CP&L
A Progress Energy Company

Serial: RNP-RA/01-0151

OCT 24 2001

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

SUPPLEMENTAL INFORMATION REGARDING
NRC BULLETIN 2001-01, "CIRCUMFERENTIAL CRACKING OF
REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES"

Ladies and Gentlemen:

By letter dated October 2, 2001, H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, provided supplemental information regarding NRC Bulletin 2001-01, under oath and affirmation in accordance with 10 CFR 50.54(f). In that letter it was stated that a non-proprietary version of the attached report was being generated and would be provided to the NRC by October 31, 2001. The non-proprietary version of the associated report is hereby being provided as an attachment to this letter. This information is not being submitted under oath and affirmation pursuant to 10 CFR 50.54(f), because the information it contains is being submitted for informational purposes.

If you have any questions regarding this matter, please contact Mr. H. K. Chernoff.

Sincerely,

for B. L. Fletcher III
Manager - Regulatory Affairs

Robinson Nuclear Plant
3581 West Entrance Road
Hartsville, SC 29550

A088

CAC/cac

Attachment

c: Mr. B. S. Mallett, NRC, Region II
Mr. K. N. Jabbour, NRC, NRR
NRC Resident Inspectors

United States Nuclear Regulatory Commission
Attachment to Serial: RNP-RA/01-0151
15 Pages

"Distribution of Reactor Vessel Penetration Interference Fits for Sample of CE-Manufactured Heads"

(Westinghouse Proprietary Class 3)

Westinghouse Non-Proprietary Class 3

Westinghouse Electric Company LLC

Nuclear Services
2000 Day Hill Road
Windsor, CT 06095

October 18, 2001
CN-CI-01-4, Rev. 000

Mr. Dwaine A. Alexander
Customer Project Manager
for Carolina Power & Light Company

Subject: **Distribution of Reactor Vessel Penetration Interference Fits for Sample of CE-Manufactured Heads**

Attachments:

A. Evaluation of the Distribution of Reactor Vessel Penetration Interference Fits for Sample of CE-Manufactured Heads
B. Quality Assurance Forms

REVIEW AND APPROVAL

This document is verified in accordance with the Westinghouse Electric Company CE Nuclear Power LLC Quality Procedures Manual, QPM-101, Revision 5.

VERIFICATION STATUS: COMPLETE

	Printed Name	Signature	Date
Cognizant Engineer	B. Nadgor	B. Nadgor	10/18/01
Independent Reviewer	M. Zajec	M. Zajec	10/18/01
Management Approval	B. M. Hinton	B. M. Hinton	10/18/01

Dear Mr. Alexander:

The purpose of this letter is to document the results of an evaluation of the as-built interference fits between the reactor vessel head and the CRDM nozzles for a sample of CE manufactured heads. Carolina Power & Light Company intends to utilize this data to characterize a typical distribution of interferences for the HB Robinson plant, in the absence of plant-specific as-built data.

Official record electronically approved in EDMS 2000

The evaluation is presented in Attachment A.

If you have any further questions on this matter please do not hesitate to contact me at (860) 731-6715.

Sincerely,

Bruce M. Hinton
Manager, Component Integrity Group

ATTACHMENT A

EVALUATION OF THE DISTRIBUTION OF REACTOR VESSEL PENETRATION INTERFERENCE FITS FOR SAMPLE OF CE-MANUFACTURED HEADS

1.0 INTRODUCTION

The purpose of this Attachment is to perform an evaluation of the distribution of the interference fits between the head penetrations and CRDM nozzles for the as-installed condition. Carolina Power & Light Company intends to utilize this data to characterize a typical distribution of interferences for the HB Robinson plant, in the absence of plant-specific as-built data

An initial review was performed of shop data available for three (3) fabricated heads for Westinghouse design plants, manufactured by Combustion Engineering (CE) during the time frame of manufacturing of the head for HB Robinson. HB Robinson, as all CE manufactured heads, has a design interference ranging from 0.0 mils to 3.0 mils (References 5.3.1 and 5.3.2). A total of 230 head hole measurements were tabulated. Average interference fit between the head hole and the CRDM nozzle was calculated for each penetration, based on "as-measured" dimensions of the hole and a nominal diameter of the nozzle considering design tolerances (nozzle shop data was not available for chosen plants). The calculated interference data was then plotted to show the distribution of the interference fits for CRDM penetrations. This distribution is assumed to be typical for Westinghouse designed plants manufactured by Combustion Engineering, and therefore, applicable to HB Robinson.

