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LONG ISLAND LIGHTING COMPANY
SHOREHAM NUCLEAR POWER STATION
P.O. BOX 618, NORTH COUNTRY ROAD • WADING RIVER, N.Y. 11792

SNRC-564

May 15, 1981

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

EQUIPMENT DYNAMIC QUALIFICATION
SER OUTSTANDING ISSUE NO. 8
SHOREHAM NUCLEAR POWER STATION - UNIT 1
DOCKET NO. 50-322

REFERENCE: NRC Seismic Qualification Review Team (SQRT)
Site Visit April 6-10, 1981

Dear Mr. Denton:

Submitted herewith are six copies of our response to the requests for supplemental and confirmatory information made by the NRC Seismic Qualification Review Team (SQRT) at the exit interview of the referenced visit. This response includes the five attachments listed below.

Attachment I

Responses to NRC SQRT requests for additional general information - dated May 14, 1981

Attachment II

Responses to NRC SQRT requests for additional information concerning their selected equipment items - dated May 14, 1981

LTR
B001
S. 1/6
ENCL
B028
S. 1/6

Attachment III - dated May 13, 1981

Title page, Qualification Summary of Equipment (SQRT form) and Qualification Summary and Evaluation for each selected item

Attachment IV - dated May 13, 1981

Requalification Plan and Equipment Lists at Qualification Level

Attachment V - dated May 13, 1981

Supplemental Technical Data

Four copies of this submittal are being forwarded directly to Dr. Morris Reich at Brookhaven National Laboratory, in accordance with Mr. R. L. Tedesco's letter to LILCO dated January 28, 1981.

We believe that the material contained in these attachments (and the supplements promised in the Attachment I response to request (3), and the Attachment II response concerning equipment item 4) provides a complete response to the NRC SQRT requests for additional information pertaining to the dynamic qualification of Shoreham equipment. It is our belief that the site review held in April 1981 and supplemented by this submittal and the commitments made in Attachment I provides an acceptable basis for the NRC SQRT closure on the issue of dynamic qualification of Shoreham equipment.

Very truly yours,

J. P. Novarro

J. P. Novarro
Project Manager
Shoreham Nuclear Power Station

JFE:mp

Enclosures

cc: Dr. Morris Reich
J. Higgins

ATTACHMENT I

MAY 14, 1981

RESPONSES TO NRC SQRT
REQUESTS FOR
ADDITIONAL GENERAL INFORMATION

(1) Provide a statement regarding any equipment which appeared on previously submitted equipment qualification lists and which is no longer regarded as safety-related.

RESPONSE:

Audit Item 21 (BOP), 1H11*PNL-SMP, was deleted from the list because it serves no safety function. It is merely a monitor and has no effect on any required equipment.

(2) Provide a statement concerning the meaning and revision of "hot standby" and "cold shutdown" categories for equipment items. Submit any equipment list pages showing revisions in this classification.

RESPONSE:

For the purposes of SQRT equipment classification, the following definitions are used to determine the appropriate functional requirements. These definitions essentially correlate to those outlined in Table 1.1, page 1-7 of the GE Standard Technical Specifications.

1. Hot Standby - Hot standby conditions as defined for the purposes of SQRT equipment classification represent the case where the reactor is subcritical but is not being placed in a forced cooldown. For conservatism, the reactor is considered isolated from the main condenser and RCIC is used to supply high pressure makeup. The reactor remains at a pressure and temperature near operational conditions and no abnormal operational conditions are assumed. In general, achieving and maintaining this condition requires only control rod insertion and high pressure makeup with RHR suppression pool cooling as required.

2. Cold Shutdown - Cold shutdown conditions represent achieving and maintaining RPV cnnditions below which the RHR system can be operated in the normal shutdown cooling mode. Systems required are those necessary to achieve this mode and to maintain it for as long as necessary. The single failure assumed for this event is the blue emergency bus causing a loss of normal shutdown capability via the loss of one RHR/RPV suction valve. For this condition, manual ADS operation and CS or LPCI circulation/core and suppression pool cooling methods will achieve and maintain cold shutdown conditions.

Equipment safety function has been reviewed for consistency with these definitions and incorporated into the equipment lists provided in Attachment IV.

