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SUBJECT: Forwards summary response to IE Bulletins 79-02, Rev 2 & 79-14, Rev 1, Suppl 2 dtd 791108 & 790907 respectively. Seismic Category I base plates evaluated to include effects of flexibility in determining anchor bolt loads.

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United States Nuclear Regulatory Commission
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261 LICENSE NO. DPR-23
SUMMARY RESPONSE TO IE BULLETINS NO. 79-02 AND 79-14

Gentlemen:

This submittal provides a summary of previous responses by Carolina Power & Light Company (CP&L) to IE Bulletin No. 79-02, Revision 2 (November 8, 1979) and IE Bulletin No. 79-14, Revision 1 Supplement 2 (September 7, 1979). Carolina Power & Light Company believes that all of the concerns and actions addressed in the two Bulletins have been resolved as they apply to H. B. Robinson Unit No. 2 . In addition, those items remaining open at the beginning of 1987 have been closed by NRC Inspection Report No. 50-261/87-08.

The enclosure to this submittal summarizes the actions taken by CP&L since the original issue of the Bulletins in 1979. Previous submittals on either Bulletin are listed at the end of the enclosure for reference.

If you have any questions concerning this submittal, please contact R. W. Prunty at (919) 836-7318.

Yours very truly,

L. I. Loflin
Manager Nuclear Licensing

DAS/che (5351MDM)

Enclosure

cc: Dr. J. Nelson Grace
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SUMMARY RESPONSE TO IE BULLETINS NO. 79-02 AND 79-14

AS REVISED AND SUPPLEMENTED

SUMMARY RESPONSE TO IE BULLETIN NO. 79-02

Carolina Power & Light Company provided a preliminary response to the Bulletin on May 22, 1979. A review of analyses revealed that the base plates for the pipe supports were "flexible" in accordance with the bulletin definition, and the plates were considered as rigid at the time of original design. Therefore, a program was initiated to investigate design requirements relative to the concerns of the Bulletin, along with an inspection effort to verify installation.

The site program was initiated as a joint effort by CP&L and the Architect/Engineer (A/E) for H. B. Robinson, Unit No. 2 on April 24, 1979, to acquire data necessary to answer the required action items listed in the bulletin.

The Seismic Category I piping systems investigated are defined in the H. B. Robinson, Unit No. 2 Final Safety Analysis Report (FSAR).

The following is a summary, by Bulletin Item, of CP&L actions taken in addressing the NRC concerns identified in the Bulletin.

Item 1. "Verify that pipe support base plate flexibility was accounted for in calculation of anchor bolt loads."

RESPONSE

Seismic Category I base plates have been evaluated to include the effects of flexibility in determining anchor bolt loads. Base plate flexibility is accounted for in the calculation of expansion anchor loads for all Seismic Category I pipe support base plates using either a conservative hand calculation or a specific finite element computer analysis for a particular base plate.

Item 2. "Verify that the concrete expansion anchor bolts have the following minimum factor of safety between the bolt design load and the bolt ultimate capacity determined from static load tests...which simulate the actual conditions of installation...:

a. Four - For wedge and sleeve type anchor bolts,

b. Five - For shell type anchor bolts."

RESPONSE

Anchor bolts currently installed in Category I seismic restraints meet the required factors of safety. Also, the effects of shear-tension interaction were evaluated using a straight-line interaction equation:

$$\frac{\text{Applied tensile load}}{\text{Allowable tensile load}} + \frac{\text{Applied shear load}}{\text{Allowable shear load}} \leq 1.0$$

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The minimum edge distance from the anchor bolt centerline to a concrete free edge and the centerline-to-centerline distance required for 100 percent bolt capacity are in accordance with published manufacturer's data. In cases where the centerline-to-centerline distance could not be met, the allowable bolt loads were reduced by straight-line interpolation in accordance with the manufacturer's recommendation.

As of March 1986, Category I seismic restraints have been reviewed and any necessary modifications completed to ensure full compliance with the Bulletin.

Item 3. "Describe the design requirements of applicable for anchor bolts to withstand cyclic loads..."

RESPONSE

Tests conducted by the anchor bolt manufacturer show that short duration, low frequency dynamic loading only slightly affects the ultimate bolt capacity. The test data shows that safety factors of four and five are more than adequate for cyclic load consideration.