In order to supplement the data sample, shop data for two (2) additional fabricated heads for Westinghouse design plants were reviewed. In this case, "as-measured" information was available for both the hole and the nozzle. An additional 156 hole/nozzle actual measurements were included into tabulation.

Therefore, a total of 386 penetration measurements were evaluated for a fleet of five (5) Westinghouse design plants to create a more comprehensive picture of the typical distribution of the interference fits for CRDM penetrations.

The following table shows the approximate dates of manufacturing for the various heads in the sample:

Plant	***NSSS Designer***	***Date***	***Head Manufacturer***
HB Robinson	Westinghouse	circa 1968	CE
1	Westinghouse	11/68	CE
2	Westinghouse	03/71	CE
3	Westinghouse	05/74	CE
4	Westinghouse	04/77	CE
5	Westinghouse	circa 1977	CE

This analytical work is performed in accordance with the requirements of the Westinghouse Electric Company CE Nuclear Power LLC Quality Procedure Manual QPM-101 (Reference 5.1)

2.0 ASSUMPTIONS

The following assumption was used in this evaluation:

> The CRDM nozzle outside diameter is assumed to be the average diameter between the maximum and minimum values based on design tolerance band, whenever as-built information for the nozzle is not available.

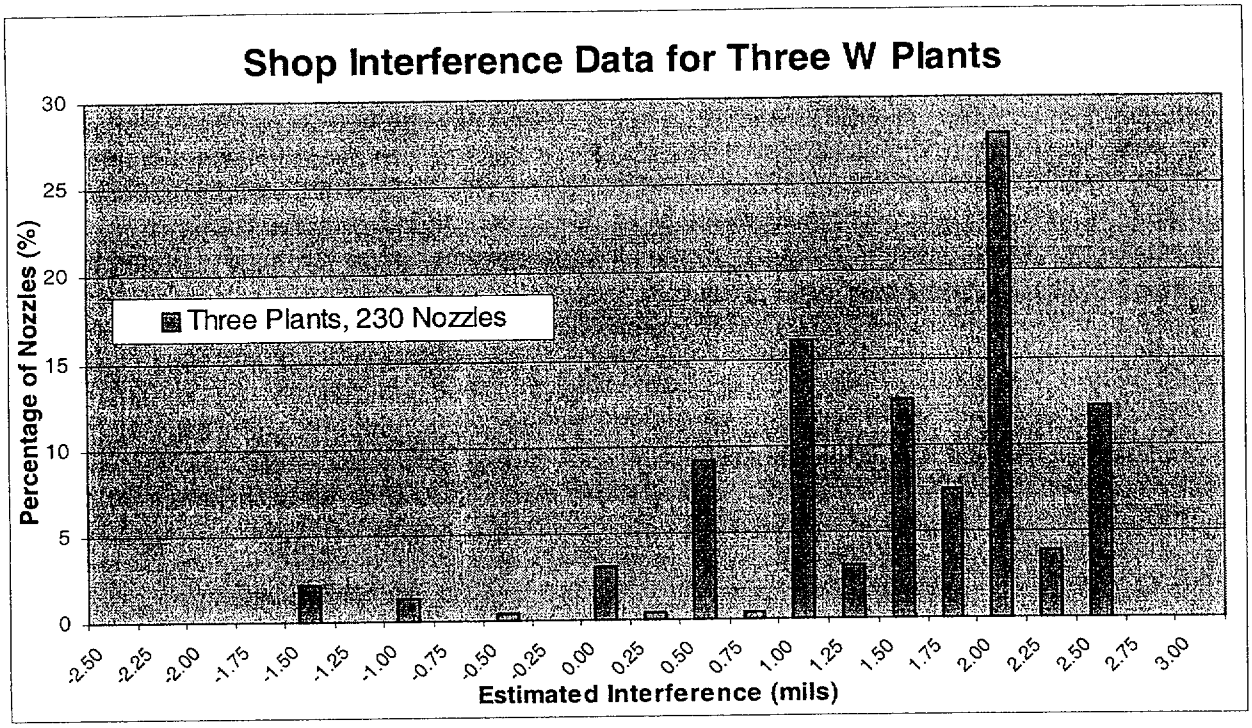
All other assumptions are stated in the body of the evaluation.

