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DENTON,H.R. Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards response to draft SER Open Item 99 re effects of high energy line breaks on control sys.Response consists of results of study performed per IE Info Notice 79-22.

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Carolina Power & Light Company

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OCT 27 1983

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

SHEARON HARRIS NUCLEAR POWER PLANT
UNIT NOS. 1 AND 2
DOCKET NOS. 50-400 AND 50-401
DRAFT SER OPEN ITEM 99 RESPONSE

Dear Mr. Denton:

Carolina Power & Light Company hereby transmits one original and forty copies of our response to Draft Safety Evaluation Report Open Item 99. This Open Item deals with the effects of high energy line breaks on control systems and is being reviewed by the Instrumentation and Control Systems Branch.

Yours very truly,

M. A. McDuffie
Senior Vice President
Nuclear Generation

FXT/pgp (8327FXT)

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Shearon Harris Nuclear Power Plant
Instrumentation and Control Systems Branch
Draft SER Open Item No. 99

Operating reactor licensees were informed by IE Information Notice 79-22, issued Spetember 19, 1979, that if certain nonsafety-grade control equipment were subjected to the adverse environment of a high energy line break, it could impact the safety analyses and the adequacy of the protection functions performed by the safety-grade equipment. The staff has requested a review by the applicant to determine whether the harsh environment associated with high-energy line breaks might cause control system malfunctions and result in a consequence more severe than those of the FSAR Chapter 15 analyses or beyond the capability of operators or safety systems.

Response

The results of a study performed to assess the effects of high energy line breaks on control systems are attached.

REPORT FOR

EFFECTS OF HIGH ENERGY LINE BREAKS ON CONTROL SYSTEMS (IE INFORMATION NOTICE 79-22)

TABLE OF CONTENTS

TABLES

0. SUMMARY

An analysis of the effects of control system malfunctions caused by postulated high energy line breaks (HELBs) was performed in response to NRC acceptance review question 420.7 (open item 99). The purpose of this analysis is to assure that any HELB induced failures of non-qualified control systems do not result in effects not considered in the FSAR Chapter 15 analysis of these events.

The analysis has identified that the power and signal cables from excore neutron detector NE-44 of the Rod Control System could be severed by HELBs. This can result in an inadvertent rod withdrawal in conjunction with the initiating HELB until reactor trip which is not clearly bounded by the existing FSAR Chapter 15 analyses. This will be eliminated by rerouting the cables from NE-44 to an area unaffected by HELB or installing the barriers to protect the cables.

The analysis also showed that no other such instances exist in the SHNPP design. This is primarily due to the following reasons:

1 - Most instruments used for control are used for plant protection as well. As such, they are safety related and are required to be protected from HELBs by the project pipe break criteria regardless of this question.

2 - Environmental qualification of the Westinghouse supplied instruments was recently upgraded, including qualification of some non-safety control instruments.

3 - All cabling used in the plant for non-safety systems is qualified for the HELB harsh environment.

4 - Concrete embedded conduit is extensively used in the containment for instrument cable routing where most of the postulated HELBs are.

1. INTRODUCTION

This report was developed in response to NRC acceptance review question 420.7 (open item 99). This question asked if the effects associated with HELBs might cause control system malfunctions and result in a consequence more severe than those of the FSAR Chapter 15 analyses or beyond the capability of operators or safety systems.

2. BACKGROUND

On September 14, 1979, the NRC issued I&E Information Notice 79-22. This resulted from a report regarding Public Service Electric & Gas Company's Salem plant based on a Westinghouse review of the environmental qualification of equipment. It was realized that certain non-safety grade equipment, if subjected to an adverse environment from a postulated high energy line break, could impact the safety analyses and the protective functions performed by safety grade equipment. This concern also led the NRC to issue a standard question to plants under OL review. This question requires an analysis to assure that high energy line breaks will not cause control system failures to complicate the event beyond the FSAR Chapter 15 analyses.

3. OVERALL APPROACH

This effort may extend into as many as three major phases. This is shown schematically on Figure 1 and described below.

PHASE I

Plant models are developed and analyzed to determine if there are any control system components affected by the effects of high energy line breaks that can result in control system malfunctions. The effects of HELBs include jet impingement, pipe whip, flooding or harsh environment. If none are found, the study is complete and the design is acceptable. If any are found, they will be compared to the Chapter 15 analyses to determine if they cause any effects not considered in these analyses. If any are found, the study will proceed to Phase II.

PHASE II

Chapter 15 type analyses that include the HELB induced control system failures will be performed for the items that escape Phase I. If these new analyses show that the ensuing transients do not exceed the Chapter 15 analyses, the study is complete and the design is acceptable. If any of the control system malfunctions exceed the Chapter 15 acceptance criteria, the study will proceed to Phase III.

