NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
THE HARTFORD ELECTRIC LIGHT COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

P.O. BOX 270
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(203) 666-6911

July 7, 1979

United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region I
631 Park Avenue
King of Prussia, Pennsylvania 19406

ATTN: Mr. B. H. Grier, Director

Docket No. 50-423
AEC-MP3-187

Gentlemen:

SUBJECT: Millstone Unit No. 3
I.E. Bulletin No. 79-02, Rev. 1

References: (1) B. H. Grier letter to W. G. Counsil dated March 8, 1979.
(2) B. H. Grier letter to W. G. Counsil dated June 21, 1979.

Reference (1) transmitted the subject I.E. Bulletin to Northeast Nuclear Energy Company requesting appropriate action. The results of our review are presented below:

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

   The Millstone Unit No. 3 calculation procedure, developed on the basis of finite element analysis of base plates involving drilled in concrete expansion bolts, considers the effects of base plate flexibility.

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

   A finite element model was used to determine loads in the drilled-in anchors. Plate flexibility, anchor stiffness, stiffening effect 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 3 finite element package was used for analysis. The element model considers pure plate bending, appropriate for the analysis of flexible base plates. The concrete and drilled-in anchors are both modelled with the

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"combination" gap elements which both model the stiffness of these components as well as represent the contact boundary condition discussed previously. Finally, forces are applied as couples and axial forces distributed to nodes of the attached member.

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 determined from static load tests (e.g. anchor bolt manufacturer's) which simulate the actual conditions of installation (i.e., type of concrete and its strength properties):

   a. Four - For wedge and sleeve type anchor bolts.

   b. Five - For shell type anchor bolts.

   The bolt ultimate capacity should account for the effects of shear-tension interaction, minimum edge distance and proper bolt spacing ....".

   (a) Project design procedures and the specification for Drilled-In Anchors at Millstone Unit No. 3 describe the design loads, purchasing requirements and installation requirements for wedge-type anchor bolts. The average ultimate strength of the bolts is a minimum of four times the bolt design load used in the design procedure.

   This minimum factor of safety of four based on the average ultimate capacity determined from static load tests conducted by anchor manufacturers in 3000 psi concrete. The specification requires an on-site prequalification test program to verify the average ultimate capacity of the bolts.

   (b) Shell-type anchor bolts are not used for Millstone Unit No. 3 Category I pipe support design.

3. "Describe the design requirements if applicable for anchor bolts to withstand cyclic loads (e.g. seismic loads and high cycle operating loads)."

   The Millstone Unit No. 3 design takes into account the variation in systems' loads, due to seismic and operational loadings, in establishing the proper bolt design load. As stated above in Item 2(a) this design load has minimum factor of safety of four with respect to the average ultimate bolt capacity. During the installation, bolts will be preloaded to a value of at least 1.5 times the allowable bolt load. This will ensure that a minimum preload greater than the established design load is present during the operational transients.

4. "Verify from existing QC documentation that design requirements have been met for each anchor bolt in the following areas:

   (a) Cyclic loads have been considered (e.g. anchor bolt preload is equal to or greater than bolt design load). In the case of the shell type, assure that it is not in contact with the back of the support plate prior to preload testing.

   (b) Specified design size and type is correctly installed (e.g. proper embedment depth)....".

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(a) The Millstone Unit No. 3 specification for Drilled-In Anchors requires that during the 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 allowable bolt load as verified by tension tests during the prequalification test program. Category I anchors are torque tested to 80% of this torque value, assuring cyclic load capability.

(b) Utilization of unique factory markings on bolts to denote overall bolt length will be used on Millstone Unit No. 3 anchor bolts.

The Applicant considers that the requirement to torque test all Category I anchor bolts, supported by the tensile test results of the prequalification test program, provides greater than 95% confidence that less then 5% defective anchors are installed in any one Category I system, and that any requirement to tensile test a statistical sample of production anchor bolts would not provide any further assurance of the adequacy of the installation.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

William G. Counsil
Vice President
Nuclear Engineering & Operations

cc: Nuclear Regulatory Commission
Office of Inspection and Enforcement
Division of Reactor Operations Inspection
Washington, D. C. 20555

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CENTRAL FILES

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