Commonwealth Edison
Dresden Nuclear Power Station
R.R. #1
Morris, Illinois 60450
Telephone 815/942-2920

50-237

PRINCIPAL STAFF			
DIR		E&IS	
D/D		PAO	
A/D		SLO	
DR&PI			
DE&TI			
DEP&OS		File	

December 4, 1981 orig+1

DJS Ltr. #81-951

IE HQ FILE COPY

Mr. James G. Keppler, Regional Administrator
Directorate of Regulatory Operations - Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

SUBJECT: Results of an Investigation into the Unit 3 and Unit 2/3 Diesel Generators at Dresden Nuclear Power Station on October 23, 1981, and November 19, 1981

Dear Mr. Keppler:

While conducting surveillance tests on October 23, 1981, Dresden Station experienced trips of both the Unit 2/3 and Unit 3 Emergency Diesel Generators. The cause of the trips of the diesels is believed to have been insufficient cooling water flow to the diesel heat exchangers, resulting in protective action trips of the diesels from high temperature. On November 19, 1981, a similar high temperature trip of the Unit 3 Emergency Diesel Generator occurred. The cause of this trip is also believed to have resulted from insufficient cooling water flow to the diesel heat exchanger.

As a result of concerns raised about the operability of the diesel generator cooling water pumps, we have taken action to preclude recurrence of the diesel generator trips and to ensure that the pumps remain operable. Some of these actions have been detailed in Confirmatory Action Letters from your office on November 20, 1981, November 25, 1981, and December 2, 1981. As described in your December 2, 1981, letter, the Unit 2/3 and the Unit 3 diesel cooling water pumps are presently operating continually, and all three cooling water pumps are being vented or inspected twice during each shift.

Operability of the Diesel Generator Cooling Water Pumps

We have conducted an extensive review of the operability of the Unit 2/3 and Unit 3 Diesel Generator Cooling Water Pumps. Our investigation has included the following:

1. Extensive testing of the pumps utilizing DOS 6600-11 (the diesel generator cooling water pump operability surveillance) and DOS 6600-1 (the diesel generator operability surveillance), as well as special pump tests with different suction and discharge piping arrangements.

2. Review of the cooling water system piping and design.

Gen.

DEC 16 1981

IE14
s
1/1

3. Review of the diesel generator cooling water pump design and discussions with the pump manufacturer.

4. Review of testimony of the operators involved in these events.

5. Review of the diesel generator alarms received and printed on the computer alarm typer during the events.

6. Review of the diesel generator control and alarm system logic and circuitry.

The investigating team consisted of station personnel, personnel from our corporate Station Nuclear Engineering Department, and an outside consultant. Based on our investigation, we conclude that the Unit 2/3 and Unit 3 diesel generator high temperature trips resulted from restricted flow in the cooling water lines to the heat exchangers. The flow restriction resulted from failure of the discharge check valves in both the Unit 2/3 and Unit 3 cooling water pump discharge lines. In both cases, the check valve disc had separated from the valve operating arm. This check valve disc causing the flow restriction is consistent with the tests performed and the observed behavior of the pumps. Both check valves have been replaced with new valves, and the similar valve for the Unit 2 diesel has also been replaced. We are revising the diesel preventative maintenance procedures to require that these check valves be inspected annually and replaced or repaired as required.

Further, we conclude that the diesel generator cooling water pumps were operable and did operate normally during the October and November events. The pumps have been operable throughout the period of our investigation. None of our testing has shown any indication of pump abnormal behavior.

Instrumentation

The results of our investigation indicated that two significant problems exist in determining pump operability and in troubleshooting potential cooling water pump malfunctions.

At the heat exchangers in the Diesel Generator rooms, personnel are hampered in determining that the heat exchangers are receiving proper flow because of inadequate instrumentation. Pump running lights are installed in the diesel generator room, which are operated by contacts at the pump breaker, to provide one indication of proper pump operation. However, the operators must infer pump flow from readings of cooling water pressure at the inlet and outlet of the heat exchangers. These pressure readings are indicated on gages which have a range of 0-200 psig. However, because the pressure drop across the heat exchanger is less than two psi, and because of vibrations at the heat exchangers, the installed gages provide an unreliable indication of cooling water flow. We have concluded that a more accurate indication of flow should be installed, and we have initiated an engineering study to design and provide that instrumentation. Currently, we believe that pressure gages with a narrower range, combined with temperature indication across the heat exchanger, should resolve this deficiency.