PHASE III

Any control system malfunctions that escape Phase II are unacceptable and must be eliminated by relocation of the affected component, physical protection (shields or barriers), or qualification of the affected component for the expected HELB environment. These modifications will be subjected to a re-evaluation (as in Phase I) to verify that no unacceptable design features have been added by the changes.

4. METHODOLOGY (PHASE I)

The objective of Phase I is to determine if there are any control system component failures induced by HELBs that can cause adverse effects that were not included in the Chapter 15 analysis of the HELB. A broad functional based method was chosen to assure that all potential scenarios were identified and evaluated. This was accomplished in discrete steps as described in the following.

Identify the Control System Components of Interest

The control systems of interest are those identified in the response to NRC acceptance review question 420.8 (open item 98), except the safety grade systems. HELB induced failures of safety grade components were explicitly excluded from this analysis because the ongoing work on pipe rupture protection and equipment qualification will assure that these do not occur.

Identify the Control System Component Failures Caused by the HELB Effects

The standard HELB effects of jet impingement, pipe whip, harsh environment and flooding were considered in this analysis. The HELBs postulated are the ones specified in FSAR Section 3.6.1.

For pipe whip and jet impingement, the HELB jet cone drawings were superimposed on the associated instrument location, conduit, trays and grounding drawings which identify the sensor, impulse line, connecting cables and controlled component locations. The components of interest were located and a list was maintained that identified the components that are struck by each jet. Components struck by pipe whip are enveloped by the resultant jets, so no separate consideration needed to be given to pipe whip. Jets impacting instrument lines and connecting cables were assumed to sever them. Jets impacting sensors and controlled components were assumed to fail these devices in the worst case mode, as determined from the experience of question 420.8 (open item 98). The resultant tabulations are given on Table 1.

For flooding, the containment post-recirculation flood level was conservatively assumed. A search was conducted to identify all sensors, connecting cables and controlled components that are located at or below this level. None were found. Instrument lines are not senstitive to flooding, so these were not searched for.

The harsh environment conditions given in FSAR Section 3.11 were used for the analysis. The environmental qualification envelopes given in the manufacturer qualification reports for each sensor and controlled component were compared to these conditions to determine whether they were qualified for the harsh environment caused by the HELB. The results of this detailed evaluation are presented in Tables 2 and 3.

As seen in Table 2, the only instruments that are subject to the HELB effects but are not qualified for the harsh environment are pressurizer pressure transmitters PT-444 and PT-445. These transmitters provide input to the PORV control and would provide a false PORV open signal if the HELB environment caused them to fail such that a false high output was generated.

However, PORV opening in this case would be blocked by an interlock based on signals from qualified pressurizer pressure transmitters. As such, there are no harsh environment induced control failures that need be considered in conjunction with the jet impingement effects of the HELB.

Also, as seen in Table 2, the letdown isolation valves (1-LCV-459 & 460) are not specifically qualified for the harsh environment. As such, they cannot be guaranteed to assume their safe failure position.(closed) following a HELB. However, there are qualified valves (letdown orifice isolation valves 1-8149A, 1-8149B and 1-8149C) in series with the letdown isolation valves that close on low pressurizer level or Phase A Containment Isolation Signal. These valves will maintain the function of letdown isolation following the HELB, so any failure of the letdown isolation valves are inconsequential.

As seen in Table 3, the only instrument that is subject to HELB effects not qualified for the harsh environment is flow transmitter FT-122. This transmitter provides the input to the charging flow control valve. The worst case failure of this transmitter will result in increased charging flow and pressurizer level until high pressurizer level reactor trip. This event is considered not significant for Chapter 15 analyses.

Analyze the Collective Effects of Each HELB

The collective effects of all malfunctions induced by each HELB as listed on Table 1 were considered to determine the overall effects, if any, on the Chapter 15 analyses. This was originally to be done by including the breaks on the block diagrams from the response to question 420.8 (open item 98) and using the block diagrams to propogate the failure effects. However, the resultant failure combinations were few and simple enough to be analyzed by inspection and compared to the Chapter 15 analyses. The results for each are given on Table 1.

5. RESULTS

As shown on Table 1, there is only one HELB induced failure of control systems that affect FSAR Chapter 15 analyses. This failure consists of the severence of the electrical conduit serving excore neutron detector NE-44, which would result in an inadvertent withdrawal of the control rod banks until reactor trip. Only a few other control system failures are induced by HELBs, but these failure modes did not affect the FSAR Chapter 15 analyses. Such favorable findings resulted due mostly to four reasons:

1 - Most instruments used for control are used for plant protection as well. As such, they are safety related and are required to be protected from HELBs by the project pipe break criteria regardless of this question.

