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AUGUST 1983

WATERFORD III SQRT VISIT REPORT (SECOND VISIT)

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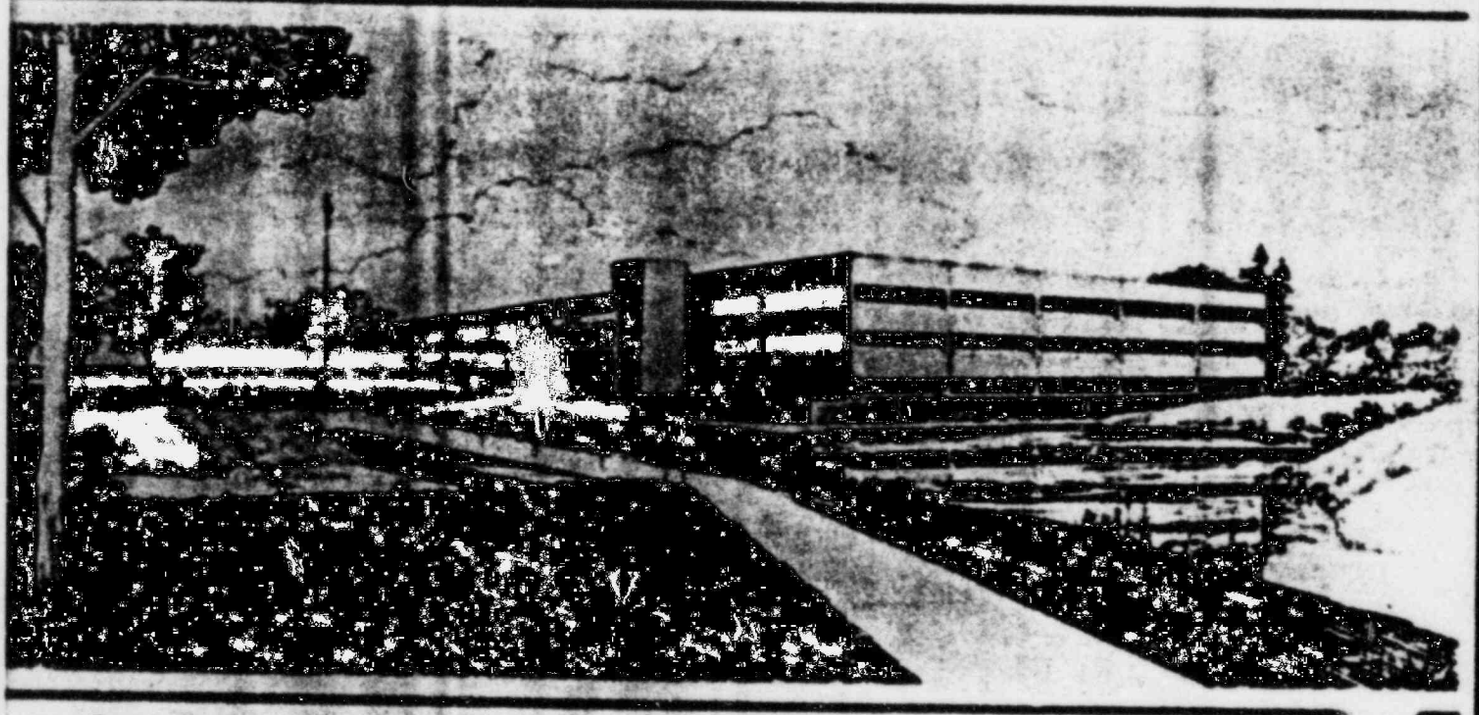
Idaho National Engineering Laboratory
Operated by the U.S. Department of Energy



This is an informal report intended for use as a preliminary or working document

Prepared for the
U.S. NUCLEAR REGULATORY COMMISSION
Under DOE Contract No. DE-AC07-76-ID01570
FIN No. A6415

EG&G Idaho

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WATERFORD III

SQRT VISIT REPORT

(Second Visit)

J. N. Singh
R. W. Macek
M. J. Russell

August 1983

EG&G Idaho, Inc.
Idaho Falls, Idaho 83415

Prepared for the
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555
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ABSTRACT

EG&G Idaho, Inc., has evaluated the Louisiana Power and Light Company's program for the dynamic qualification of safety related electrical and mechanical equipment for Waterford Nuclear Power Plant Unit 3. In this program, the applicants use test or analysis or a combination of both to qualify equipment, such that its safety function will be ensured during and after the dynamic event and provide documentation. The review indicates that an appropriate qualification has been defined and initiated for seismic category I electrical and mechanical equipment. When completed, this would provide reasonable assurance that such equipment will function properly during and after the excitation due to vibratory forces of the dynamic event.

SUMMARY

A seismic qualification review team consisting of engineers from the Equipment Qualification Branch of the Nuclear Regulatory Commission and Idaho National Engineering Laboratory made a site visit to the Waterford III nuclear power plant near Taft, Louisiana. They observed the field installation and reviewed the qualification reports for twenty five selected pieces of seismic category I electrical and mechanical equipment and their supporting structures. The review indicated that the equipment was adequately qualified for the dynamic environment.

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TABLES

1. INTRODUCTION

The Equipment Qualification Branch (EQB) of the Nuclear Regulatory Commission (NRC) has the lead responsibility in reviewing and evaluating the dynamic qualification of safety related mechanical and electrical equipment. This equipment may be subjected to vibration from earthquake loads or earthquake loads in combination with hydrodynamic loads. Applicants are required to use test, analysis or a combination of both to qualify equipment essential to plant safety, such that its function will be ensured during and after the dynamic event. These pieces of equipment and how they meet the required criteria are described by applicants in a Final Safety Analysis Report (FSAR). On completion of the FSAR review, evaluation and approval, the applicant receives an Operating License (OL) for commercial plant operation.

A Seismic Qualification Review Team (SQRT) consisting of engineers from the EQB of NRC and Idaho National Engineering Laboratory (INEL), made a site visit to Waterford Unit 3 at Taft, Louisiana from August 30 through September 3, 1982. This team included a contingent of three from INEL as consultants to NRC. The purpose of the visit was to observe the field installation, review the equipment qualification methods, procedures (including modeling technique and adequacy), and documented results for a list of selected seismic Category I mechanical and electrical equipment and their supporting structures. Following the site visit, the EG&G personnel were to advise NRC with respect to the adequacy of qualification of this equipment to perform its intended function. A preliminary report[1] containing our findings was issued. This report indicated which of the items were qualified and required no additional documentation. It also identified some equipment and certain general concerns for which additional information was needed in order for EG&G to complete the review. These were referred to as open items. The applicant investigated further and provided additional documentation sufficient to resolve these issues. All the outstanding issues were satisfactorily resolved.

