ENCLOSURE 1
ATTACHMENT 6

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-994-21-05-P04, REVISION 0, MAIN FEEDWATER LINE GL 87-11
BREAK LOCATION DETERMINATION

15 pages follow

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1.0 PURPOSE

The purpose of this calculation is to establish the locations of intermediate high energy large breaks and leakage cracks utilizing the criteria given in Generic Letter 87-11 and its attachment USNRC Mechanical Engineering Branch Technical Position, MEB 3-1, Revision 2 (Reference 3).

Combined stress tables for the Main Feedwater piping, between Containment Penetrations P-3 and P-4 to Auxiliary/Turbine Building wall interface, are developed for the sole purpose of determining the locations of intermediate large breaks and leakage cracks in accordance with the combined stress equations defined in Reference 3. Note that the piping upstream of the containment isolation check valves is non-seismic, however, the piping region between Containment Penetrations P-3 and P-4 to Auxiliary/Turbine Building wall interface was classified/analyzed seismically (Reference 6). The remainder of the piping was qualified as non-seismic (weight and thermal loads only).

2.0 BACKGROUND

PBNP's licensing basis for High-Energy Line Break (HELB) is documented in the Final Safety Analysis Report (FSAR) (Reference 2, Appendix A.2). Appendix A.2 of the FSAR defines a high-energy line as a line with design pressure greater than 275 psig and service temperature greater than 200°F. Both conditions have to be satisfied for a line to be designated high-energy. Additional background discussion regarding the BPNP HELB Program and details for establishing HELB break and leakage crack locations criteria (HELB Reconstitution Program) is provided in the AES technical position paper (see Attachment C).

Based on the above high energy line definition, Calculation PBNP-994-21-02 (Reference 13) identifies the Main Steam (MS) System Lines, Main Feedwater Piping, Steam Generator (SG) Blowdown Piping, and Sampling System Lines as high-energy lines (Reference 2, Appendix A.2).

The application of GL 87-11 methods to determine the new intermediate break and leakage crack locations is expected to be beneficial in addressing design concerns related to high energy line break effects. GL 87-11 still requires terminal end circumferential breaks to be postulated irrespective of the combined stress values at these locations.

This calculation determines break and crack locations in the high-energy lines outside containment, based on the combined stress criteria detailed in the GL 87-11 methodology. This calculation does not address the additional postulation of "a single crack, exclusive of stress, at the most severe location with respect to essential equipment" (IE Notice 2000-20, Reference 9), nor does this calculation address the consequences of or evaluate the impacts of breaks or cracks that are required to be postulated based on this criteria.

3.0 ASSUMPTIONS AND ANALYSIS NOTES

Assumptions

Piping material and geometric data and stress analysis (computer results) given in the AOR (Reference 6) for Main Feedwater piping are used as input to develop the GL 87-11 combined stress tables that, in turn, are used to determine the intermediate break and leakage crack locations.

Analysis Notes

The code of record for this plant is USAS B31.1 Power Piping Code, 1967 Edition (Reference 1). The Main Feedwater piping stress analysis documented in Reference 6 was performed using ASME B &PV Code, Section III, Subsection NC and ND, 1977 Edition up to and including 1978 Winter Addenda (Reference 8). The use of this piping analysis Code is documented as acceptable in the Pipe Code Reconciliation Study performed by Impell (see Section 5.1.1 of Reference 14).

Application of the MEB 3.1, Rev. 2 methodology for Class 2 and 3 piping requires combined stresses to be calculated in accordance with the 1986 ASME Section III, Class 2 requirements (Reference 4). As such, for consistency with the GL 87-11 criteria, additional computer analysis based on the 1986 ASME Section III was performed (Reference 6). Stress results obtained from this analysis can be directly used and compared to the threshold limits as discussed in Section 4.0.

The piping upstream of the containment isolation check valves is non-seismic, however, for analysis purposes a seismic region was defined extending at least on support in each orthogonal direction upstream of the check valves. Thus all piping from containment penetrations P-3 and P-4 to the auxiliary/turbine building wall interface was evaluated for seismic loadings (Reference 6). The remainder of the piping was qualified as non-seismic (weight and thermal loads only). As a result, application of the GL 87-11 criteria is limited to the seismic region only, and large breaks will be postulated at all welded joints in the non-seismic region of the feedwater lines.

