ENCLOSURE 1
ATTACHMENT 9

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 261
EXTENDED POWER UPRATE
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

PBNP-994-21-06, REVISION 0, HELB RECONSTITUTION PROGRAM - TASK 6 - BREAK AND CRACK SIZE/LOCATION SELECTION

14 pages follow

TABLE OF CONTENTS

1.0 Purpose and Summary Results:

The purpose of this calculation is to document the selection of break and crack sizes and locations in the high energy systems identified in HELB Reconstitution Program Task 2 Calculation PBNP-994-21-02, Rev. 0 [DI 5.6].

HELB Reconstitution Program Task 5 Calculation PBNP-994-05, Rev. 0 [DI 5.10] evaluated the most current dynamic analysis retrieved in HELB Reconstitution Program Task 4 Report PBNP-994-21-04, Rev. 0 [DI 5.7] utilizing the stress criteria contained in Generic Letter 87-11 [DI 5.5].

The enclosure to the AEC letter to WEP dated December 19, 1972 [DI 5.1], as clarified in the AEC letter to WEP dated January 24, 1973 [DI 5.2] describes, in part, the size and orientation of longitudinal and circumferential breaks and cracks.

Point Beach FSAR Appendix A.2 (formerly Appendix E) [DI 5.4] discusses the break and crack locations that met the stress criteria cited in the December 19, 1972 letter for those systems identified as high energy. The NRC issued Generic Letter 87-11, which relaxed the requirements for arbitrary intermediate pipe ruptures and redefined the applicable stress thresholds for identifying break and crack locations. NRC Information Notice 2000-20 [DI 5.9] reinstated the requirement to postulate a crack at the most adverse location, not just at the locations that met the stress threshold criteria.

Point Beach FSAR Appendix A.2 discussed systems that traverse the Primary Auxiliary Building, but does not address any other potential high energy systems in the Facade or Turbine Hall. In fact, FSAR Appendix A.2.7.2 mistakenly states that there is no safeguard equipment in the Facade. HELB Reconstitution Task 2 identified these additional systems and areas affected.

The break and crack sizes and locations for the various high energy lines are tabulated in Table 6.0-1.

No new break locations were identified. In fact arbitrary intermediate and numerous other breaks were eliminated.

2.0 Methodology:

Item 2(b) of the attachment to the December 19, 1972 AEC letter stated that piping breaks in ASME Section III, Code Class 2 and 3 systems should be postulated to occur at the following locations:

(1) the terminal ends;

(2) any intermediate locations where the longitudinal or circumferential stresses exceed $0.9(S_h + S_A)$or expansion stresses exceed $0.8S_A$; and

(3) a minimum of two intermediate locations selected on a reasonable basis.

In the clarification letter in January 1973, the 0.9 factor in Item (2) above was revised to 0.8 and pipe stress level was chosen as the "reasonable basis" in Item (3). This letter also defined a critical crack that had to be postulated at the most adverse location(s) and its size.

Item 3 of the attachment stated that longitudinal breaks should be postulated in piping 4" nominal pipe size and larger and circumferential breaks should be postulated in piping exceeding 1" nominal pipe size.

Point Beach FSAR Appendix A.2 provides pipe stress information and an isometric for the main steam system only. Other high energy systems (feedwater, steam generator blowdown, steam supply to the turbine driven auxiliary feedwater pump, etc.) were physically walked down and no pipe stress information provided.

NRC Generic Letter 87-11 relaxed the requirements for arbitrary intermediate breaks and redefined the threshold stress values for selecting break and leakage crack locations:

> Breaks were to be postulated at any location where the stresses exceed $0.8(1.8S_h + S_A)$ and cracks postulated where the stresses exceed $0.4(1.8S_h + S_A)$.
>
> Item 3.a(2) addressed break location selection for piping systems that did not have the benefit of a dynamic stress analysis. This item required postulating breaks at welds to each fitting, valve or welded attachment.
>
> Item 3.b(2) eliminated postulated longitudinal breaks at terminal ends.

