GULF STATES UTILITIES COMPANY

RIVER BEND STATION POST OFFICE BOX 220 ST. FRANCISVILLE, LOUISIANA 70775

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May 15, 1985
RBG- 20,998
File No. G9.5, G9.19.2,
G9.20.8

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington D.C. 20555

Dear Mr. Denton:

River Bend Station Unit 1
Docket No. 50-458

Gulf States Utilities Company (GSU) provides the attached information in response to Safety Evaluation Report (SER) Sections 3.10.1 and 3.10.2 and Open Item No. (5).

If additional assistance is required, please contact Mr. Rick J. King at (504) 635-4813.

Sincerely,

J. E. Booker

J. E. Booker
Manager -
Engineering, Licensing &
Nuclear Fuels
River Bend Nuclear Group

JEB/RJK/rg

Attachment

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ENCLOSURE 1

RBS SER RESPONSE

RBS SER Response

A. Seismic

1. SER Section 3.10.1, page 3-43, Second Paragraph:

FSAR Table 3.10A-1 is to include a summary of seismic qualification results, and the applicant should commit to a date for completing this table. FSAR Table 3.10B-2 is to include comments on the seismic test to be performed on Class 1E equipment that has not yet been tested. Tables 3.10A-1, 3.10B-1, and 3.10B-2 also should reference all the important applicable standards that are met in the qualification process, particularly those referenced in SRP 3.10.

RESPONSE:

Please refer to revised FSAR Tables 3.10A-1 and 3.10B-1 for a summary of seismic qualification results and for reference to all the important applicable standards that are met in the seismic qualification process. FSAR Tables 3.10B-1 and 3.10B-2 have been consolidated in revised Table 3.10B-1.

2. SER Section 3.10.1, page 3-43, Third Paragraph

FSAR Table 3.9A-5 is to include a summary of seismic qualification results, and the applicant should commit to a date for the completion of this table. The applicant also should provide a summary of seismic qualification results for safety-related mechanical systems and components in FSAR Section 3.9B.

RESPONSE:

A summary of seismic qualification results was provided in FSAR Table 3.9A-5 of FSAR Amendment No. 12. A summary of seismic qualification results for major safety-related mechanical systems and components is provided in revised FSAR Section 3.9.2.2B.

3. SER Section 3.10.1, page 3-43, Fourth Paragraph

The FSAR should indicate what operability testing is included simultaneously with thermal aging, and should discuss fatigue considerations for a number of actuation cycles.

RESPONSE:

Age effects, including, when appropriate, thermal aging, radiation aging, vibration and dynamic load aging and mechanical cycling, are addressed for equipment requiring qualification in accordance with 10CFR50.49. For details, please refer to FSAR Section 3.11 and the RBS Environmental Qualification Document (EQD).

A discussion of fatique considerations for equipment subjected to hydrodynamic loads is provided in revised FSAR Section 3.9.2.2.1.3B in FSAR Appendix 6A, Section 6A.17.

4. SER Section 3.10.1, page 3-43, Fifth Paragraph

Although mounted components are described as qualified to acceleration levels consistent with those transmitted by their supporting structures, the applicant is to clarify in the FSAR how the equipment interaction with the mounting (considering actual support deflections, etc.) is addressed.

RESPONSE:

Please refer to revised FSAR Section 3.10.3A for a clarification of how equipment interaction with the mounting is addressed.

5. SER Section 3.10.1, pg. 3-43, Sixth Paragraph

Although the applicant has committed to follow IEEE 344-1975 and RG 1.100 for BOP equipment, the methods of handling aging effects on the seismic capability of both electrical and mechanical equipment should be clarified in an FSAR amendment. This amendment also should describe what additional measures were taken to ensure that adequate consideration was given to aging, sequential testing, and upgrading of analytical methods.

RESPONSE:

Aging effects are addressed for equipment requiring qualification in accordance with 10CFR50.49 as described in FSAR Section 3.11 and the RBS Environmental Qualification Document (EQD).

6. SER Section 3.10.1, pg. 3-43, Seventh Paragraph

The applicant should commit (in the FSAR) to establish a maintenance and surveillance program to maintain equipment in a qualified status throughout plant life.

RESPONSE:

Please refer to Section 6 of the RBS Environmental Qualification Document (EQD) for a description of the maintenance and surveillance program to maintain equipment in a qualified status throughout plant life.

7. SER Section 3.10.1, pg. 3-43, Eighth Paragraph

The applicant should amend the FSAR description of the seismic qualification program and clarify the seismic margin for the required response spectra used, with respect to safety-related mechanical equipment. Also, although qualification tests for electrical equipment were performed on cabinets, vertical boards, and benchboards, the applicant must clarify the methodology used to qualify multi-cabinet assemblies, particularly those too large to test.

Response

For a clarification of seismic margin please refer to revised FSAR Sections 3.9.2.2.2A and 3.9.2.2.1B. The methodology used to qualify multi-cabinet assemblies, particularly those too large to test is clarified in revised FSAR Sections 3.10.2.1A and 3.10.3.1.1B.

8. SER Section 3.10.1, page 3-43, Ninth Paragraph

The FSAR description of testing of equipment to frequencies up to 33 Hz must include higher frequencies. The FSAR should be amended to clarify what additional safety-related mechanical equipment may experience high frequencies from hydrodynamic loads and describe how qualification tests and analyses include the envelope of input motion produced by hydrodynamic loads.

Response

The qualification of equipment to frequencies higher than 33 Hz is addressed in revised FSAR (Amendment 12) Sections 3.9.2.2A, 3.9.2.3A, and 3.10A and in revised FSAR Sections 3.9.2.2B, 3.9.3.2B and 3.10B.

9. SER Section 3.10.1, pages 3-43 and 3-44, Tenth Paragraph

In accordance with RG 1.100, where static coefficient analysis is used to verify the seismic adequacy of seismic Category I components, equipment, and supports, the applicant must clarify the RRS values and justify the use of the static coefficient.

Response:

Please refer to FSAR Section 3.7.3.5A and revised Section 3.7.3.5B for a discussion of the use of static coefficient analysis.

B. Pump and Valve

1. SER Section 3.10.2, page 3-44; Item No. 1

The FSAR must clearly state the extent to which draft standards ANSI/ASME QNPE-1 (N551.1), QNPE-2 (N551.2), QNPE-3 (N551.3), QNPE-4 (N555.4), and N41.6 and issued ANSI/ASME B.16.41 are used. In addition, the FSAR must also indicate the applicant's position with respect to RG 1.148.

Response

ANSI/ASME Standards QNPE-1 through QNPE-4 are not yet issued. Since formal drafts are not publicly available formal positions on these standards have not been established.

Draft Standard N41.6 was issued as IEEE Standard 382-1980. RBS equipment generally meets the requirements of IEEE Standards 382-1972, 323-1974, and 344-1975. However, the qualification of some recently tested equipment also meets the requirements of IEEE Standard 382-1980.

A comparison of the guidelines of ANSI/ASME Standard B16.41 against the RBS requirements for two examples (BOP and NSSS) of motor operated valve specifications is attached.

The RBS position with respect to RG 1.148 is provided.

2. SER Section 3.10.2, pg. 3-44 and 3-45, Item No. 2

Operability of extended structure valves was determined from static load tests (based on SSE accelerations) on the actuator and yoke of valve under pressure. The FSAR should clearly present the justification for excluding the effects of other loads (dynamic loads), environmental conditions (temperature and flow), and duration in the operability tests.

Response

The demonstration of operability for active valves with extended structures is accomplished by a combination of analyses and tests, among them, for some valves, static deflection tests on the valve/actuator assembly. For a description of the pump and valve operability program please refer to revised FSAR Sections 3.9.3.2A and 3.9.3.2B.

3. SER Section 3.10.2, page 3-45, Item No. 3

The discussion of testing in the operational condition is limited with regard to several components. The FSAR should address the assessment of degraded condtions and how testing was tailored to meet the requirement of SRP 3.10.II.1.a(2).

Response

Revised FSAR Sections 3.9.3.2A and 3.9.3.2B clarify that equipment is tested in the operational condition, where practical. Degraded flow conditions resulting from debris in the suppression pool are not expected to affect the operability of safety systems since the suction line openings are raised above the suppression pool floor and are equipped with strainers.

4. SER Section 3.10.2, page 3-45, Item No. 4

The applicant should amend the existing FSAR tables of pumps and valves to include the standards used and the methods (analysis, test, or combination) used for qualification. As an alternate, a separate table may be provided that lists equipment types and the above information. For example, FSAR Table 3.9-10 does not reference all the important applicable standards.

Response

A description of the standards and methods used for qualification is provided in FSAR (Amendment 12) Table 3.9A-5 and in revised FSAR Tables 3.9B-3a and 3.9B-3b.

5. SER Section 3.10.2, page 3-45, Item No. 5

In many cases, the motor of an assembly was independently qualified and the pump separately qualified for operation, using the inputs at the mounting. The FSAR must provide further justification describing how an acceptable qualification of the assembly was determined, considering simultaneous dynamic interactions between the pump, motor, and pedestal/mounting structure.

Response

Please refer to revised FSAR Sections 3.9.3.2.1A and 3.9.3.2B for a description of how qualification of the assembly was determined.

6. SER Section 3.10.2, page 3-45, Item No. 6

Although the FSAR addresses aging and the sequence of environmental conditions on the qualification process, it should clarify how these

findings will be reflected in the maintenance and surveillance program. The FSAR should be amended to include the criteria for the maintenance program as it relates to equipment qualification test and analysis results.

Response

Please refer to Section 6 of the RBS Environmental Qualification Document (EQD) for a description of the maintenance and surveillance program to maintain equipment in a qualified status throughout plant life.

7. SER Section 3.10.2, page 3-45, Item No. 7

The FSAR discussion on qualification by static analysis of valves with natural frequencies in excess of 33 Hz does not address or reference the impact of hydrodynamic load frequencies. The FSAR should identify what valves will be subjected to higher frequencies than 33 Hz (from hydrodynamic loads) and discuss the impact of these dynamic loads on their qualification and performance.

Response

The qualification of pumps and valves that are subjected to hydrodynamic loads is addressed in FSAR (Amendment 12) Section 3.9.3.2A and in revised FSAR Section 3.9.3.2B.

8. SER Section 3.10.2, page 3-45, Item No. 8

The standby liquid control valve actuator is qualified to IEEE 383-1972. The NRC requirements in the areas of aging, vibration, and seismic test methods exceed the requirements of IEEE 383-1972. Thus, the FSAR should be amended to include the additional guidelines used for qualification or provide justification for the limited consideration of these areas of concern.

Response

The qualification of the standby liquid control valve actuator has been upgraded to meet the requirements of IEEE Standard 382-1980. Please refer to revised FSAR Section 3.9.3.2.4.1.3B.

9. SER Section 3.10.2, page 3-45, Item No. 9

The staff review of the P&IDs indicates that all active simple check valves were omitted from FSAR Table 3.9.A-11 and other valves were omitted from either Table 3.9A-11 or 3.9B-3. The FSAR should be amended to include all active valves and the relevant information.

Response

FSAR (Amendment 12) Table 3.9A-11 and revised FSAR Table 3.9B-3b list all active valves. However, active simple check valves are not listed since they are qualified as part of the piping analysis. Please refer to revised FSAR Section 3.9.3.2.2A for a description of the generic testing criteria for qualifying check valves.

10. SER Section 3.10.2, page 3-45, Item No. 10

The criteria used to determine what auxiliary active safety-related equipment is included in the FSAR tables of active equipment should be described in an amendment to the FSAR. For example, the applicant should clarify why active valves on the diesel air starting system are excluded.

Response

Pumps and valves described as active per the definitions provided in FSAR Sections 3.9.3.2A and 3.9.3.2B are listed in FSAR (Amendment 12) Tables 3.9A-10, 3.9A-11 and in revised FSAR Tables 3.9B-3a and 3.9B-3b. Active pumps and valves that are appurtenances of an assembly and are not individually identifiable by a mark number are not listed. Instead, the assembly is listed in FSAR Tables 3.9A-5, 3.10A-1 or 3.9B-11. These criteria are reflected in revised FSAR Sections 3.9.3.2A and 3.9.3.2B.

11. SER Section 3.10.2, page 3-45, Item No. 11

The applicant should amend the FSAR to include the generic testing criteria for qualifying check valves for service conditions, and to address considerations of load conditions (end loads, vibrations, seismic, and reverse flow) and environmental conditions (thermal and radiation aging of sensitive materials and their impact on valve function and valve leakage.

Response

Please refer to revised FSAR Section 3.9.3.2.2A for a description of the generic testing criteria for qualifying check valves. The effect of environmental conditions and their impact on valve function and valve leakage is addressed as part of the Mechanical Environmental Qualification (MEQ) program. Please refer to Section 4 of the RBS Environmental Qualification Document (EQD).