Table 1 contains a list of personnel who attended the site visit. Subsequent sections of this report give a description of each selected piece of equipment and its mounting, followed by a brief overview of its qualification. Concerns raised during the review and their resolutions are then discussed. Findings for each piece of equipment are presented at the end of each section. Overall findings and conclusions for the plant are presented at the end of the report.

TABLE 1 LIST OF ATTENDEES

R. S. Alexandru	EBASCO
S. Black	NRC
T. Y. Chang	NRC
W. Cetta	EBASCO
J. DeBruin	EBASCO
L. Constable	NRC
A. Desphande	EBASCO
A. DeVito	EBASCO
R. J. Esnes	EBASCO
F. Drummond	LP&L
T. E. Fitzsimmons	C-E (PE)
K. K. Gala	LP&L
J. Hart	EBASCO
A. Jones	EBASCO
J. Kealy	EBASCO
E. Livesy	EBASCO
M. Meyer	LP&L
R. W. Macek	EG&G, Idaho
T. MacNair	C-E
L. V. Maurin	LP&L
E. Miller	W CCD
B. Moury	EBASCO
S. Nath	EBASCO
R. L. Novgrod	LP&L s/w
J. Parello	W RD
H. Parikh	EBASCO
R Pracos	LP&L
W. Ritter	W IED
M. J. Russell	EG&G, Idaho
Z. T. Shi	EBASCO
E. Siegel	C-E
J. N. Singh	EG&G Idaho
F. Sistino	C-E
R. K. Stampley	EBASCO
I. V Sydoriak	EBASCO
J. Tosarz	C-E (PE)
J. Tomecek	EBASCO
R. Vidal	EBASCO
W. G. Williams	LP&L
J. Zudans	W/S

2 NUCLEAR STEAM SUPPLY SYSTEM (NSSS) EQUIPMENT

2.1 Boric Acid Makeup Pump (NSSS-1)

The boric acid makeup pump, supplied by Crane-Deming with model no. 3065 A-50, is mounted with four 5/8 in. bolts in the chemical and volume control system at the minus 35 ft elevation of the reactor auxiliary building. The reference document for its qualification is the McDonald Engineering Co. report, ME-359 Certified Seismic Analysis Report of Crane-Deming End Suction Centrifugal Pump, Figure 3065, Size A50, revision 1, dated January 17, 1977.

The pump was qualified by a static beam analysis using the ICES-STRUDL computer code. 1.5 g accelerations were applied in both horizontal directions together with 1.0 g acceleration in the vertical direction. Using the same model as the static analysis, all natural frequencies were found to be larger than 33 Hz; therefore, the static analysis is permissible. The maximum stress of 58,289 psi was found in the frame foot bolts by absolutely summing the stresses from each of the three seismic load components together with normal operating and nozzle load. This stress is less than the ASME code allowable of 61,500 psi. In addition, the computed maximum deflection of 0.0068 in. is less than the maximum allowable to assure functional operability (0.025 in.).

During the review of the field installation it was noted that the motor/pump coupling was not installed. However, this concern was adequately resolved by an LP&L letter, W3582-1262, dated August 31, 1982, which indicated a completion date of October 24, 1982 for the coupling installation. During the review of the qualification report it was not evident that the application of Load Cases 4 and 5 was conservative. Also, it was not evident that the Load Cases used to calculate bolting stresses were conservative. A subsequent submittal by the applicant (LP&L letter, W3P83-0251, dated January 21, 1983) has confirmed that Load Cases 4 and 5 and the load cases used to compute the bolt up stress are conservative.

Based on our observation of the field installation, review of the qualification report, and the clarifications provided by the applicant, it is concluded that the pump is adequately qualified for the prescribed loads.

2.2 Boric Acid Tank Circulating Valve (NSSS-2)

The boric acid tank circulating valve, supplied by Fisher Controls, with drawing no. 50A9828, revision E, is welded in the chemical and volume control piping system at the minus 35 ft elevation of the reactor auxiliary building. The reference document for the valve's qualification is the Fisher Controls report, Seismic Analysis for Order 1-46610, dated April 3, 1976.

The valve was qualified by static analysis using a Fisher "in-house" computer code based on Fisher's Engineering Standard ES100, revision B, dated April 8, 1975. This code basically uses beam assumptions in the static analysis and natural frequency calculations. The valve was analyzed for 3 g accelerations in each direction with the resulting responses combined by SRSS summation. The natural frequency calculation indicated a fundamental frequency of 26 Hz which is above the ZPA frequency for the Waterford site. Therefore, the static analysis is permissible. The analysis indicated a maximum stress of 21,919 psi in the yoke legs; this value is less than the ASME code allowable of 36,000 psi. Deflections were also computed, however, no allowable value was given.

During the inspection of the field installation it was noted that the seismic supports had not been installed. This concern was adequately resolved by an Ebasco letter, Wills to DeBruin, dated September 1, 1982, which indicated completion by September 3, 1982, for the installation. During the review of the qualification report it was noted that no allowable value for the computed deflections had been given. In addition, there was no indication that Fisher's "in-house" computer code, used in the analysis, had been verified. These concerns were resolved by an LP&L letter, McGehee to Harrison, no. W3P83-0429, dated February 8, 1983. In

stated that the ES100 program has a verification document on file with CE. It also provided assurance that the calculated seismic deflections would not cause failure of the valve to operate.

Based on our observation of the field installation, review of the qualification report, and the clarifications provided by the applicant, it is concluded that the valve is adequately qualified for the prescribed loads.

2.3 Boric Acid Pump Discharge Valve (NSSS-3)

The boric acid pump discharge valve (drawing no. 039963, revision H), supplied by the William Powell Company, is welded in the chemical and volume control piping at the minus 35 ft elevation of the reactor auxiliary building. The reference document for its qualification is the William Powell Company report entitled Report on Analysis of Valve for Seismic Conditions, dated June 1, 1972.

The valve was qualified by static hand beam analysis with a 3 g seismic load applied perpendicular to the weakest bending axis. Normal operating and thrust loads were also applied. A single lumped mass natural frequency calculation indicated that the lowest frequency was 51 Hz and thus a static analysis was justified. Under the applied loads the maximum stress of 14,360 psi was found in the body to bonnet bolting. This value is less than the ASME code allowable of 32,000 psi. Computed deflections (0.006 in.) were also within manufacturing tolerances.

During the field inspection of the valve it was noted that class 1E heat tracing wire had been routed through pipe supports and that installation of the heater cable to the valve was not complete. The concern that the heat tracing wire may be clipped in the pipe support during a seismic event was adequately resolved by issuance of a design change notice (no. 426, R5), which specified that the wire be routed remote from structural elements in pipe supports. The concern that the heater

cable was not installed was also adequately resolved by an LP&L Letter, W3S82-1262, dated August 31, 1982. This letter specified a completion date of October 24, 1982 for the heater cable installation.