Stress analyses were retrieved for main steam, steam supply to the AFWPT and feedwater (portions). Stress analyses were not available for CVCS letdown, steam generator blowdown, extraction steam, condensate, feedwater (portions), heater drain and reheater drain.

3.0 Acceptance Criteria

Compliance with the requirements of the December 19, 1972 AEC letter as revised January 24, 1973 letter, the FSAR/USAR, the AEC Safety Evaluation Report Section 6.8 and Generic Letter 87-11.

These documents do not state any minimum acceptance criteria, only that the break and crack locations must be identified and the accident unit must ultimately be brought to cold shutdown with a concurrent loss of off-site power.

4.0 Assumptions:

The piping stress reports utilized are the most current versions, technically correct and complete and properly reflect the as-built condition of the plant.

The only HELB required components identified that are located in the Turbine Hall are associated with the feedwater flow control valves, feedwater pumps and condensate storage tank level. The feedwater components are required to terminate flow to a faulted steam generator (main steam or blowdown HELB event). The EPU Project will be adding a fast closing valve in each feedwater line in the Facade, thereby relegating the flow control valves and feedwater pumps to the status of back-up to the new valves. The condensate storage tank level was identified as a Reg Guide 1.97 component and is mentioned in numerous emergency procedures. The auxiliary feedwater pumps are protected by safety related low suction pressure switches located in the safety related portion of the Turbine Hall and can be supplied from the safety-related service water system. However, the condensate storage tank level transmitters were retained on the FSAR Appendix A.2 required equipment list. Since the swing battery and associated components are not normally aligned systems they were removed from the required equipment list.

The other identified high energy systems located in the Turbine Hall (condensate, heater drain tank pump discharge, heater drains, etc.) do not require any of the previously mentioned components, except condensate storage tank level. Therefore, it was determined that their inclusion as a HELB event column was not required. A walkdown was performed in the area of the condensate storage tank level transmitters and the nearest high energy line with a line of sight to the transmitters was the Unit 1 main steam line going to the east turbine nozzle. The distance was estimated to be approximately 34'. A crack in this piping could impinge on the west transmitter on the north tank. All other high energy lines are further away. A review of the HELB Task 12 Calculation predicts the jet impingement centerline pressure to be nearly zero at a distance of eight (8') feet.

5.0 Design Inputs:

5.1 AEC letter to WEP dated December 19, 1972, A Giambusso to JG Quale

5.2 AEC letter to WEP, dated January 24, 1973, K Kniel to JG Quale

5.3 AEC Safety Evaluation Report, letter from G. Lear to S Burstein, dated May 7, 1976

5.4 Final Safety Analysis Report, Revision dated 06/07

5.5 Generic Letter 87-11, June 19, 1987, *Relaxation In Arbitrary Intermediate Pipe Rupture Requirements* and Branch Technical Position MEB 3-1, Rev. 2

5.6 AES Calculation KPS-994-21-02, Rev. 0, High Energy System Selection

5.7 AES Report KPS-994-21-04, Rev. 0, Pipe Stress Analyses Retrieval

5.8 AES Calculations KPS-994-21-05, Rev. 0 (6 parts) Implementation of Generic Letter 87-11

5.9 Information Notice 2000-20, December 11, 2000, *Potential Loss of Redundant Safety-Related Equipment Because of the Lack of High-Energy Line Break Barriers*

6.0 Design Calculations:

6.1 <u>Main Steam</u>

HELB Reconstitution Program Task 5 created four (4) calculations (PBNP-994-21-05-P01, -P02, -P05 and -P06) associated with the main steam system and steam supply to the AFWPT with the application of the stress threshold values discussed in Generic Letter 87-11:

1. Both main steam lines from the containment penetration to the turbine nozzles, including the equalizing line between the two lines and the safety valve/atmospheric steam dump headers.