(3) Provide a statement of the general position and a copy of the standard for support of tubing and flexible lines.

RESPONSE:

Tubing

A question was raised during the SQRT review of certain seismically qualified instruments regarding the installation of associated instrumentation tubing. Such tubing is beyond the intended scope of the SQRT review, but was addressed on the basis that its failure could prevent functioning of the instrument itself. In response to the expressed concern, however, following is our position on the installation of instrument tubing.

The basic standard for the installation of tubing and instrumentation is Stone & Webster Engineering Mechanics Technical Guideline No. 16A (EMTG-16A), dated December 20, 1976, modified for Shoreham plant unique loadings based on Project calculations. This document is proprietary but was available at the site for review by the SQRT reviewers and is, therefore, not submitted at this time.

The specific concern raised regarding tubing installation was for the adequacy of tubing not supported near bends. As described at that time, project calculations have been performed using computer models of tubing systems having configurations representative of plant installations. These dynamic analyses have demonstrated the conservatism of the installation standards, and specifically, the design adequacy of configurations of the type addressed by the SQRT reviewers. A summary of the calculations and a copy of the computer analysis for one example configuration will be provided by May 27, 1981.

Small Bore Piping

The basic standard for the installation of small bore (2 in. and under) piping is Stone & Webster Engineering Mechanics Technical Guideline No. 5A (EMTG-5A), dated December 15, 1976, modified for Shoreham plant unique loadings based on project calculations. This document is proprietary but was available at the site for review by the SQRT reviewers and is, therefore, not submitted at this time.

The specific concern raised relating to small bore piping was with regard to the qualification of valves with eccentric masses (e.g., MOVs, AOVs) mounted on these lines. Such valves are dynamically qualified to acceleration levels required by the design specifications. For valves with eccentric masses mounted on lines outside of the primary containment, where hydrodynamic loads are less severe or not applicable, the design acceleration values based on a conservative estimate of seismic loads alone have been maintained. For such valves mounted on lines inside of the primary containment, design accelerations to which the valves must be qualified have been increased to reflect the additional effects of hydrodynamic loads.

The adequacy of the prescribed design accelerations will be confirmed by dynamic analysis of the as-built piping configuration for valves with extended operators.

(4) Provide a statement and basis for justification of mounting discrepancies between installed and tested configuration (usually welds instead of bolts).

RESPONSE:

Where mounting of the equipment cannot replicate the tested configuration, an engineering evaluation is made to justify an alternate installation. This engineering evaluation would, for example, justify the use of a welded connection for a panel where a bolted connection has been used for qualification testing. The process for identifying and resolving this concern is the Engineering and Design Coordination Report (E&DCR) system as outlined in the Stone & Webster Quality Assurance Manual. Final confirmation that the installed mounting is compatible with the qualified mounting is based on physical inspection.

(5) Provide confirmation of the limiting acceleration (g) values for the as-built configuration for the selected BOP valves - IB31*AOV082, 1E11*PCV003A, 1P41*MOV036A, 1E51*RV145, and 1E51*RV149.

RESPONSE:

Confirmation of the limiting acceleration (g) values for the as-built configuration of all valves listed above will be provided after their as-built piping review program is completed.

(6) Provide completed "four-page" SQRT forms for the selected items. The blank form was provided as an attachment to Mr. R. L. Tedesco's letter to LILCO dated January 28, 1981.

RESPONSE:

Attachment III of this submittal contains four-page SQRT forms completed for the selected equipment items.

(7) Provide completed "four-page" SQRT forms for the equipment not designated as "F" in Reference 1.

RESPONSE:

A four-page SQRT form for the safety-related equipment items listed in Attachment IV will be provided after their qualification status is designated "F" (qualification complete).

(8) Provide a description of any equipment hardware modifications required for qualification of the items not designated as "F" in Reference 1.

RESPONSE:

A description of any equipment hardware modifications required for qualification will be provided after completion of the requalification plan given in Attachment IV for items not currently complete.

(9) Provide a title page identifying equipment and showing review sign-offs for each audited equipment item designated as "F", unless the page was seen during the visit.

RESPONSE:

Title pages identifying the equipment and containing appropriate review signoffs are provided in Attachment III for the audited equipment items.

