A. Lee

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.

Department of Nuclear Energy
Building 129

Upton, New York 11973
282
(516) [illegible]
FTS 666 2448

September 14, 1981

Dr. Zoltan Rosztoczy
Chief, Equipment Qualification
Branch
MS P-1030
Phillips Building
US Nuclear Regulatory Commission
Washington, DC 20555

Dear Dr. Rosztoczy:

Enclosed please find our summary reports for the twenty-four equipment items that were reviewed by BNL during the site visit to the Enrico Fermi2 Nuclear Power Station in Michigan during the week of July 27-31, 1981.

As noted in the specific reviews of the equipment items, some open issues still remain. We are of course prepared to evaluate responses to these open issues as soon as they become available to us.

Sincerely yours,

M. Reich/jm

M. Reich, Head
Structural Analysis Group

jm
Enc.
cc: A. Lee

Enrico Fermi Nuclear Station Unit 2

Plant Visit

Documentation Review

Introduction and Summary

This report deals with the evaluation of the particular equipment that was selected by SQRT for seismic qualification of equipment installed at the Enrico Fermi 2 Nuclear Station. A site visit was made during the period, July 27-31, 1981. Prior to the plant visit, 25 pieces of equipment were scheduled for review by SQRT. One of the selected items (i.e., Item NSSS/16: In-core guide tube, Top, B11-D199) was later found to be a non-safety item and hence was excluded from the list. Thus a total of 24 pieces of equipment was reviewed at the plant site. The review team consisted of J. Curreri, M. Subudhi, A.J. Philippacopoulos, S. Sharma and P. Brown of BNL and A. Lee of NRC.

The BNL group reviewed the installations as well as the qualifying documents relating to equipment list given below.

BOP:

1. Chilled Water Pumps (T41-00-C-041-FA-001)
2. 10" Type 4340 Damper (T41-00-F-900)
3. Engine Instrument Panel (R30-00-S-900-BA-003)
4. Diesel Generator Seismic Water Pumps (R-30-00-S-900-RA-005)

5. RHR Mech. Draft Cooling Towers (E11-56-B-900-BA-003)

6. 24" 300# Globe Valve Fig.# 3051

   WE SMB-4-200 Meter Opar. (A31-00-F-900-RA-029)

7. 4"600# Y Globe Valve, Fig. 16051-Y, WE, Limit.

   SMB-0-40 MO (31-00-F-900-RA-042)

8. 18" Wafersphere Valve with Bettis Robotarm Actuator

   (A31-00-F-900-RA-153)

9. Swing Check Valves 20", V12-2001, 2002, 2003, 2004

   (A31-01-F-900-RA-001)

10. EECW Pumps B11-93M (P44-00--C-001A-RA-001)

11. Floor Mounted Instrument Racks (H21-01-P-501B-RA-001)

12. Remote Shutdown Panel (C35-P001)

13. 480 V SWGR Volt. Reg.-1500 KVA (R14-00-S-900-QL-031)

14. Battery Racks for 130 V DC Battery (R32-00-S-900-RA-003)

15. Nuclear Penetration Canister Assembly (T23-01-X-900-BA-008)

<u>NSSS</u>:

16. In-Core Guide Tube, Top (B11-D199) - Deleted

17. Reactor Vessel Stabilizer (B11-U002)

18. Isolation Valve (B21-F028)

19. Recirc. Discharge Valve (B31-F031)

20. Hydraulic Control Unit (C11-D001)

21. Barton Flow XMTR (B31-N014 A)

22. GE Relay (E11 A-K001A)

23. Bailey Diff Press (G33-N041)

24. GE Rack (H21-P025)

25. Weed Inst. Temp Element (C41-N006)

This review includes an evaluation of the original qualification of all the selected equipment, the reassessment document with regards to the site specific design spectra, and our final conclusions on the status of the individual equipment design adequacy. Since the plant is under construction since late sixties, the qualifying documents were found to be incomplete as compared to recent plant design reports. This reactor is an old Mark I Boiling Water Reactor. No hydrodynamic loads were considered in the design of equipment.

In summarizing the results of the review it was found that the dynamic qualification reports for the above menttioned equipment demonstrate design adequacy, pending submission by the applicant of further documentation for the specific individual equipment items as noted in the report. Details of the particular comments on the individual reviews are given in the evaluations that follow.

T41-00-C-040&041 Chilled Water Pump & Motor

(Model TBDP, 7.5 HP, 1745RPM Motor on 215T Frame, Westinghouse)

(Model 3196 MT 3"x 4"-8 Pump, Gould Pumps Inc.)

Two chilled water pump and motor units are located in the Auxilliary Building at an elevation of 677.5'. The pump is a one stage centrifugal pump connected to a motor via a flexible coupling. The pump and motor are individually bolted to a support frame with four 1/2" bolts. The support frame is bolted to the floor with four 5/8" bolts. The pump assemblies provide chilled water to two air conditioning cooling coils in order to maintain the control center temperature. These units are required to operate at all times.

The pump assemblies were designed according to the Detroit Edison Co., Specification No. 3071-68, issued 3/15/72 with Addendum A issued 11/15/72. These units were qualified by analysis and documented in the following reports:

1) Seismic Stress Analysis of Chilled Water Pumps, Model 3196 MT Size 3"x 4"-8', by McDonald Engineering Analysis Co., for Detroit Edison Co., Sept. 5, 1975, Report No. ME-255.
2) "Seismic Analysis of a 7.5 HP, 1745 RPM Motor on a 215 T Frame, Model TBDP", by Westinghouse Electric Co., for Goulds Pumps Inc., Jan. 26, 1979, Report No. B9-1875.

A static analysis was performed on the pump & motor assembly to determine its fundamental frequency, stress levels and deflections. The assembly was idealized by a 3-D finite element beam model. This model was processed by the computer code ICES-STRUDL II. The fundamental frequency was reported to be 39 Hz. An equivalent static analysis was used to compute stresses and deflections due to the nozzle and seismic loads. Seismic loads of 1.5 g N/S and E/W, 1.0 g vertically for the OBE and loads of 3.0 g N/S & E/W, 2.0 g vertically for the DBE were used. The loads for all three directions were applied simultaneously to the center of mass of each individual component. The reports indicate that all computed stresses were within the allowable limits.

The pump and motor are connected by a Fast Type O Flexible Coupling. The operability of the pump and coupling qualification is based on a comparison of the maximum impeller deflection and coupling misalignment with allowable limits for these deflections. The functional qualification of the motor alone is based on a separate, more conservative static analysis which compared the maximum rotor deflection against the allowable clearance. For the input g levels used in the static analysis, all deflections are reported to be less than the maximum allowable.

The chilled water pumps were amongst the items that required a seismic re-evaluation. The equipment was requalified as summarized in Table 5.3-29 (attached) of the "Seismic Re-Evaluation Summary Table". Comparison of the original input accelerations with the ZPA's of the re-evaluation response spectra showed that the original required accelerations were more conservative.

Based on our review of the equipment, analysis reports, and the field installation, we conclude that this equipment is qualified for the seismic loads specified for the Fermi 2 Plant.

Open Items

None.

