PDR-per PM

INEL
Idaho National Engineering Laboratory

April 21, 1987

Mr. Mayo Carrington, Project Manager
Technical Assistance Management Branch
Planning & Program Analysis Staff
Office of Nuclear Reactor Regulation
Bethesda, MD 20014

TRANSMITTAL OF REPORT - AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM FOR THE SOUTH TEXAS PROJECT UNIT 1 (A6415) - Oben-55-87

Ref: G. E. Marx ltr to S. B. Milam, Marx-56-84, Transmittal of NRC Form 189 for Equipment Qualification Case reviews (A6415), February 10, 1984

Dear Mr. Carrington:

The subject report is transmitted in fulfillment of subtask f of project IV for the referenced 189 for the South Texas Project Unit 1. This work was conducted under the technical direction of Mr. G. Bagchi of the Office of Nuclear Reactor Regulation, Division of PWR Licensing, Engineering Branch.

This report documents EG&G Idaho, Inc.'s evaluation of the pump and valve operability assurance program for the South Texas Project Unit 1. The EG&G Idaho, Inc. review was conducted at the plant site to evaluate compliance with pertinent codes, standards, and regulations. Several specific and generic issues were identified, which the applicant must resolve before fuel load. These issues have been transferred to the South Texas Project Unit 1 SER Section 3.10.2 (NUREG 0781) for tracking and

EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415

resolution. Based on the information obtained during the on-site audit as well as the related discussions with plant personnel and the applicant's commitment to resolve all operability issues, EG&G Idaho, Inc. concludes that the South Texas Project Unit 1 pump and valve operability program has been established and can be implemented in compliance with the applicable codes, standards, and regulations.

Very truly yours,

C. F. Obenchain, Manager
NRR and I&E Support

CK:ggo

Enclosure:
As Stated

cc: G. Bagchi, NRC/DL
G. L. Jones, DOE-ID
A. Masciantonio, NRC/DL
J. O. Zane, EG&G Idaho (w/o Encl.)

Idaho
National
Engineering
Laboratory

Managed
by the U.S.
Department
of Energy

EGG-NTA-7681
April 1987

INFORMAL REPORT

AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM FOR THE SOUTH TEXAS PROJECT, UNIT 1

C. Kido
H. M. Stromberg
H. L. Magleby

EG&G Idaho

Work performed under
DOE Contract
No. DE-AC07-76ID01570

Prepared for the
U.S. NUCLEAR REGULATORY COMMISSION

DISCLAIMER

EGG-NTA-7681

AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM FOR THE SOUTH TEXAS PROJECT, UNIT 1

Docket No. 50-498

C. Kido
H. M. Stromberg
H. L. Magleby

Published April 1987

NRR and I&E Support Branch
NRC Technical Assistance Division
EG&G Idaho, Inc.
Idaho Falls, Idaho 83415

Prepared for the
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
Under DOE Contract No. DE-AC07-76ID01570
FIN No. A6415

ABSTRACT

The South Texas Project, Unit 1 was audited December 16 to 19, 1986 to determine the adequacy of the Pump and Valve Operability Assurance Program. Nine concerns (four specific and five generic), which could not be resolved by the close of the audit, were identified to the applicant. The applicant has committed to adequately address all remaining concerns prior to fuel load. The open issues have been transferred to the South Texas SER (NUREG 0781) for tracking and resolution. The results of this audit indicate that the applicant has established and is implementing a program that will track all pumps and valves important to safety from manufacture and in-shop testing through qualification, installation, testing, maintenance, and surveillance for the purpose of assuring continued operability of these components over the life of the plant.

FOREWORD

This report is supplied as part of the "Equipment Qualification Case Reviews" project that is being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation by the NRC Technical Assistance Division of EG&G Idaho, Inc.

The U.S. Nuclear Regulatory Commission funded this work under the authorization, B&R 20-19-40-41-2, FIN Number A6415.

SUMMARY

The Pump and Valve Operability Assurance Review Team (PVORT), comprised of one member of the Nuclear Regulatory Commission (NRC) staff and three EG&G personnel, conducted an on-site audit of the South Texas Project Pump and Valve Operability Assurance Program during the week of December 16 to 19, 1986. A representative sample of active pumps and valves was selected for review and evaluation. These components are categorized as either Nuclear Steam Supply System (NSSS) or Balance of Plant (BOP), based upon which organization was responsible for the purchase and installation of the component. Westinghouse is South Texas's NSSS vendor while Bechtel, an architectural engineering firm, is responsible for the BOP components.

The process used to evaluate the plant's overall Pump and Valve Operability Assurance Program includes: (a) becoming familiar with each selected component and the system in which it is installed, (b) understanding the component's normal and safety functions, (c) visually inspecting the component's configuration and mounting, (d) reviewing those documents relating to the operability of each selected component, (e) ensuring the applicant has an adequate document retrieval system, and (f) reviewing the applicant's preoperational testing and maintenance/surveillance programs.

The results of the evaluation process are two-fold. Any component specific deficiencies or concerns are identified and documented. Of greater importance are any generic concerns, which may be identified, that could affect other components in the plant or possibly even extend to other plants.

During the PVORT review, a number of component specific concerns were raised. All but four of these specific concerns were satisfactorily resolved during the audit by the applicant supplying additional information or demonstrating that administrative procedures were in place that would

address them. The applicant committed to resolve the four component specific concerns prior to fuel load. In addition the staff also requested that prior to fuel load the applicant confirm that: (a) All of the pre-service tests required before fuel load are completed, (b) approximately 10 to 15 percent of all pumps and valves important to safety that have not yet been installed and qualified be installed and qualified, (c) the FSAR does not provide a complete list of safety-related pumps and valves (BOP and NSSS) and therefore needs to be revised, (d) nonconformancies issued during the transition of Architect Engineer from Brown and Root to Bechtel should be reviewed, (e) a 30 day operating time post-accident is not consistent with the normal practices and needs to be resolved.

The PVORT specific and generic concerns have been transferred to the South Texas SER (NUREG 0781) for tracking and closure.

CONTENTS

TABLES

AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM FOR THE SOUTH TEXAS PROJECT, UNIT 1

1. INTRODUCTION

A Pump and Valve Operability Review Team (PVORT) consisting of engineers from the NRC PWR(A) Engineering Branch (PAEB) and the Idaho National Engineering Laboratory (INEL-EG&G) performed and two-step review of the Pump and Valve Operability Assurance Program being implemented by Houston Lighting and Power Company at the South Texas Project, Unit 1. The purpose of this review was to determine if South Texas's program is adequate to ensure that pumps and valves important to safety will operate when required during the life of the plant under normal and accident conditions. South Texas Project, Unit 1 is a 1250-MWe pressurized water reactor (PWR) located 12 miles southwest of Bay City, Texas.

The first step was a review of Section 3.9.3.2 of the applicant's Final Safety Analysis Report (FSAR). This information was general in nature, however, and by itself was not adequate to properly determine the scope of the applicant's overall equipment qualification program as it pertains to pump and valve operability. The results of this FSAR review appeared as input to South Texas's Safety Evaluation Report (SER). The resolution of most SER pump and valve issues was accomplished prior to or concurrently with the on-site audit.

The second step of the review was an on-site audit to assess the applicant's overall program, while it was being implemented. The PVORT conducted an audit from December 16 to 19, 1986 of a representative sample of installed pump and valve assemblies and their supporting qualification documents at the applicant's plant site. Based upon the results of the FSAR review and the on-site audit, the PVORT was able to determine if the applicant's overall program conforms to the current licensing criteria presented in Section 3.10 of the Standard Review Plan (SRP). Conformance with SRP 3.10 criteria is required in order to satisfy the applicable portions of General Design Criteria (GDC) 1, 2, 4, 14, and 30 of Appendix A to 10 CFR 50 as well as Appendix B to 10 CFR 50.

Section 2 of this report presents the basic methodology used to evaluate South Texas's overall equipment qualification program as well as a discussion of the concerns raised during the evaluation of the selected components and other qualification issues. Section 3 presents the staff's conclusions concerning the audit. Sections 4 and 5 present the references for the NSSS and BOP components, respectively.

The open issues have been transferred to the South Texas SER (NUREG 0781) for tracking and resolution.

2. EVALUATION METHODOLOGY

In order to evaluate the adequacy of South Texas's Pump and Valve Operability Assurance Program and the extent to which it was being implemented, the PVORT conducted an audit at the plant site December 16 to 19, 1986. The on-site audit consisted of verifying the major element of the applicant's overall equipment qualification program had been (or would be) implemented for the set of selected components. By performing a detailed review on a diverse set of components, the PVORT was attempting to identify concerns that may be generic to the applicant's overall program. Table 1 presents a list of pumps and valves selected for the PVORT audit.

As the first step of the detailed review of the selected components, the PVORT conducted a plant walkdown of each component accompanied by cognizant applicant personnel. One purpose of this walkdown was to obtain information that could later be compared with the evidence of qualification contained in each component's document package. Some examples of walkdown information that was compared with relevant documents are: (a) name plate data versus design and purchase specifications, (b) installed configuration and mounting versus the configuration and type of mounting that was tested (or assumed in an analysis), (c) local equipment environment (including the environment that could result from an accident) versus the environment enveloped during required testing, (d) system interfaces versus energy or fluid requirements, and (e) installed functional accessories versus actual equipment tested. In addition, a second purpose of the walkdown was to evaluate each selected component in order to determine whether any operability concerns may have been overlooked up to that point in time. Examples of such concerns are: (a) the potential for flooding, (b) component misapplication, (c) the potential for pipe whip or missile damage, and (d) the potential for personnel interactions that could inadvertently cause a component to become inoperable.

The document review portion of the audit was conducted after the completion of the walkdown of selected components. One purpose of the document review was to verify that the principles established in

TABLE 1. PUMPS AND VALVES SELECTED FOR THE SOUTH TEXAS PROJECT UNIT 1 PVORT AUDIT

NSSS Components		BOP Components	
B1CV-FV-8400B[a]	CVCS Flow Control Valve	3S141MPA04	Auxiliary Feedwater Pump
2R171X-CV-0112C[a]	Chemical Volume and Control Isolation Valve	3S141T-AF-091	Auxiliary Feedwater Minimum Recirculation Valve
3R171NPA103A	Boric Acid Transfer Pump	3R101T-CC-0132	Component Cooling Water Surge Tank Isolation Valve
		3R281NPA101B[b]	Essential Cooling Water Pump
		A1FW-FV-7141	Feedwater Isolation Valve
		2S141T-AF-0019	Auxiliary Feedwater Stop-Check Valve
		C1CH-TV-9497A	Chilled Water Isolation Valve
		B1RM-FV-7663[a]	Reactor Water Makeup Isolation Valve
		A1MS-FSV-7414	Main Steam Isolation Valve

Note: The applicant had six weeks to prepare document packages for all but the surprise components; for those it has only a few days. The contents of the document package for the surprise components is an indicator of: (a) the applicant's ability to retrieve documents in a timely manner, and (b) the completeness of its central files.

a. Surprise component--The applicant is informed of this component only a few days prior to the on-site audit.

b. The applicant provided a separate presentation concerning the deep draft pump issue (refer to IEE Bulletin 79-15) for this component.

South Texas's program had been (or would be) uniformly implemented. Therefore, the document package for each of the audit components was reviewed to ensure that, as a minimum, each package contained the following:

- o A purchase specification that reflects design and functional requirements
- o Results of applicable in-shop tests
- o Evidence that the component was subjected to a qualification plan that addressed:
  - Pre-aging
  - Significant aging mechanisms (if applicable)
  - Normal and accident loads (including seismic and hydrodynamic loads)
  - Acceptance criteria requiring operability both during and after an event
  - Identifiable safety margins (difference between design basis parameters and the test parameters used for equipment qualification)
- o Applicable preoperational test procedures
- o Similarity statements, where he qualification of a similar equipment i used to qualify the installed equipment (if applicable)
- o Evidence that maintenance/surveillance practices incorporate qualification and operability concerns.

In addition, a second purpose of the document review was to ensure that an auditable link existed between the documents in the package and that all documents had been reviewed and approved by personnel having a working knowledge of equipment qualification issues and concerns. Those documents not present in the audit component package were requested by the PVORT. The applicant's timely response to these requests and its ability to compile a complete package for the surprise components were considered to be positive indicators of the acceptability of the applicant's central file system.

During the course of the audit, there were instances where the applicant could not provide a response to a question or a response that was consistent with the staff's positions and/or code requirements. These instances have been identified as concerns. The concerns once identified were transcribed to the South Texas SER (NUREG 0781) Section 3.10.2 for tracking and ultimate resolution.

The remainder of Section 2 is devoted to discussing the equipment and issues that were evaluated during the on-site audit. Sections 2.1 and 2.2 present the evaluation of the NSSS and BOP components, respectively. Section 2.3 summarizes the status of equipment qualification issues relating to pump and valve operability, such as the South Texas SER (NUREG 0781) issues, operability of deep draft pumps and check valves, maintenance and inservice test programs, and implementation of the overall South Texas qualification program.