(10) Provide a title page identifying equipment and showing review sign-offs for all equipment not designated as "F", after they become "F".

RESPONSE:

A title page identifying the equipment and containing appropriate review sign-offs for equipment items listed in Attachment IV will be prepared to indicate the successful completion of the qualification evaluation process. After the equipment dynamic qualification status is designated "F" (qualification complete), the title pages will be provided as requested for any selected equipment items.

(11) Provide a summary of the hydrodynamic loads consideration for each audited equipment item designated as "F", unless the summary was seen during the visit.

RESPONSE:

A summary of the hydrodynamic loads consideration for all audited equipment items is included in Attachment III. Also contained therein, as noted in (6) and (9) above, are the four-page SQRT forms and the title pages respectively.

(12) Provide a summary of the hydrodynamic loads consideration for all equipment not designated as "F" in Reference 1.

RESPONSE:

A summary of the hydrodynamic loads consideration for the equipment items listed in Attachment IV will be prepared as part of the qualification evaluation process. After the dynamic qualification status is designated "F" (qualification complete), the summaries will be available upon request for any selected equipment items.

Reference 1 cited in requests (7), (8) and (12) is the equipment lists submitted to the NRC by LILCO letter SNRC-550 dated March 27, 1981.

ATTACHMENT II

MAY 14, 1981

RESPONSES TO NRC SQRT
REQUESTS FOR ADDITIONAL INFORMATION
CONCERNING THEIR SELECTED
EQUIPMENT ITEMS

Item 1: 1H11*PNL-613 (H11P613)

a) Provide the revision of a report.

b) Revise the SQRT form.

RESPONSE:

a) Revision 1 dated May 6, 1981 of General Electric Report DRF No. A00-992 summarizing the qualification of control room and local panels is provided in Attachment V behind Tabs 1 and 2 respectively.

b) The SQRT form has been revised as requested during the review at the Site, and included under Tab 1 of Attachment III.

Item 2: 1H21*PNL-10 (H21P010)

a) Revise the SQRT form, particularly to show welding description.

RESPONSE

a) The SQRT form has been revised as requested during the review at the Site, and is submitted under Tab 2 of Attachment III.

Item 3: 1H21*PNL-36 (H21P036)

a) Revise the SQRT form.

RESPONSE:

a) The SQRT forms has been revised as requested during the review at the Site, and is submitted under Tab 3 of Attachment III.

Item 4: 1C61*PT006 (C61N006)

a) Provide a calculation of support frame frequency by Stone & Webster.

RESPONSE:

a) Testing of this pressure transmitter showed that its malfunction level of acceleration is well above the acceleration level required for Shoreham service until the input signal reaches 40 Hz, at which point the malfunction limit dropped to .26 g's as compared with the floor amplified response spectrum value of .4 g's at 40 Hz. A dynamic modal analysis was conducted to determine the support frame frequency and the response of this stand with instruments attached. Results demonstrate a fundamental frequency sufficiently low to result in modal accelerations less than 0.26g above 40 Hz, which establishes that this pressure transmitter is qualified to combined seismic and hydrodynamic loads. The supporting calculation will be provided by May 27, 1981.

Item 8: 1C41*P-024 (C41C001)

a) Revise the SQRT form to clarify that hydrodynamic loads were considered.

RESPONSE:

a) The SQRT form has been revised as requested during the review at the Site, and submitted under Tab 8 of Attachment III.

Item 10: 1R24*MCC1123

a) Provide operability evidence for the electrical devices.

RESPONSE:

a) No additional details of the testing other than presently included in the test report reviewed at the Site are available from the vendor. As shown in the vendor's test report, FA and KA breakers, HO and DO type relays and control stations, and size 1 through size 4 Type S starters were monitored during the test to determine the electrical continuity (contact chatter) and to detect any spurious operation. The test demonstrated that the electrical function of the 480 Volt Motor Control Center was not compromised by exposure to seismic and hydrodynamic loads.

