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ENCLOSURE

A Revised Narrative Summary of Operating Experience

PLANT NAME: Ark Nuclear One Unit #1

retyped per LML 8-15-77

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August 5, 1977



1-087-2

Mr. E. Morris Howard, Director
Office of Inspection & Enforcement
Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Subject: Arkansas Nuclear One-Unit 1
Docket No. 50-313
License No. DPR-51
Annual Operating Report
(File: 0520.2)

Gentlemen:

Per the request of your Mr. W. Dickerson and by our own review of the subject report previously submitted on March 1, 1977, we hereby submit a revised Narrative Summary of Operating Experience. If you have any further questions, please advise.

Very truly yours,

Donald A. Rueter

Donald A. Rueter
Manager, Licensing

DAR:tw

A. Narrative Summary of Operating Experience

On January 1, 1976, the unit was in the process of heatup following maintenance in December on control rod drive mechanisms. The unit was returned to the line on January 2.

On January 5 during a condenser tube plugging operation at approximately 70% FP, a reactor trip on low RCS pressure occurred (Reportable Occurrence No. 50-313/76-1). The trip was attributed to another ratchet trip of the Group 6 control rods similar to that which occurred in December of 1975. The unit was brought to hot shutdown and repeated attempts to move the rods were made. Only that rod which received the new drive mechanism in December would operate. The unit was cooled down and depressurized to inspect for damage. The resulting complete disassembly and inspection of the 6-1 control rod drive mechanism magnets showed nothing wrong, thus eliminating the need for complete disassembly of the other assemblies.

One Group 7 lead screw was inspected to determine if any ratchet trips had ever occurred to another group. No damage was found.

Drive units for Group 6 were completely reconditioned (i.e. honing burrs on inside of motor tubes and on lead screws) and bolted in place. A simulator was set up utilizing brush recorders, a mini-computer, and a power supply with recording capabilities to analyze the control circuitry. Findings from this indicated that both switches for one of the six phases were being energized at the same time, as identified previously. The situation was resolved by replacing all relays with two relays in parallel (switches in series) for all phases of the circuitry, thereby eliminating the possibility of any phase being neutralized due to a high contact resistance but ensuring system reliability and safety. Fill, vent, pressurization, and heatup operations were begun on January 16, with power operation being achieved on January 18.

Full power operation continued through February 20 with no unusual or unexpected equipment failures or malfunctions. On February 20 during a thunderstorm, two breakers in the 500 KV switchyard opened isolating the plant from the transmission lines. Gross generator output went from 860 MW to 190 MW rapidly and then returned to 840 MW when the breakers reclosed. Operator action averted a unit trip. Relief valves on the moisture separator and reheaters lifted, as well as the feedwater heater E2B shell relief valve, during the incident. The shell relief valve on the feedwater heater would not reseat and reactor power was reduced to 92% in order to reseat the valve.

On February 29 the Group 1 control rods fell into the core during a routine biweekly control rod exercise. The reactor was tripped manually. The operators had transferred Group 1 rods from the DC holding power supply to the auxiliary power supply and, when the manual control switch was positioned to move the rods inward, all the Group 1 rods fell into the core. The cause of this incident was the failure of a transfer switch to operate properly. Repair of the control rod drive system was made by replacing the faulty switch and the reactor was made critical.

Later on February 29, prior to synchronizing the generator to the system grid, position indication was lost on the pressurizer spray flow control valve CV-1008. The turbine was taken off the grid and reactor power was reduced to approximately 2% power for electricians to make repairs to the valve.

On March 1, the unit was again started up and placed on line. Also on this day, it was discovered that the daily pilot cell voltage readings for the station batteries were not taken from February 27 to March 1. This was reported as Reportable Occurrence No. 50-313/76-2.

On March 10, rod 2 of Group 7 dropped into the core due to a CRD stator failure. The assymetric condition caused by the dropped rod caused the integrated control system to initiate an automatic runback of the plant. Operations drove Group 7 to the bottom of the core (the group was only 9% withdrawn when Rod 2 dropped) to clear the assymetric rod condition and the plant was stabilized at 84% reactor power. Due to Technical Specification limitations on plant operation above the power level cutoff (83.5% limit) with the inoperable rod, operations continued at approximately 80% reactor power.

