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October 9, 1986
ST-HL-AE-1773
File No.: E24.2

Mr. Vincent S. Noonan, Project Director
PWR Project Directorate #5
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
SQRT/PVORT Pre-Audit Question Responses

Reference: Letter ST-HL-AE-1761 dated 9/29/86; M. R. Wisenburg to V. S. Noonan

Dear Mr. Noonan:

Attached are responses to the topical questions, for which your staff requested documented responses, plus SQRT questions provided to us at the conclusion of our 9/16/86 meeting.

If you should have any questions on this matter, please contact Mr. M. E. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

GET/yd

Attachments:
(1) Responses to NRC Topical Concerns Discussed During the September 16, 1986 SQRT/PVORT Meeting

(2) Copy of Qualification Test Procedure, STP-33186-1, Rev. A

(3) Response to NRC Comments on the STP FSAR

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cc:

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Attachment 1

Topical Concern 1

Turbine Driven Auxiliary Feedwater Pump
(3S141MPA04)
Bingham Willamette 4 x 6 x 90 MSD11

1. Davis Besse reported a partial loss of feedwater on June 9, 1985 while the plant was operating at 90% power. A contributing factor was excessive moisture content in the driving steam to the AFW pump turbine, as well as the difficulty of reestablishing steam flow following the turbine overspeed trip. The applicant should provide the following information, describing the plant specific features and preventative measures in place at South Texas.

   a. Describe how the moisture content in the driving steam to the turbine will be controlled to prevent an overspeed trip.

   b. Confirm that the maintenance procedures for the turbine driven auxiliary feedwater pump will satisfy the equipment manufacturer's recommendation. Provide assurance that all bolts for the pump and turbine assemblies will be regularly checked for their proper torque settings.

   c. Confirm that the trip and throttle valve can be operated easily when a maximum ΔP exists across the valve, such as a turbine overspeed condition.

      (1) Describe the physical location of the valve, height above the floor, valve stem orientation, and the proximity of adjacent equipment or structures that could interfere with the manual operation of the valve.

      (2) Describe the procedures for manually operating the valve during an emergency condition. Identify the responsible personnel who will be involved. Identify the use of any auxiliary equipment (such as a wheel wrench) to operate the valve.

      (3) Verify that the responsible personnel for maintaining or operating the valve are properly trained, including hands-on experience prior to fuel load.

Response to Topical Concern 1

a. The STP AFW turbine driven pump steam line contains an isolation valve with a bypass line and valve. Both of these valves are normally closed. Upon initiation of a SI signal or low steam generator level, the bypass valve opens; however, the isolation valve remains closed via a timer (5-50 seconds, currently set at 15 seconds). During this 15 seconds, the steam passes through the 1" bypass line warming up the piping between the isol tion valve and the turbine trip and throttle valve. Any moisture resulting from pipe warmup is routed to the condenser via drain lines with a steam trap. This ensures moisture is removed from the line prior to opening the isolation valves. During pre-operational testing, the isolation valve opening time will be adjusted if necessary. The STP design and physical configuration is similar to Palo Verde which has already successfully undergone testing.

b. The turbine driven auxiliary feedwater pump maintenance procedure (OPMP04-AF-0002) complies with procedures described in the vendor supplied manual and supplier design prints, including torque values for bolting where recommended or required by the manual or prints. Preventive maintenance activities also comply with vendor recommendations from the vendor supplied manual, including periodic retorquing of turbine bolting on an annual basis.

   Generically, maintenance of all qualified equipment is administratively controlled in accordance with procedures OPGP03-ZE-0010 (Qualification Maintenance Program (QMP)), OPGP03-ZM-0003 (Maintenance Work Request Program), and OPGP03-ZM-0002 (Preventive Maintenance Program). These procedures ensure any deviations from vendor recommendations are evaluated and, if approved, are documented including justification for the deviation.

c. The trip and throttle valve vendor has advised that his analysis indicates that the valve will open against the maximum ΔP across the valve which is 1339 psid.

