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Docket No. 50-271

Mr. J. B. Sinclair
Licensing Engineer
Vermont Yankee Nuclear Power
Corporation
1671 Worcester Road
Framingham, Massachusetts 01701

JUN 9 - 1983

Dear Mr. Sinclair:

SUBJECT: MARK I CONTAINMENT LONG TERM PROGRAM - PLANT UNIQUE ANALYSIS REPORT LOADS EVALUATION

Re: Vermont Yankee Nuclear Power Station

The NRC staff and its consultant Brookhaven National Laboratory (BNL) are reviewing the structural aspects of your plant unique analysis report. As a result of our review to date we have prepared the enclosed request for additional information.

To expedite this review it is requested that within three weeks of the date of this letter a meeting between the NRC and our consultants, and you and your contractor be held to discuss your response to these issues. Since it is our intent to resolve these issues at this meeting, it is imperative that you have a representative at this meeting that has the authority to make the decisions necessary to accomplish this goal.

It is suggested that this meeting be held at your contractors office; however, we are amenable to having it wherever it is most convenient. Please notify your project manager within seven days of receipt of this letter with a proposed meeting date. If you cannot meet the three week schedule, propose an alternative one.

This request for information was approved by the Office of Management and Budget under clearance number 3150-0091 which expires October 31, 1985.

Sincerely,

ORIGINAL SIGNED BY

Domenic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing

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P PDR

Enclosure: As stated

cc w/enclosure
See next page

OFFICE	DL:ORB#2	DL:ORB#2	DL:ORB#2	DL:ORB#2		
SURNAME	SNorris	VRooney	Siegel:pob:P-22	DVassallo		
DATE	6/6/83	6/6/83	6/10/83	6/9/83		

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"REQUEST FOR ADDITIONAL INFORMATION
RELATED TO THE MARK I PUAR REVIEW FOR
VERMONT YANKEE"

ITEM 1: PUAR section 2.2.1, AC section 2.13.8.2 & 2.13.8.3

The temperature monitoring system described in the PUAR using a total of 10 thermocouples placed at 5 different torus locations differs from the Acceptance Criteria in several important respects. For local temperature the criteria state that "For practical purposes, the average water temperature observed in the sector containing the discharge device at shell locations on the reactor side of the torus downstream of the quencher centerline at the same elevation as the quencher device and at the quencher support may be considered as the "local temperature". In Vermont Yankee the thermocouples are on the "outboard" side of the torus (side away from the reactor) and for two of the four SRV discharge bays are upstream of the quencher centerline. There are no thermocouples at or near the quencher supports. Therefore, measuring local temperature in the sense of the Acceptance Criteria cannot be accomplished by this system. For bulk temperature the criteria state that "Each licensee shall demonstrate that there is a sufficient number and distribution of pool temperature sensors to provide a reasonable means of bulk temperature". The brief description and illustration in the PUAR do not demonstrate that a reasonable measure of the bulk pool temperature can be obtained from the Vermont Yankee sytem. The PUAR does not make clear whether the intention at Vermont Yankee is to measure bulk pool temperature or to measure local temperature directly, or both. Explain how the local temperature limit is to be determined from bulk pool measurement or direct local measurement, and justify the adequacy of the corresponding measurement in light of the above comments regarding differences from the Acceptance Criteria.

ITEM 2: PUAR section 3.2.1, AC section 2.4

Regarding the pool swell loads on the torus shell, describe how the longitudinal and azimuthal multipliers (LDR Table 4.3.2-1) were used in conjunction with the submerged pressure histories to perform the torus shell evaluations. Provide an example of a time history at a particular location (e.g., θ = 180° at $Z/_L$ = 0.0) to illustrate their use.

ITEM 3: PUAR section 3.2.3, AC section 2.12.1

Regarding the pre-chugging and IBA/CO load analysis, the PUAR states that results for the symmetric pre-chug load were developed directly from the unit-load harmonic analysis done for CO. Does this mean that the water mass was accounted for as in CO (i.e., 100% water mass), and was this loading applied for the cycle duration stated in the LDR?