2 - Environmental qualification of the Westinghouse supplied instruments was recently upgraded, including qualification of some non-safety control instruments.

3 - Most cabling used in the plant for non-safety systems is qualified for HELB harsh environment.

4 - Concrete embedded conduit is extensively used in the containment for instrument cable routing where most of the postulated HELBs occur.

CONTROL SYSTEM MALFUNCTION CAUSED BY HELB PHASES

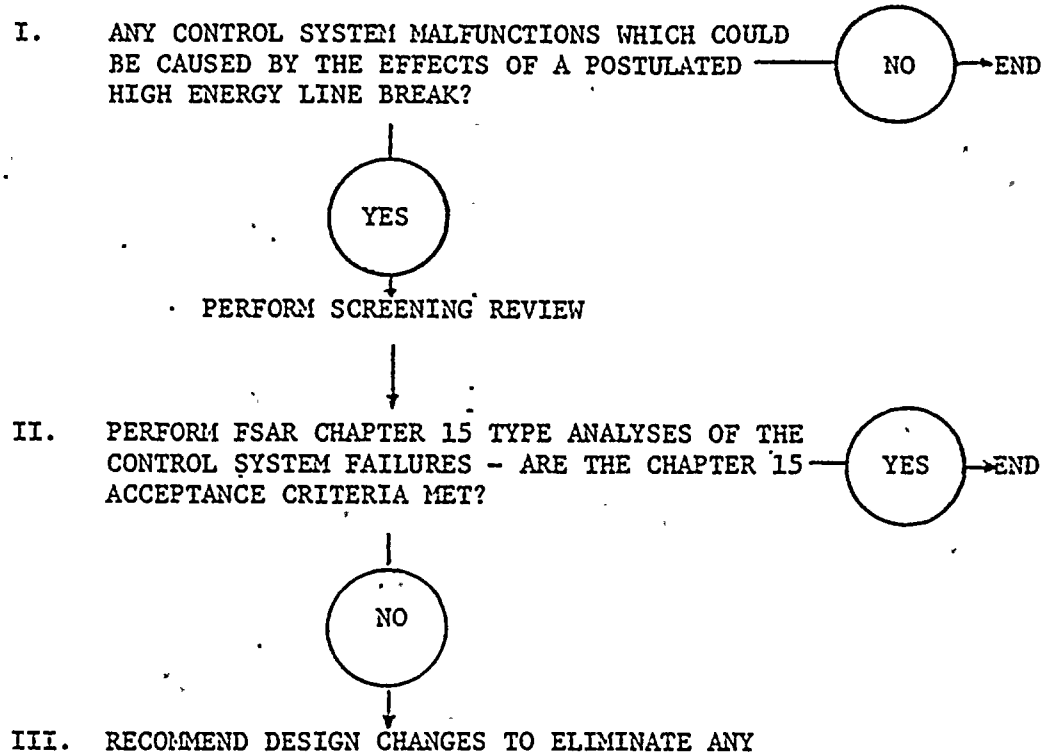

FIGURE 1

TABLE 1 - IMPACTED COMPONENTS SUBJECTED TO JET FORCES/PIPE WHIP/FLOODING
(INSIDE CONTAINMENT)

INITIATING EVENT	JET CONE NUMBER	AFFECTED COMPONENT/FAILURE MODE	FLOODING YES	FLOODING NO	EFFECT
CVCS Letdown Line Break	RJ-CS-90-1A(R-138) RJ-CS-91-1B(R-138) RJ-CS-92-1B(R-138) RJ-CS-138-1B(R-138) RJ-CS-139 1A(R-138) RJ-CS-140-1A(R-138)	Impluse Lines; C1-R6-1-T23/None - See Note C1-R6-2-T23/None - See Note Instrument Air Supply Lines Ruptured Results in PORV's 1-PCV-444B/Fail Closed 1-PCV-445A/Fail Closed 1-PCV-445B/Fail Closed Pressurizer Spray Valves 1-PCV-444C/Fail Closed 1-PCV-444D/Fail Closed		X	PORVs opening and pressurizer spray are not required for this event, so there is no effect on the Chapter 15 analyses.
Pressurizer Surge Line Break	RJ-RC-35-1A(R-163)	Impluse Lines; C1-R6-1-T23/None - See Note C1-R6-2-T23/None - See Note C1-R9-3-T32/None - See Note C1-R9-4-T32/None - See Note C1-R8-3-T28/None - See Note C1-R8-4-T28/None - See Note Instrument Air Supply Lines Ruptured Results in PORV's 1-PCV-444B/Fail Closed 1-PCV-445A/Fail Closed 1-PCV-445B/Fail Closed Pressurizer Spray Valves 1-PCV-444C/Fail Closed 1-PCV-444D/Fail Closed		X	PORVs opening and pressurizer spray are not required for this event, so there is no effect on the Chapter 15 analyses.
	RJ-RC-35-5A(R-163)	Impulse Lines: C1-R4-2-T13/None - See Note C1-R4-3-T13/None - See Note C1-R3-1-T10/None - See Note C1-R3-2-T10/None - See Note C1-R2-1-T7/None - See Note C1-R2-2-T7/None - See Note		X	NONE

