

September 30, 1982

Docket No. 50-155
LS05-82-09-089

Mr. David J. Vandewalle
Nuclear Licensing Administrator
Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Dear Mr. Vandewalle:

SUBJECT: SEP TOPIC III-7.B, DESIGN CODES, DESIGN CRITERIA AND
LOAD COMBINATIONS - BIG ROCK POINT

Enclosed is a copy of our draft evaluation of SEP Topic III-7.B. The evaluation identifies areas of codes where changes have occurred to decrease safety margins. It also identifies loads applicable to some or all of the structures at Big Rock Point which have increased in magnitude. After reviewing structural drawings of your facility, we concluded that some code changes of concern were not applicable to your facility because the structural elements to which these code changes are referring were not found in the structural drawings of Big Rock Point which we reviewed. These changes are identified in Appendix A of the enclosure. The evaluation also concludes that, based on analyses performed on a similar containment, it may be possible to overstress the shell under current loading combinations considering the new loads developed in other SEP topics. You are to review how these areas of the codes were applied in the design of Big Rock Point and the ability of structures to resist increased loads and assess the current safety margins.

You are requested to examine the facts upon which the staff has based its evaluation and respond by confirming that the facts are correct or by identifying errors and supplying the corrected information. We encourage you to supply any other material that might affect the staff's evaluation of this topic or be significant in the integrated assessment of your facility.

You are requested to respond to the factual correctness of the SER and propose a schedule for resolution of the open items within 30 days of receipt of this letter.

Sincerely,

SE04

Add: Ray Schall

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Enclosure:
As stated

cc w/enclosure:
See next page

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SYSTEMATIC EVALUATION PROGRAM

TOPIC III-7.B

BIG ROCK POINT

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

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 Big Rock Point to present codes. This was done through generic code versus code comparison without investigating specifically how the original code was applied to the Big Rock Point design; however, after reviewing drawings of structures at Big Rock

Point we concluded that certain portions of the codes were not applicable to Big Rock Point because the types of structures to which the codes are referring were non-existent at Big Rock Point. We have compared the loads and loading combinations employed in the design of Big Rock Point.

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 ASME B&PV Section VIII, 1962 to ASME BPV, Section III, Subsection NE, 1980.

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

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<u>Structural Elements to be Examined</u>	<u>Code Change Affecting These Elements</u>	
	<u>New Code</u>	<u>Old Code</u>
<u>Composite Construction</u>	AISC 1980	AISC 1953
1. Shear connectors in composite beams	1.11.4	13
2. Composite beams or girders with formed steel deck	1.11.5	--
3. Width of concrete flange - limitations	1.11.1	13(a)
<u>Compression Elements</u>	AISC 1980	AISC 1953
1. With width-to-thickness ratio higher than specified in 1.9.1.2	1.9.1.2 and Appendix C	18(b)
2. Members where sideway is not prevented	1.8.3	16
<u>Tension Members</u>	AISC 1980	AISC 1953
1. When load is transmitted by bolts or rivets	1.14.2.2	--
2. Built up members	1.18.3	28(b)
<u>Connections</u>	AISC 1980	AISC 1953
1. Beam ends with top flange coped, if subject to shear	1.5.1.2.2	--
2. Connections carrying moment or restrained member connection	1.15.5.2 1.15.5.3 1.15.5.4	--

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

<u>Structural Elements to be Examined</u>	<u>Code Change Affecting These Elements</u>	
	<u>New Code</u>	<u>Old Code</u>
<u>Members Designed to Operate in an Inelastic Regime</u>	AISC 1980	AISC 1953
Spacing of lateral bracing	2.9	—
<u>Rolled Sections and Built up Members</u>	AISC 1980	AISC 1953
Partial length cover plates	1.5.1.4.1	15 (a) (3)
	1.10.4	26 (d)
<u>Members Subject to Axial and Bending Stresses</u>	AISC 1980	AISC 1953
	1.6	12 (a)
<u>Web Plate Girders</u>	AISC 1980	AISC 1953
1. Subject to shear and tension stresses	1.10.7	--
2. Stiffeners	1.10.10.2	26
<u>Partial Penetration Weld Effective throat thickness</u>	1.14.6.1	15 (f)
<u>Short Brackets and Corbels having a shear span-to-depth ratio of unity or less</u>	ACI 349-76 11.13	ACI 318-56 --
<u>Shear Walls used as a primary load-carrying member</u>	ACI 349-76 11.16	ACI 318-56 --
<u>Precast Concrete Structural Elements, where shear is not a measure of diagonal tension</u>	ACI 349-76 11.15	ACI 318-56 --
<u>Concrete Regions Subject to High Temperatures</u>	ACI 349-76	ACI 318-56
Time-dependent and position-dependent temperature variations	Appendix A	--

