Jersey Central Power & Light Company

MADISON AVENUE AT PUNCH BOWL ROAD • MORRISTOWN, N.J. 07960 • 539-6111

October 8, 1970

Dr. Peter A. Morris, Director
Division of Reactor Licensing
United States Atomic Energy Commission
Washington D. C. 20545

Dear Dr. Morris:

For Div of Compliance

Subject: Docket No. 50-219
Oyster Creek Unit No. 1

The purpose of this letter is to confirm recent discussions held with Mr. R. McDermott of the Division of Compliance--Region I, regarding operational problems experienced at Oyster Creek, particularly the turbine hydraulic and mechanical control system.

The reactor had been operating since May 1970, without any significant operational problems until September 16, 1970, when the reactor was shut down because of an increase in the rate of unidentified leakage in the primary containment. The Technical Specification limit of 5 GPM had not been reached prior to shutdown. After correcting valve packing leaks, the unit was restarted. The generator was on the line at 3:50 p.m. on September 17, 1970.

At 11:01 p.m. on September 17, 1970, the turbine tripped while carrying a load of 400 MWe as the result of high level in the moisture separator drain tank. The reactor scrammed on high flux and all safety systems functioned as required.

The event of the turbine trip was preceded by an oscillation of approximately 2 to 5 MWe in generator load. Steam flow began to fluctuate and reactor pressure decreased slightly. The generator had been operating at 530 MWe, approximately 1600 MWt, and load was reduced to 400 MWe by recirculation flow, when the oscillation ceased. At this point, the turbine tripped.

Upon occasion, the turbine control valve cams have been known to contribute toward an oscillation in load at high valve opening positions due to the control valve loop gain being higher at these positions.

B/O R/Staff 11/9/70
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Up to the valve position associated with approximately 500 MWe, the loop gain is constant. However, oscillations can occur above 500 MWe if a perturbation, such as a load swing or pressure spike, were to occur at the higher valve open positions. The perturbation which precipitated this event was the result of load swings brought about while backwashing the main condensers. The remedy has been to reduce the load to a more stable cam position, eliminate the oscillations, and recover to the desired electrical load. In addition, until the cams are replaced, operations which may cause an upset are performed at a lower load.

Additional operating problems involving the turbine hydraulic control system have resulted from fine particles of foreign material in the turbine oil system. This is most noticeable on a restart of the turbine and requires the replacement of the 0.5 micron paper filters in the oil supply to the electric pressure regulator servovalve (moog valve) at least 3 to 4 times after a start up. The interval of change increases as the turbine continues to operate. Any foreign material which gets by the filtering system can cause erratic operation or sticking of the servovalve. The servovalve positions the output piston through the control of hydraulic oil flow. The output piston acts on a torque shaft which is common to the mechanical and electrical pressure regulators and the bypass opening jack.

The remedy for this event is to switch pressure regulation to the mechanical pressure regulator, after reducing the load to approximately 450 MWe because of the previous mentioned cam problem, remove and clean the moog valve, restore it and the electric pressure regulator to service, and return to the desired electrical load.

On September 20, 1970 at 2:40 a.m., dirt in the moog valve caused an instantaneous load spike upward of approximately 20 MWe, and upward steam flow spike of an indicated magnitude of 800,000 pounds per hour, a slight pressure decrease, a downward flux spike of approximately 10%, and no apparent change in level. The reactor had been operating at licensed power. (2)

On September 21, 1970 at 1:35 a.m., with the generator output at 500 MWe, another spike occurred. Electrical output increased to 550 MWe and decreased to 480 MWe before returning to 500 MWe. The other parameters deviated from normal as follows: Steam flow up 10^6 lb/hr -- down 600,000 lb/hr, pressure down 8 psig -- up 9 psig, flux down 15% -- up 12%, water level -- minor fluctuation. At 9:22 a.m., load was reduced from 460 MWe to 390 MWe to 350 MWe because of vibrations experienced in (3)

the turbine lube oil piping. Electrical load, pressure, steam flow, level, and feedwater flow were slowly varying. The cause was an oscillation of the regulator torque bar stimulated by sluggish operation of the servovalve. The oscillation was stopped, and the entire system returned to steady-state conditions.