Based on our observation of the field installation, review of the qualification report, and the clarifications provided by the applicant, it is concluded that the valve is adequately qualified for the prescribed loads.

2.4 Holdup Tank C (NSSS-4)

The holdup tank was reviewed during the first audit. A major discrepancy was found between the support configuration analyzed and that installed in the field. It was chosen for the second audit to allow a thorough follow-up of the corrective action. The correction plan was found to be acceptable, although modifications have not yet been made in the field. Verification of the field modification is a confirmatory action to be performed by NRC resident inspectors. The qualification details for this item are discussed in the first audit's report.

2.5 Feedwater Control Valve (NSSS-5)

The feedwater control valve (model no. 51A6372, revision G) was supplied by Fisher Controls The valve is welded into feedwater piping at the 46 ft elevation of the reactor auxiliary building. The qualification report, Seismic Certification for Order 1-51008, serial no. 5900961, dated May 4, 1976, was supplied by Fisher Controls.

Qualification was with an equivalent static analysis based on a computer code implementing the calculations in Fisher Engineering Standard ES100. The static analysis was justified by a fundamental natural frequency calculated to be 22.5 Hz. This is well above the 5 Hz zero period acceleration frequency of the mounting location. Seismic stresses were calculated as an SRSS combination of the stresses for a 3 g load

applied in each orthogonal direction independently. The maximum stress of 29,400 psi occurred in the yoke legs. This is less than the allowable of 36,000 psi.

Review of the qualification report showed that the computer program was not verified. This was discussed in the review of the boric acid tank circulating valve's qualification (NSSS-2). The review also showed that a positioner mounted on the valve in the field was not included in the analysis. Further investigation showed that the positioner had no safety function.

During the field inspection, the sister valve to this valve was observed to have an electrical cable attachment which could be tensioned under thermal motion in the appropriate direction. The thermal analysis for the associated piping predicted thermal motion that would not place the cable in tension, so that lack of slack in the cable is acceptable.

During the field inspection, the air lines to the valve appeared to be inadequately supported. Supports for the air lines had been designed but not installed. Installation is guaranteed by field change request no. FCR-IC-P-451. These air lines were also detached from the valve. This had been done so that the valve could be isolated from a pneumatic system integrity check. The procedure for the check, Mercury Procedure M123-72A, requires that the air lines be re-attached after the check

Based on our observation of the field installation, review of the qualification document and clarifications provided by the applicant, the feedwater control valve is qualified for seismic loads.

2.6 Resistor Input Card (NSSS-6)

The resistor input card, supplied by Westinghouse, with model no. 2837A86601, is mounted with standard card mounting hardware in the process instrument rack at the 46 ft elevation of the reactor auxiliary building. The reference document for the card qualification is the

Westinghouse report, Seismic Operability Demonstration Testing of the Westinghouse ISD 7300 Series Process Instrumentation Bistables, WCAP-8828, dated December 1976.

The resistor input card was qualified by multifrequency sine beat and multiaxis testing. Multifrequency excitation was achieved by superposition of various sine beats and multiaxis response was obtained by four rotations of the equipment in each test. The device was qualified to an in-cabinet response spectra that was developed from a generic floor response spectra. The generic floor spectra enveloped the Waterford site specific spectra for the mounting location. No natural frequencies were determined for this device. Five OBE and four SSE tests were performed with the card mounted in the PC card frame, which was attached to a rigid fixture on the test table. Functional operability was claimed to be demonstrated during the test; however, there was no data to support this conclusion in the qualification report.

During the review of the field installation it was noted that several rather long cables (3 ft) had not been secured. This concern was adequately addressed by review of the installation procedures and the issuance of an Ebasco letter, Wills to DeBruin, dated September 2, 1982. This letter indicated that the wire bundles will be secured by October 30, 1982. As previously noted, during the review of the qualification report there was no evidence supporting the conclusion that functional operability was verified. Therefore, the applicant was requested to provide data to support this conclusion. This was done in an LP&L letter, Maurin to Novak, no. W3P83-0251, dated January 21, 1983.

Based on our observation of the field installation, review of the qualification report, and the clarifications provided by the applicant, it is concluded that the resistor input card is adequately qualified for the prescribed loads.

2.7 Indicator (NSSS-7)

The indicator (model no. 1151, serial no. 0200, tag no. PI-101B) was supplied by Sigma. Purchase order specifications are contained in CENPD specification no. 9270-ICE-0005, revision 01, which also refers to Engineering Specification for Instrument and Control Equipment, specification no. 00000-ICE-0005. There are a total of 26 indicators. Each measures 6.05 x 2.28 x 5.87 in. and weighs about 25 oz. The item inspected in the field was mounted on Panel CP7, which was located in the control area of the auxiliary building at the 46 ft elevation. The mounting on the panel consisted of standard mounting hardware. Seismic qualification was done through tests performed by Environmental Testing Corporation and documented in report no. 13906, titled Report of Test on Environmental and Seismic Qualification of Various Items for Combustion Engineering Under Purchase Order No. 9870612.

The dynamic tests were performed with a mounting which simulated the inservice condition. These were biaxial tests with random, independent inputs. Each had a minimum duration of 30 seconds. Each test was repeated in two positions with in-phase and out-of-phase inputs. There were a total of five OBE level tests followed by an SSE level test. A test response spectrum (TRS) was generated in each case. These tests were performed to generic spectra, and in every case the equipment RRS was enveloped by the TRS generated.

The tests performed are adequate. However, the purchase order specification requires the following:

1. Scale range 15 to 25 (x100) (psia) linear
2. Accuracy ±1.5%
3. Screw terminals
4. Measures pressurizer pressure.

and qualification was claimed in spite of test performance with an accuracy of ±5%. This concern was addressed in an LP&L letter, Maurin to Novak, no. W3P83-0367, dated February 1, 1983. The 5% seismic uncertainty was included in an uncertainty analysis. The results showed that the plant design is sufficiently conservative to accommodate the combined effects of the instrument channel uncertainties, including the 5% uncertainty due to a seismic event, and ensure safe operation of the plant.

Based on our observation of the field installation, review of the qualification document, and the applicant's response to our questions, the indicator is adequately qualfied for seismic loads.

2.8 Resistance Temperature Detector (NSSS-8)

The resistance temperature detector (RTD), model no. 104AFC-1, was supplied by Rosemount. It is welded to primary coolant pump inlet piping at the 15 ft elevation of the containment building. The qualification report, Seismic Vibration Report on a Temperature Sensor for Combustion Engineering Co., no. 27320A, dated July 22, 1975, was supplied by Rosemount.

A series of single frequency tests qualified the unit. Fundamental natural frequencies of 20 Hz in both transverse directions justified the single frequency test, since the zero period acceleration frequency throughout the plant is 8 Hz or less. No resonance survey was conducted for the axial direction on the RTD. This is acceptable because of the much greater stiffness in this direction. The test mounting accurately reflected field mounting conditions. Sine dwell tests of 2 g in each transverse direction were performed at the fundamental and at 25, 33, and 44 Hz. This is well beyond the requirement of 0.3 g in the transverse direction.

