U. S. ATOMIC ENERGY COMMISSION
DIVISION OF COMPLIANCE
REGION I

CO Inspection Report No. 50-219/71-05

Subject: Jersey Central Power & Light Company

Oyster Creek 1 License No. DPR-16

Location: Forked River, New Jersey Priority

Category C

Type of Licensee: 1930 MWt BWR

Type of Inspection: Special, Announced

Dates of Inspection: November 19, 1971

Dates of Previous Inspection: October 7 - 8, 1971

Principal Inspector: F. S. Cantrell, Reactor Inspector — Date 12/17/71

Accompanying Inspectors: T. Young, Jr., Reactor Inspector — Date 12/17/71

Date

Other Accompanying Personnel: None

Date

Reviewed By: G. L. Madsen — Date 12/17/71

G. L. Madsen, Acting Sr. Reactor Inspector

Proprietary Information: None

Section I

Enforcement Action:

The reactor remained in the start - up mode for approximately one day with only one isolation condenser operable, in violation of paragraph 3.8.D of the Technical Specifications. (Paragraph 5)

Licensee Action on Previously Identified Enforcement Matters:

Not applicable.

Unresolved Items: Not applicable.

Status of Previously Reported Unresolved Items: Not applicable.

Unusual Occurrences:

A. A complete loss of instrument air occurred due to the rupture of a flexible connection in the discharge line of the "A" air compressor. (Paragraph 2)

B. One main steam isolation valve (MSIV) failed to close while testing because of a fractured cushion spud in the speed control cylinder. (Paragraph 4)

C. The motor burned out on the normally closed condensate valve on the B isolation condenser; thus rendering the isolation condenser inoperable. (Paragraph 5)

D. Two control rods did not insert the last six inches following the manual scram that was initiated because of the loss of instrument air. (Paragraph 3)

Persons Contacted:

Mr. T. McCluskey, Station Superintendent
Mr. J. Carroll, Operations Supervisor
Mr. E. Riggle, Maintenance Supervisor
Mr. R. McKeon, Shift Foreman

Management Interview:

The following subjects were discussed by Messrs. Cantrell and Young with Mr. McCluskey on November 19, 1971:

A. The failure of two control rods to insert completely when scrammed - The inspector stated that the review of this matter confirmed OC's conclusion that this failure was not a significant safety problem, and that the test results indicate that the probable cause was the throttle valve on the charging header, which prevented adequate make up in the event of a scram. Mr. McCluskey stated that the initial valve position check procedure would be changed to specify the proper valve setting.

B. The failure of a main steam isolation valve to close - Mr. McCluskey stated that all but one of the MSIVs had been inspected and no other problem had been found. He stated that other MSIVs would be inspected before the reactor was returned to power. (Mr. McCluskey informed the inspector by telephone on November 22, 1971, that inspection revealed that the cushion spud in this valve was cracked and required replacement; however, there was no indication that the crack had impaired the operation of the valve.) He stated that the Plant Operations Review Committee (PORC) had reviewed the failures and had approved returning to power. He stated that the plant had contacted the manufacturer to obtain assistance in determining the cause of the "cushion spud" failure. He stated that a written report of the failure would be made to DRL within 10 days as required by the Technical Specifications.

C. Loss of instrument air - Mr. McCluskey stated that a replacement for the failed flexible connector was being fabricated by the vendor, was due in the plant later that night, and would be installed before startup. He stated that all systems responded as expected when air pressure was lost. He stated that Jersey Central was considering installing check valves in the air compressor discharge lines to prevent a complete loss of instrument air as a result of a similar failure. Mr. McCluskey agreed that a written report of the failure would be made to DRL; however, his interpretation of the requirements of the Technical Specifications was that the failure did not require a "10 day written report".

D. Failure of isolation condenser condensate valve - The inspector stated that continued operation in the startup mode for control rod testing on November 17 and 18, 1971, with the condensate valve inoperable, was in noncompliance with the requirements of the Technical Specifications (paragraph 3.8.D). Mr. McCluskey agreed that the Technical Specification requires both isolation condensers to be operable in the startup mode; however, from a quick review of the Technical Specifications it appeared that one isolation condenser could be inoperable for seven days; however, a more thorough review on November 18, 1971, which

included the basis for the Technical Specification, showed that both isolation condensers were required with the plant in the "startup" mode. He stated that a decision was made to complete the control rod testing before returning to a cold shutdown condition. Mr. McCluskey agreed to submit a written report of this failure to DRL within 10 days as required by the Technical Specifications.