   (1) The turbine driven auxiliary feedwater pump and associated trip and throttle valve are located in the lowest elevation of the Isolation Valve Cubicle (IVC). Entry into the IVC is through a single door at elevation 55'-0", with stairs leading down to the pump elevation of 10'-0". Upon reaching elevation 10'-0", access to the pump cubicle is through fire doors. The turbine is mounted on a baseplate approximately 2 feet high. The trip and throttle valve is oriented vertically with the manual handwheel and clutch for engaging the handwheel located on top of the valve operator approximately 4 feet above the baseplate. The adjacent equipment consists of the turbine and pump piping and supports which do not prevent access to the valve for manual operation. Physical access has been verified.

   (2) Procedure 1POP05-EO-FRH1 (Response to Loss of Secondary Heat Sink) requires dispatch of a Reactor Plant Operator (RPO) to manually initiate AFW flow if control room actions are not possible or are ineffective. The RPO's actions will be in accordance with classroom training and on-the-job training (OJT) requirements. Normal system operation is described in 1POP02-AF-0001 (Auxiliary Feedwater).

   No auxiliary equipment (i.e., handwheel wrench) is required to operate the trip and throttle valve manually, even if maximum differential pressure exists across the valve.

(3) An approved maintenance procedure will contain the necessary steps for normal maintenance of the trip and throttle valve including disassembly, inspection and reassembly and will comply with the vendor supplied manual and vendor supplied prints. The procedure will be written to the appropriate level of detail to ensure that maintenance personnel can perform each task without special training.

All Reactor Plant Operators (RPOs) will be trained in Auxiliary Feedwater System operation prior to fuel load. Classroom training will consist of review of system components, system layout, and system modes of operation. Specific task training will be performed both in the classroom and on-the-job training (OJT) for all tasks identified during the Job and Task Analysis being conducted by the Nuclear Plant Operations Department, and will include manual operation of Auxiliary Feedwater System components.

Topical Concern 2

Check Valve Operability

IE Notice 86-01 dated January 6, 1986 reported an event caused by the failure of five main feedwater (MFW) check valves. These check valve failures resulted in the loss of MFW system integrity and significant water-hammer damage. The applicant should provide the following information to demonstrate check valve operability.

1. Describe the methodology used to size and install check valves, considering proximity to flow disruption devices.

2. Describe tests, if any, used to demonstrate that the valve is not damaged and can still perform its safety function.

3. Describe what measures are considered to prevent valve chatter, blockage, or failure of the disc assembly.

Response to Topical Concern 2

1. BOP check valves are specified as equal to the line size. This minimizes pressure loss in the system. Furthermore, piping velocity guidelines, used by the project to produce cost effective system designs, generally envelope the velocities necessary to fully open system check valves.

   The 18" Anchor Darling check valves used in the STP feedwater system require a velocity of approximately 9.7 fps for full open and approximately 18.0 fps for the stable full open condition. At 100% power, the velocity through the check valve will be 16.0 fps, therefore the valve will be full open at 100% power. There may be some potential for minor disc movement, however, this is not a concern. The vendor has indicated that the valve is satisfactory for 40 years service at a velocity of 16.0 fps.

   Check valves are generally located in horizontal pipe runs and the discs are oriented in a vertical position. The 18" MFW check valves are located downstream and adjacent to the MFW isolation valve. The isolation valve is an open/close 18" gate valve with a 14.75" port. The piping run upstream of the two valves is approximately 50 feet of straight pipe. This configuration minimizes the effect of flow turbulence devices considering other important arrangement needs.

   The MFW check valves are located outside containment for ease of maintenance. The MFW isolation valves must be outside containment (isolation) and close to containment to minimize non-isolatable lengths of feedwater piping outside containment. These design considerations mandate a relatively short distance between the MFW check and isolation valves and both valves being close to the containment wall but outside of it.

For NSSS check valves generic testing has been performed to determine the performance characteristics for various sizes of check valves. The performance characteristics include flow required to open, pressure drop, etc. These tests demonstrate the valves will be fully open during the design conditions, therefore, precluding cycling of the valve which results in wear.

In addition, the ability of the valve to open is assured by its inherent design characteristics. The swing check design and the clearance between the disc hanger assembly and body preclude the possibility of binding.