Based on our observation of the field installation, review of the qualification document and the applicant's response to questions, the resistance temperature detector is adequate for seismic loading.

2 9 RCP Signal Processor (NSSS-9)

The RCP signal processor, supplied by Bentley Nevada, with model no. 18740-01, is mounted with two 10-32 and four 1/4 in. bolts in the plant protection system cabinet at the 46 ft elevation of the reactor auxiliary building. The reference document for its qualification is the Wyle Lab report, Seismic Simulation Qualification Test Report on a RCP SSSS Signal Processor, Model 18740-01, dated June 15, 1978, with report no. 43844-1.

The device was qualified by random multifrequency (with superimposed sine beats), multiaxis testing. The device was mounted with six 10-32 bolts in the laboratory testing. Sine sweep resonance searches revealed natural frequencies of 18 Hz in the side-to-side, 18 Hz in the front-to-back, and 28 Hz in the vertical direction. The processor was qualified to a generic spectra which envelopes the Waterford site specific spectra at the mounting location. In addition, the test response spectra enveloped the required response spectra at all frequencies. Some environmental qualification was done in sequence with the seismic testing. 42 OBE and eight SSE tests were performed and functional operability was monitored in each test.

During the inspection of the field installation it was noted that loose cables in the cabinet had not been secured. This concern was adequately resolved by the review of the installation procedures and the issuance of an Ebasco letter, Wills to DeBruin, dated September 2 1982, which indicated the wire bundles will be secured by October 30, 1982. During the review of the qualification report it was noted that there was an equipment anomaly during the humidity and temperature environmental testing. This anomaly was later shown to be inconsequential. After several of the qualification tests, a cracked electrical connector was discovered. This concern was adequately resolved by noting the conservatism in the generic spectra and by the indication that this cracked connector did not affect the equipment's operation in subsequent SSE tests.

Based on our observation of the field installation, review of the qualification report, and the clarifications provide by the applicant, it is concluded that the RCP signal processor is adequately qualified for the prescribed loads.

2.10 Reactor Trip Switchgear Cabinet (NSSS-10)

The reactor trip switchgear cabinet (no model number) was supplied by Unit Electric Controls, Inc. It is located at the 21 ft elevation of the reactor auxiliary building. The qualification report, Seismic Simulation Test Program on Reactor Trip Switchgear, no. 42835-I, revision A, dated January 13, 1975, was provided by Wyle Labs.

A multifrequency, multiaxis test program qualified the cabinet. Resonance testing showed fundamental natural frequencies of 14.5 Hz in the side to side and 12.5 in the vertical direction, all above the zero period acceleration frequency for the mounting location of 4.4 Hz.

The TRS enveloped the RRS everywhere except below 2.4 Hz. This caused no concern for the cabinet, because its fundamental natural frequencies are all well above 2.4 Hz. There was concern that the lack of envelopment could affect the conclusion that operability was demonstrated for the cabinet mounted relays. However, since these devices are designed to operate very rapidly to prevent arcing damage, their individual components are very compact and strong. In addition, the breaker mechanism is loaded by a strong spring in the normal operating position, which would prevent low frequency motion associated with clearances in the mechanism. Therefore it is unlikely that the breakers would have a natural frequency under 2.4 Hz.

During the testing, one of the circuit breakers failed to close. This raised a concern about using the circuit breaker in an application where it must close to perform a safety function. The failure of the circuit breaker to reclose occurred in one of the [illegible] breakers tested. Examination of the subject breaker showed it to be defective with misaligned linkages. Since this anomaly was detected in the first attempt to

reclose the breaker, it is judged that this was a random failure attributable to manufacturing. All of the other eight breakers functioned (including reclosure) without incident.

The test installation used high strength bolting. This raised a concern, since the field bolting was not clearly high strength. The concern was addressed by noting that the testing was performed at levels sufficiently above those required to ensure that any reasonable bolting material would be adequate for the field installation. The ratio of applied versus required acceleration level at the fundamental natural frequency (S-S and F-B) of the cabinet is 25. Applying this factor to the yield strength of the test bolting material gives a field bolting required yield strength of 6.6 ksi. Any reasonable bolting material would meet this requirement.

Based on our observation of the field installation, review of the qualification document, and the applicant's responses to questions, the reactor trip switchgear cabinet is adequate for seismic loads.

2.11 Recorder (NSSS-11)

The recorder, supplied by Westinghouse, with model no. 7SRE201/101-000/2212, is mounted in the nuclear instrument panel with standard mounting hardware and a rear bracket. The panel is located at the 46 ft elevation of the reactor auxiliary building. The reference document for the device's qualification is a Westinghouse Advanced Energy Systems Division report, Seismic Test of Westinghouse CID Panel Mounted Process Instrumentation, dated February 1981, with report no. EL1348.

The recorder was qualified by random multifrequency, multiaxis testing. Multiaxial testing was achieved by four rotations of the specimen in each test. The equipment mounting during the tests was identical to the field mounting. Resonance searches revealed no natural frequencies less than 50 Hz from the 12 accelerometers used. Aging of the equipment at 50°C

for 500 days was done prior to seismic testing. Five OBE and four SSE tests were performed with functional operability monitored during the testing. A shift of less than 2% in the pen readings was observed.

During the inspection of the field installation several questionable field construction practices were observed. First it was noted that the rear bracket relied on friction (bolt preload) to maintain the vertical support of the recorder. This concern was adequately resolved by a design change notice NY-IC-303 R2 which modified the bracket design. In addition, this particular mounting appeared to be an isolated instance necessitated by installation space limitations. Another item noted was that some cable tiedowns were mounted to painted surfaces with adhesive glue. A concern about the life of the glue was adequately addressed by a field change request FCRE-1900, which specified that these tiedowns also be secured with screws or bolts. During the field inspection it was noted that loose cables had not been secured. As with other cabinets, this concern was resolved by inspection of two installation procedures and the Ebasco letter, Wills to DeBruin, dated September 2, 1982.

Based on our observation of the field installation, review of the qualification report, and the clarification provided by the applicant, it is concluded that the recorder is adequately qualified for the prescribed loads.

2.12 CEDM Reed Switch Position Transmitter (NSSS-12)

The CEDM reed switch position transmitter (150 in. type) was supplied by Combustion Engineering. It is mounted in a CEDM which is mounted on the reactor vessel head. The qualification report, Seismic Qualification Testing, 150 In. Reed Switch Position Transmitter and Bendix Electrical Connector, no. TR-ESE-149, dated February 2, 1977, was supplied by Combustion Engineering.