2. The steam supply lines from both main steam lines to the auxiliary feedwater pump turbine (AFWPT).

These calculations and associated stress plots were reviewed to determine which nodes, if any, exceed the break or crack criteria. There are no intermediate anchors in the main steam lines. There is one (1) intermediate anchor in each steam supply line to the AFWPTs. Since the equalizing line is included in the main steam analysis, it is not considered a branch connection. Only two intermediate locations exceeded the break criteria (6" condenser steam dump line up-stream of control valves 1-MS-2057 and 2-MS-2057). However, there are numerous locations that exceeded the crack criteria.

The identified break and crack locations and sizes are shown in Table 6.0-1.

6.2 Feedwater

HELB Reconstitution Program Task 5 created two (2) calculations (PBNP-994-21-05-P03 and –P04) associated with the feedwater system utilizing existing pipe stress analyses. A dynamic stress analysis was available for feedwater piping from the PAB/Turbine Hall interface to the containment penetrations.

A dynamic seismic stress analysis was not available for the non-seismic portion of the feedwater piping system from the 16" pump discharge nozzles to the PAB/Turbine Hall interface. Therefore, a break must be considered at each weld to a fitting, valve or welded attachment in accordance with the Branch Technical Position [DI 5.5]. Rather than identify each of these locations, it is assumed that a break occurs in each compartment that the lines traverse.

This calculation and associated stress information were reviewed to determine which nodes, if any, exceed the break or crack criteria. There were no intermediate locations in the seismic portion of the piping that exceeded the break criteria. However, there is one location that exceeds the crack criteria. As noted above, there are numerous intermediate break locations in the non-seismic portion of the piping

The identified break and crack locations and sizes are shown in Table 6.0-1.

6.3 CVCS Letdown

HELB Reconstitution Task 5 identified that no dynamic stress analysis was available for the letdown line from the containment penetration to the non-regenerative heat exchanger nozzle. These lines are routed through Rooms 140, 146, 147 (Unit 1) and Rooms 137, 144, 145 (Unit 2). The outside containment letdown isolation valves are located in Rooms 146 and 145, but have redundant components inside containment and do not need to be protected. However, they are one of the valves the operator would normally use to respond to a letdown line break. The valves are only effective for isolating breaks downstream of them. There are component cooling water valves (to/from containment) on the required equipment list that are located in Rooms 140 and 137.

Therefore, the terminal ends at the containment penetration and the heat exchanger are considered break locations. In addition, breaks must be postulated at each weld to a fitting, valve or welded attachment in accordance with the Branch Technical Position [DI 5.5]. Rather than identify each of these locations, it is assumed that a break occurs in each compartment that the lines traverse. A single crack must also be postulated at the most adverse location. However, they would be bounded by the postulated break locations.

6.4 Steam Generator Blowdown

HELB Reconstitution Task 5 identified that no dynamic stress analysis was available for the steam generator blowdown line from the containment penetration to the blowdown heat exchanger and flash tank nozzle. These lines are routed entirely within the associated unit Facade (Room 524 – Unit 1 and Room 596 – Unit 2).

Therefore, the terminal ends at the containment penetration, the heat exchanger and flash tank nozzles are considered break locations. In addition, breaks must be postulated at each weld to a fitting, valve or welded attachment in accordance with the Branch Technical Position [DI 5.5]. Rather than identify each of these locations, it is assumed that a break occurs in each compartment that the lines traverse (the piping system is limited to the applicable unit's Facade). A single crack must also be postulated at the most adverse location. However, they would be bounded by the postulated break locations.

6.5 Extraction Steam

HELB Reconstitution Task 5 identified that a dynamic seismic stress analysis was not available for the extraction steam system. Therefore, a break must be considered at each weld to a fitting, valve or welded attachment in accordance with the Branch Technical Position [DI 5.5]. Rather than identify each of these locations, it is assumed that a break occurs in every compartment that the lines traverse.. A single crack must also be postulated at the most adverse location. However, they would be bounded by the postulated break locations. These lines are routed entirely within the associated unit Turbine Hall (Room 301 – Unit 1 and Room 583 – Unit 2).

