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April 30, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: LaSalle County Station Units 1 and 2
Proposed Elimination of Pipe Whip
Restraints Associated with Arbitrary
Intermediate Pipe Breaks
Facility Operating Licenses NPF-11
and NPF-18
NRC Docket Nos. 50-373 and 50-374

References (a): FSAR Section 3.6.2.1

(b): FSAR Appendix C

(c): Byron/Braidwood letter to D. L. Farrar
from B. J. Youngblood dated January 7, 1985.

Dear Mr. Denton:

Pursuant to 10 CFR 50.59, Commonwealth Edison proposes to amend the criteria used to define break and crack location and configuration as described in Reference (a) to permit removal of pipe whip restraints associated with postulated aribitrary intermediate pipe breaks. Justification for this proposed change is provided in the attachment to this letter. A similar request on the Byron/Braidwood dockets was recently approved by your staff in Reference (c).

Commonwealth Edison has reviewed this proposed change in accordance with 10 CFR 50.59. Although no change to the Techncial Specifications is indicated by our review, we nonetheless request your prior approval and concurrence that this change does not constitute an unreviewed safety question.

Please direct any questions you may have concerning this matter to this office. Pursuant to 10 CFR 170.12, a fee remittance of $150.00 is enclosed.

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P PDR

A001 w/check $150.00
3/40 # 0007112

Three (3) signed originals and thirty-seven (37) copies of this transmittal and its attachments are provided for your use.

Very truly yours,

J. G. Marshall

J. G. Marshall
Nuclear Licensing Administrator

lm

cc: Resident Inspector - LSCS
A. Bournia - NRR
G. Wright - State of Ill.

SUBSCRIBED AND SWORN to
before me this 30th day
of April, 1985

Rosalie A. Puenta
Notary Public

0016K

LASALLE COUNTY UNITS 1 & 2

ARBITRARY INTERMEDIATE PIPE BREAKS

1.0 Introduction

Commonwealth Edison Company (CECo) has followed closely the recent activities of the Nuclear Regulatory Commission (NRC) staff and the nuclear industry relative to the treatment of design-basis pipe breaks in high energy piping systems. In particular, it is noted that the NRC staff has expressed a positive interest in the industry's proposal to modify the historic pipe break criteria to eliminate from design consideration those intermediate pipe breaks generally referred to as arbitrary intermediate breaks, i.e., those breaks which, based on stress analysis, are below the piping stress limits and/or the cumulative usage factors specified in the initial NRC criteria, but which were initially selected to provide a minimum of two breaks between terminal ends. NRC staff and industry discussions with the Advisory Committee on Reactor Safeguards (ACRS) on March 29 and June 2, 1983 have indicated general agreement with the elimination of the arbitrary intermediate breaks. That elimination accrues considerable design benefit due to the deletion of the associated pipe whip restraints and related provisions which were to mitigate the effects of intermediate pipe breaks. Additionally, operational advantages ensue from decreased numbers of pipe whip restraints to be inspected and maintained for 40 years.

2.0 Break Selection Criteria

The break selection criteria initially employed by CECo for the LaSalle County Units 1 & 2 Stations was based upon NRC Branch Technical Position MEB 3-1. That position required that pipe breaks be postulated at terminal ends and at intermediate locations where, depending on the pipe class, stresses or cumulative usage factors exceed specified limits. If two intermediate locations could not be determined based on the above because the stresses and cumulative usage factors were below the specified limits, then the two highest stress locations were selected.

3.0 Industry Experience

CECo concurs with other nuclear utilities in the belief that current knowledge and experience support the conclusion that designing for arbitrary intermediate breaks is not justified and that this requirement should be deleted. This conclusion is supported by extensive

operating experience in over 80 operating U.S. plants and a number of similar plants overseas in which no piping failures have been known to occur that would suggest the need to design protective features to mitigate the dynamic effects of arbitrary intermediate breaks. Arbitrary intermediate breaks are often postulated at locations where maximum pipe stresses are significantly less than the ASME Code allowables and within a few percent of the stress levels at other points in the same piping system. Mitigating such breaks with pipe restraints results in complicated protective features at arbitrary specific break locations but does little to enhance overall plant safety.