Section II

Details of Subjects Discussed in Section I

1. General

On November 16, 1971, at about 9:50 am, the control room received several alarms, including "air receiver low pressure", "control rod drive low air pressure", and "rod drift alarm". An instrument check showed that the air pressure was dropping and that several control rods had scrammed individually. The operator initiated a manual scram as required by the emergency procedure, "Instrument Air Failure". (The operator estimated between 5 and 20 rods had scrammed, prior to the manual scram; and that a maximum of 15 seconds elapsed between the first "rod drift" alarm and the manual scram. Two control rods (18-11 amd 30-31) failed to insert the last six inches. The loss of instrument air was caused by the rupture of a flexible connection on the discharge pipe of the on-line air compressor.

The reactor was brought to cold shutdown condition using the main condensers and the isolation condensers. Subsequently, the reactor was made critical and pressure was increased to 800 psi, using nuclear heat, in order to measure scram times of selected control rods and to determine the reason the two control rods failed to fully insert. During this period, with the reactor in the startup mode, one of the isolation condensers was determined to be inoperable. A dc operated motor on the condensate valve was shorted out, thus preventing activation of that isolation condenser. The planned control rod testing was completed before the reactor was returned to cold shutdown on November 19, 1971.

While the reactor was pressurized, the closure time of the main steam isolation valves was measured. One inside valve failed to close. A fragmented "cushion spud" in the hydraulic speed control cylinder was determined to be the cause of failure. An inspection of the other three hydraulic spud control cylinders revealed that one cylinder contained a fractured cushion spud.

Following repair and testing of the main steam isolation valves, repairs to the dc operated condensate valve in the isolation condenser, and replacement of the flexible connection that ruptured on one of the instrument air systems, the plant was brought on line on November 23, 1971.

2. Loss of Instrument Air

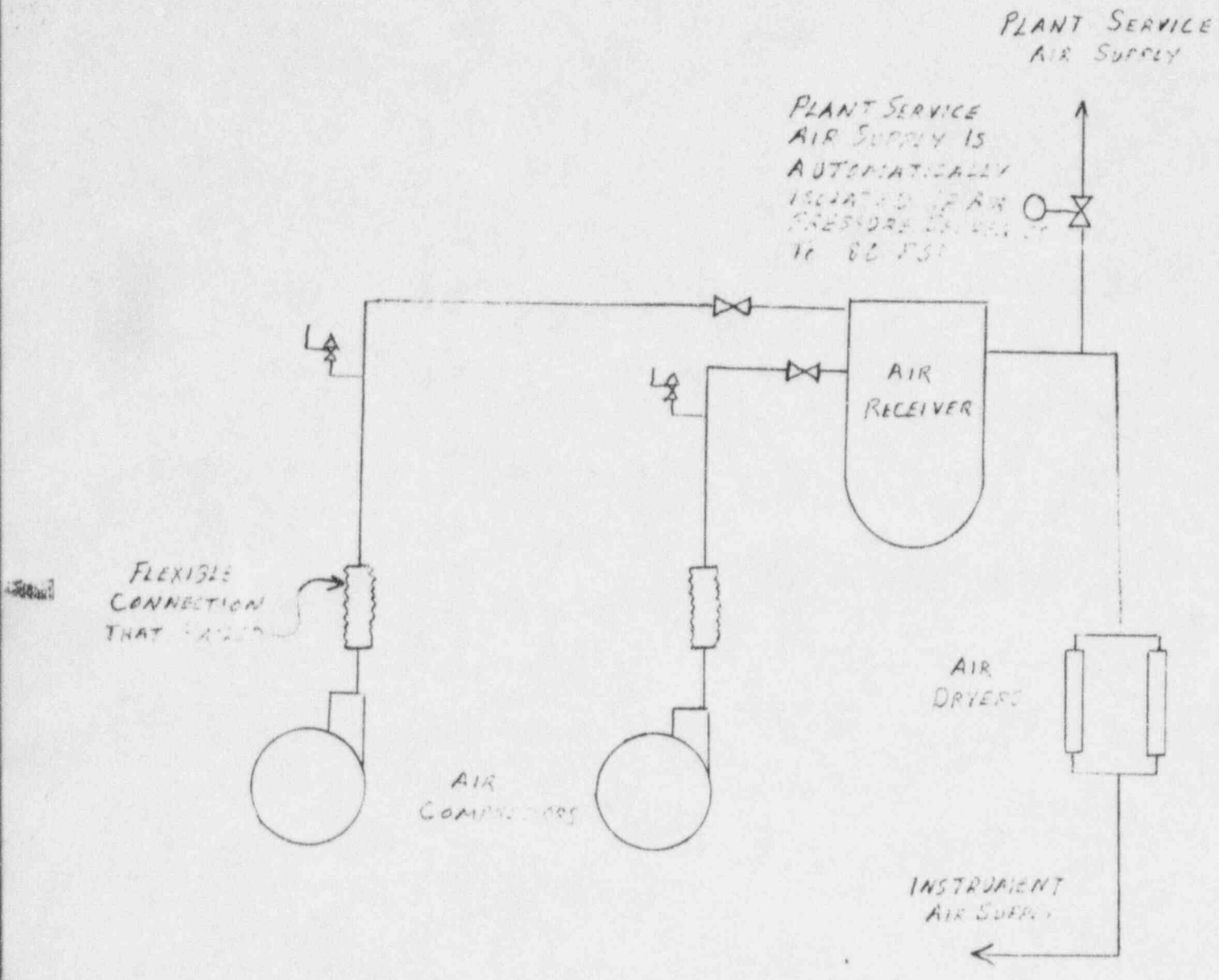
Records show the plant was shutdown by a manual scram on November 16, 1971 due to the loss of instrument air. The investigation showed that a 6" flexible connection on the discharge of the compressor ruptured catastrophically. (See sketch) The line between the compressor and the air receiver does not have a check valve. As a result, the standby compressor started, but could not supply enough air to maintain system air pressure and eventually tripped out. Plant service air was automatically isolated from the air receiver (the service air isolation valve is set to close at 80 psi). Instrument air pressure dropped to essentially "0" pressure. After the leak was isolated by closing the manual valve in the discharge line, the standby compressor was restarted. The operations supervisor stated that air pressure was below 50 psi for a period of 20 - 25 minutes (50 psi is the pressure at which the control operator is required to initiate a manual scram). Air pressure is indicated on a gage in the control room.