TABLE 5.3-29

HVAC CHILLED WATER PUMP AND MOTOR

SEISMIC RE-EVALUATION

SUMMARY TABLE

System, Structure, Component Description	Method of Original Qualification				Re-Evaluation Results				Conclusion and Remarks
	Test	Analysis	Report #	Spectra #	Spectra Comparison Fig. #	% Margin	Analysis Report #	% Margin of Safety	
Chilled Water Pump PIS # T4100C040 and T4100C041		X	B9-651	3.0 g N-S 3.0 g E-W 2.0 g Ver	B37 B38 C19		Attached	538 455 354	Equipment is requalified as accelerations used in original analyses are greater than those of the original response spectra.
Chilled Water Pump Motor (Same PIS as above)		X	B9-1875	3.6 g N-S 4.25 g E-W 3.6 g Ver	B37 B38 C19		Attached	666 687 718	

1) EQUIPMENT IDENTIFICATION:

CHILLED WATER PUMP MOTOR
(INTEGRAL WITH PUMPS: P15 & T4100C040 & T4100C041)

2) EQUIPMENT LOCATION:

5TH FL. AUX. BLDG EL. 577'-6"

3) DYNAMIC CHARACTERISTICS

Natural frequency(s)	121	Hz.
OBE damping factor	N/A	%
DBE damping factor	N/A	%
SER quake damping factor	3	%

Note: If lowest natural frequency ≥ 33 Hz, then equipment is considered rigid.

4) RESPONSE SPECTRA

			EXIST. DBE	SER QUAKE
North-South Component	S&L	Fig No.	N/A	B-37
East-West Component	S&L	Fig No.	N/A	B-38
Vertical Component	S&L	Fig No.	N/A	C-19

5) ACCELERATIONS

	EXISTING DBE	SER QUAKE	RATIO OF [illegible]
ZPA (N.S.)	3.6 g	0.47g	0.13
ZPA (E.W.)	4.25 g	0.54 g	0.127
ZPA (Vert.)	3.6 g	2(0.22g)	0.122
PEAK (N.S.)			
PEAK (E.W.)			
PEAK (Vert.)			
VALLEY (N.S.)			
VALLEY (E.W.)			
VALLEY (Vert.)			

Not req'd for rigid equip.

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1) EQUIPMENT IDENTIFICATION:

CHILLED WATER PUMPS, P15 & T4100C040 & T4100C041
(CONTROL RM A/C)

2) EQUIPMENT LOCATION:

5TH FL. AUX BLDG EL. 577'-6"

3) DYNAMIC CHARACTERISTICS

Natural frequency(s)	38.5	Hz.
OBE damping factor	N/A	%
DBE damping factor	N/A	%
SER quake damping factor	3	%

Note: If lowest natural frequency ≥ 33 Hz, then equipment is considered rigid.

4) RESPONSE SPECTRA

		EXIST. OBE	SER QUAKE
North-South Component	S&L Fig No.	N/A	B-37
East-West Component	S&L Fig No.	N/A	B-38
Vertical Component	S&L Fig No.	N/A	C-19

5) ACCELERATIONS

	EXISTING DBE	SER QUAKE	RATIO OF SER QUAKE/DBE
ZPA (N.S.)	3.0g	0.47g	0.157
ZPA (E.W.)	3.0g	0.54g	0.18
ZPA (Vert.)	2.0g	2(0.22g)	0.22
PEAK (N.S.)			
PEAK (E.W.)			
PEAK (Vert.)			
VALLEY (N.S.)			
VALLEY (E.W.)			
VALLEY (Vert.)			

Not req'd for rigid equip.

10" Shan-Rod Valve Type Dampers with Bettis Actuators

Equipment No. T41-00-F-900

Model No.: Type 4340 (Dampers), CB525-SR100 (Actuators)

Vendor: Shan-Rod Inc. (Dampers), Bettis (Actuators)

These dampers are located in the Reactor Building at an elevation of 673'3". The dampers with actuators are mounted on circular ducts with eight 5/8" bolts. The ducts are supported on both sides of the dampers with stiff channel frames. The actuators protrude from the dampers in a cantilever fashion. The weights of each damper and actuator are 207 lbs. and 70 lbs., respectively. These dampers control air flow from the control center air conditioning, specifically from the kitchen area. The dampers are normally open but, as stated in item 10b of the SQRT form, they must close in event of LOCA to minimize leakage of the makeup air from the control center.

Reference design specification for these dampers are given in Report No. B/M B9-266M. The qualification report entitled, "Seismic Analysis of Shan-Rod Inc. Type 4340 Heavy Duty Butterfly Dampers", dated August 19, 1977 (revised October 24, 1977), was prepared by Drs. R. J. Scaruzzo and J. Padovan of Akron University. This report was reviewed by the Detroit Edison Co. and is included in the company file No. B9-1119.

The qualification report consists of hand calculations for stresses in critical structural elements of the dampers, e.g., actuator bolts, actuator

plate weld and flange bolts. Disc deflections of the dampers are also calculated to ensure operability. An equivalent static horizontal acceleration of 5 g and a vertical acceleration of 3 g are considered in these calculations. The results show a minimum ratio (for anchor bolts) of 5.47 between the allowable and computed stresses. Consequently, the damper is concluded to be structurally safe not only for the original acceleration levels (5 g horizontal, 3 g vertical), but also for the new accleration levels (4.89 g horizontal, 5.7 g vertical) required under the seismic requalification plan.

The qualification report does not verify operability of the actuator or its limit switches. It is, therefore, not possible to assess if the damper will close in the event of LOCA. This question was raised during the SQRT visit and the response provided by Detroit Edison and Sargent and Lundy representatives is as follows. The emergency air make-up of the control center is 1,800 CFM of which 250 CFM is expected to be lost due to system normal leakage. The maximum discharge that can take place through the two dampers is only 470 CFM. Thus, although it is preferable that the dampers close during a LOCA, the system has more than sufficient make-up air capability to maintain its integrity even if the dampers fail to close. A written response subsequently received from Detroit Edison in this regard is attached at the end of this review.

Based on our field inspection, review of the reports and answers provided by Sargent and Lundy and Detroit Edison representatives, we conclude that this equipment is qualified for seismic loads specified for the Fermi 2 site.

Open Issues

None.

R30-00-S-900-BA-003 Engine Instrument Panel

The Diesel Generator Engine Instrument Panel contains the monitoring instruments and gages which are necesary for the safe operation of the engine generator system. The panel weighs 320 lbs. and measures 28" wide x 62" high x 8" deep. There are 4 such panels located at the 590' level of the reactor heat removal complex. They were manufactured by the Fairbanks Morse Engine Division of Colt Industries.

The panel is mounted to a tubular frame structure with four shock isolators. These are constructed with a vertical coil spring around which is wrapped a semmicircular neoprene insert.

The equipment qualification is contained in two documents. The first document is an analysis that was prepared by D.W. Ginter of the Fairbanks Morse Engine Division. The report is entitled, "The Detroit Edison Company Seismic Calculations, Nuclear Standby Generating Equipment F.M. Order 205981", dated June 24, 1975. This report documents the analysis of the natural frequencies, normal modes and the response of the overall panel, treated as a rigid body, and mounted on the four springs. The design basis earthquake is used as the loading condition. The acceleration factor for the vertical direction was taken from the Sargent and Lundy Curve 114-DB-VW using 1% damping.

The analysis report of the Engine Instrument Panel was reviewed and accepted by M.M. Hassaballa of Sargent and Lundy in his memorandum dated September 4, 1975.