RBS SER RESPONSE

Attachment

Compliance with ANSI/ASME Standard B16.41-1983,
Functional Qualification Requirements for Power Operated
Active Valve Assemblies for Nuclear Power Plants

The qualification program for power operated active valve assemblies generally complies with ANSI/ASME Standard B16.41-1983, with the following clarifications.

Valve Leakage Test

The valve hydrostatic seat test is done in accordance with MSS-SP-61 "Manufacturer's Standardization Society of the Valve and Fittings Industry, Standard Practices for Hydrostatic Testing." Pneumatic seat tests are done in accordance with ASME Section V, Article 10, Paragraph T-1040.

Cold Cycle Test

No exceptions.

Hot Cycle Test

Not performed (not required by specification)

Pipe Reaction End Loading Qualification Test

Adequacy of the valve body is demonstrated through the piping analysis. Low stresses in the valve body preclude the possibility of significant distortion and, therefore, the possibility of binding of internal components. Based on this consideration, addition of pipe end loads are not necessary. For valves where the stresses in the valve body could be significant, the piping end loads are imposed during the qualification tests. Examples include solenoid valves and air operated control valves.

Exploratory Vibration Test & Seismic Loading Test

Do not comply. However, the fundamental frequency of the valve assemblies are determined analytically and active valve assemblies are subjected to static deflection tests to demonstrate operability.

Flow Interuption Capability Test

Do not comply; however, valve closure against substantial flow is demonstrated analytically for the purge and vent butterfly valves.

Endurance Test

Not performed (not required by specification).

ENCLOSURE 2

REVISED FSAR SECTIONS

Notation of Revisions:

--- indicates deletions

___ indicates additions

Revised FSAR Sections - Index

Section	Notes
Table 3.9B-3a	
Table 3.9B-3b	
Table 3.9B-11	
3.10.2.1A	
3.10.3A	
3.10B	complete section
3.10.3.1.1B	
Table 3.10B-1	
Table 3.10B-2	deleted
Figure 3.10B-1	deleted
Figure 3.10B-2	deleted
Figure 3.10B-3	deleted
Figure 3.10B-4	deleted
Appendix 3E	deleted
Appendix 3F	deleted

Revised FSAR Sections - Index

Section	Notes
3.7.3.5B	
3.9.2.2.1A	
3.9.2.2.2A	
3.9.3.2A	
3.9.3.2.1A	
3.9.3.2.2A	
3.9.2.2B	
3.9.2.2.1B	
3.9.2.2.1.1B	
3.9.2.2.1.2B	
3.9.2.2.1.3B	deleted/added
3.9.2.2.1.4B	deleted
3.9.2.2.2B	
3.9.2.2.2.1B	deleted/added
3.9.2.2.2.2B	deleted
3.9.2.2.2.3B	deleted
3.9.2.2.2.4B	
3.9.2.2.2.5B	deleted
3.9.2.2.2.6B	
3.9.2.2.2.7B	
3.9.2.2.2.8B	
3.9.2.2.2.9B	
3.9.2.2.2.10B	
3.9.2.2.2.11B	
3.9.2.2.2.12B	
3.9.2.2.2.13B	
3.9.2.2.2.14B	
3.9.3.2B	
3.9.3.2.1B	
3.9.3.2.1.1B	
3.9.3.2.1.2B	
3.9.3.2.2B	
3.9.3.2.3B	
3.9.3.2.4.1B	
3.9.3.2.4.1.1B	
3.9.3.2.4.1.2B	
3.9.3.2.4.1.3B	
3.9.3.2.4.1.4B	added
3.9.3.2.4.2B	
3.9.3.2.4.3B	deleted
3.9.3.2.4.3.1B	deleted
3.9.3.2.4.3.2B	deleted
3.9.3.2.4.3.3B	deleted

Revise RBS FSAR Table 1.8-1, pg. 19lb (Amendment 2), as follows:

"Regulatory Guide 1.148 (March 1981)

Functional Specification for Active Valve Assemblies in Systems Important to Safety in Nuclear Power Plants

Project Position - RBS does not conform explicitly with all of the requirements of this regulatory guide, since the guide was issued after RBS valve purchase orders were placed.

However, some of the requirements of the guide are addressed in the specifications for active valve assemblies.

The valve operability program outlined in Section 3.9.3.2A and 3.9.3.2B provides the data necessary to demonstrate valve operability."

3.7.3.5B

Revise RBS FSAR Section 3.7.3.5B "Use of Equivalent Static Load Method of Analysis," page 3.7B-18 (Amendment 5), as follows:

"~~When the natural frequency of a structure or component is unknown, it may be analyzed by applying a static force at the center of mass. In order to conservatively account for the possibility of more than one significant dynamic mode contributing to the total response, the static force is calculated as 1.5 times the mass times the maximum spectral acceleration from the floor response spectra of the points of attachment of multi-span structures. This factor of 1.5 is adequate for simple beam type structures. For other more complicated structures, the factor used is justified. The vertical static force may be calculated directly from the vertical ground design response spectrum, if it can be shown that the structures supporting the equipment are rigid or quasi-rigid in the vertical direction.~~

When the natural frequencies of a system, component, or equipment are unknown, it may be analyzed by applying an equivalent static coefficient analysis. This procedure allows a simpler technique in return for added conservatism. The static acceleration of a component is conservatively assumed to be the peak spectral acceleration of the required response spectrum (RRS) which envelops the multi-support input spectra. The oscillator damping associated with the enveloping RRS must be representative of the actual component damping.

The equivalent static acceleration is then obtained by multiplying the static acceleration by a static coefficient which takes into account the effects of both multi-frequency excitation and multi-mode response. For verifying the structural integrity of frame-type components physically similar to beams and columns, the static coefficient is taken as 1.5. For equipment having other than a frame-type configuration, justification is provided for the static coefficient used.

The equivalent static forces on each subcomponent of the equipment are obtained by multiplying the subcomponent masses by the equivalent static acceleration. The resulting static load vector is distributed over the equipment in a manner proportional to its mass distribution. The static stress analysis is then performed in a normal manner."

3.9.2.2.1A

Revise RBS FSAR Section 3.9.2.2.1A "Seismic Qualification Criteria," 3rd paragraph, page 3.9A-9 (Amendment 12) as follows:

"Seismic qualification of equipment is accomplished by one of the four methods discussed in Section 3.7.3.1A. Analysis is used to demonstrate structural integrity of the equipment. <u>The acceptance criteria and margins of safety for mechanical equipment qualified by analysis or test are in accordance with Section 3.9.2.2.2A.</u> Where the equipment is classified as active, additional deflection analysis and/or testing is performed. Details of qualification methods for specific equipment are contained in Table 3.9A-5."

3.9.2.2.2A

Revise RBS FSAR Section 3.9.2.2.2A "Acceptance Criteria," 1st paragraph, page 3.9A-11, as follows:

"The acceptance criteria used are as follows:

1. Tests, when used, demonstrate that the component performs its required safety function during and after the test. The test response spectrum (TRS) generally envelops the applicable frequency range of the required response spectrum (RRS) with the suggested margin in accordance with IEEE Standard 323-1974. Where the TRS does not envelop the RRS with the suggested margins of IEEE Standard 323-1974 a justification is provided."

3.9.3.2A

Revise RBS FSAR Section 3.9.3.2A "Pump and Valve Operability Assurance," as follows:

"This section provides the operability assurance programs for pumps and valves affected by seismic loads. The operability assurance programs for pumps and valves affected by the suppression pool induced dynamic loads are provided in Appendix 6A, subsection 6A.17.

Pumps and valves installed in Seismic Category I piping systems are designed in accordance with the requirements of ASME Section III, Subsections NB, NC and ND. Tables 3.9A-10 and 3.9A-11 list the active pumps and valves, respectively., in Seismic Category I systems whose operations is required either to ensure safe shutdown or to mitigate the consequences of an accident or transient condition. Inactive pumps and valves are designed for the loading combinations of Section 3.9.3.1.2A and for the stress limits in Table 3.9A-9. Active pumps and valves that are appurtenances of an assembly and are not individually identifiable by a mark number are not listed. Instead, the assembly is listed in FSAR Tables 3.9A-5 and 3.10A-1.

Valves without significant extended structures are considered seismically adequate as a result of piping seismic adequacy (see ASME Section III, Paragraph NB-3524). For valves with operators having significantly extended structures, which are essential for maintaining pressure integrity, analysis is based upon static forces resulting from equivalent seismic accelerations acting at the center of gravity of the operator. For "active" valves, operability is checked by performing a static deflection test. A static load (equivalent to that produced by SSE conditions) is applied at the operator centroid, with simultaneous operation of the pressurized valve during and after the test.

Active components are those whose operability is relied upon to perform a safety function such as safe shutdown of the reactor or mitigation of the consequences of a postulated pipe break in the RCPB.

Nonactive components are those whose operability (e.g., valve opening or closure, pump operation or trip) is not relied upon to perform the system function during the transients or events considered in the respective operating condition category.

Safety-related valves are qualified by testing and analysis, and safety-related active pumps by analysis with appropriate stress limits and nozzle loads. The content of these programs is detailed in the following sections."

3.9.3.2.1A

Revise RBS FSAR Section 3.9.3.2.1A "Pump Operability Program," last paragraph, page 3.9A-19, as follows:

"~~To complete the seismic qualification procedures,~~ Seismic analysis of the assembly, i.e. pump, motor, and the supporting structure, was performed to assure pump operability and acceptable qualification of the entire assembly. Additionally, the pump motor is independently qualified for operation during the maximum seismic event."

Revise RBS FSAR Section 3.9.3.2.1A "Pump Operability Program," last sentence, page 3.9A-20 as follows:

"Results of analyses and tests are included in Table 3.9A-~~10~~ 5."

3.9.3.2.2A

Revise RBS FSAR Section 3.9.3.2.2A "Valve Operability Program," as follows:

"Safety-related active valves ~~must~~ are required to perform their mechanical motion during and after the course of ~~an~~ a postulated accident. Assurance must be supplied that these valves can operate during and after a seismic event. Qualification tests accompanied by analyses are conducted for all active valves.

Valves without significant extended structures are considered seismically adequate as a result of piping seismic adequacy (see ASME Section III, Paragraph NB-3524). For valves with operators having significantly extended structures, which are essential for maintaining pressure integrity, analysis is based upon static forces resulting from equivalent seismic accelerations acting at the center of gravity of the operator. For "active" valves, operability is checked by performing a static deflection test. A static load (equivalent to that produced by SSE conditions) is applied at the operator centroid, with simultaneous operation of the pressurized valve during and after the test.

The safety related valves are subjected to a series of tests prior to service and during the plant life. Prior to installation, the following tests are performed: shell hydrostatic test to ASME Section III requirements, main seat leakage tests, disc hydrostatic test, functional tests to verify that the valve opens and closes within the specified time limits when subjected to the design differential pressure, and operability qualification of motor operators for the environmental conditions over the installed life (i.e., aging, radiation, accident environment simulation, etc.) according to IEEE 323-1974 and IEEE 382-1972. Cold hydro qualification tests, hot functional qualification tests, periodic inservice inspections, and periodic inservice operation are performed ~~in situ~~ to verify and assure the functional ability of the valve. ~~The valves are designed using either the stress analyses or the requirements of ASME Section III, depending on valve size. On all active valves, an~~. An analysis of the extended structure is also performed for static equivalent seismic SSE loads. The maximum stress limits allowed in these analyses assure the maintenance of structural integrity. The limits used for Class 2 and 3 active valves are shown in Table 3.9A-9.

In addition to these tests and analyses, representative valves of each design type, pressure, and size group are tested for verification of operability during a simulated seismic event, by demonstrating operational capabilities within the specified limits. The ~~proposed~~ testing procedures are described below.

The valve is mounted in a manner ~~that represents~~ which conservatively represents the actual valve installation. The valve assembly includes the operator and all appurtenances normally attached to the valve in service. The operability of the valve during ~~an SSE~~ the faulted condition is demonstrated ~~by satisfying the following criteria~~ as follows:

~~1. All the active valves are required to have a fundamental natural frequency that is greater than 33 Hz. This is shown by suitable test or analysis.~~

1.~~2.~~ The actuator and yoke of the valve system are statically loaded by an amount equal to that determined from an analysis as representing ~~SSE~~ faulted accelerations applied at the center of gravity of the operator about the weaker axis of the yoke. The design pressure of the valve is simultaneously applied to the valve during the static deflection tests.

2.~~3.~~ The valve is then operated while in the deflected position, i.e., from the normal operating mode to the faulted operating mode. The valve is required to perform its safety-related function within the specified operating time limits.