3.0 INTERFERENCE FIT DISTRIBUTIONS

A review of shop data available for 3 fabricated heads for Westinghouse design plants, manufactured by Combustion Engineering during the time frame of manufacturing of the head for HB Robinson, was performed (Plants 1, 2 and 3 from the table in Section 1.0).

A total of 230 head hole measurements were tabulated (Reference 5.2). Average interference fit between the head hole and the CRDM nozzle was calculated for each penetration, based on "as-measured" dimensions of the hole and "as-designed" dimensions of the nozzle (average diameter of the nozzle, 3.9995 inch, was used in accordance with Reference 5.3.2). The calculated interference data was then plotted to show the distribution of the interference fits for CRDM penetrations at 3 plants (see Figure 1).

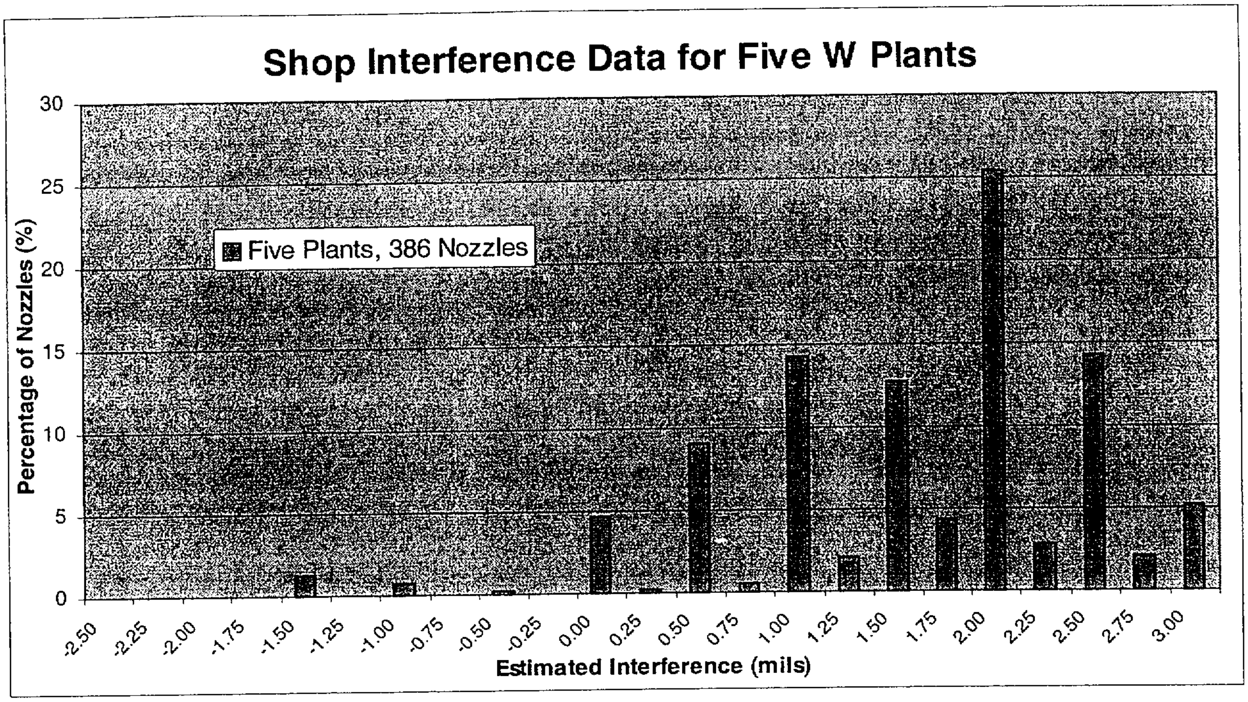
In addition, shop data for 2 more heads fabricated for Westinghouse design plants was reviewed (Plants 4 and 5 from the table in Section 1.0). In this case, "as-measured" information was available for both the hole and the nozzle (Reference 5.2). An additional 156 hole/nozzle actual measurements were included into tabulation (see Figure 2).