We have also determined that the present pump discharge gage piping and arrangement can result in unreliable readings, or readings not indicative of the actual pump discharge conditions. Because these are canned rotor pumps, there are no local indications other than pump discharge pressure that the pumps are actually operating. The cooling water pump discharge pressure gage is installed on the line supplying lubricating water to the pump motor bearings. (See Sketch on page 6).

During testing of the Unit 2/3 diesel cooling water pump, the following was observed:

1. The discharge pressure gage read 30 psig with the vent valve closed, "Y" strainer blowdown valve closed and the remaining two valves full open.

2. Upon opening the "Y" strainer blowdown valve, the discharge pressure gage reading decreased to zero.

The above test was then repeated on the Unit 3 diesel generator cooling water pumps. The discharge pressure gage reading decreased 25 psig (50 psig to 25 psig) when the strainer blowdown valve was opened. Thus, opening the vent and blowdown valves dramatically lowers the "indicated" pump discharge pressure, and can mislead an operator about the actual (higher) pump discharge pressure. We believe this phenomena resulted in the "apparent" low pump discharge pressures reported by the operators during the October events. We have added an additional discharge pressure gage directly off the discharge volute of all the diesel generator cooling water pumps to provide an accurate indication of pump discharge pressure. (See sketch)

Also reported during these events was a low pressure stream of water while venting the pump. Subsequent tests showed that when venting the pump with both the vent valve and the strainer blowdown open that the stream of water is only slightly greater when a pump is running. The observation of low pump noise during these events was proved to be consistent with flow restriction by subsequent tests which indicated that pump is actually quieter with the discharge valve closed than with that valve open.

The review of the November 19 event has indicated that the same conditions were present as those that had occurred on October 23 with one exception. A reported air/water mixture from the pump vent is now believed, based on subsequent tests, to be an atomizing effect that can occur only by partially opening the vent valve (gate valve). We believe the air/water mixture which the operator reported as being observed was caused by this penomena.

Other Items Investigated

As a result of the reported pump low discharge pressure during the October events, we suspected that the suction piping to the diesel generator cooling water pumps might have been blocked by debris or other material, or that the pumps may have become airbound during maintenance operations on the circulating water pumps which required dewatering the 3B suction bay. Also considered was the possibility

of a pump runout condition. As a result, we did the following:

1. Pumps were vented daily - no signs of air.

2. Checked for air in the suction piping using ultrasonic and X-ray techniques - no indications of air.

3. Injected air into the suction of the Unit 3 cooling water pump - were unable to airbind the pump.

4. Inspected the cooling water side of the diesel generator heat exchangers for debris and foreign material - no evidence of foreign material that might have blocked the cooling water pump suction lines.

5. Opened another suction line to provide redundant suction lines to the Unit 2/3 diesel generator cooling water pump and chained and locked all pump suction, discharge, and cross connect valves in their proper position. We are reviewing the procedures for dewatering and filling a circulating water pump bay to ensure air is not trapped in the lines or pumps as a result of these operations.

6. Based on the review by Station Nuclear Engineering Department and an outside consultant, it was determined that a large flow and low discharge piping restriction condition would be necessary to cause pump runout - this condition was not observed during the events.

In addition, the following should be noted:

1. All three diesel generator cooling water pumps were operated successfully on October 5, 1981. (Surveillance DOS 6600-11) which was after dewatering suction bay 3B.

2. The diesel cooling water pumps have a suction head (positive pressure at the pump suction) rather than suction lift and air inleakage is unlikely.

3. Blockage of the suction would reduce the net positive suction head available to pump resulting in cavitation and noisy pump operation - this was not observed during the events.

Based on the above and our investigation, we conclude that air binding and/or suction piping blockage or pump runout were not contributing factors to the October and November events.

We also evaluated the possibility of a locked rotor. In this case, the pumps would trip on thermal overload and manually resetting at the motor control center would be required. This was not experienced during these events.

All parts of the electrical system related to the operation of the cooling water pumps have been checked and/or tested with no abnormalties noted.

Conclusions

We believe that the cause of the diesel generator trips in October and November was flow blockage by the disc of the cooling water pump discharge check valves. As described above, the conflicting observations to a check valve failure have been explained. The apparent spurious starts and stops are now believed to have been either operator manual starts and stops or as an expected result of resetting the diesel generator high temperature. Therefore, the check valve failure is consistent with all the observations made during the event. The discharge check valves on all three diesel generator cooling water pumps have now been replaced with new valves. Our review further indicates that no other failures have occurred. We have, however, made some additional changes (Page 4, Item 5) to further ensure that the diesel generator cooling water pumps remain operable, and we are providing additional instrumentation to assist the operators in troubleshooting any further problems.

