TVA

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March 20, 1991

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 1 - DOCKET NO. 50-327 - FACILITY OPERATING LICENSE DPR-77 - LICENSEE EVENT REPORT (LER) 50-327/91003

The enclosed LER provides details concerning a unit shutdown required by technical specifications as a result of the failure of a centrifugal charging pump. This event is being reported in accordance with 10 CFR 50.73(a)(2)(i)(A) as the completion of a plant shutdown required by technical specifications.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

JRWilson
for J. R. Bynum

Enclosure
cc: See page 2

IE22
1/1

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1): Sequoyah Nuclear Plant, Unit 1

DOCKET NUMBER (2): 0|5|0|0|0|3|2|7 PAGE (3): 1 OF 1 0

TITLE (4) Technical specification required shutdown because of the failure of the 1B-B centrifugal charging pump.

EVENT DAY (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBER(S)
0 2	1 8	9 1	9 1	0 0 3	0 0	0 3	2 0	9 1		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following)(11)

__ 20.402(b)	__ 20.405(c)	__ 50.73(a)(2)(iv)	__ 73.71(b)
__ 20.405(a)(1)(i)	__ 50.36(c)(1)	__ 50.73(a)(2)(v)	__ 73.71(c)
__ 20.405(a)(1)(ii)	__ 50.36(c)(2)	__ 50.73(a)(2)(vii)	__ OTHER (Specify in Abstract below and in Text, NRC Form 366A)
__ 20.405(a)(1)(iii)	XX 50.73(a)(2)(i)	__ 50.73(a)(2)(viii)(A)	
__ 20.405(a)(1)(iv)	__ 50.73(a)(2)(ii)	__ 50.73(a)(2)(viii)(B)	
__ 20.405(a)(1)(v)	__ 50.73(a)(2)(iii)	__ 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
Russell R. Thompson, Compliance Licensing	6 1 5 8 4 3 - 7 4 7 0

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
X	C B	P	P 0 2 5	Y					

SUPPLEMENTAL REPORT EXPECTED (14)

__ YES (If yes, complete EXPECTED SUBMISSION DATE) | X | NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On February 15, 1991, at 1858 Eastern standard time (EST) with Unit 1 in Mode 1, the centrifugal charging pump (CCP) was declared inoperable and removed from service. The 1B-B pump had been in continuous operation for several months. The first indication of possible pump degradation was when Operations attempted several iterations to increase letdown flow. When CCP flow decreased and current increased, the pump was declared inoperable. ASME Section XI testing was performed and degradation of the pump was confirmed. Disassembly of the pump showed heavy wear on the impeller shoulders in the wear ring area as well as on the balance drum. The shaft was also found to have a crack that was determined to have existed for several months or even years. The root cause of the pump failure could not be conclusively determined. Potential contributing factors to the failure include long-term gas entrainment and/or the entrainment of gas and/or solid material through the pump associated with a return of the boric acid makeup system to service. The 1B-B CCP was repaired and tested, and subsequently declared operable at 1454 EST on February 23, 1991. Expanded vibration monitoring of the CCPs, in addition to the procedural controls for returning the boric acid makeup system to service, is being implemented to preclude rapid failures of the CCPs.

DESCRIPTION OF EVENT

On February 15, 1991, at 1858 Eastern standard time (EST) with Unit 1 in Mode 1 (100 percent reactor power, reactor coolant system [RCS] pressure at 2,235 pounds per square inch gauge [psig], and RCS average temperature at 578 degrees Fahrenheit [F]), the 1B-B centrifugal charging pump (CCP) (EIIS Code CB) was declared inoperable because of an observed decrease in pump flow and an observed increase in pump motor current. Technical specification Limiting Conditions for Operation (LCO) 3.1.2.2, 3.1.2.4, and 3.5.2 each require two CCPs to be operable in Mode 1. LCO 3.5.2 (applicable in Modes 1, 2, and 3) requires the CCP to be returned to operable status within 72 hours, or the plant must be placed in at least Mode 3 (hot standby) within the next 6 hours and in Mode 4 (hot shutdown) within the following six hours. LCOs 3.1.2.2 and 3.1.2.4 (applicable in Modes 1, 2, 3, and 4) similarly require the CCP to be returned to operable status within 72 hours, or the plant must be placed in at least Mode 3 and borated to a shutdown margin equivalent to at least 1 percent delta k/k at 200 degrees F within the next six hours. If the CCP is not restored within the next seven days, the plant must be placed in Mode 5 (cold shutdown) within the next 30 hours. A unit shutdown was initiated at 1601 EST on February 18, and Mode 3 entry at 1955 EST on February 18, and Mode 4 entry at 0128 EST on February 19, 1991.