The methodology used for system layout is per Westinghouse document 1.12, "Systems Standard Design Criteria NSSS Layout Guidelines." In addition, valve sizing is determined by line size and flow rates at which the valve is required to operate.

In summary, the flow rates in NSSS systems are significantly in excess of the flow rates specified in Table 1 which is a sample of generic flow tests performed by Westinghouse for check valves. The check valves used on STP are 4C88, 6C88 and 8C88. As the table shows, these valves are effectively represented by the style and size range of valves actually flow tested.

2. Check valves which are within the scope of the ASME Section XI Pump and Valve Inservice Test Plan are tested to verify operability periodically. For check valves which perform a safety-related function in the open direction, this testing verifies full-stroke capability by ensuring that design flow can be established through the valve using normal system pumps. For check valves which perform a safety-related function in the closed direction, performance of a leakage test is performed to ensure valve operability. Some check valves may require testing in both the open and closed positions. If full flow testing is impractical, check valves will be disassembled and inspected to verify operability, one of each type at each refueling outage.

   The Main Feedwater System check valves are excluded from the ASME Section XI Pump and Valve Inservice Test Plan. The reasons for this exclusion are that the Auxiliary Feedwater System utilizes dedicated penetrations into each steam generator and the Main Feedwater System isolation valves and regulating valves are utilized in lieu of the check valves for isolating the steam generator in the event of a feedwater line break. All Main Feedwater System check valves and steam generator feedpump discharge check valves are scheduled to be disassembled and inspected every 79 weeks as part of the normal Preventive Maintenance Program.

   Startup testing ensures the Main Feedwater System will perform as designed by verifying adequate steam generator level control during transients including plant heatup, load swings, load rejection, and plant trips.

TABLE 1

The following is a list of check valve ID's and some data on those models known to have been flow tested during development.

Valve	Minimum Full Open Velocity by Test (fps)	Style A - Original B - Newer Model
3C82	5.4	B
3C84	5.4	B
3C88	5.8	B
4C82		B
4C87		B
4C88		B
6C88		B
8C88		A
8C82	7.1*	B
8C84	7.1*	B
10C82		B
10C88	10.4	B
12C84		A
14C84		A

*Measured on similar Style A

3. The response to Item 1 discusses the velocity needed to fully hold open the disc of the MFW check valve at 100% power. The potential for disc chatter does exist when the plant is operated at less than 20% power. Check valves capable of the wide range of flows needed for the main feedwater system requirements, and without any potential for check valve chatter would be difficult to procure if not impossible to design.

The tilting disc design was specified due to its ability to handle the wide range of flows required in the MFW system, and also for its non-bolted disc design, providing a greater ability to withstand the effects of water hammer.

The MFW check valves are selected based on 100% power operations, designed to consider water hammer and located to satisfy other overriding safety considerations.

The response to Item 2 discusses testing of check valves which are within the scope of the ASME Section XI Pump and Valve Inservice Test Plan. Failure of a check valve to meet the test criteria for design flow, leakage, or acceptable internal inspection will result in documented corrective maintenance in accordance with OPGP03-ZM-0003 (Maintenance Work Request Program). In addition, trending of leakage rates for applicable check valves is performed to detect degradation with corrective actions taken to prevent undetected failure including increasing test frequency or performing corrective maintenance. All corrective maintenance activities are reviewed to determine if the potential for common mode failure exists.

Topical Concern 3

High Head Safety Injection Pumps
(2N121NPA101 A, B, C)
Pacific Pump 60 x 10 WYRF

Low Head Safety Injection Pumps
(2N121NPA102 A, B, C)
Pacific Pump 10 x 16 WYRF

Essential Cooling Water Pumps
(3R281NPA101 A, B, C)
Hayward Tyler 24 VSN

Containment Spray Pumps
(2N101NPA101 A, B, C)
Pacific Pump 10 x 16 WYRF

3. IE Bulletin 79-15 dated July 11, 1979 reported industry-wide problems associated with the long-term operation of deep draft pumps. The applicant's letter dated August 31, 1979 and referenced by NUREG/CR-3049 described the appropriate pumps, but stated that operating experience had not yet been achieved.