On March 19, shutdown of the reactor began in order to remove the reactor vessel head and examine the surveillance specimen holder tubes because of wear problems indentified at another B&W unit. Upon examination of the holder tubes by use of remote closed circuit television, it was found that the spring cartridge was missing from 2 of 3 specimen tubes. In addition, one of those tubes, identified as tube no. 3, had the push rod missing and detached from the specimen; the journal bearing missing; and part, if not all, of the holder tube missing from the top of the shroud to the upper hinge of the specimen tube. Tube no. 2 was in the same condition as tube no. 3 except that part, if not all the the push rod was attached to the specimen and part, if not all, of the holder tube was still around the push rod. All of tube no. 1 was intact and the specimen was removed and sent off for analysis and evaluation. A 6 1/2 foot section of holder tube came out of tube no. 1 when the specimen was removed. The specimens for tubes no. 2 and 3 were in their proper location (Reportable Occurrence No. 50-313/76-3).

Defueling was begun on April 2 and was completed on April 6 for retrieval of loose parts. No major problems were encountered during defueling, except that when removing several assemblies from the core, the spacer grids would hang on the spacer grids of adjacent assemblies.

A special tool was fabricated to rotate the remaining specimen holder tubes so that the internals could be removed from the reactor vessel. This was accomplished and the internals were removed on April 15.

Inspection by remote closed circuit television was initiated inside the reactor vessel and internals to determine if any damage had occurred due to the loose parts and to determine the location of said loose parts. Loose parts were located, removed and the remainder of the holder tubes were removed from the internals.

The unit was taken critical on June 19 and low power physics testing was performed before rolling the turbine on June 20.

During the shutdown, a reportable occurrence report concerning the failure of PS-2400, Reactor Building pressure switch to Channel A of the RPS, to trip on increasing pressure above 18.5 psia, was filed. The discovery was made during routine calibration on April 22, and was reported as Reportable Occurrence No. 50-313/76-4. The pressure switch was recalibrated and tested to verify the channel trip.

Two other events reported as reportable occurrences not related to maintenance items were discovered on May 5 and May 6. These occurrences involved finding that the fuel handling area ventilation system was not in operation during fuel handling operations for approximately 5 hours on May 1 (Reportable Occurrence Report No. 50-313/76-6) and identification that the control system for the control room emergency air conditioning system did not agree with design drawings nor did the proper design permit damper closure time to be met (Reportable Occurrence Report 76-7). On June 12, while filling the Sodium Thiosulfate Tank, this tank was overflowed via the borated water recirculation pump due to incorrect valve lineup. Approximately 9500 gallons of water containing approximately 0.262 curies were spilled on the ground. This occurrence was reported as Reportable Occurrence No. 50-313/76-11.

On June 21 the outboard generator esciter bearing developed 6 mils vibration. Power was decreased and shortly thereafter sparks were observed to be coming from the bottom half of the bearing. The turbine was manually tripped, the plant was cooled down and the bearing was removed for examination. It was found to be eroded and pitted. The erosion and wear on the bearing was the result of electrolysis and was enough to allow the shaft to drop causing the rotating permanent magnets on the pilot exciter to contact the pilot stator. There are two 1/2" pipes installed through the exciter cowling and extended to the bearing which are used to guide wooden dowels that are inserted from outside the exciter cowling to the shaft to measure vibration. These pipes made metal-to-metal contact with the bearing, and one of the pipes was also in contact with the exciter cowling, providing a path for electrical current to flow. Insulating board was installed at a point where both pipes pass through the exciter cowling in order to eliminate any electrical path.

The unit was brought on line on June 22.

On June 28, during surveillance testing of process radiation monitor RI3814, valve CV3812 failed to open on command due to apparent binding in the valve between stem and bushing. The valve was placed in the ES position awaiting repairs during refueling in January 1977. This incident was reported as Reportable Occurrence No. 50-313/76-13.