3.~~4.~~ Electric motor operators and other electrical appurtenances necessary for operation are qualified in accordance with IEEE Standards 323-1974, ~~and IEEE~~ 344-1975, and 382-1972.

4. Nonmetallic components of valves that are located in a harsh environment are qualified under the Mechanical Environmental Qualification program in accordance with Section 4 of the RBS Environmental Qualification Document.

The accelerations used for the valve qualification are 3.0 g horizontal and 3.0 g vertical. The piping design maintains the motor operator accelerations to these levels with an adequate margin of safety.

Adequacy of the valve body is demonstrated through piping analysis. Low stresses in the valve body preclude the possibility of significant distortion, and therefore the possibility of binding of internal components. Based on this consideration, pipe end loads need not be simulated during the operability tests.

For valves where the stresses in the valve body could be significant, e.g. solenoid valves and air-operated control valves, the piping end loads are imposed during the operability tests.

For selected active valve categories specific qualification programs are conducted to demonstrate operability. The method of qualification for these valves is detailed below:

A. Butterfly Valves

The Containment and Drywell Vent/Purge Isolation Valves are evaluated for operability during a postulated accident by both analyses and testing.

1. The valve assembly is analytically evaluated and shown to perform its safety function, i.e., to close within the required time. The analysis of the valve combines seismic, hydrodynamic, operating and LOCA loads.

2. The valve assembly is statically loaded to an amount equal in magnitude to the dynamic force applied at the actuator C.G. The design pressure of the valve is simultaneously applied and the valve is operated while in the deflected position.

3. Electrical appurtenances (limit switches and solenoid operated valves) are qualified in accordance with the requirements of IEEE Standards 323-1974 and 344-1975.

4. In addition, assurance of operability is demonstrated by the following tests:

   a. in-shop shell hydrostatic tests

   b. cold cyclic tests

   c. seat leakage tests

   d. pre/post installation function tests.

B. Check Valves

Check valves are characteristically simple in design, and their operation is not affected by seismic accelerations or the applied nozzle loads. Check valve design is compact, and there are no extended structures or masses whose motion could cause distortions or restrict operation of the valve. The nozzle loads due to the maximum dynamic excitation do not affect the functional ability of the valve since the valve disc is designed to be isolated from the casing wall. The clearance supplied by the design around the disc prevents the disc from becoming bound or restricted due to any casing distortions caused by nozzle loads. Therefore, the design of these valves is such that when the structural integrity of the valve is assured, using standard design or analysis methods, the ability of

the valve to operate is assured by the design features. In addition to these design considerations, the valves are also subjected to the following tests and analysis:

1. Stress analysis, including the faulted loads and disc impact loads

2. In-shop hydrostatic test

3. In-shop seat leakage test

4. Periodic in situ valve exercising and inspection to assure the functional ability of the valve.

For the feedwater check valves, the operability following a postulated feedwater line break is also demonstrated. The maximum disc impact velocity and the pressure differential across the disc are determined. A stress analysis of the valve, which considers the impact and the seismic inertia loads, demonstrates the valve's adequacy.

The above testing program applies only to valves with extended structures i.e., the motor operator. Testing is conducted on a representative number of valves from each of the primary safety-related design types (e.g., motor-operated gate valve). Selected valve sizes are qualified by the tests and the results used to qualify that group of valves which the tested valve represents. Stress and deformation analyses are used to support the interpolation.

The basic criteria used in selecting the representative valve for qualification testing is based on an evaluation of the following parameters:

1. Valve assembly weight

2. Valve size, type, and pressure ratings

3. Valve actuator type and performance characteristics

4. Mounting arrangement of the valve and its appurtenances.

The methodology utilized in assessing the degree of similarity and evaluating the differences generally follows generically the guidelines of ANSI/ASME Standard B16.41, draft ANSI Standard N278.2.4 Functional Qualification Requirements for Power Operated Safety-Related Active Valve Assemblies for Nuclear Power Plants.

Valves that are safety-related but have no extended structure, such as check valves and SRVs, are considered separately.

~~Check valves are characteristically simple in design, and their operation is not affected by seismic accelerations or the applied nozzle loads. Check valve design is compact, and there are no extended structures or masses whose motion could cause distortions or restrict operation of the valve. The nozzle loads due to maximum seismic excitation do not affect the functional ability of the valve since the valve disc is designed to be isolated from the casing wall. The clearance supplied by the design around the disc prevents the disc from becoming bound or restricted due to any casing distortions caused by nozzle loads. Therefore, the design of these valves is such that when the structural integrity of the valve is assured, using standard design or analysis methods, the ability of the valve to operate is assured by the design features. In addition to these design considerations, the valves are also subjected to the following tests and analysis:~~

1. ~~Stress analysis, including the SSE loads~~

2. ~~In-shop hydrostatic test~~

3. ~~In-shop seat leakage test~~

4. ~~Periodic in situ valve exercising and inspection to assure the functional ability of the valve.~~

Using the methods described, all the safety-related valves in the system are qualified for operability during a ~~seismic~~ <u>the faulted</u> event. These methods conservatively simulate the ~~seismic~~ <u>faulted</u> event and ensure that the active valves can perform their safety-related function when ~~necessary~~ <u>required</u>."

3.9.2.2B

Revise RBS FSAR Section 3.9.2.2B "Seismic Qualification of Safety-Related Mechanical Equipment," as follows:

"3.9.2.2B Seismic and Hydrodynamic Qualification of Safety-Related Mechanical Equipment

This subsection describes the ~~criteria for~~ dynamic, i.e. seismic, and where applicable, hydrodynamic, qualification of safety-related floor-mounted, pipe-mounted and fuel handling mechanical equipment. ~~and the qualification testing and/or analysis applicable to this plant for all of the major components on a component-by-component basis.~~ In some cases, a module or assembly consisting of mechanical and electrical equipment is qualified as a unit, for example, ECCS pumps. These modules are generally discussed in this ~~paragraph~~ Section rather than in Sections 3.10B and 3.11. ~~Seismic~~ Operability qualification of active pumps and valves ~~testing~~ is ~~also~~ discussed in Section 3.9.3.2B. ~~Electrical supporting equipment such as control consoles, cabinets, and panels which are part of the NSSS are discussed in Section 3.10B.~~"

3.9.2.2.1B

Revise RBS FSAR Section 3.9.2.2.1B "Tests and Analysis Criteria and Methods," as follows:

"The ability of equipment to perform its ~~Seismic Category I~~ safety function during and after the exposure to dynamic loads ~~an earthquake~~ is demonstrated by tests and/or analysis. Selection of testing, analysis, or a combination of the two is determined by the type, size, shape, and complexity of the equipment being considered. ~~When~~ Where practical, the ~~Seismic Category I operations are performed simultaneously with vibratory~~ equipment operability is established by testing. ~~Where this is not practical,~~ Otherwise, the operation and/or loads are simulated by mathematical analysis and applied in addition to physical tests.

Equipment which is large~~,~~ and/or can be represented by a frame type structure ~~simple, and/or consumes large amounts of power~~ is usually qualified by analysis ~~or static bend test~~ to show that the loads, stresses, and deflections are less than the allowable maximum. Analysis and/or ~~static bend~~ testing are ~~is also~~ used to show that there are no ~~natural frequencies below 33 Hz or 60 Hz if the equipment is affected by hydrodynamic loads.~~ equipment resonances within the frequency range of interest (generally 1 to 33 Hz for equipment subjected to seismic loads only, and 1 to 60 Hz for equipment subjected to seismic and hydrodynamic loads). If ~~a natural frequency lower~~ equipment resonances are discovered within the applicable frequency range ~~than 33 Hz or 60 Hz if the equipment is affected by hydrodynamic loads is discovered,~~ dynamic tests may be conducted and, in conjunction with mathematical analysis, used to verify operability and structural integrity ~~at~~ under the required ~~seismic input conditions~~ dynamic loads.

When the equipment is qualified by dynamic test, the response spectrum ~~or time history of the attachment point~~ method is generally used in determining input motion. Testing is performed on prototypes of equipment and is supported by analysis to demonstrate similarity between the prototype and equipment installed at RBS.

Natural frequency may be determined by running a continuous sweep frequency search using a sinusoidal steady state input of low magnitude. ~~Seismic conditions~~ Dynamic loads are simulated by testing using random vibration input or single frequency input ~~(within equipment capability)~~ at frequencies throughout the applicable range ~~33 Hz or 60 Hz if the equipment is affected by hydrodynamic loads.~~ Whichever method is used, the equipment response ~~input motion~~ during testing envelopes the actual equipment response ~~input motion~~ expected during dynamic loading ~~earthquake~~ conditions. The TRS, where applicable, generally envelops the applicable frequency range

of the RRS with margins greater than 10%. If poke-throughs occur they are justified on a case by case basis.

The equipment being dynamically tested is mounted in on a way that fixture which simulates the actual intended service mounting and causes no dynamic coupling to the equipment. Equipment mounted on intermediate structures is qualified to the acceleration levels at the mounting location which takes into account the transmissibility of the supporting structure.

Equipment having an extended structure, such as a valve operator, is analyzed by applying static equivalent seismic SSE loads at the center of gravity of the extended structure. In cases where the equipment structural complexity makes mathematical analysis impractical, a static bend test is used to determine spring constant and operational capability at maximum equivalent seismic load conditions."

3.9.2.2.1.1B

Revise RBS FSAR Section 3.9.2.2.1.1B Random Vibration Input," as follows:

"3.9.2.2.1.1B ~~Random~~ Vibration Input

Dynamic tests are generally performed using random multi-frequency vibration input. ~~When random vibration input is used, the actual input motion envelopes the appropriate floor input motion at the individual modes.~~ However, single frequency input such as sine waves can be used provided one of the following conditions is met:

1. The ~~characteristics of the required~~ device input motion ~~are~~ is dominated by one frequency.

2. The ~~anticipated~~ device is rigid, or its response ~~of the equipment~~ is adequately represented by one mode.

~~3. The input has sufficient intensity and duration to excite all modes to the required magnitude, such that the testing response spectra envelope the corresponding response spectra of the individual modes."~~

3. The device can be characterized as passive, in which case its safety function is satisfied by maintaining structural integrity.

4. The device is tested to a sufficiently high acceleration level to excite all modes over the frequency range of interest."

3.9.2.2.1.2B

Revise RBS FSAR Section 3.9.2.2.1.2B "Application of Input Motion," as follows:

"When dynamic tests are performed, the input motion is applied to one vertical and one horizontal axis simultaneously. However, if the equipment response along the vertical direction is not sensitive to the vibratory motion along the horizontal direction, and vice versa, then the input motion may be ~~is~~ applied to one direction at a ~~at~~ time. In the case of single frequency input, the time phasing of the inputs in the vertical and horizontal directions are such that a purely rectilinear resultant input is avoided."

3.9.2.2.1.3B

Delete RBS FSAR Section 3.9.2.2.1.3B "Fixture Design."

Add RBS FSAR Section 3.9.2.2.1.3B "Hydrodynamic Fatigue," as follows:

"3.9.2.2.1.3B Hydrodynamic Fatigue

A number of NSSS components are mounted inside the River Bend Station reactor building, and are subjected to hydrodynamic loads. One of the possible hydrodynamic loads (i.e., loads due to SRV actuation) is predicted to occur sufficiently often that fatigue effects might possibly develop over the projected 40 year life of the plant.

In order to assess whether such fatigue effects could significantly degrade the NSSS components to a point where performance of their safety-related functions might be impaired, a representative sample of the NSSS components was evaluated in depth. This sample included a valve, a pump, an electric motor, and a level switch. The evaluation methods used included both test and analysis of sufficient duration to simulate 40 years of in-service application.

The tested components were subjected to test response spectra which enveloped the required response spectra due to hydrodynamic loads resulting from SRV actuation. The test durations were of sufficient length to simulate the number of SRV actuations expected during 40 years of plant operation. The fatigue testing preceded testing for the five upset events and one faulted event. In all cases, the components were demonstrated to be able to perform their safety function within predetermined acceptance criteria during and after all fatigue, upset and faulted testing.

Fatigue usage calculations were performed on the analyzed components. Stress reversals of sufficient magnitude and number were selected to simulate the number of SRV actuations expected during 40 years of plant operation. In all cases, conservative calculations predicted usage factors considerably less than 1.0 for all critical elements.

Based on the work summarized above, it has been concluded that fatigue due to hydrodynamic loads resulting from SRV actuation does not constitute a safety concern for NSSS equipment at the River Bend Station."

3.9.2.2.1.4B

Delete RBS FSAR Section 3.9.2.2.1.4B "Prototype Testing."