4.0 METHODOLOGY AND ACCEPTANCE CRITERIA

This calculation uses the GL 87-11 (Reference 3) methodology to determine postulated pipe break and crack locations. The analysis in Reference 6 was performed using ASME B &PV Code, Section III, Subsection NC and ND, 1977 Edition up to and including 1978 Winter Addenda (Reference 8) as the piping code consistent with DG-M09 (Reference 14). For consistency with the GL 87-11 criteria and MEB 3-1, additional computer analysis based on the 1986 ASME Section III was performed (Reference 6). All stress components for the ASME Section III stress combination are obtained from the 1986 ASME Section III analysis.

The following is a discussion of the high-energy line break criteria used to establish the break locations using the GL 87-11 methodology.

4.1 Intermediate Large Breaks

The GL 87-11 and MEB 3-1, Revision 2 criteria (Reference 3) for intermediate large breaks is based on the combined stress formula given by the sum of Equations 9 and 10 of ASME B&PV Code Section III, Class 2 and 3 as follows:

$$B_1\, PD_0/2t + B_2\, M_{DW}/Z + B_2\, M_{OBE}/Z + i\, M_{TH}/Z \geq 0.8\,(1.8\, S_h + S_A) \qquad (1)$$

In above equation, the first term is the longitudinal pressure stress. The second and third terms represent the stresses due to deadweight and OBE load cases respectively. The fourth term is the thermal expansion stress. A stress table which summarizes all Node Points that exceed the threshold limit for breaks and cracks was developed and is provided in Attachment A. As a minimum, the ten highest stress points in the seismic region were included. Based on the results from the pipe stress analysis (Reference 6), stresses are shown for Equation 9 (Level B) and Equation 10. Local stresses due to IWA's, if present, are also included and combined as applicable. The combined stresses are compared to the threshold limits for cracks and breaks.

Where:

- P = Design internal pressure, psi
- D_0 = Outside diameter of the pipe, in
- t = Nominal thickness of the pipe, in
- M_{DW} = Resultant moment due to dead weight, in-lbs
- M_{OBE} = Resultant moment due to operating basis earthquake, in-lbs
- M_{TH} = Resultant moment due to thermal expansion, in-lbs
- S_h = Material allowable stress at temperature, psi
- S_A = Material allowable stress range, psi
- Z = Section modulus of pipe, in^3
- i = stress intensification factor, as given in Figure NC-3673.2(b)-1
- B_1 = primary stress index for pressure stress as given in Table NB-3681(a)-1
- B_2 = primary stress index for bending stresses as given in Table NB-3681(a)-1

Large intermediate breaks are to be postulated only in locations where the combined stress exceeds the threshold value of $0.8(1.8S_h + S_A)$ (Reference 3). The requirements for arbitrary intermediate large breaks are eliminated by Reference 3.

4.2 Circumferential Breaks at Terminal Ends of Main and Branch Lines

Terminal Ends

The GL 87-11 criteria state that circumferential breaks have to be postulated at terminal ends of the main run as well as the branch piping. Terminal ends of a piping run are defined as the ends terminating at components, or at other piping (run pipe), or at intermediate anchors. Footnote 3 of MEB 3-1, Rev. 2 provides a definition for the term "terminal ends" which was missing in the Giambusso letter (Reference 5). The footnote defines terminal ends as "Extremities of piping runs that connect to structures, components (e.g., vessels, pumps, valves), or pipe anchors that act as rigid constraints to the piping motion and thermal expansion. A branch connection to a main piping run is a terminal end of the branch run, except where the branch run is classified as part of the main run and is shown to have a significant effect on the main run behavior..."

Terminal ends for the Feedwater piping are summarized on Table 7.1 (Section 7.0).

Branch Lines

There are no significant branch connections to the main piping run of the feedwater piping, and as such, there are no additional locations that require to be postulated as terminal ends. The two bypass lines around the isolation check valves were analyzed integrally with the main lines and their effect on the main run behavior has been considered.

4.3 High-Energy Line Leakage Cracks (Small Breaks)

The GL 87-11 and MEB 3-1, Revision 2 criterion for leakage cracks is based on the same combined stress formula given in equation (1) above, except the threshold stress value on the right side of the equation is reduced by one-half as follows:

$$B_1\, PD_0/2t + B_2\, M_{DW}/Z + B_2\, M_{OBE}/Z + i\, M_{TH}/Z \geq 0.4\,(1.8\, S_h + S_A) \qquad (2)$$

Leakage cracks are to be postulated in locations where the combined stress exceeds the threshold value of $0.4(1.8S_h + S_A)$.

