

**Detroit
Edison**

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EF2-45,399

Mr. James G. Keppler
Regional Director
United States Nuclear
Regulatory Commission
Region III
799 Roosevelt Road
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- References:
- 1) Enrico Fermi Power Plant-Unit 2
 - 2) USNRC Licensing Docket 50-341
 - 3) Letter EF2-45,399 From Edward Hines, Edison to J. G. Keppler, USNRC, Dated July 6, 1979
 - 4) USNRC IE Bulletin 79-02, Revision 1
 - 5) Letter of September 7, 1979, R. A. Ciatto Teledyne Engineering Services to D. W. Hayes, USNRC.

Subject: Status Update on Detroit Edison Company Activities Relative to Concrete Anchor Installation and Inspection Programs For Safety Related Pipe Supports-IE Bulletin 79-02, Revision 1

Dear Sir:

This communication is intended to provide you with an update relative to Detroit Edison Company activities during the last two months in the areas of installation, testing and QC inspection of concrete anchors used with QA Level I (Seismic Category I) pipe supports, and to supplement our initial response to IE Bulletin 79-02, as provided in Reference 3. This letter also constitutes the plant-specific response to IE Bulletin 79-02 for Fermi 2.

The results of the Generic Testing Program, conducted on behalf of 14 utilities, by Teledyne Engineering Services was transmitted to you with Reference 5. The essential findings of that program were:

- a) Concrete expansion anchor bolts which are not preloaded do not deteriorate when subject to cyclic loadings.
- b) A linear assumption for shear-tension interaction is highly conservative. Actual tests indicate that an elliptical relationship is realistic for most types of anchors.
- c) Base plate flexibility must be considered in determining the load on installed expansion anchors.

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- d) Testing confirms that there is no reason to apply different factors of safety to different types of expansion anchors.

Based upon the results of the Teledyne Program, Detroit Edison has adopted the following policies:

- a) Effective October 1, 1979, all concrete anchors used to install QA Level I pipe supports will be wedge bolt type anchors of the type manufactured by ITT Phillips Division and the Hilti Company. No other brands or styles of fasteners have been approved for this service at this time. Approximately 75% of all QA Level I pipe supports are in this category.
- b) Fermi 2 project standards have been implemented which require that all anchor bolts of a given diameter be installed to a single minimum embedment length, unless specifically directed otherwise by the approved engineering documents.
- c) Allowable design loads have been developed based upon manufacturer-supplied ultimate average failure load data, and a minimum safety factor of four (4).
- d) Actual on site tests, in representative project concrete, were conducted by both anchor bolt suppliers to determine the minimum installation torque necessary to insure that the installed anchor bolt is capable of developing the full design load without further set of anchor (1/4 of the average ultimate load).
- e) All wedge bolt installations used with QA Level I pipe supports are subject to the below-listed QC inspections and tests:
 - 1) 100% of all installed anchors are inspected to verify that the minimum embedment depths specified are achieved. This inspection is conducted after installation torquing. This is accomplished by measuring the net projection from the structural concrete surface and subtracting that figure from the overall minimum length of the anchor. The anchor length is determined by reference to the length code which is stamped on the exposed end of the anchor bolt.
 - 2) 100% of all installed anchor bolts are subjected to a post-installation torque test. Acceptance criteria require that the developed test torque is at least 80% of the original installation torque.

It is important to note that this torque testing program is intended to verify that the original anchor setting torque was applied to the anchor bolt installation, and not to insure that a long term residual preload is maintained in the installation. This is based upon the generic test program findings that indicate that anchor prestress is not a requisite for reliable anchor bolt behavior under vibratory loading.

- 3) In addition to the above mentioned torque tests, 1 of 100 installed anchors are subjected to a direct tensile test. Acceptance criteria for the test require that the washer under the nut cannot be turned by hand while the anchor is subjected to a tensile test load equal to the design load.
- 4) Anchor bolt hole locations, anchor bolt size and anchor bolt type are as specified on the engineering documents.
- 5) Minimum anchor bolt spacing and edge distances are in compliance with the approved engineering documents.
- 6) Minimum thread projection beyond the face of the nut is within the limits specified.

The results of this testing and inspection will be fully documented in the permanent Fermi 2 site QC records.

For those QA Level I pipe supports already installed using shell type concrete expansion anchors, Edison does not, in general, plan to replace those anchors, provided the below listed installation inspection and the design verification programs previously described in Reference 3 yield satisfactory results.

The basis for the decision lies in the results of the generic testing program, and supplemental on site tests conducted by Edison, which produced the following findings:

- a) Shell-type concrete expansion anchor ultimate strength is principally a function of wedge insertion and hole diameter.
- b) Maintenance of prestress in the anchor installation is not required for proper anchor behavior, however, anchor bearing on the back of the plate will be cause for inspection rejection to prevent load reversal on the shell.
- c) There is no reason to apply different factors of safety to different types of anchors.

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In making the determination as to the acceptability of a specific installation, using shell-type anchors, the below-listed criteria will be addressed.

- a) The design verification, based upon consideration of base plate stiffness and application of a safety factor of five (5) to the average ultimate strength of the anchor bolt, shows that the size, number and placement of the anchors is acceptable. Shear-tension interaction relationship will be in accordance with the lesser of the test data or the relationship:

$$\left(\frac{P}{P_u}\right)^n + \left(\frac{V}{V_u}\right)^n \leq 1$$

$n \leq 2.0$

- b) Inspections are conducted, and appropriate QC Documentation is available to verify the following. Inspection frequency shall be according to Bulletin 79-02, Appendix A, Method a.
- 1) The size, number and location of the anchors is in agreement with the approved design drawing, or in accordance with engineering approved variations from the design drawing.
 - 2) Embedment depth of the shell insures that the shell is not contacting the back of the plate.
 - 3) Thread engagement within the shell and nut are per design.
 - 4) Plate bolt-hole size is per design.
 - 5) Acceptable wedge insertion has been accomplished.

If during the conduct of the referenced programs, specific instances of non-conformance with design, installation or inspection criteria occur remedial actions will be taken, as appropriate to revise the design, provide required supplemental inspections or replace the existing shell-type concrete expansion anchors with wedge-type anchors. These will be installed, inspected and tested in accordance with approved criteria and procedures.

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We believe that this communciation, together with the previously submitted generic testing program report, and reference 2, provide a complete response to your requests for information, as enumerated in IE Bulletin 79-02.

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

Yours very truly,

Edward Hines

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cc: Mr. John G. Davis, Acting Director
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