At 0254 EST on February 15, Unit 1 had experienced a pressurizer safety valve (EIIS Code AB) leak for approximately 42 minutes, which subsequently reseated. This resulted in a 1.5 gallon per minute (gpm) leak from the RCS to the pressurizer relief tank (PRT) (EIIS Code AB) that reduced the volume control tank (EIIS Code CB) level to a point of requiring makeup. At 0410 EST on February 15, Unit 1 boric acid blender (EIIS Code CB) was placed in service after a 10-day outage from boron blockage. Precautions were taken to vent and flush as much piping as possible to the holdup tank (HUT) before pumping to the CCP suction header. After the flush, the blender was used to raise volume control tank (VCT) level (reference Final Safety Analysis Report figures 9.3.4-1 through 9.3.4-6).

At 1200 EST on February 15, the Shift Operation Supervisor (SOS) received a request from the Chemistry section to increase RCS letdown flow through the chemical and volume control system (CVCS) demineralizer beds (EIIS Code CB). This request was made to improve Unit 1 RCS chemistry. At 1400 EST, the Unit 1 lead Reactor Operator (RO) swapped from letdown orifice valve FCV-62-73 to FCV-62-74 to increase flow. FCV-62-73 was allowing 60 gpm flow and is rated at 75 gpm. The valve swap failed to change flow since FCV-62-74 also allowed only 60 gpm. At 1415 EST the RO with the assistant shift operations supervisor (ASOS) and the SOS concurrences, placed FCV-62-72 in parallel with FCV-62-74. FCV-62-72 is rated for 45 gpm. With two orifices in service, letdown flow increased to 105 gpm. The operator then took manual control of FCV-62-89 (pressurizer level control valve) to increase charging flow to compensate for the additional letdown. The maximum charging flow delivered from the 1B-B pump was 110 gpm. With 105 gpm letdown and approximately 12 gpm seal return flow the pump could not

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

DESCRIPTION OF EVENT (Continued)

maintain pressurizer level, i.e., a gradual decline in level began. The RO then removed FCV-62-72 from service and proceeded to stabilize charging flow and return pressurizer level to normal. By 1440 EST, charging and letdown flows were back to normal and pressurizer level control was returned to automatic (1B-B CCP flow at 88 gpm total). At 1548 EST during Operations' shift turnover, the pressurizer level appeared to be controlling in a ± 1 percent band.

During this event, at approximately 1200 EST on February 15, a pressurizer spray valve failed to reseat after manual operation. The valve was subsequently closed by isolating its air supply. This valve malfunction did not contribute to nor was it caused by the failure of the 1B-B CCP.

Pressurizer level P250 trend data indicates that at approximately 1615 EST, the pressurizer level again began a slow downward trend. Fifteen to twenty minutes later the evening shift RO noticed this level trend and informed the Unit 1 ASOS. The 1B-B CCP flow had decreased to 80 gpm while motor current increased from 34 to 36.5 amps. At 1700 EST, after attempts to increase charging flow had failed, the lead RO swapped from the 60 gpm orifice to the 45 gpm orifice. Pressurizer level began to increase and was returning to normal. An auxiliary unit operator (AUO) was sent to verify that both flow control valves FCV-62-93, -89 were performing normally.

