JUL 7 1981

Docket No.: 50-389

RECEIVED
JUL 13 1981
U.S. NUCLEAR REGULATORY COMMISSION

Dr. Robert E. Uhrig
Vice President
Advanced Systems and Technology
Florida Power & Light Company
P. O. Box 529100
Miami, Florida 33152

Dear Dr. Uhrig:

SUBJECT: ST. LUCIE PLANT, UNIT 2 FSAR - REQUEST FOR ADDITIONAL INFORMATION

From the review of your application for an operating license by the Structural Engineering Branch, we find that we need additional information regarding the St. Lucie Plant, Unit 2 FSAR. The specific information (a copy of which was provided to Mr. Dotson on 6/9/81) required is listed in the Enclosure.

Responses to the enclosed request should be submitted by July 10, 1981. If you cannot meet this date, please inform us within seven days after receipt of this letter of the date you plan to submit your responses.

Please contact Mr. Nerses (301-492-7468), St. Lucie 2 Project Manager, if you desire any discussion or clarification of the enclosed report.

Sincerely,

Original signed by
Robert L. Tedesco
Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

cc: See next page.

Enclosure:
As stated

JUL 28 1981

SEE PREVIOUS CONCURRENCE.

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OFFICE	DL:LB#3	DL:LB#3	DL:AD/L				
SURNAME	VNerses/wt	FMiraglia	RLTedesco				
DATE	6/6/81	6/ /81	6/ /81				

JUL 7

NRC PDR
Local PDR
Docket File
Branch File
DEisenhut
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TMNovak
GLainas
JKnight
VNoonan
DMuller
PCheck
WKreger
LRubenstein
FSchroeder
RHartfield, MPA (Q-1's & Q-2's only)
ELD
IE (3)
BGrimes
MErnst
FMiraglia
ASchwencer
BJYoungblood
JRMiller
NSIC
ACRS (16)
TERA
RLTedesco
HPolk

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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ST. LUCIE

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JUL 7 1981

ST. LUCIE UNIT 2

STRUCTURAL ENGINEERING BRANCH

REQUEST FOR ADDITIONAL INFORMATION

220-1

220.1 (3.3.1) Table 3.3.1 lists the Auxiliary Building as being designed for a torando velocity of 300 mph while the other buildings are designed for 360 mph. The Containment Shield Building is omitted from this Table. Section 3.3.2.2 states the Shield Building is designed for 300 mph. Correct Table 3.3-1 to reflect your actual design velocities. Justify in detail why the velocity of 300 mph is used instead of 360 mph. Sumbit your supporting calculations.

220.2 (3.3.2.2) Provide your basis and method of calculations to support the pressure differential in the Diesel Generator Building of 2.25 psi. If venting is considered in any other building,provide method of computing differential pressures.

220.3 (3.5.3.1.1) You stated in Section 3.5.3.1.1 that the modified Petry Formula was used to evaluate the concrete for missile protection. The current requirement for computing required concrete wall thicknesses is the NDRC Formula. Submit a table showing the required wall thicknesses compared with the actual wall and roof thicknesses for all Category I structures, based on the NDRC Formula.

220.4 (3.4.1) In Section 3.4.1 you stated that polyvinyl chloride (PVC) water stops were used in the construction joints. When PVC is exposed to radiation, it converts into hydrochloric acid which will attack the concrete. Show that the water stops will not be degraded by radiation.

220.5 (3.5.3) On Page 3.5-24 you stated the maximum thickness of concrete barriers is two feet. What is the minimum thickness provided and show that this is enough to stop the potential missile using the NDRC Formula.

220.6 (3.5.3.1) Describe your procedure used to predict thicknesses which prevent spalling or scabbing of concrete barriers and generation of secondary missiles.

220.7 (3.5) Provide label on ordinate of Figure 3.7-5.

220.8 (3.7.1) State where the design time history is applied to the mathematical model relative to the finished grade. If deconvolution procedures are used describe these procedures and furnish the response spectra computed for the input to the math models shown in Figure 3.7-30 thru 3.7-51.