4.0 Benefits from Removal

Elimination of the arbitrary intermediate break locations results in the elimination of the associated pipe whip restraints and other structural provisions to mitigate the consequences of these breaks. Significant operational benefits are also realized over the 40-year life of each plant. As identified in NUREG/CR-2136, these benefits accrue in the areas of plant reliability and reduced exposure of plant personnel to radiation during inspection of this excessive number of pipe whip restraints.

4.1 Access

Access during plant operation for maintenance and inservice inspection is improved due to decreased congestion from these restraints and their supporting structural steel. Also, fewer restraints must be removed to gain access for weld inspections. In addition to the decrease in maintenance effort, a corresponding reduction in man-rem exposure can be realized from fewer manhours spent in radiation areas.

4.2 Recovery from Unusual Conditions

Recovery from unusual plant conditions can also be improved by elimination of congestion due to excessive pipe restraints. In the event of a radioactive release or spill inside the plant, decontamination is much simpler when complex shapes, represented by the structural frameworks supporting the restraints, are eliminated. This results in decreasing man-rem exposures associated with decontamination and restoration activities. Similarly, access for control of fires within certain areas of the plant would be improved, especially under low visibility conditions. Substantial overall benefits in these areas can be realized by reducing the number of whip restraints required.

4.3 Decrease in Heat Loss

By design, whip restraints fit closely around the high energy piping with gaps typically being on the order of half an inch. These restraints and their supporting steel significantly increase the heat transfer to the surrounding environment. Also, the insulation must be cut back in these areas. This is done because thermal movement of the piping system during start-up and shutdown can deform the piping insulation against the fixed whip restraint thus reducing insulation effectiveness. This heat loss contributes to the over-temperatures of the LaSalle containments. The elimination of whip restraints associated with arbitrary intermediate breaks would assist in reducing the normal environmental temperatures.

4.4 Removal

Because the restraints are already in place at LaSalle, the restraints determined not to be required would be removed as access time and alara considerations allow during plant shut down conditions.

5.0 Alternative Pipe Break Criteria

Based on the preceding information, CECo requests NRC approval of the alternative pipe break criteria given in 5.1 and 5.2 below which eliminate the original arbitrary intermediate pipe breaks, i.e., those breaks which, based on stress analysis, are below the stress limits and the cumulative usage factors specified in the current NRC criteria, but which were initially postulated to provide a minimum of two breaks between terminal ends.

Application of the alternative pipe break criteria described below does not alter CECo's commitment to quality that has been used in the design of safety related structures, systems, and components. The quality assurance program ensured that safety related structures, systems, and components have been designed, fabricated, erected, and tested to the quality standards commensurate with their safety function.

5.1 ASME Section III Piping Inside Containment

- o Piping systems are designed to accommodate pipe breaks at terminal ends and locations where the stress or usage factor criterion of MEB 3-1 is exceeded. No arbitrary intermediate pipe breaks are postulated where the stress and/or usage factor criteria are not exceeded.

- Elimination of arbitrary intermediate pipe breaks must not adversely affect the remaining pipe breaks and their associated pipe whip restraints.

- For plant flooding evaluations, environmental qualification of equipment, and structural design of equipment in areas traversed by high energy piping systems, pipe breaks will continue to be postulated in accordance with the present project criteria, i.e., in each area traversed by the high energy piping system, non-mechanistic breaks are postulated at the location that results in the most severe environmental consequences. Therefore, elimination of the arbitrary intermediate pipe breaks does not impact environmental qualification of equipment nor plant structural design.

5.2 ASME Section III and Seismically Designed Non-ASME Section III Piping Outside Containment

- Piping systems are designed to accommodate pipe breaks at terminal ends and locations where the stress criterion of MEB 3-1 is exceeded. No arbitrary intermediate pipe breaks are postulated unless the stress criterion is exceeded.