On July 1 the shaft seal cavity pressure between the first and second stage seals on the "D" RCP rose to full reactor coolant system pressure, indicating first stage seal malfunction. Seal return flow and temperature remained normal, so operation continued while carefully observing the pump seals for changing conditions.

On July 8 the reactor tripped when power was lost to the non-nuclear instrumentation system. Automatic control action caused reactor power to increase until the reactor protection system tripped the reactor on high pressure. The cause, a shorted out power supply, was found, corrected and the reactor was made critical later that day.

On July 9, while placing the unit in operation, operators experienced difficulty in maintaining turbine generator seal oil pressure, and the air side seal oil pump finally failed after placing the unit in operation. Hydrogen seals were maintained using the seal oil backup pump on the main turbine lube oil reservoir. The unit operated in this manner until July 13 when a non-isolable crack in a weld on the 1/2" lubricating oil line just below the pump inboard bearing forced a reduction to 50% power to repair both leaks. The unit was brought back up to full power on July 15 following an incident of exceeding the reactor power level cut-off without proper xenon reactivity (reported in Reportable Occurrence No. 50-313/76-17).

On July 12 it was discovered that the Sodium Thiosulfate Tank (T-9) was below the Technical Specification limit for sodium thiosulfate concentration. The cause was a suspected leak from the tank. This event was reported in Reportable Occurrence No. 50-313/76-16.

On July 16, while running the $H_2$ Purge System and Penetration Room Ventilation System surveillance tests, the $H_2$ Purge inlet fan tripped and would not restart and the Penetration Room Ventilation System fan and filter bleed valve breakers tripped, respectively. The cause was determined to be that the thermal overload was set too low for the breaker environment. This incident(s) was reported in Reportable Occurrence 50-313/76-18.

On July 17 the unit tripped while conducting turbine throttle valve tests. The cause of the trip was traced to a bad electronic card in the electro-hydraulic turbine control system. A false turbine overspeed signal was generated by the bad component causing a turbine trip. The unit was placed back in operation after the bad component was replaced.

On July 19, power was reduced to 90% when the control room indication showed that number 3 turbine governor valve was in the test mode of operation. The valve was opened from the control room until the test light cleared and normal operations continued.

On July 22, it was discovered that surveillance testing of the control room emergency ventilation system was not performed on July 12 as required by Tech. Specs. This discovery was reported in Reportable Occurrence No. 50-313/76-19.

The unit continued to operate normally, escept for the abnormal readings in RCP shaft seal cavity pressures on "C" and "D" RCP's, until August 6. A bad stator on CRDM No. 3 in Group 2 was found on July 30, and was repaired during the shutdown on August 6, 1976.

During this shutdown "B", "C" and "D" RCP shaft seals were repaired after excessive shaft leakoff was discovered from all three pumps.

On August 14, the Environmental Technical Specification quarterly limit for total curies released in liquid effluents was exceeded and reported in Non-Routine, Radiological Environmental Report No. 50-313/76-1.

On August 16, the unit was returned to operation, but a few hours later the "D" RCP seal failed resulting in a seal leak-off of 25 gpm (Reportable Occurrence Report No. 50-313/76-22). The reactor was manually tripped. Investigations showed that the seal failure was the result of excessive pump thrust being transmitted from the shaft through two out of position seal ring body drive keys and into the running seal faces. Operating Procedures have been altered to alleviate the possibility of procedures being any future cause. However, system contaminants from the spring outage were the probable contributors to the earlier degradation of seal components.

On August 23, while reviewing surveillance tests, it was discovered that several weekly tests for the offsite power protective relaying interlocks and circuitry, several monthly tests on the diesel generator protective relaying, starting interlocks and circuitry, and quarterly tests for the station batteries and switchyard batteries had not been performed in compliance with the surveillance test schedule. Reportable Occurrence No. 50-313/76-23 was filed concerning this matter.

On September 13, the unit was again returned to operation. During the escalation in power on September 14, the power level cutoff was exceeded without proper xenon reactivity worth and was reported in Reportable Occurrence No. 50-313/76-27. Nevertheless, the unit operated satisfactorily through September 24 when a faulty vibration trip of the generator caused the unit to trip. The unit was returned to operation that same day and operated at 100% reactor power through October. However, a burned out stator on control rod drive mechanism 6, Group 4 required that the rod be fully withdrawn until the next shutdown which would necessitate replacement of the stator.