5.0 REFERENCES

1. USAS B31.1.0, Power Piping Code, 1967 Edition.
2. PBNP FSAR, Appendix A.2, High Energy Pipe Failure Outside Containment.
3. Generic Letter 87-11 – Relaxation in Arbitrary Intermediate Pipe Rupture Requirements, June 19, 1987
4. ASME Section III, 1986 Editions.
5. AEC-DOLs Letter to WPS of December 15, 1972 (Mr. Giambusso to Mr. James).
6. Shaw Calculation No. 129187-P-0018, Rev. 0A, "Point Beach Unit 2- Feedwater Outside Containment – Piping Qualification for Extended Power Uprate Conditions".
7. Drawing No. M-2202 Sh. 2, Piping Subsystem P&ID Feedwater System, Rev. 48.
8. ASME Section III B&PV Code, Subsection NC and ND, 1977 Edition up to and including 1978 Winter Addenda.
9. NRC Information Notice 2000-20, Potential Loss of Redundant Safety Related Equipment Because of the Lack of High Energy Line Break Barriers, 12/11/2000.
10. Becthel Drawing No. P-211, Piping Isometric Feedwater Loop A & B (EB-9) Unit -2, Rev. 8.
11. Becthel Drawing No. P-221, Main Feed Water from 2-P28A and B to 2-X21A and B (DB-1), Rev. 3.
12. Becthel Drawing No. P-222, Main Feed Water from 2X21A & B to 16" EB-9(DB-1), Rev. 7.
13. Calculation No. PBNP-994-21-02, HELB Reconstitution Program-Task 2, High Energy System Selection, Rev. 0.
14. DG-M09, Rev. 2, Design Requirements for Piping Stress Analysis.

6.0 GL 87-11 BREAK AND LEAK LOCATION CALCULATIONS

As discussed in Section 4.0, the threshold stress limits used by GL 87-11 are determined in accordance with the requirements of ASME Section III Code, for Class 2 and 3 piping. This Section provides additional information on the GL 87-11 method to determine postulated break and crack locations.

Application of GL 87-11 Criteria

The requirements of GL 87-11 (Reference 3) are applied to the Main Feedwater piping from containment penetrations anchors P-3 and P-4 to the auxiliary/turbine building wall interface. The piping upstream of the containment isolation check valves is non-seismic as discussed in Section 3.0. Therefore, application of the GL 87-11 criteria is limited to the seismic region only, and large breaks will be postulated at all welded joints in the non-seismic region of the feedwater lines.

A stress table which summarizes all Node Points that exceed the threshold limit for breaks and cracks was developed taking piping stress data from Reference 6 computer analyses. As a minimum, the ten highest stress points in the seismic region were included. The stress table is provided in Attachment A. Based on the results from the pipe stress analysis (Reference 6), stresses are shown for Equation 9 (Level B) and Equation 10. The combined stresses were compared to the threshold limits for cracks and breaks.

7.0 RESULTS & CONCLUSIONS

Results

The Main Feedwater lines between Containment Penetrations P-3 and P-4 to the auxiliary/turbine building wall interface analyzed as a seismic region, have been evaluated for break and crack locations following the requirements and criteria of Generic Letter GL 87-11. The remainder of the piping from the auxiliary/turbine building wall interface to Boiler FW Pumps 2P-28A and 2P-28B and Heat Exchangers 2HX-21A and 2HX-21B is classified and analyzed as non-seismic and therefore, application of the GL 87-11 criteria is not applicable. As a result, large breaks are required to be postulated at all welded joints in the non-seismic region of the feedwater lines.

Large Breaks

Terminal end circumferential breaks are to be postulated at the terminal ends of the main feedwater lines at the containment penetration anchors P-3 and P-4. These two break locations are the only large breaks postulated in the seismic region which extends from containment penetrations P-3 and P-4 to the auxiliary/turbine building wall interface.

As seen from the stress table in Attachment A, all Main Feedwater combined stresses are well below the intermediate large break threshold limit. Therefore, no intermediate large breaks need be postulated for the Main Feedwater line in the seismic region. The locations where large breaks are required to be postulated are summarized in Table 7.1 below.

