CENTRAL FILES

POWER AUTHORITY OF THE STATE OF NEW YORK

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July 6, 1979
IPN-79-45

Mr. Boyce Grier, Director
Office of Inspection and Enforcement
Region I
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, Pa. 19406

Subject: Indian Point 3 Nuclear Power Plant
Docket No. 50-286
Response to NRC I&E Bulletin 79-02 (Rev.1)

Dear Mr. Grier:

This letter addresses the action items 1, 2, 3, and 4 contained in I&E Bulletin 79-02, Rev. 1, on pipe support base plates using concrete expansion anchor bolts in Class I systems. These systems are defined in Section 1.3.1 of the FSAR.

The response to specific action items is given below:

1. A review of the original design of the pipe supports for Indian Point 3 indicates that base plate flexibility was not considered in the calculation of anchor bolt loads. The design of the base plates are being evaluated per the flexibility criteria of I&E Bulletin 79-02 (Rev. 1), and revised anchor bolt loads calculated as described in Attachment 1.

2. Safety factors and shear-tension interaction (STI) factors as defined in Attachment 1 are being calculated on manufacturer's published ultimate capacity data interpolated for 3000 psi concrete. Minimum embedments were assumed for these calculations. The calculations performed to date indicate that in some cases the minimum factor of safety stipulated in I&E Bulletin 79-02 (Rev. 1) were not met.

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As a first step, justification for utilizing a lower factor of safety will be provided. If this is not possible, the support will be modified to meet the minimum requirement stipulated in 79-02 (Rev. 1). This procedure has been instituted.

3. The initial installation of expansion anchors incorporated minimum torque values based on manufacturer's recommendations. A program will be initiated to develop specific correlations between torque and preload. If the original torque values do not result in adequate preload, a program will be initiated to verify adequate preloading of expansion anchors.

4. In reviewing the IP3 QC Construction documentation, we have found that for all applicable supports in seismic Class I systems as defined in our FSAR, sufficient documentation exists verifying that the original construction design requirements such as preloading, bolt type, diameter, and a minimum embedment depth have been met for supports. The documentation contains approved concrete anchor installation and inspection procedures, engineering approvals of installation variances, noted by QC inspection records.

   These records provide for the verification of the following attributes:

   a. Concrete anchor type

   b. Anchor diameter as required by engineering/design

   c. Minimum embedment depth as per approved procedure

   d. Preloading by torquing per approved procedure

   e. Leveling nuts were not installed at the time of preloading anchor bolts per approved procedure

   f. Except for a select few at the beginning of construction, wedge type anchors were used in lieu of shell type anchors as per a written approved procedure.

In addition to record verification, an engineering evaluation and a random field survey were performed on concrete anchored supports to verify independently that the specific attributes noted above did meet the pre-established design requirements.

Approximately 1000 pipe supports which use expansion anchors are being evaluated, some as a result of the 79-07 effort. Of these, approximately 400 have been fully analyzed and the anchor bolts have been found capable of supporting the loads. Analysis of the remaining supports is not yet complete.

In the random field survey, 105 hanger assemblies utilizing approximately 400 concrete anchors were examined in 11 Seismic Class I lines. Of 80 bolt embedments measured, all had the minimum required embedment. There are basically three possible categories of hanger base plate or anchor bolt variances that exist. They are:

A. Installation variances which are cases where the actual installation deviates from the original installation package which existed at the time of construction. During a review of one-hundred and five hanger assemblies, nine hanger assemblies were noted utilizing 3/4" anchors when the package called for 7/8" anchors. Initial inspection of QC documentation found that the 3/4" anchor substitution for the 7/8" anchor was approved in four out of the nine cases. A discrepancy in the type of anchors specified was found between UE&C hanger details and Wedco's approved procedures which called for Hilti Kwik bolts. Since an approved procedure called for Kwik bolts, it is our contention that an engineering evaluation was performed. The Authority is continuing its search of QA records for reconciling this difference.

