UNITED STATES
NUCLEAR REGULATORY COMMISSION
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G. Bagchi
PDR

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MEMORANDUM FOR: Vincent S. Noonan, Chief
Equipment Qualification Branch
Division of Engineering

FROM: T. Y. Chang
Equipment Qualification Branch
Division of Engineering

THRU: Goutam Bagchi, Section Leader
Equipment Qualification Branch
Division of Engineering

SUBJECT: SECOND TRIP REPORT FOR SEISMIC CRITERIA IMPLEMENTATION REVIEW MEETING WITH LOUISIANA POWER & LIGHT COMPANY (LP&L) ON WATERFORD NUCLEAR POWER STATION UNIT 3

The Seismic Qualification Review Team (SQRT), consisting of engineers from the Equipment Qualification Branch (EQB) and the Idaho National Engineering Laboratory (INEL, EG&G), conducted two site visits to Waterford Nuclear Power Generating Station Unit 3 near New Orleans, Louisiana, during the periods of September 14 through September 18, 1981, and August 30 through September 3, 1982. The visits served two purposes: (1) to perform a plant site review of the seismic and dynamic qualification methods, procedures, and results for selected safety-related mechanical and electrical equipment and their supporting structures, and (2) to observe the field installation of the equipment in order to verify and validate equipment modeling employed in the qualification program. The trip report for the first site visit was issued on August 30, 1982. This present trip report is a report about the second site visit.

The background, review procedures, findings and required follow-up actions are summarized below. A list of attendees at the conference is contained in Attachment I, and a list of the equipment selected for audit is shown in Attachment II. The SQRT visit report is included as Attachment III.

1. Background

The applicant has described the equipment qualification program, consisting of analysis and dynamic testing, in Sections 3.9 and 3.10 of the Final Safety Analysis Report (FSAR). This program is used to confirm the ability of seismic Category I mechanical and electrical (includes instrumentation and control) equipment and their supports, to function properly during and after the safe shutdown earthquake (SSE) specified for the plant.

The plant site reviews were performed to determine the extent to which the qualification of equipment, as installed in Waterford 3, meets the current licensing criteria as described in the Standard Review Plan (SRP) Sections 3.9.2 and 3.10.

2. Review Procedures

Prior to the site visits, the SQRT reviewed the equipment seismic qualification information contained in the pertinent FSAR sections and the reports referenced therein. Representative samples of seismic Category I mechanical and electrical equipment, including both NSSS and BOP scopes were selected for each plant site review. The review consisted of field observation of the actual equipment configuration and its installation, followed by the review of the corresponding test and/or analysis documents. Brief technical discussions were held during the review sessions to provide SQRT's feedback to the applicant on the equipment qualification. An exit conference was held to summarize and conclude the plant site visit.

3. Findings

The results of field observations and the review of the qualification reports and pertinent documents for equipment as listed in Attachment II are summarized in Attachment III for each piece of equipment evaluated.

The two plant site reviews identified a need to provide additional information on some generic issues and certain clarifications for individual pieces of equipment. A subsequent submittal, dated September 27, 1982, resolved most of the open issues/items from the first review. The remaining open issues/items from the first review, and those from the second review are presented in the following section.

4. Issues/Items for Follow-Up Actions

4.1 Generic Issues/Items

1) There are still equipment and component mostly in BOP instrumentation and control area not seismically and dynamically qualified at the time of the second SQRT audit. The status and schedule of qualification of these equipment were requested by the SQRT in the second audit. Subsequently a status report was received by the SQRT on September 2, 1982. This status report should be submitted monthly for staff review until completion of qualification of all safety-related equipment. All safety-related equipment should be qualified before fuel loading.

2) An evaluation of Waterford 3's seismic qualification program should be performed by the applicant using the applicable criteria from Standard Review Plan Section 3.10 to ensure that all safety-related equipment has adequate margin to perform their intended design functions during seismic events when considering the effects of possible multi-mode response and simultaneous vertical and horizontal excitations on equipment operability. The applicant has not yet provided any report indicating the results of such a review.

