April 30, 1982

Docket No. 50-219
LS05-82

Mr. P. B. Fiedler
Vice President and Director - Oyster Creek
Oyster Creek Nuclear Generating Station
Post Office Box 388
Forked River, New Jersey 08731

Dear Mr. Fiedler:

SUBJECT: SYSTEMATIC EVALUATION PROGRAM TOPIC III-7.B, DESIGN CODES, DESIGN CRITERIA, AND LOADING COMBINATIONS - OYSTER CREEK

Enclosed is a copy of our draft evaluation of SEP Topic III-7.B and our contractor's reports which form the basis for our SER.

You are requested to examine the facts upon which the staff has based its evaluation and respond either by confirming that the facts are correct or by identifying errors and supplying the corrected information. The SER identifies areas of codes, load magnitudes, and load combinations where changes have occurred to decrease margins of safety. You should review how these codes were applied in the design of Oyster Creek and assess the safety margins where code changes have been identified as potentially significant. We encourage you to supply any other material that might affect the staff's evaluation or be significant in the integrated assessment of your facility.

Sincerely,

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1/1
DSU USE(51)
ADD:
R. Fell

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
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Enclosures:
As stated

cc w/enclosures:
See next Page

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DATE	4/22/82	4/22/82	4/22/82	4/27/82	3/ /82	4/28/82	

Mr. P. B. Fiedler

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SYSTEMATIC EVALUATION PROGRAM
TOPIC III-7.B

OYSTER CREEK

TOPIC: III-7.B, DESIGN CODES, DESIGN CRITERIA, AND LOAD COMBINATIONS

I. INTRODUCTION

SEP plants were generally designed and constructed during the time span from the late 1950's to late 1960's. They were designed according to criteria and codes which differ from those accepted by the NRC for new plants.

The purpose of this topic is to assess the safety margins existing in Category I structures as a result of changes in design codes and criteria.

II. REVIEW GUIDELINES

The current licensing criteria which governs the safety issue in this topic is 10 CFR 50, Appendix A, GDC 1, 2, and 4 as interpreted by Standard Review Plan 3.8.

III. RELATED SAFETY TOPICS

The following SEP topics are related to III-7.B:

1. II-3.B, Flooding Potential and Protection Requirements
2. III-2, Wind and Tornado Loadings
3. III-3.A, Effects of High Water Level on Structures
4. III-4.A, Tornado Missiles
5. III-5.A, Effects of Pipe Breaks Inside Containment
6. III-5.B, Effects of Pipe Breaks Outside Containment
7. III-6, Seismic Design Considerations
8. VI-2.D, Mass and Energy Release for Postulated Pipe Break Inside Containment

IV. EVALUATION

The evaluation is based on a Technical Evaluation Report (TER) prepared by the Franklin Research Center (FRC) in conjunction with the NRC staff through contract. The report is entitled "Design Codes, Design Criteria, and Loading Combinations" and is attached to this Safety Evaluation Report as Enclosure (1).

We have compared structural design codes employed in the design of Category I structures at Oyster Creek to present codes. This was done through generic code versus code comparison without investigating specifically how the original code was applied to the Oyster Creek

design; however, after reviewing drawings of structures at Oyster Creek, we concluded that certain portions of the codes were not applicable because the types of structures to which the codes are referring were non-existent. We have compared the loads and loading combinations employed in the design of Oyster Creek as described in the FDSAR to those required today.

A result of these comparisons is that a number of code changes could potentially impact significantly margins of safety (denoted by scale A and Ax in Enclosure 1). This can be attributed to several factors such as:

1. New codes have imposed stricter limitations than old,

2. New codes have included sections governing design of certain types of structures which were not included in the older codes,

3. Design loads required today were not included in the plant design, and

4. Certain load combinations judged to be significant were not included in plant design.

In Enclosure (1), some items have been judged to potentially impact margins of safety regarding the containment as a result of comparing the original containment design code (ASME BPV Section VIII, 1962) to ASME BPV Section III Division 1, 1980.

The code changes of concern from Enclosure (1) are:

LIST OF STRUCTURAL ELEMENTS TO BE EXAMINED

Structural Elements to be Examined	Code Change Affecting These Elements	
	New Code	Old Code
Compression Elements	AISC 1980	AISC 1963
With width-to-thickness ratio higher than specified in 1.9.1.2	1.9.1.2 and Appendix C	1.9.1
Tension Members	AISC 1980	AISC 1963
When load is transmitted by bolts or rivets	1.14.2.2	--*

*Double dash (--) indicates that older code had no provisions.

