

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2
REVIEW OF PIPING REANALYSIS PER I&E BULLETIN 79-07

SAFETY EVALUATION REPORT

INTRODUCTION/BACKGROUND

In their April 24, 1979 response to I&E Bulletin 79-07 Carolina Power and Light Company (CP&L) stated that the recirculation and main steam piping had been analyzed by GE using a computer code that combined directional seismic responses by algebraic summation. All other safety related piping was analyzed by UE&C using a computer code that combined directional seismic responses by algebraic summation. CP&L has supplied supplemental information on this subject at meetings with the NRC staff and in letters dated May 15, 21, 22, 29, and June 4, 1979.

DISCUSSION

CP&L has stated that a reanalysis of all affected piping in the "as-built" condition will be completed with the results showing all piping stresses remaining below their allowable values, as specified in the BSEP FSAR by July 21, 1979. Additionally, all loads on attached equipment (nozzle loads) will be acceptable. Upon completion of modifications to certain pipe supports which were determined to be originally underdesigned, all pipe supports attached to safety related piping or equipment in the plant will be "operable" and within FSAR criteria. These modifications will be completed prior to return to power operation.

The recirculation and mainsteam lines were reanalyzed by GE using PISYS. The responses from two directions, the most disadvantageous combination of one horizontal with the vertical, were combined by the absolute sum and the results were within FSAR allowable. Refer to Evaluation Section for reanalyses done by UE&C.

The licensee's response to IE bulletin 79-04 states that no VELAN swing check valves are in any of the affected piping. Further, IE Bulletin 79-02 was addressed when piping support modifications were found to be necessary.

The licensee has stated that the reanalysis has no effect on pipe break criteria since the postulated break was analyzed to occur at any point on the pipe, inside or outside containment.

EVALUATION

The reanalysis technique employed was a lumped mass response spectra modal analysis. This dynamic analysis procedure is an acceptable method. The absolute combination of responses in two directions is also acceptable to the staff.

POOR ORIGINAL

1131 360

7910010 10 110

Once the support modifications are complete, the affected piping stresses, attached equipment loads, and support designs will all be in accordance with FSAR criteria and acceptable to the staff. UE&C has reanalyzed category 1 (pressure boundary) and category 2 (other safety related) lines using Square Root of Sum of Squares (SRSS) load combination instead of algebraic summation. This analysis employed a conservative factor of 2 to convert from OBE to DBE. When the use of SRSS methodology for a 2D analysis was questioned because it did not conform to FSAR commitment, the licensee applied a conservative factor of 1.38 to the SRSS results to convert to absolute sums, which is an acceptable load combination method with a 2D analysis. In such cases, credit for conservatism in the OBE/DBE relationship was taken (a more realistic factor of 1.2 was used instead of 2). When this exercise was completed, one of the first 39 reanalyzed lines was found to exceed total allowable stress by 2%, but was still less than 0.9 Sy as permitted by the FSAR and was found acceptable.

For the remaining 411 unreanalyzed lines, SRSS stresses were estimated from the algebraic summation stresses by applying a factor of 1.5. The SRSS results were then converted to absolute sums for use with the 2D analysis by applying a factor of 1.38. Credit was again taken for the conservatism in the OBE/DBE relationship. When this exercise was completed, 39 additional lines were found suspect. SRSS stresses were computed for these lines which eliminated the factor of 1.5. However, several of these lines still gave stresses in excess of code allowable. To resolve this problem, the licensee recomputed the total stress using coincident point values instead of maximum values. This method is more realistic and is acceptable to the staff. The new total stresses were all within code allowable.

The above procedure which the licensee took in completing the piping seismic stress reanalysis under IE Bulletin 79-07 is acceptable to the staff.

We find the licensee's responses concerning I&E Bulletin 79-02 and 79-04 acceptable. The reanalysis has no effect on BSEP pipe break criteria committed to in the FSAR.

The staff still has some concern as to whether the reanalyses effort reflects the true as-built conditions in the plant. However, CP&L has completed a walk-down of the piping and supports inside the dry well to verify that the as-built condition has indeed been utilized. Additionally, the licensee has committed to a field verification of all lines on both units by June 15, 1979. We find this commitment acceptable.

CODE VERIFICATION

The licensee has indicated that the following computer programs were used in the reanalysis of this plant:

POOR ORIGINAL

1131 361

PISYS - General Electric Company
ADLPIPE-2 - United Engineers and Constructors

GE has stated that the code PISYS combines the responses due to seismic multi-axial excitation by absolute summation; the modal response due to each excitation are combined by methods as specified in Regulatory Guide 1.92. A Fortran listing of the dynamic response calculations section of PISYS has been submitted by GE and these statements have been certified and confirmed. GE is also presently solving a set of NRC generated benchmark problems as part of the code verification effort.

UEC has indicated that the code ADLPIP-II combines the responses due to seismic excitation by the SRSS method when used with the response spectra technique. This has been confirmed by examining the code listing and by verifying the code by solving a set of benchmark problems.

In addition to satisfying the code verification requirements, the licensee has also agreed to provide the NRC two problems for confirmatory analysis. These confirmatory problems will be solved independently by consultants to the NRC at Brookhaven National Laboratory. The models submitted for these piping problems will be confirmed by the licensee as corresponding to the "as-built" condition. We find these commitments acceptable.

CONCLUSION

Based on the discussion and evaluation presented above, we conclude that the requirements set forth in I&E Bulletin 79-07 are adequately satisfied to allow resumption of operation upon completion of the modifications identified in our meeting of June 4, 1979.

POOR ORIGINAL

1131 362