VERMONT YANKEE NUCLEAR POWER CORPORATION

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REPLY TO:
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B.4.2.1

WVY 79-76

July 6, 1979

United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region 1
King of Prussia, Pennsylvania

Attention: Mr. Boyce H. Grier, Director

References: (a) License No. DPR-28 (Docket No. 50-271)
(b) USNRC Letter to VYNPC dated March 8, 1979; I&E Bulletin 79-02
(c) USNRC Letter to VYNPC dated June 21, 1979; I&E Bulletin 79-02, Revision No. 1

Dear Sir:

Subject: Response to I&E Bulletin No. 79-02, Revision 1

Upon receipt of the subject I&E Bulletin a three part effort was initiated by Vermont Yankee which addresses your concerns as follows:

a. A program was initiated to develop a generic base plate flexibility computer analysis.

b. Planning for re-analysis of base plate stresses and anchor bolt applied loads was initiated.

c. A program of inspection of concrete expansion anchor bolts at Vermont Yankee was initiated.

The following presents an item by item explanation of our actions to meet your concerns. These are presented in the same sequence as your bulletin:

1. Since base plate flexibility was not considered in Vermont Yankee design, we have initiated a program to develop a finite element computer program which accounts for flexibility in the

existing base plates. This program will produce anchor bolt loads, base plate stresses and deflections which result from applied loads, shears, moments and the effect of the stiffness of the base plate and attached structure.

The analytical model used in this analysis employs a finite element, three dimensional mesh assuming linear elastic steel to model the base plate. Tension only, one dimensional axial, non-linear elements are used to represent the bolts; and compression only, non-linear axial elements are used to model the concrete behind the base plate.

The process of reanalyzing Vermont Yankee base plates is ongoing. The following sequence of events is being followed:

- Identify affected base plates and verify with drawings.
- Compile loads, shears and moments from piping analysis.
- Transfer loads, shears and moments to base plates.
- Reanalyze base plates.
- Review resulting anchor bolt loads to verify they are less than bolt design loads.

2. Original design loads for seismic piping support anchor bolts at Vermont Yankee were predicated on the recommendations of the anchor bolt manufacturer. These values are supported by his test program. Properly installed anchor bolts will develop the ultimate loads originally published. The factor of safety recommended by the manufacturers of all concrete expansion anchor bolts in use at Vermont Yankee is four. In other words the ultimate load, verified by the manufacturers test program is four times the design load. If testing justifies a change in the ultimate load our design load will change by the four to one factor of safety but the factor itself is an arbitrary value equally applicable to all equipment. We, therefore, see no way to justify the use of two factors of safety for one type of equipment. We will, for these reasons, continue to use the manufacturers recommended factor of safety of four for all concrete expansion anchor bolts.

   The ultimate capacity of the bolts will include the effects of shear and tension interaction, proper edge distance and spacing.

3. To prevent the application of high cyclic loading on concrete

expansion anchor bolts at Vermont Yankee our test program is designed to verify that a pre-tension equal to the bolt design load exists in each anchor bolt. Manufacturers test data indicates that this procedure develops the full tension and shear capability and assures little to no cycling of anchor bolt loads.

4. Sufficient QC documentation cannot be found at Vermont Yankee to assure correct installation. A testing program has been initiated to accomplish this. Testing consists of, first identifying the number, size (diameter), plate hole size, thread engagement, type, location and length (embedment depth) of the bolts. The bolts are then torqued or loaded in tension to an equivalent tensile value equal to the bolt design load (the relationship of torque to tension is being verified by test). The test assures that anchor b[illegible]shells sleeves and leveling nuts are not in contact with [illegible]ack side of the base plate. An initial visual inspect[illegible] revealed less than 5% of the concrete expansion anchor bolts were loose. These were retorqued above design load. The testing program has shown thus far no failures of any anchor bolts. Furthermore, since anchor bolts are used for dead-weight anchors as well as seismic restraints and have not shown a history of failures even though they have been under constant load since their installation, we feel that initial correct installation has been amply demonstrated. Our program will continue, however, until we are confident the sample population assures that correct installation has been achieved for all Seismic Category I piping systems at Vermont Yankee.

It is possible that verification of correct installation of anchor bolts at Vermont Yankee will be completed before the analytical program. In the event a review of the applied loads from the results of the re-analysis indicates any value in excess of the design load for any bolt, a design adjustment will be made and modifications to the structure accomplished to rectify any inadequacies.

A large majority of the 2½ inch diameter and smaller pipes at Vermont Yankee were analyzed by the chart method which can be shown to be very conservative. Visual inspection of the supports for these pipes will be conducted any failure to meet our inspection requirements will require the failed piping supports to be included into our sampling and testing program. They would then be required to meet the requirements of that program.

If no failures or incorrect installation of the concrete expansion anchor bolts for these pipes is noted, no further effort will be undertaken.

5. Anchor bolt testing at Vermont Yankee is now being conducted in accessible areas. This testing program consists of the following tasks:

   - Develop testing and inspection procedure.
   - Develop and execute test program to correlate torque versus bolt tension.
   - Identify seismic supports and verify with drawing.
   - Test all applicable anchor bolts per procedure.

   All areas inaccessable during power operation will be tested prior to return to power after our next scheduled refueling outage.

   It should be noted that Vermont Yankee pipe analyses were conducted by highly conservative static methods. Included in these analyses was the "Robinson Fix". This analytical method accounted for possible resonances between structure and piping and imposed multipliers to all piping to include further conservatism. It has been shown in later analyses that most piping does not fall in the resonance regime thus, these systems are over designed by factors ranging from approximately 7 to 13 due to design analysis conservatisms.

   In conclusion we feel that because of the very low failure rate identified in our initial inspection program already accomplished, because of the complete lack of noted failures of dead load supports and due to the known conservatisms in design, Vermont Yankee has demonstrated initial adequacy in the design and installation of seismic piping restraints and their anchor bolts.

   Our program of continued testing and analysis will v[illegible] this adequacy.

We feel certain the above answers your concerns on this s[illegible], however, if you require further information, please contact us at your convenience.

Sincerely,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Robert H. Groce,
Licensing Engineer

RHG/smw