Table 7.1 – Postulated Large Breaks at Terminal Ends and Intermediate Locations

Break Location	Node Point	Notes
16" FW header at Containment Penetration P-3.	1005	Terminal End
16" FW header at Containment Penetration P-4.	2005	Terminal End
At all welded joints, fittings, and welded attachments in the non-seismic region (from the auxiliary/turbine building wall interface to Boiler FW Pumps 2P-28A and 2P-28B and Heat Exchangers 2HX-21A and 2HX-21B	N/A	Terminal Ends and Intermediate Breaks

Leakage Cracks (Small Breaks)

Leakage cracks need to be postulated at locations where the combined stresses exceed the threshold limits as shown in the stress table (Attachment A). Based on the combined stresses summarized in the stress table, there are no locations where leakage cracks are required to be postulated in the seismic region of the Main Feedwater piping.

Conclusions

An evaluation of the Main Feedwater lines between the Boiler FW Pumps 2P-28A and 2P-28B and Heat Exchangers 2HX-21 A and 2HX-21B to Containment Penetrations P-3 and P-4 using the GL 87-11 and its associated USNRC Branch Technical Position MEB 3.1, Rev. 2 (Reference 3) is described in this calculation. The calculation shows that:

- Intermediate stress related and arbitrary large breaks are required to be postulated. The locations where these breaks are to be postulated are summarized in Table 7.1.
- Circumferential large breaks are required to be postulated at the terminal ends of the lines as shown in Table 7.1.
- Leakage cracks (break size = ½ times the pipe wall thickness x ½ the pipe internal diameter) are not required to be postulated in the seismic region.

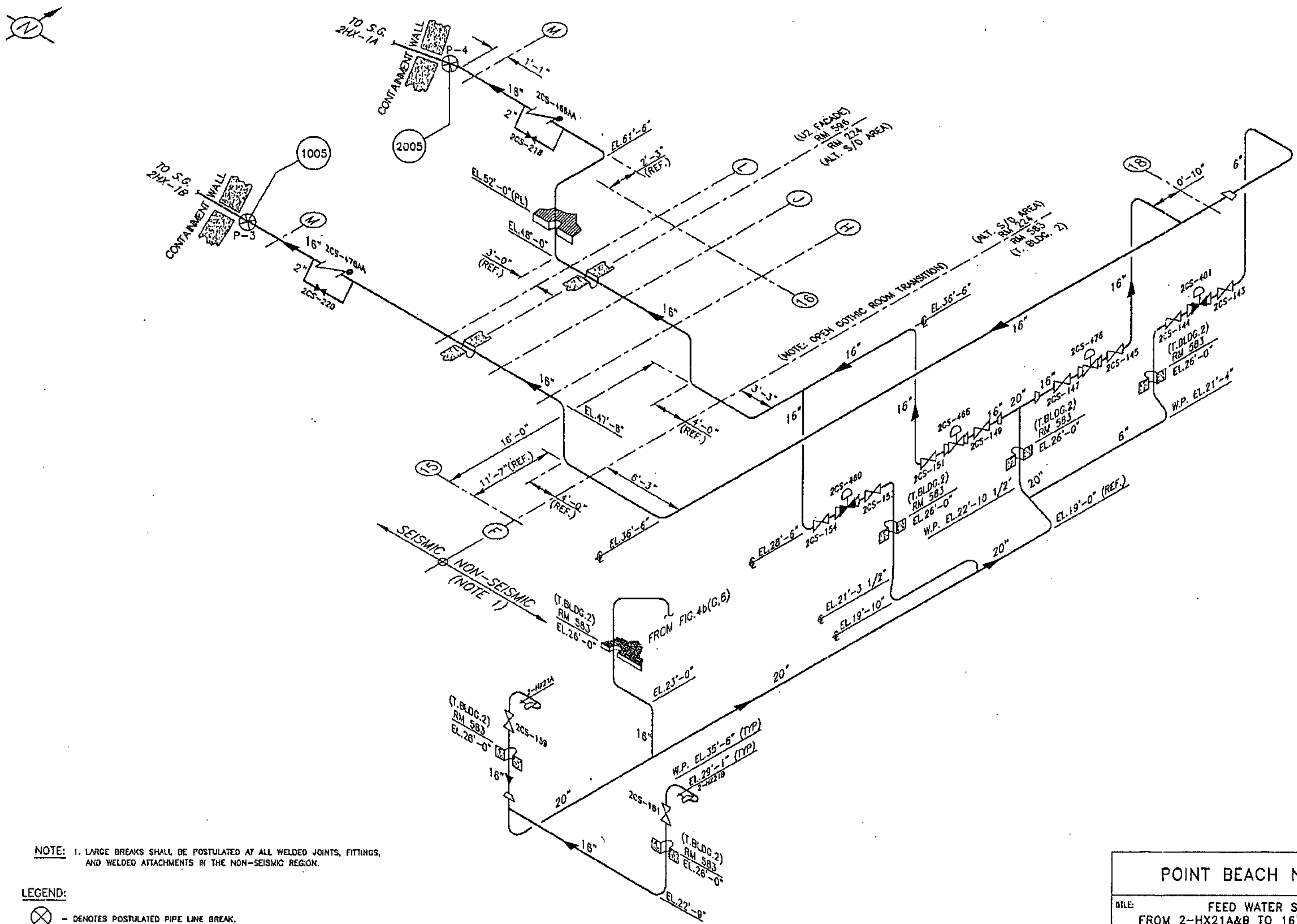
This calculation does not address the postulation of a single crack, exclusive of stress, at the most severe location with respect to essential equipment (IE Notice 2000-20, Reference 9), nor does this calculation address the consequences or evaluate the impacts of breaks or cracks that are required to be postulated based on this criteria.