Based on our investigation, we believe that the circumstances which account for the observed behavior during the October and November events with the Unit 2/3 and Unit 3 diesel generator cooling water pumps have been identified and explained, and that the probability of similar events occurring has been significantly reduced. We feel that the conditions of your November 25, 1981, Confirmatory Action Letter have been satisfied. After concurrence by your office, we will return the operation of the Unit 2/3 and Unit 3 diesel cooling pump to their normal standby condition, and we will resume normal surveillances of their operability.

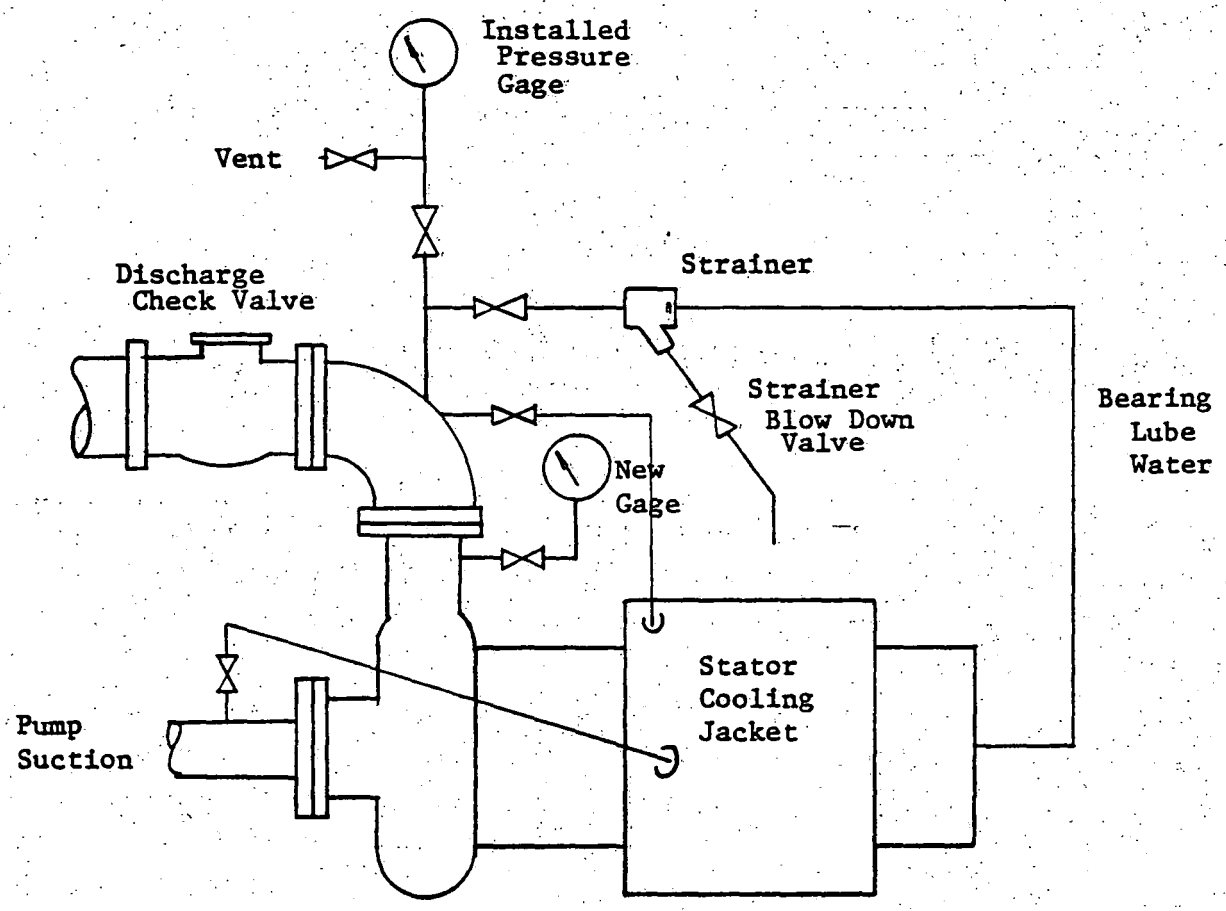
Very truly yours,

D J Scott

D. J. Scott
Station Superintendent
Dresden Nuclear Power Station

DJS/DLF/jrh

cc: C. Reed
F. Palmer
J. Abel
D. Farrar
File/NRC
File/Numerical


Installed
Pressure
Gage
Vent
Discharge
Check Valve
Strainer
Strainer
Blow Down
Valve
Bearing
Lube
Water
New
Gage
Stator
Cooling
Jacket
Pump
Suction