3.9.2.2.2B

Revise RBS FSAR Section 3.9.2.2.2B "Seismic Qualification of Specific NSSS Mechanical Components," as follows:

"3.9.2.2.2B Dynamic ~~Seismic~~ Qualification of Specific NSSS Mechanical Components

The following sections discuss the dynamic ~~testing or analytical~~ qualification of major NSSS components ~~equipment~~. A listing of seismic Category I equipment, with the exception of active pumps and valves, is provided in Table 3.9B-11. The operability qualification of pumps and valves is described in Section 3.9.3.2B. ~~Seismic qualification is also described in Sections 3.9.1.4B, 3.9.3.1B, and 3.9.3.2B.~~"

3.9.2.2.2.1B

Delete RBS FSAR Section 3.9.2.2.2.1B "Jet Pumps."

3.9.2.2.2.1B

Add RBS FSAR Section 3.9.2.2.2.1B "HPCS Diesel Generator," as follows:

"3.9.2.2.2.1B HPCS Diesel Generator

The high pressure core spray diesel generator is qualified by a combination of test and analysis. The testing program consists of two phases. The first phase involves self starting of the diesel engine by using startup procedures deliberately designed to cause maximum engine vibration.

Devices on the engine which experience vibration levels greater than expected under seismic plus normal startup procedures are qualified by this technique.

Active devices not qualified by the first phase are then placed on a shaker table and seismically qualified in the normal way. All essential active devices mounted on the engine are therefore qualified by test.

The analysis program covers all passive components not qualified by the testing approach. Both static and dynamic analyses are performed, depending on whether the equipment is rigid below the seismic ZPA. In addition, the generator is analyzed dynamically since it cannot be qualified by either of the testing approaches. Deflection analyses are also performed on the generator to ensure operability under all postulated conditions."

3.9.2.2.2.2B

Delete RBS FSAR Section 3.9.2.2.2.2B "CRD and CRD Housing."

3.9.2.2.2.3B

Delete RBS FSAR Section 3.9.2.2.2.3B "Core Support (Fuel Support and CR Guide Tube)."

3.9.2.2.2.4B

Revise RBS FSAR Section 3.9.2.2.2.4B "Hydraulic Control Unit (HCU)," as follows:

"~~The HCU was analyzed for the SSE faulted condition, using the method of "Sum of Absolute Values of the Modal Loads."~~

The HCU's are located in the reactor building and are subjected to both seismic and hydrodynamic loads. A complete HCU assembly was qualified by multi-axis/multi-frequency testing in the frequency range from 1 to 100 Hz. The required safety function, i.e. to de-energize and initiate reactor scram was successfully demonstrated during testing. As the result of fatigue failure resulting from the over conservatively applied hydrodynamic loads, during testing, the HCU's are qualified for a limited life. Maintenance and surveillance procedures are being implemented to ensure that the HCU's will not be operated beyond the expiration of their qualified life without refurbishment.

3.9.2.2.2.5B

Delete RBS FSAR Section 3.9.2.2.2.5B "Fuel Assembly (Including Channels)."

3.9.2.2.2.6B

Revise RBS FSAR Section 3.9.2.2.2.6B "Recirculation Pump and Motor Assembly," as follows:

"The recirculation pump and motor assembly is located inside the reactor building and is classified as a passive, safety related component.

The recirculation pump, including its appurtenances and supports, individually and as an assembly, is designed to withstand accelerations the seismic forces of 4.5g horizontal and 3.0g vertical as follows:. This compares to the calculated RBS required accelerations of 0.75g horizontal and 0.5 vertical. Details of the qualification are as follows:

1. The flooded pump, motor, and recirculation system piping assembly is analyzed as a system. free body The system is supported by constant support hangers from the brackets on the motor mounted stand member, with hydraulic snubbers attached to brackets on the pump case and the top of the motor frame. Calculations using a finite-element model of the RBS system determined the natural frequencies, mode shapes, and maximum dynamic acceleration responses using the response spectrum method. The maximum acceleration values are less than the RBS design values. Natural frequencies are greater than 33 Hz, as determined by analysis, therefore, an equivalent static load method of seismic analysis is used.

2. Primary stresses due to horizontal and vertical dynamic seismic forces are considered to act simultaneously and therefore added algebraically. Horizontal and vertical dynamic seismic forces are applied to mass centers, and equlibrium reactions are determined for motor and pump brackets.

3. Load, shear, and moment diagrams are were constructed using design valves in excess of calculated to scale, using live loads, dead loads, and calculated snubber reactions. Combined bending, tension, and shear stresses were are determined for each major motor flange bolting and pump case.

4. The maximum combined tensile stress in the cover bolting is was calculated including tensile stress from design pressure.

5. The brackets on the pump case, were designed to withstand loads resulting from the building dynamic seismic response.

6. Analyses have been completed which demonstrate that the natural frequency of the assembled pump and motor structure under seismic loading is greater than 33 cycles per second."

3.9.2.2.2.7B

Revise RBS FSAR Section 3.9.2.2.2.7B "ECCS Pump and Motor Assembly," as follows:

"There are five ECCS pumps, one LPCS, one HPCS, and three RHR pumps. All five pumps are located in the auxiliary building and are not subjected to hydrodynamic loads.

A prototype ECCS pump motor has been dynamically ~~seismically~~ qualified via a combination of static analysis and dynamic testing. The ~~complete~~ motor assembly has been dynamically ~~seismically~~ qualified by multiaxis/ multifrequency ~~via dynamic~~ testing, in accordance with IEEE Standard 344~~,~~ -1975. The qualification test program included demonstration of startup and shutdown capabilities, as well as no load operability during dynamic ~~seismic~~ loading conditions.

For static analysis, the seismic forces of each component or assembly are obtained by concentrating its mass at the center of mass of the component or assembly and multiplying by the seismic acceleration (earthquake coefficient). The magnitude of the RBS specific earthquake coefficients is .430g ~~-*-~~ vertical and 1.106g ~~--*--~~ horizontal compared to an equipment capability of 2.35g vertical and 2.1g horizontal. ~~(except below mounting flange, --*---~~ horizontal).

The qualification of the pump motor assembly~~ies~~ as a unit~~s~~ while operating under faulted ~~SSE~~ conditions was provided by analysis. ~~in the form of a static earthquake-acceleration analysis since the natural frequency is above 33 Hz. Under this criterion, the units were considered to be supported as designed and maximum specified vertical and horizontal accelerations being constantly applied simultaneously in the worst-case combination and the results of the analysis indicate that the pump is capable of sustaining the above loadings without overstressing the pump components.~~ A three-dimensional finite element model of the pump/motor and its support was developed and dynamically analyzed using the response spectrum analysis method. The result of the analyses demonstrated that the stresses at all critical locations are less than their corresponding allowable values when the pump/motor assembly is subjected to the applicable static and dynamic loads. Pump operability is further established by demonstrating that the calculated critical location displacements are less than the corresponding allowables."

Delete footnote:

~~*Information to be provided upon completion of new loads program.~~"

3.9.2.2.2.8B

Revise RBS FSAR Section 3.9.2.2.2.8B "RCIC Pump Assembly," as follows:

"The RCIC pump construction is a barrel-type on a large cross-section pedestal. Qualification was performed by analysis. ~~The seismic design analysis is based on 1.5g horizontal and 1.5g vertical accelerations.~~ The RCIC pump is not subjected to hydrodynamic loads. Results are obtained by using acceleration forces acting simultaneously in three directions, one vertical and two horizontal, and calculated using the square root of the sum of the squares method. The pump mass, support system, and accessory piping have been shown, by analysis, to have a natural frequency greater than 33 Hz. ~~or 60 Hz for equipment affected by hydrodynamic loads.~~

The RCIC pump assembly is ~~has been~~ analytically qualified by static analysis for seismic loading as well as the design operating loads of pressure, temperature, and external piping loads. The results of this analysis confirm that the stresses are substantially less than 90 percent of the allowable."

3.9.2.2.2.9B

Revise RBS FSAR (Amendment 16) Section 3.9.2.2.2.9B "RCIC Turbine Assembly," first paragraph, page 3.9B-39, as follows:

"The RCIC turbine is not subjected to hydrodynamic loads and has been seismically qualified via a combination of static analysis and dynamic testing. The turbine assembly consists of rigid masses, wherein static analysis has been utilized, interconnected with control levers and electronic control systems, necessitating final qualification via dynamic testing. Static loading analysis has been employed to verify the structural integrity of the turbine assembly and the adequacy of bolting under operating and seismic loading conditions. The complete turbine assembly has been seismically qualified via dynamic testing, in accordance with IEEE Standard 344-1975 as interpreted by Reg. Guide 1.100. The qualification test program included demonstration of startup and shutdown capabilities, as well as no load operability during seismic loading conditions."

Delete remainder of section.

3.9.2.2.2.10B

Revise RBS FSAR Section 3.9.2.2.2.10B "Standby Liquid Control Pump and Motor Assembly," as follows:

"~~The SLC positive displacement pump and motor mounted on a common base plate have been qualified by static analysis.~~

~~The seismic design analysis is based on 1.75g horizontal and 1.75g vertical acceleration. Results are obtained by using acceleration forces acting simultaneously in three directions, one vertical and the other two horizontal, and calculated using the square root of the sum of the squares method. The pump/motor/base assembly has been shown by static analysis to have a natural frequency greater than 33 Hz. The SLC pump and motor assembly has been analytically qualified by static analysis for seismic loading as well as the design operating loads of pressure, temperature, and external piping loads. The results of this analysis confirm that the stresses are substantially less than 90 percent of allowable.~~

<u>The SLC positive displacement pump and motor are mounted on a common base plate in the reactor building. The SLC pump structural integrity and operability is demonstrated by three-dimensional finite element analysis. The analysis demonstrates that the critical location stresses are less than the allowable stress limits.</u>

<u>The structural integrity and operability of the motor is demonstrated by type test in accordance with IEEE Standards 323-1974 and 344-1975. The dynamic test includes vibration aging postulated as the result of hydrodynamic loads."</u>

3.9.2.2.2.11B

Revise RBS FSAR Section 3.9.2.2.2.11B "RHR Heat Exchangers," as follows:

"~~A dynamic analysis is performed to verify that the RHR heat exchanger can withstand seismic loadings characterized by the floor response spectra given in Fig. 3.9B-3 and 3.9B-4. Seismic testing is an impractical method to verify the seismic adequacy of equipment when predictable seismic loads can be determined by analysis.~~

A three-dimensional finite element model is developed to dynamically analyze the heat exchanger and its supports using the response spectrum analysis method, and to verify that the RHR heat exchangers can withstand seismic loadings. The RHR heat exchangers are located in the auxiliary building and therefore do not experience hydrodynamic loads. The RBS specific response spectra are used in the analysis for seismic loads. The same model is used to statically analyze and evaluate the nozzles due to the effects of the external piping loads and dead weight in order to ensure that nozzle load criteria and limits are met. Critical location stresses are evaluated and compared with the allowable stress criteria. The results of the analysis demonstrate that the stresses at all investigated locations are less than their corresponding allowable values.

The seismic qualification of the RHR heat exchangers meets the requirements of Reg. Guide 1.92 and ASME, Section III, Class 2 and 3."

3.9.2.2.2.12B

Revise RBS FSAR Section 3.9.2.2.2.12B "Standby Liquid Control Tank," as follows:

"3.9.2.2.2.12B Standby Liquid Control Storage Tank

~~The standby liquid control storage tank is a cylindrical tank, 9 ft in diameter and 12 ft high, bolted to the concrete floor. Stresses are hand-calculated by conventional methods. The magnitude of the earthquake coefficients for Safe Shutdown Earthquake (SSE) are 1.75g horizontal and 1.75g vertical. The standby liquid control tank has been qualified by analysis for:~~

~~1. Stresses in the tank bearing plate~~

~~2. Bolt stresses~~

~~3. Sloshing loads imposed by earthquake natural frequency of sloshing = 0.58 Hz~~

~~4. Minimum wall thickness~~

~~5. Buckling.~~

The standby liquid control storage tank is located inside the reactor building and is subjected to seismic and hydrodynamic loads. The tank is considered a rigid body and is qualified by three-dimensional static analysis. Sloshing of the fluid within the tank is considered in the analysis."

3.9.2.2.2.13B

Revise RBS FSAR Section 3.9.2.2.2.13B "Main Steam Isolation Valve," to read as follows:

"The main steam isolation valves are qualified for dynamic loads by a combination of test and analysis. The MSIV's are modeled in the RBS main steam piping stress analysis.

Maximum stresses and moments are calculated and compared to allowables to ensure structural integrity of the valve and yoke as a whole. The MSIV actuator, including the barret and valve stem, is dynamically tested to both seismic and hydrodynamic loads using multi-axis/multi-frequency inputs. Stroke times are measured before, during and after the dynamic testing to ensure operability under all dynamic conditions. The MSIV body and externals are not included in this testing since they are not susceptible to externally applied dynamic loads."