LIST OF STRUCTURAL ELEMENTS TO BE EXAMINED

Structural Elements to be Examined	Code Change Affecting These Elements	
	New Code	Old Code
Connections	AISC 1980	AISC 1963
a. Beam ends with top flange coped, if subject to shear	1.5.1.2.2	--
b. Connections carrying moment or restrained member connection	1.15.5.2 1.15.5.3 1.15.5.4	--
Members Designed to Operate in an Inelastic Regime	AISC 1980	AISC 1963
Spacing of lateral bracing	2.9	2.8
Short Brackets and Corbels having a shear span-to-depth ratio of unity or less	ACI 349-76 11.13	ACI 318-63 --
Shear Walls used as primary load-carrying members	ACI 349-76 11.16	ACI 318-63 --
Precast Concrete Structural Elements, where shear is not a measure of diagonal tension	ACI 349-76 11.15	ACI 318-63 --
Concrete Regions Subject to High Temperatures	ACI 349-76	ACI 318-63
Time-dependent and position-dependent temperature variations	Appendix A	---
Columns with Spliced Reinforcement subject to stress reversals; f_y in compression to $1/2\ f_y$ in tension	ACI 349-76 7.10.3	ACI 318-63 805
Steel Embedments used to transmit load to concrete	ACI 349-76 Appendix B	ACI 318-63 ---

*Double dash (--) indicates that older code had no provisions.

LIST OF STRUCTURAL ELEMENTS TO BE EXAMINED (Cont.)

Structural Elements to be Examined	Code Change Affecting These Elements	
	New Code	Old Code
Containment Vessels		
1. Containment vessels of materials no longer listed as code acceptable	ASME Sec. III, NE-3112.4	ASME Sec. VIII, UG-23
2. Containment vessels containing telltale holes	ASME Sec. III, ---	ASME Sec. VIII, 1962 UG-25(d)
3. Containment vessels designed by formula and subject to substantial loads	ASME Sec. III, NE-3131	ASME Sec. VIII, ---
4. Stiffening rings for cylindrical shells subject to external pressure	ASME Sec. III, NE-3133.5(a)	ASME Sec. VIII, UG-29
5. Different materials used for the shell and stiffening rings	ASME Sec. III, NE-3133.5(b)	ASME Sec. VIII, ---
6. Vessels with reducer section with "reversed" curvature when $R_L/t < 23$	ASME Sec. III, Fig. 3324.11 (a)(6)-1	ASME Sec. VIII, Fig. UG-36(d)
7. Vessels with positive locking devices - Quick actuating closures	ASME Sec. III, NE-3327.1	ASME Sec. VIII, ---
8. Pressure indicating devices for vessels having quick actuating closures	ASME Sec. III, NE-3327.4	ASME Sec. VIII, ---
Shell Openings and Attachments		
1. Openings and reinforcements Provisions for fatigue analysis	ASME Sec. III, NE-3331(b)	ASME Sec. VIII, UG-36
2. Reinforcement for openings	ASME Sec. III, NE-3334.1 NE-3334.2	ASME Sec. VIII, UG-40(b) UG-40(c)
3. Bellows expansion joints, over 6 inches in diameter	ASME Sec. III, NE-3365(f)	ASME Sec. VIII, ---
4. Bellows - New design requirements	ASME Sec. III, NE-3365.2	ASME Sec. VIII, ---

LIST OF STRUCTURAL ELEMENTS TO BE EXAMINED (Cont.)

All elements whose failure under impulsive and impactive loads must be precluded	**ACI 349-76 Appendix C**	**ACI 318-71 ---**

Section 10 of Enclosure (1) address load and load combination changes with occurred as a result of criteria changes and identifies specific plant structures for which various loads and load combinations may be significant. Based upon a lack of detailed information on the stress results for loads and load combinations used during design of structures at Oyster Creek, these loads and load combinations may be potentially significant.

Enclosure (2) provides details of an analysis of the primary containment (dry well only) for combined seismic and LOCA loadings which was performed by our contractor, Lawrence Livermore Laboratory. This analysis indicates that the primary containment may be stressed beyond code allowables in a localized region.

V. CONCLUSIONS

We conclude that after comparing design codes, criteria, loads, and load combinations, a number of changes have occurred which could potentially impact margins of safety. These changes are identified above. These differences between plant design and current licensing criteria should be resolved as follows:

1. Review Seismic Category 1 Structures at Oyster Creek to determine if any of the structural elements for which a concern exists are a part of the facility design of Oyster Creek. For those that are, assess the impact of the code changes on margins of safety on a plant specific basis, and

2. Examine on a sampling basis the margins of safety of Seismic Category 1 structures for loads and load combinations not covered by another SEP topic and denoted by Ax in Enclosure (1). (The load tables should be reviewed to assure their technical accuracy concerning applicability of the loads for each of the structures and their significance. The list of Category 1 structures should be reviewed to assure completeness. Note that individual loads such as snow have increased beyond your original design, are not covered by another SEP topic, and therefore, must be addressed in this topic.)

Regarding the ability of the Oyster Creek primary containment to resist the seismic and LOCA loads described in Enclosure (2), we conclude that the containment may be stressed beyond code allowables in a localized region.