Stress Table for Feedwater System Loops A and B - Unit 2

FW Piping from Containment Penetration P-3 & P-4 to Auxiliary/Turbine Building Wall (Seismic Piping Region)

(Based on analysis results from Shaw Group Pipe Analysis, Reference 6)

Input Data from Analysis										
NODES	Outside dia. D_O (in)	Pipe thickness t_n (in)	Eq. 9B Stress psi	Eq. 10 Stress psi	Comb. Stress psi	Limit for Crack	Limit for Break	Ratio = Comb. St. / Crack Limit	Ratio = Comb. St. / Break Limit	COMMENTS
1115	16	0.843	15308	1633	16941	19800	39600	0.8556	0.4278	16" Pipe downsteam of support EB-9-2H202
1120	16	0.843	15853	2085	17938	19800	39600	**0.9060**	0.4530	16" Pipe at support EB-9-2H202
2080	16	0.843	9857	6786	16643	19800	39600	0.8406	0.4203	16" Elbow usptream of valve 2CS-466AA
2090	16	0.843	9724	6646	16370	19800	39600	0.8268	0.4134	16" Pipe at support EB-9-2H18
2095	16	0.843	9765	5841	15606	19800	39600	0.7882	0.3941	16" Pipe upsteam of support EB-9-2H18
2099	16	0.843	9784	6010	15794	19800	39600	0.7977	0.3988	16" Pipe upsteam of support EB-9-2H18
2100	16	0.843	9919	6953	16872	19800	39600	0.8521	0.4261	16" Elbow usptream of support EB-9-2H18
2105	16	0.843	7814	8057	15871	19800	39600	0.8016	0.4008	16" Elbow usptream of support EB-9-2H18
2200	16	0.843	14658	1990	16648	19800	39600	0.8408	0.4204	16" Pipe downstream of support EB-9-H202
2205	16	0.843	16071	2801	18872	19800	39600	0.9531	0.4766	16" Pipe at support EB-9-H202



NOTE: 1. LARGE BREAKS SHALL BE POSTULATED AT ALL WELDED JOINTS, FITTINGS, AND WELDED ATTACHMENTS IN THE NON-SEISMIC REGION.

LEGEND:

⊗ – DENOTES POSTULATED PIPE LINE BREAK.

(XXX) – DENOTES BREAK NODE NUMBER.