B. Service-induced variances which are variances as a result of normal plant operation. The only service induced variances found were anchors which had slightly relaxed to a value below the construction applied preload. These thirty anchors retained a significant proportion of their original preload and were re-preloaded to the original installation torque values.

C. Updated criteria variances which are differences between the present day criteria and the criteria under which the plant was constructed. In seventeen cases, concrete surface irregularities were found in the vicinity of the base plate anchor bolts. The field survey noted cases in which the mating surfaces of the base plate and the concrete were not perfectly flush owing to minor depressions or elevations of the concrete surface and small variations inherent in manufacturing and construction processes. Each of these type of cases will be individually evaluated by engineering and a determination made on its acceptability or the need for rework.

The results of the QC construction documentation review, the support/anchor bolt analysis and the random field survey efforts to date all provide sufficient evidence that the anchor bolts will be found acceptable to I&E Bulletin 79-02 (Rev. 1) requirements.

Very truly yours,

Paul J. Early
Assistant Chief Engineer-
Projects

PJE:rz
cc: Office of Inspection and Enforcement
Division of Reactor Operations Inspection
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ATTACHMENT 1

Anchor Bolt Load Calculation

A. Flexibility

A base plate shall be assumed rigid if the unstiffened distance between the member welded to the plate and the edge of the plate is less than or equal to twice the thickness of the plate.

B. Anchor Bolt/Concrete Edge Distance

The base plate and supporting structure designs shall be reviewed to verify that the allowable minimum edge distance is maintained. Allowable loads shall be reduced according to the manufacturer's specifications when minimum edge distances are not met.

C. Anchor Bolt Spacing

Anchor bolt spacing must be maintained for full anchor strength as for the anchor to edge spacing in B. above.

D. Anchor Bolt Load Calculation

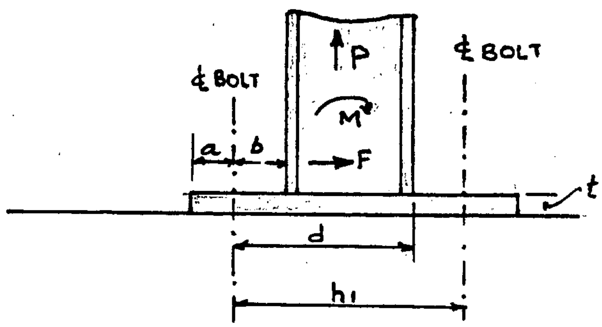
The method of anchor bolt load calculation applied to a typical pipe support base configuration is given below:

Rigid when: $a + b \leq 2t$

Flexible when: $a + b > 2t$

$$T = \alpha_i \left(\frac{M}{N_1 h_i} + \frac{P}{N_2} \right)$$

$$V = \frac{F}{N_2}$$



Where: T,V = Anchor design tension and shear loads

M,F,P = Moment, shear and axial force acting on the connection

N_1 = Number of anchor bolts in tension

N_2 = Total number of anchor bolts

i = Flexibility index

i = 1 when rigid

i = 2 when flexible

α_i = Prying action factor for given plate flexibility

h_i = Moment arm

h_1 = Centerline distance between bolts

$h_2 = d + 2t$ (not to exceed h_1)

Where the connection is subject to biaxial loading, the aforementioned approach must be repeated for the other principal plane and the absolute sum of the bolt reactions combined.

E. Anchor Bolt Allowables

The design tension load for each anchor shall be less than or equal to the Maximum Allowable Design Load (MADL). The MADL is defined as follows:

$$MADL = \frac{Fu}{SF}$$

Where: Fu = ultimate static capacity based on manufacturer's published data.

SF = Safety Factor

SF = 4 for wedge and sleeve anchors

SF = 5 for shell anchors

When both shear and tension act on an anchor, a straight line shear-tension interaction must be assumed as follows:

$$\frac{T}{Ta} + \frac{V}{Va} < 1.0$$

Where: T = Design tension force

Ta = MADL in tension

V = Design shear force

Va = MADL in shear