The applicant provided draft justification during the second SQRT audit, which concluded that the equipment qualified by the IEEE 344-1971 Standard can still be demonstrated to be qualified, and therefore operational, using current NRC criteria. The justification is basically relying on the following: (1) all floor response spectra have only one peak response, namely, they are all narrow band, (2) peaks occur at very low frequency due to the dominant soft soil response around 1.6 Hz for horizontal peak and 2.2 Hz for vertical peak, (3) the response spectra values decay rapidly and monotonically so that all practical purposes the zero period acceleration (ZPA) is reached at 5.0 Hz, and this is much lower than 33 Hz used for most plants, (4) the SSE ZPA values on all floors are equal to or less than 0.5g horizontally and 0.4g vertically.

The staff reviewed the above justification and compared them with containment structure floor response spectra contained in Section A of CBI Stress Report for Waterford Station Unit 3 Steel Containment Vessel (Prepared by CBI, December 6, 1977). These justifications apparently are valid for various containment floor response spectra in the vertical direction, however, not all the justifications are applicable for containment floor response spectra in the horizontal directions. Generally, for horizontal spectra in the containment, there are more than one peak responses; furthermore, the zero period acceleration is reached not at 5.0 Hz, but closer to 8.0 Hz. Therefore, the applicant should identify equipment that are qualified by single frequency and/or single direction test which are not covered by the justification provided by the applicant as mentioned above. Additional justification should be provided by the applicant on the qualification of these equipment.

3) The effect of aging on the seismic capacity of equipment located in the mild environment should be addressed by the applicant.

The applicant indicated that surveillance and periodic testing program will be established in lieu of actually aging the equipment before subjecting it to seismic testing. Inservice testing and inservice inspection program of pumps and valves will be submitted to NRC for review by October 1, 1982. Normal maintenance program for electrical equipment is in the process of preparation by the applicant. The applicant is committed to provide samples of this program for NRC review when this program is completed.

4) Seismic qualification of complex electric equipment by analysis alone to ensure operability is highly questionable, and IEEE 344-1975 cautions against this. The failure mode of such equipment may not be adequately addressed by purely analytical method. For example, it is a common practice to qualify some

large electric motors seismically by analytical means; however, the insulation by wiring in the motor may become brittle after a certain duration of service due to the aging of the insulation. Thus in reality the motor may not be able to perform its designed safety function during and after earthquake.

The applicant should perform a review of all electrical equipment where operability qualification was performed by analysis, and provide additional justification for the validity of the qualification by providing supporting test information on similar items and/or specific reasons why operability can be assured on the basis of analyses alone.

5) From the first site visit, it was noticed that during the review of NSSS-PE-10 (Deborating Ion Exchanger), NSSS-PE-15 (Purification Filter) and NSS-PE-33 (Hold Up Tank), nozzle loads were neglected in the stress analysis. This seems to be a generic pattern for all ASME Section VIII tanks and vessels in the NSSS scope.

The applicant informed the SQRT during their second site visit that nozzle loads have actually been simulated in the original analyses for all ASME Section VIII tanks and heat exchangers. The applicant further notified the SQRT that a follow-up effort was conducted where nozzle loads were directly evaluated for each specific component, and this analysis verified the validity of the original designs. The applicant is committed to send a letter to the staff to confirm the result of this analysis by October 1, 1982.

6) Walkdown from the second audit revealed that there are still air lines and heater cables not connected (because of on-going testing), and loose cables (not yet tied down) are noted in several of the electrical cabinets. In addition, there are items from the first audit that modification should be made, such as the change of design of the hold up tank. This generic concern will be followed up by the NRC resident inspectors.

4.2 Specific Open Items:

Clarification, verification and/or confirmation should be provided for the following items:

1) Control Components (BOP-E-68, first visit). Confirm that components which malfunctioned in the qualification testing are not included in Waterford safety systems, or confirm that the malfunctions will not adversely affect the systems.

2) Pressure Switch (NSSS-ICE-16, first visit), and Low Oil Pressure Switch (NSSS-PE-31, first visit). Assurance must be

provided that chattering of the switches will either not occur or will not be detrimental to safety should it occur.