FCV-62-93, seal injection back pressure valve, was full open, but pressurizer level control valve FCV-62-89 was only opening approximately 75 percent. A work request was written to check the stroke of the valve under the normal maintenance process. By 1858 EST 1B-B CCP flow had dropped to approximately 50 gpm and motor current had increased to 40 amps. The 1A-A CCP pump was then started and 1B-B pump removed from service and declared inoperable. The action statements of LCOs 3.1.2.2, 3.1.2.4, and 3.5.2 were entered. At no time before or during this event did the Operations crew observe any further unusual operating characteristics of 1B-B CCP, e.g., swings in amps or flow. After stopping the 1B-B CCP a decision was made to check for possible gas binding. At 1920 EST, a section of the common CCP suction header from the RHR header was vented for 57 seconds to disspell gases (weekly venting times normally run 30 to 100 seconds).

At 2010 EST, the pump discharge vent (62-529) was also vented in accordance with Surveillance Instruction (SI)-40, "Centrifugal Charging Pump," for 2-3 minutes with much of this time a gas/water mixture being dispelled. The AUO involved indicated that water came out of the 15-foot vent hose approximately five seconds after he opened the vent 1-1/2 turns. The hose continued to pulse with water then gas then water for 2-3 minutes. The amount of gas appeared to decrease as the vent progressed. The AUO indicated that on normal monthly venting of this pump, no gas is found at the pump vents. Later discussions with the pump vendor indicate that this sequence could have been related to water boiling because of latent heat in the pump after shutdown. A second pump vent at approximately 2020 EST yielded approximately 20 seconds of gas. At this point, radiological control requested venting to be stopped until an airborne sample could be taken of the room.

DESCRIPTION OF EVENT (Continued)

At 2107 EST, 1B-B CCP was restarted and 1A-A CCP stopped to see if pump venting had corrected the low flow condition. 1B-B CCP maximum flow was still 50 gpm with 40 amps of motor current indicated. The 1A-A CCP was then restarted and 1B-B CCP stopped. Another pump vent was performed through the pump suction and discharge piping (62-513 and 62-529) and very little gas was vented from either valve. At 2127 EST, another 1B-B CCP run was performed with maximum flow of 50 gpm still present. At this point a decision was made to perform an ASME Section XI pump test to determine if pump degradation was the cause of the low flow. A special SI-40 performance package was obtained and instrumentation for the test was installed.

At 0830 EST on February 16, SI-40 was performed with the 1B-B pump on mini-flow. Resulting data showed a pump test failure on a discharge pressure of 2350 psig (Technical Specification minimum 2400 psig) and inboard bearing vibration of 2.5 mils horizontal (max 1.5H). Outboard bearing vibration was also measured and determined to be 8.5 mils horizontal. During this performance test the 1B-B pump ran for approximately 30 minutes and exhibited a slowly decreasing discharge pressure during its entire run. Maintenance was initiated via work request to determine the cause and correct the problem.

At 1300 EST, Maintenance began pump uncoupling to check alignment and see if binding was evident. After uncoupling, the pump motor and speed increaser were run and determined to be functioning properly with no unusual parameters indicated. Since the pump rotated freely by hand it was recoupled for further testing. Another SI-40 test was performed along with the measurement of additional parameters recommended by Westinghouse. During this test, the continued degradation of the pump was apparent. Discharge pressure had decreased to 2340 psig and inboard vibration had increased to 3.5 mils horizontal. Monitoring of vendor recommended parameters indicated a balance drum recirculation flow of 150 gpm (vendor specification of 20-40 gpm) and outboard bearing vibration 11.5 mils horizontal. From this test data internal damage was evident and tear down of the pump was initiated. Disassembly of the pump identified excessive wear of the wear rings and balance drums, and a crack in the shaft located under the eleventh stage impeller.

The possibility of requesting an extension to the technical specification allowed outage time was evaluated. However, uncertainties existed concerning the ability to adequately test the pump with the plant at power. Repair of the 1B-B CCP utilized a higher head rotating element than what had been installed in the pump at the time of failure. This necessitated the use of an orifice at the discharge of the pump, and required full flow testing to demonstrate pump operability. Based on the uncertainties associated with full flow testing at power, an extension was not formally pursued, and a plant shutdown was initiated at 1601 EST on February 18, in accordance with technical specifications. Mode 3 was entered at 1955 EST on February 18, and Mode 4 was entered at 0128 EST on February 19.