- Elimination of arbitrary intermediate pipe breaks must not affect the remaining pipe breaks and their associated pipe whip restraints.

- For plant flooding evaluations, environmental qualification of equipment, and structural design of equipment in areas traversed by high energy piping systems, pipe breaks will continue to be postulated in accordance with the present project criteria, i.e., in each area traversed by the high energy piping system, non-mechanistic breaks are postulated at the location that results in the most severe environmental consequences. Therefore, elimination of the arbitrary intermediate pipe breaks does not impact the environmental qualification of equipment nor plant structural design.

6.0 Eliminated Pipe Breaks

Attachment A lists by subsystem those arbitrary intermediate pipe breaks and associated pipe whip restraints which can be eliminated from the design because the stress and usage factor limits are not exceeded. The

FSAR will be revised after NRC approval of this submittal to show the physical location of the restraints within a given subsystem.

The application of the proposed alternative pipe break criteria results in the elimination of 10 break locations and 11 pipe whip restraints per unit.

6.1 Elimination of Breaks Not Yet Identified

The existing guidelines in MEB 3-1 of the SRP (NUREG-0800) Revision 1 will be met for those piping systems, or portions thereof, which are not included in this submital. If other piping subsystems included within the systems identified in Table D-1, but not specifically identified in this submittal, subsequently qualify for elimination under the alternative pipe break criteria of Section 5.0, they will be appropriately identified to the staff.

7.0 Additional Technical Justification

In this submittal CECo is providing additional technical information to justify this request. Specific NRC concerns are addressed in Attachments B through F as follows:

1.	Technical justification for elimination of arbitrary intermediate pipe breaks	Attachment B
2.	Provisions for minimizing intergranular stress corrosion cracking in high energy lines	Attachment C
3.	Provisions for minimizing the effects of thermal and vibration induced piping fatigue	Attachment D
4.	Provisions for minimizing water/steam hammer effects	Attachment E
5.	Provisions for minimizing local stresses from welded attachments	Attachment F

8.0 Conclusion

CECo has reviewed the basis for the postulated intermediate pipe breaks on designated high energy lines and has compared the design stresses and usage factors with the initial SRP MEB 3-1 Guidelines. On the basis of ASME Code calculations, there is no technical justification for such postulated intermediate pipe breaks. The probability of pipe rupture at the values of stress and usage assignable to these intermediate pipe breaks is extremely remote (10^{-9}) to 10^{-11}) whether in carbon steel or stainless steel pipes.

Elimination of these arbitrary intermediate pipe breaks affects the need for pipe whip restraints originally designed to mitigate these breaks. The evaluation of these breaks under Alternative Criteria that fully conforms to the SRP MEB 3-1 guidance, but which omit these arbitrary intermediate pipe breaks on the high energy lines, results in a significant decrease in the number of pipe restraints required for high energy line breaks.

Removal of those pipe restraints associated with the arbitrary intermediate pipe breaks results in several benefits. These benefits are identified in Attachment G. Also avoided are the maintenance and surveillance of these surplus restraints over the 40 year life of the plant.

ATTACHMENT A

Summary of Class 1 Piping
Intermediate Break and Pipe Whip Restraint Reductions

System	Subsystem	Intermediate Break Locations	Breaks/ Break ID Eliminated	Pipe Whip Restraints/ Restraint ID Eliminated
Main Steam	MS02 (RCIC)	-Elbow welds between horizontal leg following valve/vertical riser and bottom of riser on Reactor Core Isolation Coolant line.	2/C121 /C123	4/R46 /R47 /R48 /R50
Residual Heat Removal System	RH01, RH04, RH05, RH06	-Elbow welds at bottom of 12" riser containing valve E12-F090A. -Elbow weld on riser between RPV and valve for RHR lines 40BA, 40BB, and 53B.	4/C69 /C83 /C87 /C91	2/R18 /R30
Reactor Water Cleanup	RR01	-Elbow welds on horizontal leg prior to riser on 4" branch line between the 6" line and closed valve.	2/C95 /C97	2/R35 /R36
Main Steam Miscellaneous Piping	MS25	-Half couplings at 2" branch lines 1MS14AB and 1MS14AC off 3" header.	2/C5 /C9	3/SR06 /SR10 /SR12
		Totals	10	11

Attachment B

TECHNICAL JUSTIFICATION FOR ELIMINATION OF ARBITRARY INTERMEDIATE BREAKS

The following items provide generic technical justification for the elimination of arbitrary intermediate pipe breaks and their associated pipe whip restraints.