<u>Structural Elements to be Examined</u>	<u>Code Change Affecting These Elements</u>	
	<u>New Code</u>	<u>Old Code</u>
<u>All Structural Elements</u>	ACI 349-76	ACI 318-56
1. Ultimate bond strength	Chapter 12	--
2. Allowable bond stress	--	Table 305(a)
<u>Columns with Spliced Reinforcement</u>	ACI 349-76	ACI 318-56
subject to stress reversals; f_y in compression to $1/2 f_y$ in tension	7.10.3	--
<u>Steel Embedments used to transmit load to concrete</u>	ACI 349-76 Appendix B	ACI 318-56 --
<u>Element Subject to Impulsive and Impactive Loads</u> whose failure must be precluded	ACI 349-76 Appendix C	ACI 318-56 --
<u>Composite Construction</u>	ACI 349-76 Chapter 17	ACI 318-56 --
<u>Containment Vessels</u>		
1. Plates, if understrength	ASME Sec. III, 1980 NE-3112.4	ASME Sec. VIII, 1956 UG-5(b)
2. Containment vessels of materials no longer listed as code acceptable	ASME Sec. III, 1980 NE-3112.4	ASME Sec. VIII, 1956 UG-23
3. Containment vessels designed by formula and subject to substantial thermal or mechanical loads	ASME Sec. III, 1980 NE-3131	ASME Sec. VIII, 1956 Various paragraphs
4. Stiffening rings for cylindrical shells subject to buckling loads	ASME Sec. III, 1980 NE-3133.5(a)	ASME Sec. VIII, 1956 UG-29

<u>Structural Elements to be Examined</u>	<u>Code Change Affecting These Elements</u>	
	<u>New Code</u>	<u>Old Code</u>
5. Stiffening rings of material different than shell material	ASME Sec. III, 1980 NE-3133.5(b)	ASME Sec. VIII, 1956 --
6. Vessels with Quick Actuating Closures	ASME Sec. III, 1980 NE-3327.1	ASME Sec. VIII, 1956 Footnote to UG-35

Shell Openings and Attachments

1. Unstayed flat heads and covers	ASME Sec. III, 1980 NE-3325 Figs. (c) and (m)	ASME Sec. VIII, 1956 UG-34(d) Figs. (b) and (a)
2. Openings and reinforcements; subject to cyclic loads	ASME Sec. III, 1980 NE-3331(b)	ASME Sec. VIII, 1956 --
3. Reinforcement for openings	ASME Sec. III, 1980 NE-3334.1, NE-3334.2	ASME Sec. VIII, 1956 UG-40
4. Bellows and bellows expansion joints	ASME Sec. III, 1980 NE-3365	ASME Sec. VIII, 1956 --

Roofs

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Extreme environmental snow loads are provided by SEP Topic II-2.A. NRC Regulatory Guide 1.102 (Position 3) provides guidance to preclude adverse consequences from ponding or parapet roofs. Failure of roofs not designed for such circumstances could generate impulsive loadings and water damage, possibly extending to Seismic Category I components of all floor levels.

1. Not shown in tabular summary of code change impacts.

Section 10 of Enclosure (1) addresses load and load combination changes which occurred as a result of code changes and identifies specific plant structures for which various 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 Big Rock Point, these loads and load combinations may be potentially significant.

Based on an analysis of a similar containment (San Onofre 1) it may be possible to overstress the shell at grade elevation when considering the new loads developed in other SEP Topics (VI-2.D, VI-3 and III-6) in current loading combinations.

V. CONCLUSIONS

We concluded 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 I Structures at Big Rock Point to determine if any of the structural elements for which a concern exists are a part of the facility design of Big Rock Point. For those that are, assess the impact of the code changes on margins of safety on a plant specific basis.
2. Examine on a sampling basis the margins of safety of Seismic Category I 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 Category I structures considered should be reviewed to insure completeness.)

The licensee should determine the ability of the containment to withstand newly developed loads in current loading combinations.