DESCRIPTION OF EVENT (Continued)

Subsequent assessment of the damaged rotating element revealed that significant wear had occurred on all 11 wear ring surfaces and on the balancing drum surface. Each impeller was worn similarly as the balance drum, with grooves worn approximately 1/16 inch deep on 180 degrees of its circumference. The outside diameter of the impeller shroud on some of the impellers also had indications of slight rubbing. Small metal filings, probably from the rubbing condition, were found in each diffuser and approximately four boric acid crystals, approximately 1/8 inch in diameter were found in the No. 3 and No. 4 diffusers. A heavy coating of oxide buildup was evident on the last stage impellers and decreased, going toward the suction. The first stage impeller was totally clean of oxide, as if exposed to an abrasive material. An oxide buildup should have been present on all stages. Examination of the pump shaft revealed an approximately 280 degree circumferential crack 33 inches from the outboard end. This crack was at the edge of the 11th stage impeller near the balance drum. The shaft runout (deflection) was checked and the maximum measurement was 0.070 inches toward the outboard end of the shaft.

A metallurgical analysis of a section of the shaft containing the crack was sent to Westinghouse for evaluation. Testing performed included a detailed surface examination, hardness measurement, electron microscope examination and chemical analysis. The Westinghouse evaluation showed the crack initiation occurred due to high-cycle fatigue several months or even several years earlier. The fretting marks around the crack may have occurred after the cracking, since fretting marks were not observed at other places on the shaft where the impellers are installed. As the crack started to grow, flexing or slipping of the shaft may have been allowed, inducing the fretting. This fretting could have been caused before the crack by shrink fitting the impellers. Since no stress points or material flaws could be seen on the surface of the shaft at the crack area, the potential cause of failure could have been the result of an initiating event causing high loading at this point. No material or manufacturing defects were identified.

An evaluation of the internal components and casing surface was performed, including a liquid penetrant test, with the following conclusions:

The overall condition of the 1B-B CCP casing internal surfaces was found acceptable for continued service.

The 1B-B CCP impeller elements showed the following:

1) Polishing of the surface of the first impeller as well as the other first few stages indicated that a mild abrasive medium was induced into the pump during a recent operational time frame.

2) Eccentric uniform wear had occurred in the wear ring area of all the impeller elements indicating the concentricity of the system had been compromised.

DESCRIPTION OF EVENT (Continued)

To determine if foreign material was injected into the pump, the seal water injection filter downstream of the pump was removed and inspected. Also, a startup strainer was installed in the 1B-B pump suction line during its return to operability testing. No material was found in either location outside what normally might be expected.

Section XI data of vibration and developed head for the 1B-B pump was reviewed, and gave no prior indication of an adverse trend. Also maintenance history gave no indication of equipment problems and showed the rotating element to be of the improved type (IE Notice 80-07) from Pacific Pump. In an effort to ensure reliability of the remaining CCPs, their Section XI data was also reviewed along with other special performance data, including balance drum flow, taken following the 1B-B CCP failure. None of the data showed adverse trends or degradation of any other pump. Both Westinghouse and Pacific Pump were involved in the evaluation of pump data.

CAUSE OF THE EVENT

The actual pump failure, i.e., the inability of the CCP to develope adequate flow and discharge pressure, was the result of high recirculation flow caused by excessive wear of the wear rings and balance drum. The excessive wear may have been exacerbated by the crack in the pump shaft. Westinghouse and Pacific Pump were both involved in the evaluation of the pump failure mechanism and the postulated contributing factors.

The root cause of the crack and the excessive wear could not be determined. The crack is considered to have been initiated months to years before the actual failure of the CCP because of the oxidation present in the crack.