220.9 (3.7.1) Some of the response spectra points computed for the artificial time histories fall below the design response spectra. Show that no more than 5 points fall more than 10% below the design spectra for each damping value.

220.10 (3.7.2) Your seismic models include provisions for structural torsion, however, the soil springs do not include a torsional component. Describe how you account for the torsion at the foundation soil interface.

220.11 (3.7.3.12) In Table 3.7-24 the maximum moment at mass points 20, 22, 23 and 24 show smaller values for the time history method than for the response spectra method. Explain these differences since the time history method is expected to yield a larger response than the response spectra method. This situation exist for other structures shown in other tables.

220.12 (3.7.2) The natural frequency of 70.36 Hz shown in Table 3.7-18 for Es = 40 ksi, E-W Direction, Mode 1, is in error. What is the correct frequency?

220.13 (3.7.3) Outline the method used to account for differential structural movement during an earthquake for piping that is supported by different seismic Category I structures.

220.14 (3.7.3)	Describe the method used to analyze the Turbine Building for seismic motion.
220.15 (3.7.3)	Describe your criteria for system/subsystem decoupling. Standard Review Plan 3.7.2 contains an acceptable criteria.
220.16 (3.7.3)	The comparison points in Table 3.7-38, sample problem 2 do not match. Show other point comparisons for each problem and show points where difference between methods is a maximum.
220.17 (3.7.3.9)	In Section 3.7.3.9, Item C, you used the words "significant support displacement". Define the threshold of significant and the basis for this lower bound if a lower bound is used.
220.18 (3.7.3.3)	In Section 3.7.3.3 you stated sufficient mass points will be included in the model and sufficient dynamic modes computed. Define "sufficient" for number of mass points and dynamic modes.
220.19 (3.7.3.4)	In Section 3.7.3.4 what is your criteria for moving the frequency of the subsystems with respect to the supporting system?

220.20 (3.7.3.7) Your modal response combination procedure (Section 3.7.3.7) uses only SRSS and omit consideration of closely spaced modes. Use Regulatory Guide 1.92 for combinaing modes that are closely spaced and correct the appropriate loads.

220.21 (3.7.3.1) Your procedure in Section 3.7.3.1.1 a, 1, (b) for determining piping support locations is unnecessarily complicated. State the frequency you intend to use for support spacing.

220.22 (3.7.3.12) Your description of the method for analyzing the buried seismic Category I piping and tunnels is very sketchy. Provide a more detailed procedure and copies of calculations including any referenced material.

220.23 (3.7.3) What method is used to determine the composite damping for the reactor vessel and the primary loop system.

220.24 Provide a comparison of results of Unit 1 seismic analysis to the results of Unit 2 analysis to support your conclusion this site is a "Multi-unit site" addressed by Regulatory Guide 1.12.

220.25 (3.5) The ductility relationships for reinforced concrete beams and slabs are larger than those acceptable to the staff. Reevaluate your concrete beams and slabs for a ductility of $\frac{.05}{P-P'} \leq 10$. The ductility ratios for steel members are larger than those acceptable to the staff. Reevaluate the beams for a ductility ratio of 10 and columns with a $Kl/r \leq 20$ for a ductility ratio of 1.3. For columns with a $kl/r > 20$ use a ratio of 1.0.

220.26 (3.8.2) Provide a comparison of your load combinations with the load combination equations in Standard Review Plan 3.8.2, II.3 and address the effects of not meeting the load combinations, including any loads that are missing from your combinations.

220.27 (3.8.2.4) Describe how the containment steel shell is anchored to the concrete foundation slab. Describe the procedures used to account for the shear stresses between the steel shell and the concrete on both sides of the ellipsoidal head for the loads which will produce these stresses.

220.28 (3.8.2) The methodology used to analyze the containment shell to guard against buckling is not completely described. Provide the following:

(1) Details of the assumptions and boundary conditions used in the analyses of the dome and the cylinder and justify why the analysis for each section was done separately.

(2) All the load combinations which are considered critical (the limiting cases) for the buckling analysis. For each load combination state the most likely effected regions of the shell for this type of compressive loadings.