A biaxial, multifrequency test was performed to qualify the transmitter. However, the transmitter was tested in only one position, so that the test results are not conclusive. Combustion Engineering had

caught this oversight in qualifying the transmitter for other plants, and performed testing to correct the deficiency. A report of the testing was forwarded to be reviewed for qualification of the transmitter, 150" Reed Switch Position Transmitter and Litton Electrical Connector, CE report no. TR-ESE-442, dated October 9, 1981). The reed switch position transmitter (RSPT) was qualified by a series of biaxial, multifrequency (random) tests. Two production RSPTs were mounted in a production control rod drive mechanism. Both the RSPTs and the drive mechanism were subjected to temperature and radiation aging before seismic testing. The drive mechanism was mounted on a fixture simulating the longest nozzle to which it could be attached. The entire assembly was then mounted on a uniaxial test table which had a drive cylinder oriented 45° from the horizontal. Testing was done in four positions. The second test position was obtained by exchanging the positions of the two RSPTs in the drive mechanisms. This resulted in a 180° horizontal rotation of both RSPT between the first and second position. The third and fourth test positions were obtained by rotating the entire assembly 90° horizontally on the test table from the orientation of the first two positions. The RSPT positions in the drive mechanism were exchanged again between the third and fourth position. This adequately addressed the requirement that seismic testing be multidirectional. Five OBE tests, followed by an SSE test, were performed in each of the four positions. Proper envelopment of RRS by TRS was demonstrated for each test. Operability was demonstrated both during and after each test. No structural failures occurred.

Based on our review of the field installation, review of the qualification documents, and the applicant's responses to questions, the CEDM reed switch position transmitter is adequate for seismic loading.

2.13 Pressure Transmitter (NSSS-13)

The pressure transmitter (model no. 1153GA9, tag no. PT101D) was supplied by Rosemount. The purchase order specified Rosemount model 1152GP or equal. The one in the field was 1153GA9, which is reportedly better. This locally mounted item is placed in the reactor building at an elevation of 21 ft. It weighs about 21 lb. The mounting consists of horizontal and

vertical plates, with the plate being bolted to the strut using four 5/16 in. bolts. The appurtenances were loose and flexible and would not affect the dynamics of the system. This item was qualified by test. The tests are documented in RMT report no. 3788: Qualification of Test Report for Rosemount Transmitters, Model 1153, Series A, dated March 28, 1979. Dayton T. Brown Laboratories prepared the report for Rosemount. CE reviewed and accepted the report according to the acceptance letter RAR no. 9403340-26.

The dynamic qualification consisted of type testing. The model tested was 1153DA5. It is representative of all 1153 series A transmitters. The remainder of the model line differs by the spring constant (thickness) of the sensing diaphragm. The stiffness of the metal sensing diaphragm, whose movement is minute (0.004 in.), does not constitute a significant design difference. The tests were conducted at Environ Laboratories, Inc. in Minneapolis, Minnesota. The sine-sweep test did not indicate any natural frequencies in any of the vertical, side-to-side, or front-to-back directions below 40 Hz. This was followed by sine-dwell tests at 10, 20, and 30 Hz with an input of up to 3.5 g's. The comparable required g-levels are 0.25 g in each direction.

The equipment converts pressure to electrical signal. The single frequency, single axis tests are adequate to demonstrate operability for this relatively rigid item. All units performed well during the testing, exhibiting ±0.1% deviation from readings taken prior to the test. Following the tests, all readings were within the acceptance level of ±0.5% of span with the exception of zero reading for transmitter serial no. 106186, which deviated by 2%. However, this was a one time occurrence which corrected itself with the passage of time. Hence, it is of no consequence.

Based upon the field observation and the review of the qualification report, the pressure transmitter is adequately qualified for the seismic environment.

3 BALANCE OF PLANT (BOP) EQUIPMENT

3.1 20 KVA Inverter (BOP-1)

The 20 kVA inverter (model no. SV1200/AC34R/TS200MB/RL14, tag no. SUPS 3MB-S) was supplied by Solid State Controls, Inc. Purchase order specification no. 215-70 contains the general specification, while details are in project identification no. LOU-1564.282. The rectangular box type structure measures about 111 W x 89 H x 36 D in. and weighs about 4,500 lb. Two of these were located side by side in the auxiliary building at the 21 ft elevation. The inverter is a part of the vital AC system and supplies emergency 120 V power. The mounting consisted of seven 1/2 in. bolts attached to the floor. There were eight bolt holes in the base; however, due to inaccessibility, there were only seven bolts installed in the field. An analysis was done which showed the strength adequacy for this mounting. The referenced qualification document is: Summary Report on Seismic Evaluation of 20 kVA Inverter to Solid State Controls, Inc., dated November 23, 1977. It was prepared by Battelle Columbus Labs for Solid State Controls, Inc. and reviewed by Ebasco.

This equipment was qualified through test. The laboratory mounting had six 1/2 in. bolts. The dynamic test consisted of single axis random input with cross coupling accounted for by increasing the input level based on preliminary test and analysis. This was achieved through initially testing and calculating the coupling effect based on off-axis response. TRS were generated for each test. There were 15 OBE and three SSE level tests performed. In each case the TRS enveloped the RRS adequately. Operability was verified.

There were some in situ tests performed on this unit by Wyle Laboratories. The results of these test are reported in the document: Seismic Recertification Analysis and Test of Class 1E Static Uninterruptible Power Supply, test report no. 46097-1, dated May 1982. These tests were performed to support the analysis. The relevant natural frequency results are

	In Situ Test (Hz)	Analysis (Hz)
s/s	16.8	15.1
f/b	23.5	22.1
Coupled s/s & f/b	25.1	25.7

The correlation appears very satisfactory. The critical stresses from the analysis are as follows:

Identification	Total Stress (psi)	Allowable Stresses (AISC) (psi)
Anchor bolts (ASTM A307)	9,948 (tension)	19,736
	5,165 (shear)	10,000
Structural member	11,667	21,600

The stresses are within the allowables.

The tests performed are adequate. Operability was verified. However, during the field inspection, two things were detected:

1. The first concerned the plate box on the top of the unit which was not securely attached.

   This problem was corrected and confirmed after it was pointed out.

2. The second problem related to the two cabinets not being connected on their common side. The qualification test report had recommended that this be done with a spacer grid in-between.

   On inquiry, the applicant indicated that this would be done, per DCN NY-E-842, dated March 26, 1982, but that there was difficulty in procuring the parts.

Based upon our observation of the field installation, review of the qualification reports and the response to our questions, the 20 kVA inverter unit is adequately qualified for the seismic environment.

3.2 Diesel Generator Lube Oil Piping (BOP-2)

The diesel generator lube oil piping was supplied as part of the generator (model no. KSV-16-T) by Cooper Energy Services (formerly Cooper-Bessemer). The piping is located adjacent to the engine at the 21 ft elevation of the reactor auxiliary building. The qualification report, Emergency Diesel Generator, Engine Mounted System, AM-3383, CES-0279-1, dated July 27, 1976, was supplied by Cooper Energy Services.