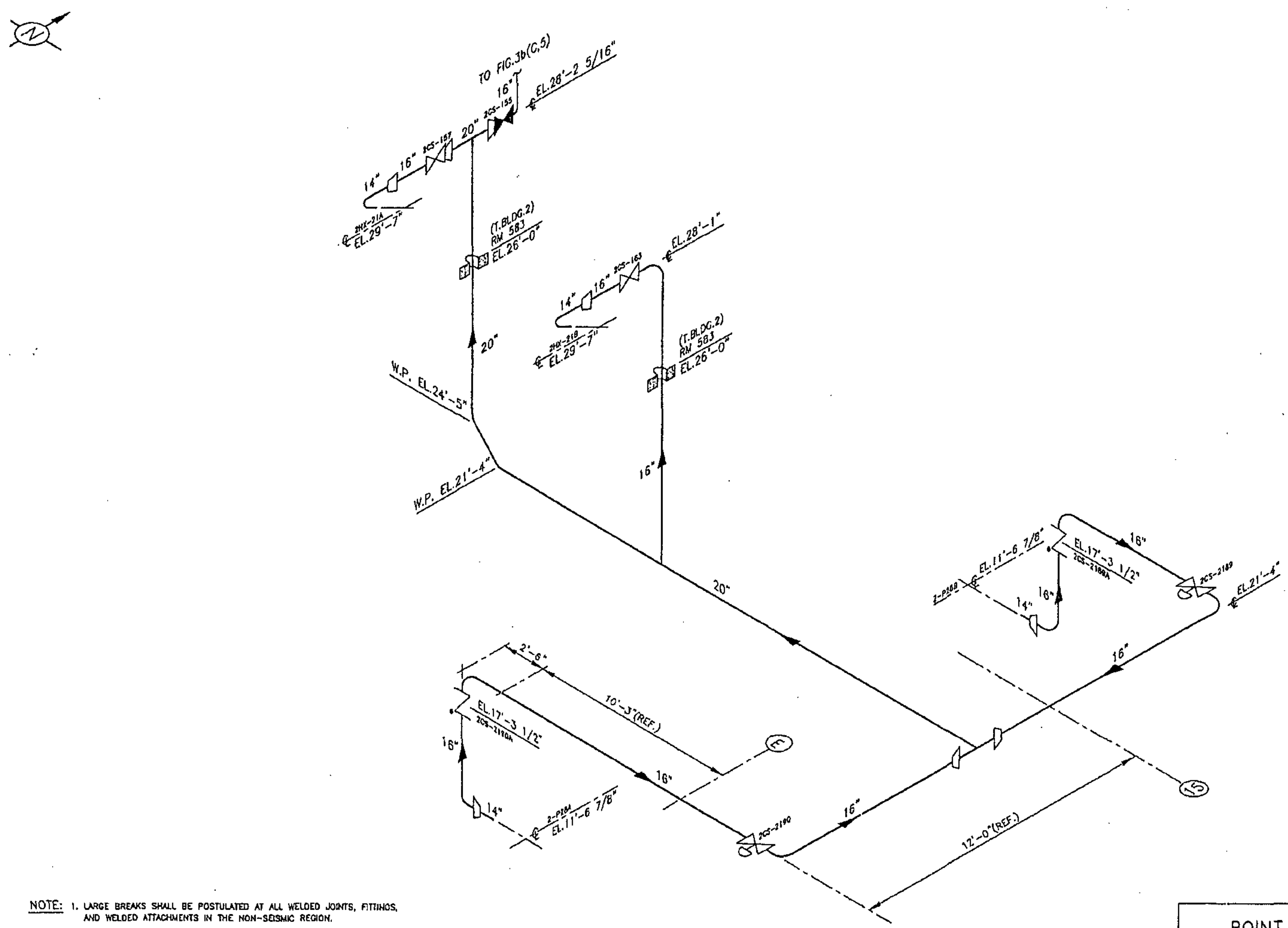
Calc. No. PBNP-994-21-05-P04, Rev. 0
Attach. B, Page B1

AUTOMATED ENGINEERING SERVICES CORP.
40 SHUMAN BLVD. SUITE 220, NAPERVILLE, IL 60563

POINT BEACH NUCLEAR PLANT

TITLE: FEED WATER SYSTEM, UNIT 2
FROM 2-HX21A&B TO 16" LOOP A&B EB-9 (DB-1)
POSTULATED LINE BREAKS
ISOMETRIC

DWN: NNC	DATE: 07-09-08	SCALE: NONE	SH.	REV.
CHKD:	APPVD:	DWG. NO. SK-FW-FIG.3b		



NOTE: 1. LARGE BREAKS SHALL BE POSTULATED AT ALL WELDED JOINTS, FITTINGS, AND WELDED ATTACHMENTS IN THE NON-SEISMIC REGION.

LEGEND:

⊗ – DENOTES POSTULATED PIPE LINE BREAK.

(XXX) – DENOTES BREAK NODE NUMBER.

