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August 18, 1982
EF2 - 59,061

Mr. R. L. Tedesco
Assistant Director for Licensing
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Tedesco:

References: (1) Enrico Fermi Atomic Power Plant Unit 2
NRC Docket No. 50-341

(2) NRC Letter to H. Tauber from B. J. Youngblood, "Completion of Fermi-2 Containment Analyses and Modifications", dated March 23, 1982

(3) "Mark I Containment Program Structural Acceptance Criteria Plant - Unique Analysis Applications Guide", Task Number 3.1.3, Mark I Owners Group, General Electric Company, NEDO-24583, Revision 1, July 1979

Subject: Evaluation of the Enrico Fermi-2 Drywell-to-Wetwell Vacuum Breakers

This letter provides a report on the evaluation which was conducted for the Fermi-2 vacuum breaker valves between the wetwell and drywell. This submittal is for your review, and responds to Staff requirements provided in the Reference (2) letter.

Fermi-2 has twelve (12) GPE 18" O.D. drywell-to-wetwell vacuum breaker valves. The general arrangement of the GPE valve design has been provided in the attached Figure #1. The vacuum breakers would open after a postulated LOCA to vent non-condensables from the wetwell airspace into the drywell when the steam in the drywell begins to condense. The size and number of vacuum breakers has been determined to ensure that the Fermi-2 drywell vacuum conditions do not exceed the external pressure design limit (-2 psig) for the structure. Section 6.2.1.2.1.10 of the Fermi-2 FSAR provides a more detailed discussion of the vacuum breakers.

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During the chugging phase of a LOCA, the pressure fluctuation in the suppression pool vent system may cause the vacuum breaker pallets to cycle open and closed. The cyclic impact of the pallet on the valve seat due to chugging in the vent system presented a loading condition which had not been previously included in the vacuum breaker valve design. Therefore, as part of the Fermi-2 Mark I Containment Modification Program, Detroit Edison has re-evaluated the design of its vacuum breakers for this new loading condition.

The forcing function utilized in the vacuum breaker design evaluation was obtained from a segment of the pressure-time histories measured in the Mark I Owners Group Full Scale Test Facility (FSTF) vent system and wetwell during one of the chugging tests. The FSTF pressure-time history data was adjusted to account for Fermi-2 plant-unique geometric parameters, such as vent/pool area ratio, drywell volume/vent area ratio, submergence head, etc., to establish the expected loading function. The design loading function was then established by applying a conservative safety factor of 1.6 to this plant-unique pressure-time history. The expected and design loading functions were applied to an analytic valve dynamic model to determine the maximum pallet-to-seat impact velocity during chugging. The valve dynamic model included the effects of torque alleviation in the pallet assembly as a consequence of the flow or leakage through the open valve. The predicted maximum expected and design impact velocities during chugging for the Fermi-2 vacuum breakers were 4.0 and 7.6 rad/sec respectively.

For completeness, the re-evaluation of the vacuum breaker valve design included the loading conditions, identified in the Reference (3) Plant Unique Analysis Applications Guide, which could be combined with the chugging load. The impact velocities for these other loading conditions were conservatively assessed using a single-degree-of-freedom model to represent pallet movement. The resulting impact velocities for Safety Relief Valve, seismic and pool swell load conditions were found to be negligible with respect to the predicted maximum impact velocity experienced during chugging.

The impact velocities predicted for the limiting design loading conditions were utilized in dynamic structural impact analyses to determine the stresses in the valve components. The analytical model developed for the analysis treated the moving parts of the valve as a single-degree-of-freedom system rotating about a pivot point at the shaft location. The results of the structural analyses predicted that several valve components would exceed the ASME code limits. These components were the pallet, hinge arm, hinge arm stud and the shaft. The results of additional analyses

showed that utilizing available higher strength materials for these components would provide the necessary corrective action. The maximum allowable impact velocity corresponding to the ASME code allowable limit for Service Level A, for the higher strength materials, was determined to be 9.28 rad/sec. Therefore, corrective action instituted by a repair program to replace the appropriate valve components with ones made from higher strength materials would restore the valve to within ASME allowable limits for the predicted design impact velocity of 7.6 rad/sec.

Accordingly, Detroit Edison is currently proceeding with a program to replace the components that exceed the ASME code limits. The attached Table 1 lists the components, the existing materials, and higher strength materials which will be utilized in manufacturing the replacement parts.