1. Operating procedures and pipe and system designs minimize the possibility of intergranular stress corrosion cracking, thermal and vibration induced fatigue, and water/steam hammer in these lines in which arbitrary pipe breaks are currently postulated. Detailed design provisions for these phenomena are provided in Attachments C, D, & E, respectively.

2. Welded attachments are not located in close proximity to the breaks to be eliminated. Consequently, local bending stresses resulting from these attachments does not significantly affect the stress levels at the break locations (refer to Attachment F).

3. The remaining postulated pipe breaks and whip restraints are not affected by removal of the arbitrary intermediate breaks.

4. Pipe breaks are postulated to occur at locations where, depending on the pipe class, stresses are only 80% of Code allowables or where the cumulative usage factor is only 10% of the allowable 1.0. The arbitrary breaks to be eliminated all exhibit stresses and usage factors below these conservative thresholds.

5. Pipe rupture is recognized in Branch Technical Position MEB 3-1 as being a "rare event which may only occur under unanticipated conditions".

6. Arbitrary intermediate breaks are only postulated to provide additional conservatism in the design. There is no technical justification for postulating these breaks.

7. Elimination of pipe whip restraints associated with the arbitrary breaks can facilitate in-service inspection, reduce heat losses from the restrained piping, and reduce the potential for restraining pipe due to unanticipated thermal growth and seismic motion.

8. Pipe break related equipment qualification (EQ) requirements are not affected by the elimination of the arbitrary breaks. Breaks are postualted non-mechanistically for EQ purposes.

It is concluded that the elimination of arbitrary intermediate breaks is technically justified, based on the preceding reasons.

ATTACHMENT C

PROVISIONS FOR MINIMIZING STRESS CORROSION CRACKING IN HIGH ENERGY LINES

Industry experience has shown (NUREG-0691) that intergranular stress corrosion cracking (IGSCC) will not occur unless the following conditions exist simultaneously: high residual tensile stresses, susceptible piping material, and a corrosive environment. Elimination of any one of these conditions will preclude the formation of IGSCC.

Although any stainless or carbon steel piping will exhibit some degree of residual stress and material susceptibility to IGSCC, Commonwealth Edison Company has taken positive steps to minimize the potential for IGSCC by choosing piping material with low susceptibility to stress corrosion, by conservative design margins and by preventing the existence of a corrosive environment. The material specifications consider compatibility with the system's operating environment (both internal and external), as well as other materials in the system, applicable ASME code requirements, fracture toughness characteristics, and welding, processing, and fabrication techniques.

A summary of design changes made at LaSalle to minimize the potential for IGSCC is included in response to FSAR Question Q 121.8. Additionally, the IHSI treatment of stainless steel headers on the recirculation loops has been accomplished on Unit 2 and is scheduled for Unit 1 at the first refueling outages of sufficient duration to accomplish this improvement against IGSCC. At LaSalle Units 1 and 2 only a portion of the RHR system is made of stainless steel. All other systems where arbitrary intermediate breaks have been postulated are made from ferritic type carbon steel. Replacement and removal of stainless steel from much of the primary pressure loop piping and equipment was accomplished during plant design and erection.

The likelihood of IGSCC in stainless steel increases with carbon content. Consequently, only the lower carbon content stainless steels (304, 316) were used for the stainless steel portion of the RHR system at the LaSalle Station. The existence of a corrosive environment is prevented by strict criteria for internal and external pipe cleaning, and by water chemistry control during start-up and normal operation.