3.9.2.2.2.14B

Revise RBS FSAR Section 3.9.2.2.2.14B "Main Steam Safety/ Relief Valves," to read as follows:

"The main steam safety relief valves are qualified for dynamic loads by a combination of test and analysis. The SRV's are modeled in the RBS main steam piping analysis which generates RRS at the inlet flange interface to valve, as well as forces and moments the outlet flange interface. The complete valve/ actuator assembly is then dynamically tested for both seismic and hydrodynamic loads using multi-axis/multi-frequency inputs. Moments on the outlet flange were simulated during this testing. The SRV is required to operate within its specified limits before, during and after the dynamic testing."

3.9.3.2B

Revise RBS FSAR Section 3.9.3.2B "Pump and Valve Operability Assurance," as follows:

"~~The active pumps and valves are listed in Table 3.9B-3.~~

~~Active mechanical equipment classified as Seismic Category I are designed to perform their functions during the life of the plant under postulated plant conditions. Equipment with faulted condition functional requirements include "active"* pumps and valves in fluid systems such as the residual heat removal system and the core spray systems.~~ Safety related pumps and valves must perform a mechanical motion during the course of accomplishing a safety function.

~~Operability is assured by satisfying the requirements of the following programs. Safety-related valves are qualified by prototype testing and analysis and safety-related active pumps are qualified by analysis with suitable stress limits and nozzle loads. The content of these programs is detailed below.~~ Operability is assured by a comprehensive program of testing and analysis. Testing includes 1) shop tests such as hydrostatic tests and performance tests, 2) pre-operational tests to ensure proper installation and interfaces, 3) startup tests to verify that the active pumps and valves perform within their specified limits under a variety of normal and abnormal conditions, and 4) in-service tests to ensure continued operation within specified limits during the life of the plant. In addition, dynamic and environmental testing is performed as discussed in Section 3.9.2.2B and for equipment requiring qualification per 10CFR50.49 in Section 3.11 and the RBS Environmental Qualification Document.

The active pumps and valves are listed in Tables 3.9B-3a and 3.9B-3b, respectively. Active pumps and valves that are part of the Division 3 (HPCS) diesel generator are not identified separately since they are qualified as part of the diesel generator assembly."

Delete footnote:

~~*Active equipment must perform a mechanical motion during the course of accomplishing a safety function.~~

3.9.3.2.1B

Revise RBS FSAR Section 3.9.3.2.1B "ECCS Pumps," as follows:

"All active pumps are qualified for operability by first being subjected to rigid tests before ~~both prior to installation in the plant~~ and after installation in the plant. The in-shop tests include (1) hydrostatic tests of pressure-retaining parts to 125 percent of the design pressure, (2) seal leakage tests, and (3) performance tests, while the pump is operated with flow, to determine total developed head, minimum and maximum head, and Net Positive Suction Head (NPSH) requirements. Also monitored during these operating tests are bearing temperatures (except water-cooled bearings) and vibration levels. Both are shown to be below specified limits. After the pump is installed in the plant, it undergoes the cold hydro tests, functional tests, and the required periodic in-service inspection and operation. These tests demonstrate reliability of the pump for the design life of the plant.

~~In addition to these tests, the safety-related active pumps are analyzed for operability during an SSE condition by imposing the following criteria: 1) the pump is not damaged during the seismic event, and 2) the pump continues operating despite the SSE loads.~~

The design features of the ECCS pumps, particularly the sizing of the pump internal passages are such that particulates that might pass through suction side strainers will not affect pump operability following a LOCA when debris may be present in the suppression pool."

3.9.3.2.1.1B

Revise RBS FSAR Section 3.9.3.2.1.1B "Analysis of Loading, Stress, and Acceleration Conditions," as follows:

"In order to avoid damage during the faulted plant condition, the stresses caused by the combination of normal operating loads, SSE, and dynamic system loads are limited to the material elastic limit, as indicated in Section 3.9.3.1B and Table 3.9B-2. A three-dimensional finite element model of the pump/motor and its supports is developed using the response spectrum method of dynamic analysis. The same model is analyzed for static nozzle loads, pump thrust loads and dead weight. Critical displacements and stresses are evaluated and compared with the allowable criteria. The average membrane stress (S_m) for the faulted condition loads is maintained at 1.2S, or approximately 0.75 S_y (S_y = yield stress) and is the maximum stress in local fibers (S_m + bending stress S_b) is limited to 1.8S, or approximately 1.1 S_y. The maximum dynamic ~~seismic~~ nozzle loads are also considered in an analysis of the pump supports to ensure that a system misalignment does not occur.

Performing these analyses with the conservative loads stated and with the restrictive stress limits of Table 3.9B-2 as allowables ensures that critical parts of the pump are not damaged or excessively displaced during the faulted event and, therefore, the reliability of the pump for post-faulted condition operation will ~~is~~ not be impaired ~~by the seismic event~~.

A dynamic analysis is performed ~~made~~ to determine the seismic load from the applicable floor response spectra. This ~~A~~ analysis demonstrates ~~is made to check~~ that faulted condition nozzle loads and seismic accelerations do not impair the operability of the pumps during or following the faulted event.

Components of the pump having a natural frequency above 33 Hz, are essentially rigid. This frequency is sufficiently high to avoid problems with amplification between the component and structure for all seismic loads. For components with a ~~Where~~ natural frequency ~~is~~ below 33 Hz, an analysis is performed to determine the amplified input accelerations necessary to perform the static analysis. ~~The adjusted accelerations are determined using the same conservatisms contained in the horizontal and vertical accelerations used for "rigid" structures. The static analysis is performed using the adjusted accelerations, and the results must satisfy the stress limits stated in Table 3.9B-2.~~"

3.9.3.2.1.2B

Revise RBS FSAR Section 3.9.3.2.1.2B "Pump Operation During and Following SSE Loading," as follows:

"3.9.3.2.1.2B Pump Operation During and Following <u>the Faulted</u> ~~SSE~~ Loading <u>Condition</u>

Active pump/motor rotor combinations are designed to rotate at a constant speed under all conditions. Motors are designed to withstand short periods of severe overload. The high rotary inertia in the operating pump rotor and the nature of the random, short duration loading characteristics of the <u>dynamic</u> ~~seismic~~ event <u>will</u> prevent the rotor from becoming seized. In actuality, the <u>dynamic</u> ~~seismic~~ loadings cause only a slight increase, if any, in the torque (i.e., motor current) necessary to drive the pump at the constant design speed. Therefore, the pump ~~does not shut down during the SSE and~~ continues to operate at the design speed ~~despite the SSE~~ <u>while subjected to the faulted</u> loads.

The functional ability of the active pumps after a faulted condition is assured since only normal operating loads and steady state nozzle loads exist. For the active pumps, the faulted condition is greater than the normal condition only due to seismic SSE loads on the equipment itself. The SSE event is infrequent and of relatively short duration compared to the design life of the equipment. Since it is demonstrated that the pumps are not damaged during the faulted event, the post-faulted condition operating loads are no worse than the normal plant operating limits. This is ensured by requiring that the imposed nozzle loads (steady-state loads) for normal conditions and post-faulted conditions are limited by the magnitudes of the normal condition nozzle loads. The post-faulted condition ability of the pumps to function under these applied loads is proven during the normal operating plant conditions for active pumps."

3.9.3.2.2B

Revise RBS FSAR Section 3.9.3.2.2B "SLC Pump and Motor Assembly and RCIC Pump Assembly," as follows:

"~~These equipment assemblies are small, compact, rigid assemblies, with natural frequencies well above 33 Hz. With this fact verified, each equipment assembly has been seismically qualified via static analysis only. This static qualification verifies operability under seismic conditions and ensures structural loading stresses within Code limitations.~~

The SLC pump and motor are dynamically qualified as described in Section 3.9.2.2.10B. In addition, an analysis is performed to evaluate the interaction between the SLC pump and motor. The extent of this interaction is determined by assuming the SLC pump shaft and motor shaft are disconnected, and then calculating the relative displacement of the shaft centerlines when subjected to dynamic and static loads, thermal displacement, and initial misalignment. The results show that the displacements due to both continuous and intermittent loads between the two centerlines of the pump and motor shafts do not exceed the allowable limit for continuous loading of the coupling hardware used to join the shafts.

The only safety function of the RCIC pump/turbine is the mitigation of a control rod drop accident which does not result in environmental or other challenges significantly different than those encountered during normal plant operation. The RCIC pump is rigid below the seismic ZPA and is seismically qualified by analysis using a three dimensional finite element model as discussed in Section 3.9.2.2.2.8B. Small piping providing cooling water to the mechanical seals is analyzed using static coefficient analysis. A deflection analysis of the shaft is performed to ensure that minimum clearances are maintained under combined seismic and radial hydraulic thrust loads at the impellers. The RCIC turbine was dynamically qualified by type test as discussed in Section 3.9.2.2.2.9B."

3.9.3.2.3B

Revise RBS FSAR Section 3.9.3.2.3B "ECCS Motors," as follows:

"Qualification of the Class 1E motors used for the ECCS motors is in compliance with IEEE 323-74. The qualification of all motor sizes is based on completion of a type test, followed up with review and comparison of design and material details and seismic analysis of production units, ranging from 600 to 3,500 Bhp, with the motor used in the type test. All manufacturing, inspection, and routine tests by the motor manufacturer on production units are performed on the test motor.

The type test has been performed on a 1,250 hp vertical motor in accordance with IEEE 323-74, first simulating normal operation during the design life, then the motor being subjected to a number of seismic events, and then to the abnormal environmental condition possible during and after a loss-of-coolant-accident (LOCA). The test plan for the type test was as follows:

1. Thermal aging of the motor electrical insulation system (which is a part of the stator only) was based on extrapolation in accordance with the temperature life characteristic curve from IEEE 275-66 for the insulation type used on the ECCS motors. The amount of aging equaled the total estimated operation days at maximum insulation surface temperature.

2. Radiation aging of the motor electrical insulation equals the maximum estimated integrated dose of gamma during normal and abnormal conditions.

3. The normal ~~operation and~~ induced current vibration effect on the insulation system has been simulated by 1.5 g's horizontal vibration acceleration at current frequency for a 1-hour duration.

4. Motor Bearings are selected and their operating life is established based on bearing manufacturer's test and operating data using the calculated bearing loads.

5.~~4.~~ The dynamic load ~~seismic~~ deflection analysis on the rotor shaft, performed to ensure adequate rotation clearance, has been verified by static loading and deflection of the rotor for the type test motor.

6.~~5.~~ Dynamic ~~Seismic~~ aging and testing has been performed on a biaxial test table in accordance with IEEE 344.75. During this type~~,~~ test, the shake table was activated simulating the maximum design limit of the

safe shutdown earthquake with motor starts and operation combination as may possibly occur during a plant life.

7.6. An environmental test simulating a 100 day LOCA condition ~~with 100 days duration time~~ has been performed with the test motor fully loaded, simulating pump operation. The test consisted of startup and 6 hours operation at 212°F ambient temperature and 100 percent steam environment. Another startup and operation of the test motor after 1-hour standstill in the same environment was followed by sufficient operation at high humidity and temperature, based on extrapolation in accordance with the temperature life characteristic curve from IEEE 275-1966 for the insulation type used on the ECCS motors."

3.9.3.2.4.1B

Revise RBS FSAR Section 3.9.3.2.4.1B "Class 1 Active Valves," as follows:

"The Class 1 active valves are the main steam isolation valves, safety/relief valves, ~~and~~ standby liquid control valves and the High Pressure Core Spray injection valve. Each of these valves is designed to perform its mechanical motion in conjunction with a design basis accident. Seismic qualification for operability is unique for each valve type; therefore, each method of qualification is detailed individually below."

3.9.3.2.4.1.1B

Revise RBS FSAR Section 3.9.3.2.4.1.1B "Main Steam Isolation Valve," to read as follows:

The MSIV is mathematically modeled in the main steam line system analysis to ensure that design limits are not exceeded for both piping input loads and actuator dynamic loads. The valve's actual input loads, amplified accelerations, and resonance frequencies are determined based on site excitation input to the system as a part of the overall steamline analysis. Pipe anchors and restraints are applied as required to limit pipe system resonance frequencies and amplified accelerations to within acceptable limits for the MSIVs.

The MSIV actuator is qualified for dynamic requirements by multiaxis/multifrequency testing over a frequency range from 1 to 100 Hz. During the test the actuator is supported in a manner which simulates the actual valve body mounting and orientation. Stem seals and stem-to-cover clearances are duplicated on the test fixture. The shake table input equals or exceeds the specified RBS dynamic loads.

The actuator was cycled from "open" to "close" during each loading condition and operated within the specified time limits.