A purchase order for the manufacture and delivery of the replacements has been issued. Detroit Edison has been seeking to expedite the material ordering and manufacturing schedules to allow the modifications to the vacuum breakers to be completed prior to fuel load. However, should the material delivery schedule be extended, the modifications to the valves will be completed following receipt of the replacement parts, but prior to the second fuel cycle. Utilizing the existing materials, the maximum allowable impact velocity to establish a safety margin of 2.0 against failure, for the critically stressed component, was determined to be 5.27 rad/sec. This value is greater than the expected impact velocity of 4.0 rad/sec. As such, the current vacuum breaker design would meet the Mark I Program Short Term Criteria. Therefore, in the event that the vacuum breaker modification cannot be completed prior to fuel load, interim plant operation through the first fuel cycle is justified.

If you have any questions, please contact Mr. L. E. Schuerman, (313) 649-7562.

Sincerely,

Harry Tauber

Attachment

cc: Mr. L. L. Kintner
Mr. B. Little

Mr. R. L. Tedesco

Attachment - Table 1

TABLE 1

LIST OF COMPONENTS REQUIRING HIGHER STRENGTH MATERIALS

Component	Existing Material Specification	Replacement Material Specification
Pallet	SA-516 GR70	SA-564
Hinge Arm	SA-516 GR70	SA-564
Hinge Arm Stud	SA-320-B8	SA-564
Shaft	SA-320-B8	SA-564

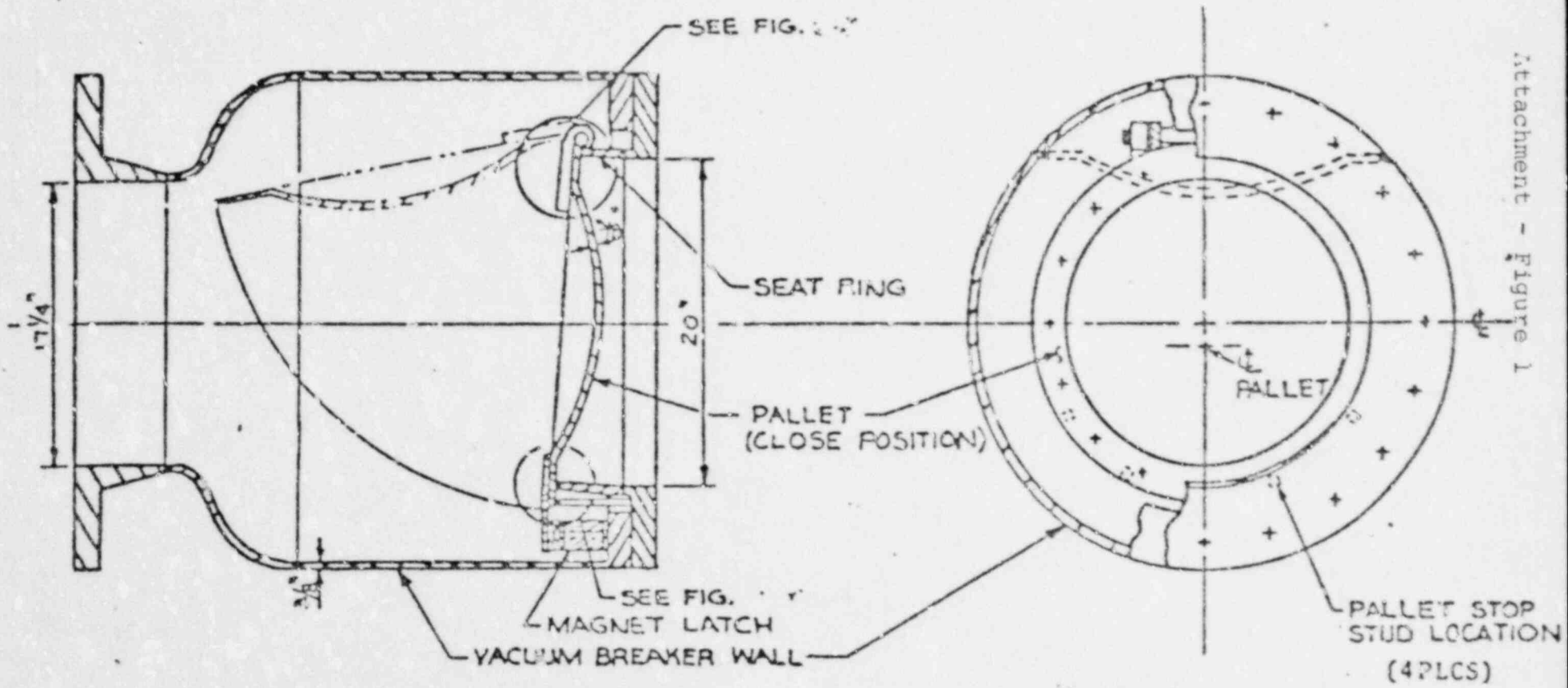

FIGURE 1

GPE 18" VALVE GEOMETRY

(GPE TYPE LD-240-208)