6.6 Condensate

HELB Reconstitution Task 5 identified that a dynamic seismic stress analysis was not available for the condensate system, including the return from the steam generator blowdown heat exchanger in the applicable unit's Facade. Therefore, a break must be considered at each weld to a fitting, valve or welded attachment in accordance with the Branch Technical Position [DI 5.5]. Rather than identify each of these locations, it is assumed that a break occurs in every compartment that the lines traverse. A single crack must also be postulated at the most adverse location. However, they would be bounded by the postulated break locations. The majority of this piping is routed entirely within the associated unit Turbine Hall (Room 301 – Unit 1 and Room 583 – Unit 2). The condensate return from the steam generator blowdown heat exchangers are routed through Rooms 524 (Facade), 360 (South Service Building), 301 Turbine Hall) for Unit 1 and Rooms 596 (Facade), 224 (Alternate Shutdown Area), 122 (Water Treatment Area) and 583 (Turbine Hall) for Unit 2.

6.7 Heater Drain

HELB Reconstitution Task 5 identified that a dynamic seismic stress analysis was not available for the heater drain system. Therefore, a break must be considered at each weld to a fitting, valve or welded attachment in accordance with the Branch Technical Position [DI 5.5]. Rather than identify each of these locations, it is assumed that a break occurs in every compartment that the lines traverse. A single crack must also be postulated at the most adverse location. However, they would be bounded by the postulated break locations. These lines are routed entirely within the associated unit Turbine Hall (Room 301 – Unit 1 and Room 583 – Unit 2).

6.8 Reheater Drain

HELB Reconstitution Task 5 identified that a dynamic seismic stress analysis was not available for the reheater drain system. Therefore, a break must be considered at each weld to a fitting, valve or welded attachment in accordance with the Branch Technical Position [DI 5.5]. Rather than identify each of these locations, it is assumed that a break occurs in every compartment that the lines traverse. A single crack must also be postulated at the most adverse location. However, they would be bounded by the postulated break locations. These lines are routed entirely within the associated unit Turbine Hall (Room 301 – Unit 1 and Room 583 – Unit 2).

7.0 Conclusions:

Those systems that have a dynamic seismic stress analysis available were evaluated in accordance with the break and crack stress thresholds identified in the Branch Technical Position MEB 3-1 attachment to Generic Letter 87-11 [DI 5.5]. For those systems that did not have a dynamic seismic stress analysis, it was assumed that a break occurred in each compartment the line traversed.

The results of those evaluations are tabulated in Tables 6.0-1. The room numbers identified in the Table are the same as those assigned in the Appendix R Program and GOTHIC models. No new break locations were identified. In fact arbitrary intermediate and numerous other breaks were eliminated.