ITEM 4: PUAR section 3.2.4, AC section 2.13

The PUAR states that the modeling of the water mass in the SRV load computer model was fraught with difficulty. When the water mass was included in the model, measured outputs could not be reproduced by applying measured input to the computer model. A dry structure analysis produced acceptable results, however, and therefore, the dry structure analysis method was subsequently used as a basis for all SRV analysis. This is a very troublesome point. Since there is no physical reason cited in the PUAR for using a dry containment in the SRV analysis, one is left with the impression that there is an error somewhere in the modeling which is fortuitously compensated for by introducing a second modelling error, i.e., non-inclusion of the water in the torus. A further difficulty is the implication these modelling results have for other loads such as CO and chugging for which a fluid-structure computer model is also used and where the water was included in the analysis. Since no verifying measurements for these loads could be made, the possibility exists that these calculations are badly off the mark. Justify the exclusion of the torus water from the SRV analysis on physical grounds and explain why these physical reasons differ for the CO and chugging loads.

ITEM 5: PUAR Appendix 1, AC section 2.13.9

The Acceptance Criteria call for the torus shell to be instrumented with strain gages, accelerometers, and pressure transducers during SRV in-plant tests. Since no accelerometers were used in the Vermont Yankee torus, explain how data from the other instrumentation was used to compensate for the lack of accelerometers.

ITEM 6: PUAR Appendix 1, AC section 2.13.9

Appendix 1 of the PUAR mentions that calibration factors relating predicted to actual pressures and predicted to actual frequencies were obtained by comparing OBUBS02 calculated values with the same quantities measured in the four in-plant tests. This appendix further states that verification of the computer model led to a further calibration factor for the column loads. Provide more details on how the calibration factors relating QBUBS and the in-plant tests were obtained, especially how the Vermont Yankee method conforms to the model calibration guidelines of the Acceptance Criteria (AC section 2.13.9.2). Provide information on the actual forcing function used including amplitudes, frequency content and pressure wave forms. Were separate calibration factors obtained for subsequent actuations? Also provide more detail on the calibration factor for column loads and explain why it is invariant over the frequency range of the loading.

ITEM 7: PUAR section 4.2, AC section 2.10
The static load magnitude imposed on the vent header deflector in the analysis described in the PUAR seems appropriate if Figure 4.3.9-1 in the PULD accurately shows the initial impact pressure spike. Does this figure show the correct impact magnitude or should it be modified as per paragraph 1. of section 2.10.1 of the Acceptance Criteria?

ITEM 8: PUAR section 4.3.2, AC section 2.12.2
Regarding the downcomer lateral chugging loads: What is the fundamental tied downcomer frequency? What was the corresponding dynamic load factor? What was the resultant static equivalent load used in the stress analysis of the downcomer?

ITEM 9: PUAR section 4.3.2, AC section 2.12.1
For synchronized multiple downcomer lateral chugging loads, the Acceptance Criteria Specification is based on an exceedance probability for 10^{-4} per LOCA. The PUAR shows that two load cases were considered for multiple lateral loads. Why were only two load cases necessary and what static loads were applied? To what exceedance probability did these load magnitudes correspond?

ITEM 10: PUAR section 4.3.1.1, AC section 2.6.2
In the calculation of stresses in the downcomers resulting from pool swell water impact, was the virtual mass of water near the downcomer accounted for, and was the 8 psid pressure called for in the Acceptance Criteria applied over the bottom 50° of the angled portion of the downcomer?

ITEM 11: PUAR section 4.3, AC section 2.14
Were the LOCA bubble drag loads calculated according to Acceptance Criteria specifications as given in section 2.14.2 of the AC?

ITEM 12: PUAR section 5.2
Many of the ring girder loads for Vermont Yankee were analyzed using a computer model constructed for another Mark I plant of "similar" dimensions. What is the other plant? What are the dimensions of the ring girder and surrounding shell structure of this other plant? Are attachments to the ring girder similar? Were the loads used on this model the Vermont Yankee loads or the loads from the other plant?