The report presented a dynamic analysis. However, the number of dynamic degrees of freedom included in the analysis was not clearly adequate. Therefore the piping was qualified by an equivalent static analysis, as allowed by C.1 of Regulatory Guide 1.100. This was done using the 1 g static solutions in all three directions presented on pages A-80 through A-194 of the qualification report. Stresses for each direction were multiplied by the product of the pertinent peak spectral value and 1.5. The maximum of the SRSS combination of these stresses in all three directions was 14,000 psi, well under the 27,000 psi allowable. Because of this margin, the analysis was accepted despite the fact that three short runs of pipe were not included in the model. Lack of consideration of the 100 psi pressure loading was accepted on the same basis. The support configuration of the model matched field mounting conditions.

Based on our observation of the field installation, review of the qualification document, and responses by the applicant to questions asked, the diesel generator lube oil piping is adequate for seismic loading.

3.3 Level Switch (BOP-3)

The level switch, supplied by Magnetrol, with model no. A103F-TDM-EP/VP-S1MD4-S1MD4, is mounted with eight 5/8 in. bolts on the top of the jacket water standpipe located at the 21 ft elevation of the

reactor auxiliary building. The reference document for the qualification is a Wyle Labs report, Liquid Levels Controls, dated May [illegible], 1977, as the report no. 43235-1.

The switch was qualified by random multifrequency, multiaxis testing. Prior to qualification testing, 0.2 g sine sweep resonance searches revealed natural frequencies of 45 Hz in the side-to-side, 17 Hz in the front-to-back, and 32 hz in the vertical direction. The qualification testing was done for model A153F, which is nearly identical to A103F. The seismic qualification testing was done in sequence with environmental testing and aging. Five OBE and one SSE seismic tests were performed with the test mounting identical to the field mounting. Functional operability was monitored during and after the tests with some chatter observed during the tests.

During the field inspection, it was noted that the unit was free to rotate one-quarter turn. Also, a 5 ft length of flexible electrical conduit leading to the switch was unsupported. The rotation concern was adequately resolved by LP&L securing the unit on September 2, 1982. The concern about the unsupported conduit was resolved by noting that the conduit was remote from other equipment and that the conduit is designed to relieve the loading on the electrical leads. As previously indicated, the qualification report indicated chattering during the seismic qualification. This concern was also resolved by contacting the equipment vendor who indicated that the switch was not required to function during the seismic event.

Based on our observation of the field installation, review of the qualification report and the clarifications provided by the applicant, it is concluded that the level switch is adequately qualified for the prescribed loads.

3.4 Axial Fan (BOP-4)

The axial fan [model no. 84-26-870(S-41), tag no. E28(3A-5A)] was supplied by Joy Manufacturing Company. The purchase order no. is NY-403548.

dated April 23, 1976. Other relevant information is contained in Ebasco's specification no. 602-75 and project specification no. LOU-1564.748L. This enclosed motor, direct drive fan is 84 in. in diameter and 48 in. long. It weighs 4,048 lb. The unit is located in the auxiliary reactor building at an elevation of 56 ft 6 in. The field mounting consists of members welded to the fan housing which are bolted to a vertical wall. Each extension attachment has four 5/8 in. bolts. This fan is part of the diesel generator room 'A' ventilation system. It evacuates the diesel generator room and maintains the temperature within limits. It operates at 870 rpm and has a 60 hp motor. The qualification document referenced is: Axial Flow Fan [E-28(3A-5A)] S-41, dated September 28, 1976. It was prepared by Joy Manufacturing Company and reviewed by Ebasco.

The unit has been qualified by analysis. The lowest shaft frequency is around 41.5 Hz, indicating a relatively rigid unit. This justifies the static equivalent analysis performed. The required acceleration levels for this location are 0.49 g in each of the horizontal and 0.3 g in the vertical direction. The critical parameters to be checked for seismic events are:

1. The clearance between the tips of the fan and the stationary housing

2. The clearance between the motor rotor and stator

3. Maximum stresses.

These are calculated and compared as follows:

Identification	Total Stress (psi)	Allowable Stress (psi)
Anchor bolt	26,046	33,000
Shaft	5,122	45,000

Identification	Critical Deflection (in.)	Allowable Deflection (in.)
Fan rotor	2.622×10^{-3}	0.16
Motor rotor	7×10^{-5}	0.025

The analysis is adequate. The critical stresses and deflections are within allowables. However, balancing of the unit installed in the field was not performed. The applicant has committed to field balancing the fan in an LPL letter, Armington to Prados, no. W3S82-1270, dated September 2, 1982.

Based on our observation of the field installation and review of the qualification document the axial fan is adequately qualified for seismic loads.

3.5 HVAC Water Pump (BOP-5)

The HVAC water pump, model no. 4013, is supplied by Buffalo Pumps Co. It is bolted to a concrete pad at the 46 ft elevation of the reactor auxiliary building with six 7/8 in. bolts. The qualification report, Model 4013 CRE Pump, M2 Frame, dated January 1977, was supplied by McDonald Engineering Analysis Co.

The pump was qualified with an equivalent static analysis using the computer code STRUDL. This was justified by a dynamic analysis which predicted a fundamental natural frequency of 36 Hz. One g horizontal loads were included with a 0.67 g vertical load for each horizontal direction. The envelope of these two load cases was considered along with nozzle and impeller loads. Load combinations were performed correctly. This was verified for nozzle load combinations by checking each calculation because the discussion in the report did not describe the treatment of nozzle loads. The treatment of the remaining loads was described adequately in the discussion.

The maximum stress, 9,956 psi, occurred in the impeller key. This was less than the 10,000 psi allowable. The maximum calculated deflection of 7 mils occurred between impeller and casing. This is less than the 8 mil maximum allowable deflection.

Based on our observation of the field installation and review of the qualification document, it is concluded that the HVAC water pump is adequately qualified for seismic loadings.

3.6 Gravity Damper (BOP-6)

The gravity damper, supplied by American Warming & Ventilation Inc., with model no. DAA-P-2230, is mounted with 66 3/8 in. bolts in the containment cooler fan ducting at the 31 ft elevation of the reactor building. The reference document for its qualification is the American Warming and Ventilating report, Seismic Calculations of DAA-P-2230 H.D. Counter Balanced Damper with Sealed Jamb Construction, dated May 19, 1977.

The damper was qualified by static analysis using an "in-house" computer program. The documentation of the program indicated that the damper vanes are analyzed as simply supported beams with distributed loads from seismic accelerations and pressure differentials. The damper was analyzed for 1 g horizontal and 0.67 g vertical accelerations with the resulting loads and stresses being combined by SRSS summation. The maximum stress of 2,717 psi was found in the vanes and compares to an allowable stress of 23,400 psi. The natural frequency calculation (based on a simply supported uniform beam) indicated the lowest natural frequency was 50 Hz and, therefore, the static analysis is permissible.