Item 4. "Verify from existing QC documentation that design requirements have been met for each anchor bolt in the following areas:

a. Cyclic loads have been considered... In the case of the shell type, assure that it is not in contact with the back of the support plate prior to preload testing.

b. Specified design size and type is correctly installed..."

RESPONSE

Per manufacturer recommendation, self-drilling anchors are not preloaded by applying torque to the bolt. In tests, the manufacturer did not preload the self-drilling anchor. The results of the cyclic tests show this type of anchor to be adequate without preloading when using a safety factor of five.

In the case of wedge anchors, the ultimate pullout loads and torque values used were from published manufacturer's data derived by testing performed by an independent testing laboratory. Review of the tests indicates that prior to testing, the anchor bolts were torqued to torque values specified in the manufacturer's catalog, insuring that bolt preload was equal to or greater than design load.

In April 1979, CP&L initiated a verification and testing program to assure the proper installation of base plates and anchor bolts. This original verification and testing program was completed in June 1979 per the requirements of the original Bulletin. As detailed in correspondence to the NRC in July 1979, only one bolt per base plate was tested at that time. As a result of later Bulletin revision and discussion with the NRC, 100 percent of the physically accessible anchor bolts on accessible restraints for safety related piping greater than 1 1/2-inch in diameter were inspected. Statistical information necessary to

demonstrate that the Bulletin requirements were met were included in correspondence to the NRC during this period. The verification also involved inspection of embedment depth for self-drilling anchors, thread engagement, center-to-center distances, minimum edge distance, and proper expansion of self-drilling anchors.

Only a small percentage of the base plates had been grouted underneath and, in most cases, these supports were attached directly to the floor and carried compression loads only. As allowed by the Bulletin, bolts not subject to tension do not require testing. In cases where the bolts were in tension, the grout was removed to allow verification that self-drilling anchors with threaded studs and leveling nuts had been installed. The leveling nuts were then "backed off" prior to the tension test.

The verification team did not inspect or document the sizes of base plate bolt holes; however, the team did inspect each bolt and anchor and, if the base plate hole was enlarged or elongated, a washer was installed to ensure proper bearing surface for the bolt head.

Since issuance of the Bulletin, no self-drilling anchors have been used in Category I seismic restraint design. For the majority of applications, wedge anchors are used, and for the more difficult designs, the undercut anchor is used. Both installations are governed by an approved Robinson construction procedure which controls the drilling of holes, installation of anchors, and torquing activities. Site Quality Assurance/Quality Control personnel inspect new installations in accordance with an approved procedure and verify hole depth, diameter, angularity, torque, and other aspects of installation. In cases where the required criteria is not met, the pipe support engineer is consulted for disposition.

Item 5. "Determine the extent that expansion anchor bolts were used in concrete block (masonry) walls to attach piping support in Seismic Category I systems... If expansion anchor bolts were used in concrete block walls:

a. Provide a list of systems involved, with the number of supports, type of anchor bolts, line size, and whether these supports are accessible during normal plant operation.

b. Describe in detail any design consideration used to account for this type of installation.

c. Provide a detailed evaluation of the capability of the supports, including the anchor bolts and block wall to meet the design loads.

d. Describe the results of testing of anchor bolts in concrete block walls and your plans and schedule for any further action."

RESPONSE

There are no Seismic Category I restraints attached to block (masonry) walls using concrete expansion anchors at H. B. Robinson, Unit 2. Therefore, this item is not applicable to H. B. Robinson, Unit No. 2.

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Item 6. "Determine the extent that pipe supports with expansion anchor bolts used structural steel shapes instead of base plates. The systems and lines reviewed must be consistent with the criteria of IE Bulletin No. 79-02, Revision 1. If expansion anchor bolts were used as described above, verify that the anchor bolt and structural steel shapes in these supports were included in the actions performed for the Bulletin. If these supports cannot be verified to have been included in the Bulletin actions:

a. Provide a list of the systems involved, with the number of supports, type of anchor bolt, line size, and whether the supports are accessible during normal plant operation.

b. Provide a detailed evaluation of the adequacy of the anchor bolt design and installation.

c. Describe your plans and schedule for any further action necessary to assure the affected systems meet Technical Specifications operability requirements in the event of an SSE."