Calc. No. PBNP-994-21-05-P04, Rev. 0
Attach. B, Page B2

AUTOMATED ENGINEERING SERVICES CORP.
40 SHUMAN BLVD. SUITE 220, NAPERVILLE, IL 60563

POINT BEACH NUCLEAR PLANT				
TITLE: FEED WATER SYSTEM, UNIT 2 FROM 2-P28A&B TO 2-HX21A&B (DB-1) POSTULATED LINE BREAKS ISOMETRIC				
DWN: NNC	DATE: 07-09-08	SCALE: NONE	SHT.	REV.
CHKD:	APPVD:	DWG. NO. SK-FW-FIG.4b		

Calc. No. PBNP-994-21-05-P04 Rev. 0
Attachm. C, Page C1

TECHNICAL POSITION PAPER FOR ESTABLISHING HELB BREAK & LEAKAGE CRACK LOCATION SELECTION CRITERIA

Rev. 0, December 4, 2006
Rev. 1, August 7, 2008

1.0 Introduction

Point Beach currently utilizes different Pipe Break Outside Containment (PBOC) location selection criteria in the HELB Program and EQ Program in regards to environmental parameters. The HELB Reconstitution Program (Program), as currently envisioned, will prepare documented calculations for the pressure, temperature and humidity time histories for a variety of HELB scenarios. Since the Program will reconstitute the design basis for PBOC and the resultant event environment outside Containment, these environmental parameters would be equally applicable and used as the input to the EQ Program. With this approach PBNP will have a single unified HELB approach to address impacts on EQ and structural effects including compartment pressures and temperatures, jet impingement, pipe whip among others

Before proceeding with the Program, a major consideration needs to be addressed and agreed upon by PBNP. This involves the adoption of Generic Letter 87-11 and its associated NRC Mechanical Engineering Branch Technical Position, MEB 3-1, Revision 2. Considerable discussions have taken place in the past on the extent and use of GL 87-11 and its associated MEB 3-1, Rev. 2. Currently, PBNP EQ Program uses a variation of the MEB 3-1 document involving the use of the combined stress threshold for break location of $0.8(1.2\ S_h + S_A)$ to establish the EQ parameters (Reference 4, 5). It is noted that Revision 1 of MEB 3-1 stipulates the above break location threshold limit.

The PBNP FSAR Appendix A.2 (Reference 2) states "Break locations are selected in accordance with Reference 1. Consideration of arbitrary intermediate pipe ruptures is no longer required per NRC Generic Letter 87-11." The Reference 1 stated in the foregoing quotation is the Giambusso Letter of December 19, 1972. The Giambusso criteria included the threshold limit of $0.8(S_h+S_A)$ and other requirements.

PBNP HELB DBD T-47 (Reference 6) provides a detailed discussion of the background history for the break location criteria. Without repeating these details, it is appropriate to state that the HELB location criteria have evolved over the years and there is a realization that these sets of criteria are "non-mechanistic" in nature. In other words, even though the pipe is designed to all design and analysis rules, additional precautions were imposed to provide added assurance for designing the plant SSCs against postulated pipe breaks. To provide a basis for establishing break locations, the AEC and NRC staff promulgated rules that tied these location selections to the stresses in the piping system. As the ASME Section III Piping Code equations (specifically Equations 9 and 10) (Reference 10) evolved so has the break location stress threshold limits. These changes in the break location criteria have led to the numerous discussions cited in the HELB DBD and the differences in the criteria used in the EQ Program and the FSAR citation.

Calc. No. PBNP-994-21-05-P04, Rev. 0
Attach. C, Page C2

2.0 Line Characterization Criteria and Break Selection Rules

It is noted that the criteria for the identification of HE lines outside containment (Design pressure>275 psi and service temperature > 200°F) and the fact that the current licensing bases of most vintage plants, including PBNP, do not recognize moderate energy lines, are separate and distinct criteria that should not be linked to the break location selection. In other words, changes to the HE break location selection criteria do not automatically require the re-visitation of the criteria for high and moderate energy line characterization. In fact, SRP 3.6.2, GL87-11 and MEB 3-1, Rev. 2 do not address the line characterization criteria, which is reviewed in SRP 3.6.1.

Since the line characterization for line breaks remains the same as stated in the FSAR, the section of MEB 3-1, Rev. 2 pertaining to moderate energy lines do not apply since the PBNP licensing basis does not characterize lines in this category. Similarly, the HE line definition for PBNP remains unchanged and only the lines that satisfy the "and" criteria and the "normally depressurized" rule need to be included in the HELB Program.