(3) Compare and justify the methodology used in your analysis with the acceptable methods stated in the current version of the ASME Code subsubarticle NE-3100. Provide a discussion of the factor of safety for each service level.

(4) Provide a copy of the referenced papers used in the buckling analysis of the containment shell.

220.29
(3.8.3)

State the code used in the design of the steel structural supports for the reactor coolant system and show a comparison of the code used to the current version of the ASME Code Section III, Division I, Subsection NF. Also show a comparison of the ACI 349 Code to the ACI 318-71 Code you used for design of the Concrete Internal Structure.

220.30 (3.8.3.4) You stated that the allowable stress for the factored load combinations was increased. These load combinations contain the earthquake loading. The staff does not allow any increase in the allowable for earthquake loads. Reevaluate the structures without the increase in the allowable stresses and provide the results of your reevaluation.

220.31 (3.8.3) (3.8.4) In several analysis you have used static loads to represent a dynmaic loading. Provide your procedures for transforming the dynamic loads into static loads.

220.32 (3.8.3.4) You stated that the cable tray restraints were designed for a "minimum natural frequency within 16 hz". You further say the HVAC restraints are designed with a minimum natural frequency of 15 hz. What provisions were made to ensure the first natural frequency was 15 or 16 hz and how do you account for higher modes in the systems? Also state how the restrains are anchored to the structure. FSAR Section 3.8.3.1.5 contains several restraint designs.

220.33 (3.8.5.5) You stated you used only the passive earth pressure on the portion of the structures to resist sliding. Discuss how you accounted for this load on the walls and provide a table showing the structure and the maximum earth pressure.

220.34 (3.8.5.2) State the codes used and list any deviations to the codes used for foundation design. Compare the codes used to the present version of the codes showing deviations and the effect of these deviations.

220.35 (3.8.5) Provide a table showing the factor of safety against sliding, overturning and flotation for the load combinations shown in Standard Review Plan 3.8.5.

220.36 (3.8.4.3) The load combinations listed in Section 3.8.4.3.2.1 are not in accordance with Standard Review Plan 3.8.4. Compare your load combinations with the SRP load combinations and discuss the effects of your deviations.

220.37 Identify all masonry walls in your facility which are in proximity to or have attachments from safety-related piping or equipment such that wall failure could affect a safety-related system. Describe the systems and equipment, both safety and non-safety-related, associated with these masonry walls. Include in your review, masonry walls that are intended to resist impact or pressurization loads, such as missiles, pipe whip, pipe break, jet impingement, or tornado, and fire or water barriers, or shield walls. Equipment to be considered as attachments or in proximity to the walls shall include, but is not limited to, pumps, valves, motors, heat exchangers, cable trays, cable/ conduit, HVAC ductwork, and electrical cabinets, instrumentation and controls.

Provide a re-evaluation of the design adequacy of the walls, identified above, to determine whether the masonry walls will perform their intended function under all postulated loads and load combinations.

Submit a written report upon completion of the re-evaluation program. The report shall include the following information.

(i) Describe, in detail, the function of the masonry walls, the configurations of these walls, the type and strengths of the materials of which they are constructed (mortar, grout, concrete and steel), and the reinforcement details (horizontal steel, vertical steel, and masonry ties for multiple wythe construction). A wythe is considered to be (as defined by ACI Standard 531-1979) "each continuous vertical section of a wall, one masonry unit or grouted space in thickness and 2 in. minimum in thickness."

(ii) Describe the construction practices employed in the construction of these walls and, in particular, their adequacy in preventing significant voids or other weaknesses in any mortar, grout, or concrete fill.

(iii) The re-evaluation report should include detailed justification for the criteria used. References to existing codes or test data may be used if applicable for the plant conditions. The re-evaluation should specifically address the following.

(a) All postulated loads and load combinations should be evaluated against the corresponding re-evaluation acceptance criteria. The re-evaluation should consider the loads from safety and non-safety-related attachments, differential floor displacement and thermal effects (or detailed justification that these can be considered self limiting and cannot induce brittle failures), and the effects of any potential cracking under dynamic loads. Describe in detail the methods used to account for these factors in the re-evaluation and the adequacy of the acceptance criteria for both in-plane and out-of-plane loads.