TABLE 1 - IMPACTED COMPONENTS SUBJECTED TO JET FORCES/PIPE WHIP/FLOODING
(INSIDE CONTAINMENT)

INITIATING EVENT	JET CONE NUMBER	AFFECTED COMPONENT/FAILURE MODE	FLOODING YES	FLOODING NO	EFFECT
		Impulse Lines			
	RJ-RC-35-5B(R-163)	C1-R10-1-T35/None - See Note C1-R10-2-T35/None - See Note C1-R9-5-T33/None - See Note C1-R9-6-T33/None - See Note C1-R8-5-T29/None - See Note C1-R8-6-T29/None - See Note		X	NONE
Safety Injection Line Break	RJ-RC-66-1(R-154) RJ-RC-66-2(R-154)	Electrical Conduit: 17020 M-S4-3/ Severed Cables		X	A. Safety Injection Line Break. B. Inadvertent Rod withdrawal.
CVCS Charging Line Break	RJ-CS-95-1A(R-137) RJ-CS-114-3A(R-137) RJ-CS-83-2B(R-138) RJ-CS-83-4A(R-138) RJ-CS-83-4B(R-138) RJ-CS-84-1A(R-138) RJ-CS-85-4B(R-137)	Impulse Lines: C1-R9-3-T32/None - See Note C1-R9-4-T32/None - See Note C1-R8-3-T28/None - See Note C1-R8-4-T28/None - See Note Electrical Conduitss: 17005J-SR3/None - See Note 17002M-2/Severed Cables Instrument Air Supply Lines Ruptured Results in PORV's 1-PCV-444B/Fail Closed 1-PCV-445A/Fail Closed 1-PCV-445B/Fail Closed Pressurizer Spray Valves 1-PCV-444C/Fail Closed 1-PCV-444D/Fail Closed		X	PORVs opening and pressurizer spray are not required for this event, so there is no effect on the Chapter 15 analyses.

TABLE 1 - IMPACTED COMPONENTS SUBJECTED TO JET FORCES/PIPE WHIP/FLOODING
(INSIDE CONTAINMENT)

INITIATING EVENT	JET CONE NUMBER	AFFECTED COMPONENT/FAILURE MODE	FLOODING YES	FLOODING NO	EFFECT
CVCS Charging Line Break	RJ-CS-83-3B(R-138) RJ-CS-84-1B(R-138)	Instrument Rack C1-R8-RPS/None-See Note		X	PORVs opening and pressurizer spray are not required for this event, so there is no effect on the Chapter 15 analyses.
		Electrical conduit: 17005J-SR3/None - See Note			
		Instrument Air Supply Lines Ruptured Results in PORV's 1-PCV-444B/Fail Closed 1-PCV-445A/Fail Closed 1-PCV-445B/Fail Closed			
		Pressurizer Spray Valves 1-PCV-444C/Fail Closed 1-PCV-444D/Fail Closed			
CVCS Charging Line Break	RJ-CS-83-2A(R-138)	Electrical Conduit: 17002M-2/Severed Cables		X	PORVs opening and pressurizer spray are not required for this event, so there is no effect on the Chapter 15 analyses.
CVCS Charging Line Break	RJ-CS-83-5B(R-137)	Impulse Lines: C1-R9-3-T32/None - See Note C1-R9-4-T32/None - See Note C1-R10-1-T35/None - See Note C1-R10-2-T35/None - See Note C1-R9-5-T33/None - See Note C1-R9-6-T33/None - See Note		X	PORVs opening and pressurizer spray are not required for this event, so there is no effect on the Chapter 15 analyses.
		Electrical Conduit: 17024K-3/Severed Cables 17002B-SR2/None - See Note Instrument Air Supply Lines Ruptured Results in PORV's 1-PCV-444B/Fail Closed 1-PCV-445A/Fail Closed 1-PCV-445B/Fail Closed Pressurizer Spray Valves 1-PCV-444C/Fail Closed 1-PVC-444D/Fail Closed			

TABLE 1 - IMPACTED COMPONENTS SUBJECTED TO JET FORCES/PIPE WHIP/FLOODING
(INSIDE CONTAINMENT)