Propagation of the crack was most probably a long term effect of high static and dynamic hydraulic loading of the shaft. These high load conditions could result from pump operation with gas slugs or solid material present in the flow, or other "off design" pump operation. It is postulated that some amounts of gas may have been periodically passed through the CCPs during periods of pump operation before the CCP hydrogen gas generation issue was identified and mitigated (reference LER 50-328/90012).

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

CAUSE OF THE EVENT (Continued)

Another contributing factor to crack propagation is postulated to be possible ingestion of solid material (residual solids from the interior of the pipe) or gas into the CCP from the boric acid makeup system. The CCP could have been subjected to the solid material or gas as a result of returning the boric acid makeup system to service following evolutions to unblock plugged boric acid piping. Investigation of this event concluded that the practices of unblocking plugged boric acid piping, as well as the method for returning the boric acid makeup system to service following a makeup system outage, are not adequately controlled. The boric acid makeup system does not have vents or drains designed into the system to support the unblocking evolutions and subsequent return to service. Solid material and/or air may have remained in the system following the unblocking efforts. Solid material may have been swept into the common suction header piping, or directly into the pump suction. Similarly, air, trapped in the nonvented boric acid piping, may have been added to any nonvented hydrogen in the pump suction piping, resulting in a sufficiently large void to hydraulically imbalance the pump. The lack of formal, consistent guidance for these evolutions is considered to have contributed to the potential ingestion of material into the CCP. This problem is exacerbated by the fact that the blockage of the boric acid lines is a repetitive problem.

Similarly, the excessive wear of the wear rings and balance drum can be postulated to be the direct result of a loss of clearances resulting from the ingestion of solid material or gas into the CCP. Some wear may have occurred previously as a result of gas entrainment. Though the magnitude of the impact cannot be conclusively determined, the presence of the crack in the shaft is also a potential contributor to the loss of clearances.

In summary, we could not definitively establish the cause(s) of the failure of the 1B-B CCP. Through extensive investigation, we have identified several potential causes or contributors and are taking corrective actions to address each. However, the exact role of these potential contributors could not be clearly established.

ANALYSIS OF THE EVENT

This event is being reported in accordance with 10 CFR 50.73(a)(2)(i)(A) as the completion of a plant shutdown required by technical specifications.

During and following the event all systems performed normally. The 1A-A CCP started and was immediately capable of providing normal pressurizer level control. The 1A-A pump continued to perform as expected and the pressurizer level control instrumentation was placed in automatic.

The loss of one CVCS CCP is a scenario encompassed by the bases of Technical Specifications 3.5.2, 3.1.2.4, and 3.1.2.2 for Boration Control Systems and Emergency Core Cooling Subsystems.

In both bases, one CCP is required to assure functional capability with the other pump assumed to be inoperable because of a single failure consideration.

ANALYSIS OF THE EVENT (Continued)

This incident duplicated the described scenario. During the period of time that 1B-B CCP was out of service, 1A-A CCP was operable or operating with all required subsystems, power supplies, and flow paths available. Required boron concentrations and volumes were maintained in the refueling water storage tank and the boric acid storage tank. The diesel generator was available to supply emergency power during this period if it was required.

For these reasons the health and safety of the public was not threatened by this event.

CORRECTIVE ACTION

The 1B-B CCP was disassembled and the rotating element replaced. Subsequent testing demonstrated acceptable pump performance.

During the evaluation of the 1B-B CCP failure, full spectrum vibration measurements and balance drum recirculation flow measurements were taken on a shiftly basis on the remaining CCPs in operation to monitor for degradation. Review of this data did not identify adverse trends in pump performance. Comprehensive vibration monitoring of the CCPs has continued since the 1B-B CCP was returned to service, and will continue to be performed. The frequency of the monitoring, currently performed weekly on the operating CCPs, will be adjusted as trending data warrants. Additionally, appropriate procedures will be revised to monitor balance drum recirculation flow for trending as part of the quarterly Section XI pump testing.

As a precautionary measure, the rotating element for the 1A-A CCP will be replaced during the Unit 1 Cycle 5 refueling outage, in conjunction with the planned replacement of the 1A-A pump case. The removed element will be closely inspected to determine if any defects are present. The results of this inspection will be used to develop replacement plans, as necessary, for the Unit 2 CCP rotating elements.

