U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-245/85-25
50-336/85-33

Docket No. 50-245
50-336

License No. DPR-21
DPR-65 Priority -- Category C

Licensee: Northeast Nuclear Energy Company
P.O. Box 270
Hartford, Connecticut

Facility Name: Millstone Station, Unit 1 & 2

Inspection At: Berlin, CT and Waterford, CT

Inspection Conducted: October 21-25, 1985

Inspectors: Frederick P Paulitz 11-20-85
F. P. Paulitz, Reactor Engineer date

Approved by: Clifford J. Anderson 11/21/85
C. J. Anderson, Chief, Plant System Section date

Inspection Summary: Inspection on October 21-25, 1985 Report No. 50-245/85-25 and 50-336/85-33

Areas Inspected: Routine announced inspection of: (1) Followup of Unit 2 reactor coolant pump motor failure on September 28, 1985 and (2) Degraded grid voltage detection system and associated operating procedure. The inspection involved 34 inspection-hours on site and three inspection hours in NUSCO office by a region based inspector.

Results: Of the two areas inspected, no violations, deviations, or unresolved items were identified.

DETAILS

1.0 Persons Contacted

1.1 Northeast Utilities

E. Bireley, Licensee Engineer
G. Pitman, Manager, Generation Electrical Engineering
J. Regan, Supervisor, Generation Electrical Engineering
M. Bonaca, System Manager, Reactor Engineering
J. Radder, SCIENT, Safety Analysis, PRA
J. Nowel, U1 Shift Supervisor
*J. Summa, U1 Assistant Engineer Supervisor
J. Stetz, U1 Unit Superintendent
*R. Palmieri, U1 Operation Supervisor
*S. Scace, U2 Unit Supervisor
*W. Romberg, Station Superintendent

1.2 United States Nuclear Regulatory Commission

J. Shedlosky, Senior Resident Inspector
K. Naidu, Vendor Branch, IE
J. Jacobson, Vendor Branch, IE

*Denotes those present at the exit meeting.

2.0 Followup of Unit 2 Reactor Coolant Pump (RCP) Motor Failure

2.1 Pre-Event Conditions

The unit had been shut down at 11:18 a.m. on September 27 because the licensee expected a loss of off-site power. The expected loss of the 345KV switchyard could be caused by flashover of insulators. This would be due to the salt deposits on the insulators as the result of hurricane Gloria passing through the State of Connecticut. The RCP's had been stopped and the reactor was being cooled by natural circulation.

2.2 Event

During the unit restart on September 28 the RCP "C" was started at 5:43 p.m. and immediately the motor breaker tripped open. The breaker trip was caused by the motor protective ground fault relay 50 GS. The relay trip set point is 5 amperes. After waiting one hour, which is the allowable time between restarts, the pump was restarted and again the motor breaker tripped open due to the action of the 50 GS relay. No further attempts were made to restart the pump.

2.3 Cause

A number of work orders were issued to direct an investigation of the protective relay action and to perform any necessary repairs to the motor. The work orders issued for all four motors are listed in Appendix A.

A high potential test of the motor winding revealed that a ground condition occurred at 5,000 volts. The motor rated voltage is 6,600 volts and is normally tested to 14,000 volts. The motor is General Electric Model 295X290, Type K, Frame No. 6396 rated at 6500 HP and 900 RPM.

The motor was uncoupled from the pump and removed for examination. This removal required five days to complete. The rotor was removed from the stator to permit a visual inspection of the stator winding. This inspection revealed that 11 stator windings had sustained insulation damage. In addition, one winding had two copper bars that were partially turned and one of these bars had a gouge that was half through the bar. The damage was near the stator laminations which could make the repair difficult. A high potential test, with the rotor removed, revealed that a potential of 12,000 volts was required before the winding conducted to ground.

The cause of the stator damage was a loose rotor lamination retention finger. There are 132 fingers located at each end of the rotor between the rotor bars and the amortisseur ring. These fingers have a shoulder that engages a groove in a hold down ring that is located below the amortisseur ring at each rotor end. The hold down ring is secured by ten bolts that screw into the spider which is part of the rotor shaft. When the bolts are torqued to the specified 400 foot pounds this force is transmitted through the hold down ring to the finger which then holds the rotor laminations in compression. The licensee believes that lamination shifting may have caused the lamination compression to decrease and allow the finger to become loose. This resulted in the stator winding damage.

2.4 Safety Evaluation

The RCP motor and its source of electrical power is classified as non Class 1E electric. The loss of reactor coolant flow which could result from a motor or electrical power failure is an analyzed event.

