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EF2-45,399

Mr. James G. Keppler
Regional Director
United States Nuclear
Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

References: 1) Enrico Fermi Power Plant - Unit 2
2) USNRC Licensing Docket 50-341
3) Letter of March 8, 1979, J. G. Keppler, USNRC to Edward Hines, Edison
4) USNRC IE Bulletin 79-02, Revision 1

Subject: Detroit Edison Company Response to IE Bulletin 79-02, Revision 1

Dear Sir:

This communication is in response to your letter of March 8, 1979, on Docket 50-341, concerning potential design and operating problems associated with concrete expansion anchors used to attach pipe supports to building structures. Detroit Edison has joined with several other utilities to have Teledyne Engineering Services (TES) perform much of the generic analysis and conduct a generic testing program on various expansion anchors. Much of our response is based on this work and this information will be submitted to you when the testing program is complete near the end of July, 1979.

Due to the results of new piping stress analyses being conducted subsequent to the original support design, a large number of Seismic Category I supports are being redesigned.

Our response to the subject bulletin will fall into two categories:

1) Those originally designed and installed hangers that did not require redesign due to a new piping stress analysis

2) Those hangers currently being redesigned

Below are your requests for information as stated in the subject bulletin and our responses to those requests:

Request No. 1

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

Response No. 1

The concepts of plate flexibility and the attendent "prying action" which results in amplification of anchor bolt loads were not accounted for in the original design of safety related pipe supports on Fermi 2. For the new hangers and hangers being redesigned at this time, plate flexibility and anchor bolt load amplification due to the effects of "prying action" are being considered. The technique employed, which was developed by our architect-engineer, based upon the results of finite element analysis, basically consists of application of a plate flexibility factor (anchor bolt load amplification factor) to the basic calculated anchor bolt load. The plate flexibility factors were developed as a function of plate thickness and the unstiffened distance between the bolt center line and the member welded to the plate.

The anchor bolt amplification factors have been spot checked by Detroit Edison using the TES model and found to be conservative. The TES model is a non-linear finite element model using the ANSYS code and will be completely described in the forthcoming TES report.

For those designs which did not change, as a result of new piping systems stress analysis, a detailed design review is being conducted and analysis performed as appropriate to insure that anchor bolt design loads are not exceeded when the effects of plate flexibility are considered.

All of the above work, including any hanger modifications that may result, is scheduled for completion prior to fuel load. This is scheduled for May of 1981.

Request No. 2

Verify that the concrete expansion bolts have the following minimum factors of safety between the bolt design load and the bolt ultimate capacity determined from static load tests:

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.

Response No. 2

The original design, and redesign work performed prior to the issuance of Bulletin 79-02, was performed based upon a margin of safety of four for shell-type anchors. Soon after the issuance of Bulletin 79-02, design criteria were modified to increase the margin of safety to five for shell-type inserts. Plate and anchor designs which were previously produced based upon a minimum factor of safety of four for shell-type inserts are being reviewed, and appropriate design changes will be instituted if a minimum margin of safety of five

cannot be demonstrated for shell-type inserts.

Wedge-type anchor bolts have not been used in designs for safety-related pipe supports on Fermi 2 to date. We are currently evaluating switching to a wedge-type anchor for the remaining seismic category I hangers yet to be installed (approximately 75%). If we do switch to wedge anchors, designs will be based on a margin of safety of four relative to the anchor bolt manufacturer's published average ultimate load ratings.

The effects of shear-tension interaction, minimum anchor spacing and minimum edge distance are accounted for in all safety-related pipe support design or design review work being conducted for Fermi 2. Spacing criteria are based upon the anchor manufacturer's published recommendations. Where those recommendations cannot be followed, the manufacturer's recommended criteria for derating of the design loads for the anchors are followed. Shear tension interaction is presently accounted for using a straight line interaction diagram. This may be modified when the results of the TES test program are available. This data will be submitted as part of the TES report.

Request No. 3

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

Response No. 3

Fatigue is not normally considered for earthquake induced loads due to the limited number of load cycles anticipated over the life of the plant. TES is conducting low and high cycle tests of various anchors in the generic test program.

The results of this program will be forwarded to you when the program is concluded. Any changes in design criteria due to this testing will also be reported at this time.

Request No. 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 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).

Response No. 4

Those hangers not requiring redesign and already installed did not have a specific torque criteria established for preload. Consequently, no QC documentation is available to verify bolt preload.

Checking of preload will be a requirement of our inspection program for those anchors already installed. Installation torque values have since been established for new designs to provide for pretension slightly greater than the design load. Shell anchors currently being installed use these torque requirements and have QC records to verify this torque. If wedge anchors are used, site specific torque values will be supplied and use verified in QC records.

The Fermi 2 anchor installation procedure requires that 10% of the category I anchors be tested to a specified "proof load" equal to approximately 50% of the catalogue ultimate using a direct pull test. The piping subcontractor has recently chosen to test 100% of the anchors for category I piping systems. The procedure also calls for the anchor to be set a minimum of 1/16 inch below flush to prevent bearing on the base plate. Documentation that the proof load and installation depth requirements were met is part of the final QC inspection "write off" of the anchor installation.

Detroit Edison feels that this program and QC documentation provide considerable assurance that the anchors have been installed properly and will function as designed. We are, however, instituting an inspection program for all category I piping hangers to verify the other pieces of data required in Revision 1 of the subject bulletin. A combination of sampling methods a & b from Appendix A of the bulletin will be used to verify:

1. Correct size and placement per design
2. Embedment depth (not bearing on plate)
3. Thread engagement of bolt or stud in anchor
4. Plate bolt hole size
5. Full expansion of shell

This will be done for shell anchors that are presently in place. Recently installed shell anchors have this information as part of the QC documentation, while similar data will be required of wedge anchors. In addition, the wedge anchors will be permanently marked with a code defining the bolt length.

Again, this re-inspection and any required modifications will be done along with our anchor installation work and will be completed and documented prior to Fuel Load in May of 1981.

If you require our further input in this matter, please advise us.

Sincerely yours,

Edward Hines

cc: Mr. John G. Davis, Acting Director
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Division of Reactor Inspection Programs
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Washington D.C. 20555

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