Abnormal Occurrence

Report No. 73-19

SUBJECT: Violation of the Technical Specifications, paragraph 3.7.A.2, in that although both startup transformers were energized to carry power to the station 4160V AC buses, neither transformer could be considered operable due to an improper setting on the C phase differential monitoring relays. Further, during the event (later described under "Situation") neither diesel generator was able to restart after having once been initiated in the "Fast Start" mode and been secured when power was again lost to the 4160V AC buses.

These situations are considered to be abnormal occurrences as defined in the Technical Specifications, paragraph 1.15D (failure of one or more components of an engineered safety feature that causes the feature to be incapable of performing its intended function) and 1.15G (observed inadequacies in the implementation of procedural controls such that the inadequacy causes the existence or development of an unsafe condition in connection with the operation of the plant).

Notification of this event, as required by the Technical Specifications, paragraph 6.6.2.a, was made to AEC Region I, Directorate of Regulatory Operations, by telephone on Saturday, September 8, 1973, at 10:15 a.m., and further elaborated upon personally with Mr. E. Greenman from AEC Region I, Directorate of Regulatory Operations, on Tuesday, September 11, 1973, in the morning during his visit to the site. Further, the problem with the startup transformers was telecopied to AEC Region I on Monday, September 10, 1973, at 1:30 p.m., and the difficulty experienced with the Diesel Generators was telecopied on Thursday, September 13, 1973, at 5:00 p.m.

SITUATION: A plant shutdown had progressed to the point where, with electrical output at approximately 90 MWe, a transfer of station loads from the Auxiliary Transformer to the Startup Transformers was attempted. When a closing signal was applied to the S1A breaker, a loss of power occurred on the 1A 4160V AC bus which, among other things, caused two circulating water pumps, three reactor recirculation pumps, and the operating condensate and feedwater pumps to trip. Diesel Generator #1 was initiated in the "Fast Start" mode, reenergizing the 1C 4160V AC bus, restoring power to the requisite safeguard systems should they have been required. An attempt was made to start the B and C Condensate Pumps, but before either pump could be started, the reactor scrammed due to low water level. In reconstructing the subsequent events, the following seems pertinent:

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1. Following the scram, the 1B 4160V AC bus was energized properly from the SB transformer.

2. The "lockout" relay, 86SA, was reset manually, the S1A breaker was closed, Diesel Generator #1 was synchronized with "system," and the 1C breaker was closed.

3. Diesel Generator #1 was secured. At this time, the "Trouble" alarm was annunciated in the Control Room and an electrician was dispatched to determine the cause.

4. An attempt was made to start the A Condensate Pump, but the in-rush current apparently tripped S1A breaker, Diesel Generator #1 was not initiated in the "Fast Start" mode due to the engine "lockout" relay which has previously been actuated (the cause for the "Trouble" alarm).

5. An attempt was made to start the B or C Condensate Pumps, but the in-rush current apparently tripped the S1B breaker. Diesel Generator #2 was initiated in the "Fast Start" mode reenergizing the 1D 4160V AC bus. For the period of time taken for Diesel Generator #2 to come up to speed, buildup voltage and reenergize the bus (less than 15 seconds), the station was without AC power.

6. Both the SA and SB transformer "lockout" relays were reset manually and both S1A and S1B breakers were closed.

7. Diesel Generator #1 was initiated in the "Fast Start" mode when the electrician reset the engine "lockout" relay.

8. Diesel Generator #2 was synchronized with "system," the 1D breaker closed, and the Diesel Generator was secured. Upon securing the unit, the "Trouble" alarm was annunciated (apparently due to the engine "lockout" relay being activated). The electrician was advised of the situation.

9. Again an attempt was made to start the B or C Condensate Pumps with the same results as before. However, Diesel Generator #2 failed to start.

10. The electrician reset the engine "lockout" relay for #2 Diesel Generator and the unit was initiated in the "Fast Start" mode.