Interference (mils)	*Number of Nozzles*	*%*	*Cumulative %*
-2.50	0	0.00%	0.00%
-2.25	0	0.00%	0.00%
-2.00	0	0.00%	0.00%
-1.75	0	0.00%	0.00%
-1.50	5	2.17%	2.17%
-1.25	0	0.00%	2.17%
-1.00	3	1.30%	3.48%
-0.75	0	0.00%	3.48%
-0.50	1	0.43%	3.91%
-0.25	0	0.00%	3.91%
0.00	7	3.04%	6.96%
0.25	1	0.43%	7.39%
0.50	21	9.13%	16.52%
0.75	1	0.43%	16.96%
1.00	37	16.09%	33.04%
1.25	7	3.04%	36.09%
1.50	29	12.61%	48.70%
1.75	17	7.39%	56.09%
2.00	64	27.83%	83.91%
2.25	9	3.91%	87.83%
2.50	28	12.17%	100.00%
2.75	0	0.00%	100.00%
3.00	0	0.00%	100.00%
Total	230	100%	

Note: Negative interference values indicate a gap condition between the head hole and CRDM nozzle housing. There are no actual gaps. Negative interferences result because an assumed average nozzle diameter is used in the absence of the as-built data for the nozzles, as mentioned in Section 2.0. It is known that manufacturer matched the nozzles to oversized bores during assembly to guarantee an interference fit.

Figure 1



*Interference (mils)**	*Number of Nozzles*	*%*	*Cumulative %*
-2.50	0	0.00%	0.00%
-2.25	0	0.00%	0.00%
-2.00	0	0.00%	0.00%
-1.75	0	0.00%	0.00%
-1.50	5	1.30%	1.30%
-1.25	0	0.00%	1.30%
-1.00	3	0.78%	2.07%
-0.75	0	0.00%	2.07%
-0.50	1	0.26%	2.33%
-0.25	0	0.00%	2.33%
0.00	18	4.66%	6.99%
0.25	1	0.26%	7.25%
0.50	35	9.07%	16.32%
0.75	2	0.52%	16.84%
1.00	55	14.25%	31.09%
1.25	8	2.07%	33.16%
1.50	49	12.69%	45.85%
1.75	17	4.40%	50.26%
2.00	98	25.39%	75.65%
2.25	11	2.85%	78.50%
2.50	55	14.25%	92.75%
2.75	** 8	2.07%	94.82%
3.00	** 20	5.18%	100.00%
Total	386	100%	

Notes:

* Negative interference values indicate a gap condition between the head hole and CRDM nozzle housing. There are no actual gaps. Negative interferences result because an assumed average nozzle diameter is used in the absence of the as-built data for the nozzles, as mentioned in Section 2.0. It is known that manufacturer matched the nozzles to oversized bores during assembly to guarantee an interference fit.