In each of the above events, the servovalve was found to be dirty. On the second event, the primary servovalve internal 20 micron filter was plugged. An investigation was begun to determine the mechanism by which foreign material was bypassing the 0.5 micron prefilter.

At 9:39 a.m. on September 22, 1970, while operating at 500 MWe, (4) the reactor scrammed as the result of the closure of the main steam line isolation valves caused by a low pressure in the main steam line. All reactor systems functioned as required. The cause of this operation was a plugging of one of the nozzles in the servovalve torque motor, which caused the turbine control valves to open, slightly decreasing reactor pressure. The operator reduced reactor power by recirculation flow in an attempt to switch to the mechanical pressure regulator. This further reduction in power and pressure caused the main steam line isolation valve closure.

The following is a summation of the corrective actions taken by plant personnel under the direction of a General Electric representative as a result of this incident:

The complete servovalve filtering system was inspected, flushed, and cleaned. A new 0.5 micron filter was installed in series with the existing filters immediately before the servovalve.

Inspection of the prefilters disclosed a bypass flow path, resulting from a missing rubber gasket on the prefilter and pinched sealing rubber gasket on a second filter in the prefilter train. A filter changing procedure was developed, and all maintenance personnel have been instructed in the proper method of changing filters.

The servovalve was cleaned, and a new torque motor assembly installed to replace the motor with the plugged nozzle.

The electrical portion of the regulator was inspected and all connections checked. Proper response time of the servovalve was verified, and the electric pressure regulator was checked for noise using an oscilloscope. No spiking or noise was noted in the amplifier system.

On a routine start-up check of turbine valve operation on the morning of September 23, 1970, it was discovered that the main steam bypass valves would not open. A check of the mechanical linkage used

to operate these valves uncovered a broken aluminum push-pull rod. The bar was not completely severed; however, it could not operate in the push direction (valve opening). The linkage mechanism had operated at the time of the shutdown on September 22, 1970.

The exact cause of failure of the rod was not determined. It is hypothesized that possibly the rod had been stepped on or a chain hoist hung from it during construction. (The rod is mounted horizontally on a span of approximately 12' 6"). Metallurgical examination of the rod will be completed as soon as the rod is made available to General Electric for testing. This rod and the control valve cams will be replaced during the week of October 18, 1970. The damaged rod was repaired by inserting a hollow steel sleeve inside the original bar, fastened with bolts.

General Electric was requested to review this incident and reported that the original design was adequate and that the repair was stronger than the original design. The PORC and GORB reviewed the incident and the repair.

The fact was considered that the bypass valves would not have operated if required on a turbine trip. This situation had been analyzed previously; and therefore, was not considered as an unreviewed safety question. With all the work that could be accomplished during shutdown, the final checking had to be made during operation. The unit was restarted and the generator was on the line at 8:00 a.m. on September 24, 1970.

The summary of events discussed so far was reviewed by General Electric and Jersey Central with Division of Compliance personnel on September 25, 1970.

Operation at load with the electric pressure regulator in service indicated some additional problems not attributed to cams or dirt in the servovalve. The first of these problems was the initiation of a pressure set point change without operator action. The corrective action taken was to replace two wire wound potentiometers (set point pressure control and set point meter control) with composition type potentiometers.

Also, resistance and ground checks were made on all inputs to the electric pressure regulator. A 30,000 ohm ground was removed from the pressure sensor linear variable differential transformer. The 2 amplifiers in the electric pressure regulator were replaced with new amplifiers of the same design.

After final checking, the EPR was placed in service the afternoon of September 30, 1970 and has been functioning satisfactorily since that time.

Very truly yours,

Ivan R. Finfrock, Jr.
Manager, Nuclear Generating Stations

IRF/pk

cc: Mr. R. W. Kirkman, Regional Director
Division of Compliance