The capability of the main steam isolation valve to close following a downstream line break was demonstrated by the type test. The test specimen was a 20-in valve of a design representative of the RBS MSIVs."

3.9.3.2.4.1.2B

Revise RBS FSAR Section 3.9.3.2.4.1.2B "Main Steam Safety/Relief Valves," to read as follows:

A mathematical model of this valve is included in the main steam line system analysis as with the MSIVs. This analysis ensures that the equipment design limits are not exceeded.

Dynamic testing consists of multiaxis/multifrequency tests of a complete valve/actuator assembly over a frequency range from 1 to 100 Hz in both the relief and safety modes during which the SRV is required to operate within the specified limits while subjected to moments and accelerations exceeding the RBS requirements.

The safety/relief valve actuator is qualified to IEEE Standards 323-74 and IEEE 344-75 by type test."

3.9.3.2.4.1.3B

Revise RBS FSAR Section 3.9.3.2.4.1.3B "Standby Liquid Control Valve (Explosive Valve)," as follows:

"The two SLC explosive valves are has been generically qualified to IEEE Standards 323-1974, 344-1975 and 382-1980 by type test of a RBS prototypical valve/actuator assembly. The generic qualification test demonstrated the capability of the valve to perform its safety function during and after exposure to the postulated dynamic and environmental challenges the absence of natural frequencies below 33 Hz and the ability to remain operable after the application of horizontal seismic loading equivalent to 6.5 g's and a vertical seismic loading equivalent to 4.5 g's at 33 Hz."

3.9.3.2.4.1.4B

Add RBS FSAR Section 3.9.3.2.4.1.4B "High Pressure Core Spray Injection Valve," as follows:

"3.9.3.2.4.1.4B High Pressure Core Spray Injection Valve

Qualification of the Class 1 active HPCS injection valve (E22-F004) was performed in two parts, with the actuator qualified by type testing and the valve qualified by analysis.

Type testing of an actuator was performed in accordance with IEEE 344-1975 and 382-1980. The actuator was mounted on a valve during qualification to simulate the interface. To account for the effect of dynamic aging, the actuator was subjected to both vibration aging and SRV aging prior to the upset and faulted event RRS testing (five upset and one faulted). Following the RRS testing, the actuator was subjected to an additional series of uniaxial sine beat tests simulating the faulted event for a second time. The actuator was then tested to the LOCA (chugging) post-aging condition. Actuator operability was demonstrated during the most severe faulted event testing. Dynamic similarity between the River Bend actuator and the tested actuator was established by a similarity analysis.

A stress evaluation was performed on the yoke legs and the valve body to demonstrate structural integrity of these components when subjected to the RBS dynamic load requirements. The evaluation was perfomed in accordance with the rules of ASME B&PV Code Section III where applicable. At locations where the ASME code does not specifically apply (e.g., yoke legs), methods employed by vendor or methods based on principles of stress analysis were used. All stresses were shown to be within the allowable limits.

The stress evaluation also included a fatigue calculation on critical valve components. Stress cycles due to SRV blowdowns, seismic events (both upset and faulted), and chugging were considered. All components were found to satisfy the fatigue requirement. As for valve operability, qualification was demonstrated using static bend test data. The subject valve belongs to a family of block valves supplied by Anchor/Darling that had been generically tested for operability using the static bend test method. A stem deflection analysis was also performed to further demonstrate that the valve would remain operable under the most severe loading condition."

3.9.3.2.4.2B

Revise RBS FSAR Section 3.9.3.2.4.2B "ASME Code Class 2 and 3 Active Valves," as follows:

"There are ~~GE has~~ six valves within the NSSS scope of supply which are Class 2 active and no Class 3 active valves. These six Class 2 active motor-operated valves are used in the HPCS system.

~~These valves are generically qualified by testing valves that are typical of the valves supplied by GE. Operability is ensured by testing under both the static design basis load and at the maximum capability static load. These tests ensure operability during and after the design basis load. The actuators are qualified to IEEE 382-1972, to levels that exceed the design loadings.~~

Qualification of these Class 2 active HPCS valves was performed similar to that for the injection valve described in Paragraph 3.9.3.2.4.1.4B, with the actuators qualified by type testing and the valves qualfied by analysis. The valves were evaluated for fatigue capability where applicable and valve operability was demonstrated using static bend test data. These standard valves are seismically qualified to IEEE Standards 344-1975 and 382-1980. Qualification of the actuator furthermore meets the requirements for IEEE Standard 323-1974."

3.9.3.2.4.3B

Delete RBS FSAR Section 3.9.3.2.4.3B "Test Results."

3.9.3.2.4.3.1B

Delete RBS FSAR Section 3.9.3.2.4.3.1B "Main Steam Isolation Valves."

3.9.3.2.4.3.2B

Delete RBS FSAR Section 3.9.3.2.4.3.2B "Safety/Relief Valves."

3.9.3.2.4.3.3B

Delete RBS FSAR Section 3.9.3.2.4.3.3B "Standby Liquid Control Valve (Explosive Valve)."

Table 3.9B-3a

SUMMARY OF ACTIVE PUMPS

MPL	Equipment Description Manufacturer	ID Number	Method of Qualification	Qualification Standards (1)
C41-C001	SLC pump/motor Union/GE	21A1921AE	Test/Analysis	Pump: efgi Motor: abhij
E12-C002	RHR pump/motor Byron Jackson/GE	283K371G012	Test/Analysis	Pump: efgi Motor: abhij
E21-C001	LPCS pump/motor Byron Jackson/GE	283X429G001	Test/Analysis	Pump: efgi Motor: abhij
E22-C001	HPCS pump/motor Byron Jackson/GE	21A1913AK	Test/Analysis	Pump: efgi Motor: abhij
E51-C001	RCIC pump Bingham	21A9443AX	Analysis	befij
E51-C002	RCIC turbine Terry Turbine	21A9526AJ	Test/Analysis	ab

(1) a: IEEE-323-74
b: IEEE-344-75
c: IEEE-382-80
d: NUREG-0588, Cat. 1
e: Reg. Guide 1.48, Rev. 0
f: Reg. Guide 1.60, Rev. 1
g: Reg. Guide 1.61, Rev. 0
h: Reg. Guide 1.89, Rev. 0
i: Reg. Guide 1.92, Rev. 0
j: Reg. Guide 1.100, Rev. 1

Table 3.9B-3b

SUMMARY OF ACTIVE VALVES

MPL	Equipment Description Manufacturer	ID Number	Method of Qualification	Qualification Standards (1)
B21-F022/F028	MSIV Atwood & Morrill	10504935ARG001	Test/Analysis	abcdj
B21-F041/F047/F051	SRV Crosby	22A6441	Test	abcdj
C11-F009/F182	Solenoid valve Valcor	21A9317	Test	abcdj
C11-F010	Vent valve Fisher	21A1997P001	Test	bj
C11-F011	Drain valve Fisher	21A1997P002	Test	bj
C11-F180	Vent valve Hammel Dahl	22A6924AA	Test	bj
C11-F181	Drain valve Hammel Dahl	22A6924AB	Test	bj
C41-F004	Explosive valve Conax	21A9370AB	Test	abcdj
E22-F001	MOV Anchor Darling	105D5007KG014	Test/Analysis	abcdj
E22-F004	MOV Anchor Darling	105D5007KG008	Test/Analysis	abcdj

Table 3.9B-3b (cont'd)

SUMMARY OF ACTIVE VALVES

MPL	Equipment Description Manufacturer	ID Number	Method of Qualification	Qualification Standards (1)
E22-F010/F011/F023	MOV Anchor Darling	105D5007KG006	Test/Analysis	abcdj
E22-F012	MOV Anchor Darling	105D5007KG002	Test/Analysis	abcdj
E22-F015	MOV Anchor Darling	105D5007KG016	Test/Analysis	abcdj

(1) a: IEEE-323-74
b: IEEE-344-75
c: IEEE-382-80
d: NUREG-0588, Cat. 1
e: Reg. Guide 1.48, Rev. 0
f: Reg. Guide 1.60, Rev. 1
g: Reg. Guide 1.61, Rev. 0
h: Reg. Guide 1.89, Rev. 0
i: Reg. Guide 1.92, Rev. 0
j: Reg. Guide 1.100, Rev. 1

Table 3.9B-11

EQUIPMENT QUALIFICATION RESULTS

MPL	Equipment Description Manufacturer	ID Number	Method of Qualification	Qualification Standards (1)
B21-N005	Flow element GE	283X555G001	Analysis	a
B33-C001	Recirc pump motor Bingham/GE	762E637ADG001	Analysis	afgh
B33-F023	Recirc MOV Anchor Darling	922B192ABG001	Analysis	afgh
B33-F060	Recirc FCV Hammel Dahl	768E574P005	Analysis	afgh
B33-F067	Recirc MOV Anchor Darling	9220192BBG001	Analysis	afgh
C11-D001	HCU GE	767E800G001	Test/Analysis	gh
C41-A001	SLC tank Richland Engineering	283X596G001	Analysis	a
E12-B001	RHR heat exchanger EPCO	283X548G002	Analysis	f
E12-N012/N014	RHR flow orifice Vickery Sims	21A9505DA/ 21A9505DB	Analysis	d
E21-N002	LPCS flow orifice Vickery Sims	21A9505DC	Analysis	d

Table 3.9B-11 (cont'd)

EQUIPMENT QUALIFICATION RESULTS

MPL	Equipment Description Manufacturer	ID Number	Method of Qualification	Qualification Standards (1)
E22-N007	HPCS flow orifice Vickery Sims	21A9505DD	Analysis	d
E33-D001/D021	Flow orifice Vickery Sims	22A5369	Analysis	d
E51-N001	RCIC flow orifice Vickery Sims	21A9505DE	Analysis	d
F11-E001	Fuel prep machine GE	283X759G001	Analysis	fgh
F11-E002	New fuel inspection stand GE	767E248G004	Analysis	fgh
F11-E011	General purpose grapple GE	767E555G001	Analysis	b
F11-E012	Jib crane California Pacific	105D5950P002	Analysis	fgh
F11-E014/E017	Fuel handling platform GE/Pro & Rem	767E546G009	Analysis	f
F13-E005	Head holding pedestal CBIN	105D5987G001	Analysis	f
F13-E008	Dryer separator sling Votaw	767E707G001	Test/Analysis	b

Table 3.9B-11 (cont'd)

EQUIPMENT QUALIFICATION RESULTS

MPL	Equipment Description Manufacturer	ID Number	Method of Qualification	Qualification Standards (1)
F13-E009	Head strongback carousel Votaw	767E572G004	Analysis	b
F14-E002	Control rod grapple Industrial Design	767E593G001	Analysis	b
F15-E003/E006	Refueling platform GE/Pro & Rem	767E457G007	Analysis	f
F16-E005	Auxiliary platform AVEL	767E594P013	Analysis	fgh
F16-E002	Fuel storage rack GE		(Part of F16-E012)	
F16-E006	In-vessel rack Gould	767E997G003	Not required until first refueling outage	
F16-E009	Defective fuel storage container GE	117C2072G005	Analysis	b
F16-E011	Equipment storage rack GE	767E206G001	Analysis	f
F16-E012	Fuel storage vault GE	769E504G001	Analysis	abfgh
F42-D001	Incline fuel transfer tube GE	283X690G001	Analysis	acefgh

Table 3.9B-11 (cont'd)

EQUIPMENT QUALIFICATION RESULTS

MPL	Equipment Description Manufacturer	ID Number	Method of Qualification	Qualification Standards (1)
F42-G001	Bellows Associated Piping	10505916P001	Analysis	afgh
G33-N011	RWCU flow orifice Vickery Sims	21A3544AAP001	Analysis	d
G33-N035	RWCU flow element Premutit	21A3548ACP001	Analysis	a
G33-N040	RWCU flow orifice Vickery Sims	21A3548ACP001	Analysis	d
[illegible]	RWCU flow element Fluidics	21A3544ABP001	Analysis	a

(1) a: ASME
b: ASTM
c: AISC
d: ANSI B16.5
e: ANSI B31.1
f: Reg. Guide 1.92, Rev. 0
g: Reg. Guide 1.100, Rev. 1
h: IEEE 344-1975

3.10.2.1A

Revise RBS FSAR Section 3.10.2.1A "Testing," 2nd paragraph, page 3.10A-3, as follows:

"In seismic qualification testing, equipment auxiliary components, such as relays, switches, and instruments necessary for proper operation, are mounted in a manner similar to which they are to be installed, and then tested and qualified along with the equipment.

For multicabinet assemblies, the test prototype units sometimes consist of a smaller number of cabinets than the assembly being qualified. In such cases, and evaluation of the responses due to the front-to-back, side-to-side, vertical and torsional modes of the multicabinet assemblies, with respect to those of the tested units is made. This evaluation assures the adequate qualification of the multi-cabinet assemblies and the electrical components located in them."