ITEM 13: PUAR section 5.3.2, AC section 2.14
Calculation of ring girder drag loads were not in accordance with the Acceptance Criteria. Therefore provide the details of a submerged structure load calculation for a given segment of the ring girder. Include numerical values of a VT/D calculation, as well as source strength, as a function of frequency. In addition, provide the acceleration volume, drag coefficient, interference effect multiplier and pertinent geometric parameters and configuration used in the calculation.

ITEM 14: PUAR section 5.3.2, AC section 2.14.5
The PUAR states that FSI effects are accounted for in the submerged structure loadings. Additional detail is needed on how this was done. Is the criteria for including FSI effects the same as that stated in the AC? How were the FSI loadings obtained? Is the boundary acceleration added to the local fluid acceleration as suggested in the AC or has another method been used?

ITEM 15: PUAR section 7.1.3
The PUAR states that the catwalk structure stresses were computed without the catwalk grating. Does this mean that the grating is normally absent and will only be put in place when the catwalk is used? If the grating is always in place, by what amount will it raise catwalk stresses?

ITEM 16: PUAR section 8.1, AC section 2.13.8, NUREG-0783 section 5.1
The use of a local temperature of 210° in the equation for mass flux rate 42 #m/sec-ft^2 on p. 105 of the PUAR seems to be based on a misinterpretation of the guidelines in NUREG-0783. In order to get to

210°, the quencher submergence must be at least 14 ft (14 ft of water corresponds to a total pressure of about 20.8 psi, so the saturation temperature is 230°. Subtract the 20° subcooling and one gets 210°). Although no exact submergence of the quencher for Vermont Yankee can be found in the PUAR, it can't be much more than 7 ft. Therefore, the saturation temperature minus the 20° subcooling at that submergence will be not much above 200°F. Also, Fig. 8-1 does not clearly answer the question of maximum bulk pool temperature. What is the maximum bulk pool temperature reached during any of the transients required for consideration and does it conform to the Acceptance Criteria in light of the above comments?

ITEM 17: AC section 2.1

Section 2.1 of the Acceptance Criteria states that "as part of the PUA, each licensee shall specify procedures (including the primary system parameters monitored) by which the operator will identify the SBA, to assure manual operation of the ADS within the specified time period. Longer time periods may be assumed for the SBA in any specific PUA, provided (1) the chugging load duration is correspondingly increased, (2) the procedures to assure manual operation within the assumed time period are specified, and (3) the potential for thermal stratification and asymmetry effects are addressed in the PUA."

The PUAR does not specifically address the above requirement. Clarification is needed.

ITEM 18: PUAR section 4.3.1, AC section 2.6

Provide pool swell impact and drag transient histories used in the calculation of pool swell loads on the main vent, vent header and downcomers. Provide enough detail to show how the load histories applied at the nodal points of the shell and beam models comply with the Acceptance Criteria.

ITEM 19: PUAR section A1, AC section 2.14.3 and 2.14.4

Use of SRV test data for submerged structure drag loads represents an exception to the Acceptance Criteria. The method described in Appendix 1 of the PUAR needs to be reviewed further, however, several problems which arise immediately are listed here:

(1) The frequency content of different SRV load cases have been shown by experience to be different - multiple valve actuations show a lower frequency content than single valve tests. The PUAR method does not address this problem. Arguments in the PUAR that "structures involved are responding to a fairly uniform random field" are unconvincing.

(2) Using a uniformly distributed pressure as a way to obtain static loads giving strains equivalent to those measured can lead to nonconservatisms when Figure A1-5 is used to predict static drag pressures on structures whose geometry is different from those on which the strains were measured.

(3) Scaling the static drag pressure upward from test conditions to more severe SRV cases by the ratio of calculated shell pressures is an oversimplification which uses a global parameter to scale local effects. The local pressure on a submerged object due to simultaneous multiple SRV actuation can ratio very differently from the torus shell pressures, depending on the phasing and location of the quencher relative to the object.

ITEM 20: PUAR section 6.0, AC sections 2.14.3 and 2.14.4
The PUAR analysis of the T-quencher, its support and the submerged portion of the SRV line does not mention quencher water jet or bubble drag loads on these structures. Where have these loads been included or why have they been ignored?

ITEM 21: Provide the loads that were used in the torus attached piping.