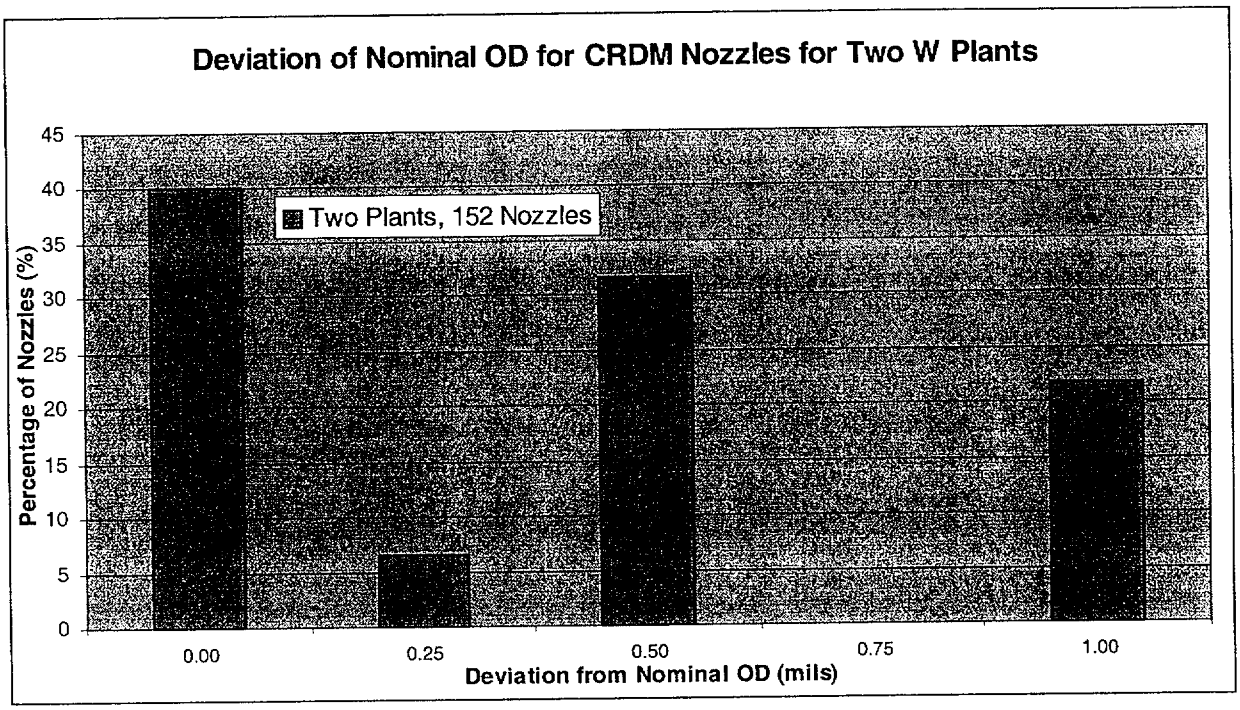
** The 8 nozzles with 2.75 mils interference and the 20 nozzles with 3.00 mils interference are from the plants where the nozzle as-built outside diameter is available.

Figure 2

3.1 *Evaluation of the Nozzle Diameter As-Built Data*

In order to verify the correctness of the assumption in Section 2.0, regarding the use of the average diameter of the nozzle for calculation of the interference data, available data on actual nozzle outside diameters at two CE manufactured Westinghouse design plants were plotted (Plants 4 and 5 from the table in Section 1.0). The deviations of nozzle diameter for 152 nozzles from its nominal size of 4.000 inch are shown in Figure 3.

Average nozzle diameter deviation of reviewed nozzles is 0.392 mils, i.e. the average nozzle diameter is 3.9996 inch. Therefore, the assumption to use an average diameter of 3.9995 inch for calculation of interference fits is reasonable.



Deviation (mils)	*Number of Nozzles*	%
0.00	61	40.13%
0.25	10	6.58%
0.50	48	31.58%
0.75	0	0.00%
1.00	33	21.71%
Total	152	100%

Figure 3

4.0 CONCLUSION

Figure 2 shows the distribution of interference fits for the total population of heads sampled for this evaluation. Within the limits of the assumption regarding as-built outside nozzle diameter, the evaluation shows no penetrations have an interference fit greater than 3.0 mils. This assumption was shown to be reasonable in Section 3.1. However, even if this assumption was not correct and all nozzles were conservatively assumed to be at their maximum diameter at the plants where as-built nozzle dimensions were not available, the data shows that none of 386 penetrations would exceed the maximum design interference of 3.0 mils.

Figure 6

5.0 REFERENCES

5.1 Westinghouse Electric Company CE Nuclear Power LLC Quality Procedures Manual QPM-101, Revision 05.

5.2 Westinghouse Calculation Note No. CN-CI-01-1, Rev. 000, "Potential for Detectable Leakage in HB Robinson Reactor Vessel Head", dated 08/01.

5.3 Westinghouse Drawing No.

1. E-232-285-3, "Control Rod Penetration Details, Westinghouse Electric Corporation 155 1/2" I.D. reactor Vessel".
2. E-232-284-5, "Control Rod Mechanism Housing Details for Westinghouse Electric Corporation 155 1/2" I.D. reactor Vessel".