For all other systems with postulated arbitrary intermediate breaks, ferritic type carbon steel was the choice for the piping, fittings, and valve bodies forming the pressure boundaries. This ferritic material has been found satisfactory from the standpoint of non-susceptibility to IGSCC for the service conditions encountered. Because most BWR-5 systems are not made of stainless steels, the question of IGSCC in stainless steels does not arise for most systems at LaSalle.

In addition, all stainless steel piping has been inspected. No IGSCC has occurred to date at LaSalle. IGSCC is not a concern with whip restraints associated with strictly carbon steel piping.

All piping involved in the elimination of arbitrary intermediate breaks has been cleaned and flushed as part of the pre-operational test program. The piping has been flushed with demineralized water subject to written criteria for limits on total dissolved solids, conductivity, chlorides, fluorides and pH. Flush water quality was monitored periodically. The flushing was controlled by detailed procedures written for each system. Water chemistry for preoperational testing was controlled by written specifications.

During plant operation, water chemistry is monitored in the reactor plant. The major water chemistry standards are included in the plant operating procedures for the lines in which arbitrary breaks were previously postulated. The water chemistry requirements are provided in the Technical Specifications.

Table C-1 summarizes the systems in which currently postulated arbitrary intermediate breaks are to be eliminated.

ATTACHMENT C

TABLE C-1

Elimination of Arbitrary Breaks and Restraints
Systems Summary
(Showing the Preponderance of Carbon Steel Piping vs. Stainless Steel Piping)

Piping System	Pipe Material	Operating Temp. (F)	Number of Breaks/ Restraints Deleted Per Unit
Main Steam	CS	550	2/4
Residual Heat Removal System	304 SS CS	550 550	1/1 (C69/R18) 3/1
Reactor Water Cleanup	CS	550	2/2
Main Steam Miscellaneous Piping	Low Carbon Alloy Steel (5% Cr, ½%Mo)	550	2/3
		Totals	10/11

SS - Stainless Steel
CS - Carbon Steel

ATTACHMENT D

PROVISIONS TO MINIMIZE THE EFFECTS OF THERAML AND VIBRATION INDUCED PIPING FATIGUE

I. GENERAL FATIGUE DESIGN CONSIDERATIONS

For Class 1 lines, fatigue considerations are addressed by the cumulative usage factor (CUF). To ensure that piping does not fail due to fatigue, the ASME Code has established the CUF limit at 1.0. By definition, all arbitrary intermediate break locations have CUFs below 0.1.

For Class 2 and 3 lines, fatigue is considered in the allowable stress range check for thermal expansion stresses. This stress is included in the total stress value used to determine postulated break locations. All arbitrary break locations exhibit stresses less than 80% of the code allowables. If the number of thermal cycles is expected to be greater than 7,000, then the allowable stresses are further reduced by an amount dependent on the number of cycles.

II. THERMAL DESIGN CONSIDERATIONS

For Class 1 lines anticipated flow conditions that could result in piping thermal transient stresses have been defined. Piping thermal transient stresses have been calculated for these conditions and the stresses have been included in cumulative usage factors and documented in stress reports for the piping.

III. VIBRATION DESIGN CONSIDERATIONS

Piping at LaSalle is designed and supported to minimize transient and steady state vibrations. Preoperational and start-up testing was performed to ensure that vibration of the piping systems was within allowable limits. Preoperational and startup piping vibration programs have been completed at LaSalle Units 1&2. The purpose of the program was to ensure that operational piping vibration did not result in exceedances of allowable stress amplitudes nor result in undesirable system responses. The freedom from restraint or snubber lock-up was also observed; and a cold/hot walkdown was included. A dynamic vibration monitoring system is permanently installed at LaSalle, however its usage is directed toward selective monitoring of rotating machinery.

ATTACHMENT E

PROVISION FOR MINIMIZING STEAM/WATER HAMMER EFFECTS

1. Water hammer is prevented in the ECCS discharge lines by maintaining the lines in a full condition. The lines are kept full up to the discharge valves by fill pumps which replace any leakage from the lines. Beyond the discharge valve the line is not drained when the system is not operating, so the discharge lines will remain full from the previous use.

