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July 6, 1979

United States Nuclear Regulatory Commission
Region I
631 Park Avenue
King of Prussia, PA 19406

ATTENTION: MR. BOYCE H. GRIER, DIRECTOR

SUBJECT: Beaver Valley Power Station - Unit No. 2
Pipe Support Base Plate Design Using Drilled-In Anchors
Response to IE Bulletin 79-02
Docket No. 50-334 - 50-412

Gentlemen:

The following is the response of the Duquesne Light Company to IE Bulletin 79-02 as it applies to Beaver Valley Power Station, Unit 2. The item numbers listed below are referenced to similarly numbered items in IE Bulletin 79-02.

Item (1)

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

The primary means of attaching pipe supports is by field welding to plates embedded in concrete, thus minimizing the use of concrete expansion anchors. For those relatively few cases where base plates and concrete anchors are used, design guides are utilized, which account for the increased loads on concrete expansion anchors due to base plate flexibility effects.

A procedure has been developed which is applied to common pipe support base plate configurations, to account for plate flexibility in determining the load induced in the drilled-in anchor bolts. This procedure includes load factors to be applied to the anchor bolt load to provide for the effects of plate flexibility. The load factors were developed using finite element analysis techniques.

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(3)

A finite element model was used to determine load in the drilled-in anchor. Plate flexibility, anchor stiffness, stiffening effects of members attached to the plate, as well as concrete flexibility are represented in the model. The contact boundary conditions at the interface of the plate and concrete; and plate and drilled-in anchors are satisfied in the solution.

The ANSYS III finite element package was used for the analysis. The element model considers pure plate bending which is appropriate for the analysis of a flexible base plate. The concrete and drilled-in anchor are both modeled with the combination gap element which models the stiffness of these components as well as represents the contact boundary conditions discussed previously. Finally, the forces are applied as couples and axial forces distributed to the nodes of the attached members.

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."

2(a) Project design procedures and the specification for drilled-in anchors for the BVPS-2 project specify the allowable design loads, purchasing requirements, and installation requirements for wedge type anchor bolts.

The average ultimate capacity of bolts is a minimum of four times the allowable design load used in the design procedure. This minimum factor of safety of 4 is based on the average ultimate capacity determined from static load tests conducted by anchor manufacturers in 3,000 psi concrete. The project specifications require an on-site prequalification test program to establish torques and turn-of-the nut requirements to properly set the anchors in the concrete at BVPS-2, as well as to verify the average ultimate capacity of the bolts.

2(b) Shell type anchor bolts are not used for BVPS-2 Category I pipe support design.

Item (3)

"Describe the design requirements, if applicable, for anchor bolts to withstand cyclic loads."

To account for cyclic loadings, the BVPS-2 design procedures use a conservative allowable design load which has a minimum factor of safety of 4 with respect to the average ultimate bolt capacity.

Conclusions of the FETF Report on "Drilled-in Expansion Bolts under Static and Alternating Load" (BR-5853-C-4 dated January, 1975), indicate that properly installed anchors perform satisfactorily under cyclic loads. Installation requirements of the specification ensure proper bolt installation.

Item (4)

"Verify from existing QC documentation that design requirements have been met."

4(a) BVPS-2 specification for drilled-in anchors requires that, during the on-site prequalification test program, the minimum installation torque for proper setting of the anchors be established. This required installation torque will develop a bolt preload at least 1.5 times the bolt design load as verified by tension tests performed in the same on-site test program. Category I anchors are randomly torque tested to 80 percent of this torque value in accordance with specified frequency of testing, assuring a properly installed bolt.

4(b) The BVPS-2 specification for drilled-in anchor requires all anchor bolts to be permanently marked with a standard marking system on the exposed end of the anchor which will identify the overall length of the anchor. This enables Site Quality Control to determine that the proper length anchors have been installed.

DUQUESNE LIGHT COMPANY

By E. J. Woolever
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