According to the maintenance supervisor, specifications for the failed flexible connection were obtained from the vendor of the air compressor and a new flexible connection was fabricated to the same specifications, except a double wire braid was specified for the replacement, instead of a single braid. (A piece of thin wall 6 inch flexible pipe was welded to two 150 psi pipe flanges. The flexible pipe was reinforced with a double wire braid in order to minimize the possibility of a sudden failure.) The replacement flexible connection was installed before the reactor was returned to power.

Jersey Central's evaluation of the cause of the failure was that the weld points in the connection are where the flexible pipe is welded to the pipe flanges and that the flexible connection was originally installed with a strain, created by misalignment of the flanges. As a result of vibration, failure started at the weld and continued until the flexible connection was completely separated.

According to the maintenance supervisor, each compressor discharge line is protected by a safety valve that is set to relieve at 137 psi. According to the operations supervisor, the safety valves have not been retested since being installed and there are no requirements for periodic testing.

Plant Air Supply



3. Failure of Two Control Rods to Fully Insert When Scrammed and a Measured Increase in Average Scram Time

Two control rods (18-11 and 30-31) stopped at the "02" notch (approximately 6 inches from full insertion) when the reactor was scrammed on November 16, 1971. In the investigation of the cause, the throttle valve in the charging header was determined to be 1 1/2 turn open rather than a normal 4 turns open. (The proper valve position provides a 60# pressure drop across the valve when the control rods are scrammed with reactor pressure greater than 800 psi.) In order to confirm that mispositioning of the throttle valve was the prime cause of the two rods not fully inserting, both rods were scrammed with the reactor at 800 psi, both with the individual accumulator charging water valves open and with the valves closed. Scram times were also measured for these and other positions. When the individual accumulator charging valves were open, both control rods drove to the fully inserted position ("00" notch). When scrammed with the individual accumulator charging valve closed, both control rods stopped at the "02" notch. Scram times were as follows:

	Charging Water Valved	
Position	On	Off
18-11	3.59 sec.	3.98 sec.
30-31	3.62 sec.	4.03 sec.

The eight select rod drives* that are monitored for scram insertion time by a recorder, showed an average scram time of 3.25 seconds for 90% insertion at a reactor pressure of 800 psi on November 18, 1971. TS 4.2.C.2 requires the average to be in the range of 2.4 to 3.1 seconds and the individual insertion time to be in the range of 1.9 to 3.6 seconds or an evaluation be made to provide reasonable assurance that proper control rod drive performance is maintained.

Jersey Central concluded that the control rod scram times are affected by reactor pressure and that the higher average scram time was a result of the scram being initiated with reactor pressure at 800 psi and that the results seen were acceptable.

*Required by TS 4.2.C.2.