2.1 Nuclear Steam Supply System (NSSS) Components

2.1.1 Chemical and Volume Control Flow Control Valve, B1CV-FV-8400B (Audit Status: Closed)

2.1.1.1 Component Description. This component is a 2-inch air operated valve with both the valve body (Serial Number 8435078-1-2) and actuator (Model 3250 L) being manufactured by ITT Grinnell. The component is located in the MAB/238K building at the 41 foot elevation. The valve is

normally open passing boric acid flow to a polishing system. On a boric acid tank lo-lo level signal, this valve closes to prevent a loss of boric acid inventory assuming a failure in the NNS Polishing System. This component is designed for 300 psig, 200°F, 523 gpm, borated water, a maximum differential pressure of 300 psig and a maximum operating time of 10 seconds in both the open and closed directions. Under normal operating conditions the system provides 110 psig, 105°F, 30 gpm and borated water. Accident conditions require the valve to close and cause a differential pressure of 150 psig.

2.1.1.2 Component Walkdown. The walkdown of this component inspected all portions of the installation except that the manufacturer nameplate data could not be verified as pipe insulation had been installed. During the walkdown, one concern was identified. The concern involved the grounding strap installation. While verifying the valve installation the staff noticed that grounding straps had not been attached to the solenoid valves, actuator or conduits. By examining the installation, it was not clear if the missing straps were an oversite, left off intentionally or installation was not complete. The applicant was questioned about the installation status to which they researched and provided a response. The response indicated that the installation was complete and within the design requirements. Based on the applicant's response, the concern was considered to have been addressed.

2.1.1.3 Document Review. The review of the qualification documents[1-8] revealed that component qualification was addressed by a combination of shop and functional testing and analysis. The valve has been qualified as a result of static deflection, IEEE sequential qualification (limit switches and solenoid valve), shell and seat leakage, and operational testing. A seismic analysis was performed for seismic qualification. No concerns were identified during the document review.

2.1.1.4 Findings. No concerns specific to this component remained after the walkdown and document review.

2.1.2 Chemical Volume and Control System (CVCS) Isolation Valve, 2R171X-CV-0112C, (Audit Status: Closed Pending Confirmation)

2.1.2.1 Component Description. This component is a 6-inch gate valve manufactured by Westinghouse (serial number 06000GM82FBB0D008 W750002) and is driven by a Limitorque motor operator (Model SB-00-15). The valve is located in the Mechanical Auxiliary Building Room M033 at the 10-ft level. The valve is normally closed, isolating the reactor water storage tank (RWST) from the charging pump header. The safety function of the valve is to open to provide emergency makeup flow on either a safety injection signal or Volume Control Tank (VCT) low-low level signal. At maximum ΔP=200 psi the required opening or closing time is required to be less than 15 seconds. The maximum allowable leakrate for the valve packing and seat are 18 cc/hour and 1.25 cc/hour, respectively. Upon loss of power to the actuator, the valve fails as is. The valve is required to remain operational 24 hours following an event.

The component was selected as a surprise audit item in order to assess the applicant's ability to retrieve appropriate documentation given only 4 days notice. The applicant's retrieval of the qualification documents, accessibility of cognizant personnel, and preparation for the audit was found to be consistent with other components audited.

2.1.2.2 Component Walkdown. The valve was verified to be identified by the Equipment Tag Number 2R171X-CV-0112C. The valve was observed to be line mounted and butt welded. The valve appeared to be fully installed with all piping and electrical connections complete. The valve is located outside containment and therefore T-drains and grease reliefs are not required. None were observed on the valve. No concerns were identified by the walkdown of this component.

2.1.2.3 Document Review. The review of the qualification documents[9-14] revealed that the qualification of this component was addressed by a combination of vendor tests, hot and cold functional tests, static deflection test, seismic analysis, and environmental tests. The vendors tests included hydrostatic pressure, leakage, and functional

checks. No anomalies were found. The cold hydro and pre-op tests were performed without problems. The valve will be full stroke tested quarterly and leak tested at each refueling.

Seismic qualification was based on a static equivalent test and stress analysis. The SSE requirement is 4 g in each orthogonal axis acting simultaneously. The static deflection tests applied 4.5 g in both horizontal directions to 4-inch and 12-inch Westinghouse valves. A Westinghouse memorandum provided a similarity statement for the range of valve sizes between 4 and 18 inches. End loads were simulated to .75 Sy, meeting the specified requirement. The applied pressure was 2500 psi. The closing and opening times were 6 to 6.5 seconds, which is less than the 15 second limit. The results of the valve analysis met the acceptance limits. The calculated natural frequency of 157 Hz justified the use of a static equivalent load. Deflection at the valve packing was calculated to be .001 inch, compared to the structural interference limit of .013 inch.

The environmental qualification was performed in accordance with the IEEE 382-1972 sequential test guidelines. The equipment environmental requirements were identified on the PVORT Form as 140°F, .6 psig, 100% relative humidity, and 10^7 Rads. The Limitorque operator was qualified to 40 years at 130°F, 2200 operating cycles, 4×10^6 Rads, 7.7 g RIM test. There was no evidence of damage or faulty operation. The radiation requirement was not demonstrated by the referenced qualification report. In addition, the environmental qualification did not include simulation of a design basis event and did not provide demonstration that the valve would function properly at 140°F. It will be reported as a deficiency as part of the System Component Evaluation Work (SCEW) sheet review under the environmental qualification review of Standard Review Plan Section 3.11.

2.1.2.4 Findings. All questions were satisfactorily resolved during the audit except for the environmental qualification of the valve operator. This item will be resolved upon satisfactory resolution of the SRP Section review items and is not reported as an open item in this report. See Table 4, footnote "L".

2.1.3 Boric Acid Transfer Pump, 3R171NPA103A, (Audit Status: Open)

2.1.3.1 Component Description. This component is a horizontal, single stage canned motor pump manufactured by Crane Chempump (Model GVE-20K-23H-1S) and is driven by Crane Chempump motor (Frame No. 180). The pump is located in the Mechanical Auxiliary Building at the 10 ft level. The pump is normally operating to transfer boric acid to the boric acid tank, chemical volume control system makeup, and boric acid purification system. The safety function of the pump is to provide boric acid to the charging pump suction for emergency boration during cold shutdown procedures. The pump/motor assembly is bolted to a baseplate that is anchored to the floor. The pump is required to remain operational for 30 days following an event.

2.1.3.2 Component Walkdown. The walkdown of this component identified three concerns, all of which were adequately resolved before the end of the audit. First, the cover of a thermal cutout switch, which detects heat buildup in the motor stator, was found to be loose. The applicant investigated the concern, and reported that the electrical connections were properly sealed and qualified for the environment. The applicant committed to properly secure the switch cover prior to turnover to the startup group. Second, the cover of an electrical junction box was found to be completely open. The applicant explained that conduit systems, which include junction boxes, are not turned over until after the area has been turned over from the construction group to operations. Since the area had not yet been turned over, the box cover was not required to be installed. The area is scheduled to be turned over prior to the hot functional tests in late January. Third, the flange connection on the pump intake nozzle had one stud whose threads were flush with the top of the nut. The staff has found that the common practice at other plants is to have 1 1/2 to 2 threads past the nut in order to ensure adequate thread engagement. Upon questioning, the applicant presented documentation on the South Texas thread engagement and bolt torquing procedures. The procedure allows the threaded bolt or stud to be flush with the nut. Adequate thread strength is assured by the selection and control of fastener materials. Although the South Texas approach to thread engagement is a departure from

common industry practices, the basis for the South Texas procedures appears to be justified. The walkdown of other components indicated that the applicant is implementing these procedures as specified throughout the plant. The staff accepted the applicant's explanations and resolutions to the above walkdown concerns.

2.1.3.3 Document Review. The review of the qualification documents[15-23] revealed that the qualification of this component was addressed by a combination of vendor tests, radiation exposure test, seismic analysis, and similarity analyses. The pump performance curves were examined and found to meet or exceed the purchase order specifications. The system component evaluation worksheet (SCEW) was reviewed, demonstrating that the component was qualified for the required environmental service conditions. The limited life components were identified as the teflon motor lead connector (5 years) and Class H motor insulation (27 years). These components were included in the applicant's equipment qualification program for replacement.

The OBE and SSE seismic analyses were performed using triaxial accelerations of 1.05 g and 2.1 g. The stress analysis of the pump assembly indicated that the smallest margin of allowable stress was at the rear cradle support (32010 psi bending stress compared to 38880 psi allowable). The analysis also considered ASME code design, natural frequency, and deflection. The results met the specified acceptance criteria.

The PVORT form stated that the bearings are checked for wear every six months. However, the review of the vendor's instruction manual recommends that the front and rear bearings be inspected not later than 3 months or 1500 running hours after initial startup. If wear is negligible at the end of two inspections, the vendor allows the inspection period to be changed to every six months. The applicant said that the six month period in the PVORT form was used to indicate the normal maintenance period. The applicant explained that Revision 0 of the preventive maintenance (PM) procedures was issued as a skeleton document and included only general work instructions. Additional details would be added in subsequent revisions.

The applicant is presently reviewing the PM's of all equipment for content and compliance with the vendor's recommendations. The revised PM work instructions will include important notes taken verbatim from the vendor's manual. The applicant provided an example of a revised PM for the recycle evaporator feed pump. In addition the staff verified that the NSSS mechanical equipment maintenance requirements are being tracked and scheduled for completion in January 1987. The applicant's explanation and discussion of the maintenance program satisfactorily resolved the staff's concern.

The PVORT form and discussion with the applicant indicated that the qualification of the motor was based on similarity to generic component and material tests performed by the vendor. Upon questioning, the applicant was able to provide a letter, which linked the seismic and environmental qualification of the pump motor to the family of motors covered by the vendor tests. The test reports and analyses were reviewed and found to be satisfactory with the exception of two items.

First, there was an apparent discrepancy in the level of radiation for which the component is qualified. The test sequence described in WCAP 8687 (EQDP-AE-3) indicated 10000 Rad, but the qualification summary Table I in the same report showed 400 Rad. The PVORT form showed a value of 2100 Rad, which matched the SCEW requirement of 2000 Rad (40 years service) plus 100 Rad (accident). The applicant investigated the situation and confirmed that the component is qualified to 10000 Rad and that the 400 Rad value is erroneous. The staff agrees that the equipment is qualified for the environment, and recommends that the apparent discrepancy in documentation be resolved. Therefore, the applicant shall (1) modify the WCAP 8687 report and PVORT form to correct the apparent discrepancy in the qualified level of radiation and (2) confirm that the equipment file has been supplemented with the appropriate documentation.

The second open issue was that the documentation file did not reference operability of the motor at reduced voltages. The applicant shall (1) provide a copy of the test report which references operability of canned motors at reduced voltages, (2) describe the basis for similarity of

the motor test results to the operation of the boric acid transfer pump used at South Texas, and (3) confirm that the equipment qualification file has been supplemented with the appropriate test data and required analyses.

2.1.3.4 Findings. After the evaluation of this component two issues, discussed above, remained open. The two specific issues are summarized in Section 3 (specific issues 3 and 4) and have been transferred to the South Texas SER (NUREG 0781) for tracking and closure.

2.2 Balance of Plant (BOP) Components

2.2.1 Auxiliary Feedwater Pump, 3S141MPA04 (Audit Status: Closed Pending Confirmation)

2.2.1.1 Component Description. This component is a turbine driven auxiliary feedwater pump. The turbine was manufactured by Terry Turbine (Model GS-2N) and the pump by Bingham Willamette Company (Model MSD). The pump and turbine are located in the IVC 008 building at the 11 feet 1 inch elevation. This pump is one of four auxiliary feedwater pumps (3 electric driven and 1 turbine driven) all of which are in parallel loops. During normal plant operation, all pumps are in standby. On receipt of an ESF (Engineered Safety Feature) signal or manual initiation, the auxiliary feedwater system is started to provide water from the auxiliary feedwater storage tank to the steam generators. The turbine driven auxiliary feedwater pump is designed for 2250 psig, 120°F, 600 gpm, total discharge head (TDH) of 3260 feet and water flow. Normal operating conditions are 1475 psig, 120°F, 550 gpm, 3400 TDH, and water flow. In the event of an accident the system conditions are 1325 psig, 120°F, 675 gpm, 3000 TDH and water flow.

2.2.1.2 Component Walkdown. The walkdown of this component identified four concerns all of which were resolved before the close of the audit.

The first concern involved a QC (Quality Control) Receiving Hold Tag that had been installed on the governor on May 6, 1981. The concern was

that the hold tag was identifying a condition which existed since 1981 and had not been rectified. The applicant researched the document files and found that the tag had been installed by Brown and Root. The purpose of the tag was to identify that qualification documentation had not been received for the trip and throttle valve Limitorque operator. The documentation was subsequently received and the Receiving Hold condition was lifted. However, the Hold Tag was not removed. The applicant explained that the hold was lifted during the period of time when Brown and Root responsibilities were shifted to Bechtel. The documentation was closed when the documentation was received, however, the tag was not removed as an oversight. The tag was subsequently removed before the close of the audit. This was considered to be an adequate resolution of this concern.