During the review of the qualification report it was noted that Section VII of the SQRT form was incorrect. It was revised and incorporated into the audit package. Also, during the review of the qualification report it was noted that no bearing load allowables had been given and that no standard for computing the allowable stresses was mentioned. These concerns were addressed by closer examination of supporting literature

supplied with the report. From this information it was found that the maximum allowable bearing load was 1,810 lb and that the allowable stress was 90% of the minimum yield stress for the material. Since the actual bearing load is much less than 1,810 lb and because the allowable stress is consistent with the AISC code allowables, this concern was adequately resolved.

Based on our observation of the field installation, review of the qualification report, and the clarifications provided by the applicant, it is concluded that the gravity damper is adequately qualified for the prescribed loads.

3.7 Three inch 150 lb Diaphram Valve (BOP-7)

The diaphram valve (tag no. 7FS-V130, model no. FS-302, serial no. 76-3527-8-14, project id. LOU-1564.103A, purchase order no. NY-403522 of December 31, 1974) was supplied by ITT Grinnell. This is a 3 in. non-nuclear safety category 7, seismic class I, handwheel operated diaphram valve with an ASTM-351 CF8 stainless steel body, an ASTM A-445 ductile iron bonnet, a Cr. MEPT diaphram, and an EPT "O" ring valve. It is located in the fuel handling area at the 46 ft elevation. The qualification document is: Seismic Report W-146 Seismic Analysis for Louisiana Power & Light Company Order #NY 403522, rev. 1, dated July 1979. It was accepted by Ebasco Services Inc. according to the letter LW3-1458-79 of July 25, 1979.

The valve, located in the fuel pool system, functions as an isolator between the fuel pool and a component cooling water line. It is welded to the piping. The report states that the valve was designed and analyzed in accordance with the 1971 ASME Boiler and Pressure Vessel Code, including winter 1973 Addendum. The natural frequency of the system is very high (1210 Hz). The system, thus, is relatively rigid and an equivalent static analysis is adequate. The required acceleration levels for this location are 1.0 g in each of the horizontal directions and 0.67 g vertical. The

analysis was performed with 3.0 g's in each of the horizontal and 4.0 g's in the vertical direction. The resulting stresses in the components were well below their allowables.

Considering the passive function of the valve, where the structural integrity alone would assure its adequacy, the static equivalent analysis is adequate.

Based on our observation of the field installation, and the review of the qualification documents, the diaphram valve is adequately qualified for seismic loads.

3.8 One Inch 2500 lb Relief Valve (BOP-8)

The 1 in., 2,500 lb relief valve (ISI-2502B) was supplied by the Crosby Valve and Gage Co. The valve is welded to the safety injection piping at the 21 ft elevation of the reactor containment building. The qualification report, 1 x 1 2,500 lb Relief Valve, no. EC-618, dated June 18, 1979, was supplied by Crosby Valve and Gage Company.

An equivalent static analysis was used to qualify the valve. A hand calculated fundamental natural frequency of 374 Hz justified the static analysis. One g loads in both horizontal directions and a 0.67 g vertical load were considered along with weight and operating loads. The calculation yielded a 3,500 psi maximum stress at the inlet neck, which compares to a 16,600 psi allowable.

Operability of the valve during a seismic event was not addressed in the analysis. However, operability is assured by a feature of the design. The valve stem connects to the seat via a ball/cup contact area. This prevents binding loads from developing between the upper and lower bearing surfaces by accommodating relative displacements and rotations between them.

The analysis did not include consideration of nozzle loads applied by the connecting piping. However, the connecting piping was seismically

qualified, as documented in the Ebasco report, Stress Analysis Calculation No. 1020, dated April 17, 1981. Since the valve body is much stronger than the connecting piping, qualification of the piping justifies not considering the nozzle loads in the valve analysis. This conclusion is supported by the large margin of safety demonstrated above.

Based on our observation of the field installation, review of the qualification document, and the applicant's responses to questions, the 1 in. 2,500 lb relief valve is qualified for seismic loading.

3.9 Half-Inch Globe Valve (BOP-9)

The half-inch globe valve (tag no. 2HV-V621) was supplied by Velan Engineering Company. The valve is welded to HVAC piping at the 46 ft elevation of the reactor containment building. The qualification report, Extension of Seismic Analysis to Manual Valves, no. SR-6684, revision 1, dated December 10, 1981, is supplied by Velan Engineering Company.

Qualification is with an equivalent static analysis, which was justified by a hand calculated fundamental natural frequency of 49 Hz. The valve actually qualified has an identical body to this valve, but it has an actuator instead of a handwheel operator (see the Velan Engineering report no. SR-6631). Extension of qualification to the handwheel operated valve is acceptable because of the high fundamental natural frequency of the actuated valve, and because of the reduced weight and eccentricity of the handwheel operated valve. The required seismic loads for a rigid valve at the mounting location are a 0.5 g horizontal and a 0.3 g vertical load. 1 g horizontal and 0.67 g vertical seismic loads in conjunction with weight and operating loads were considered in the analysis. Not considering a second horizontal seismic load was accepted because of the symmetry of the valve. The method of combining loads was acceptable. The maximum stress in the valve body was 4,900 psi which is below the 26,200 psi allowable. No deflection calculations were required since the valve need not operate during a seismic event.

A small gap (1/8 in.) was noted between the valve and a nearby flange during field inspection. Hand calculations showed a maximum predicted seismic deflection of the valve of 1 mil. Therefore the possibility of contact between valve and flange is not a concern.

Based on our observation of the field installation, review of the qualification document, and the applicant's response to questions, the half-inch globe valve is qualified for seismic loading.

3.10 Indicator (BOP-10)

The indicator (model no. 1151, tag no. EI GN 4613) was supplied by International Instruments. This panel-mounted device measures 6.05 x 2.28 x 5.87 in. and weighs about 25 oz. The panels are located in the reactor auxiliary building at the 46 and 21 ft elevations. The mounting consists of a fixture in the cabinet specifically designed for the indicator. The qualification of this item is documented in report no. SSI-3, Indicating Instrument Model 9270 and Meter Models 1122, 1136, and 1151, dated February 10, 1976. It was prepared by Acton Laboratories for International Instruments and reviewed by Ebasco.

In the light of the more recent testing of the same equipment, which is discussed in the section for Indicator (NSSS-7), the old test report only substantiated the general findings of the new tests. The qualification of this item is, therefore, based on the new test series and discussed in the section for the indicator identified above.

Based on the discussion presented in the section for the Indicator (NSSS-7), this item is adequately qualified.