   The NRC staff has accepted the Licensing Review Group II (LRG-II) guidelines (Revision 1, September 19, 1983) as a position regarding deep draft pump operability. The applicant shall compare the South Texas program for long-term operability of deep draft pumps with the LRG-II guidelines and provide the following information to demonstrate its position.

   a. Identify deviations, if any, from the LRG-II guidelines.

   b. Provide justification for any deviations from the LRG-II guidelines.

   c. Describe actual operating experience of deep draft pumps, including longest continuous run.

Response to Topical Concern 3

By letter dated April 19, 1982, ST-HL-AE-816, HL&P informed the NRC that the vertical pumps at STP do not fall into the category of deep draft pumps (30-60') per the NRC guidance document that was submitted to HL&P by letter dated March 17, 1982. This assumes the pump as being measured from the top of the coupling housing to the bottom of the suction bell as noted below:

HHSI - 21.5' from top of the coupling housing to bottom of the suction bell (16.8' from bottom of bowl to foundation mounting)

LHSI - 21.8' from top of the coupling housing to bottom of the suction bell (17.3' from bottom of bowl to foundation mounting)

CS - Same as LHSI

ECW - 27.2' from top of the coupling housing to bottom of the suction bell (22.5' from bottom of bowl to foundation mounting)

The HHSI, LHSI and CS pumps were manufactured by Pacific Pumps. The ECW pump was manufactured by Hayward Tyler.

a. There are no apparent deviations from the intent of the LRG-II guidelines for the STP vertical pumps. The high head SI pumps, low head SI pumps and containment spray pumps at South Texas Plant were manufactured by Pacific Pumps. These pumps are very similar in design to the Byron Jackson deep draft pumps addressed by LRG-II Revision 1. The only significant design difference between manufacturers is that Byron Jackson uses a double suction first stage impeller, while Pacific Pumps uses a high suction specific speed inducer before the first radial impeller. Both of these design features provide rotor stability over a wide range of flows. Pacific Pumps completed extensive shop testing of the South Texas pumps to verify rotor stability. The LRG-II guidelines for vibration monitoring have been accounted for at South Texas in installing permanent monitoring equipment on the pumps. This equipment includes proximity probes to measure shaft deflections and accelerometers to measure motor vibrations.

   During preoperational testing, these pumps will be tested under various conditions including minimum flow, design flow, and near run-out. Inlet pressure, differential pressure, flow rate and vibration levels will be measured and verified acceptable in accordance with the design specifications. Following preoperational testing, the pumps will be tested using a set of reproducible conditions measuring inlet pressure, differential pressure, flow rate and vibration levels as a baseline and then quarterly tested to monitor the pumps for degradation.

   In addition to normal startup testing, the Essential Cooling Water Pumps will receive expanded commissioning tests and inspections as recommended in IEB 83-05 (ASME Nuclear Code Pumps and Spare Parts Manufactured by the Hayward Tyler Pump Company). This program consists of pre-starting tests including pump-to-motor alignment verification and rotation by hand to detect potential rubbing; operational tests at normal flow, minimum flow, and run-out flow evaluating pump flow vs. head performance, vibration, packing gland temperature, motor current, and pump leakage; and a pump rundown check from normal flow by stopping the motor and evaluating time required for rotation to stop. The pumps are then operated at normal flow for 48 continuous hours and are acceptable if no maintenance or repair is then required.

During the preoperational and startup phases prior to fuel load, these pumps will accumulate many hours as a result of normal testing activities, system flushing, and operation to support other systems. Sufficient monitoring is performed prior to fuel load to ensure pump operability and detection of degradation if it occurs.

Following disassembly and reassembly, these pumps will be hand turned to assure there is no major misalignment. Post-maintenance tests using the normal quarterly test procedures described above will be performed to verify pump operability.

b. Not applicable. See the response to item a. above.

c. The Pacific Pumps LHSI, HHSI and containment spray pumps are new to the nuclear industry and have little operating experience in actual plant use. However, the pumps received extensive testing in the vendor shop including a prototype 100-hour endurance test across a wide range of flows. Additionally, Pacific Pumps has provided a similar bearing system and configuration on numerous condensate and heater drain pumps in both nuclear and fossil electric generating plants. These pumps will be tested several times prior to fuel load as discussed in the response to paragraph a.

