

December 9, 1982

Docket No. 50-409
LS05-82-12-015

Mr. Frank Linder
General Manager
Dairyland Power Cooperative
2615 East Avenue South
LaCrosse, Wisconsin 54601

Dear Mr. Linder:

SUBJECT: SEP TOPIC III-7.B, DESIGN CODES, DESIGN CRITERIA AND
LOAD COMBINATIONS - LACROSSE BOILING WATER REACTOR

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 LaCrosse 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 LaCrosse which we reviewed. These changes are identified in Appendix A of the enclosure. The evaluation also concludes that the ability to resist seismic and LOCA loads developed in other SEP topics should be determined after the seismic analysis of the containment has been completed and reserve margin determined. You are to review how these areas of the codes were applied in the design of LaCrosse 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

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G. Staley

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OFFICE							
SURNAME							
DATE							

Mr. Frank Linder

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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,

Original signed by:

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

OFFICE	SEP B <i>DP</i>	SEP B <i>mm</i>	SEP B <i>4</i>	SEP B <i>WTR</i>	ORB#5 <i>RTD</i>	ORB#5 <i>mm</i>	
SURNAME	DPersinko:bl	TMichael's	RHermann	WRussell	RDudley	DCrutchfield	
DATE	11/15/82	11/15/82	11/15/82	11/15/82	12/1/82	12/1/82	

Mr. Frank Linder

cc

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SYSTEMATIC EVALUATION PROGRAM
TOPIC III-7.B
LACROSSE BOILING WATER REACTOR

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 LaCrosse to present codes. This was done through generic code versus code comparison without investigating specifically how the original code was applied to the LaCrosse design; however, after reviewing drawings of structures at LaCrosse we concluded that certain portions of the codes were not applicable to LaCrosse because the types of structures to which the codes are referring were non-existent at LaCrosse. We have compared the loads and loading combinations employed in the design of LaCrosse.

A result of these comparisons is that a number of code changes could potentially impact margins of safety significantly (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 Section III, Subsection B, 1963 to ASME Section III Subsection NE, 1980.

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

<u>Structural Elements to be Examined</u>	<u>Code Change Affecting These Elements</u>		
	<u>New Code</u>	<u>Old Codes</u>	
<u>Composite Construction</u>	AISC 1980	AISC 1953	AISC 1971
1. Shear connectors in composite beams	1.11.4	13	NA
2. Composite beams or girders with formed steel deck	1.11.5	--	NA
3. Width of concrete flange - limitations	1.11.1	13(a)	NA
<u>Compression Elements</u>	AISC 1980	AISC 1953	AISC 1971
1. With width-to-thickness ratio higher than specified in 1.9.1.2	1.9.1.2 and Appendix C	18(b)	NA
2. Members where sideway is not prevented	1.8.3	16	NA
<u>Tension Members</u>	AISC 1980	AISC 1953	AISC 1971
1. When load is transmitted by bolts or rivets	1.14.2.2	--	--
2. Built up members	1.18.3	28(b)	NA
<u>Connections</u>	AISC 1980	AISC 1953	AISC 1971
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.
NA -- Not applicable.

<u>Structural Elements to be Examined</u>	<u>Code Change Affecting These Elements</u>		
	<u>New Code</u>	<u>Old Codes</u>	
<u>Members Designed to Operate in an Inelastic Regime</u>	AISC 1980	AISC 1953	AISC 1971
Spacing of lateral bracing	2.9	--	NA
<u>Rolled Sections and Built up Members</u>	AISC 1980	AISC 1953	AISC 1971
	1.5.1.4.1	15(a) (3)	NA
Partial length cover plates	1.10.4	26 (d)	NA
<u>Members Subject to Axial and Bending Stresses</u>	AISC 1980	AISC 1953	AISC 1971
	1.6	12 (a)	NA
<u>Web Plate Girders</u>	AISC 1980	AISC 1953	AISC 1971
1. Subject to shear and tension stresses	1.10.7	--	NA
2. Stiffeners	1.10.10.2	26	NA
<u>Partial Penetration Weld Effective throat thickness</u>	1.14.6.1	15 (f)	NA
<u>Short Brackets and Corbels having a shear span-to- depth ratio of unity or less</u>	ACI 349-76	ACI 318-56	ACI 318-71
	11.13	--	NA
<u>Shear Walls used as a primary load-carrying member</u>	ACI 349-76	ACI 318-56	ACI 318-71
	11.16	--	NA
<u>Precast Concrete Structural Elements, where shear is not a measure of diagonal tension</u>	ACI 349-76	ACI 318-56	ACI 318-71
	11.15	--	NA
<u>Concrete Regions Subject to High Temperatures</u>	ACI 349-76	ACI 318-56	ACI 318-71
Time-dependent and position-dependent temperature variations	Appendix A	--	--