To minimize the potential for injection of solid material or gases when placing the boric acid makeup system into service, administrative controls will be developed and formalized to support unblocking efforts and the return of the system to service following a system outage. This will be accomplished by June 3, 1991.

In the interim, an Operations Night Order has been issued which requires the CCP suction piping to be vented immediately before and after the boric acid makeup system is placed in service. (This limits the potential voids in the system to just the air associated with the boric acid makeup system piping). Similarly, a Maintenance Management Directive has been issued which provides precautions to be followed while unblocking plugged boric acid lines.

Long term corrective actions associated with vent paths for the CCP suction header and connected piping are tracked by Condition Adverse to Quality Report (CAQR) SQP 900343. Evaluations have been performed which identified piping sections which require additional vent capabilities. Modifications to provide the additional vent capabilities are being tracked by the CAQR.

CORRECTIVE ACTION (Continued)

Periodic hydrogen gas entrainment through the CCP is minimized by the corrective actions outlined in LER 50-328/90012.

To address problems with blockage in the boric acid blend system, the heat trace design and configuration will be reviewed for adequacy including an evaluation of thermocouple locations to determine if adequate monitoring of the entire circuit exists. This review will be completed by June 3, 1991.

ADDITIONAL INFORMATION

LER 50-328/90012 reported an event in which fluctuations in pump flow and motor current were observed on CCP 2B-B because of hydrogen gas entrainment. As stated previously, the condition reported in LER 50-328/90012 may have contributed to propagating the crack in the pump shaft prior to TVA's identification of the gas generation problem. The venting program currently in place will minimize the CCPs future exposure to gas entrainment.

After the CCP failure, a review of the Nuclear Experience Review database identified two CCP failures at Catawba Nuclear Station. Contact with Catawba was established early in the event to obtain relevant information from their experience.

LERs 50-414/88026 Revision 1 and 50-413/89027 Revision 1 each described events at Catawba Units 1 and 2, respectively, in which CCPs rapidly degraded to the point of being inoperable. The Unit 2 event also involved a cracked CCP shaft. The inability of the Catawba CCP, to develope sufficient flow and discharge pressure was also the result of lost internal clearances. Excessive wear was noted on the rotating elements, especially on the balance drum.

Gas entrainment through the CCP, was postulated to be a contributing cause of the Catawba failures, though a gas generation problem had not been identified. The SQN CCP failure is considered to be very similar to the Catawba failures, in that flow and discharge pressure of the CCP rapidly degraded. Also, the flow degradation was the result of excessive rotating element wear, which was not predicted by routine periodic Section XI surveillance testing. The contributing factors to the CCP failures are also similar in that ingestion/entrainment of gas or other material through the CCPs was postulated to have contributed to or induced the excessive wear. The information gained from the Catawba failure was valuable in evaluating the 1B-B SQN CCP failure.

No prior CCP failures of this nature have occurred at SQN.

NRC Form 366A (6-89) U.S. NUCLEAR REGULATORY COMMISSION Approved OMB No. 3150-0104 Expires 4/30/92

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

COMMITMENTS

1. The rotating element for the 1A-A CCP will be replaced during the Unit 1 Cycle 5 refueling outage.

2. The removed 1A-A element will be inspected to determine if any defects are present.

3. Comprehensive vibration monitoring of the CCPs will continue to be performed.

4. Appropriate procedures will be revised by April 5, 1991, to monitor balance drum recirculation flow for trending as part of the quarterly Section XI pump test.

5. To minimize the potential for injection of solid material or gases when placing the boric acid makeup system into service, administrative controls will be developed and formalized to support unblocking efforts and the return of the system to service following a system outage. This will be accomplished by June 3, 1991.

6. To address problems with blockage in the boric acid blend system, the heat trace design and configuration will be reviewed for adequacy including an evaluation of thermocouple locations to determine if adequate monitoring of the entire circuit exists. This review will be completed by June 3, 1991.