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R. W. BARR

Detroit Edison

ENRICO FERMI UNIT 2 PROJECT
ENGINEERING

October 23, 1979

EF2-50,590

To: R.W. Barr
Project Quality Assurance Director

From: M.G. Sigetich
Supervising Engineer, EG44

Reference: 1) Letter on Docket 50-341 dated August 28, 1979 from Mr. G. Fiorelli, USNRC Region III to Mr. Edward Hines, Detroit Edison Company

2) EF2-46,349 dated September 28, 1979

3) EF2-50,242 dated September 21, 1979

Subject: Report of Engineering's Evaluation of an Identified Design Deficiency in QA Level I Pipe Support Struts

Pursuant to the rules of 10CFR50.55(e), Item 3, attached is a copy of the subject report.

Written by: J.H. Casiglia
/sp

Approved: W.F. Colbert 10/24/79
W.F. Colbert
Project Engineer

cc: T.A. Alessi
L. Bertani
T.H. Dickson
W.M. Everett
W.J. Fahrner
F.E. Gregor
D.L. Schweikhart
R.J. Stanley
W.M. Street
R.A. Vance
H.A. Walker
Doc. Control

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ENRICO FERMI POWER PLANT UNIT 2

DEFICIENCY REPORT

EXCESSIVE LOAD-PIN CLEARANCE IN QA LEVEL I PIPE SUPPORT STRUTS

INTRODUCTION

During a postulated seismic event, the inertial and differential anchor movement loads developed by the Category I piping systems are transferred to the building structure by the pipe support system. The magnitude, direction and characteristic nature (force, moment, displacement, etc.) of the loads is predicted by the computerized piping system stress analysis. The overall validity of that analysis is dependent upon the accuracy with which the physically-installed support system satisfies the structurally-related (orientation, stiffness, etc.) assumptions, concerning the support system, which were made during the performance of the analysis.

Pipe support devices, which are capable of resisting both tensile and compressive loads and transferring these loads to the building structure, are known as struts. When modelled analytically in the piping analysis, the strut is assumed to be structurally rigid along its axis and yet provides no restraint to movement or rotation of the piping system in other directions.

In order to achieve the required axial structural rigidity, the strut is provided with close-fitting pinned connections at the pipe attachment point (clamp) and structure attachment point (rear bracket). In order to provide for required off-axis flexibility, the pinned connection must be provided with a slight clearance between the pin and its mating connection.

It has been determined by both analytical studies and industry experience that as long as the total cumulative clearance in the pinned connections at the ends of the struts does not exceed approximately 1/16-inch, in the axial direction, the validity of the stress analysis is not compromised.

DESCRIPTION OF THE DEFICIENCY

In order to provide the required off-axis flexibility for the QA Level I struts used on Fermi 2, the originally specified acceptance criteria permitted up to 1/8-inch diametral clearance between each load pin and its mating connection.

Upon closer engineering evaluation of the potential effect of this specified clearance, it was established that cumulative "stack-up" of the tolerances between each pin and its mating connection on a strut assembly could result in a total of ¼ inch of free axial movement between the building structure and the supported pipe, during a postulated seismic event.

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DESCRIPTION OF THE DEFICIENCY (contd)

It was also determined, during the course of the above described investigation, that specific criteria to insure that threaded portions of the strut end pins (bolt studs) were not in the load-bearing portion of the connection were not specified; and approved strut designs with threaded portions of the load pins in the shear plane of the end connection had been released for construction.

The above constitutes a departure from good design practice and poses the potential for further increase to the clearance in the strut end connection due to crushing of the thread crest under compressive loading.

It was concluded that the potential for excessive displacement between the building structure and the supported QA Level I piping compromised the integrity of the seismic analysis of that piping. Therefore, pursuant to the rules of 10CFR50.55(e) item 1 (ii), a reportable design deficiency existed.

NUCLEAR REGULATORY COMMISSION NOTIFICATION

In accordance with the rules of 10CFR50.55(e), Item 2, verbal notification of the above design deficiency was provided to the NRC Region III staff, by the Fermi 2 project Quality Assurance director on October 2, 1979.

CORRECTIVE ACTION

All QA Level I strut assemblies not presently so-designed, will be redesigned to incorporate struts which are equipped with close-clearance spherical bearings in the end connections. These bearings provide the axial rigidity required for proper performance of the strut, while still allowing for the necessary off-axis movement capability to permit free thermal growth of the piping system, as required by the design and accounted for in the piping stress analysis.

SAFETY IMPLICATION OF THE DEFICIENCY

An engineering assessment of the potential effects of excessive tolerance in strut end connections concluded that during a postulated site seismic event, impactive loads which are not accounted for in the piping analysis or support system design, would be generated. If the magnitude of those loads were sufficiently high, the potential for support system structural failure and attendant overstress of the QA Level I piping would exist.

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SAFETY IMPLICATION OF THE DEFICIENCY (contd)

It has been concluded that by redesigning the QA I struts, as previously described, the originally-provided design margins against structural failure of critical piping systems due to earthquake loadings will be preserved and the piping systems will be capable of performing their intended safety function.

Prepared by: J.H. Casiglia
J.H. Casiglia, PE
Engineering Work Leader

Approved: M.G. Sigetich
M.G. Sigetich
Supervising Engineer, EG44

Approved: W.F. Colbert
W.F. Colbert, PE
Project Engineer, EF2

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