3) Boric Acid Makeup Pump (NSSS-PE-14, second visit).

   a) An explanation must be provided for load cases 4 and 5 which shows that they are conservative.

   b) An explanation must be provided for the load combinations used in computing bolting stresses which shows that they are conservative.

4) Boric Acid Tank Circulating Valve (NSSS-PE-25, second visit).

   a) Verification must be provided for the computer calculations based on Engineering Standard ES100, Revision B, dated 4/8/75.

   b) Confirmation must be provided that the deflections calculated in Seismic Analysis for Order 1-46610, dated 4/3/76, for Tag No. CH-511, will not cause interference on valve closure.

5) Holdup Tank C (NSSS-PE-33, first/second visit). Assurance must be provided that required support modifications have been completed.

6) Resistor Input Card (NSSS-ICE-5a, second visit). Verification must be provided that operability of the resistor input card was demonstrated by testing.

7) 1151 Indicator (NSSS-ICE-8-1, second visit). Confirmation must be provided that the 5% variation observed during testing is not detrimental to safety.

8) CEDM Reed Switch Position Transmitter (NSSS-ICE-15, second visit). A test report must be provided which demonstrates an adequate basis for the qualification of the transmitter.

The review of the applicant's implementation of the equipment qualification program is continuing and the applicant is required to resolve all outstanding items as identified above in an expedient manner.

Ti-yi Chang

T. Y. Chang
Equipment Qualification Branch
Division of Engineering

Enclosure:
As stated

cc: R. Vollmer, w/o closure
W. Johnston
T. Novak
G. Knighton
S. Black
V. Noonan
G. Bagchi
A. Lee
J. Jackson
J. Singh, INEL
M. Reich, BNL

ATTACHMENT I
SQRT VISIT TO WATERFORD 3

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. Mowry	EBASCO
S. Nath	EBASCO
R. L. Novgrod	LP&L s/u
J. Parello	W RD
H. Parikh	EBASCO
R. Prados	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
V. Tokarz	C-E (PE)
J. Tompeck	EBASCO
R. Vidal	EBASCO
M. G. Williams	LP&L
J. Zudans	NUS

ATTACHMENT II
SQRT VISIT TO WATERFORD 3

LIST OF EQUIPMENT SELECTED FOR AUDIT

a) NSSS Equipment

1. BORIC ACID MAKEUP PUMP (NSSS-PE-14)
2. BORIC ACID TANK CIRCULATING VALVE (NSSS-PE-25)
3. BORIC ACID PUMP DISCHARGE VALVE (NSSS-PE-24/29/28)
4. HOLDUP TANK C (NSSS-PE-33)
5. FEEDWATER CONTROL VALVE (NSSS-PE-52)
6. RESISTOR INPUT CARD (NSSS-ICE-5a)
7. 1151 INDICATOR (NSSS-ICE-8-1)
8. RESISTANCE TEMPERATURE DETECTOR (NSSS-ICE-10-1)
9. RCP SIGNAL PROCESSOR (NSSS-ICE-2f)
10. REACTOR TRIP SWITCHGEAR CABINET (NSSS-ICE-3)
11. RECORDER (NSSS-ICE-9-1)
12. CEDM REED SWITCH POSITION TRANSMITTER (NSSS-ICE-15)
13 ROSEMOUNT PRESSURE TRANSMITTER (Model PT-101D)

b) BOP Equipment

1. 20 KVA INVERTER (SQ-E-10)
2. DIESEL GENERATOR LUBE OIL PIPING (SQ-E-74/76)
3. LEVEL SWITCH (SQ-E-84)
4. AXIAL FAN (SQ-HV-11)
5. HVAC WATER PUMP (SQ-HV-13)
6. GRAVITY DAMPER (SQ-HV-39)
7. THREE INCH 150 LB DIAPHRAM VALVE (SQ-MN-57)
8. ONE INCH 2500 LB RELIEF VALVE (SQ-MN-148)

9. HALF-INCH GLOBE VALVE (SQ-MN-255)
10. 1151 INDICATOR (SQ-IC-1)
11. ELECTRIC RELAY (SQ-IC-60)
12. FOUR INCH 300 LB GATE VALVE (SQ-MN-106)