ATTACHMENT B

QUALITY ASSURANCE FORMS

Other Design Document Checklist

Instructions: The Independent Reviewer is to complete this checklist for each Other Design Document. This Checklist is to be made part of the Quality Record package, although it need not be made a part of or distributed with the document itself. The second section of this checklist lists potential topics which could be relevant for a particular "Other Design Document". If they are applicable, then the relevant section of the Design Analysis Verification Checklist shall be completed and attached to this checklist. (Sections of the Design Analysis Verification Checklist which are not used may be left blank.)

Section 1: To be completed for all "Other Design Documents"	Yes	N/A
Overall Assessment		
1. Are the results/conclusions correct and appropriate for their intended use?	☒	
2. Are all limitations on the results/conclusions documented?	☒	
Documentation Requirements		
1. Is the documentation legible, reproducible and in a form suitable for filing and retrieving as a Quality Record?	☒	
2. Is the document identified by title, document number and date?	☒	
3. For a complete or page change revision, is there a revision history page?	☐	☒
4. Are all pages identified with the document number including revision number?	☒	☐
5. Do all pages have a unique page number?	☒	☐
6. Does the content clearly identify, as applicable:		
a. objective.	☒	☐
b. design inputs (in accordance with QP 3.2).	☒	☐
c. conclusions.	☒	☐
7. Is the verification status of the document indicated?	☒	
8. If an Independent Reviewer is the supervisor or Project Manager, has authorization as an Independent Reviewer been documented?	☐	☒
Assumptions / Contingencies		
1. Are local assumptions documented, justified and verified?	☒	☐
2. Have Internal and External assumptions and contingencies which must be cleared by Westinghouse or the customer been listed on a Contingencies and Assumptions form?	☐	☒
3. Is the Project Manager responsible for clearing the Assumptions / Contingencies identified on the form?	☐	☒

Other Design Document Checklist

Assessment of Significant Design Changes	Yes	N/A
1. Have significant design-related changes that might impact this document been considered?	☒	☐
2. If any such changes have been identified, have they been adequately addressed?	☒	☐
Selection of Design Inputs		
1. Are the design inputs documented?	☒	
2. Are the design inputs correctly selected and traceable to their source?	☒	
3. Are references as direct as possible to the original source or documents containing collection/tabulations of inputs?	☒	
4. Is the reference notation appropriately specific to the information utilized?	☒	
5. Are the bases for selection of all design inputs documented?	☒	☐
6. Is the verification status of design inputs transmitted from customers appropriate and documented?	☐	☒
7. Is the verification status of design inputs transmitted from W NucSys appropriate and documented?	☒	☐
8. Is the use of customer-controlled sources such as Tech Specs, UFSARs, etc. authorized, and does the authorization specify amendment level, revision number, etc.?	☐	☒
9. a. Is the document accurate and complete and, if applicable, has proper equipment assembly and/or operational sequencing been detailed?	☒	☐
b. If required, has mock-up testing been performed to verify the document's accuracy, completeness and proper assembly or operational sequencing?	☐	☒
References		
1. Are all references listed?	☒	☐
2. Do the reference citations include sufficient information to assure retrievability and unambiguous location of the referenced material?	☒	☐
3. Do the item numbers in the document agree with the item numbers on the reference?	☒	☐

Section 2: Other Potentially Applicable Topic Areas - use appropriate sections of the Design Analysis Verification Checklist (QP 3.4, Exhibit 3.4 - 3) and attach.	Yes	N/A
1. Use of Computer Software	☐	☒
2. Applicable Codes and Standards	☒	☐
3. Literature Searches and Background Data	☒	☐
4. Methods	☒	☐
5. Hand Calculations	☒	☐
6. List of Computer Software	☐	☒
7. List of optical disks (CD-ROM), computer disks or Microfiche	☐	☒

Other Design Document Checklist

Independent Reviewer's Comments				
Comment Number	**Reviewer's Comment**	**Response Required?**	**Author's Response**	**Response Accepted?**
1.	Correct the total number of nozzles reviewed in table of Figure 2.	Yes	Number is corrected.	Yes
2.	Edditorilal.	No		

Checklist completed by:

Independent Reviewer:

M. Zajec		
Printed Name	Signature	Date