The following data was reviewed by the inspector:

a. The individual scram times were all in the range of 1.9 to 3.6 seconds

b. The scram time for all control rods was measured on November 10, 1971 from 1000 psi. The average time for 90% insertion was 2.90 seconds.

c. The measured eight control rods all have internal strainers. One other control rod drive does not have internal strainers. This rod was scrammed and timed from both 800 psi and 1000 psi. The scram time at 1000 psi was 2.68 seconds and at 800 psi - 3.15 seconds.

d. Prior to the approval of Amendment No. 3 to Operating License and Change No. 7 to the Technical Specifications, the scram time for 25 selected control rod drives was measured by the recorder. The average times measured were as follows:

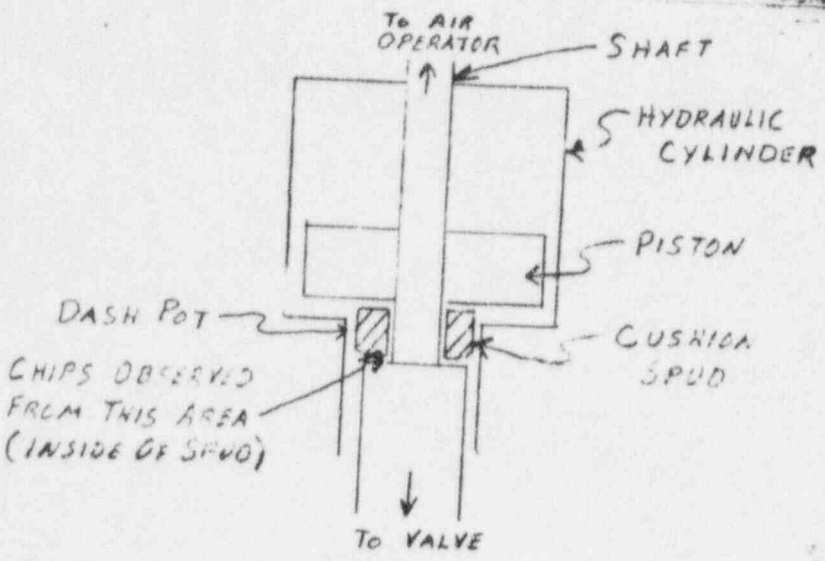
October 2, 1970	2.72 seconds
December 25, 1970	2.85 seconds
November 10, 1971	2.90 seconds

e. The individual scram time for two control rods that were in both the 25 rod group and the 8 rod groups is shown below:

Date	Reactor Pressure	Position	
		10-19	8-11
		(seconds)	
May 22, 1970	1000	2.89	2.76
Dec. 25, 1970	1000	2.87	3.11
Dec. 25, 1970	1000	2.91	3.18
Nov. 10, 1971	1000	2.96	3.23
Nov. 18, 1971	800	3.25	3.59

4. Main Steam Isolation Valve Failure

While timing the closing of the MSIVs prior to startup on November 17, 1971, NS03B which is located inside containment, failed to close. The containment was deinerted and the valve was disassembled to determine the cause of the failure. The inspection showed that the "cushion spud" in the hydraulic cylinder had fragmented and a segment of the "cushion spud" caused interference between the piston and the cylinder wall.



The cushion spud is "captured" between the piston and a larger shoulder of the shaft. In the above sketch the piston is shown with the valve in the closed position and the cushion spud in the dash pot. This cushion spud and dash pot decelerates the valve plug assembly just prior to seating.

The valves are 24 inch Atwood and Morrill Co. valves, Model 204SI-H. The valve operator is a Hydro-Line Manufacturing Co., Rockford, Ill., Model 612-003-1B with a hydraulic dash pot Model N2K with 6 inch Bore x 13 inch stroke.

The other 3 MSIVs were inspected for the same defect. (NS03A on the same line subsequently was reported to have a cracked cushion spud, but the fracture had not impaired the operation of the valve.)

According to Mr. Riggle, the manufacturer provided the specifications for the cushion spud and a replacement was machined to the manufacturer's specifications.

Mr. Carroll reported by phone November 21, 1971 that the valves had been reassembled and tested. The outside valves were set to close in eight seconds and the inside valve was set for six seconds.

5. Failure of Isolation Condenser Condensate Valve

On September 18, 1971, the overload heaters on valve No. V1435 were found open. The valve was opened to activate the isolation condenser but would not close. Valve 1435 is a 10 inch valve with a 4 hp dc motor operator. The valve is located in the isolation condenser condensate line. During normal operation, this valve is closed and all other valves are set in the position required for emergency operation. Since the valve is dc powered, only battery power is required to open the valve and activate the isolation condenser. Following closure of the overload heaters the valve was cycled several times satisfactorily, but the cause of the failure was not determined. The valve was returned to service. The valve operated satisfactorily when the isolation condenser was initiated following a scram on November 16, 1971; however, the valve would not operate while attempting to measure the time for opening and closing during the evening shift on November 17, 1971. Subsequently, on November 18, 1971, maintenance personnel determined the cause of the failure to be a burned out motor. The heater and breaker had not tripped; however, an intermittent ground was detected when a signal was initiated to operate the valve. The motor was returned to the vendor for reworking. After reinstallation, the valve operation was tested satisfactorily on November 20, 1971. The vendor indicated the failure may have been caused by oil on the windings.