2.5 Immediate Corrective Action

The insulation around the damaged stator windings were cleaned. The windings were reinsulated, using a combination of mica and epoxy, under the supervision of the motor vendor. The two copper bars that

were moved from their original position by the loose rotor finger were not repositioned, due to the potential of damage to the bars. These bars were reinsulated in place.

The damaged rotor finger was removed and a weight welded at that location to provide for proper balance. The bolts were retorqued to 400 foot pounds. Clearances were checked between the hold down ring and the rotor spider. This clearance is required to assure that the force is applied to the rotor lamination by the fingers and not to the rotor spider. The other three RCP motors were also removed and their bolt torque checked. They had a similar condition as the "C" pump. Some bolts were found finger tight with a torque value of about 30 foot pounds. One of the pump motors required the rotor lamination stack to be moved to provide the necessary clearance between the hold down ring and the rotor spider. All of the motors were replaced, but left uncoupled from their pumps for further surveillance tests.

2.6 Surveillance Tests

The licensee has included the RCP motors in the Inservice Test Program since August 1985. Each of the motors were run uncoupled from their pumps and measurements taken for vibration, bearing oil flow and temperature. The RCP "C" motor was energized at 3:07 p.m. on October 22. The motor starting current decreased to the running condition after about 8 seconds. The motor continued to run until it was stopped by the operator after 20 minutes later. The decision to stop the motor was a result of a high differential pressure across the temporary upper bearing oil filter. The recorded pressure of 2.7 pounds was approaching the 3 pound vendor recommended limit to assure adequate oil flow. After the filter was replaced, the motor was again energized at 7:00 p.m., and was run satisfactory for 3 hours before being stopped. The other three RCP motors and connected cables were given a DC leakage current test before they were removed from the pumps for further inspection. For all of the RCP motors their stators were given a hi pot test before the rotors were removed, after the rotor was reinstalled, and again after the motor was resintalled. The test indicated that there were no problems associated with the motor insulation.

2.7 Long Term Corrective Action

The licensee has purchased a spare RCP motor from General Electric Canada about a year ago with delivery expected by about November 1, 1985. This is also the time the plant is expected to restart from the "C" RCP motor failure. The repaired motor will be replaced at the next refueling outage by the spare motor. The "C" RCP motor would then be refurbished and used to replace one of the other motors during the following refueling outage. This process would continue until all the motors have been refurbished with the last one being

the spare. The new motor purchased has each rotor lamination made from one punching which is secured and compressed in a different manner than the original installed motors.

2.8 Conclusion

The immediate and long term corrective action along with the Inservice Inspection Program should assure reliable operations of the RCP's.

3.0 Degraded Grid Voltage

3.1 Background

Following a trip of Millstone Point Unit 2 on July 5, 1976 the grid voltage dropped from 352KV to 333KV. This voltage drop, together with additional voltage drops associated with the transformers involved, together with voltage drops in power and control cables, reduced the control power voltage within individual 480 volt controllers, to a voltage which was insufficient to actuate the main line controller contactor. As a result, the control power fuses were blown. Since these contactors are used for 480 volt motors including motor operated valves, these electrical components could not function. In addition, because the motor operated valves positions are interlocked with their respective charging pumps the "A" charging pump failed to start.

The licensee concluded that under similar low voltage conditions, the operability of 480 volt Engineered Safety Features equipment might no longer be assured. All licensees were requested by the NRC in a Generic Letter to analyze their off-site/on-site voltage relationship and provide the necessary detection of limits for the degraded grid voltage condition and the automatic protection of the on-site Class 1E electric system components.

The licensee was requested to provide automatic protection of the class 1E electric system for a degraded grid voltage condition with or without a loss of coolant accident (LOCA) condition. This automatic protection included detection of low grid voltage and separation of the class 1E busses from the offsite grid. The loads would also be stripped from the busses. The standby emergency diesel generators would be started and connected to their respective busses. This would be followed by the necessary loads being automatically reenergized. Due to the large number of nuclear power plants in the New England area the licensee requested that this automatic protection be only applied when there is a degraded grid voltage condition at the same time there is also a LOCA event. The effect of separating from the grid during a degraded grid voltage condition is further degradation of the grid. Based upon this consideration the licensee was

requested to develop an operating procedure which would give guidance to the operator for action to protect the Class 1E system from the degraded grid voltage condition when there was no LOCA event.