Table 6.0-1
Break and Crack Size and Location Summary

Main Steam System With Dynamic Analysis

Line Designation	Node #	Break/Crack	Line Size	Room No.
Loop 1A containment penetration	7010	1MS-B1	30"	524
Loop 1A turbine nozzle connection	380	1MS-B2	24"	301
Loop 1B containment penetration	5	1MS-B3	30"	524
Loop 1B turbine nozzle connection	240	1MS-B4	24"	301
Loop 1A atmospheric dump MS-2016	26055	1MS-B5	6"	524
Loop 1A safety valve inlet MS-2010	7070	1MS-B6	8"	524
Loop 1A safety valve inlet MS-2011	8000	1MS-B7	8"	524
Loop 1A safety valve inlet MS-2012	8030	1MS-B8	8"	524
Loop 1A safety valve inlet MS-2013	8060	1MS-B9	8"	524
Loop 1A supply to AFWPT	7018	1MS-B10	3"	524
Loop 1A supply to AFWPT anchor EB-8-A120	5	1MS-B11	3"	524
Loop 1A supply to AFWPT MS-2020	385	1MS-B12	3"	237
Loop 1B atmospheric dump MS-2017	25020	1MS-B13	6"	524
Loop 1B safety valve inlet MS-2005	25016	1MS-B14	8"	524
Loop 1B safety valve inlet MS-2006	25017	1MS-B15	8"	524
Loop 1B safety valve inlet MS-2007	25018	1MS-B16	8"	524
Loop 1B safety valve inlet MS-2008	25019	1MS-B17	8"	524
Loop 1B supply to AFWPT	16	1MS-B18	3"	524
Loop 1B supply to AFWPT anchor EB-8-A119	1055	1MS-B19	3"	524
Loop 1B supply to AFWPT MS-2019	590	1MS-B20	3"	237
Loop 1A/B to condenser dump MS-2057	630	1MS-B21	6"	301
Loop 1A/B to condenser dump MS-2056	725	1MS-B22	6"	301
Loop 1A/B to condenser dump MS-2055	825	1MS-B23	6"	301
Loop 1A/B to condenser dump MS-2054	925	1MS-B24	6"	301
Loop 1A/B to condenser dump MS-2053	5065	1MS-B25	6"	301
Loop 1A/B to condenser dump MS-2052	4070	1MS-B26	6"	301
Loop 1A/B to condenser dump MS-2051	3065	1MS-B27	6"	301
Loop 1A/B to condenser dump MS-2050	2070	1MS-B28	6"	301
Loop 1A/B to radwaste anchor SA-3-601-S29	1355	1MS-B29	3"	237

There are eighty-one (81) crack locations in the various Unit 1 main steam and supply to the auxiliary feedwater pump turbine lines as noted in Tables 7.2 of calculations PBNP-994-21-05-P01 and P05.

Loop 2A containment penetration	7010	2MS-B1	30"	596
Loop 2A turbine nozzle connection	380	2MS-B2	24"	583
Loop 2B containment penetration	5	2MS-B3	30"	596
Loop 2B turbine nozzle connection	240	2MS-B4	24"	583
Loop 2A atmospheric dump MS-2016	26055	2MS-B5	6"	596
Loop 2A safety valve inlet MS-2010	7070	2MS-B6	8"	596
Loop 2A safety valve inlet MS-2011	8000	2MS-B7	8"	596
Loop 2A safety valve inlet MS-2012	8030	2MS-B8	8"	596
Loop 2A safety valve inlet MS-2013	8060	2MS-B9	8"	596
Loop 2A supply to AFWPT	7018	2MS-B10	3"	596
Loop 2A supply to AFWPT anchor EB-8-A121	1190	2MS-B11	3"	596
Loop 2A supply to AFWPT MS-2020	785	2MS-B12	3"	237
Loop 2B atmospheric dump MS-2015	25020	2MS-B13	6"	596
Loop 2B safety valve inlet MS-2005	25016	2MS-B14	8"	596
Loop 2B safety valve inlet MS-2006	25017	2MS-B15	8"	596
Loop 2B safety valve inlet MS-2007	25018	2MS-B16	8"	596
Loop 2B safety valve inlet MS-2008	25019	2MS-B17	8"	596
Loop 2B supply to AFWPT	16	2MS-B18	3"	596
Loop 2B supply to AFWPT anchor EB-8-A118	5	2MS-B19	3"	596
Loop 2B supply to AFWPT MS-2019	550	2MS-B20	3"	237
Loop 2A/B to condenser dump MS-2050	630	2MS-B21	6"	583
Loop 2A/B to condenser dump MS-2051	725	2MS-B22	6"	583
Loop 2A/B to condenser dump MS-2052	825	2MS-B23	6"	583
Loop 2A/B to condenser dump MS-2053	925	2MS-B24	6"	583
Loop 2A/B to condenser dump MS-2054	5065	2MS-B25	6"	583
Loop 2A/B to condenser dump MS-2055	4070	2MS-B26	6"	583
Loop 2A/B to condenser dump MS-2056	3065	2MS-B27	6"	583
Loop 2A/B to condenser dump MS-2057	2070	2MS-B28	6"	583
Loop 2A/B to radwaste anchor SA-3-601-S32	1535	2MS-B29	3"	237
Loop 2A/B to radwaste anchor SA-1-601-S408	400	2MS-B30	3"	237

There are seventy-one (71) crack locations in the various Unit 2 main steam and supply to the auxiliary feedwater pump turbine lines as noted in Tables 7.2 of calculations PBNP-994-21-05-P02 and P-06.