INITIATING EVENT	JET CONE NUMBER	AFFECTED COMPONENT/FAILURE MODE	FLOODING YES	FLOODING NO	EFFECT
CVCS Letdown Line Break	RJ-CS-87-2B(R-137) RJ-CS-87-3B(R-137)	Impulse Lines: C1-R4-2-T13/None - See Note C1-R4-3-T13/None - See Note		X	NONE
Auxiliary Feedwater Line Break	RJ-AF-60-5B(R-074)	Impulse Lines: C1-R13-1-T47/None - See Note C1-R13-2-T47/None - See Note		X	NONE
Small Break LOCA	Unrestrained Pipe Whip & Jet Impingement Area (SG-1B Area)	Impulse Lines: C1-R8-3-T28/None - See Note C1-R8-4-T28/None - See Note C1-R6-2-T23/None - See Note C1-R6-1-T23/None - See Note Instrument Air Supply Lines Ruptured Results in PORVs 1-PCV-444B/Fail Closed 1-PCV-445A/Fail Closed 1-PCV-445B/Fail Closed Pressurizer Spray Valves 1-PCV-444C/Fail Closed 1-PCV-444D/Fail Closed		X	PORVs opening and pressurizer spray are not required for this event, so there is no effect on the Chapter 15 analyses.
Small Break LOCA	Unrestrained Pipe Whip and Jet Impingement Area (SG-1C Area)	Impulse Lines: C1-R13-1-T47 C1-R13-2-T47		X	A. Small Break LOCA B. Steam generator 1C Main feedwater control valve opens too far, overfeeding the steam generator until main feedwater isolation occurs on a Safety Injection Signal or HI-HI Level in the steam generator. This does not complicate the small LOCA event.

TABLE 1 - IMPACTED COMPONENTS SUBJECTED TO JET FORCES/PIPE WHIP FLOODING

(INSIDE CONTAINMENT)

INITIATING EVENT	JET CONE NUMBER	AFFECTED COMPONENT/FAILURE MODE	FLOODING YES	FLOODING NO	EFFECT
Small Break LOCA	Unrestrained Pipe Whip and Jet Impingement Area (SG-1A Area)	Impulse Lines: C1-R4-2-T13/None - See Note C1-R4-3-T13/None - See Note C1-R3-1-T10/None - See Note C1-R3-2-T10/None - See Note C1-R2-1-T7/None - See Note C1-R2-2-T7/None - See Note Instrument Air Supply Lines Ruptured Results in Letdown Isolation Valves 1-LCV-459/Fails Closed 1-LCV-460/Fails Closed		X	Letdown is not required for this event, so there is no effect on the Chapter 15 analyses.
Small Break LOCA	Unrestrained Pipe Whip and Jet Impingement Area (SG-1B Area)	Impulse Lines: C1-R10-1-T35/None - See Note C1-R10-2-T35/None - See Note C1-R9-5-T33/None - See Note C1-R9-6-T33/None - See Note C1-R8-5-T29/None - See Note C1-R8-6-T29/None - See Note		X	NONE
Small Break LOCA	Unrestrained Pipe Whip and Jet Impingement Area (SG-1C Area)	Impulse Lines: C1-R15-1-T53/None - See Note C1-R15-2-T53/None - See Note C1-R14-1-T51/None - See Note C1-R14-2-T51/None - See Note C1-R13-1-T47/None - See Note C1-R13-2-T47/None - See Note Electrical Conduit: 17020 M-S4-3/Severed Cables		X	A. Small Break LOCA B. Inadvertent Rod withdrawal

TABLE 1 - IMPACTED COMPONENTS SUBJECTED TO JET FORCES/PIPE WHIP FLOODING
(INSIDE CONTAINMENT)

INITIATING EVENT	JET CONE NUMBER	AFFECTED COMPONENT/FAILURE MODE	FLOODING YES	FLOODING NO	EFFECT
Main Feedwater Line Break	RJ-FW-67-1B(R-071)	Impulse Lines: C1-R4-2-T13/None - See Note C1-R4-3-T13/None - See Note C1-R3-1-T10/None - See Note C1-R3-2-T10/None - See Note C1-R2-1-T7/None - See Note C1-R2-2-T7/None - See Note		X	NONE
Main Feedwater Line Break	RJ-FW-68-1B(R-071)	Impulse Lines: C1-R10-1-T35/None - See Note C1-R10-2-T35/None - See Note C1-R9-5-T33/None - See Note C1-R9-6-T33/None - See Note C1-R8-5-T29/None - See Note C1-R8-6-T29/None - See Note		X	NONE
Main Feedwater Line Break	RJ-FW-69-4A(R-071)	Electrical Conduit: 17020M-S4-3/Severed Cables		X	A. Main Feedwater Break. B. Inadvertent Rod withdrawal.
Main Feedwater Line Break	RJ-FW-69-1B(R-071)	Impulse Lines: C1-R15-1-T53/None - See Note C1-R15-2-T53/None - See Note C1-R14-1-T51/None - See Note C1-R14-2-T51/None - See Note C1-R13-1-T47/None - See Note C1-R13-2-T47/None - See Note		X	NONE
Main Steam Line Break	RJ-MS-1-1C(R-067) RJ-MS-1-3C(R-067)	Impulse Lines: C1-R4-2-T13/None - See Note C1-R3-1-T10/None - See Note C1-R2-1-T7/None - See Note C1-R2-6-T8/None - See Note C1-R7-3-T26/None - See Note		X	NONE