   The HPCS is a motor-operated system and has no steam supply line.

   Water hammer will be prevented in the RCIC system during RCIC startup by sequentially opening the RCIC steam supply isolation valves. The RCIC steam supply line remains isolated until the reactor pressure reaches 50 psi. At the 50 psi point the RCIC isolation valves are opened sequentially. The outboard isolation valve is opened first and any condensation is drained from the line. The bypass valve is then opened to allow condensation to drain from the line and allow the line to warmup to the reactor temperature corresponding to 50 psi; this allows the inboard isolation valve to be opened without water hammer occurring. Additionally, the steamlines are sloped to allow any condensation in the lines to drain off to drain pots when the system is not operating. Therefore, the steam supply line will be a dry steam line even after a cold shutdown. Hence, the steam supply line will be at the reactor temperature corresponding to 50 psi when the inboard isolation valve is opened, thereby preventing water hammer. As the reactor pressure increases the temperature of the line will increase, matching the corresponding saturation points.

2. As indicated in part 1. above, the ECCS discharge lines are maintained in a full condition by a jockey pump in each fill line to replace leakage from the lines to the suppression pool (the LPCS and RHR-A share a common pump). Pressure limit switches which alarm in the control room are provided to inform the operator of off-normal conditions. The pressure

switch setpoint valves and instrument accuracies are listed below.

	HPCS	LPCS	RHR
range	0-100 psig	0-500 psig	0-600 psig
contact point 1	50 psig	475 psig (Inc)	400 psig (Inc)
contact point 2	---	40 psig (Dec)	---
required accuracy	± 1%	± 10 psig	± 2%
rated accuracy	± 1%	± 1%	± 1%

3. The main steam and feedwater systems are expected to experience steam and water hammer loadings, respectively. Analyses have been performed for these loadings and the main steam and feedwater systems have been designed to accommodate and minimize effects of these loadings. Main steam piping has been analyzed and designed for the effects of isolation valves closures, turbine stop valve closures, and safety relief valve openings. The feedwater piping has been analyzed and designed for the effects of check valve closure caused by flow reversal from the RPV after a feedwater pump trip. The main steam and feedwater stress reports include the stresses and usage factors calculated from the analyses of these events.

ATTACHMENT F

PROVISION FOR MINIMIZING LOCAL STRESSES FROM WELDED ATTACHMENTS

CECo has reviewed those arbitrary intermediate break locations to be eliminated and has determined that in no case are welded attachments placed in close proximity to postulated break locations. As a result, local bending stresses induced by the attachment will not affect the stresses at the postulated break point. To ensure that this is the case, the local stresses have been determined and added to the primary stress reports.

ATTACHMENT G

SUMMARY OF BENEFITS FOR THE ELIMINATION OF ARBITRARY INTERMEDIATE PIPE BREAKS - LASALLE COUNTY STATION

Changes Resulting from Break Elimination	Cost Savings*	Operational Benefits
Elimination of 11 Pipe Whip Restraints per Unit	Unknown	o Potential improvement in quality of inservice inspection (ISI)
	o Dose Reduction Costs $ 55,000	o Dose reduction from improved personnel access during maintenance, ISI and recovery from unusual plant conditions, e.g., radioactive spills, fires, etc.
	Unknown	o Improved capability to recover from unusual plant conditions, e.g., decontamination, following radioactive spills, access for fire lighting, etc.
	Material Replacement	o Reduced system heat loss resulting from improved insulation design.
	$ 50,000	o Dose reduction by eliminating the need to set and maintain restraint clearance gaps.
Elimination of Analyses Associated with the Dynamic Effects and Loading Conditions	o Load reduction and structural analyses costs to accommodate lower EAM load ratings $ 50,000	o Improved system layout and design for future plant modifications.
TOTAL SAVINGS (UNITS 1 AND 2)	$155,000	11.0 man-rem in dose reduction over the 40-year plant life.

*Estimate is Applicable to each Unit.