Feedwater System With Dynamic Analysis

Loop 1A Containment penetration	3005	FW-B1	16"	524
Loop 1B Containment penetration	2005	FW-B2	16"	524
Loop 2A Containment penetration	2005	FW-B3	16"	596
Loop 2B Containment penetration	1005	FW-B4	16"	596
Loop 1A at Column Row G (support EB-9-10)	2135	FW-C1	16"	360
There are no crack locations on Unit 2				

CVCS Letdown System - No Dynamic Analysis Available

A break must be postulated at the weld to every valve, fitting and welded attachment.

The line from the containment penetrations to the non-regenerative heat exchanger is 2". Rather than identify each of those locations, a break is postulated in each room the line traverses. These rooms are identified in Section 6.3 of this calculation.

Steam Generator Blowdown System No Dynamic Analysis Available

A break must be postulated at the weld to every valve, fitting and welded attachment.

The line from the containment penetrations to the blowdown heat exchanger and flash tank is 2". Rather than identify each of those locations, a break is postulated in each room the line traverses. These rooms are identified in Section 6.4 of this calculation.

Extraction Steam System - No Dynamic Analysis Available

A break must be postulated at the weld to every valve, fitting and welded attachment.

The largest line in the extraction steam system piping to #5A & B feedwater heater is 16" and are routed entirely within Rooms 301 and 583. Lines smaller than this line are also routed entirely in these rooms and are bounded by it.

Condensate System - No Dynamic Analysis Available

A break must be postulated at the weld to every valve, fitting and welded attachment and is postulated in each compartment the line traverses. Lines smaller than the lines identified are also routed entirely in these rooms and are bounded by them.

The largest line in the condensate system between #2 and #3 heaters is 12" and is routed entirely within Rooms 301 and 583.

The largest line in the condensate system between #3 and #4 heaters is 18" and is routed entirely within Rooms 301 and 583.

The largest line in the condensate system between #4 heaters and the feedwater pump suctions is 20" and is routed entirely within Rooms 301 and 583.

The largest line in the condensate system return line from the steam generator blowdown heat exchangers is 4".

Feedwater System – Portion With No Dynamic Analysis Available

A break must be postulated at the weld to every valve, fitting and welded attachment.

The piping in the feedwater system between the feedwater pump discharges and the start of the dynamic analysis is 22" and is routed entirely in Rooms 301 and 583. Lines smaller than this line are also routed entirely in these rooms and are bounded by it.

Heater Drain System – No Dynamic Analysis Available

A break must be postulated at the weld to every valve, fitting and welded attachment. Lines smaller than this line are also routed entirely in these rooms and are bounded by it.

The largest line in the heater drain system between the #5 heaters and #4 heaters/condensers is 10" and is routed entirely within Rooms 301 and 583.

The largest line in the heater drain system between the heater drain pump discharges and the connection to the condensate system is 12" and is routed entirely within Rooms 301 and 583.

The largest line in the heater drain system in the heater drain tank vent to #4 heaters and condenser is 14" and is routed entirely within Rooms 301 and 583.

The largest line in the #3 and #4 heater vent to the condenser is 1-1/2" and are routed entirely within Rooms 301 and 583.

The largest line in the heater drain system in the #5 heater vent to the heater drain tank and condenser is 14" and is routed entirely within Rooms 301 and 583.

Reheater Drain System – No Dynamic Analysis Available

A break must be postulated at the weld to every valve, fitting and welded attachment.

The largest line in the reheater drain system from the reheater stilling manifolds to the #5 heaters and the condensers is 10" and is routed entirely within Rooms 301 and 583. Lines smaller than this line are also routed entirely in these rooms and are bounded by it.