The second document is a test report prepared by Wyle Labs, Huntsville, Alabama. The test report was accepted by J.R. Alexander of Sargent and Lundy in a memorandum dated, June 22, 1978 to D. R. Larson. The test report is Wyle Job No. 43961, May 1, 1978. This report describes the results of the seismic qualification test of the active instruments which are mounted on the instrument panel. These instruments include the Synchro-Start Electric Switch Model ESSB-3AT, Dresser Industries Ashcraft Pneumatic Temeprature Tarnsmitter Model C-5680, Moore Products Co. Pneumatic Temperature Transmitter Model 33, and the Nullmatic Pneumatic Controller Model 55. These instruments were premounted in a fabricated test fixture and were subjected to biaxial random motion tests in the frequency range of 1-40 Hz with 5 OBE's and 1 SSE each of 30 seconds duration. The tests was conducted in the two principal planes.

The tests demonstrated that the specimens possessed sufficient integrity to withstand, without compromise of structure or operational function, the simulated seismic environment.

The OBE and SSE levels for the test were obtained from the levels of the response of the panel as determined from the analysis. However, the analysis was carried out with a Fairbank Morse Program A033 and subsequently program MOFOR was used to calculate the modal forces on the masses. This is a linear analysis. The results of this analysis showed that the relative motions across the isolation springs in the vertical mode would amount to 0.16" while the available clearance is only 0.12". This means that the clearance in these

isolators must be increased to accommodate the actual motions that were calculated otherwise impact will occur. This will raise the accelerations on the panels substantially and invalidate the RRS values of the tests. This issue is not addressed in the qualifying documents. If the clearance is increased, however, the test results together with the analysis show that the panel and the instruments are adequately designed for the required dynamic load. It is therefore necessary to document the requirement for increasing the clearance.

Open Issue:

A statement is required from DECO which says that the clearance between the panel bracket and the vibration isolator housing will be increased so that no impact will occur during an DBE conditon. This is to be done on all four similar panels.

Diesel Generator Service Water Pump Assembly

(Equipment No. R30-00-S-900-BA-003)

(Model No. 8 x 12 JMC-2 STG/HTWPI)

The Fermi2 plant has four diesel generators which are located in the RHR unit. Each diesel generator employs one service water pump. The latter provides the diesel engine with service water in order to maintain the temperature of the engine at prescribed operating levels. The pumps are required to operate whenever the diesel generators are in use. During the SQRT visit, a typical service water pump assembly was inspected. The respective vendors of the pump and the motors are, the Goulds Pumps Inc., and the Allis Chalmers Corp. The design of this equipment was carried out according to the Specification DECO 3071-134.

Qualification of the equipment was performed by an analyses carried out by McDonald Engineering Analysis Company, Birmingham, Alabama. Results are given in the following document:

> "Seismic-Stress Analysis of ASME Section III Class 3 Pumps, Model VIT Size 8x12 JMG-2", by McDonald Engineering Analysis Company, June 20, 1975.

The Detroit Edison Company has reviewed the qualification report. It was concluded that the pump meets all specification requirements and that

it will function for all required loads including both normal and seismic loads.

A two-dimensional lumped-mass finite element model was developed based on beam elements and the dynamic analysis of the equipment was done by utilizing the STRUDL computer program. The motor of the pump was considered to be rigid and its mass was lumped at its CG. The mass of the concrete pump support above the floor as well as the mass of the pool water surrounding the suction pipe were also included in the model. With regard to the boundary conditions a cantilever action was assumed in both directions, above and below the floor where the equipment is located. Nodal points were inserted at important locations, i.e., shaft bearings, so that the stresses and deflections can be obtained directly from the STRUDL computer output.

From the eigenvalue solution it was found that the lowest natural frequency in the horizontal direction is 0.64 Hz, whereas the corresponding frequency in the vertical direction is 49.2 Hz which is higher than 33 Hz rigid cutoff. Based on these results the modal superposition technique was employed for the seismic assessment of the equipment in the horizontal direction whereas for the vertical direction only hand calculations were performed because vertical frequencies were found to be above the rigid cutoff. These hand calculations are based on the following acceleration levels:

0.11 g for OBE

0.18 g for DBE

In addition to the seismic loads a 75 psi internal design pressure for 100°F temperature as well as other pump normal loads were considered. The nozzle loads including bending and torsional moments plus shear and axial forces were taken into account in the analysis.

Stress and deflection calculations were performed at various parts of the assembly. Stresses in the column, the column flange and bolting, the pump casing flange and the bolting, as well as the discharge head flange and the discharge head weld, were checked for possible overstress conditions. It was concluded that the stresses for these items were below the allowable levels. The stresses at the intersection between nozzle and casing as well as the motor holddown bolts were found to be below the allowable stress levels. Deflection calculations were performed for the shaft and the impeller. The deflection of the shaft relative to its bearings was 0.035 inches which is smaller than the allowable (0.05 inches). The upper and lower impeller deflections were also found satisfactory.

The stress at the anchor bolts were computed on the basis that they are required to withstand the overturning moment generated by the upper part of the assembly (pump and motor), by the lower part (suction column) and by the nozzle loads selected for the worst contribution in the magnitude of the overturning moment. Inpsection showed these bolts were attached as per design specification.

The seismic qualification of the equipment is based on the Housner spectra. During the SQRT visit at the plant site, the applicant was requested to present the results of the requalification of the equipment based on the site specific spectra. From the review of the requalification results it was concluded that while the design of the motor is still adequate for the new seismic loads this is not the case for the pump. In particular, based on the new site specific spectra the computed value of the shaft deflection exceeds the allowable required for the operability of the pump. Some overstress conditions was also found in the bolt stress of the column flange.

Based on our review of the reports, the field installation and the clarification provided by the applicant, we conclude that the equipment is not qualified due to the operability problems and overstress conditions which are possible to occur during a seismic event. This jugdment is based on the results of the reevaluation of the equipment with the new site specific spectra for the Fermi 2 Plant.

Open Items

1) Resolution of the maximum shaft deflection.

2) Resolution of the overstress condition.

E11-56-B-900-BA-003 RHR Cooling Tower

The RHR complex is an individual structure of the Fermi 2 Plant and employs a set of four one cell cooling towers which are classified into two divisions, each division containing a pair of such towers. These towers are parts of the residual heat removal service water system and they are located on the roof of the RHR complex. The top of the towers are at the 637'-6" elevation. This particular equipment was reviewed as a system made up from such components as: fan, motor, eliminators, fill, spray system etc., surrounded by reinforced concrete structural formations.

The major mechanical equipments included is a typical unit are the fan, the motor and the gear reducer. The fan has a 240" diameter, and operates under a 940 lb. trust for 3 lb/ft^2 loading. The motor employs two speeds and develops 150 H.P. The 36 gear reducer weighs 3150 lb.

The equipment was qualified by a combination of analytical and test procedures. The pertinent qualification report is:

> "Enrico Fermi Atomic Power Plant Unit #2, Residual Heat Removable Service Water System Cooling Tower Component Design Criteria and Design Calculations", by the Marley Company, Mission, Kansas, Feb. 8, 1974.

This qualfication report was reviewed and approved by the Sargent and Lundy Engineers.

The load combinations used for the analysis include dead, operating, seismic and tornado loads. The latter were obtained from a tornado analysis performed for the RHR complex. Each tower is open both at the top and the

bottom in order to perform its required cooling function thus, in the analysis it was considered as a vented system. The various equipment inside the tower we analyzed by assuming a static pressure drop associated with the tornado load. These loads are higher than the seismic loads and thus they control the design.

