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SUPERINTENDENT  
NUCLEAR OPERATIONS DEPARTMENT

July 9, 1979

BECo. Ltr. #79-137

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

License No. DPR-35  
Docket No. 50-293

Response to I&E Bulletin No. 79-02, Rev. 1  
"Pipe Support Base Plate Designs  
Using Concrete Expansion Anchor Bolts"

Dear Sir:

The Boston Edison Company program to respond to Bulletin No. 79-02 is divided into a generic effort and a plant specific effort. The purpose of the generic effort is: (1) to clarify and develop the acceptance criteria for base plate analysis and inspection, (2) to develop a computer program as an analytical tool for the plant specific effort, and (3) to develop bolt testing data for: (a) static and cyclic loadings (b) shear and tension interaction, and (c) verification of analysis results. Teledyne Engineering Service has been engaged for the generic effort. A formal presentation of the effort was made to the NRC through the Utility Owners Group and Teledyne Engineering Service on April 26, 1979. The status of this effort is delineated in Attachment A.

The plant specific effort is to implement the requirements in IE Bulletin No. 79-02 using the information developed in the generic effort.

The status of our plant specific effort is as follows:

Identification of pipe supports using concrete expansion bolts in seismic Category I piping systems in accordance with the Pilgrim Nuclear Power Station Unit 1 FSAR.

We have completed a file search to identify the seismic pipe supports in the Category I piping systems. In those systems we have identified:

1468 pipe supports  
1283 seismic pipe supports  
576 seismic pipe supports using concrete expansion bolts

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Pipe supports for piping systems 2-inch in diameter or less are treated separately from this work scope. With the exception of a portion of the HPCI system (2"-GB-23), these piping systems are all conservatively designed by the chart analysis method. The proper installation of the base plate and anchor bolts for these piping systems will be verified by a sampling inspection. The seismic supports using expansion anchors and identified on pipe 2"-GB-23 will be included in our program as described herein.

Reanalysis of base plates to account for: 1. The effect of base plate flexibility on the concrete expansion bolts; 2. The minimum factor of safety between the bolt design load and the bolt ultimate capacity determined from static load tests.

An analysis procedure has been developed to account for items 1. and 2. The computer program delineated in Attachment A is used to account for the effect of base plate flexibility on the concrete expansion bolts. This computer program for flexible plate analysis is used when the following conditions are not met:

- (a) The unstiffened distance between the member welded to the plate and the edge of the plate is equal to or smaller than twice the thickness of the plate.
- (b) Bolts are not in tension for all loading cases.
- (c) Bolts are in pure shear for all loading cases.
- (d) When the following equation is satisfied for rectangular plates which two or four bolts of symmetrical arrangement:

$$\frac{K f_t}{F_t} + \frac{f_s}{F_s} \leq 1$$

$f_t$  = Bolt tension load obtained from rigid base plate analysis

$f_s$  = Bolt shear load obtained from rigid base plate analysis

$F_t$  = Ultimate tension capacity divided by factor of safety, 4 or 5 as required per the Bulletin

$F_s$  = Ultimate shear capacity divided by factor of safety, 4 or 5 as required per the Bulletin

$K = 2$  This conservatively assumes a 100% increase in tension loads ( $f_t$ ) due to plate flexibility. Our studies indicate that maximum increase in tension loads due to plate flexibility is approximately 60%.

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The description of the analytical model was presented to the NRC on April 26, 1979. We understand that Teledyne has revised this model to incorporate all of the comments made at the NRC meeting. A factor of safety of four is used for wedge and sleeve type anchor bolts. A factor of safety of five is used for shell type anchor bolts. The manufacturer's written recommendation or Teledyne's testing data are used to account for the effect of shear-tension interaction, minimum edge distance and bolt spacing.

To date, we have analyzed 255 plates used in seismic supports. The results of this reanalysis are as follows:

171 plates met the requirement considering the flexibility of the base plate.

54 plates require further evaluation to consider the effect of base plate flexibility on the bolts.

This analysis indicates that 21% of the base plates require computer analysis or additional evaluation to establish their acceptability or to determine the field modification to satisfy design requirements. The reanalysis work is approximately 35% complete.

Description of design requirement for anchor bolts to withstand cyclic loads.

We are performing the cyclic tests on the anchor bolts to determine the characteristics of anchor bolts to withstand cyclic loads. This test is anticipated to be completed by July 15, 1979. The testing program was presented to the NRC on April 26, 1979. We will present the test findings and evaluation in our final report to address this concern.

Field Inspection

The field inspection program for verification of base plates against design documents and testing of concrete expansion anchors is broken down into three (3) categories due to Station environment conditions.

1. Category 1 - Accessible only during outages.
2. Category 2 - Limited access during power operation and outages.
3. Category 3 - Unlimited access during power operation and outages.

CATEGORY 1 - RESULTS (COMPLETED)

26 base plates containing 136 bolts of the wedge and sleeve type were inspected with 12 loose nuts found. Other installation details met design documents.

3 base plates containing 5 bolts of the shell type were inspected with no deviations against design documents. Three (3) bolts were torqued to specified values.

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CATEGORY 2

A visual inspection of base plates associated with suction piping to the emergency core cooling system revealed the following results:

23 base plates containing 101 bolts of the shell type with the following deviations:

1. 4 base plates not flush with concrete surface.
2. 1 base plate with the addition of washers on 5 out of 6 bolts.
3. 1 base plate with machine bolts instead of stud-bolts.

No testing of anchors has been done in this category.

CATEGORY 3

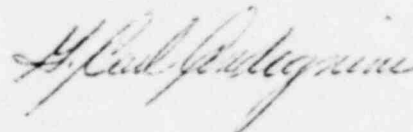
88 base plates containing 326 bolts of the shell type have been visually inspected. A review of 10 of the base plates has been verified against design documents with no deviation. A review of the balance of the base plates is in progress. 40 pipe supports on systems 2" and under have been inspected.

Action

All seismic Category I base plates will be reanalyzed, inspected and modified, if required, to assure the requirements of I&E Bulletin No. 79-02 are met. Reanalysis work will be completed by October 1, 1979. Inspection work will be done by February 28, 1980. The final report will be issued by April 15, 1980.

The results of Boston Edison's work to date and our confidence that the expansion type seismic anchor plates will perform their intended safety function, Boston Edison is confident that the plant can continue to operate safely concurrent with completion of the outlined program. However, should you have further questions feel free to contact us.

Very truly yours,



cc: United States Nuclear Regulatory Commission  
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