This concern raised an issue that the staff requested the applicant to consider. This issue was the control of tags either issued or resolved during the transition period. The referenced tag appeared to be an isolated case and therefore not an indication of a programmatic problem. However, the staff was concerned that a tag was still attached for five years after the nonconformance was closed and that no action was taken to remove the tag. The applicant shall confirm that nonconformances issued for safety related pumps and valves during the transition period have been reviewed and assure they have been properly picked up by a Bechtel program and dispositioned. This action item is summarized in Section 3 (Generic Issue 4) and has been tranferred to the South Texas SER (NUREG 0781) for tracking and closure.

The second concern identified during the plant walkdown involved a startup work request (SWR) tag that had been attached to the governor. The concern was that the tag was identifying a condition affecting qualification which required consideration during the document review. The applicant provided controlling documentation for the SWR tag. The documentation demonstrated that the reason for the SWR was to allow the governor to be refurbished by the vendor as it was not operating properly. Based on the documentation, the reason for the SWR and the vendor doing the

refurbishing, the SWR was not considered to affect qualification. Therefore, this concern was considered to have been adequately addressed.

The third concern identified during the walkdown involved trip and throttle valve operation after a trip signal is received such as an overspeed. The concern was that due to the congested area in which the valve was installed, manual operation of the trip and throttle valve, if required, would be extremely difficult. The applicant researched this concern and provided a response. The response indicated that after a trip signal, an operator would have to reset the trip mechanism at the valve by repositioning a linkage. After the trip is reset, the valve would be operated from the control room by using an electric motor operator. The trip mechanism was located in a congested area and not very accessible; however, since the process for resetting the trip is simple and does not require much effort, the staff agreed that resetting the trip and opening the trip and throttle valve would not be major problems.

The fourth concern identified during the walkdown involved thread engagement on pipe flange bolts. During the walkdown, it was noticed that several bolts on one of the flanges had the bolt flush with the top of the nut. The staff had two concerns: the first was that the installation may not be consistent with facility procedures and the second was that the stress limits for the nut and bolt could be exceeded with this type of an installation. The applicant researched this concern and provided a response. In response, the applicant provided a copy of the facility procedure governing thread engagement. The procedure demonstrated that the installation was in compliance. The applicant also provided copies of the ASTM specifications for nut and bolt installations and demonstrated that the installation was within limitations as identified by ASTM. Therefore, stress limits should not be exceeded. Based on the applicant's response this issue is considered to have been resolved.

2.2.1.3 Document Review. The review of the qualification documents[1-7] revealed that qualification was addressed by a combination of shop and functional testing and analysis. This assembly was qualified as a result of environmental, performance and hydrostatic testing.

Pre-operational, vibrational and functional tests are scheduled to be performed early in 1987. This component is to be tested quarterly under IST and every 18 months for auto-start as a method for ensuring operability. In addition to these tests the turbine was qualified by analysis and the pump by seismic stress analysis.

The document review identified four concerns all except one of which were addressed before the end of the audit.

The first concern identified involved the way design, operating and accident conditions were identified on the PVORT form. On the PVORT form, design flow was identified as 600 gpm with accident conditions requiring 675 gpm. Design TDH was identified as 3260 ft and normal conditions gave 3400 feet. In both cases, operating conditions appeared to exceed design conditions. The applicant reviewed this concern and provided a response. In response, the applicant provided a copy of the pump operating curves and showed that the parameters were taken off of the curves.

The second concern identified involved a five year cycle tear down of the turbine to verify adequate torquing of bolts internal to the turbine. During the document review, it appeared that vendor specified maintenance of a five year cycle tear down was not scheduled to be performed. The applicant researched and provided a copy of a schedule showing that the turbine was to be dismantled every five years and bolts torqued in accordance with the vendor's requirements. This response was considered to be acceptable.

The third concern identified during the walkdown also involved maintenance specified by the vendor. In the qualification documentation the vendor recommended that the overspeed trip be operated monthly. It was not clear that this task was identified in the maintenance schedule. The applicant researched and provided a copy of the procedure where this monthly requirement was identified for performance.

The fourth concern involved a design modification made to the control circuitry for the turbine supply steam isolation valves. The applicant was

questioned about moisture in the driving steam affecting turbine operation. In response, the applicant described a modification to the control circuitry for the turbine steam isolation control valves. This modification installed a 15 second timer in the control circuits for the isolation valves. The timer opened a 1-inch steam bypass for fifteen seconds to allow the turbine inlet lines to warm up before the steam isolation opens. After 15 seconds, the 4-inch steam isolation valve opens and the bypass closes. One additional thing should be noted, the turbine trip and throttle valve is a normally open valve which closes to throttle steam flow as turbine speed builds up. This system allows the piping and turbine to warm up for fifteen seconds before full steam flow is provided. The concern for this modification was in three parts: the first was that it was not clear that the modification met EQ standards, the second was that the fifteen second time delay might adversely affect the ability of the turbine to provide water within the time limits assumed for the safety analyses, and the third was that this modification had not been tested and, therefore, it was not clear that it would work as intended. The applicant researched all three parts of the concern and provided a response. In response to the first part of the concern, the applicant described the equipment used and provided assurance that the applicable EQ criteria had been met. The second part of the concern was reviewed and the applicant found that the turbine was not required to be started in less than 15 seconds nor was it required to provide water in less than 100 seconds. This response was found to be acceptable, however, it should be noted that the safety analysis was not reviewed to verify the timing. The third part of the concern was reviewed and the applicant indicated that the steam required to test the modification would not be available until hot functional testing. For this reason, the applicant committed to confirming that:

1. The isolation valve operation is adequate to assure proper turbine operation.

2. If the modification as described at the audit is not satisfactory, the applicant shall describe the problems and the steps taken to resolve them.

This action item is summarized in Section 3 (specific issue 1) and has been transferred to the South Texas SER (NUREG 0781) for tracking and closure.

2.2.1.4 Findings. All concerns except one were resolved before the close of the audit. For the remaining concern, the applicant committed to providing confirmation when pre-operational testing on the turbine steam inlet valves was completed and if testing was not satisfactory, describe the problems and resolutions. This concern is considered to be closed pending receipt of the confirmation.

2.2.2 Auxiliary Feedwater Minimum Recirculation Valve, 3S141T-AF-091 (Audit Status: Closed Pending Confirmation)

2.2.2.1 Component Description. This valve is a 4 x 1 1/2 in. automatic recirculation control valve manufactured by Yarway (Model ARC). This component is located in the Isolation Valve Cubicle (IVC)/101 building at the 22 foot elevation. Valve AF-091 is in the auxiliary feedwater pump 3S141MPA03 discharge and acts as the minimum flow recirculation valve as well as the discharge check valve. Normally this valve is lined up for recirculation as the auxiliary feedwater pump is shut down and in standby. When the pump starts, water originally flows through the recirculation line. As pump discharge pressure increases, the differential pressure across the check valve increases which causes the check valve to open. The check valve opening causes the recirculation line to close. This valve was designed for 2700 psig, 465°F on the discharge and 120°F on the inlet, 675 gpm and a maximum differential pressure of 1150 psig. Normal conditions are 1325 psig, 120°F, and 675 gpm (when the AFW pump is operating). In the event of an accident the system conditions are 1324 psig, 120°F and 675 gpm.

2.2.2.2 Component Walkdown. The walkdown of this component identified one concern which was resolved before the close of the audit. This concern involved a 1-inch pipeline at the valve outlet that was open to the local atmosphere. The line in question tapped into the 4-inch valve outlet line; although two valves were installed in the 1-inch line, the

line terminated in the air. It was not clear whether or not the installation was complete. The applicant reviewed the drawing and identified that the line was a vent line. The applicant explained that the cap for the line had been removed for venting and would be reinstalled when venting was completed. This explanation was found acceptable.

2.2.2.3 Document Review. The document review[8-15] for this valve demonstrated that qualification was addressed by a combination of shop and functional tests and analysis. The valve was qualified as a result of shell and seat leakage tests and static deflection tests. Preoperational testing is scheduled to be performed in late 1986 or early 1987 and IST operability verification is to be performed quarterly. Seismic analysis of the valve assembly was performed as well as a Mechanical Equipment Environmental Qualification analysis.

During the document review, two concerns were identified, one of which remains as a confirmatory issue. The first concern involved flushing requirements identified by the vendor. The vendor specified that system flushing be performed prior to valve installation. The applicant was requested to demonstrate that the vendor's requirement was met. The vendor reviewed their flushing procedures and provided a copy of the procedure used for flushing. The procedure demonstrated that the valve was removed and a spool piece installed before flushing was performed. This was considered to be an adequate demonstration.

The second concern involved maintenance requirements identified by the vendor. The vendor specified that the recirculation assembly be inspected every 1-2 years and the check valve spring and guides be inspected every 3-4 years. The applicant was requested to demonstrate that the maintenance requirements were identified. At the time of the audit, the applicant explained that the maintenance requirements for this valve had not yet been established. Therefore, the applicant committed to confirming that the appropriate maintenance requirements are identified and will be performed. This action item is summarized in Section 3 (specific issue 2) and has been transferred to the South Texas SER (NUREG 0781) for tracking and closure.

2.2.2.4 Findings. After the review of this component, all concerns except one have been addressed. For the remaining concern, the applicant committed to confirming that the appropriate maintenance requirements are identified and will be performed. This concern is considered to be closed pending receipt of the confirmation.

2.2.3 Component Cooling Water Surge Tank Isolation Valve, 3R101T-CC-0132 (Audit Status: Closed)

2.2.3.1 Component Description. Component cooling water surge tank isolation valve is a 24-inch butterfly valve manufactured by Rockwell International (Model L151.C1-Z-56) with a Limitorque actuator (Model SMB-0-25-H3BC). Normally this valve is open and closes on a low level signal in the surge tank. The valve is designed for 150 psig, 250°F, 12966 gpm, water flow, maximum differential pressure of 150 psig and a maximum opening and closing time of 10 seconds. Normal operating conditions are 15 psig, 122°F, 12489 gpm and water flow. In the event of an accident the system conditions are 15 psig, 117°F, 1958 gpm and water flow.

2.2.3.2 Component Walkdown. The walkdown of this component identified two concerns which were resolved before the close of the audit.

The first concern involved some T-drains installed on the motor operator. On each end of the motor a plug had been installed. Holes had been drilled into the plug to form a T. The applicant was asked to explain the purpose of these plugs and the status of their installation. In response, the applicant explained that the plugs were installed in all Limitorque actuators in a harsh environment in order to meet environmental qualification. It was explained that the plugs were installed to permit the motors to breathe and moisture to be drained off. This response was found to be acceptable.

The second concern identified during the walkdown involved torquing values identified by the valve manufacturer. Attached to the valve was a tag identifying torquing values for the packing gland bolts. It was not

clear that the maintenance procedures had identified the correct torquing criteria. The applicant reviewed this concern and provided a procedure demonstrating that the correct torquing criteria had been identified.

2.2.3.3 Document Review. The review of qualification documents[16-27] revealed that qualification was addressed using similarity by a combination of shop and functional testing and analyses. Qualification testing was performed on an 18-inch valve and analysis used to qualify the 24-inch. This was found to be acceptable. The component was qualified by separate tests of the actuator, terminal blocks, and non-metallics, and by frequency search, dynamic, static operability, hydro (shell and seat), functional motor operated valve prerequisite and control logic pre-operability tests of the assembly. To ensure operability in the future a differential pressure stroke preop and system hydro test will be performed as well as quarterly IST operability testing. In addition to tests the following analyses were used for qualification; limitorque actuator assessment, limitorque qualified life, 18-inch valve design report, 24-inch valve design report and mechanical equipment qualification.

During the document review, two concerns were identified, both of which were resolved before the end of the audit.

The first concern involved a similarity statement. As the documents were reviewed, it was noticed that the 24-inch valve was qualified by similarity, using the test results of an 18-inch valve. The documents originally provided for review did not contain a discussion of how the qualification of the smaller valve qualifies the larger. The applicant reviewed this concern and provided a copy of the Mechanical Equipment Qualification Package for review. In this document, a similarity discussion was provided.

The second concern involved the PVORT long form provided for the audit. On the long form, it was indicated that the safety position was open to allow component cooling water flow back to suction header train "B". This indicates that the safety position is open. However, a review of the drawings indicated that the valve was a surge tank isolation valve.

Since it was an isolation valve, the shut position was also a safety position. This issue was discussed with the applicant's systems engineer and this was found to be the case. In order to verify that the valve could perform both safety functions, the staff requested the applicant to demonstrate that this valve was being tested in its open and shut directions. The applicant provided a copy of a procedure (Component Cooling Water System Train 1B Valve Operability test, 1PSP03-CC-0008, Revision 0) for review. This procedure demonstrated that this valve was being tested in both directions. The procedure adequately addressed this concern.

2.2.3.4 Findings. No concerns specific to this component remained after the review of this component.

2.2.4 Essential Cooling Water Pump, 3R281NPA101B, (Audit status: Closed)

2.2.4.1 Component Description. This component is a vertical 20,610 gpm capacity pump manufactured by Hayward Tyler (Model 24VSN) and is driven by a Reliance Electric 800 HP motor (Model V6840). The pump is located in Room P105 of the Essential Cooling Water (ECW) Intake and Discharge structure at the 34-ft level. There are three identical ECW pumps.

