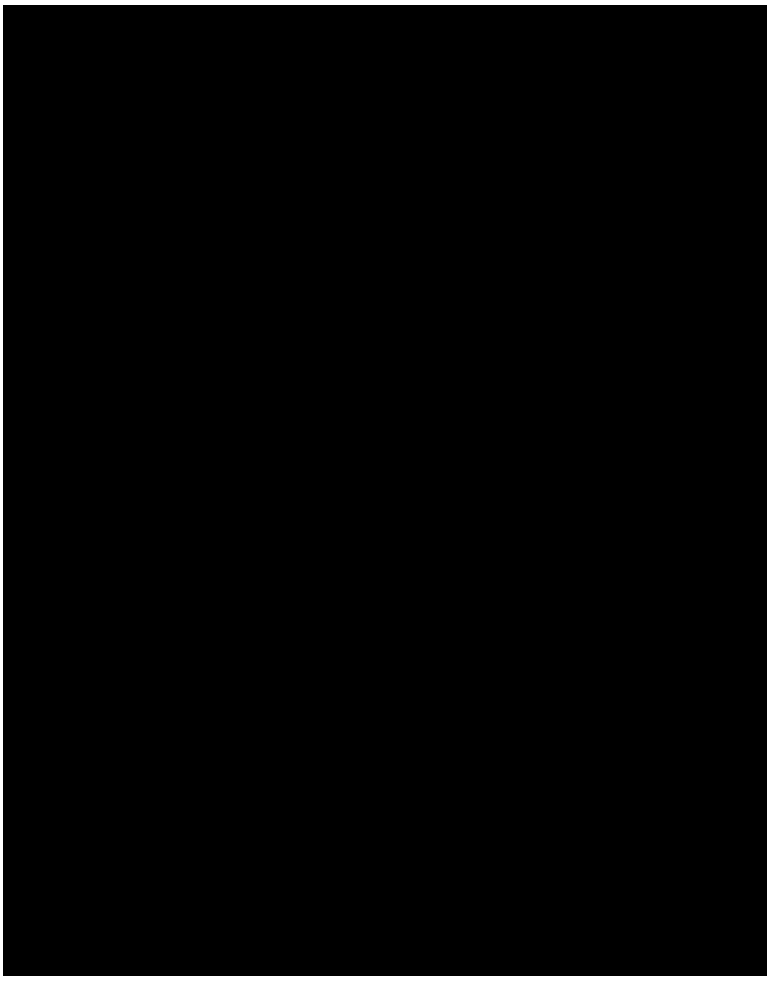

Fig. 4: 7013 Charging Mechanism for "A"-Phase

- Plant Director asked EE if a generator clearance was needed. EE indicated not for the scope of this gear work, but would be needed for the OEM work planned for next week.
- Once the gear was replaced, the plan was to leave the spring charged overnight, evaluate hydraulic integrity and extent of spring charge in the morning.
- Approximately 3:10 pm, Plant Director and Engineering Manager returned to the administration building.
- At 3:41 pm, Unit 1 tripped due to GSU protective relay neutral overcurrent on MT1P (primary) and MT1B (backup) when the close coil on the "A"-phase of Unit 3 7013 breaker was manually operated inadvertently allowing the changeover valve to shift and re-direct hydraulic fluid pressure onto the drive piston (see Fig. 5). The drive piston linkage is tied to the "A"-phase breaker contacts. There was sufficient charge in the hydraulic accumulator to move the drive piston and close the contacts from its current state. The DC circuit that normally operates the open and close solenoids was de-energized during the gear replacement.

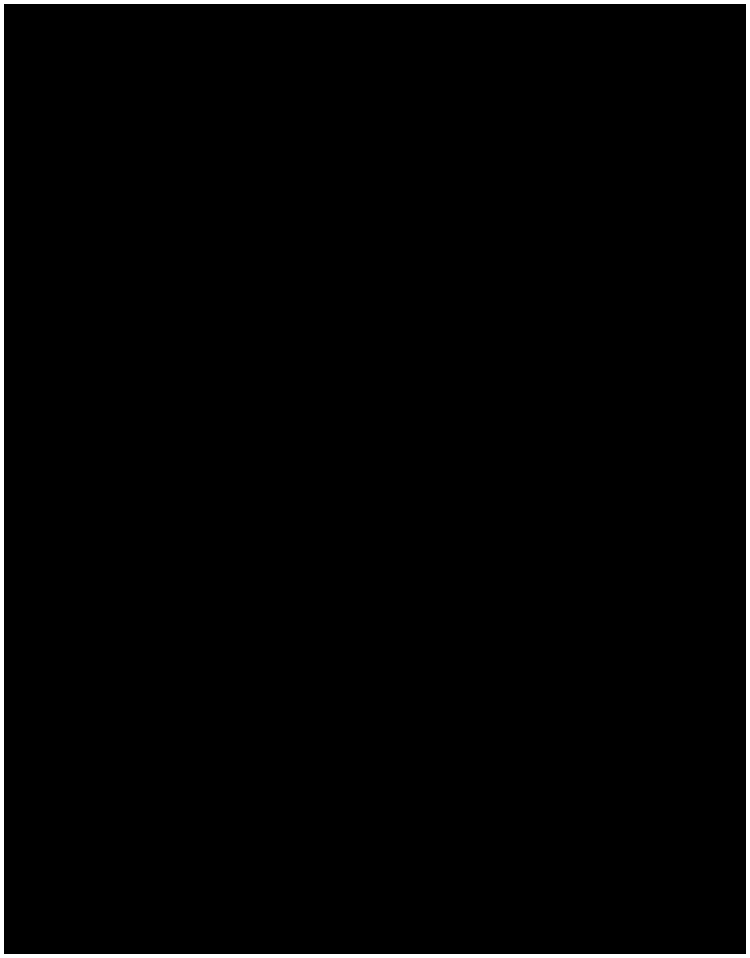

Fig. 5: 7013 Close Coil Solenoid for "A"-Phase

- Approximately 3:50 pm, Engineering Manager met Plant Director at the COM3 substation yard who indicated that the "A" phase of the generator breaker closed, then proceeded to the COM3 control room.
- (See Fig. 6) It was verified that the generator rotor was on the turning gear at 3.5 rpm as normally prescribed when the unit is off-line, then jumped to 7 rpm during the 7-second period when the generator rotor was motorized upon the "A" phase of Breaker 7013 closing. 30,000 A (40,000 A peak) was measured across the A-B phase of the generator rotor.

Fig. 6: COM3 Turbine Speed and Phase Current During Event

Causal and Influencing Factors

- Lack of activity coordination between substations and plant operations.
- Work was conducted on the generator breaker without establishing a robust clearance order/ tag-out to protect the generator in the event of an unexpected system response.