DUKE POWER COMPANY
P.O. BOX 33189
CHARLOTTE, N.C. 28242

HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

December 15, 1983

Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

Re: RII:JPO
50-413 and 50-414

Dear Mr. O'Reilly:

Please find attached a final response to IE Bulletin 79-02, Revision 2 for Catawba Nuclear Station, Units 1 and 2. This response is a summary by item of the extent and manner in which Duke Power Company intends to satisfy Actions 1 through 9 of the bulletin.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

LTP/php

Attachment

cc: NRC Resident Inspector
Catawba Nuclear Station

Mr. Robert Guild, Esq.
Attorney-at-Law
P. O. Box 12097
Charleston, South Carolina 29412

Palmetto Alliance
2135½ Devine Street
Columbia, South Carolina 29205

IE11
1/1

CATAWBA NUCLEAR STATION

Responses to USNRC IE Bulletin 79-02, Revision 2

Original: July 5, 1979
Revision 1: January 7, 1980
Revision 2: November 28, 1983

Catawba Nuclear Station is in the later stages of construction of Unit 1. Unit 2 is in the middle stage of Construction. The following is a summary, by item, of the extent and manner in which Duke Power Company intends to satisfy Actions 1 through 9 of the IE Bulletin 79-02, Revision 2.

Response 1: Duke Power Company accounts for base plate flexibility in the calculation of expansion anchor loads for all seismic Category I pipe support base plates using either a conservative hand calculation method which has been verified by non-linear finite element analysis or a specific non-linear finite element analysis for a particular base plate. The models and boundary conditions, including appropriate load-displacement characteristics of the anchors, used for the finite element analyses are based on Duke studies and on work performed by Teledyne Engineering Services which was sponsored by a group of thirteen (13) utilities formed to respond to generic items of IE Bulletin 79-02. All expansion anchor support plates designed prior to implementing these analysis methods were re-analyzed accordingly and modified if required to comply with allowable expansion anchor loadings.

Response 2: The minimum factors of safety between the expansion anchor design load and the anchor ultimate capacity determined from static load tests used in design of seismic Category I pipe supports are as follows:

For supports originated prior to November 1, 1980

Normal - 4 Upset - 3 Faulted- 2	Using straight line shear/tension interaction formula.

For supports originated on or after November 1, 1980

Normal - 4 Upset - 4 Faulted- 4	Option to use less conservative shear/tension interaction formula

These factors of safety are for wedge type and sleeve type expansion anchors which are the only type of anchors used at Catawba Nuclear Station for seismic Category I pipe support applications.

Expansion anchor installations for seismic Category I piping supports are restricted to normal weight structural concrete of varying nominal strengths. Expansion anchor ultimate load capacities are based on manufacturer's test results and recommendations for normal weight concrete and installed concrete strengths.

Catawba seismic Category I expansion anchor designs properly account for shear-tension interaction, minimum edge distances and bolt spacing in accordance with manufacturer's test results and recommendations.

Duke Power Company has completed an evaulation of minimum safety factors for expansion anchors used for seismic Category I pipe supports at Catawba Nuclear Station. The intent of this evaulation was to verify with 95% confidence that less than 5% of the expansion anchors for supports in any piping system fail to meet the minimum safety factor of 4 for all conditions. This statistical approach is similar to that taken for Duke's McGuire Nuclear Station in response to the same I & E Bulletin. The results of the evaluation for Catawba clearly indicate that the statistical condition stated above is satisfied.

The evaluation consisted of a review of all 48 piping systems supported with seismic Category I pipe supports. Statistically, achieving the desired confidence limit/failure percentage required review of 59 randomly selected supports for each system. Twenty-five systems contained less than 59 supports with expansion anchors, therefore all supports in these systems were reviewed and all of these supports had a minimum safety factor of 4 for all conditions. The remaining 23 systems contained more than 59 supports with expansion anchors. Fifty-nine randomly selected supports in each of these systems were reviewed. Only one support was found to have an anchor with a safety factor less than 4 for any load condition. This support was redesigned to achieve a minimum safety factor of 4 for all conditions. Additionally, the remainder of the supports for that system (FW) were reviewed (totaling 94) and found to have minimum safety factors of 4 for all conditions. In all, 1,894 supports were reviewed.