(b) The mechanism for load transfer into the masonry walls and postulated failure modes should be reviewed. For multiple wythe walls in which composite behavior is relied upon, describe the methods and acceptance criteria used to assure that these walls will behave as composite walls, especially with regard to shear and tension transfer at the wythe interfaces. With regard to local loadings such as piping and equipment support reactions, the acceptance criteria should assure that the loads are adequately transferred into the wall, such that any assumptions regarding the behavior of the walls are appropriate. Include the potential for tensile stress transfer through bond at the wythe interfaces.

Existing test data or conservative assumptions may be used to justify the re-evaluation acceptance criteria if the criteria are shown to be conservative and applicable for the actual plant conditions. In the absence of appropriate acceptance criteria a confirmatory masonry wall test program is required by the NRC in order to quantify the safety margins inherent in the re-evaluation criteria. Describe in detail the actions planned and their schedule to justify the re-evaluation criteria. If a test program is necessary, provide your commitment for such a program and a schedule for submittal of a description of the test program and a schedule for completion of the program. This test program should address all appropriate loads (seismic, tornado, missile, etc.). Submit the results of the test program upon its completion.

Enclosed is a copy of SEB Interim Criteria for evaluating masonry walls. Document and explain any deviation to this criteria you used to evaluate the walls.

220.38 (3.8.2) The allowable stresses shown in table 3.8-7 are not in accordance with the ASME Code for acceptance testing at ambient temperature. Revise the allowable stresses to conform to the ASME Code allowables for the testing conditions you entend to use.

In several of the load cases, it appears you are increasing the AISC allowable stresses and it is the staff's position that increases in the allowable stresses are onlyallowed for thermal loads and no others. Revise your allowable stresses to conform to this position.

Enclosure 1

SEB INTERIM CRITERIA FOR

SAFETY-RELATED MASONRY WALL EVALUATION

TABLE OF CONTENTS

1. General Requirements

The materials, testing, analysis, design, construction and inspection related to the design and construction of safety-related concrete masonry walls shall conform to the applicable requirements contained in Uniform Building Code - 1979, unless specified otherwise, by the provisions in this criteria.

The use of other industrial codes, such as ACI-531, ATC-3 or NCMA is also acceptable. However, when the provisions of these codes are less conservative than the corresponding provisions of the interim criteria, their use should be justified on a case-by-case basis.

2. Loads and Load Combinations

The loads and load combinations shall include consideration of normal loads, severe environmental load, extreme environmental load, and abnormal loads. Specifically, for operating plants the load combinations provided in plant's FSAR shall govern. For operating license applications, the following load combinations shall apply (for definition of load terms, see SRP Section 3.8.4.II-3).

(a) Service Load Conditions

(1) D + L

(2) D + L + E

(3) D + L + W

If thermal stresses due to T_o and R_o are present, they should be included in the above combinations, as follows:

(1a) $D + L + T_o + R_o$
(2a) $D + L + T_o + R_o + E$
(3a) $D + L + T_o + R_o + W$

Check load combination for controlling condition for maximum 'L' and for no 'L'.

(b) Extreme Environmental, Abnormal, Abnormal/Severe Environmental and Abnormal/Extreme Environmental Conditions

(4) $D + L + T_o + R_o + E'$
(5) $D + L + T_o + R_o + W_t$
(6) $D + L + T_a + R_a + 1.5\ P_a$
(7) $D + L + T_a + 1.25\ P_a + 1.0\ (Y_r + Y_j + Y_m) + 1.25\ E + R_a$

(8) $D + L + T_a + R_a + 1.0\ P_a + 1.0\ (Y_r + Y_j + Y_m) + 1.0\ E'$

In combinations (6), (7), and (8), the maximum values of P_a, T_a, R_a, Y_j, Y_r, and Y_m, including an appropriate dynamic load factor, should be used unless a time-history analysis is performed to justify otherwise. Combinations (5), (7) and (8) and the corresponding structural acceptance criteria should be satisfied first without the tornado missile load in (5) and without Y_r, Y_j, and Y_m in (7) and (8). When considering these loads, local section strength capacities may be exceeded under these concentrated loads, provided there will be no loss of function of any safety-related system.