11. With two CRD pumps running, the Control Rod Drive System hydraulic control station bypass valve was opened to assist in the recovery of reactor water level. The minimum level reached, as recorded by the Feedwater Control System level recorder, was 9' above the core, 1'10" above the actuation point for initiating the Core Spray System and isolating the reactor.

12. The MSIV's were closed by the operator and the Isolation Condensers were manually initiated to eliminate the water inventory loss from the vessel and to provide for decay heat removal.

CAUSE: The problem experienced with the Startup Transformer breakers S1A and S1B was traced to an incorrect setting of the current transformer ratio matching taps for the C phase differential relay on both units. In attempting to either carry a sizeable load and/or start a large load, a differential fault current based upon the improper tap setting was sensed, tripping the bus supply breakers. The problem experienced with the Diesel Generators was identified to be as a result of relay contact actuation which is inherent in the design of the circuit (see Figure 1). When the unit is initiated in the "Fast Start" mode, power to the engine fault circuit is cut off. With the unit at speed, the OAD relay is energized closing contacts in the engine "lockout" circuit. Under normal conditions, the bearing oil pressure switch would be closed, enabling the MBR relay to be energized, opening a contact in the engine "lockout" circuit. However, that relay could not be energized due to the opened Fast Start Relay contacts and consequently the bearing oil pressure contacts remained closed. When the unit was stopped, the Fast Start Relay was deenergized, closing the Fast Start Relay contacts. Before the MBR relay could be energized and its respective contacts opened in the engine "lockout" circuit, the "lockout" relay was actuated which prevented a subsequent start. The engines would remain locked out until the relays could be manually reset locally, as was the case.

REMEDIAL ACTION:

The current transformer ratio matching taps were set up properly and station loads were returned to normal. This action was completed by 8:30 a.m. The company Relay Department was contacted and load checks were conducted on each of the transformer phase differential relays. All checks were satisfactory. As regards

the Diesel Generator problem, during the loss of power conditions the "lockout" relays were reset allowing the units to restart. A "Fast Start" test of #1 Diesel Generator was subsequently conducted while monitoring the engine fault relay circuitry, turning up the problem as previously discussed. General Motors has been contacted with regards to a modification which could be made to the circuit to circumvent the problem.

SAFETY SIGNIFICANCE:

The designed redundancy for the station vital power supplies (i.e., off-site power and diesel generators) was not present and, in fact, had not been present since July 30, 1973 when a test of the Startup Transformer phase differential relays had been conducted. Under a bona-fide loss of power condition, both diesel generators would have performed their intended function and, in fact, did since both units actuated to energize their respective buses upon initially sensing undervoltage. However, had a problem arisen, which required a subsequent "Fast Start" immediately after the units had been secured from a "Fast Start," such as occurred here, no AC power would have been available to power any necessary safeguards equipment until the engine "lockout" relays could be reset.

RECOMMENDATIONS:

1. Prepare procedures, in conjunction with the Relay Department, for all Relay Department work in the plant. All work must be coordinated with the Shift Foremen.

2. Prepare a design change to the diesel generator logic circuits to prevent lockout following shutdown of the diesel. General Motors should be contacted for recommendations.

3. Review and revise Procedure 511, as required.

Prepared by: _____ Date: 9/16/73

PORC Approval: _____ Date: 9/17/73

RESPONSE TO ENCLOSURE QUESTIONS
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Section B of Enclosure Questions is pertinent since this event involved both Startup Transformers.

RESPONSE:

B.1 Power to both buses was lost for approximately 15 seconds until the Diesel Generator could start and supply power to one bus. Refer to report for details. NOTE: As described in the report the designed startup transformer capability was lost for a period of approx. 38 days.

B.2 Since the event caused a Reactor Scram Turbine Trip, this question does not appear pertinent. Please review report for details.

B.3 Both automatic and manual actions were taken as detailed in the report.

B.4 No voltage excursions are relevant to the occurrence.

B.5 No frequency excursions are relevant to the occurrence.

B.6 Date of event: 9/8/73