The required response spectra were provided from the seismic assessment of the RHR complex. In this analysis the Housner spectra were used and thus the floor response spectra are based on this input. A re-evaluation of the RHR cooling tower equipment based on the new site specific spectra for the Fermi 2 Plant indicated that the original evaluation of the equipment based on the Housner spectra is still adequate. The governing loads are still due to the tornado event.

The motor is mounted on a concrete pedestal with a set of four 3/4" anchor bolts (ASTM A-307). The shear stresses of these bolts are much lower than the allowable. The fan assembly was analyzed individually, in order to assure that it will maintain its structural integity and will perform its function under the loading events considered. A set of standard stress equations were used for the blade shank and bore evaluations. The blade clamp stresses were justified by the applicant. A set of tests were performed for the evaluation of the natural frequencies and the damping values of the fill and the eliminators. The natural frequencies of these components were found first, using the strain gage readings obtained from a Sanborn recorder. Following the determination of the natural frequencies, the damping was determined on the basis of fundamental vibration equations using recorded response time histories. The frequency value obtained by test for the fill

was verified by computation. The stresses in the fill and eliminator retainers were found to be below the allowable limits.

Very few of the equipment comprising the cell unit even for the most completed cooling tower unit were available for inspection during the SQRT visit. According to the applicant the remaining three cooling towers were even in a less completed state.

Based on our review of the reports, the field inspection and the clarifications provided by the applicant, the set of equipment-components of the cooling towers of the plant are not qualified since the in-service mounting of these components cannot be verified until completion of assembly.

Open Items

Complete field installation.

Powell 24", 300 lbs. Motor Operated Globe Valves

Equipment No. A 31-00-F-900-RA-029

Model No.: Valve 3051 WE; Actuator Limitorque SMB-4

Vendor: Wm. Powell Co.

These are two identical valves (identified as V8-2139 and V8-2140) located in the Reactor Building at elevations of 605'-11" and 589'-6", respectively. Each valve weighs 7515 lbs. and measures approximately 100" in height. The valves are welded to 24" pipes of the by-pass loop of the RHR heat exchanger. They are normally open but are required to close to allow shutdown cooling. These valves are required for both hot standby and cold shutdown conditions.

The valves are qualified by using beam-type idealization to analyse the valve body, and by utilizing tests for the (Limitorque) actuator. The qualifications reports consist of: (1) Seismic Analysis Report No. S-64048, dated, November 21, 1973, for the globe valve, and (2) Test Report No. 6-6246-1, dated, May 30, 1976 for the Limitorque valve actuator. These reports were prepared by Midwest Technical Service, Inc. and Aero Nav Laboratory, respectively. The first report was reviewed independently by the Ralph M. Parsons Co.

For the seismic analysis the valve body is assumed to be a cantilever beam with concentrated loads at various locations. A natural frequency of 24 Hz is calculated based on the maximum deflection of this cantilever beam. Maximum bending stresses for all critical sections of the beam are calculated from the bending moments due to the concentrated loads. Finally, combining

the bending and axial thrust stresses maximum allowable g's are calculated for each of the critical sections. Based on these calculations, the bonnet is found to be the weakest section of the valve with a maximum allowable g's of 10.27. This g level is, however, much higher than 1.862 g required for either of the two valves under the seismic reassessment plan. The required g value is obtained from the seismic analysis of the piping system to which these valves are attached. In calculating allowable g's, the effect of torsional stresses due to eccentricity of the motor weight is ignored. The torsional stresses will bring down allowable g levels to some extent but they are still expected to remain several times higher than the required g level.

The Limitorque actuator was subjected to single axis single frequency tests in which the effect of cross couplings between the two horizontal and one vertical motions was taken into account. The mounting conditions for these tests were as recommended by the manufacturer for field mounting. The test results show that the actuator has no natural frequency over the range 5-33 Hz, and that it maintains its functional operability in all three directions up to an acceleration of 6 g. This compares favorably with the required accelerations of 1.862 g.

Based on our field inspection, review of the reports and answers provided by Sargent & Lundy representative, we conclude that this equipment is qualified for seismic loads specified for the Fermi 2 site.

Open Issues

None.

A31-00-F900-RA-042: Motor Operated 4", 600 lb. Globe Valve

(W.E. Model-Fig. 16051-Valve)

(Limitorque Model SMB-0-40-Operator)

This equipment is a motor operated valve mounted on the minimum flow by-pass piping in the high pressure coolant injection (HPCI) system. It is located in the Reactor Building at elevation 555.5". This valve, which is normally closed, opens to discharge cooling water from the HPCI pump in the event of a low flow condition in the HPCI line. The valve is butt welded to the piping, there are no other supports.

This equipment was designed according to the Detroit Edison Co. Specification No. 3071-501. The following reports document the qualification of this equipment by test and analysis.

1) "Qualification Type Test Report, Limitorque Valve Actuators for Class 1E Service Outside Primary Containment", by Limitorque Corporation Test Laboratory, May 28, 1976, Report No. B0003.
2) "Report of Seismic Test on an SMB-0-25 Motor Actuator", by Aero Nav Laboratories, Inc., Jan. 6, 1976, ELT Report No. 5720.
3) "Seismic Analysis Report for a 4", 600 lb. Globe Valve, Figure 16051- W.E., with a Limitorque SMB-0-40 Motor Operator", by Wm. Powell Co., Jan. 25, 1974, Report No. S-65867.
4) See attached sheet.

Seismic tests were performed by Aero Nav Laboratories Inc. on an SMB-0-25 motor actuator to verify the units operability and to determine natural frequencies. These tests were conducted using IEEE-332 guidelines. The test mounting and the field mounting of the actuator were identical. Natural frequency scans and dwell tests to 6 g's in three directions were performed. No resonant frequencies below 33 Hz. were found. The actuator reportly performed satisfactorily during the dwell tests.

At the site audit, we noted that the installed actuator was an SMB-0-40, not the SMB-0-25, actuator tested by Aero Nav Laboratories Inc. We discussed this with the applicants, Detroit Edison Co. and with personnel from Sargent & Lundy Engineers. They indicated that the two actuators were the same model, and were dynamically identical. The difference being between the starting torque switch settings on the units.

The Wm. Powell Report, dated January 25, 1974, describes an analysis performed on the complete valve-actuator assembly to determine its fundamental frequency and maximum allowable g loads (based on allowable stresses). The maximum allowable g levels were computed by static analysis at critical sections of the valve assembly and the result was reported as 7.52 g's. The fundamental frequency of the assembly was computed using a three segment cantilever/lumped mass model. This model, processed by the program NATF3, predicted a fundamental frequency of 22 Hz.

The Wm. Powell Report considered 22 Hz to be outside of the range of seismic excitation and qualified the valve based on the tatic analysis allowable g levels. We discussed this with the applicant. They indicated that the model used to compute the fundamental frequency of the valve assembly was conservative and that the installed unit would have a fundamental frequency larger than 22 Hz. They also referred us to the natural frequency scan test on the valve actuator. As noted above, no resonant frequencies below 33 Hz were found in the valve actuator test, and the actuator is the most flexible portion of the valve assembly. Based on this information we accept the reports' contention that resonance will not occur and that a static analysis is justified.