TABLE 1 - IMPACTED COMPONENTS SUBJECTED TO JET FORCES/PIPE WHIP/FLOODING
(INSIDE CONTAINMENT)

INITIATING EVENT	JET CONE NUMBER	AFFECTED COMPONENT/FAILURE MODE	FLOODING YES	FLOODING NO	EFFECT
Main Steam Line Break	RJ-MS-2-1C (R-067)	Impulse Lines: C1-R10-1-T35/None - See Note C1-R9-5-T33/None - See Note C1-R8-5-T29/None - See Note C1-R8-8-T30/None - See Note FT-1MS-0485-IV-W-HP-T65/None - See Note		X	NONE
Main Steam Line Break	RJ-MS-3-1C(R-067) RJ-MS-3-3C(R-067)	Impulse Lines: C1-R15-1-T53/None - See Note C1-R14-1-T51/None - See Note C1-R13-1-T47/None - See Note C1-R13-7-T49/None - See Note FT-1MS-0495-IV-W-HP-66/None - See Note		X	NONE
Main Steam Line Break	RJ-MS-1-2C(R-067)	Impulse Lines: C1-R2-3-T8/None - See Note C1-R7-2-T26/None - See Note		X	NONE
Main Steam Line Break	RJ-MS-3-2C(R-067)	Impulse Lines: C1-R13-5-T49/None - See Note FT-1MS-0495-IV-W-LP-T66/None - See Note		X	NONE
Main Steam Line Break	RJ-MS-2-2C	Impulse Lines; C1-R8-7-T30/None - See Note FT-1MS-0485-IV-LP-T65/None - See Note		X	NONE
Steam Generator Blowdown Line Break	AJ-BD-7-1A(R-177) AJ-BD-14-1B(R-177)	Instrument Rack A1-R7 Impacted Results in FT-122/Fail Low		X	A. Steam Generator Blowdown Line Break B. Increase Charging Flow Until Reactor trip. C. Event Not Considered Significant for Chapter 15 Analysis.

TABLE 1 - IMPACTED COMPONENTS SUBJECTED TO JET FORCES/PIPE WHIP/FLOODING
(INSIDE CONTAINMENT)

INITIATING EVENT	JET CONE NUMBER	AFFECTED COMPONENT/FAILURE MODE	FLOODING YES	FLOODING NO	EFFECT
Safety Injection Line Break	AJ-SI-50-1(R-152)	Instrument Rack A1-R7 Impacted Results in FT-122/Fail Low		X	A, Safety Injection Line Break. B, Loss of Charging Flow. C, Event Not Considered Significant for Chapter 15 Analysis.
Main Steam Line Break	AJ-MS-8-2A (R-068) AJ-MS-8-2B (R-068) AJ-MS-9-2A (R-068) AJ-MS-9-2B (R-068)	Electrical Cable Trays: C1701/Severed Cables C1705/Severed Cables C1206/Severed Cables		X	All steam dump valves opening are not required for this event so there is no effect on the FSAR Chapter 15 Analysis.

NOTE: This is a safety grade impulse line that will be protected against the effects of the HELB.

TABLE 2 - COMPONENTS SUBJECTED TO HELB ENVIRONMENTS (INSIDE CONTAINMENT)

SYSTEM	AFFECTED COMPONENT	FUNCTION	MODEL NUMBER	SAFETY RELATED YES	SAFETY RELATED NO	HELB ENVIRONMENT QUALIFICATION (1) YES	HELB ENVIRONMENT QUALIFICATION (1) NO
Steam Generator Water Level Control System	LT-474	Steam Generator 1A Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-475	Steam Generator 1A Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-476	Steam Generator 1A Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-484	Steam Generator 1B Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-485	Steam Generator 1B Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-486	Steam Generator 1B Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-494	Steam Generator 1C Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-495	Steam Generator 1C Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-496	Steam Generator 1C Narrow Range Level	ITT Barton 764 (2)	X		X	
	FT-474	Steam Generator 1A Steam Flow	ITT Barton 764 (2)	X		X	
	FT-475	Steam Generator 1A Steam Flow	ITT Barton 764 (2)	X		X	
	FT-484	Steam Generator 1B Steam Flow	ITT Barton 764 (2)	X		X	
	FT-485	Steam Generator 1B Steam Flow	ITT Barton 764 (2)	X		X	
	FT-494	Steam Generator 1C Steam Flow	ITT Barton 764 (2)	X		X	

