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CONNECTICUT YANKEE ATOMIC POWER COMPANY
HADDAM NECK PLANT
RR #1, BOX 127E, EAST HAMPTON, CONN. 06424

September 28, 1973

CYH-2476

Mr. A. Giambusso
Deputy Director for Reactor Projects
Directorate of Licensing
U. S. Atomic Energy Commission
Office of Regulation
Washington, D. C. 20545

Dear Mr. Giambusso:

In accordance with Section 5.7.2 of the Connecticut Yankee Technical Specifications the following report involving failure of steam generator seismic support hold-down bolts is hereby submitted as Abnormal Occurrence Number 73-8.

The Connecticut Yankee steam generator supports consist of a 13' - 11" I.D. x 14' - 11 1/2" O.D. truncated conical skirt 16' - 8.8" high furnished at its upper end with four radial linear ball bearing sliding blocks to which the steam generator mounting feet are bolted. At the lower end of the skirt eight linear ball bearing sliding blocks, all parallel to each other, and parallel to the skirt's radial center line to the reactor, fasten the skirt to its foundation. Each of the sliding block assemblies consists of two fixed outer sections and a sliding inner section. The inner section is keyed to its mating outer sections through two linear ball bearing assemblies, that allow the inner section to translate without restriction but restrain it against the five remaining possible modes of motion. The fixed outer sections are bolted to the upper skirt ring girder in the case of the steam generator mounts and to the skirt support ring girder in the case of the skirt support mounts. Each of the fixed outer sections are keyed to its mating ring girder so that the hold-down bolts can only be tensily loaded.

During assembly, all of the hold-down bolts were equally preloaded to a level in excess of the maximum bolt load that could be induced in the event of a design level earthquake or a primary loop piping rupture. The preloading was accomplished by heating the bolts and nuts in an electric oven to 725°F, inserting the bolt in place and, when thermocouple measurement showed that the bolt had cooled to 675/670°F, the nut was drawn up hand tight.

A total of 256 hold-down bolts are installed - 64 per steam generator. These bolts are approximately 2 5/8" in diameter by 3' long, threaded on one end. Twenty three bolts were found to be broken or with the bolt head raised up from the ring girder

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flange- as if the bolts were backed off several turns. Eight broken bolts have been identified and the remaining fifteen are also suspected of being broken. These twenty three are distributed as follows: No. 1 steam generator one (1); No. 2 steam generator eleven (11); No. 3 steam generator three (3); No. 4 steam generator eight (8).

The Architect-Engineer-Installer (Stone & Webster Engineering Corp.) has investigated these failures and reached the following conclusions:

> "In our judgement, on review of the pattern of bolt failures, it is clear that those bolts that failed were set before cooling down to 675/670°F thereby overstressing the threads with resulting failure. Since less than 10% of all of the bolts have thus failed in a period of over seven years, it is clear that the metalurgy of the bolt material used is adequate for the designed preload applied and since this preload constitutes, the maximum possible loading that these bolts can be subjected too, they may be considered safe and the concept of overheating at installation of the 5% that did fail be accepted as the cause."

Although the Architect-Engineer initially stated that all bolts were required, analyses are presently being conducted to determine whether some number of bolt failures can be tolerated and still assure that the hold down support will satisfactorily perform its design function. For example, the No. 1 steam generator support structure has only one (1) broken bolt out of sixty four (64).

As bolt replacement is shown to be necessary, replacement will be accomplished with new bolts and nuts of the same material and heat treatment as the original installation using full quality assurance and control procedures in their manufacture and installation. Clearance holes will be required to be cut in the upper and lower flanges of the skirt lower ring girder to allow bolt replacement; analysis will also be completed to determine the extent of restoration required. Procedures will be developed before commencing repair activities. These will be performed using full quality assurance and control procedures.

A special report summarizing this repair activity will be submitted in accordance with section 5.7.3 of the Technical Specifications.

Very truly yours,

F. W. Hartley
Plant Superintendent

FWH/bn
cc: DRO