Heat rejection to the ECW system (ECWS) is accomplished by three redundant cooling water loops, each loop having its own pump, motor, self-cleaning strainer, piping, valves, and instrumentation. During normal ECWS operation, one ECW pump delivers cooling water from the Essential Cooling Pond (ECP) to the Component Cooling Water Heat Exchanger (CCWHX), essential chiller condensors, and CCW pump supplementary coolers. Heat is rejected from the serviced components and transferred to the ECP. In the event of a LOCA, loss of offsite power (LOOP), or safe shutdown earthquake (SSE), all three ECWS loops are required to operate initially to provide cooling water for safety-related equipment. Following the event, the plant can be shut down, cooled down, or maintained in the cold shutdown mode with only two ECWS loops in operation.

The applicant explained that the vertical pumps at South Texas do not fall into the category of deep draft pumps as described by an NRC guidance document dated March 17, 1982. The ECW pump is 27.2 ft long from the top of the coupling housing to the bottom of the suction bell compared to the 30 to 60 foot length described by the NRC document. The staff pointed out that the 30 - 60-foot length is a guideline not a fixed value. The potential for excessive vibration, mechanical wear, and pump malfunction should be considered in the pump qualification. During the review of the ECW pump the staff was mindful of industry-wide problems associated with the long term operation of deep draft pumps. The evaluation of this generic issue is presented in Section 2.3.3.

2.2.4.2 Component Walkdown. The pump was verified to be a Hayward Tyler pump model number 24VSN and serial number 804402. The motor was verified to be a Reliance motor model number V6840 and serial number 998234F1. The pump appeared to be completely installed and operable. All components appeared to be in place with all piping and electrical connections made. The pump appeared to have a permanently installed vibration measuring system. The system appeared to be in place and functional. No concerns were identified by the walkdown of this component.

2.2.4.3 Document Review. The review of the qualification documents[28-35] revealed that the qualification of this component was addressed by a combination of vendor tests, pump performance tests, seismic analyses and environmental tests. A static equivalent seismic analysis was performed using a conservative load of .4 g in two perpendicular horizontal directions. The seismic requirement is .15 g OBE and .30 g SSE. The static analysis methodology was verified to be acceptable, because the RRS curve showed a cutoff frequency at 14 Hz even though the lowest natural frequency was computed as 22.7 Hz. A concern identified in the review was that the horizontal support on the casing shaft provided restraint in only one horizontal direction. The applicant resolved this concern by verifying that the static analysis used a model with horizontal support only in one direction consistent with the actual installation. The results of the analysis demonstrated that the stresses and deflections were acceptable.

Environmental qualification was performed in accordance with NUREG 0588 Revision 1 Category 2d. The equipment was qualified to environmental conditions of 104°F, 80% humidity, and 100 R gamma, which met or exceeded the specified requirements. The BUNA-N gaskets were identified in the PVORT form as having a limited life of 5 years. However, the staff discovered that the maintenance procedure was not yet in place. Upon questioning, the applicant presented the special EQ Maintenance Requirement Book, which identifies all limited life components and maintenance tasks. The staff reviewed the document and verified that the 5-year replacement had been identified.

The pump performance records were reviewed and found to be acceptable. The pump curve indicated a maximum capacity of 20,610 gpm at 105 ft head, compared to the requirement of 19,280 gpm at 110 ft head. Vibration measurements were taken at the upper thrust and upper pump bearing and were found to be acceptable.

This component was initially identified by the applicant as a deep draft pump in a letter dated August 31, 1979. In a recent letter dated October 9, 1986 the applicant stated that none of the vertical pumps, including the ECW pump, fit the 30 - 60 ft column length category used in an NRC guidance document on deep draft pump operability. The staff pointed out that the 30 - 60 ft length is a suggested guideline, and that the potential for excessive vibration could still exist for shorter lengths. The staff evaluated the qualification documents to determine to what extent long-term operation and vibration had been addressed.

The applicant pointed out that entire IST program has already been submitted to other elements of the staff for comment. On the basis of a cursory review of the IST procedure 1PSP03-EW-0002, the staff finds that the ECW pump will be periodically tested and monitored to detect any degradation of baseline operating parameters. The maintenance and IST programs appear to be consistent with the LRG-II guidelines for long-term operability of deep draft pumps. The results of the vibration tests were acceptable. The ECW pump has already achieved more than 48 hours of operation at the plant without incident. Significant additional hours will

be accumulated prior to fuel load and plant startup. Section 2.3.3 of this report discusses the generic issue of deep draft pump operability. No open issues were identified in this area.

2.2.4.4 Findings. All questions were satisfactorily resolved during the audit.

2.2.5 Feedwater Isolation Valve, A1FW-FV-7141, (Audit Status: Closed)

2.2.5.1 Component Description. This component is an 18-inch gate valve manufactured by WKM (Model POW-R-Seal D2) and is driven by an integral nitrogen filled hydraulic cylinder (Model OPG). The valve is located in the Isolation Valve Cubicle (IVC) Room 303 at the 47 ft - 6 inch level. The valve is normally open. Upon receipt of a feedwater isolation signal (Train A and/or Train B) the valve is required to close in less than 5 seconds. Functional accessories that are used to make the valve operational include Valcor solenoid operated dump valves and Namco limit switches. Upon loss of power to the actuator solenoid, the valve fails closed. The equipment is required to remain operational for 30 days following an event.

2.2.5.2 Component Walkdown. The valve was verified to have equipment Tag Number A1FW-FV-7141. The valve model number and serial number could not be verified because the valve body had the insulation in place and these numbers were not visible. The model numbers of the accessories were verified. The solenoid dump valve was verified to be Valcor 2700-77 and the limit switch was verified to be Namco EA-180-21302. The valve was verified to be line mounted and was installed approximately 19° from vertical to clear the main steam line. The valve appeared to be fully installed with all piping and electrical connections complete. No concerns were identified by the walkdown of this component.

2.2.5.3 Document Review. The review of the qualification documents[36-46] revealed that the qualification of this component was addressed by a combination of vendor tests, dynamic tests, structural analyses, environmental analyses and environmental test. The seismic

qualification test was based on random frequency, biaxial loads applied in two orientations. The staff noticed that the test response spectra (TRS) did not appear to envelope the required response spectra (RRS) below 7 Hz. The applicant explained that the curve was shown for a generic case. The staff verified that for the plant response spectra of the piping the curve did envelope the RRS above 2.5 Hz.

The valve was qualified by test with the operator vertical. The actual installation is with the operator 19° from vertical. The method of qualification was to demonstrate by analysis that the rotation of 19° would not introduce any effect that would invalidate the structural or operability qualifications. The applicant provided evidence that the analytical model was verified by comparison of measured natural frequencies (floor mounting) and computed frequencies. The model and analysis were considered acceptable.

A concern was identified that the fundamental frequency was reportedly 27 Hz, although the Wyle test report showed resonance at 12 Hz. The analytical model was verified using 27 Hz without considering the 12 Hz resonance. The applicant explained that during the resonance search test, the 12 Hz resonance was recorded in vertical direction at various locations on the valve. The test valve was supported from the test fixture at one end while the nozzle loads were applied at the other end using loading cylinders. The vertical resonance is due to flexibility in the loading cylinder system. This is further evident from the fact that the 12 Hz frequency is consistently recorded at all accelerometers on the valve which monitored the vertical response. The true frequency of the valve is around 27 Hz (lateral) which was also confirmed during the earlier test reported in the same Wyle test report. The valve is rigid in the vertical direction. The applicant's response was considered to be acceptable.

The environmental qualification was performed in accordance with NUREG 0588 Revision 1 and IEEE 323-1974. The equipment was qualified to environmental conditions of 335°F, 5.8 psig, 100% relative humidity, and 1.6×10^5 R gamma. The PVORT form indicated that the solenoid valve O-rings have a limited life of 13 years. Replacement of the O-rings was

confirmed in the special Equipment Qualification Maintenance Book. The staff also confirmed that in order to maintain qualification of the Namco limit switches, the applicant will replace the gaskets, contact lever, assembly boot lubricant, lever shaft, and O-ring assembly. Qualification with this replacement was considered acceptable.

The valve and its accessories are located in the valve isolation cubicle. This area is susceptible to a main steam line break. The qualification temperature of 335°F was established without consideration of superheating the escaping steam when the tube bundle in the steam generator becomes uncovered. The applicant responded to this issue by explaining that the South Texas plant is designed with three separate isolation valve cubicles. If a steam line would break in one cubicle the other two would not be affected and redundant channels would still be available. The valve would close and remain closed upon failure of accessories. In addition, this issue is under consideration for the Environmental Qualification program; the function and failure mode of all components in the isolation valve cubicle, not qualified for the 535°F calculated considering superheat, are being evaluated.

2.2.5.4 Findings. All questions were satisfactorily resolved during the audit.

2.2.6 Auxiliary Feedwater Stop Check Valve, 2S141T-AF-0019, (Audit Status: Closed)

2.2.6.1 Component Description. This component is a 4-inch stop check valve manufactured by Rockwell (Model 2006-JMPQTY) and is driven by a Limitorque motor operator (Model SMB-2-40 DC). The valve is located in the (Isolation Valve Cubicle) IVC at the 22 ft level. The valve is normally closed for containment isolation. The valve opens to supply auxiliary feedwater to steam generator 1D from the turbine driven auxiliary feedwater pump 14, upon receipt of an ESF signal. Upon loss of power to the motor operator the valve fails as is. The maximum acceptable internal and external leak rate is 8 cc/hr and zero, respectively.

2.2.6.2 Component Walkdown. The walkdown of this component identified two concerns, both of which were satisfactorily resolved before the close of the audit. First, the RTD was found to be disconnected and unlabeled. The applicant provided documentation indicating that various temperature wells were being reworked. The temperature elements would be reinstalled upon completion of the task. Regarding the absence of any equipment tags, the applicant explained that the placement of startup work request (SWR) tags in the field was at the discretion of the systems engineer. The status of the equipment was tracked by the Master Completion List (MCL). The printout of the MCL 67812 indicated a required completion date of October 15, 1986 which had not been met. Upon questioning, the applicant explained that the MCL's were tied to specific milestones. Milestone 26 represented hot functional tests scheduled for late January 1987. The "date required" entry was used by the plant engineering group for tentative scheduling purposes. The explanation of the RTD was acceptable. Second, the electrical cable to the motor operator appeared to be correctly installed, but the flexible conduit sheath was found to be disconnected. Also rain water was falling on the equipment since the building roof was not completely installed. The staff asked the applicant to ensure that the equipment was properly installed and qualified for the location. The applicant explained that the area was under the jurisdiction of the construction group until the roof was complete. Turnover to the operations group would be contingent upon acceptance of a completely installed component including conduit connection and inspection for moisture. The electrical connections were sealed and qualified for the environment. SWR 11555 (MCL 84345) was generated by the applicant during the audit in order to replace the broken flex conduit. This explanation and the commitment to ensure proper component installation was considered to be acceptable.

2.2.6.3 Document Review. The review of the qualification documents[47-60] revealed that the qualification of this component was addressed by a combination of vendor tests, stress analyses, and similarity analyses. The valve was qualified as the result of hydrostatic shell, seat leakage, and static deflection tests. The motor operator was qualified by similarity using test results for a Limitorque SMB-3-100 model which covers

models SMB-2-40 and -60. Environmental qualification of an SMB-0-25 was used as the basis for qualifying the SMB-2-40 model. The motor has a qualified life of 16 years on the basis of 2004 operating cycles achieved compared to 5000 cycles needed for 40 years. The staff verified that the applicant has scheduled the replacement of the motor and other limited life components.

The static pull test was performed with a 5.2 g resultant load (3 g triaxial accelerations) and 2700 psig. The measured leakage of .3 cc in 5 minutes was less than the limit of .67 cc/5 min. The 35 second opening and closing times were less than the 60 second maximum limit. The highest calculated stress was 21300 psi compared to 22500 psi allowable.

2.2.6.4 Findings. No specific issues remained after the evaluation of this component.

2.2.7 Chilled Water Isolation Valve, C1CH-TV-9497A, (Audit Status: Closed)

2.2.7.1 Component Description. This component is a 4-inch butterfly valve manufactured by Valtek (Model Valdisk) and is driven by an integral pneumatic operator (size 25 sq in.). The valve is located in the electrical auxiliary building (EAB) at the 75 ft 4 in. level. The valve is used in conjunction with C1CH-TV-9497B to act as a 3-way combining valve to regulate temperature of the EAB. The valve's safety function is to open upon receipt of a safety injection signal to allow maximum cooling of the EAB. Upon loss of power to the actuator the valve fails in the open position. The valve is required to remain operational for 30 days following an event.

2.2.7.2 Component Walkdown. The walkdown of this component identified one concern that was adequately resolved before the close of the audit. The position and installation of the valve body could not be inspected because it was covered by insulation. Upon questioning, the applicant provided documentation which verified that the installation was in accordance with the vendor's recommendations. Review of the component outline drawing indicated that the actuator should be mounted vertically

upright. Valve 9497A was mounted in the upside-down position without a solenoid valve. The applicant explained that the piping configuration required 9497A to be mounted in the inverted position and that its solenoid valve be mounted to valve 9497B in the correct upright position. During the document review the applicant demonstrated that the qualification tests and analyses were valid whether the valve was mounted upright or inverted. This explanation was satisfactory.