TABLE 2 - COMPONENTS SUBJECTED TO HELB ENVIRONMENTS (INSIDE CONTAINMENT)

SYSTEM	AFFECTED COMPONENT	FUNCTION	MODEL NUMBER	SAFETY RELATED YES	SAFETY RELATED NO	HELB ENVIRONMENT QUALIFICATION[1] YES	HELB ENVIRONMENT QUALIFICATION[1] NO
	FT-495	Steam Generator 1C Steam Flow	ITT Barton 764 (2)	X		X	
	NI-44	Power Range Neutron Flux Detector	W - 1GTD (2)(4) WL - 24154 WL - 24156		X	X	
Pressurizer Level Control	LT-459	Pressurizer Level	ITT Barton 764 (2)	X		X	
	LT-460	Pressurizer Level	ITT Barton 764 (2)	X		X	
	LT-461	Pressurizer Level	ITT Barton 764 (2)	X		X	
	LSE-1CS-0459	Letdown Line Isolation Valve 1-LCV-459 Solenoid	ASCO FT-831654 (6)		X		X
	LSE-1CS-0460	Letdown Line Isolation Valve 1-LCV-460 Solenoid	ASCO FT-831654 (6)		X		X
Pressurizer Pressure Control	PT-444	Pressurizer Pressure Control Transmitter	ITT Barton 753 (2)		X		X
	PT-445	Pressurizer Pressure Control Transmitter	ITT Barton 753 (2)		X		X
	LT-459	Pressurizer Level	ITT Barton 764 (2)	X		X	
	LT-460	Pressurizer Level	ITT Barton 764 (2)	X		X	
	LT-461	Pressurizer Level	ITT Barton 764 (2)	X		X	
	PT-455	Pressurizer Pressure	ITT Barton 763 (2)	X		X	
	PT-456	Pressurizer Pressure	ITT Barton 763 (2)	X		X	
	PT-457	Pressurizer Pressure	ITT Barton 763 (2)	X		X	

TABLE 2 - COMPONENTS SUBJECTED TO HELB ENVIRONMENTS (INSIDE CONTAINMENT)

SYSTEM	AFFECTED COMPONENT	FUNCTION	MODEL NUMBER	SAFETY RELATED YES	SAFETY RELATED NO	HELB ENVIRONMENT QUALIFICATION (1) YES	HELB ENVIRONMENT QUALIFICATION (1) NO
	PSE-1RC-0444B1	Pressurizer Power Relief Valve 1-PCV-444B Control Solenoid	ASCO FT-831654 (3)		X		X
	PSE-1RC-0444B2	Pressurizer Power Relief Valve 1-PCV-444B Control Solenoid	ASCO FT-831654 (3)		X		X
	PSE-1RC-0445A1	Pressurizer Power Relief Valve 1-PCV-445A Control Solenoid	ASCO FT-831654 (3)		X		X
	PSE-1RC-0445A2	Pressurizer Power Relief Valve 1-PCV-445A Control Solenoid	ASCO FT-831654 (3)		X		X
	PSE-1RC-0445B1	Pressurizer Power Relief Valve 1-PCV-445B Control Solenoid	ASCO FT-831654 (3)		X		X
	PSE-1RC-0445B2	Pressurizer Power Relief Valve 1-PCV-445B Control Solenoid	ASCO FT-831654 (3)		X		X
	I/P-1RC-0444C	Pressurizer Spray Valve 1-PCV-444C Pneumatic Converter	Fisher 546 (3)		X		X
	I/P-1RC-0444D	Pressurizer Spray Valve 1-PCV-444D Pneumatic Converter	Fisher 546 (3)		X		X
T-AVG Control	TE-0411B	DT-TAVG Control (RTD) Hot Leg	RDF 21204 (2) (5)	X		X	
	TE-0411C	DT-TAVG Control (RTD) Cold Leg	RDF 21204 (2) (5)	X		X	
	TE-0421B	DT-TAVG Control (RTD) Hot Leg	RDF 21204 (2) (5)	X		X	
	TE-0421C	DT-TAVG Control (RTD) Cold Leg	RDF 21204 (2) (5)	X		X	
	TE-0431B	DT-TAVG Control (RTD) Hot Leg	RDF 21204 (2) (5)	X		X	
	TE-0431C	DT-TAVG Control (RTD) Cold Leg	RDF 21204 (2) (5)	X		X	

TABLE 2 - COMPONENTS SUBJECTED TO HELB ENVIRONMENTS (INSIDE CONTAINMENT)