3.0 Proposed Unified PBOC Criteria for the PBNP HELB Reconstitution Program

The following criteria for the Pipe Break Outside Containment (PBOC) are proposed for the HELB Reconstitution Program. Adoption and use of this set of criteria will be across all PBNP Programs (EQ, HELB and others).

3.1 Retain the definition that all lines outside containment are designated as ASME Section III Class 2 and 3 as stated in the FSAR, Appendix A.2 and DG-M09 (Reference 9).

3.2 Retain the current definitions for HE lines, which does not require the characterization of lines for moderate energy.

3.3 Adopt the use of GL 87-11 and MEB 3-1, Rev. 2 rules for HE lines only including the rules for break and leakage crack location selection in their entirety. These rules utilize the 1986 ASME Code Equations 9 and 10 with the use of stress indices for dead weight and OBE resultant moments (B_2 indices) and longitudinal pressure (B_1 indices) and stress intensification factors (i) for thermal expansion only. It is noted that the pipe stress analyses compute the resultant moments for the load cases. These resultant moments are independent of which Design Code is used. The code equations or in this case of establishing the break locations, the combined stress equation are computed from the stress resultants based on the specific formulations.

3.4 In addition, IN 2000-20 (Reference 7) clarifies the requirement of postulating a single open crack at the location most damaging to those essential structures and systems.

3.5 Types of breaks and cracks should be in accordance with the MEB 3-1 Section B.3.

3.6 When break criteria are based on stress calculation, it is recommended that breaks and cracks be based on the calculated stresses (Section B.1.c(2)(b)(ii)) and not at each pipe fitting (Section B.1.c(2)(b)(i)) of MEB 3-1, Rev. 2. The stress requirement of Section B.1.c(2)(b)(ii) should be based on the primary piping stress evaluation (Section NC/ND-

3653 of the ASME Code Section III) and local stresses at the integral welded attachments(IWA), where applicable.

3.7 Where breaks locations are selected without the benefit of stress calculations, it is recommended that breaks be postulated at the piping welds to each fitting, valve, or welded attachment.

Calc. No. PBNP-994-21-05-P04, Rev. 0
Attach. C, Page C3

4.0 Regulatory & Licensing Issues

Use of the MEB 3-1 equations to determine break and crack locations does not require prior NRC approval. The 50.59 process and changes to the FSAR would be required.

In order to be compatible with the activities previously performed for the EQ Program, a 50.59 Screening/Evaluation should be performed to accept the use of the of the proposed PBOC criteria for determining break and crack locations.

The proposed PBOC criteria has the potential of eliminating all intermediate large breaks and almost all small breaks (leakage cracks), except the one (single) mandatory crack at the most adverse location. The 50.59 Screening/Evaluation should also address the elimination of the longitudinal crack at the terminal ends required by the Giambusso letter, but eliminated by MEB 3-1.

5.0 Conclusion

The above approach would result in a single unified set of HELB/EQ criteria that would be applicable to all HELB related design parameters for the evaluation plant SSCs. The possible elimination of large breaks should result in lower environmental loads (compartment pressure and temperature) that would result in increasing design margins for the plant SSCs.

The HELB Reconstitution Program will utilize the Proposed PBOC Criteria and systematical address and documents the analysis and results in the various tasks outlined in the Task 1 Report (Reference 8)

6.0 References

1. "General Information Required for Consideration of the Effects of a Piping System Break Outside of Containment", AEC December 19, 1972 (Giambusso Letter)
2. PBNP FSAR Appendix A.2, High Energy Pipe Failure Outside Containment
3. USNRC Generic Letter GL 87-11, Relaxation in Arbitrary Intermediate Pipe Rupture Requirements and associated Revised MEB 3-1 of SRP 3.6.2
4. PBNP Calculation M-09334-357-HE.1
5. PBNP Calculation M-09334-357-HE.2, Rev. 01, High Energy Line Breaks in Selected Piping Systems
6. PBNP HELB DBD T-47, High Energy Line Break Design Basis Document, Rev. 0
7. USNRC Information Notice 2000-20, Potential Loss of Redundant Safety-Related Equipment Because of the Lack of High-Energy Line Break Barriers
8. AES Corp. PBNP HELB Reconstitution Program Task 1 Report, Rev. 0.
9. PBNP Design Guide DG-M09, Rev. 2, Design Requirements for Pipe Stress Analysis.
10. ASME B & PV Code Section III, Subsections NC and ND, 1986 Edition.