Item 12: 1T48*RC-002

a) Explain how nozzle loads were considered in the qualification.

b) Provide a record of how the hydrodynamic loads were considered.

c) Confirm status of NRC acceptance that the T-quencher SRV load is bounded by the ramshead SRV load in the frequency range of interest in equipment qualification.

d) Provide operability evidence for attached accessories after the dynamic test.

e) Revise the SQRT form, particularly to note the frequencies of the several components.

RESPONSE:

a) Nozzle loads are negligible because the input and output piping is attached using flexible couplings.

b) A record of how the hydrodynamic loads were considered is provided for the audited equipment in Qualification Summary and Evaluation sheets under each Tab of Attachment III. For the Hydrogen Recombiner, this record is under Tab 12.

c) In 1979, the NRC questioned the adequacy of the SRV ramshead load definition for the qualification of "low frequency" components. The question arose due to the fact that the ramshead ARS were exceeded by the T-quencher ARS at frequencies lower than approximately 7 Hz. Justification that the effects of ramshead SRV loads on Shoreham equipment bound those resulting from a T-quencher discharge has been submitted to the NRC (LILCO letter SNRC-438 dated October 23, 1979). In addition, for equipment items such as 1T48*RC-002, which has a minimum natural frequency of 14 Hz, the adequacy of the ramshead load definition was never questioned in the frequency range of interest.

d) No additional information on the operability testing of these accessories is available. The tests demonstrated that the structural integrity of the hydrogen recombiner was adequate to survive a faulted event. The "Barton" pressure transmitters functioned correctly both before and after the seismic test series. The pressure transmitters were monitored electrically during testing. Thus, the abililty of these accessories to perform their required safety function under combined seismic and hydrodynamic loads is demonstrated.

e) The SQRT form has been revised as requested during the review at the Site, and submitted under Tab 12 of Attachemnt III. However, frequencies of the various accessories are not included since the scan test was instrumented to measure only frequencies associated with the modes of the main frame. For qualification by multi-frequency testing, determination of the fundamental frequency (Fo) is required to establish the frequency range over which the TRS must envelop the RRS, i.e., from Fo to the ZPA asymptote. The frequency of accessories provides no information pertaining to acceptance criteria and is therefore not measured in a multifrequency test.

Item 13: 1T48*PNL-68

a) Revise the SQRT form, particularly to note welds instead of bolts.

RESPONSE:

a) The SQRT form has been revised as requested during the review at the Site, and is submitted under Tab 13 of Attachment III. Field mounting by welding instead of bolting has been noted.

Item 14: 1T46*L/U059 (in 1H21*PNL-060)

a) Provide more detailed test data for the L/U (logic unit).

b) Revise the SQRT form, particularly to indicate g level.

RESPONSE:

a) More detailed test data for this Logic Unit was obtained from the vendor and provided for NRC review under Tab 14 of Attachment V.

b) The SQRT form has been revised as requested during the review at the Site, and submitted under Tab 14 of Attachment III.

Item 16: 1P41*MOV026

a) Revise the SQRT form, particularly the "PSAS" abbreviation.

RESPONSE:

a) The SQRT form has been revised as requested during the review at the Site, and is submitted under Tab 16 of Attachment III. The PSAS entry has been changed to read "Piping Analysis."

Item 17: 1B31*AOV082

a) Revise the SQRT form.

b) Provide a calculation of the frequency.

c) Confirm the maximum acceleration of the valve for the as-built configuration, considering the hydrodynamic loads and the flexibility of the pipe.

d) Provide operability evidence for the valve operator.

e) Provide the maximum acceleration for the associated valve inside the primary containment (1B31*AOV081).

f) Provide a schedule for installing the pipe support which had not yet been installed and confirm the adequacy of the support.

RESPONSE:

a) The SQRT form has been revised as requested during the review at the Site, and is submitted under Tab 17 of Attachment III.

b) The frequency analysis of the operator has been revised using the model changes requested by the NRC, and is provided under Tag 17 of Attachment V. Results show that the operator frequency is 63 Hz.

c) Pipe stress analyses based on design configurations for the audited item 1B31*AOV082 in the secondary containment and for an identical valve 1B31*AOV081 in the primary containment have been conducted on these 3/4 in. lines, using the revised model of this operator referenced in (b) above. Results were as listed below:

	Horizontal-g's	Vertical-g's
1B31*AOV082	0.6	0.6
1B31*AOV081	1.0	2.5

Confirmation of the limiting acceleration (g) valves for the as-built configurations will be provided after their as-built piping review is completed.

d) No additional information on the operability testing of this actuator is available. As shown in the vendor's report, the relative displacement between actuator stem and valve frame is 4.7 mils. Since the clearance provided is 131 mils, operability is assured for a combined seismic and hydrodynamic environment.

e) See response (c) above.

f) Installation of supports for small bore piping is not performed on a precise schedule known far in advance. Completion of the as-built piping review program will assure installation of required supports.