2.2.7.3 Document Review. The review of the qualification documents[61-71] revealed that the qualification of this component was addressed by a combination of vendor tests, dynamic test, static deflection test, environmental tests of non-metallic components, and seismic analyses. The valve was qualified as the result of hydrostatic shell, seat leakage, and stroke timing tests. The BUNA-N gaskets are qualified for 5 years and are covered in the South Texas Mechanical Equipment Qualification Program (Appendix A).

The static pull test was performed at a 4.3 g triaxial loading and 150 psig. The opening and closing times were 1.2 and .5 seconds respectively compared to the 60 second limit. The disc and seat leakage test results met their acceptance criteria. The stress analysis of the valve assembly indicated that the smallest margin of allowable stress was at the yoke (8563 psi shear stress compared to 18000 psi allowable).

2.2.7.4 Findings. No specific issues remained after the evaluation of this component.

2.2.8 Reactor Water Make-Up Isolation Valve, B1RM-FV-7663, (Audit Status: Closed)

2.2.8.1 Component Description. This component is a 4-inch Class 3 globe valve manufactured by WKM (Model 70-28-2) and is driven by an integral pneumatic operator (Model DRT, Size 140 $in.^2$). The valve is located in the Mechanical Auxiliary Building at the 10 ft level. The valve is normally open. The safety function is to close upon receipt of a safety injection signal in order to isolate the non-essential service water. Upon

loss of power to the actuator the valve fails closed. The valve is required to remain operational 30 days following an event.

The component was selected as a surprise audit item in order to assess the applicant's ability to retrieve the appropriate documentation given only 4 days notice. The applicant's retrieval of the qualification documents, accessibility of cognizant personnel, and preparation for the audit was found to be consistent with other components audited.

2.2.8.2 Component Walkdown. The walkdown of this component identified one concern that was satisfactorily resolved before the close of the audit. There was a small leak at the valve stem. The PVORT form indicated that zero external leakage was allowed. An equipment tag indicated that the valve had been turned over to the nuclear plant operations department. Upon questioning the system engineer explained that the valve packing had not been completely tightened in order to verify valve stroke times. The amount of leakage was small (1 or 2 cc) and did not appear to be increasing. The applicant generated a maintenance work request (MWR 7882) to tighten the packing to stop the leakage. However, the staff noticed that neither the MWR nor the vendor's manual specified the torquing value for the packing. The applicant discussed the plant maintenance procedure for repacking valves. Unless otherwise instructed the maintenance craftsman would tighten the packing until no leakage was observed, then stroke time the valve repeatedly to assure that the specified operating times were met. The applicant's explanation satisfactorily resolved the staff's concern.

2.2.8.3 Document Review. The review of the qualification documents[72-84] revealed that the qualification of this component was addressed by a combination of vendor tests, environmental qualification and aging analysis, seismic tests, and similarity analyses. The applicant pointed out that the valve was modified and requalified in order to meet seismic requirements.

During the initial seismic test it was noted that the lower yoke was cracked where the nut holds the yoke to the lower body and that the

handwheel housing was developing a crack. The applicant determined that the handwheel for manual operation was not essential to the normal and safety-related function of the valve. The applicant and Bechtel agreed that the valve could be modified by removing the lower yoke and handwheel assembly. The seismic tests were rerun with the upper yoke and actuator assembly attached directly to the valve. The applied loading was 3 g horizontal and 2 g vertical, enveloping the SSE requirement of 1.5 g per axis. The measured stroke time was 11 seconds compared to the 15 second system requirement. The leak rates were confirmed to be within specification. The staff verified that the component outline drawing, valve specification, and qualification documents were consistent with the valve assembly as modified.

The full sequential IEEE 323-1974 qualification tests were performed to meet the environmental service conditions of 125°F, 100% relative humidity, and 2100 Rad total radiation. The BUNA/nylon material must be replaced every 5 years. The staff verified that the applicant has included limited life components in the equipment qualification maintenance book.

2.2.8.4 Findings. No specific operability issues remained after the evaluation of this component.

2.2.9 Main Steam Isolation Valve (MSIV), AIMS-FSV-7414, (Audit Status: Closed)

2.2.9.1 Component Description. This component is a 30-inch globe valve manufactured by Atwood and Morrill and is driven by an integral air operator. The valve is located in the Main Steam Isolation Valve Cubicle (MSIVC) Room 503, Bay A, at the 55-ft level. The valve normally is fully open. The safety function of the valve is to close in less than 5 seconds on a high - 2 containment pressure signal. The MSIV also closes on a low-low T cold primary loop temperature (above the P-11 setpoint) and low steam line pressure. The opening time of the valve at maximum ΔP = 1430 psi is required to be less than 15 minutes. Functional accessories that are used to make the valve operational include 5 Namco limit switches and 5 Chicago Fluid Power solenoids. The maximum allowable

leakrate for the valve packing and seat are 2.5 cc/hour and 86 cc/hour, respectively. Upon loss of power to the actuator solenoid, the valve fails closed.

2.2.9.2 Component Walkdown. The valve was verified to be an Atwood and Morrill valve serial number 3-13839. The valve was observed to have a N-Stamp identifying the valve as Class 2. The valve was verified to be line mounted and butt welded. The limit switch accessories were verified to be Namco model EA7402102 The solenoid valves were mounted in covered boxes and the model numbers could not be verified. They were mounted, however, so that the speed adjusting screws penetrated the boxes and allowed adjustments to be made without removing the covers. One of the speed adjusting screws did not have a locking nut installed. In response to this concern the applicant provided a copy of a "Work Request" which was still in progress. This request called for replacing the solenoids in the MSIVs with the qualified Chicago Fluid Power models. Although the solenoids were replaced on the MSIV inspected, the applicant contended that the missing locking nut would have been identified during the quality control verification. This explanation was considered acceptable.

2.2.9.3 Document Review. The review of the qualification documents[85-92] revealed that the qualification of this component was addressed by a combination of vendor tests, hot and cold functional tests, seismic analysis, static deflection test, and environmental tests. The vendor tests considered shell and disk hydrostatic pressure, seat and packing leakage, and operational checks. No anomalies were found. The hot functional pre-op test is scheduled for early 1987. Performance tests were done on a scaled-down 26-inch valve assembly. The basis for similarity was acceptable.

Seismic qualification was based on a static equivalent test and stress analysis. The safe shutdown earthquake (SSE) requirement is 4 g in all three directions. The static deflection test used 7.55 g applied perpendicular to the valve shaft and a test pressure of 1350 psig but at ambient temperature. The staff noticed that end loads were not included in the test. The applicant referenced deflection test data on 32 similar

valve assemblies which met their specified 5 second closing limit with end loads applied. This explanation was satisfactory. The stress analysis calculated a stress level of 6500 psi which met the ASME Code Class 1 acceptance criteria. The calculated natural frequency of 38.7 Hz was verified by determining the stiffness from the static deflection test.

The environmental qualification was performed in accordance with the IEEE (323-1974, 344-1975, 382-1972, 382-1980) sequential test guidelines. The equipment was qualified to environmental conditions of 335°F, 2.8 psig, 100% relative humidity, and 3.5×10^5 R. The solenoids were subjected to 335 hr thermal aging at 138°C, equivalent dosage of 10^6 R, and 90 minutes of vibration aging per axis. No defects were identified and the solenoid are qualified for 40 years (1800 cycles). The limit switches were qualified in a similar manner, except that the qualified life is 10 years. Replacement of the limit switches was not yet listed in the special EQ Maintenance Book. The applicant explained that various administrative controls are in place to assure that the maintenance program will be complete as required. On the basis of other equipment qualification packages reviewed during the audit, the staff finds the overall maintenance program and controls to be acceptable. The staff did remind the applicant that the identification and disposition of limited life components is vital to maintaining equipment in a qualified state.

The MSIV is located in the Isolation Valve Cubicle and is susceptible to a main steam line break. The required qualification temperatures identified for this component were developed without the consideration of superheating the escaping steam should the tube bundle in the effected steam generator become uncovered. The applicant provided an explanation of consideration of this issue which is described in Section 2.2.5.3 of this report.

2.2.9.4 Findings. All questions were satisfactorily resolved during the audit.

2.3 Other Equipment Qualification Issues

This section summarizes the status of other issues relating to pump and valve operability that were addressed by the PVORT. The following discussions combined with the detailed review of selected equipment provided additional basis for PVORT's conclusions concerning the applicant's overall program.

2.3.1 Safety Evaluation Report (SER) Items, (Audit Status: Closed)

The PVORT reviewed the pump and valve operability assurance information contained in Section 3.9.3.2 of the South Texas Unit 1 FSAR and later conducted an onsite audit to determine the extent to which the pumps and valves important to safety meet the criteria listed above. The issues which resulted from the South Texas FSAR evaluation appeared in an SER (NUREG 0781) dated April 1986. Many of these SER issues were resolved by material submitted by the applicant up to and including FSAR Amendment 54. Additional qualification issues not covered in NUREG 0781 were discussed at a preaudit meeting held September 16, 1986. Several of these preaudit issues were adequately resolved by the applicant in a letter dated October 9, 1986. The remaining SER and preaudit issues were resolved during the site audit held December 16-19, 1986.

The staff researched the issue of long term operation of deep draft pumps during the audit. In a letter dated October 9, 1986, the applicant indicated that the South Texas vertical pumps do not fall into the category of "deep draft" pumps. The program does meet the intent of the NRC and LRG-II guidelines with respect to long term operation, vibration monitoring, maintenance and inspection. Based on the applicant's response and site verification, the South Texas pump qualification program should be adequate to assure operability of vertical pumps. Deep draft pump operability is discussed in detail in Section 2.3.2.

The staff requested information regarding operability of containment purge and vent valves in accordance with NUREG-0737, TMI Item II.E.4.2(6). In letters dated October 9 and November 26, 1986, the applicant provided a

response to the request. The response indicated that the containment purge and vent system has been revised to incorporate a pneumatic valve on the outboard side of the intake and exhaust lines. The applicant committed to provide documentation demonstrating valve operability prior to fuel load. The staff's position regarding operability of these valves will be included in future supplement to the South Texas SER (NUREG 0781).

The Table 2 summarizes the remaining SER issues originally identified in NUREG-0781 and describes the manner by which each issue was addressed. The FSAR needs to be amended as indicated in the notes to Table 2. The resolutions of the SER issues will be addressed by the staff in the supplements to the SER (NUREG 0781), rather than in the revisions to this report.

2.3.2 Long Term Operability of Deep Draft Pumps, (Audit Status: Closed)

IE Bulletin 79-15 was issued July 11, 1979 as the result of industry-wide problems associated with the long term operation of deep draft pumps. Plants under construction were required to identify such pumps, provide operating history, and verify the pumps' ability to operate without incurring vibration-induced problems. At the time of the bulletin, South Texas Project Unit 1 was in a position only to identify the types of pumps used, since operating history was unavailable. 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. As a follow-up to the initial response the applicant was asked to 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.

TABLE 2. STATUS OF SOUTH TEXAS PROJECT UNIT 1 SER ITEMS FOR PUMP AND VALVE OPERABILITY ASSURANCE

	SER Items[a]	Finding Resolution	Status
1.	As of Amendment 38, Tables 3.10-1, 3.11-2, 3.11-5, and 3.11N-1 have not been added to the FSAR. The Pump and Valve Operability Review Team (PVORT) is interested in examining these seismic and environmental qualification tables to evaluate the applicant's overall pump and valve operability assurance program.	Note[b]	Closed
2.	It is not clear that Table 3.9-1.2 (Amendment 44) is a complete list of active balance-of-plant (BOP) valves. (a) BOP check valves have not been included in the table. (b) Some valves listed in Table 3.9-1.2 no longer appear to be used. For example, containment purge valves HA002 and HA004, as well as radiation monitoring valves RP002 and RP005, have been deleted from Table 7.3-9 (Amendment 43). (c) For all active BOP valves, the applicant should list the function, American Nuclear Society (ANS) safety class, and active status in a manner similar to the way Table 3.9-1.2A lists NSSS valves.	Note[c]	Closed
3.	Table 3.9-1.2A (Amendment 41) lists active NSSS valves. However, several valves are flagged with the footnote "*BOP scope of supply." The applicant must clarify the purpose of the footnote.	Note[b]	Closed
4.	The applicant must clearly show the extent to which RG 1.148 ANSI/ASME N551.1 draft standards, and ANSI B16.41 are met.	Note[d]	Closed

TABLE 2. (continued)

	SER Items[a]	Finding Resolution	Status
5.	The applicant must clarify the methods used for qualification. Specific information should be presented in the FSAR and be available for review at the site. The applicant must demonstrate: (a) the extent to which operational testing is performed at design-basis conditions (full flow, pressure, temperature, etc.) (b) The technical basis for qualifying equipment by similarity analysis and prototype testing (c) qualification of the equipment as an assembly rather than individual components (d) the extent to which qualification by analysis, as presented in Table 3.9-10, was supplemented by correlated test results and documented operating data	Note[e]	Closed
6.	The applicant should clearly show how implementation of the initial test program, maintenance and surveillance, inservice inspection, and quality assurance programs will maintain equipment operability throughout the 40-year plant life. Specific criteria should be presented in the FSAR and be available for review at the site.	Note[e]	Closed
7.	The following actions by the applicant would enhance PVORT understanding of the plant: (a) The applicant should identify any pumps and valves that are considered to be functional accessories for active safety-related equipment. (The diesel generator lubrication system described in FSAR Section 9.5.7 is safety related and is designed to seismic Category I,	Note[f]	Closed