RESPONSE

A small percentage of supports with expansion anchor bolts at H. B. Robinson Unit No. 2, use structural steel shapes instead of base plates. These installations have been reviewed for compliance with Bulletin requirements.

Item 7. "For those licensees that have had no extended outages to perform the testing of the inaccessible anchor bolts, the testing of anchor bolts in accessible areas is expected to be completed by November 15, 1979."

RESPONSE

This item is not applicable to H. B. Robinson, Unit No. 2.

Item 8. "Maintain documentation of any sampling inspection of anchor bolts required by Item 4 on site and available for NRC inspection.

RESPONSE

Calculations performed to check for tension due to base plate flexibility and to satisfy Bulletin concerns as well as tension test reports are permanently stored at H. B. Robinson, Unit No 2 and are available for NRC inspection.

Item 9. "All holders of construction permits for power reactor facilities are requested to complete Items 5 and 6 for installed pipe supports within 60 days of the date of issuance of Revision No. 2."

RESPONSE

Modifications to Seismic Category I piping supports to ensure compliance with the Bulletin have been completed as of March 1986.

(5351MDM/che)

SUMMARY RESPONSE TO IE BULLETIN NO. 79-14 AS REVISED AND SUPPLEMENTED

IE Bulletin No 79-14 issued on July 2, 1979 and subsequently revised and supplemented, requested licensees to take certain actions to verify that seismic analyses are applicable to as-built plant configurations. Carolina Power & Light Company provided a 30-day response to Revision 1 of the Bulletin on August 2, 1979. An inspection and verification program was implemented to demonstrate that the design specifications and drawings used to obtain input information for the seismic analysis of plant safety-related systems reflected as-built configurations. Any variances found were evaluated to determine the effect on the operability of the system.

The inspection and verification program was conducted by CP&L with analytical services provided by the A/E. The program covered the inspection, examination, evaluation, and any necessary reanalyses of piping systems and piping support systems identified as safety related by the FSAR. The program was intended to meet the requirements of Revision 1 of the Bulletin.

The following information summarizes actions by CP&L to satisfy I&E Bulletin No. 79-14 as revised and supplemented:

After issuance of the Bulletin, CP&L initiated an inspection program in July 1979, to verify application of the seismic analysis to the installed configuration of safety-related piping to which the Bulletin applied. Special procedures were developed to govern the inspection of the piping and associated restraints. These procedures provided guidance for the verification of pipe run geometry, support and restraint locations, pipe attachments, valve weights and eccentricities, and so forth, with the physical parameters derived from field measurements. Design parameters, such as material and temperature, were derived from piping flow diagrams and other available plant design documents.

In January 1984, an independent consulting firm was retained to perform a third party technical review of the program for complying with the Bulletin. As a result of this review, the program was restructured with a redefined scope. New procedures were developed by both CP&L and the A/E to accomplish the revised program. In addition, a number of "position papers" were written to present the technical background and justification for the methods used in the analysis.

To determine the accuracy and completeness of field data gathered prior to 1984, a representative group of piping systems were chosen to be completely reinspected per the new procedures. The resulting inspection packages were designated as "benchmark" packages. A total of 19 systems were reinspected. The systems selected for benchmarking provided an accurate representation of the various systems within all areas of the plant.

Information obtained from the new walkdown of the 19 systems was then compared to information obtained prior to 1984. In addition, new stress analyses was performed using the newly obtained data. The results of these analyses were compared to previous analysis results and, based on this comparison, the conclusion was made that sufficient correlation did exist

between previous data and the "benchmark" data to permit use of the previously acquired data. However, there was a need to supplement the previously acquired data because of newly imposed requirements. Additional data required was:

1. Walkdown of small bore branch lines on 6" and under pipe identified by line number.

2. Clearances between the pipe and wall or floor penetrations.

3. Valve identification on branch lines identified in Item 1 above.

4. Valve identification of valves in main run lines not included in the earlier valve weight verification report.

5. Valve operator orientation.

6. Verification of penetration configuration for containment penetration numbers 57, 58, 59, 62, 63, and 64.

7. Dimensional verification of curved pipe sections on packages CH-7, FW-3A, SI-1, SI-2, SI-3, SI-6, SI-7, and SI-20.

8. Differences identified by the individual package between existing data (walkdown, modification, etc.) and the latest revision flow diagram.