The ECW pumps are vertical wet pit pumps similar in design to pumps produced by various manufacturers and utilized in various industrial applications. During testing of STP, these pumps will accumulate several thousand hours of operational time under full system temperature and pressure.

Topical Concern 4

The application has not provided the information to demonstrate operability of the containment purge and vent valves per NUREG-0737, TMI Item II.E.4.2(6). This information was requested in an NRC letter dated July 31, 1985 from R. G. LaGrange (NRC-EQB) to G. Knighton (NRC-LB3). The applicant shall submit the appropriate documentation for review prior to fuel load. The evaluation of this issue will be done in the NRC staff's office, not during the plant audit.

Response to Topical Concern 4

The information to demonstrate operability of the containment motor-operated purge and vent valves per NUREG-0737, TMI Item II.E.4.2(6) has been submitted to the NRC via letters (1) M. R. Wisenburg to G. W. Knighton (ST-HL-AE-1245) dated April 30, 1985 and (2) M. R. Wisenburg to V. S. Noonan (ST-HL-AE-1748) dated September 15, 1986.

By letter from M. R. Wisenburg to G. W. Knighton (ST-HL-AE-1467) dated October 30, 1985, HL&P informed the NRC that the system has been revised to incorporate a pneumatic quick closure, fail closed valve on the outboard side of both the intake and exhaust penetrations (this information has subsequently been incorporated into the FSAR as part of Amendment 53). These valves will be environmentally and seismically qualified to IEEE 323-1974, NUREG-0588, Revision 1, and IEEE 344-1975. In addition, the operability program will show that the valves will close, within the specified time limits under the flow induced loads due to a LOCA. This analysis will show that there is sufficient torque margin to close the valve and that stresses in valve parts critical to operation will be well within allowable values.

The Qualification Test Procedure (STP-33186-1 Rev. A) for IEEE 323 and NUREG-0588 qualification of the valve seat material is provided as Attachment 2 for your information. Other tests and analyses will show environmental and seismic qualification of the total valve assembly. A separate analysis will also show that the valve is capable of closure under the flow induced loads of a LOCA.

Attachment 2

ATTACHMENT 2
ST-HL-AE-1773
PAGE 1 OF 25

DDS16 STP-14926-001

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HOUSTON, TEXAS 77252-2166

TO
SUPPLIER DATE ____________

VALTEK
MOUNTAIN SPRINGS PARKWAY - P.O. BOX 2200
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ATTN: LYNN LARSON

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ENCLOSED IS ONE (1) COPY OF THE FOLLOWING DOCUMENTS:

SUPPLIER NUMBER	SH	REV	TITLE	BECHTEL LOG NUMBER P O CAT UNIT SEQ ACR	SUB	STATUS	
STP-33186-1		~~N/A~~ A	QUALIFICATION TEST PROCEDURE ON VALVE & ACTUATOR	4409 00266 VT	B	1	
STP-33186-1		~~N/A~~ A	QUALIFICATION TEST PROCEDURE ON VALVE & ACTUATOR	8409 00266 VT	B	1	**

SIGNED A.J. DiPena / B. Shah DATE 9/25/86
GROUP SUPERVISOR

SHIPPING
DATE ________ SIGNED ________
TDC

ATTACHMENT 2
ST-HL-AE-1773
PAGE 2 OF 25

INDEX SHEET

SUPPLIER DOCUMENT NO. STP-331861

A = ADDED SHEETS
R = REVISED SHEETS
D = DELETED SHEETS

A-R-D	SHEET NO.	REVISION	DATE	DESCRIPTION
R	2	A		Cover pg - pg 1
A	2A	A		Rev. Record - pg i
R	3-17			Table of Contents
				thru 6.0, pages
				2 thru 16.
A	18-22			Appendix A & B
				pgs 17 thru 22

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MECHANICAL		
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WIRING		
CONDUIT		
MQS		
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STP-33186-1 QUALIFICATION TEST PROCEDURE ON VALVE & ACTUATOR

PACKAGE NO. 17768

Bechtel Log No
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14926-8409.00266-B1

IMPORTANT
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