TABLE 2. (continued)

SER Items[a]	Finding Resolution	Status
SC3 requirements. The system includes one engine-driven and two motor-driven pumps, which are not listed in any of the tables in FSAR Section 3.9.)		
(b) FSAR Tables 3.9-4 and -4C provide the stress criteria for Class 2 and 3, nonactive, BOP and NSSS pumps, respectively. The applicant should identify these nonactive pumps.	Note[b]	Closed
(c) FSAR Section 3.9.3.2.1.2 describes an NSSS program for testing various valve designs and sizes during a simulated fault event. The applicant must describe the criteria used to select the valves for testing and specify the range of sizes that are covered.	Note[b]	Closed
(d) FSAR Section 3.9.3.2.2 and 3.9.3.2.3 describe the methodology used to demonstrate operability of BOP pumps and valves, respectively. The applicant must identify the seismic accelerations and describe how they were applied to qualify "rigid" and "flexible" BOP equipment.	Note[b]	Closed
(e) The applicant must specify the range of sizes of BOP valves that are covered by program 1 in FSAR Section 3.9.3.2.3. Also, the applicant must confirm that the evaluation of the BOP check valves will include "stress analysis of critical parts, which may affect operability including the faulted condition loads," as is the case for NSSS check valves.	Note[b]	Closed
(f) The PVORT is interested in examining the lists of pumps and valves that are designated for inservice testing per FSAR Section 3.9.6.	Note[f]	Closed

TABLE 2. (continued)

a. The South Texas SER items for pump and valve operability assurance were identified in an SER (NUREG 0781) dated April 1986. These items are based on the staff's review of FSAR Section 3.9 and 3.10 (Amendment 44) as well as a pre-audit meeting held September 16, 1986.

b. This issue was completely resolved by the applicant in FSAR Amendments 45 through 54. The staff has verified that the FSAR includes the appropriate tables and text description.

c. The three concerns originally identified as examples have been adequately resolved in revisions to the FSAR; however, the site audit found other discrepancies. This concern was transferred to generic issue 3 and explained further in section 3.

d. During the site audit, the applicant provided a response to this concern. FSAR Table 3.9-23 (Amendment 54) describes compliance with Regulatory Guide 1.148. The FSAR information was found to be adequate and resolved the concern. The applicant did not address ANSI/ASME N551.1 and ANSI B16.41. This was not found to be unacceptable as N551.1 is draft and a response is not required. ANSI B16.41 is a new standard and the applicant has not been required to respond.

e. During the FSAR revision from Amendment 45 to Amendment 54, the necessary information was provided. The information and site verification were found to be adequate and resolved this concern.

f. During the site audit, both of these areas were verified. No discrepancies were identified. Based on the site verification both concerns have been adequately addressed.

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

In a letter dated October 9, 1986 the applicant stated:

"By letter dated April 19, 1982, ST-HL-AE0816, 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 (High Head Safety Injection)	-	21.5' from top of the coupling housing to bottom of the suction bell (16.8' from bottom of bowl to foundation mounting)
LHSI (Low Head Safety Injection)	-	21.8' from top of the coupling housing to bottom of the suction bell (17.3' from bottom of bowl to foundation mounting)
CS (Containment Spray)	-	Same as LHSI
ECW (Emergency Cooling Water)	-	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."

In response to Part (a) the applicant stated:

"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 included 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 prestarting 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, pump alignment is checked in accordance with approved procedures. Post-maintenance tests using the normal quarterly test procedures described above will be performed to verify pump operability."

In response to part (b) the applicant stated:

"Not applicable. See the response to item (a) above."

In response to part (c) the applicant stated:

"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 item (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."

Evaluation: The applicant's response was verified during the audit. Concerns for pump vibration appears to have been adequately addressed. The pump column and bowl restraints drawing was obtained and reviewed for Essential Cooling Water pump 3R281NPA101B. The results of the review of this pump are presented in Section 2.2.4. The installation appeared to be adequate to provide required support. Vibration measurements are to be taken at the pump top and bottom on a schedule consistent with ASME Section XI requirements. A baseline vibration level will be obtained during preoperational testing. Debris in the fluid has been addressed. Sleeve bearings were installed in lieu of close tolerance bearings thereby ensuring suspended solids would not be a problem. Dissolved solids are being controlled by chemistry control.

In summary, although the applicant does not declare any pumps to be deep draft types the applicant appears to meet the testing and monitoring requirements identified in LRG-II Issue 9-RSB for deep draft pumps. The South Texas Pump and Valve program does meet the intent of the NRC's suggested guidelines for long term operability of deep draft pumps.

2.3.3 Operability of Check Valves, (Audit Status: Closed)

IE Information Notice 86-01 dated January 6, 1986 reported that an event occurred at an operating plant which was 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. As a followup to the concerns discussed in IEN 86-01, the staff requested the applicant to 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.

In a letter dated October 9, 1986, the applicant provided a response to these questions. Additionally, check valve operability was discussed at the site audit. A presentation of the responses is provided below.

In response to Item 1, the applicant stated:

"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 valve used in the STP feedwater system requires 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 (for required isolation) and yet close to the containment wall 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.

"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 3 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."

In response to Item 2, the applicant stated:

"Check valves, which are within the scope of the ASME Section XI Pump and Valve Inservice Test Plan, are periodically tested to verify operability. 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

TABLE 3. FLOW TESTS OF GENERIC CHECK VALVES

The following is a list of check valves representative of those used at South Texas 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.

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."

In response to Item 3, the applicant stated:

"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."

Evaluation. Based upon the above responses and on-site discussions with plant personnel, the staff finds that the applicant has devoted considerable attention to demonstrating check valve operability. The methodology used to size and install check valves is consistent with industry practices. Vendor test data and procedures have been referenced. Implementation of the ASME Section XI inservice test program will provide added assurance of operability. There were no open issues regarding check valve operability.

2.3.4 Post-Accident Qualified Life, (Audit Status: Closed, Pending Confirmation)

The PVORT forms and the qualification files listed the required post-accident qualified life for the equipment as 30 days, except for specifically identified component with shorter life requirements. Normally a post-accident operability time of at least 100 days is specified by the

plants. The applicant was asked to provide the bases for establishing the 30 day requirement. In response, the applicant provided a brief written statement. The statement is paraphrased below.

The 30-day qualification period is a conservative estimate for the time required for the harsh environments to return to pre-accident conditions with the exception of radiation. South Texas Project qualifies equipment for 180 days of post-accident radiation. At 30 days the only safety function that is required is shutdown cooling. For shutdown cooling one train of essential cooling water, essential chilled water, component cooling water, low-head safety injection and/or residual heat removal must be operable. A combination of fail-safe valves, accessibility for maintenance, flexibility in alignment, installation of temporary equipment, redundant function and three trains of redundant systems provide numerous ways of providing the shutdown cooling.

The applicant was advised that acceptance of the 30-day post-accident operability would be evaluated by the staff and that final resolution would be determined as part of the Environmental Qualification review per Standard Review Plan Section 3.11.

2.3.5 Implementation of the Overall Program, (Audit Status: Open)

The PVORT's evaluation of the applicant's overall qualification program was based on many factors, including the FSAR review, resolution of SER items, and the on-site review of selected equipment. Another important factor was the follow-up evaluation of the applicant's administrative programs that are linked to equipment qualification. The PVORT evaluated these programs during the on-site audit. This evaluation enabled the PVORT to gain a better perspective of the programmatic scope and implementation of the applicant's overall equipment qualification program. For example, the PVORT's concern about deep draft pump operability led to discussions of the applicant's vibration analysis program, in-service test procedures, preventive maintenance procedures, and quality control program. Throughout the audit, it was apparent that the applicant's document control system was

sufficiently complete and organized to retrieve the documents necessary to support these discussions. The programs mentioned above enhance the PVORT's confidence that the applicant's overall qualification program can ensure that all pumps and valves important to safety will operate as required for the life of the plant.

The PVORT's evaluation of the applicant's overall program was not entirely absent of qualification issues, however. The PVORT did identify five generic issues, which were discussed with the applicant at the exit meeting. Two generic issues have already been discussed in Sections 2.2.1 (Disposition of Nonconformances during BOP transition) and 2.3.4 (30 day post-accident operating time). The other three issues are discussed below.

At the conclusion of the audit, it was apparent that the South Texas lists of active pumps and valves were not totally up-to-date. In preparation for the site audit the PVORT used the FSAR tables of active pumps and valves, supplemented by information contained in the master equipment list. A number of discrepancies were discovered in the FSAR tables. The applicant shall provide a complete list of active safety-related pumps and valves in the FSAR prior to fuel load. This action item is identified as Generic Issue 3 in Section 3.

The staff requires that all equipment important to safety be properly qualified prior to fuel load. However, the PVORT audit was conducted months in advance of the expected fuel load date before the applicant had been able to qualify, test, and install all of its equipment. The applicant did provide evidence that the documentation and installation was complete for approximately 85 percent of the South Texas equipment at the time of the audit. The remaining 15 percent is scheduled to be completed prior to fuel load. Similarly, some preoperational tests remain to be completed. The hot functional tests were scheduled to commence in July 1986.

Therefore, the second generic issue was that all pumps and valves important to safety are required to be properly qualified prior to fuel load. Complete qualification includes, but it is not limited to,

confirmation that (a) the associated documentation is complete and readily accessible, (b) the equipment is properly installed, and (c) the appropriate administrative procedures have been performed as required. This action item is identified as Generic Issue 2 in Section 3.

Finally, the third generic issue presented to the applicant at the exit meeting was to confirm that all pre-service tests required to be completed before fuel load have been performed. The applicant also needs to provide a list of all preservice tests to be performed, the schedule for these tests and justification for any tests scheduled beyond fuel load. This action item is identified as Generic Issue 1 in Section 3.

Section 3 summarizes the three generic issues mentioned above, the two generic issues discussed in Sections 2.2.1 and 2.3.4 and the four specific issues discussed in Sections 2.1.3 (two issues), 2.2.1 and 2.2.2. All issues have been transferred to the South Texas SER (NUREG 0781) for tracking and closure.

3. CONCLUSION

The South Texas Unit 1 Equipment Qualification personnel are dealing with the equipment qualification issue in a positive manner. The PVORT has reached this conclusion because the applicant has: (a) provided adequate documentation to demonstrate qualification of a representative sample of pump and valves important to safety, (b) established administrative programs to determine, monitor, and maintain equipment operability for the life of the plant, (c) demonstrated an adequate central file system by the timely retrieval of information requested by the staff, (d) demonstrated that it corresponds closely with the NSSS vendor, architect-engineer, and equipment suppliers concerning details of construction, design, maintenance, utility policy, and plant operation, and (e) demonstrated overall accountability by committing the appropriate personnel to implement these policies and programs.

Based on the results of the onsite audit, the PVORT concludes that an appropriate Pump and Valve Operability Assurance Program has been defined and is being implemented at South Texas. The continued implementation of this program should provide adequate assurance that all pumps and valves important to safety will perform their safety-related functions as required for the life of the plant.