This review was made on Unit 1 supports existing as of October 1982. Since that time, many Unit 1 seismic Category I pipe supports have been added, all designed to a safety factor of 4 for all conditions. All Unit 2 seismic Category I pipe supports will be designed with a minimum safety factor of 4 for all conditions.

In summary, Duke Power Company is statistically 95% confident that less than 5% of all seismic Category I expansion anchor designs for any system in Catawba fail to meet a minimum safety factor of 4 for all conditions. Furthermore, it is believed that this condition will exist throughout the operating life of the plant.

Response 3: Duke Power Company designs pipe supports to resist all applicable loadings including seismic loads, hydro test loads, normal operating loads, thermal loads, etc. A support is designed for a static or quasi-static load resulting from the most critical combination of the applicable loadings. The safety factors used for the expansion anchors are as specified in Response 2. Duke Power Company co-sponsored tests performed by Teledyne Engineering Services to demonstrate that expansion anchors installed at Catawba Nuclear Station will perform adequately under both low cycle/high amplitude loading (seismic) and high cycle/low amplitude loading (operating loads). The final test report was generically submitted to USNRC for all Duke Power Company Stations as described in Mr. L. C. Dail's (Duke) letter to Mr. J. P. O'Reilly (USNRC, RII) dated August 15, 1979 regarding Catawba Nuclear Station.

Response 4: All expansion anchors used in seismic Category I applications are either wedge type or sleeve type. These anchors are inspected for proper installation in accordance with Duke Power Company's Quality Assurance Procedure M-52, "Concrete Expansion Anchor Installation Inspection". This procedure assures that the anchors are properly installed in accordance with the manufacturer's recommendations.

Procedure M-52 criteria includes, but is not limited to, inspection of expansion anchor size, type, perpendicularity, torque, embedment depth, spacing, distance to free concrete edge and unauthorized modification of the anchor. This procedure also requires inspection for evidence of plate bolt hole oversizing (i.e. cupped washers, visibly excessive hole diameters). As additional precautions the following apply:

1. Duke Power Company Quality Assurance Procedures prohibit deviations from design drawings and specifications without written authorization and approval by the Design Engineering Department.

2. Catawba Nuclear Station qualifies each concrete expansion anchor operator by installation test and verbal examination on proper installation procedure.

In order to address the question of the relationship of cyclic load carrying capacity to installation procedure (anchor preload), the tests referred to in Response 3, performed by Teledyne Engineering Services and sponsored by the group of thirteen (13) utilities, have been performed on anchors installed in accordance with manufacturer's recommended installation procedures and have no more preload than is provided by the use of these procedures. Based on Duke's understanding of the behavior of expansion anchors and on cyclic testing which has been performed, Duke Power Company is confident that the anchors will perform adequately.

Response 5: Seismic Category I pipe supports are prohibited from being attached to block (masonry) walls using concrete expansion anchors.

Response 6: A limited number of seismic Category I pipe supports installed with concrete expansion anchors do utilize structural shapes instead of base plates. These hangers are included in actions performed to satisfy the requirements of IE Bulletin 79-02.

Response 7: Catawba Nuclear Station is currently under construction, therefore Bulletin Item 7 is not applicable.

Response 8: Catawba Nuclear Station is currently under construction, therefore Bulletin Item 8 is not applicable.

Response 9: Those pipe supports which have not been installed are included in actions performed to meet the requirements of IE Bulletin 79-02 as outlined in Responses 1 through 6.

Revision 2 of Item 2 of the Bulletin requests verification by Duke Power Company that a uniform factor of safety was applied for all load combinations in the design of expansion anchors for Catawba Nuclear Station. The expansion anchor design factors of safety utilized are outlined in Response 2.

There are no previously unreported instances in which Duke Power Company did not meet the revised (R2) sections of Item 4 prior to its issuance.