The required SSE acceleration levels based on the reassessment piping analysis were 0.96 g N/S, 0.32 g vert. these values compare to the maximum allowable g levels of 7.5 g's in any direction for structural integrity, and 6.0 g's in any direction for operability.

Based on our review of the reports, the field installation, and our discussions with the applicant, we conclude that this equipment is qualified for the reassessed seismic loads specified for the Fermi 2 Plant.

Open Item

None.

COMPUTED BY: MSW

CHECKED BY: R.J. Fraser 7/30/81

PLANT: ENRICO FERMI POWER PLANT - UNIT 2

SUBJECT: VALVE ACCELERATIONS

VALVE TAG	STRESS REPORT	OBEI ACCELERATIONS (g)			NODE POINT	PIPING DWG
		A_x	A_y	A_z		
V8-2196	HPCI-05 5/23/78	.511	.245	.172	95	3165

x = PLANT N/S

y = PLANT VERTICAL

z = PLANT E/W

SSEI = 1.875 x OBEI

A31-00-F-900-RA-153: 20 Inch Wafersphere Valve with
Bettis Robotarm Actuator
(Jamesburg Valves with T316-B-SR1 Bettis Actuators)

This equipment is used for isolation purposes and to purge the airspace from the torous and the containment. Six of these valves are located in the Reactor Building at an elevation of 576'-0". The two containment purge valves (V21-2015, 2016) are connected to two lines installed opposite to each other with respect to the containment. One end of each of the valves is flange mounted with twenty 1-1/8 inch bolts while the other end is full penetration butt welded. The four other valves (VR3-3013, 3014, 3015, 3016) are connected to two lines coming from the torous. These are also located opposite to each other, but are placed 90° to the containment purge lines. Two of the four torous purge valves, namely, VR3-3014 and 3016, are flange mounted to the twenty inch lines on both ends of the valves and are installed in series with the other two valves. The mounting of the two latter valves are similar to the containment purge valves. Each valve is equipped with a T316-B-SR1 Air Operated Bettis Actuator, a NAMCO limit switch, and a ASCO Solenoid Valve.

The equipment was designed as per the Detroit Edison Specifications 3071-501 and 3071-12. The following reports were reviewed at the plant site.

(1) "Seismic Qualification of Valves covered by Detroit Edison Co., P.O. NO. IE-86782 for the E. Fermi Atomic Plant Unit 2 and processed under Jamesbury Order Nos. NC 46261, NC-34252 and JPB-7311"., Report No. JHA-76-34

by John Henry Associates, Inc., dated August 31, 1977, approved by Daniel International Corporation dated February 10, 1978.

(2) "ASCO Seismic Test Report" on ASCO Solenoid Valves 831655 and 831667. Report No. 91, dated November 4, 1974.

(3) NAMCO Report "Certificate of Seismic Qualification Test" on NAMCO Limit Switch, Report No. F-C3879.

The first report includes the design calculations of a typical valve as per ASME code formulae. The last two summary pages of the report relate to the seismic qualification of the valve. No details regarding the finite element model was available for review. According to the report the valve has a fundamental frequency above 33 Hz. Furthermore the stresses resulting from a static analysis with a horizontal coefficient of 5 g and a vertical coefficient of 3 g, are stated to be below the allowables. It was later confirmed by the applicant that the valve assembly was included in the piping analysis. The maximum g-values at the valve center of gravity from the piping analysis are found to be 1.065 g in the vertical direction and .971 in the horizontal direction. It should be noted that the SSE results yield lower g-valves than the OBE. However, these numbers are still within the design limits.

The last two reports were not available for full review. Instead, only summary statements of the reports consisting of 2 to 3 pages were submitted. These summaries state that both the solenoid valve and the limit switch were tested in the Laboratory for seismic environment. The test results did not show any adverse effects due to seismic excitation. When asked if the full

text of the test reports were ever reviewed by Fermi, the applicant confirmed that the complete original set of reports concerning these tests have never been sent to them.

It should be noted that from a generic viewpoint, the final g-values obtained from the as-built analysis of the piping system should also be checked for design limit compliance.

Based on our review, the inspection of the field installations and the responses from the applicant, we conclude that this equipment is qualified for seismic environment at the Fermi Site.

Open Items

None.

A31-01-F-900-RA-001: Swing Check Valves

(Anchor Valve Co.)

A 20"-900# Exercisable Swing Check Valve is mounted on each of the four feedwater lines, in series with an isolation valve. Essentially this device serves to isolate the reactor primary system from that of the secondary. Each end of the valve is connected to the pipe via a full penetration butt welding. All of the valves are located in the Reactor Building at an elevation of 278'-9-1/2". The valves are designed as per the Detroit Edison Specifications 3071-12 and 3071-501.

Seismic qualification of this equipment is established by analysis only. The report containing all design calculations is entitled "Design of 20" 900 lb excercisable swing check valve for Class 1 nuclear valve", Anamet Laboratories Report No. 373-98, Rev. A, dated October 30, 1973. This report was reviewed and accepted by Detroit Edison Co. It is dated November 26, 1973, and is filed in the DECO file #PL-378.

Most of the information included in the report relates to the standard design calculations performed as per ASME valve design methods. The last three pages summarize the results obtained from a static analysis of the valve with a horizontal load of 5 g and vertical load of 3 g. According to the report, the analysis was carried out via a computer program called "BILAPSS" developed at Anamet. No details concerning the methods of analysis and the modeling of the equipment was available for review.

The stress results summarized in the report are found to be below the allowable limits. The check valve is very compact in design and also is mounted in line with the piping system. The piping analysis resulted in a maximum valve acceleration of 0.178 g in vertical direction and 0.008 g in the horizontal direction. Since these values do not exceed the design g-values and the natural frequency of the valve is much higher than 33 Hz, no particular problem is anticipated with regards to this equipment during a seismic event.

The equipment was reassessed for the new site specific floor response spectra by performing a new piping analysis. These results are also found to be within the design g-level.

Based on our review, the inspection of field installations, and applicant responses, we conclude that this equipment is qualified for the expected seismic environment at the Fermi site.

Open Items

None.

P44-00-C-001A-RA-001: EECW Pumps

(8x6x14-1/2 Deming Pump with 100 HP 1760 RPM Lowell-Red Band Motor)

Two Emergency Equipment Cooling Water pump assemblies are located in the Reactor Building at an elevation of 613'-6". These function to provide cooling water for the emergency equipment. Each pump is of the centrifugal type and is mounted to the floor by four 3/4 inch bolts. The motor is similarly mounted to the floor and connected to the pump via a limited and float type coupling. The design specifications for this equipment are given in DECO 3071-512 and DECO 3071-85. At the time of the inspection the pumps were not in the installed position. Instead, a piece of piping was connected between the suction and discharge line for flushing. It is expected that the equipment will be reinstalled in a couple of months.

The report qualifying this equipment for seismic environment was prepared by McDonald Engineering and is dated September 28, 1973. It is entitled "Certified Seismic Analysis Report of Crane-Deming Horizontal Split Case Pump, Figure 5063 size 8x6x14-1/2". The report was reviewed and accepted by Detroit Edison Co. The equipment was qualified by analysis using the finite element computer code ICES-STRUDL.

The analysis model consists of the Deming pump, a GE motor (of the same capacity as the Red Band motor), and the flexible coupling. In a discussion with the applicant it was confirmed that structural similarity between the two types of motors indeed exists. In view of this, the report can be accepted for the Red Band motor and original pump assembly.

