DAIRYLAND POWER COOPERATIVE • P.O. BOX 817 • 2615 EAST AV. SOUTH • LA CROSSE, WISCONSIN 54601
(608) 788-4000

June 29, 1981

In reply, please refer to LAC-7635

DOCKET NO. 50-409

U. S. Nuclear Regulatory Commission
Attn: Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
Division of Operating Reactors
Washington, D. C. 20555

SUBJECT: DAIRYLAND POWER COOPERATIVE
LA CROSSE BOILING WATER REACTOR (LACBWR)
SEP TOPIC III.5.B
PIPE BREAK OUTSIDE CONTAINMENT

REFERENCE: (1) DPC Letter, LAC-7387, Linder to Eisenhut, dated February 27, 1981

Gentlemen:

Enclosed find the Safety Evaluation Report (SER) for Pipe Break Outside Containment (SEP III.5.B) which we have prepared for the La Crosse Boiling Water Reactor.

Our letter, Reference 1, identified topics for DPC to submit for NRC evaluation. The subject topics were listed in the schedule submitted with Reference 1.

If there are any questions regarding this report, please contact us.

Very truly yours,

DAIRYLAND POWER COOPERATIVE

Frank Linder, General Manager

JDP:FL:ee

cc: J. G. Keppler, Reg, Dir., NRC-DRO III
NRC Resident Inspectors

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SEP EVALUATION

OF

PIPE BREAK OUTSIDE CONTAINMENT

TOPIC III-5.B

FOR THE

LA CROSSE BOILING WATER REACTOR

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1.0 INTRODUCTION

The safety objective of Systematic Evaluation Program (SEP) Topic III-5.B, "Pipe Break Outside Containment" is to assure that pipe breaks would not cause the loss of needed functions of "safety-related" systems, structures and components and to assure that the plant can be safely shut down in the event of such breaks. The needed functions of "safety-related" systems are those functions required to mitigate the affects of the pipe break and safely shutdown the reactor plant. The current criteria for review of pipe breaks outside containment are contained in Standard Review Plan 3.6.1 and 3.6.2 including their attached Branch Technical Positions.

2.0 BACKGROUND

In December 1972, the staff sent letters (Reference 1) to all power reactor licensees requesting an analysis of the effects of postulated failures of high energy lines outside of containment. A summary of the criteria and requirements in this letter is set forth below:

a. Protection of equipment and structures necessary to shutdown the reactor and maintain it in a safe shutdown condition, assuming a concurrent and unrelated single active failure of protected equipment, should be provided from all effects resulting from ruptures in pipes carrying high energy fluid, where the temperature and pressure conditions of the fluid exceed 200°F and 275 psig, respectively, up to and including a double-ended rupture of such pipes. Breaks should be assumed to occur in those locations specified in the "pipe whip criteria". The rupture effects to be considered include pipe whip, structural (including the effects of jet impingement), and environmental.

b. In addition, protection of equipment and structures necessary to shutdown the reactor and maintain it in a safe shutdown condition, assuming a concurrent and unrelated single active failure of protected equipment, should be provided from the environmental and structural effects (including the effects of jet impingement) resulting from a single open crack at the adverse location in pipes carrying fluid routed in the vicinity of this equipment. The size of the cracks should be assumed to be ½ the pipe diameter in length and ½ the wall thickness in width.

A meeting was held with Dairyland Power Cooperative (the licensee) in January 1973 to discuss the information already available on the facility design concerning postulated pipe ruptures, to discuss the criteria, and to assess those areas where additional information was required. In response to NRC letters, a report concerning postulated high energy pipe ruptures outside containment was filed by the licensee on January 17, 1974. A subsequent letter from DPC dated August 15, 1974 answered additional questions requested by AEC letter dated April 8, 1974. The licensee also

submitted additional information by letters dated January 23, 1975, and January 12, 1976. Based on these transmittals, the staff issued Amendment No. 5 to Provisional Operating License No. DPR-45 for the La Crosse Boiling Water Reactor (Reference 2). This amendment added interim surveillance requirements to the Technical Specifications for the La Crosse Boiling Water Reactor pending completion and acceptance of certain modifications to the facility to assure that it will withstand the consequences of postulated ruptures in the high energy fluid piping outside containment without loss of capability to achieve and maintain safe shutdown of the facility. The required facility modifications were performed during the period 1974-1976.

The reevaluation of the effects of pipe breaks outside containment under SEP Topic III-5.B involves the comparison of the LACBWR plant with current criteria for pipe breaks outside containment. An "effects oriented" approach is used to determine the acceptability of plant response to pipe breaks, i.e., each structure, system, component, and power supply which must function to mitigate the effects of the pipe break and to safely shutdown the plant is examined to determine its susceptibility to the effects of the postulated break. Break effects considered are compartment pressurization, pipe whip, jet impingement, spray, flooding, and environmental conditions of temperature, pressure and humidity. (The effects of potential missiles generated by fluid system ruptures and rotating machinery are evaluated under SEP Topic III-4.C, "Internally Generated Missiles".)