3.10.3A

Revise RBS FSAR Section 3.10.3A "Methods and Procedures of Analysis or Testing of Supports of Electrical Equipment and Instrumentation," 2nd paragraph, page 3.10A-4, as follows:

"The response of racks, panels, cabinets, and consoles is considered in assessing the capability of instrumentation and electrical equipment. Electrical equipment and instrumentation is tested, wherever feasible, with their supporting structures in their installed configuration. Mounted components are qualified to the acceleration levels ~~consistent with those transmitted by their~~at their mounting location which takes into account the transmissibility of the supporting structure."

3.10B

Revise RBS FSAR (Amendment 16) Section 3.10B "Seismic Qualifications of Seismic Category I Instrumentation and Electrical Equipment (GE Scope of Supply)," as follows:

3.10B SEISMIC AND HYDRODYNAMIC QUALIFICATIONS OF SEISMIC CATEGORY I INSTRUMENTATION AND ELECTRICAL EQUIPMENT (GE SCOPE OF SUPPLY)

3.10.1B ~~Seismic~~ Dynamic Qualification Criteria

3.10.1.1B Seismic Category I Equipment Identification

Seismic Category I instrumentation and electrical equipment is listed in Table 3.2-1. "Active" NSSS pumps, motors, valves and valve-mounted equipment are listed in tables 3.9B-3a and 3.9B-3b.

Seismic Category I instrumentation and electrical equipment is designed to withstand the ~~safe-shutdown-earthquake-(SSE)~~ faulted event ~~defined-in-Section-3.7.1A~~, without functional impairment.

~~In addition, the equipment is evaluated and qualified to hydrodynamic loads as described in Section 3.9.~~

The Class 1E instrumentation, ~~and~~ electrical equipment and support structures supplied by GE requiring seismic qualification are identified in Table 3.10B-1. ~~The supporting structures for this equipment are identified in Table 3.10B-2.~~ The seismic qualification of these instrumentation, equipment, and supports is described in the following subsections.

Section~~s~~ 3.9.2.2B ~~3.9.3.2, and 3.9.3.4~~ addresses ~~similar topics on~~ the dynamic qualification testing and analysis of the Category I mechanical components, equipment, and their supports, including the integral or associated electrical components such as valve-mounted components and pump motors.

3.10.1.2B ~~Seismic~~ ~~(~~Dynamic~~)~~ Design Criteria

3.10.1.2.1B NSSS Equipment

The seismic criterion used in the design and subsequent qualification of all Class 1E instrumentation and electrical equipment supplied by GE is as in the following paragraph.

The Class 1E equipment is capable of performing ~~all~~ its safety-related functions during 1) normal plant operation, 2) anticipated transients, 3) design basis accidents, and 4) post-accident operation while being subjected to, and after the cessation of, the accelerations resulting from the seismic

and hydrodynamic loads at the point of attachment of the equipment to the building or supporting structure.

The criteria for each of the devices used in the Class 1E systems depend on the use in a given system; for example, a relay in one system may have as its safety function to deenergize and open its contacts within a certain time, while in another system it must energize and close its contacts. Since GE supplies many devices for many applications, the approach taken was to test the device in the worst case configuration. In this way, the capability of protective action initiation and the proper operation of fail-safe circuits is assured.

From the basic input ground motion data, a series of response curves at various building elevations are developed after the building layout is completed. Standard requirement levels that meet or exceed the maximum expected unique plant information are included in the purchase design specifications for Seismic Category I equipment. Equipment is dynamically qualified either by GE or by the supplier. In either case Suppliers of equipment, such as batteries and racks, instrument racks control consoles, etc, are required to submit test data, operating experience, and/or calculations to substantiate that their the components, systems, etc, do not suffer loss of their safety function during or after exposure to seismic and hydrodynamic loads. The magnitude and frequency of the SSE loadings which each component may experience are determined by its specific location within the plant.

3.10.2B Methods and Procedures for Qualifying Electrical Equipment and Instrumentation (Excluding Motors and Valve-Mounted Equipment)

3.10.2.1B Methods of Showing NSSS Equipment Compliance with IEEE 344-1975 and Regulatory Guide 1.100

Procedures

GE supplied Class 1E equipment meets the requirement that the seismic dynamic qualification should demonstrate the capability to perform the required safety function during and after the seismic and hydrodynamic loads. Both analysis and testing were used but most equipment was tested. Analysis was primarily used to determine the adequacy of mechanical strength such as (mounting bolts, and pressure boundaries. etc) after operating capability was established by testing.

Analysis - GE supplied Class 1E equipment performing primarily a mechanical safety function (pressure boundary devices, etc) was analyzed since the passive nature of their critical safety role usually made testing

~~impractical~~ <u>unnecessary</u>. Analytical methods sanctioned by IEEE 344-1975~~, Section 5,~~ were utilized in such cases (See Table 3.10B-1 for indication of which items were qualified by analysis).

<u>Testing</u> - GE supplied Class 1E equipment having ~~primarily~~ <u>an active</u> electrical safety function was tested in compliance with IEEE 344-1975~~, Section 6~~.

<u>Documentation</u>

Available documentation verifies that the seismic qualification of GE supplied Class 1E equipment is in accordance with the requirements of IEEE 344-1975~~, Section 8~~ <u>and Reg. Guide 1.100</u>.

3.10.2.2B Testing procedures for Qualifying Electrical Equipment and Instrumentation ~~(Excluding Motors and Valve-Mounted Equipment)~~

The test procedure required that the device be mounted on the table of the vibration machine in a manner similar to its normal, installed configuration. The device was tested in the operating states as if it were performing its Class 1E functions, and these states were monitored before, during, and after the test to assure proper function and absence of spurious function. In the case of the relay example, both energized and deenergized states and normally open and normally closed contact configurations were tested if the relay is used in those configurations in its Class 1E functions.

The dynamic excitation was a random multiple frequency test in which the applied vibration was a sinusoidal table motion at a fixed peak acceleration and a discrete frequency at any given time. The vibratory excitation was applied in two orthogonal axes (horizontal and vertical) simultaneously with the axes chosen as those coincident with the most probable mounting configuration. The device was then rotated 90 deg in the horizontal plane and the test repeated. Each device therefore has been tested in the three major orthogonal axes.

The first step was ~~to~~ <u>usually a</u> search for resonances in each axis. This was done since resonances cause amplification of the input vibration and are the most likely cause of malfunction. The resonance search was usually run at low acceleration levels ~~(0.2G)~~ in order to avoid damaging the test sample in case a severe resonance was encountered. The resonance search was ~~run from 1 to 60 Hz (if the shaker system has capability)~~ <u>performed for the applicable frequency range</u> in accordance with IEEE 344; if the device was large enough, the vibrations were monitored by accelerometers placed at critical locations from which resonances were determined by

comparing the acceleration level with that at the table of the vibration maching. Sometimes, the devices either were too small for an accelerometer, with their critical parts in an inaccessible location, or had critical parts that would be adversely affected by the mounting of an accelerometer. The vibrations were monitored at the closest location.

Following the frequency scan and resonance determination, the devices were tested to determine their ~~malfunction limit~~ dynamic capability. ~~This test was a necessary adjunct to the assembly test as is shown in later discussion. The~~ For multi-frequency testing, five OBE and one SSE test were run at the appropriate TRS. In some cases, the TRS was gradually increased until device malfunction occurred or the shake table limit was reached. For single-frequency testing a malfunction limit test was run at each resonant frequency as determined by the frequency scan. In this test, the acceleration level was gradually increased until either the device malfunctioned or the limit of the vibration machine was reached. If no resonances were detected (as was usually the case), the device was considered to be rigid (all parts move in unison) and the malfunction limit was therefore independent of frequency. To achieve maximum acceleration from the vibration machine, rigid devices were malfunction tested at the upper test frequency ~~(60 Hz)~~ since that allowed the maximum acceleration to be obtained from deflection-limited machines.

The summary of the tests on the devices used in Class 1E applications is given in Table 3.10B-1. ~~includes the "qualification" limit for each device tested.~~

The above procedures were required of purchased devices as well as those made by GE. Vendor test results were reviewed and if unacceptable, the tests were repeated either by GE or the vendor. If the vendor tests were adequate, the device was considered qualified to the limits of the test.

3.10.2.3B Qualification of Valve-~~Mounted Equipment~~ Operators

~~The piping analysis establishes the response spectra, power spectral density function, or time history characteristics, and develops a horizontal and a vertical acceleration for the pipe-mounted equipment. Pipe-mounted valves normally have a natural frequency greater than, or equal to, 60 Hz. Class 1E motor-operated valve actuators were qualified in accordance with IEEE 382-1972.~~

~~The safety relief valve, including the electrical components mounted on the valve, are subjected to a dynamic seismic test. This testing is described in Sections 3.9.2.2.2.14B and 3.9.3.2.6B.~~ The qualification of valve operators is discussed in Section 3.9.2.2B.

3.10.2.4B Qualification of NSSS Motors

Seismic qualification of ~~the ECCS~~ NSSS motors is discussed in Section 3.9.2.2B~~.2.7B in conjunction with the ECCS pump and motor assembly. Seismic qualification of the standby liquid control (SLC) pump motor is discussed in Section 3.9.2.2.2.10B in conjunction with the SLC pump motor assembly.~~

3.10.3B Methods and Procedure of Analysis or Testing of Supports of Electrical Equipment and Instrumentation

3.10.3.1B ~~Seismic~~ Dynamic Analysis and Testing Procedures ~~and Restraint Measures~~

3.10.3.1.1B ~~NSSS Equipment (Other Than Motors and Valve-Mounted Equipment)~~ Panel Mounted Equipment

~~The Class 1E equipment supplied by GE is used in many systems on many different plants under widely varying seismic requirements. The siesmic qualification tests were performed at all frequencies from 5 to 60 Hz (the actual qualification range was 1 to 60 Hz, but since test facility capability sometimes limited the lower frequency test to 5 Hz, a combination of test and analysis was used to assure that there were no untested resonances).~~

The Class 1E equipment supplied by GE is used in many systems on many different plants and is subjected to ~~under~~ widely varying dynamic loads. ~~seismic requirements.~~ The ~~seismic~~ qualification tests were performed to envelop the applicable frequency range. ~~at all frequencies from 5 to 33 Hz.~~ For supports subjected to seismic loads only, the tested frequencies range from 1 to 33 Hz. ~~(the actual qualification range was 1 to 33 Hz, but since test facility capability sometimes limited the lower frequency test to 5 Hz~~ Where testing below 5 Hz ~~is~~ was limited by the capability of the test facility, a combination of test and analysis ~~is~~ was used to assure that there were no untested resonances~~)~~.

For multicabinet assemblies that are too large for the test table, one or two bays of the assembly are tested which gives representative results in the front-to-back and vertical directions. The side-to-side results are evaluated and are generally found to be conservative due to the increased flexibility of the narrower section. If conservatism cannot be established the panel is accurately modelled and a computer analysis of its structural response is performed."

Some GE supplied Class 1E devices were qualified by analysis only. ~~A sample analysis is shown in Appendix 3F.~~ Analysis was used for passive mechanical devices and was sometimes used in combination with testing for larger assemblies containing Class 1E devices. For instance, a test might have been run to

determine if there were natural frequencies in the equipment within the critical frequency range. If the equipment was determined to be free of natural frequencies within the critical seismic frequency range, then it was assumed to be rigid and a static analysis was performed. ~~as shown in Appendix 3B.~~ If it had natural frequencies in the critical frequency range, then calculations of transmissibility and responses to varying input accelerations were determined to see if Class 1E devices mounted in the assembly would operate without malfunctioning. In general, the testing of Class 1E equipment was accomplished using the following procedure.