Both cases of L having its full value or being completely absent should be checked.

3. Allowable Stresses

Allowable stresses provided in Chapter 24 of UBC-79, as supplemented by the following modifications/exceptions shall apply.

(a) When wind or seismic loads (OBE) are considered in the loading combinations, no increase in the allowable stresses is permitted.

(b) Use of allowable stresses corresponding to special inspection category shall be substantiated by demonstration of compliance with the inspection requirements of the NRC criteria.

(c) No tension perpendicular to bed joints of either reinforced or unreinforced masonry walls is allowed, except in the evaluation of unreinforced masonry walls of operating plants. In such cases, the allowable values of UBC-79 can be used, if justified by test program or other means.

(d) For load conditions, which represent extreme environmental, abnormal, abnormal/severe environmental, and abnormal/extreme environmental conditions the allowable working stresses may be multiplied by the factors shown in the following table:

TYPE OF STRESS	FACTOR
Axial or Flexural Compression (1)	2.5
Bearing	2.5
Reinforcement stress except shear	2.0 but not to exceed 0.9 fy
Shear reinforcement and/or bolts	1.5
Masonry tension parallel to bed joint	1.5
Shear carried by masonry	1.0
Masonry tension perpendicular to bed joint	
for reinforced masonry	0
for unreinforced masonry(2)	1.0

Notes

(1) When anchor bolts are used, design should prevent facial spalling of masonry unit.

(2) See 3 (c).

4. Design and Analysis Considerations

(a) The analysis should follow established principles of engineering mechanics and take into account sound engineering practices.

(b) Assumptions and modeling techniques used shall give proper considerations to boundary conditions, cracking of sections, if any, and the dynamic behavior of masonry walls.

(c) Damping values to be used for dynamic analysis shall be those for reinforced concrete given in Regulatory Guide 1.61.

(d) In general, for operating plants, the seismic analysis and Category I structural requirements of FSAR shall apply. For other plants, corresponding SRP requirements shall apply.

(e) The analysis should consider both in-plane and out-of-plane loads.

(f) Interstory drift effects should be considered.

(g) In new construction, no unreinforced masonry wall is permitted, also all grout in concrete masonry walls shall be compacted by vibration.

(h) For masonry shear walls, the minimum reinforcement requirements of ACI-531 or ATC-3 shall apply.

(i) Special constructions (e.g. multiwythe, composite) or other items not covered by the code shall be reviewed on a case-by-case basis for their acceptance.

(j) Licensees or applicants shall submit QA/QC information, if available, for staff's review.

In the event, QA/QC information is not available, a field survey and a test program reviewed and approved by the staff shall be implemented to ascertain the conformance of masonry construction to design drawings and specifications (e.g. rebar and grouting).

(k) For masonry walls requiring protection from spalling and scabbing due to accident pipe reaction (Y_r), jet impingement (Y_j) and missile impact (Y_m), the requirements of SRP 3.5.3 shall apply. Any deviation from the SRP 3.5.3 shall be reviewed and approved on a case-by-case basis.

5. Revision of Criteria

The criteria will be revised, as appropriate, based on:

(a) Design review meetings with the selected licensees and their A/E's.

(b) Experience gained during review.

(c) Additional information developed through testing and researches.

6. References

(a) Uniform Building Code - 1979 Edition

(b) Building Code Requirements for Concrete Masonry Structures ACI-531 - 79 and Commentary ACI-531R - 79.

(c) Tentative Provisions for the Development of Seismic Regulations for Buildings - Applied Technology Council ATC 3-06.

(d) Specification for the Design and Construction of Load-bearing Concrete Masonry - NCMA August, 1979.

(e) Trojan Nuclear Plant Concrete Masonry Design Criteria Safety Evaluation Report Supplement - November, 1980.