Item 18: 1E11*PCV003A

a) Provide a calculation of the frequency.

b) Confirm the maximum acceleration of the valve.

c) Consider the effect of hydrodynamic loads in light of the possible revised frequency.

d) Provide operability evidence for the valve.

e) Revise the SQRT form.

f) Provide information concerning the support of instrument lines (see exit interview request for statement and standard for small tubing).

RESPONSE:

a) The frequency analysis of the operator has been revised using the model changes requested by the NRC, and is provided under Tab 18 of Attachment V. Results show that the operator frequency is 33 Hz.

b) A pipe stress analysis based on the design configuration has been conducted on this 1" [illegible]n. line, using the revised model of this operator referenced in (a) [illegible]e. Results show 2.9 horizontal and 3.0 g's vertical accelerations [illegible] at the operator center-of-gravity from combined seismic and hydrodynamic load. Confirmation of the limiting acceleration (g) values for the as-built configuration will be provided after their as-built piping review is completed, as indicated in Item 5 of Attachment I.

c) The vendor designed this operator to 3.0 g's horizontal and vertical accelerations acting at the center of gravity of the operator with a 1.3 minimum factor of safety on stress. Since these accelerations including the factor of safety are above the required accelerations noted in (b) above, the adequacy of the actuator to withstand combined seismic and hydrodynamic loads is established.

d) No additional information of operability testing of this actuator is available. As shown in the vendor's report, the relative displacement between actuator stem and valve frame is 28 mils. Since the clearance provided is 111 mils, operability is assured for a combined seismic and hydrodynamic environment.

e) The SQRT form has been revised as requested during the review at the Site, and is submitted under Tab 18 of Attachment III.

f) Information concerning the support of instrument lines is provided in Item (3) of Attachment I.

Item 19: 1R23*T-102

a) Provide the mounting configuration (which could not be inspected during the visit due to the integrated flush activities).

b) Revise the SQRT form, particularly to note the frequencies of the several components.

RESPONSE:

a) Transformer 1R23*T-103 has been deenergized and its mounting has been inspected. Its mounting is described on the SQRT form and considered in the summary and evaluation under Tab 19 of Attachment III. The mounting of T-101 and T-102, is assumed to be the same and will be confirmed when access is possible.

b) The SQRT form has been revised as requested during the review at the Site including the frequency range, and is submitted under Tab 19 of Attachment III. As discussed in Item 12(e), the frequency of any components is not measured in a multi-frequency test.

Item 20: 1M50*PNL-04

a) Revise the SQRT form, particularly to indicate the weight and the frequency range.

RESPONSE:

a) The SQRT form has been revised as requested during the review at the Site, including the weight and the frequency range covered by the test, and is submitted under Tab 20 of Attachment III.

Item 21: 1H11-PNL-SNP

This item was dropped because it is not safety-related.

Additional Item 2: 1B21*PS020 (B21N015)

a) Provide information by Stone & Webster concerning the support of small tubing.

RESPONSE:

a) This information is provided in Item (3) of Attachment I.

Additional Item 5: 1C11*LS095 (C11N013)

a) Provide an evaluation of the safety significance of contact chatter.

RESPONSE:

a) The test results for this pipe-mounted level switch show malfunction (onset of chatter) limits of 1.3 g's horizontal and vertical for frequencies below 30 Hz and .4 g's for frequencies above 30 Hz. The pipe stress analysis gives accelerations including all modal contributions equal to 1.0 g's horizontal and .8 g's vertical, as shown by an SRSS of modal accelerations. The contribution above 30 Hz is less than .1g . Hence, this evaluation demonstrates that the level switch can withstand the Shoreham dynamic environment from combined seismic and hydrodynamic loads, without reaching unacceptable chatter.