Assemblies (i.e., control panels and local racks) containing devices with established seismic and hydrodynamic malfunction limits were mounted on the table of a vibration machine in the manner it was to be mounted when in use. ~~and vibration testing it by running~~ All control panel and local rack tests have been performed according to the requirements of IEEE Standard 344-1975. The initial vibration test in each case was a low level resonance search. As with the devices tested to IEEE Standard 344-1975, the assemblies were tested in the three major orthogonal axes. The resonance search was run in the same manner as described for devices. If resonances were present, the transmissibility between the input and the location of each Class 1E device was determined by measuring the accelerations at each device location and calculating the magnification between it and the input. Once known, the transmissibilities could be used analytically to conservatively determine the ~~response~~ input motion at any Class 1E device location for any given input To the base of the assembly. ~~(if was assumed that the transmissibilities were linear as a function of acceleration even though they actually decrease as acceleration is increased--therefore, a conservative assumption). As long as the device input accelerations were determined to be below their malfunction limits, then the assembly was considered a rigid body with a transmissibility equal to 1 so that a device mounted on it would be limited directly by the assembly input acceleration.~~

~~Since control panels and racks constitute the majority of Class 1 electric assemblies supplied by GE, seismic qualification testing of these is discussed in more detail. There are basically four generic panel types. One or more of each type was tested using the above procedures.~~

~~Fig. 3.10B-1 through 3.10B-4 illustrate the four basic panel types referenced above and show typical accelerometer locations. The status of the dynamic tests on the Class 1E panels supplied by GE for this plant are summarized in Table 3.10B-2.~~

The full acceleration level tests described disclosed that ~~most of~~ the panel types had more than adequate mechanical

strength and that a given panel design acceptability was just a function of its amplification factor and the malfunction levels of the devices mounted in it. Many devices were mounted in the test panel or rack and qualified as an assembly. Other devices were tested individually as described above. Subsequent Sometimes panels were , therefore, tested at lower acceleration levels and the transmissibilities measured to the various devices. as described above. By dividing the devices' malfunction levels by the panel transmissibility between the device and the panel input the panel seismic qualification level could be determined. Several high level tests have been run on selected generic panel designs to assure the conservativeness in using the transmissibility analysis described.

3.10.4B Operating License Review

3.10.4.1B NSSS Control and Electrical Equipment (Other Than Motors and Valve-Mounted Equipment)

The dynamic test results for safety-related panels and control equipment within the NSSS scope are maintained in a permanent file by GE and can be readily audited in all cases. The equipment used in Class 1E applications at RBS passed the prescribed tests. Where equipment failed to pass the tests, it was rejected. In some cases, equipment which failed one test was modified or repaired to meet the performance requirements and retested. If the retested equipment passed the latter test, it could be used in a Class 1E application.

Table 3.10B-1 lists the NSSS control devices by item number and vendor.

Also, A summary of the test conditions results for the devices used in Class 1E applications is given in the Table 3.10B-1. The acceleration level shown in the right columns of Table 3.10B-1 is the acceleration at which either the device malfunctioned or the limit of the vibration machine was reached.

3.10.4.2B NSSS Motors

Seismic qualification test results for the ECCS motors are discussed in Section 3.9.2.2.2.7B in conjunction with the SLC pump motor assembly. Seismic qualification test results for the SLC motor is discussed in Section 3.9.2.2.2.10B in conjunction with the SLC pump motor assembly.

3.10.4.3B Valve-Mounted Equipment

The safety/relief valves, including the electrical components mounted on the valve, are subjected to dynamic tests. The results of these tests are discussed in Sections 3.9.2.2.2.14B and 3.9.3.2.5B.

Table 3.10B-1

NSSS SEISMIC CATEGORY I ELECTRICAL AND
INSTRUMENTATION EQUIPMENT QUALIFICATION RESULTS

Equipment	Method	Results
Temperature Elements	The temperature elements are qualified by both dynamic testing and analysis. The applicable standard is IEEE 344-1975.	The temperature elements that have been designated as having an active safety function have been dynamically tested demonstrating qualification. Mounted similar to field conditions, they have been subjected to SRV vibration aging, chugging, seismic and hydrodynamic loads. Bi-axial testing, over the frequency range of 1 to 100 Hertz, was accomplished in three mutually perpendicular axes with Test Response Spectra enveloping the Required Response Spectra. The temperature elements maintained their functional and structural integrity during testing. Those elements having a passive safety function were analyzed to show structural integrity when subjected to process pressures and loads in excess of the requirement for their location.
Temperature Switch	The temperature switch is shown to be qualified by an analysis of its structural capability.	The safety function of the temperature switch is passive. Analysis shows that it exceeds its structural requirements when subjected to required seismic and hydrodynamic loads. Calculations indicate a high natural frequency making it a rigid body in the range of interest and its capability far exceeds its stress requirements.

Table 3.10B-1 (cont'd)

NSSS SEISMIC CATEGORY I ELECTRICAL AND INSTRUMENTATION EQUIPMENT QUALIFICATION RESULTS

Equipment	Method	Results
Pressure Transmitters, Differential, Absolute and Gauge	The transmitters are qualified by dynamic testing meeting the guidelines of IEEE 344-1975.	The transmitters can be subjected to both seismic and hydrodynamic loads during their installed life. Testing in an as-installed condition included random frequency excitation to meet SRV aging, upset and faulted seismic and chugging requirements. Tests were performed in three mutually perpendicular axes. During testing the transmitters maintained structural integrity and met functional requirements.
Level Transmitters	Level transmitters are shown to be qualified for their application by both analysis and testing. Testing was performed to meet the guidelines of IEEE 344-1975.	The level transmitters have both an active or passive safety function depending on their application. Those transmitters with a passive safety function have been shown to meet structural requirement by analysis. They have natural frequencies higher than the range of interest and have been shown to have structural integrity to withstand the required seismic and dynamic conditions. Those transmitters whose safety function is active were tested in their safety related operating mode and were continuously monitored. They maintained

Table 3.10B-1 (cont'd)

NSSS SEISMIC CATEGORY I ELECTRICAL AND
INSTRUMENTATION EQUIPMENT QUALIFICATION RESULTS

Equipment	Method	Results
		their structural integrity and met accuracy requirements during testing. Five OBE's and one SSE tests were performed in three mutually perpendicular axes. Excitation was applied bi-axially over a frequency range of 1-100 Hertz.
Level Switch	The switches are shown to be qualified for their installed location by testing performed to meet the guidelines of IEEE 344-1975.	The level switch has an active safety function and can be subjected to seismic and hydrodynamic loads during its plant life. Vibration aging, SRV, OBE, SSE and Sine Beat testing was performed in three mutually perpendicular axes to levels greater than required for their River Bend installed location. During testing the switches met structural and functional requirements.
Pressure Switch	The pressure switch is qualified by dynamic testing to meet the applicable standards of IEEE 344-1975.	This switch has an active safety function and can be subjected to seismic loads during its plant life. Five OBE and one SSE multi-frequency, bi-axial seismic tests were performed on the switch at levels exceeding the River Bend requirements. Excitation was applied in three mutually perpendicular axes. The switch met its functional and structural requirements.

Table 3.10B-1 (cont'd)

NSSS SEISMIC CATEGORY I ELECTRICAL AND
INSTRUMENTATION EQUIPMENT QUALIFICATION RESULTS

Equipment	Method	Results
Stop Valve Switch	This switch is qualified based on dynamic testing at levels greater than its River Bend requirement.	This device has an active safety function and has demonstrated structural and functional integrity when subjected to seismic conditions in excess of the River Bend requirement. It demonstrated no natural frequencies below the ZPA point. Discrete frequency dwells were applied, bi-axially, to a maximum level of 5.5 g's from 1-35 Hertz in three mutually perpendicular axes.
Pressure Indicators	The pressure indicators have been qualified by dynamic testing, meeting the guidelines of IEEE 344-1975.	Indicators can have an active or passive safety function. The indicators mounted in an as installed condition were subjected to bi-axial random testing over a frequency range of 1-250 Hertz. Five OBE's and one SSE were applied in three mutually perpendicular axes. Test Response Spectra that included both seismic and hydrodynamic loads enveloped the Required Response Spectra. The indicator maintained structural integrity throughout testing.
Insulated Detectors	The detectors have been qualified by dynamic testing to meet the guidelines of IEEE 344-1975.	Detectors have an active safety function and met structural and functional requirements when subjected to seismic testing at amplitudes greater than required. Five OBE and one SSE bi-axial random tests were performed in three

Table 3.10B-1 (cont'd)

NSSS SEISMIC CATEGORY I ELECTRICAL AND INSTRUMENTATION EQUIPMENT QUALIFICATION RESULTS

Equipment	Method	Results
		mutually perpendicular axes over a frequency range of 1-100 Hertz. Functional performance was demonstrated before, during, and after seismic excitation.
IRM Detector	A combination of test and analysis demonstrates qualification of the detectors for their installed location.	The IRM Detector movement during a seismic event is controlled by the fuel bundle and maximum excitation occurs at the natural frequency of the bundle. The detector was tested at discrete frequencies in the horizontal axes and analyzed for vertical loads. Capabilities, both tested and analyzed, exceed the River Bend requirements, demonstrating qualification.
Conductivity Element	The Conductivity Cell was analyzed to withstand seismic loads significantly greater than required.	The safety function of the cell is passive, however, it must maintain its structural integrity. Analysis indicates no resonances in any axis below 100 Hertz and the ability to withstand loads more than fifteen times greater than required.
Condensing Chamber	This equipment is qualified by analysis to meet the River Bend seismic requirement applying the ASME Boiler and Pressure Vessel Code Section III.	Stress analysis indicates that the condensing chamber meets the requirements of the ASME CODE and that the lowest calculated allowable moment reaction exceeds the maximum moment of any River Bend Condensing Chamber installation.

Table 3.10B-1 (cont'd)

NSSS SEISMIC CATEGORY I ELECTRICAL AND
INSTRUMENTATION EQUIPMENT QUALIFICATION RESULTS

Equipment	Method	Results
Thermometer	The thermometer is shown to be qualified by analysis to meet its structural seismic requirements.	The thermometer has a passive safety function and can be subjected to seismic loads during its plant life. Analysis indicates a lowest natural frequency of 247 Hertz, well above the range of interest. Additionally it is shown to be qualified for 30g's with adequate margin. Requirement for its location is 3.0g's.
Local Panels	All panel qualification is by test of equivalent panels and devices. The applicable standard is IEEE 344-1975.	All panels were installed in an equivalent manner to those tested. Multi-frequency, bi-axial testing was performed by applying five OBE and two SSE level tests in each of three mutually perpendicular axes. Functional performance and structural integrity were monitored throughout the test series. In the instances where instruments were not tested on the panel the response at the device location was determined by multiplying the Required Response Spectra and ZPA by the amplification factor for that device location on the panel and comparing the result with individual instrument test data. Qualification of panels is assured since the TRS enveloped the RRS, and functional and structural requirements were met.

Table 3.10B-1 (cont'd)

NSSS SEISMIC CATEGORY I ELECTRICAL AND
INSTRUMENTATION EQUIPMENT QUALIFICATION RESULTS

Equipment	Method	Results
Control Room Panels	The control room panels are qualified by test to the specified requirements using the applicable standards of IEEE 344-1975.	Control room panels and essential devices are seismically qualified to the IEEE 344-1975 criteria by comparing these panels to similar panels that have been qualified by test. The control room panels are steel structures that can be compared to other seismically similar structures, and the instruments can be considered separately. A review of the River Bend panels shows that the lowest natural frequency for all but two panels is 12 HZ or higher. This compares to a cutoff frequency of 8 HZ (conservatively rounded up to 10 HZ) for the River Bend floor response spectra. Therefore, all but two panels behave as rigid bodies at River Bend, and the device RRS are the same as the floor response spectra. The two panels, with natural frequencies less than 10 HZ, were tested to floor TRS which envelop the River Bend floor response spectra, so they are qualified as an assembly. For the devices in the remainder of the panels, all but two were tested to the multi-frequency, multi-axis requirements of IEEE 344-1975. Comparison of the

Table 3.10B-1 (cont'd)

NSSS SEISMIC CATEGORY I ELECTRICAL AND
INSTRUMENTATION EQUIPMENT QUALIFICATION RESULTS

Equipment	Method	Results
		device TRS to the River Bend device RRS (which are the same as the floor response spectra) shows that all devices are qualified. For the two devices tested to single-frequency requirements, resonance search data show they are rigid to 26 HZ with a loading capability far in excess of the River Bend floor ZPA.

Table 3.10B-1 (cont'd)

EQUIPMENT/MANUFACTURER CROSS-REFERENCE

Equipment	Purchased Part Drawing	Equipment Code	Manufacturer
Temperature Element	145C3224	A	California Alloy
Temperature Element	159C4313	P	California Alloy
Temperature Element	158B7072		California Alloy
Temperature Element	159C4520	P	California Alloy
Temperature Switch	157C4629	P	California Alloy
Pressure Transmitter	169C8392	A,P	Rosemount
Pressure Transmitter	169C8394	P	Rosemount
Pressure Transmitter	169C8869	P	Rosemount
Level Transmitter	184C4775	A	Gould
Level Transmitter	145C3156	P	Barton
Level Switch	184C4776	A	Magnetrol
Pressure Switch	184C4770	A	Barksdale
TSV Switch	163C1303	A	Namco
Pressure Indicator	163C1104	A,P	Robert Shaw
Detector	237X731	A	GE
Detector	112C3144		GE
Conductivity Element	163C1544	P	Balsbaugh
Condensing Chamber	204B7269	P	
Thermometer	145C3103	P	
Local Panels		A	
Control Room Panels		A	

Delete Figures 3.10B-1 through 3.10B-4

Delete Appendix 3E and 3F