The information gathered during walkdowns was documented and used to generate the appropriate information for evaluation of the piping system. This was performed using a procedure developed for the preparation of as-built stress isometric drawings. The system was then evaluated using a procedure for pipe stress as-built evaluation and design comparison to determine whether the previous analysis was acceptable.

Systems not meeting the acceptance criteria of the evaluation procedure were reanalyzed. For this effort, two changes were initiated. All piping 2 1/2" larger previously analyzed by the "chart method" were reanalyzed by computer. Also, a dynamic DBE analysis was performed (previously static) in areas where DBE response spectra were available.

There were several reasons for abandoning the chart method analysis. Adequate documentation could not be produced to verify the accuracy of the analysis and, in some cases, the validity of the analysis may have been questionable. As the reanalysis effort progressed, it became apparent that because of the new requirements, many calculated pipe support loads were increasing to values higher than obtained in previous DBE analyses. This increase would have required modification of a high percentage of existing supports. For this reason it was decided to perform a dynamic DBE analysis. The dynamic DBE response spectra analysis produced more accurate loads on the supports which, in most cases, were less than the loads from the static analysis. Because no operating basis earthquake (OBE) response spectra were made for H. B. Robinson, Unit No. 2, this analysis was not changed (i.e., still performed statically). Changes in the analysis methodology were incorporated into the FSAR by Amendment No. 4, dated July 22, 1986.

The CP&L reviews for Bulletin compliance have been performed and analysis reconciliation completed.

REFERENCES

1. Letter from E. E. Utley, CP&L, to J. P. O'Reilly, NRC, Subject: Preliminary Response - IE Bulletin 79-02, dated May 22, 1979 (Serial: GD-79-1340).

2. Letter from E. E. Utley, CP&L, to J. P. O'Reilly, NRC, Subject: Response to IE Bulletin 79-02, dated July 9, 1979 (Serial: GD-79-1719).

3. Letter from B. J. Furr, CP&L, to J. P. O'Reilly, NRC, Subject: Supplemental Response to IE Bulletin 79-02, dated July 20, 1979 (Serial: GD-79-1861).

4. Letter from B. J. Furr, CP&L, to J. P. O'Reilly, NRC, Subject: Response to IE Bulletin 79-02, Revision No. 2, dated December 10, 1979 (Serial: GD-79-3141).

5. Letter from R. E. Morgan, CP&L, to J. P. O'Reilly, NRC, Subject: IE Bulletins IEB-79-02 & IEB-79-14, dated February 15, 1984 (Serial: RSEP/84-139).

6. Letter from R. E. Morgan, CP&L, to J. P. O'Reilly, NRC, Subject: IE Bulletins IEB-79-02 & IEB-79-14, dated June 29, 1984 (Serial: RSEP/84-448).

7. Letter from R. E. Morgan, CP&L, to Dr. J. N. Grace, NRC, Subject: IE Bulletins IEB-79-02 & IEB-79-14, dated March 17, 1986 (Serial: RNPD/86-937).

8. Letter from B. J. Furr, CP&L, to J. P. O'Reilly, NRC, Subject: Seismic Analyses for As-Built Safety Related Piping Systems, dated August 2, 1979 (Serial: GD-79-1978).

9. Letter from B. J. Furr, CP&L, to J. P. O'Reilly, NRC, Subject: Seismic Analyses for As-Built Safety-Related Piping Systems, I. E. Bulletin 79-14, dated September 5, 1979 (Serial: GD-79-2179).

10. Letter from B. J. Furr, CP&L, to J. P. O'Reilly, NRC, Subject: Seismic Analyses for As-Built Safety Related Piping Systems, dated September 25, 1979 (Serial: GD-79-2410).

11. Letter from R. B. Starkey, CP&L, to J. P. O'Reilly, NRC, dated October 15, 1079 (Serial: RSEP/79-1138).

12. Letter from B. J. Furr, CP&L, to J. P. O'Reilly, NRC, Subject: Supplemental Response to IE Bulletin 79-14 Seismic Analyses for As-Built Safety Related Piping Systems, dated March 31, 18-981 (Serial: NO-81-554).