The first natural frequency of assembly was found to be 20.12 Hz in lateral and 15.87 Hz in vertical direction. The design g-valves used for this equipment are 1.41 g in both horizontal directions and 0.5 g in vertical direction.

The analysis results with regards to the stress conditions, input acceleration levels, deflection of impeller shaft and the flexible coupling misalignment, are found to be within the allowable limits. The equipment was required to be reassessed based on the site specific floor response spectra with 7% soil damping. The floor response spectra yields maximum input g-values that are .31 g in horizontal and 2.87 g in vertical direction. Since the vertical g'level exceeds the vendor design g'load, additional calculations were performed to determine the new stress levels.

The analysis results indicated that the low fundamental frequencies in the assembly are due to the flexible coupling and shaft. A reanalysis of this portion with the new g'-values yield stresses within the allowable levels, except for the pump outboard bearing where the reassessed value is 40% above the rated value. In order to resolve this issue, the applicant has taken the position to reduce the life of the equipment to 60 hrs. The applicant has confirmed that this duration of the pump life is sufficient enough for all emergency applications anticipated during the plant lifetime.

Based on our review, inspection of the field installations and the applicant's responses, we conclude that this equipment is qualified to the seismic loading specified for the Fermi site.

Open Items

None.

Floor Mounted York Instrument Rack

(Equipment No. H21-01-P-501B-RA-001

(Model No. #21-P501B)

This rack is located in the Reactor Building at elevation 551'-0" and is related to the control air system. The in-service mounting consists of six 1/2" bolts which are set up in two sets of three bolts on both the sides of the rack. The vendor is the York Electro-Panel Control Co. Inc., the rack is designed in accordance with the DECO Specification No. 3071-165.

For the qualification of the equipment an analysis was performed and documented in the following report:

"Seismic Analysis of Floor Mounted Instrument Racks", Report No. 77113-2, by Analytical Engineering Assoc. Inc., December 22, 1977.

This report was reviewed and approved by the Detroit Edison Company. The seismic qualification of the rack is based on the Housner spectra and it is not required to be requalified on the basis of the new site specific spectra. The equipment has been classified as passive.

A dynamic analysis was performed based on finite element techniques. Originally the STARDYNE computer program was employed for the analysis. For this purpose, a finite element model of the rack was developed by idealizing the rack as an assemblage of beam elements. The instruments were included in this model by considering them as rigid masses lumped at various locations on

the model. The modal characteristics of the model were determined and it was found that the lowest frequency is 13.8 Hz. Responses were then computed on the basis of the response spectrum technique by utilizing spectral values of the required response spectra with damping equal to 1/2% and 1% for the Operating Basis and Safe Shutdown earthquake respectively. Total stresses were computed for both seismic and dead loads. The resulting stresses were found to be below the allowable stress levels.

On the basis of the computed frequencies of the rack, it is concluded that amplifications of the floor response spectra are expected. Such amplifications are critical for the operability of the various instruments which are mounted at various locations along the rack. In order to avoid amplifications of the floor response spectra by transmission through the rack, it was decided that provisions will be made so that the natural frequencies of the rack will be shifted to higher levels. This was done by employing a set of two bolts in addition to the four bolts which were originally provided to hold down the rack on the floor. Thus, the final number of hold down bolts became equal to six. This field mounting was verified during the inspection of the equipment.

Based on this modification a new finite element model of the rack was developed. The modal shapes and frequencies of the rack were re-computed by using the STRUDL computer program. From the results of this analysis it was concluded that due to insertion of the additional two hold down bolts the bending mode of the support was eliminated from the modal shapes of the rack. As a result of this change, the corresponding frequencies are higher. The fundamental frequency is now above 33 Hz. Based on the new free vibration characteristics of the rack it is concluded that the floor response spectra

will not be amplified and thus the instruments which are mounted on the rack can be qualified for the floor response spectra. During the SQRT visit in the plant site, the applicant indicated that for the qualification of the instruments located in the rack the floor response spectra were utilized.

In conclusion, the structural integrity of the rack has been demonstrated and the usage of the floor response spectra (instead of specific response spectra obtained at the mounting locations along the rack) has been justified. During the inspection of the equipment, the inspector pointed out to the applicant that a set of instrumentation tubes were supported on a temporary support. The applicant replied that the supports of these tubes will be completed. In addition, during the SQRT meeting, the applicant was requested to revise the SQRT form for this equipment such that the re-calculated frequencies and the STRUDL computer code are indicated. Finally, the applicant was requested to conform that this particular equipment is not required to be re-qualified on the basis of the new site specific spectra for the Fermi-2 Plant.

Based on our review of the reports, the field installation and the clarification provided by the applicant, we conclude that the equipment is qualified for all seismic loads pending on the proper revision of the SQRT form of the equipment and the proper support installation of the instrumentation tubes.

Open Items

1) Applicant's statement that the equipment does not require re-qualification for the site specific spectra.

2) Report new frequencies in the SQRT form.

3) Report the STRUDL code in the SQRT form.

4) Assurance that proper supports will be provided for the instrumentation tubes.

C35-P001: Remote Shutdown Panel

The Remote Shutdown Panel controls the Remote Shutdown System. Mounted on the panel are the controls which can shutdown the reactor in the event of a situation which renders the Control Room uninhabitable or unable to function. The panel is located in the Reactor Building at the 613'6" level. It measures 96"x 30"x 90" and weighs 3000 lbs.

The seismic qualification of this equipment is shown by laboratory tests. The tests were performed by the Wyle Laboratory, Huntsville, Alabama. Actually, there are two tests reports. One is a report on the panel minus the Analogic Measurometer that is normally mounted on the panel. This instrument is a reactor pressure meter. The second is a report on the seismic qualification of the Analogic Measurometer itself.

The seismic test results for the Remote Shutdown Panel were reviewed and approved by W.F. Colbert of Detroit Edison in a letter dated July 27, 1977. The seismic qualification of the panel is contained in the Wyle Test Report No. 43414-1, dated, June 6, 1977. The panel was subjected to a low level (approximately 0.2 g horizontally and vertically) sine sweep along each direction from 1 Hz to 40 Hz to establish major resonances. Following a low level sine sweep along the horizontal and vertical direction, the panel was subjected to simultaneous horizontal and vertical inputs of random motion consisting of frequency bandwidths spaced one-third octave apart over a frequency range of 1 Hz to 40 Hz. The resulting TRS was analyzed at a damping ratio of 2% for the OBE and 5% for the SSE by a spectrum analyzer and plotted

at one-third octave frequency intervals over a frequency range from 1 Hz to 250 Hz. Five OBE and one SSE level tests were performed in each test orientation.

The Analogic Measurometer was subjected to a multiaxis-multifrequency seismic test as required by the Relainace Electric Company. This follows the test plan of the panel both in number of tests and in concept except that the RRS is defined at the actual location on the Remote Shutdown Panel as was previously obtained from an accelerometer mounted at that location. The test specimen was installed in a Reliance fabricated panel mount test fixture. The test was performed with the test mounting simulating the in-service mounting as closely as possible.

It was demonstrated the Remote Shutdown Panel, as well as the Analogic Measurometer which is mounted on the panel, possessed sufficient structural and electrical integrity to withstand the required dynamic environments without loss of function.

Open Issues:

None.