Additional Items 6 and 7: 1E51*RV145 and 1E51*RV149

a) Revise SQRT form, particularly to indicate the natural frequency of the internal components.

b) Either confirm that no chatter occurs or provide an evaluation of the safety significance of chatter.

c) Correct the drawing to show the actual set pressure.

RESPONSE:

a) The SQRT form has been revised as requested during the review at the site, and submitted under Tab A6 of Attachment III. Based on the frequency analysis under Tab A6 of Attachment V, a note has been added to the SQRT form stating that the frequency of the spring is considerably higher (307 vs 68 Hz) than the valve frequency, and that steam released by chatter (unlikely in view of the high frequency of the spring) has no impact on safety.

b) Although chatter of these relief valves is unlikely because the spring is quite stiff (307 Hz), its occurrence would have no impact on safety, since the discharge is to the drainage system.

c) The drawings has been revised to call out the correct set pressure for both relief valves.

Additional Item 8: 1T46*AOD040

a) Provide a record of how the hydrodynamic loads were considered.

b) Clarify the fequency (40 Hz, not 60 Hz).

c) Modify the input g level due to the frequency modification.

d) Provide operatility evidence for the limit switch.

e) Provide operability evidence in the SQRT form for the actuator.

RESPONSE:

a) A record of how hydrodynamic loads were considered is provided in the Qualification Summary and Evaluation submitted under Tab A8 of Attachment III.

b) Review of the vendor's calculation shows that the correct fundamental frequency of the damper is 40 Hz, which is reflected in the SQRT form submitted under Tab A8 of Attachment III.

c) The input g-level has been modified to reflect the frequency change. The modified g level in combination with a multi-mode factor of 1.5 is accommodated by the 3.2 minimum factor of safety shown in the vendor's stress report, as noted in the SQRT form.

d) Operability monitoring and results for this limit switch are contained in the Table II Summary, Item No. 19 of the vendor's test report. A copy of this Table is provided under Tab A8 of Attachment V, showing that the limit switch performed its function to established requirements.

e) The SQRT form has been revised to acknowledge operability evidence for the actuator, and is provided under Tab A8 of Attachment III. Since the limit switch of (d) above and the actuator were tested as a unit, the results of the testing are summarized on one page (page 3 of the form) which is used for qualification by test. A copy of the operability monitoring results for both limit switch and actuator is provided under Tab A8 of Attachment V (Test Items No. 19 and 17, respectively).

Additional Item 9: 1T46*MOD034

a) Provide a record of how the hydrodynamic loads were considered.

b) Provide operability evidence in the SQRT form for the actuator.

c) Revise the stress calculation to reflect transmissibility, including a factor of 1.5.

d) Provide a stress calculation for the hold-down bolts to the bonnet, including a factor of 1.5.

e) Provide operability evidence for the limit switch.

RESPONSE:

a) A record of how hydrodynamic loads were considered is provided in the Qualification Summary and Evaluation contained under Tab A9 of Attachment III.

b) Operability evidence for the actuator has been acknowledged in the SQRT form, and is summarized under Tab A9 of Attachment III in the Qualification Summary and Evaluation.

c) The effects of transmissibility were evaluated based on the frequency analysis described below instead of a stress analysis.

Since the actuator is mounted on a horizontal frame of considerable extension from its attachments to the reactor building wall, a frequency analysis was carried out to determine the transmissibility effects at the actuator base. As shown in this analysis, provided under Tab A9 of Attachment V, the frequency is 24 Hz. From the spectra supplied with the SQRT form and using a multi-mode factor of 1.5, this frequency corresponds to input accelerations required at the actuator base of 2.0 g's horizontal and 1.5 g's vertical, which are well below the test levels.

d) It is concluded based on the considerations presented in (c) above, that the adequacy of hold-down bolts to withstand combined seismic and hydrodynamic loads was demonstrated by test, and therefore a stress calculation is not required.

e) Excerpts from the vendor's test report are provided under Tab A8 of Attachment V, demonstrating that the limit switch performed its function to established requirements (same switch as used in Item A8).