Structural Elements to be Examined	Code Change Affecting These Elements	
	New Code	Old Codes
<u>All Structural Elements</u>	ACI 349-76	ACI 318-56 ACI 318-71
1. Ultimate bond strength	Chapter 12	-- NA
2. Allowable bond stress	--	Table 305(a) NA
<u>Columns with Spliced Reinforcement</u>	ACI 349-76	ACI 318-56 ACI 318-71
subject to stress reversals; f_y in compression to $1/2 f_y$ in tension	7.10.3	-- NA
<u>Steel Embedments</u> used to transmit load to concrete	ACI 349-76 Appendix B	ACI 318-56 -- ACI 318-71 --
<u>Element Subject to Impulsive and Impactive Loads</u> whose failure must be precluded	ACI 349-76 Appendix C	ACI 318-56 -- ACI 318-71 --
<u>Composite Construction</u>	ACI 349-76 Chapter 17	ACI 318-56 -- ACI 318-71 NA
<u>Containment Vessels</u>		
1. Containment vessels of materials no longer listed as code acceptable	ASME Sec. III, 1980 NE-3112.4	ASME Sec. VIII, 1962 UG-23
2. Containment vessels designed by formula and subject to substantial thermal or mechanical loads	ASME Sec. III, 1980 NE-3131	ASME Sec. VIII, 1962 Various paragraphs
3. Stiffening rings for cylindrical shells subject to buckling loads	ASME Sec. III, 1980 NE-3133.5(a)	ASME Sec. VIII, 1962 UG-29
4. Stiffening rings of material different than shell material	ASME Sec. III, 1980 NE-3133.5(b)	ASME Sec. VIII, 1962 --

<u>Structural Elements to be Examined</u>	<u>Code Change Affecting These Elements</u>	
	<u>New Code</u>	<u>Old Codes</u>

<u>Structural Elements to be Examined</u>	<u>Code Change Affecting These Elements</u>	
	<u>New Code</u>	<u>Old Code</u>
4. Stiffening rings of material different than shell material	ASME Sec. III, 1980 NE-3133.5(b)	ASME Sec. VIII, 1962 --
5. Quick-Actuating Closures	ASME Sec. III, 1980 NE-3327.1	ASME Sec. VIII, 1962 Footnote to UG-35

Shell Openings and Attachments

1. Openings and reinforcements; subject to cyclic loads	ASME Sec. III, 1980 NE-3331(b)	ASME Sec. VIII, 1962 UG-36
2. Reinforcement for vessel openings	ASME Sec. III, 1980 NE-3334.1, NE-3334.2	ASME Sec. VIII, 1962 UG-40
3. Bellows and bellows expansion joints	ASME Sec. III, 1980 NE-3365	ASME Sec. VIII, 1962 --

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.

Areas exist in Enclosure (1) where information was not available. In some cases, such as original design codes utilized, assumptions were made based on time frame and codes utilized in other structures. In other cases, no assumptions could be made and the tables were left blank.

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 LaCrosse, these loads and load combinations may be potentially significant.

A part of this topic consists of assessing the ability of containment to withstand pressure and temperature loads developed in Topics VI-2.D, VI-3 and seismic loads developed in Topic III-6. The LACBWR containment was originally designed for 52 psig pressure and 280°F temperature. The results of Topic VI-2.D and VI-3 show a containment pressure of 43 psig and temperature of 270°F developed during a LOCA. This governs over the results for a main steam line break. Since the original design was performed for larger loads, it is judged that these pressure and temperature loads would be adequately resisted; however, because of the larger seismic loads and because it is not known whether the original pressure and temperature loads were combined with seismic loads, the containment may not be able to resist seismic, pressure and temperature loads in the correct combination.

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 I Structures at LaCrosse to determine if any of the structural elements for which a concern exists (Section 13, pages 79-82 of Enclosure 1) are a part of the facility design of LaCrosse. 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 all Seismic Category I Structures for loads (Section 10.3, pages 29-38 of Enclosure 1) and load combinations (Section 10.4, pages 39-53 of Enclosure 1) not covered by another SEP topic and denoted by Ax in Enclosure (1). The Category I Structures considered should be reviewed to insure completeness.

3. Verify that the code editions (codes compared are given on page 77 and Appendix B of Enclosure 1) assumed by the staff are correct. For the load tables (Section 10.3 of Enclosure 1) where no information was available, and therefore, blanks exist, the required information must first be provided. For the load combination tables (Section 10.4 of Enclosure 1) where assumptions were made, also verify the technical accuracy concerning applicability of the loads for each structure and their significance.

The ability of the containment to resist seismic and LOCA loads in the correct combination should be determined after the seismic analysis of the containment is completed and reserve margins determined.