480 Volt SWGR Volt Regulator - 1500 KVA

(Equipment No. R14-00-S-900-QL-03)

(Model No. 787C48 4AE)

This equipment is contained in a floor mounted rectangular box located in the Auxiliary Building. The equipment was supplied by the I-T-E Imperial Corporation, Switchgear Division, Philadelphia, Pennsylvania. It was manufactured by the General Electric Co., Pittsfield, Massachusetts. There are two such units in the plant both of which are identical. Their role is to regulate the voltage in such a manner that a uniform steady state voltage output results. This equipment of a particular importance for instruments and other equipment whose operation is affected by input voltage variations.

During the SQRT visit to the plant site, the equipment was in operation. From the inspection, it became apparent that the in-service mounting was different than the mounting description given in the SQRT form. It was also found that the temperature of the room in which the unit is located was elevated. The applicant said that this was due to the fact that the air-conditioning lines provided to keep the room temperature lower were not yet in operation.

A concern was expressed with regards to the clearance between the voltage regulator and other nearby electrical equipment i.e., the transformer. Some pieces of rubber padding were placed in the space between the sides of the regulator and the sides of the equipment at its junction. The applicant was requested to assure that this clearance is adequate to accommodate the lateral displacements of the equipment in the event of a seismic disturbance.

The 480 volt SWGR regulator was qualified by the Wyle Laboratories, (Scientific Services and Systems Group, Huntsville, Alabama). The procedures and the results of the seismic simulation test program performed by Wyle Lab for the regulator are reported in a document entitled:

"Seismic Simulation Test Program on a Voltage Regulator",
by Wyle Lab, April 9, 1975.

The equipment qualification is based on the requirement that it will demonstrate sufficient structural integrity and electrical operability when subjected to the simulated seismic environment appropriate for the Fermi 2 Plant site.

The test mounting of the equipment was intended to simulate actual in-service mounting. According to the specifications given to the Wyle Lab six 7/8"-9 standard pressed steel cap screws were used for mounting purposes. When the regulator was placed on the test table, it was found that the pre-drilled test table hole did not line up with the center mounting hole of the equipment. Because of this, the front center of the reinforced regulator mounting pad was welded to the test table. The in-service mounting was subsequently modified to reflect the test conditions. The revised mounting design verified during the inspection consists of 2"-1/4" leg fillet welds with two welds per mounting pad. The design for the mounting was revised later. The new design specifications was reviewed and found adequate.

Resonant search and multi-frequency multi-axes tests were performed for the qualification of the voltage regulator. The sweep rate for the resonant search test was one octave per minute over the frequency range of 1 Hz to 50 Hz. The amplitude used for both horizontal and vertical directions was equal to 20% g. The random input synthesized from frequencies spaced 1/3 octave apart in the frequency range of 0.5 Hz to 50 Hz, was applied

simultaneously in the horizontal and the vertical direction. With 30 seconds input duration, a set of five OBE and one SSE tests were performed at different equipment orientations. Incoherent phasing between the horizontal and vertical random inputs was synthesized during the tests.

A spectrum analyzer was employed for the analysis of the table motion and it was demonstrated that the required response spectra are enveloped by the test response spectra over the frequency of the interest. The response of the regulator during the tests was measured by a total of fourteen accelerometers placed at various locations within the unit. The regulator was energized during the seismic test and fluctuations of the voltage of the input lines were simulated in order to evaluate the performance of the equipment under the imposed random inputs.

The operability of the 480 V SWGR voltage regulator before, during and after the seismic excitation was verified on the basis of the records obtained from ten electrical monitoring channels used for the test. These tests also demonstrated that the equipment maintained its structural integrity.

During the seismic qualification review at the plant site the side-to-side maximum displacement was calculated and found to be satisfactory. The evaluation of this displacement is based on the acceleration record of one of the accelerometers employed during the seismic simulation test. This particular accelerometer was picked among others because it measured the acceleration response in the side-to-side direction and was located at the top portion of the regulator.

Based on the inspection of the equipment at its in-service installation, the review of the technical reports and the clarifications provided by the applicant, it is concluded that the equipment is qualified for the seismic loads employed for design of the E. Fermi 2 Plant.

Open Items

None.

R32-00-S-900-RA-003 Battery Racks-KCU-17

The battery racks are open frame structures which support an array of batteries. The batteries are intended to provide D.C. power for the outside primary containment isolation valves.

A single rack measures 11'6" long x 18.8" wide by 21.75" high. There are four such units in a group and two groups in a room. There are a total of 16 units in the two rooms which are located in the Auxiliary Building at the 643'6" level.

The battery racks are seismically qualified by similarity and by analysis. The analysis is based upon a detailed dynamic analysis of a similar rack which used the response specturm modal analysis technique. The results obtained from calculations made in this report are justified by a comparison with the same type of calculations made in the similar system.

The KCU-17 Battery Racks are structurally similar to a LC-15 rack. Both have simialr geometry and bracing. The assembly techniques and hardware are also similar.

Two conclusions may be drawn from the similarity. First, those modes which characterize and which dominate the dynamic behavior of the LC-15 rack will also characterize and dominate the dynamic behavior of the KCU-17 rack. In addition, the degree of modal interaction among the dominant modes will be about the same as that of the KCU-17 rack.

The seismic qualification for the KCU-17 battery rack is documented in a report entitled, "Seismic Analysis Report of KCU-17 Single Tier Battery Rack for Enrico Fermi Power Plant, Unit 2". The report dated June 1, 1977 was prepared by the Corporate Consulting and Development Company, LTD for C & D Batteries Division and was approved by J. Roland Yow.

The calculation methods used to analyze the KCU-17 rack are compared with the same technique when applied to the LC-15 battery rack. The results are then compared to those obtained from a detailed dynamic anlaysis of the LC-15 rack. The finite element model analysis was used to represent the LC-15 single tier rack. Both modal and stress analysis were performed using the finite element program MRI-STARDYNE3. The response spectrum modal analysis technique was used. The response of all modes below 40 Hz were combined using the absolute summation method.

The structural simplicity of the basic rack design lends itself to hand calcualtions which were confirmed by the finite element anlaysis. The same type of hand calculations were then used to evaluate the natural frequencies of the KCU-17 rack.

The comparison between the simplified and dynamic analysis is made by means of a static coefficient which represents the ratio of dynamic to static responses. Model interaction effects are accounted for by a ratio greater than 1. For the LC-15 racks, the maximum factor was reported to be 1.26. However, for the KCU-17 battery rack, the factor was taken as 1.5, as suggested by the IEEE Standard 344.

The input response spectrum was also conservatively taken. The largest floor response horizontal and transverse spectrum acceleration were combined with the largest vertical spectrum that exists at or above the fundamental natural frequency. The combination of of the two was made by taking the square root of the sum of the squares. This combination was then multiplied by the factor of 1.5 to account for modal interaction. Additional conservatism was introduced by using an input at the DBE acceleration levels but requiring the lower OBE allowable stress levels. The results show that the maximum stress developed in the frame is 15539 psi which is less than the allowable of 18,000 psi for the material.

The battery racks KCU-17 are therefore dynamically qualified for the required loads.

Open Issues:

None.

Nuclear Penetration Canister Assembly

(Equipment No. T23-01-X-900-BA-008

The Nuclear Penetration Canister Assembly provides for the containment isolation of electrical cable feed through while at the same time providing radiation shielding. The penetrations are welded assemblies which measure 19" x 19" x 113" long. The one that was inspected was located at the 604' level, in the Reactor Building at the primary containment.