The previous evaulation of pipe breaks outside containment for the LACBWR plant was performed using some methods and criteria which are no longer used by the staff in the review of current plants. For example, the current definition of a high energy fluid system is one that is maintained under conditions where either or both the maximum operating temperature and pressure exceeds 200°F and 275 psig is different from the definition applied in the previous review where a high energy fluid system was one in which both temperature and pressure exceed 200°F and 275 psig. The SEP reevaluation of this topic is performed using the current criteria in Standard Review Plan 3.6.1 and 3.6.2 and their attached Branch Technical Positions.

3.0 EVALUATION

The results of the SEP reevaluation of pipe breaks outside containment for LACBWR are provided in Table 1. The following paragraphs provide additional information used to evaluate certain pipe breaks listed in Table 1.

The safe shutdown systems which were examined from the standpoint of protection from pipe break effects are identified in the SEP Safe Shutdown Review for LACBWR (Reference 2). These systems are:

1) Reactor Control and Protection Systems.
2) Shutdown Condenser
3) Manual Depressurization System

4) Alternate Core Spray

5) Emergency Service Water Supply System

6) Reactor Building and Turbine Building Main Steam Line Isolation Valves

7) Instrumentation for the Above Systems and Equipment

8) Emergency Power (AC and DC) for the Above Systems and Equipment

3.1 PIPE WHIP

The design of the LACBWR plant is somewhat unusual in that it is a BWR which employs a relatively large, PWR-type, cylindrical steel containment structure. As a result, several systems important to safety are located wholly or predominantly within containment. These include the Shutdown Condenser, the Manual Depressurization System, the High and Low Pressure Core Spray Systems, the high energy portion of the Alternate Core Spray System.

Potential interactions between portions of safety systems located outside of containment with high energy fluid systems are confined to two locations: 1) the pipe tunnel area between containment and the turbine building, and 2) the mezzanine floor level of the turbine building near the east turbine building wall. A 1974 study (Reference 3) thoroughly studied pipe break effects in these areas and concluded that the function of the ACS (the only safe shutdown system at

risk from HELB effects) could be assured if suitable facility modifications were made. The recommended modifications included addition of pipe whip restraints at specified locations in the main steam line and main bypass line, and the addition of a valve capable of isolating the HPSW system from the alternate core spray line. The latter modification precludes degradation of ACS flow capability in the event of damage to the HPSW system from HELB effects. These required facility modifications have been made by the licensee.

3.2 ADVERSE ENVIRONMENTAL EFFECTS

The control room, electrical equipment room, penetration room and the diesel generator rooms will not be damaged by a high energy line break since all of these rooms are protected by concrete walls and are remote from high energy piping runs.

With respect to pressurization, the control room, electrical room, penetration room and the diesel generator rooms are isolated from the turbine building by concrete walls or substantial steel personnel access doors which open out into the turbine building and are set in steel frames. The penetration area and diesel generator rooms are located off the machine shop so that two or more personnel doors are interposed between these rooms and the turbine building.

If the ability of the turbine building corrugated aluminum and steel insulated wall panels (and their attachments to the structural frame) to withstand the internal turbine building

pressure is compared with the structural integrity of a personnel access steel door set into a steel frame or compared to structural concrete walls, it can only be concluded that the turbine building wall panels will blow out to relieve building pressure before the walls and doors isolating the specified rooms are damaged.

The peak turbine building pressure as a result of a HELB has been calculated to be 3.39 psig. This figure assumes a rigid structure and does not account for the turbine building wall panels blowing out.

Due to the negative pressure normally maintained in these areas, the minimum pressure build-up in the turbine building and the short duration of the pressure spike, areas protected by two sets of steel doors would not encounter any water or steam seepage. The control room and electrical equipment room steel doors opening into the turbine building are not located near any high energy line. Due to the short duration of the pressure differential, any seepage into the control room or electrical equipment room would most likely be air compressed by the expanding steam.

Consequently, no adverse environmental effects are anticipated in the control room, penetration area, diesel generator or electrical equipment rooms.

During previous reviews, it was determined that the containment building pressure switches located in the pipe tunnel were overly vulnerable to high energy pipe break effects. DPC has since relocated these penetrations to the above-grade electrical penetration room.