3.2 Procedure

The Operating Procedure Number OP 340, revision 21, change 0, Effective date August 25, 1983 Title 24KV Electric System was discussed with the licensee personnel engineering and operating staff. This procedure pertains to Unit 1. Procedures applicable to Unit 2 were not reviewed as part of this inspection. The Unit 2 procedures were discussed previously in inspection report 50-336/85-19.

The following details in the operating procedure were noted:

When a alarm is received that there is 345KV on the reserve station service transformer primary the operator takes the following action:

•Request CONVEX to raise the system voltage above 345KV or 347KV if unit 1 is supplying power via the 4.16KV system to unit 2.

•Notify the Duty Officer.

•If the voltage cannot be raised above the alarm point or the generator current is greater than 17.5 Kilo amps the following operations are taken:

-- Notify CONVEX that reactor power is being reduced until the generator current is normal. The power reduction is accomplished by reducing the speed of the recirculation pumps. The power reduction is about 10%.

-- If after the above reduction the 345KV system voltage has not returned to normal start the gas turbine and diesel generator and let them idle.

-- Monitor bus voltage on 4.16KV Class 1E busses. If the voltage drops to 3646 volts on any two busses notify CONVEX that the Station want to open the Unit 1 generator breaker at the 345KV switchyard.

-- Prior to opening the generator breaker the main steam bypass valves are opened about 10% using the speed load changer. After CONVEX gives permission the breakers are opened and the generator speed and excitation are adjusted.

•The station electrical service is being supplied power from the unit 1 main generator and is not subject to the degraded grid voltage condition.

3.3 Evaluation

The operating procedure 24KV Electrical System, OP 340, revision 21, for degraded grid voltage has been revised (change 1) effective date February 1, 1985 to include operator attention that in addition to the 345KV alarms for a degraded grid voltage condition the alarms from the new sensors on 4.16KV busses 14A, 14B, 14C and 14D may also be received. These alarms are identified in operating procedure 4160 Volt Electrical System, OP 341, revision 13 effective date February 1, 1985. The operator would monitor the voltage of the above busses.

3.4 Conclusion

The operating procedure OP 340 provides a technically acceptable means by operator action to protect the Class 1E electrical system during a degraded grid voltage condition without a coincident LOCA condition.

4.0 Exit Interview

The inspector met with the licensee personnel denoted in Detail paragraph 1 at the conclusion of the inspection on October 25, 1985. The inspector summarized the purpose and scope of the inspection. The licensee acknowledged the inspector's findings. At no time during this inspection was written material provided to the licensee by the inspector.

APPENDIX A

Work Order Number

M2 85 11413 "A" Reactor Coolant Pump Motor
Remove motor from pump, disassemble motor, inspect, repair and reassemble motor as necessary. Reinstall and align motor to pump.

MO2 85 11440 "A" Reactor Coolant Pump Motor
Perform inspection of stator and rotor. Hipot stator before rotor removal, after rotor installation, and again after motor is re-installed. Test surge capacitors. Make current and phase ampere checks during motor test run.

M2 85 11463 "A" Reactor Coolant Pump Motor
Inspect and repair motor per Special Procedure SP 85-2-18 and 85-2-19.

M2 85 11336 "B" Reactor Coolant Pump Motor
Remove motor for inspection of rotor bolt torque

M2 85 11442 "B" Reactor Coolant Pump Motor
same as M2 85 11440 "A" RCP

M2 85 11456 "B" RCP Motor
Motor rotor spider ring bolts were found to be loose and some rotor finger out of place. Repair per special procedure.

M2 85 11053 "C" RCP Motor
Ground indicated on C phase, repair and replace under other AWOs.

M2 85 11199 "C" RCP Motor
Repair stator damage, check torque on rotor spider fingers.

M2 85 11240 "C" RCP Motor
Repair rotor and stator winding per GE Tech Rep

Ms2 85 11272 "C" RCP Motor
Perform electrical tests on motor as necessary. GE performed repair and motor was tested to a maximum of 12KVDC

Cause of probem was loose rotor clamping system due to insulation shrinkage over the past 12 years.

M2 85 11339 "D" RCP Motor
Remove inspection plates on lower bearing housing to check torque on rotor bottom. If repairs are to be made use either AWO.

M2 85 11441 "D" RCP Motor
same as M2 85 11440 "A" RCP Motor

M2 85 11674 "D" RCP Motor
same as M2 85 11463 "A" RCP Motor

M2 85 11412 "D" RCP Motor
Remove motor from pump, disassemble motor inspect, repair and reassemble motor, reinstall and align motor to pump.