3.11 Electric Relay (BOP-11)

The electric relay (type MDR 137-8, tag no. CX-610) was supplied by Reliance Electric Company. This particular item did not have a specific purchase order and reportedly was an off the shelf item. This P&B relay was mounted on Cabinet 2A, Section E, with standard mounting hardware. The

cabinet was located in the reactor auxiliary building at an elevation of 35 ft. The qualification document referenced is: Seismic Simulation Test Program on Twenty One Components, no. 753.1, dated October 30, 1978. It was prepared by Wyle Laboratory (test report no. 44258-1, dated October 18, 1978) for Reliance Electric Company and reviewed by Ebasco.

The relay was qualified through tests. The tests consisted of single frequency, biaxial (in each horizontal and vertical directions), independent inputs (in phase and out of phase) in the range of 1 through 35 Hz with increments of one third octave. This amounts to a series of single frequency tests. The ZPA level accelerations for the floor are 0.4 g in each of the horizontal and 0.3 g in the vertical direction. The input ZPA level for the tests were 2.8 g's in each of the horizontal and 2.1 g's in the vertical direction. Out of the 21 specimens, 5 experienced contact chatter in the 5 to 35 Hz range.

There were two resulting concerns from this test series:

a. the use of the single frequency input for the test, and

b. chattering of the timers during the test.

The applicant was made aware of the inadequacy of using a single frequency input in tests on a generic basis and the applicant committed to investigate and respond to the concern. The response, made during the second audit, goes as follows: single frequency testing for the Waterford site meets current requirements (IEEE 344-1975) because (1) all floor response spectra are narrow band, having a single peak, (2) peaks occur at very low frequencies due to the dominant soft soil response of the site (around 1.6 Hz horizontally and 2.2 Hz vertically), (3) response spectra curves decay rapidly and monatonically so that the ZPA for Waterford occurs at 5 Hz, much lower than the standard ZPA of 33 Hz, and (4) all ZPA values are less than or equal to 0.5 g horizontally and 0.4 g vertically. Floor response spectra for the site were reviewed by the SQRT, and all were as described above except for those of the containment building (see Section A

of the CBI Stress Report for Waterford Station Unit 3 Steel Containment Vessel, dated December 6, 1977). Generally, horizontal floor spectra in containment had multiple peaks and a ZPA nearer to 8 than 5 Hz. Therefore, the applicant's response was found acceptable for all equipment except that located in containment. The applicant then reviewed the qualification of all equipment in containment and found none qualified by single frequency testing (see the LP&L letter, Maurin to Knighton, no. W3P83-0502, dated February 11, 1983). This resolved the concern.

When asked about the chattering of the timers, the applicant produced a letter from Ebasco Services Incorporated (dated August 10, 1979) to Mr. D. Harper of Reliance Electric Company addressing Qualification of Electrical Components. This letter states: "Ebasco has analyzed the circuits that the five relays are part of, and we have determined that contact chatter would in no manner compromise the safe operation or shutdown of the plant."

Based on our observation of the field installation, review of the qualification documents and particularly on the responses of the applicant to our questions, this unit is qualified for the prescribed loads.

3.12 Four Inch 300 lb Gate Valve (BOP-12)

The gate valve (model no. 4 in. 300 lb Gate Valve, w/Actuator) was supplied by Anchor/Darling Valve Company. The valve, measuring 29 x 12 x 12 in., is located on the condensate system piping in the reactor auxiliary building at the minus 4 ft elevation. It is welded to the piping. The purchase order specifications are contained in document no. NY-403458, dated October 31, 1973, Ebasco specification no. 92-71 and project no. LOU-1564.099A. The referenced qualification document is LAB no. 80.281: Seismic Class I Analysis of 3 and 4 In. Stainless Steel Gate Valves with Handwheel Operators, Waterford Steam Electric Station Unit 3, S.J.O. Nos. 4463-64, -68, -69, -80, -99, -100. It was prepared and reviewed by Anamet Laboratories, Inc. for Anchor/Darling Valve Company and accepted by Ebasco Services in the letter to Ms. Dori Solyan dated January 27, 1981.

The dynamic qualification of this valve is based on static analysis. Analysis shows that the valve system is comparatively rigid, legitimizing the static analysis. The loads considered were earthquake, gravity, piping and pressure. A load of 3 g was applied in each of the two horizontal and the vertical directions. This compares to a requirement of 1, 1, and 0.67 g.

This is a passive component in that it only has to maintain the pressure boundary of the condensate system. The stress analysis satisfies the criteria of faulted condition given in the ASME B&PV Code, Section III, "Nuclear Power Plant Components," Subsection NC (Class 2) and ND (Class 3). The stress summary is as follows:

Location	Identification	Total Stress (psi)	Allowable Stress (psi)
Valve body	Seismic + operating + internal pressure + piping reaction	11,531	37,440
Yoke	Seismic + operating + internal pressure + piping reaction	4,980	18,480

The maximum deflection in the yoke of the valve was 0.0025 in. against an allowable of 0.020 in.

Based on our observation of the field installation and review of the qualification report, the valve is adequately qualified for seismic loads.

4 FINDINGS AND CONCLUSIONS

Waterford III had two SQRT review-visits. This report is for the second visit. After the visit, a preliminary trip report[2] containing the findings was issued. That report indicated which of the items were qualified and required no additional documentation. It also identified some equipment and certain general concerns for which additional information was needed in order to complete the review. Through submittals, the general concerns were satisfactorily resolved. These documents, further provided the additional documentations required for the resolution of outstanding issues with respect to the identified equipment. It is therefore concluded that the reviews of the Waterford Unit III is satisfactorily completed and all open items have been resolved.

Based on our review, we conclude that an appropriate qualification program has been defined and implemented for the seismic Category I mechanical and electrical equipment which will provide reasonable assurance that such equipment will function properly during and after the excitation due to the vibratory forces imposed by a safe shutdown earthquake.

5. REFERENCE

1. R. W. Macek, M. J. Russell, J. N. Singh, Waterford III SQRT Visit Report (Initial Report), EGG-EA-5643, Rev. 2, April 1983.

2. B. F. Saffell ltr to J. E. Solecki, Review of Dynamic Qualification of Safety Related Electrical and Mechanical Equipment for Waterford III SER Input (A-6415), Saff-421-82, October 15, 1982.

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16 ABSTRACT (200 words or less)

EG&G Idaho, Inc., has evaluated the Louisiana Power and Light Company's program for the dynamic qualification of safety related electrical and mechanical equipment for Waterford Nuclear Power Plant Unit 3. In this program, the applicants use test or analysis or a combination of both to qualify equipment, such that its safety function will be ensured during and after the dynamic event and provide documentation. The review indicates that an appropriate qualification has been defined and initiated for seismic category I electrical and mechanical equipment. When completed, this would provide reasonable assurance that such equipment will function properly during and after the excitation due to vibratory forces of the dynamic event.

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