During this operational period several incidents were reported in reportable occurrence reports. These incidents are as follows:

1. Cracks were found in the Spent Fuel Cooler E27B outlet nozzle (9/26/76, Reportable Occurrence Report No. 500-313/76-28).

2. Failure of Primary Makeup Pump P36B (10/3/76, Reportable Occurrence Report No. 50-313/76-29).

3. A leak was discovered in a socket weld in Primary Makeup Pump P36C suction relief line (10/3/76, Reportable Occurrence Report No. 50-313/76-30).

4. Failure to perform the weekly surveillance test on offsite power protective relay interlocks and circuitry (10/20/76, Reportable Occurrence Report No. 50-313/76-31).

5. Failure of Reactor Building Chilled Water Inlet Valve CV-6702 to function properly (10/21/76, Reportable Occurrence Report No. 50-313/76-32).

On November 1 a perturbation in the feedwater control system caused a large load swing on the main generator. During this transient, a main feed pump tripped and the plant was automatically runback to 40% reactor power. Adjustments were made to the feed pump speed control system, but, after placing the pump back in service severe fluctuations in the pump speed required taking the pump back out of service. These fluctuations also caused a reactor coolant system transient and the reactor tripped. The reactor trip was caused by a malfunctioning pressurizer spray flow control valve. Following the feed pump induced transient to the RCS, the system pressure began to decay, even with all pressurizer heaters energized and the pressurizer spray control valve indicating closed. However, the valve either not closed or was leaking sufficiently to cause the RCS pressure to decay until the reactor protection system automatically tripped the reactor upon reaching the pressure/temperature limits.

The burned out CRD stator on Group 4, rod 6 was replaced and additional adjustments were made to the feed pump speed control. Plant heatup began on November 2, with the unit being placed back in operation on November 2.

The unit was limited to about 78% reactor power until November 7 when the "all rods out configuration" was achieved and operation at 100% was resumed. However, on November 5, it was noted that the Control Rod Drive Mechanism number 8, Group 4 stator was burned out. The rod was declared inoperable in the 100% withdrawn position.

On November 22, an inadvertent trip of the fire system deluge while being returned to service rendered Diesel Generator #1 inoperable as a result of wet circuitry. This was reported in Reportable Occurrence No. 50-313/76-33.

The steam flow control valve controlling steam flow to the second stage coil in B moisture separator and reheater was throttled back about 40% during this time period because of suspected leaks in the second stage tube bundle. This resulted in the B reheat steam temperature being reduced by about 10F. This reduced unit efficiency slightly until December 15 when the B and D moisture separators and reheaters were isolated to investigate the leaks.

A leak was discovered in the heat affected zone of valve SF-11 in the Spent Fuel Pool Cooling System on December 1. This occurrence was reported in Reportable Occurrence No. 50-313/76-34.

On December 20, power from the inverter holding Rod 8, Group 4 in the withdrawn position was lost and the rod dropped into the core. An assymetric condition resulted and caused the Integrated Control System (ICS) to begin running the reactor power back to 40%. The inverter also furnished power to 50% of the ICS and indicating instruments on the control panel in the control room. A false pressure indication caused automatic energization of all pressurizer heater banks, causing a reactor trip on high pressure. Cooldown was initiated to replace the burned out stator on Rod 8, Group 4.

On December 21, the unit was returned to operation and operated until December 28, when a level sight glass blew out on a high pressure feedwater heater. The noise and quantity of steam that resulted initially

caused operators to believe a major failure had occurred so a reduction in load began. At approximately 92%, the broken sight glass was discovered and power reduction ceased. During the incident, a heater drain pump tripped and thus required manual control of heater drain tank level by modulating the heater drain tank high level dump regulator bypass valve. The bypass valve would not close subsequently, and it is estimated approximately 1500 to 1600 gpm of water was recirculated back to the condenser rather than being pumped forward to the feedwater system. Power was limited to approximately 93% for the remainder of the year as a result of additional flow through the condensate demineralizers.