Table 4 presents a summary of the audit results. The following is a status of all unresolved pump and valve operability concerns and the applicant's commitments:

Specific Issues:

1. Issue. During the site audit, it was identified that the applicant had developed a design to minimize the impact of moisture in auxiliary feedwater turbine driving steam. The design had not been tested at the time of the audit. The applicant committed to confirming when pre-operational testing

TABLE 4. SUMMARY OF PVORT AUDIT FOR SOUTH TEXAS PROJECT UNIT 1

Equipment Description	Plant I.D.	Function	Findings (note)	Resolution (note)	Status (note)
Chemical and Volume Flow Control Valve (Grinnell 2" diaphragm valve)	B1CV-FV-8400B (NSSS)	Valve is normally open. Closes on a boric acid storage tank lo-lo level.	--	--	Closed
Chemical and Volume Control Isolation Valve (Westinghouse 6" Gate Valve)	2R171X-CV-0112C (NSSS)	Valve is normally closed. Opens on a safety injection signal or VCT Lo-Lo level signal to provide flow to charging pump suction.	--	--	Closed[1] (Pending Confirmation)
Boric Acid Transfer Pump (Crane Chempump 125 gpm)	3R171NPA103A (NSSS)	Normally operates to provide boric acid for CVCS makeup and boric acid purification. Emergency function is to provide flow to the charging pump suction for emergency boration.	Note[a,b]	Note[c]	Open[d]

TABLE 4. (continued)

Equipment Description	Plant I.D.	Function	Findings (note)	Resolution (note)	Status (note)
Auxiliary Feedwater Pump (Bingham Willamette Co., 600 gpm)	3S141MPA04 (BOP)	Pump normally in standby. Operates on an ESF signal or manually to provide emergency feedwater to the steam generators.	Note[e]	Note [c]	Open[d]
Auxiliary Feedwater Minimum Flow Recirculation Valve (Yarway, 4" Auto Recirculation Valve)	3S141T-AF-0091 (BOP)	Valve is normally lined up for recirculation with its associated Aux Feed Pump in standby. Valve aligns itself to flow to steam generator or recirc to storage tank as required on an ESF signal.	Note[f]	Note[c]	Open[d]
Component Cooling Surge Tank Isolation Valve (Rockwell, 24" Butterfly Valve)	3R101T-CC-0132 (BOP)	Valve normally open to allow flow from surge tank. Valve closes to isolate surge tank on a low surge tank level.	--	--	Closed

TABLE 4. (continued)

Equipment Description	Plant I.D.	Function	Findings (note)	Resolution (note)	Status (note)
Essential Cooling Water Pump (Hayward Tyler, 20610 gpm)	3R281NPA101B (BOP)	Pump normally provides flow from essential cooling pond to serviced components. In an emergency (Safety Injection Signal, LOOP, or low water header pressure) pump provides cooling water to essential equipment.	--	--	Closed
Feedwater Isolation Valve (WKM 18" Gate Valve)	A1FW-FV-7141 (BOP)	Valve is normally open. Valve closes on a feedwater isolation signal.	--	--	Closed
Auxiliary Feedwater Stop-Check Valve (Rockwell 4" Stop-Check)	2S141T-AF-0019 (BOP)	Valve is normally closed. Valve opens on an ESF signal and Auxiliary Feedwater Pump #14 operation to feed steam generator 1D.	--	--	Closed

TABLE 4. (continued)

Equipment Description	Plant I.D.	Function	Findings (note)	Resolution (note)	Status (note)
Chilled Water Isolation Valve (Valtek 4" Butterfly Valve)	C1H-TV-9497A (BOP)	Valve is normally open acting as a temperature regulating valve for the Electrical Auxiliary Building. Valve opens completely on a safety injection signal.	--	--	Closed
Reactor Water Makeup Isolation (WKM 4" Globe Valve)	B1RM-FV-7663 (BOP)	Valve is normally open. Valve closes on a safety injection signal to isolate nonessential service water.	--	--	Closed
Main Steam Isolation Valve (Atwood & Morrill 30" Globe Valve)	A1MS-FSV-7414 (BOP)	Valve is normally open. Valve closes on an isolation signal.	--	--	Closed
ALL PUMPS AND VALVES IMPORTANT TO SAFETY	--	Operate as required during the life of the plant under accident conditions.	Note[g], h,i,j,k	Note[c]	Open[d]

a. (SPECIFIC ISSUE) During the document review, the component appeared to be qualified to three different radiation levels. The applicant shall (1) modify the WCAP 8687 and PVORT form to correct the apparent discrepancy and (2) confirm that the equipment qualification file has been supplemented with the appropriate documentation.

TABLE 4. (continued)

b. (SPECIFIC ISSUE) During the documentation review, documentation supporting operation at degraded voltages could not be provided. The applicant shall (1) provide a copy of the test report which references operability of canned motors at reduced voltages, (2) describe the basis for similarity of the test results, and (3) confirm that the equipment qualification file has been supplemented with the appropriate information.

c. At the conclusion of the site audit, the staff summarized the open issues. The applicant was informed of the appropriate actions necessary to resolve the specific and generic issues prior to fuel load.

d. Qualification status will be "closed" upon resolution of specific and generic issues.

e. (SPECIFIC ISSUE) At the time of the audit, the applicant had not tested the new design to minimize the impact of moisture in the AFW turbine driving steam. The applicant shall confirm when pre-operational testing is satisfactorily completed, identify deficiencies discovered during testing, and describe the disposition of the deficiencies.

f. (SPECIFIC ISSUE) During the audit, the applicant could not provide a preventive maintenance schedule as it had not been developed. The applicant shall provide a copy of the maintenance schedule demonstrating that the manufacturer's recommended maintenance will be performed.

g. (GENERIC ISSUE) At the conclusion of the PVORT audit, it was apparent that a complete list of active pumps and valves had not been provided in the FSAR. At the site audit, the applicant committed to confirm that all active NSSS and BOP pumps and valves are correctly identified in the FSAR.

h. (GENERIC ISSUE) Some preservice tests required to be completed prior to fuel load have not yet been performed. At the site audit, the applicant committed to confirm that all appropriate preservice tests have been completed prior to fuel load.

i. (GENERIC ISSUE) Some pumps and valves important to safety have not been completely qualified and installed. At the site audit, the applicant committed to confirm that all pumps and valves important to safety are completely qualified and installed prior to fuel load. Also, the applicant shall confirm that the original loads used in tests and analyses to qualify pumps and valves important to safety are not exceeded by any new loads (i.e., design load reconciliation).

j. (GENERIC ISSUE) The applicant shall perform a review to ensure that nonconformances issued for safety related pumps and valves during the transition of architect engineers from Brown and Root to Bechtel were properly picked up by a Bechtel program and dispositioned.

TABLE 4. (continued)

k. (GENERIC ISSUE) The 30 day post-accident operating time for qualifying equipment is not consistent with post-accident times used at other plants. Typically 100 days or greater post-accident periods are used. The applicant was advised that acceptance of the 30-day post-accident operability period would be evaluated by the staff and that final resolution would be determined as part of the Environmental Qualification review per Standard Review Plan 3.11.
l. The required irradiation and maximum temperature were not demonstrated by test. This item will be considered closed upon acceptance of the Environmental Qualification per SRP Section 3.11 Review.

was satisfactorily completed, identifying deficiencies discovered during testing, and describing the disposition of the deficiencies.

2. Issue. During the site audit, the applicant was requested to provide the preventive maintenance schedule for AF-0091 (Auxiliary Feedwater Minimum Flow Recirculation Valve). The maintenance schedule had not been developed. The applicant committed to providing proof that manufacturer-recommended maintenance will be performed.

3. Issue. The review of the boric acid transfer pump (Tag Number 3R171NPA103A) identified an apparent discrepancy in the level of radiation for which the equipment is qualified. The test sequence described in WCAP 8687 (EQDP-AE-3) indicated 10000 R, but the qualification summary Table I in the same report showed 400 R. The PVORT questionnaire reported 2100 R. The applicant shall (1) modify the WCAP 8687 report and PVORT form to correct the apparent discrepancy in the qualified level of radiation and (2) confirm that the equipment qualification file has been supplemented with the appropriate documentation.

4. Issue. The review of the boric acid transfer pump (Tag Number 3R171NPA103A) identified concerns regarding the qualification document file. The equipment was claimed to be fully qualified, but the documentation file did not reference operability of the motor at reduced voltages. The applicant shall (1) provide a copy of the test report which references operability of canned motors at reduced voltages, (2) describe the basis for similarity of the motor test results to the operation of the boric acid transfer pump used at South Texas, and (3) confirm that the equipment qualification file has been supplemented with the approximate test data and required analyses.

Generic Issues:

1. Issue. At the time of the audit, most construction tests had been completed. However, the hot functional tests are scheduled for January 1987. The applicant shall confirm that all preservice tests for safety-related pumps and valves that are required before fuel load have been completed. The applicant shall also provide a list of all preservice tests to be completed, the schedule for these tests, and the justification for any tests scheduled beyond fuel load.

2. Issue. At the time of the audit, approximately 10 to 15 percent of all safety related pumps and valves had not been qualified. The applicant shall confirm that all safety related pumps and valves are properly qualified and installed prior to fuel load. In addition, the applicant shall provide written confirmation that the original loads used in tests or analyses to qualify safety-related pumps and valves are not exceeded by any new loads, such as those imposed by a LOCA (hydrodynamic loads) or as-built conditions.

3. Issue. At the conclusion of the PVORT audit, it was apparent that a complete list of safety-related pumps and valves had not been provided in the FSAR. The applicant shall confirm that all safety-related NSSS and BOP pumps and valves, including check valves, are correctly identified in the FSAR prior to fuel load.

4. Issue. During the site audit, a nonconformance tag was found attached to a component (3S141MPA04) five years after the nonconformance had been cleared. The applicant explained that the nonconformance was cleared during the transition of Architect Engineer from Brown and Root to Bechtel as the constructor. As a result of the changeover, the tag was overlooked. This tag appeared to be an isolated case and therefore not an indication of a programmatic problem. However, the staff was concerned that a tag was attached for five years and no action taken. The

applicant shall confirm that nonconformances issues for safety related pumps and valves during the transition period have been reviewed and assure that they have been properly picked up by a Bechtel program and dispositioned.

5. Issue. At the site audit, it was identified that the applicant was using a 30 day post-accident operating time for qualifying equipment. Typically 100 days or greater post-accident is used. The applicant was advised that acceptance of the 30-day post-accident operability period would be evaluated by the staff and that final resolution would be determined as part of the Environmental Qualification review per Standard Review Plan 3.11.

4. REFERENCES (NSSS COMPONENTS)

Chemical And Volume Control Flow Control Valve, B1CV-FV-8400B

1. Westinghouse Electric Corporation, Diaphragm Valve E-Specification, Revision 1, E-Spec. 952854, February 27, 1978.

2. Westinghouse Electric Corporation, TGX/THX Diaphragm Valve E-Specification, Revision 3, E-Spec. 952878, October 31, 1984.

3. ITT Grinnell, Determination of Natural Frequency for ITT Grinnell Diaphragm Valves, 1612, April 3, 1985.

4. Westinghouse Electric Corporation, Equipment Qualification Test Report-Namco Externally Mounted Valve Limit Switches, WCAP 8687 Supplement 2-H03 A/H06A, March 1983.

5. Westinghouse Electric Corporation, Equipment Qualification Data Package - Safety Related Externally Mounted Limit Switches, EQDP-HE-3/HE-6, March 1985.

6. Westinghouse Electric Corporation, Equipment Qualification Test Report-ASCO Solenoid Valves, WCAP-8687 Supplement 2-H02A/H05A, March 1983.

7. Westinghouse Electric Corporation, Equipment Qualification Data Package-Safety Related Solenoid Valves, EQDP-HE-2/HE-5, January 1985.

8. Westinghouse Electric Corporation, Equipment Qualification Test Report-ASCO Solenoid Valve Qualification to a Derated Westinghouse Generic LOCA/MSLB Profile, WCAP-8687 Supplement 2-H02A/H05A Addendum 1, January 1985.

Chemical and Volume Control Isolation Valve, 2R171X-CV-0112C

9. Westinghouse Electric Corporation, Motor Operated Gate Valve E-Spec, E-Spec. 952850 Revision 0, February 25, 1976.

10. Westinghouse Electric Corporation, TGH/THX Motor Operated Gate, E-Spec. 952874 Revision 5, September 4, 1985.

11. Westinghouse Electric Corporation, Stress Report for Westinghouse Class 1 Nuclear Valves, EM-5158 Revision 1, May 27, 1980.

12. Westinghouse Electric Corporation, Operability Test Report for Westinghouse Nuclear Gate Valves, EM-4995, Revision 0, January 28, 1977.

13. Westinghouse Electric Corporation, Equipment Qualification Data Package--Limitorque Electric Motor Operator (outside containment), WCAP-8687, EQDP-HE4, Revision 4, March 1983.

14. Westinghouse Electric Corporation, Equipment Qualification Test Report--Limitorque Electric Motor Operator (outside containment), WCAP-8687, Supplement 2--H04A, Revision 2, March 1983.

Boric Acid Transfer Pump, 3R171NPA103A

15. Westinghouse Electric Corporation, General E-Specification, Class 3 Pumps, 678910 Revision 1, May 16, 1973.

16. Westinghouse Electric Corporation, General E-Specification, South Texas Class 3 Pumps and Motors, 952576 Revision 1, August 26, 1975.

17. Westinghouse Electric Corporation, General E-Specification, Auxiliary Canned Pump Motors, 952343, Revision 1, September 4, 1974.

18. Westinghouse Electric Corporation, Purchase Order, South Texas Canned Motor Pumps, 546-AAM-248060-BE, October 4, 1976.

19. Westinghouse Electric Corporation, Purchase Order, South Texas Canned Motor Pumps, 546-CAM-248061-BE, October 4, 1976.

20. Chempump, Code Design and Seismic Analysis, A-18709, August 23, 1977.

21. Westinghouse Electric Corporation, Lubricant and Bearing Report for Medium, Large and Chempump Motors, NS-I&CSL-82146, Revision 1, June 22, 1983.

22. Westinghouse Electric Corporation, Equipment Qualification Test Report, Chempump Canned Motor Pump, WCAP-8687, Supplement 2A03A, March 1983.

23. Westinghouse Electric Corporation, Equipment Qualification Data Package, Chempump Canned Motor Pump, WCAP-8587, EQDP-AE-3, March 1983.

5. REFERENCES (BOP COMPONENTS)

Auxiliary Feedwater Pump, 3S141MPA04

1. McDonald Engineering Analysis Company, Seismic-Stress Analysis of Turbine Driven Pumps, ME-557, May 10, 1986.

2. Terry Corporation, Equipment Qualification Documentation Manual for AFW Turbine Driven Pump, E/L 20742, 20730, 20613, 20736, 20746, and 20735, November 1985.