SYSTEM	AFFECTED COMPONENT	FUNCTION	MODEL NUMBER	SAFETY RELATED YES	SAFETY RELATED NO	HELB ENVIRONMENT QUALIFICATION (1) YES	HELB ENVIRONMENT QUALIFICATION (1) NO
Rod Control	NM-44	Power Range Neutron Flux Detector	W - 1GTD (2)(4) WL - 24154 WL - 24156		X	X	
Engineered Safety Features Actuation	PT-445	Pressurizer Pressure	ITT Barton 763 (2)	X		X	
	PT-456	Prewsurizer Pressure	ITT Barton 763 (2)	X		X	
	PT-457	Pressurizer Pressure	ITT Barton 763 (2)	X		X	
	LT-474	Steam Generator 1A Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-475	Steam Generator 1A Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-476	Steam Generator 1A Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-484	Steam Generator 1B Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-485	Steam Generator 1B Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-486	Steam Generator 1B Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-494	Steam Generator 1C Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-495	Steam Generator 1C Narrow Range Level	ITT Barton 764 (2)	X		X	
	LT-496	Steam Generator 1C Narrow Range Level	ITT Barton 764 (2)	X		X	

TABLE 2 - COMPONENTS SUBJECTED TO HELB ENVIRONMENTS (INSIDE CONTAINMENT)

SYSTEM	AFFECTED COMPONENT	FUNCTION	MODEL NUMBER	SAFETY RELATED YES	SAFETY RELATED NO	HELB ENVIRONMENT QUALIFICATION (1) YES	HELB ENVIRONMENT QUALIFICATION (1) NO
	TE-412B	RCS Loop 1 DT/T AVG Protection (RTD) Protection Set I	RDF 21204 (2) (5)	X		X	
	TE-412D	RCS Loop 1 DT/T AVG Protection (RTD) Protection Set I	RDF 21204 (2) (5)	X		X	
	TE-422B	RCS Loop 2 DT/T AVG Protection (RTD) Protection Set II	RDF 21204 (2) (5)	X		X	
	TE-422D	RCS Loop 2 DT/T AVG Protection (RTD) Protection Set II	RDF 21204 (2) (5)	X		X	
	TE-432B	RCS Loop 3 DT/T AVG Protection (RTD) Protection Set III	RDF 21204 (2) (5)	X		X	
	TE-432D	RCS Loop 3 DT/T AVG Protection (RTD) Protection Set IV	RDF 21204 (2) (5)	X		X	
	PT-951	Containment Pressure	ITT Barton 351 (2)	X		X	
	PT-952	Containment Pressure	ITT Barton 351 (2)	X		X	
	PT-953	Containment Pressure	ITT Barton 351 (2)	X		X	

NOTE 1: Shearon Harris Plant Specific Equipment Qualification Envelope (Inside Containment)

Temperature	376°F
Pressure	52psi
Relative Humidity	100%
Radiation	1.2×10^6 R γ
Chemistry	Boric Acid Spray 8.5-11 PH

NOTE 2: Qualified per WCAP 8587. This qualification reference indicates the individual qualification details for each particular type of equipment, meeting IEEE 323-1974, supplied by the NSSS Vendor, Westinghouse. This WCAP is a generic reference document for all NSSS supplied IE equipment meeting IEEE 323-1974.

NOTE 3: The solenoid operators associated with the PORVs and the pneumatic converters for the Pressurizer Spray Valves are not qualified for the harsh environment and their instrument air supply lines could be impinged upon by the jet caused by HELB. The failure of the solenoid operators will result in their associated valves going to their failed closed position which will not complicate any event beyond the FSAR Chapter 15 analyses.

NOTE 4: Excore Power Range Neutron Flux Detectors are not qualified for HELB relative humidity of 100%. However, these Excore Power Range Neutron Flux Detectors have been qualified to a relative humidity of 95%. Due to the fact that the excore detectors are required to function properly for a very limited amount of time after the HELB (until reactor trip), these components have been determined to be functionally qualified.

NOTE 5: Due to the fact that these RCS temperature narrow range RTD's are only required to function less than five minutes after the HELB, these components have been determined to be functionally qualified.

NOTE 6: The letdown orifice isolation valves (in series with the unqualified valves) are qualified and will perform the function of letdown isolation following the HELB.

TABLE 3 - COMPONENTS SUBJECTED TO HELB ENVIRONMENTS (OUTSIDE CONTAINMENT)

SYSTEM	AFFECTED COMPONENT	FUNCTION	MODEL NUMBER	SAFETY RELATED YES	SAFETY RELATED NO	HELB ENVIRONMENT QUALIFICATION YES	HELB ENVIRONMENT QUALIFICATION NO
Pressurizer Level Control	FT-122	Charging Header Flow	ITT Barton 752		X		X