3.3 PEAK PRESSURES

Analyses have been performed (Reference 3) to determine possible adverse effects due to compartment pressurization following high energy line breaks. It was determined that there exists sufficient communication among areas of interest (condenser compartment, turbine building, feedwater pump area, high pressure heater compartment) to preclude buildup of significant differential pressures between these areas. Peak pressure was therefore calculated for the turbine building treated as a single volume. The calculations show that peak building pressure occurs following a main steam line break and could reach 3.39 psig. Such a pressure transient would be quickly relieved by means of local failure of the corrugated metal panelling which constitutes the exterior walls of the turbine building. Damage to interior structural elements would not occur.

3.4 FLOODING AND SPRAY EFFECTS FROM MODERATE ENERGY LINE BREAKS

Interaction between MELB flood and spray effects and safe shutdown equipment is generally limited at the LACBWR by

means of physical separation (See Table 1).

One area where physical separation is not adequate to completely preclude potential interactions is the electrical penetration room at the location of the 480-V Essential Bus 1A Switchgear. This equipment is subject to spray effects from a postulated MELB in the eight-inch Alternate Core Spray Line which runs overhead through the penetration room, offset horizontally from the location of the switchgear enclosure by approximately five feet. It can be demonstrated, however, that the consequences of the worst-case postulated MELB in this area pose no safety concerns, since:

a. A postulated MELB, in the ACS line in this location would not cause a loss of off-site power;

b. it does not compromise the integrity of the RCPB;

c. no mitigating systems are required to operate;

d. shutdown and cooldown of the reactor can be accomplished using ordinary means.

Furthermore, even in the event that the Essential Bus 1A Switchgear is lost, and further assuming that emergency onsite AC power is subsequently needed, this power would still be available from redundant (and separate) Essential Bus 1B.

4.0 CONCLUSIONS

Based upon previous plant reviews (References 2 & 3) and subsequent plant modifications, there is a reasonable assurance that fluid system breaks outside containment will not cause the loss of needed functions of safety-related systems at the LACBWR facility.

TABLE 1. EFFECTS OF PIPE BREAK OUTSIDE CONTAINMENT

ZONE	PIPE BREAK	AFFECTED MITIGATING SYSTEM	AFFECTED SAFE SHUTDOWN SYSTEM	ADEQUACY OF PROTECTION REMARKS
Crib House	LPSW, CW	None	ACS (Diesel Driven Pumps)	Adequate. Closest ME Line with respect to Diesel pumps is 6"/ 3" SW line, with separation of approximately 20 feet. Leakage from break in these would not adversely affect Diesel pump operation. Flooding not a concern since leakage would collect in trash trough and drain downstream of intake flume.
Turbine Building Mezzanine (El. 654')	MS, MSBP, CS, (HELB)	ACS	ACS	Adequate. Pipe restraints have been added to the MS & MSBP pipe runs to preclude damage to ACS line from pipe whip. See Evaluation text.
Turbine Building Mezzanine (El. 654')	HPSW, LPSW, CW (MELB)	None	ACS	Adequate. A remote-manual actuated, motor-operated isolation valve has been installed in the HPSW Line close to its connection to the ACS line so the HPSW leakage can be isolated in the event that the HPSW line (a ME system) is broken. This prevents reduction in ACS flow capacity due to diversion of fluid through the break.

TABLE 1 (Continued)

ZONE	PIPE BREAK	AFFECTED MITIGATING SYSTEM	AFFECTED SAFE SHUTDOWN SYSTEM	ADEQUACY OF PROTECTION REMARKS
Turbine Building Grade Floor (El. 640')	HPSW, CW, CCW, LPSW, DW, (MELB)	None	None	Adequate. No safe shutdown equipment at risk from MELB spray or flooding effects in this zone.
Electrical Penetration Room (El. 640')	ACS (MELB)	None	480-V Essential Bus 1A Switchgear	See text.
Pipe Tunnel	HFSW, CCW FW, DW (MELB)	None	None	Adequate. No safe shutdown equipment at risk from MELB spray or flooding effects in this zone.

TABLE 1 (Continued)

List of Abbreviations

ACS	-	Alternate Core Spray System
CCS	-	Component Cooling Water System
CS	-	Condensate System
CW	-	Circulating Water System
DW	-	Demineralized Water System
FW	-	Feedwater System
HELB	-	High Energy Line Break
HPSW	-	High Pressure Service Water
LPSW	-	Low Pressure Service Water
MELB	-	Moderate Energy Line Break
MS	-	Main Steam System
MSBP	-	Main Steam Bypass System
RCPB	-	Reactor Coolant Pressure Boundary
SW	-	Screen Wash System

REFERENCES

1. NRC letter, A. Giambusso to DPC, dated 12/13/72.

2. Robert W. Reid, Division of Operating Reactors, to John P. Madgett, General Manager DPC, dated April 5, 1976.

3. NES letter P-5101-77, to R. E. Shimshak (DPC) dated 12/4/74.