3. Bingham Willamette, QA Manual, H40.27, March 13, 1985.

4. Bingham Willamette, Environment Qualification Plan for Auxiliary Feedwater Pumps, E32.101 Revision 1, April 30, 1985.

5. Bingham Willamette, Aging Analysis Non-Metallic Material, B57697, June 20, 1985.

6. Bingham Willamette, Hydrostatic Test, C20742, June 18, 1982.

7. Bechtel Engineering Corporation, Mechanical Equipment Environmental Qualification Report, MEQ-1, November 4, 1986.

Auxiliary Feedwater Minimum Recirculation Valve, 3S141T-AF-091

8. Nuclear Qualification Services, Seismic Qualification Report, Report 1300, August 6, 1985.

9. Nuclear Qualification Services, Seismic Qualification Procedure, Procedure 1300, February 7, 1985.

10. Bechtel Engineering Corporation, Mechanical Equipment Qualification, 14926-MEQ-1, November 4, 1986.

11. Acton, Seismic Qualification Program for 4" and 6" ARC Valves, 17201-82N, December 10, 1984.

12. Balley Cont/Yarway, Procedures for EQ, PQE 0143-010, February 6, 1985.

13. Yarway, Assembly Drawing, 048104-5701, February 21, 1985.

14. Bechtel Engineering Corporation, Design Specification for ASME Section III Class 3 Automatic Recirculation Valves 4L529TB1016 for the Houston Lighting and Power Company, South Texas Electric Generating Station, Revision 1, December 13, 1984.

15. Yarway, Installation, Operation and Maintenance of ARC Automatic Recirculation Control Valve Series 5300, 3" (DN80) through 16" (DN400), 14926-6455-00027-AQ4.

Component Cooling Water Surge Tank Isolation Valve, 2R101T-CC-0132

16. Houston Lighting and Power Company, South Texas Project, Component Cooling Water System Train 1B Valve Operability Test, 1PSP03-CC-0008, Revision B, August 26, 1985.

17. Limitorque Corporation, Test Report for Limitorque Actuators, B0058, January 11, 1980.

18. Wyle Laboratory, Assessment Report on Limitorque, 47664-05, September 10, 1986.

19. Limitorque Corporation, Test Report for Terminal Blocks, B0119, July 1, 1982.

20. Wyle Laboratory, Test Report for Valve Non-Metallic, 47770-3, February 7, 1986.

21. Wyle Laboratory, Dynamic Evaluation (Frequency) Test, 45116-1, July 23, 1980.

22. Wyle Laboratory, Test Program, 45116-2, May 15, 1981.

23. Rockwell International, Design Report, 65407-32, September 22, 1981.

24. Rockwell International, Design Report, 65407-36, October 13, 1981.

25. Hill McCanna, Design Report, DR65407, July 7, 1980.

26. Bechtel Engineering Corporation, Qualified Life of Limitorque, E4028-1, July 9, 1986.

27. Bechtel Engineering Corporation, Mechanical Equipment Qualification, MEQ-1, November 4, 1986.

Essential Cooling Water Pump, 3R281NPA101B

28. Hayward Tyler Pump Company, Certified Pump Performance Curve (Pump 1B), 4040-00001, Test Report 1805, September 15, 1983.

29. Reliance Electric Limited, AC Induction Motor Test Record, 4040-01012, FA-6052-F1, December 12, 1978.

30. Hayward Tyler Pump Company, Pump NPSH Curve, 4040-00002, Serial 8044, April 10, 1984.

31. Hayward Tyler Pump Company, Pump Hydrostatic Test Certificate, 2-0173-8044, August 24, 1979.

32. C. K. McDonald, Seismic Analysis Report for Hayward Tyler Essential Cooling Water Pumps, 4040-01060, ME-381, April 28, 1978.

33. Reliance Electric Limited, Seismic Stress Analysis Vertical Motors, 4040-1061, 77-S-171, ME-499, January 16, 1978.

34. Wyle Laboratory, Aging Analysis of Nonmetallic Age Sensitive Materials of ECW Pumps, 4040EQ1-00001, 57689-1, December 21, 1984.

35. Reliance Electric Limited, Reliance Summary Report-Nuclear Power Motor Systems Type Test Support Analysis, Formette Wound Motors NUC-12, 4040-1062, NUC-12, October 27, 1979.

Feedwater Isolation Valve, A1FW-FV-7141

36. WKM, Seismic Test Report 18 x 16 FWIV, Wyle Test Report 43898-1, January 8, 1980.

37. WKM, Test Report-Solenoid Valve Assembly (Dump Valve), QR-27700-77, April 3, 1985.

38. Bechtel Engineering Corporation, Qualified Life of Valcor Components, E-4026-1, February 5, 1986.

39. Wyle Laboratory, Seismic Analysis of FWIV, 57688-1, October 4, 1985.

40. WKM, Analysis of FWIV with Faulted Nozzle Loads, 15-0082-07, February 23, 1981.

41. Bechtel Engineering Corporation, Seismic Qualification of FWIV, S-4026-1, October 20, 1986.

42. Namco, Test Report for Namco Limit Switches, QTR 121 and 105, June 1, 1981.

43. Wyle Laboratory, Evaluation of Environmental Qualification and Aging, NES-57688-1, April 14, 1986.

44. Bechtel Engineering Corporation, Mechanical Equipment Qualification for Nonmetallic Material, MEQ-1, November 4, 1986.

45. WKM, Assembly Drawing, RS259313, March 2, 1984.

46. WKM, Assembly Drawing, RS263185, April 1, 1985.

Auxiliary Feedwater Stop Check Valve, 2S141T-AF-0019

47. Rockwell International, Valve Body Analysis (ASME Design Report), RAL 2062, September 18, 1985.

48. Rockwell International, Valve Support Structure Analysis, RAL 3172, October 1, 1985.

49. Rockwell International, Modal Survey Test Procedure A-691-85-01, November 22, 1985.

50. Rockwell International, Pull Test Plan, MS7855 (RAL 1072), December 4, 1985.

51. Limitorque Corporation, Actuator Test, B0058, January 11, 1980.

52. Rockwell International, Modal Survey Test, RAL 7099 Appendix C (A-710-86), March 11, 1986.

53. Rockwell International, Pull Test, RAL 7099 Appendix E (MS-7855), March 11, 1986.

54. Rockwell International, Cast Steel Globe Nonreturn Valve Pressure Seal Bonnet-Welded Ends, General Assembly Drawing, D85-32184-02, May 21, 1985.

55. Limitorque Corporation, Terminal Block, B0119, July 1, 1982.

56. Bechtel Engineering Corporation, Mechanical Equipment Qualification, MEQ-1, November 4, 1986.

57. Bechtel Engineering Corporation, Post-DBE Qualification (Limitorque), E-6458-1, January 27, 1986.

58. Rockwell International, Hydrostatic Test Data Sheet, MS-7114, November 25, 1985.

59. Rockwell International, Performance Test Report, MS-7844, November 25, 1985.

60. Bechtel Engineering Corporation, Design Specification for ASME Section III Gate, Globe, and Check Valves 2 1/2 Inches and Larger, 46529TB-1000, Revision 4, June 23, 1986.

Chilled Water Isolation Valve, C1CH-TV-9497A

61. NAMCO, Test Report for Limit Switch, QTR-15, August 28, 1980.

62. Bechtel Engineering Corporation, Qualified Life for NAMCO Limit Switch, E-4409-3, July 11, 1986.

63. Bechtel Engineering Corporation, Mechanical Equipment Qualification for Nonmetallic Materials, 14926-MEQ-2, November 4, 1986.

64. Valtek, Test Report (Actuator and System 80 Positioner), QTR 15744, August 9, 1983.

65. Southwest Research Institute (SWRI), Seismic Test Report, 7295-315, June 1, 1983.

66. Valtek, Pull Test Procedure, SPP-915, March 15, 1985.

67. Valtek, Seismic Design Report (Analysis and Pull Test), 34753/52, October 17, 1985.

68. Valtek, Qualification Procedure, 34753-QPI, October 8, 1985.

69. Valtek, Assembly Drawing, A-34753-21, August 14, 1984.

70. ASCO, Test Report for ASCO Solenoid Valve, AQS21678/TR, January 1978.

71. Bechtel Engineering Corporation, Qualified Life for ASCO Solenoid Valve, E-4409-2, July 15, 1986.

Reactor Water Makeup Isolation Valve, B1RM-FV-7663

72. Farwell and Hendricks, Seismic Qualification Plan, 10282 Revision 4, August 22, 1985.

73. Farwell and Hendricks, Test Report, 10282.1, April 21, 1986.

74. WKM, Assembly Drawing (Test Valve), RS258097, August 31, 1980.

75. WKM, Assembly Drawing (Limit Switch), RS278772, January 29, 1979.

76. WKM, Assembly Drawing (Candidate Valve), RS258082, September 21, 1982.

77. WKM, Assembly Drawing (Limit Switch), RS278781, January 29, 1979.

78. ASCO, ASCO Solenoid Report, AQS-21678, March 1978.

79. ASCO, ASCO Solenoid Report, AQR-67380, November 18, 1983.

80. NAMCO, NAMCO Report, QTR-105 and -121, June 1, 1981.

81. Bechtel Engineering Corporation, ASCO Qualified Life, E4026-2, February 25, 1986.

82. Bechtel Engineering Corporation, Mechanical Equipment Qualification, 14926-MEQ-1, November 4, 1986.

83. Wyle Laboratory, Evaluation of Environmental Qualification, NES-57688-1, April 14, 1986.

84. Brown and Root, Code Data Package-4 Inch 150# BW40, 70-28-2 DRT NUC 3 Control Valve, RIP 3552, May 9, 1984.

Main Steam Isolation Valve, A1MS-FSV-7414

85. Westinghouse Electric Corporation, Main Steam Stop Valve E-Spec, E-Spec 952857 Revision 2, March 14, 1978.

86. Westinghouse Electric Corporation, TGH/THX Main Steam Stop Valve E-Spec, E-Spec 952881, Revision 5, January 7, 1986.

87. Atwood and Morrill, 30-inch Main Steam Isolation Valve Stress Analysis, 1608A, February 18, 1977.

88. Atwood and Morrill, Static Seismic Deflection Test for a 30-inch Main Steam Isolation Valve, 208-13839-00, November 22, 1978.

89. Westinghouse Electric Corporation, Equipment Qualification Data Package-Safety Related Externally Mounted Limit Switches, WCAP-8587 EQDP-HE-3, March 1983.

90. Westinghouse Electric Corporation, Equipment Qualification Test Report-Namco Externally Mounted Valve Limit Switches-Environmental and Seismic Testing, WCAP-8687 Suppl-2-H03A, March 1983.

91. Westinghouse Electric Corporation, Equipment Qualification Test Report-South Texas Project Units 1 and 2 MSIV Solenoid Valves, WCAP-11160, October 1986.

92. Atwood and Morrill, Performance Testing of a 26-inch MSIV During Simulated Guillotine Break Conditions, Report Number 43, May 9, 1977.

NRC FORM 335 (2.84) NRCM 1102, 3201, 3202

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

SEE INSTRUCTIONS ON THE REVERSE

1. REPORT NUMBER (Assigned by TIDC, add Vol. No., if any)
EGG-NTA-7681

2. TITLE AND SUBTITLE
AUDIT OF THE PUMP AND VALVE OPERABILITY ASSURANCE PROGRAM FOR SOUTH TEXAS PROJECT, UNIT 1

3. LEAVE BLANK

4. DATE REPORT COMPLETED
MONTH: April YEAR: 1987

5. AUTHOR(S)
C. Kido, H. M. Stromberg, and H. L. Magleby

6. DATE REPORT ISSUED
MONTH: April YEAR: 1987

7. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code)
EG&G Idho, Inc.
P. O. Box 1625
Idaho Falls, ID 83415

8. PROJECT/TASK/WORK UNIT NUMBER

9. FIN OR GRANT NUMBER
A6415 Project IV

10. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code)
Mechanical Engineering Branch
Division of Engineering and System Technology
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

11a. TYPE OF REPORT
Technical Report

b. PERIOD COVERED (Inclusive dates)

12. SUPPLEMENTARY NOTES

13. ABSTRACT (200 words or less)

The South Texas Unit 1 was audited December 16 to 19, 1986 to determine the adequacy of the Pump and Valve Operability Assurance Program. Nine concerns (four specific and five generic), which could not be resolved by the close of the audit, were identified to the applicant. The applicant committed to adequately address all remaining concerns prior to fuel load. The results of this audit indicate that the applicant has established and is implementing a program that will track all pumps and valves important to safety from manufacture and in-shop testing through qualification, installation testing, maintenance, and surveillance for the purpose of assuring continued operability of these components over the life of the plant.

14. DOCUMENT ANALYSIS - a. KEYWORDS/DESCRIPTORS

b. IDENTIFIERS/OPEN-ENDED TERMS

15. AVAILABILITY STATEMENT
Unlimited

16. SECURITY CLASSIFICATION
(This page) Unclassified
(This report) Unclassified

17. NUMBER OF PAGES

18. PRICE