The penetrations were qualified by analysis. The maximum valves from the required response spectra were used to determine the maximum induced stress. The maximum load combinations considered include Pressure + Dead Load + SSE + Jet Force.

There are two qualification reports. The first is entitled, "Stress Analysis for Electrical Penetration Canister Assembly", dated, June 18, 1973 and the second "Seismic Analysis of Electrical Penetration Assemblies", dated, January 17, 1974. The reports were prepared by the Cornax Corporation. The reports were reviewed and approved by the Ralph M. Parsons Co., signed by G.L. Mailer and subsequently approved by R. A. Vance of Detroit Edison in a letter to the Cornax Corporation, dated, May 4, 1976.

The analysis was done for a representative worst case canister tube since all canister tubes and mounting supports are almost identical. The worst case was taken as one which supports the greatest total weight of feed through assemblies. These are the penetrations which contain the medium voltage power units X-101A and X-101D with 3-750 MCM feedthroughs and 3-500 MCM feedthroughs. The vibration natural frequencies were determined by using

the Rayleigh Method. The lowest natural frequency was 8 Hz in the side to side as well as in the vertical direction. The stress calculations show that the maximum stress at critical structural elements are less than the allowable stress levels.

It is concluded that the Nuclear Penetration canister assemblies are capable of withstanding the required dynamic loads imposed during the operation and design basis earthquakes and will perform their intended function under the maximum loadings.

Open Issues:

None.

Reactor Vessel Stabilizer Equipment No. B11-U002

Model No. 76E926 PI; Vendor: GE

The reactor pressure stabilizer is located in the Containment Building at an elevation of 565'. It consists of a set of eight steel bumpers each measuring 7'x15"x13" and weighing approximately 2,000 lbs. The main components of these bumpers are: a lug, welded to the reactor vessel, two brackets welded to the shield wall, and a series of springs and washers held between the brackets with a pre-tensioned rod. The bumpers are located equi-distance around the circumference of the reactor vessel and are used to restrain its horizontal movement. They do not provide any resistance to the vessel's movement in the vertical direction.

The stabilizer is required to be functional under both hot standby and cold shutdown conditions. Its pertinent reference design specifications are included in GE Document No. 762E926. The qualification reports consist of a GE Design Record File, B13-107, Presure Vessel Stabilizer, dated January 30, 1978, and a Sargent and Lundy Report, SDD-DECO-004, Assessment of Stabilizer Truss, dated April 24, 1981.

In the Sargent and Lundy report, a resultant horizontal load of 2070 kips is calculated as an absolute sum of equivalent static loads of 346, 1579 and 145 kips for seismic, pipe pressure and pipe rupture forces, respectively. Based on this horizontal load a design load of 429 kips is obtained for each

bumper of the stabilizer. The GE report shows that for a design load of up to 600 kips the pre-tensioned rod would be the critical member of the bumper assembly, i.e., stresses in the brackets and welds would considerable lower than those in the rod. Under a combined loading of pre-tension and thermal expansions of both the rod and the pressure vessel, a maximum stress of 82 ksi is calculated in the rod. This value is considered acceptable when compared to an allowable stress of 90 ksi. The calculated stress is not appreciably affected by the seismic, pipe pressure and pipe rupture forces since the length of the rod between the brackets is not expected to change too much under these forces. Furthermore, when calculating the new stresses due to seismic reassesment there is no substantial increase in the rod stresses. The increase in the seismic load does increase the bumper design load to some extent, but it remains below 600 kips.

Based on our field inspection, review of the reports and responses provided by GE representatives, we conclude that this equipment is qualified for seismic loads specified for the Fermi 2 site.

Open Issues

None.

B21-F022/28: Main Steam Isolation Inboard and Outboard Valves

(Model No. DWG 21150-H)

The Enrico Fermi 2 Nuclear Boiler System is equipped with main steam isolation valves (MSIV). Each of the plant's four main steam lines contain a pair of MSIV's. One of the valves are located inside the drywell while the other outside at the steam tunnel. All eight Fermi 2 MSIV's are identical. They serve to isolate the turbine for the steam carried in the main steam line. When they are closed, no steam can pass to the Turbine Building.

A typical main steam isolation valve was inspected at the plant site. It was located at the steam tunnel outside of the drywell. One of the Review Team's concerns was verification that the valve was not tilted from the vertical plane. This type of deviation in the in-service mounting was found previously in another BWR Plant. According to GE recommendations, the optimum operability of the valve is achieved, when the axis of the valve is inclined at 45° from the axis of the main steam line, whereas the plant defined by these axes is vertical. The MSIV inspected at the Fermi 2 Plant was found to have the recommended orientation. The body of the valve is welded on to the 26" main steam line, while the bonnet flange, has a set of twenty 2" bolts. The applicant was requested to comment on the available space between the actuator of the valve and the surrounding equipment and structural formations. According to the applicant there is sufficient space for the required operability of the valve.

The seismic qualification procedures for this equipment are given in a report entitled:

"Seismic Analysis for Atwood & Morrill 26", Size 'Y'
Type Main Steam Isolation Valve", by Atwood & Morrill
Order No. 11682.

This report contains two revisions dates, 1/24/72 and 9/30/73. The report was reviewed and approved by the General Electric Company (10/1/73).

A model of a typical main steam isolation valve was developed in order to evaluate its free-vibration characteristics as well as its response due to prescribed seismic loads. The STARDYNE computer code was employed for the analysis. The discretized model of the valve contains a total of 39 nodes. In modeling the valve, the yoke rods, pneumatic cylinder, springs and the valve stem were represented by a system of lumped masses and springs. In this idealization, the valve body was treated as rigid. Based on this model, the natural frequencies and the modal shapes were evaluated first. The frequencies were found in the range of 0.25 to 33 Hz. For the response computations the input was applied concurrently in each of the horizontal and vertical axis. In order to assure the structural integrity of the valve, stress calculations were performed by taking into account of other loads such as dead and operating loads. A static simulated test was performed in order to test the operability of the valve.

At a latter time, new evaluations were made with regard to the seismic qualification of the equipment. In particular, the 39-node model mentioned above was expanded to a new more detailed model consisting of 48 nodes. The additional items contains in the new model included the actuator and damper pistons, as well as other parts of the valve. This new model is considered to be more accurate than the first.

The conclusion obtained by utilizing the new model was that the valve will maintain its structural integrity and will operate for the specified GE acceleration levels which are, 1.5 g in horizontal and 0.6 g in vertical directions. Stress computations based on these seismic levels as well as other loads (i.e., dead and operational loads), indicated that no stresses above the allowables will occur at any point of the valve. The ASME requirements for fatigue were also satisfied.

Due to the fact that the equipment is pipe mounted, the GE reprsentative was requested to verify that the acceleration levels obtained by the piping analysis of the main steam lines, are consistant with the acceleration levels employed for the qualification. It was concluded that the vertical acceleration obtained from the piping analysis was higher than the value used for the qualification. In order to resolve this unacceptable situation, an additional calculation was carried out. The results of the latter calculation indicated that the allowable acceleration levels of the valve where higher than those demonstrated from the piping analysis. The GE representative was requested to document these calculations. An official summary explaining the different stages of the qualification efforts was also requested.

At the close of the Seismic Qualification Review Meeting, the applicant was requested to revise the SQRT form to include the following:

1) Correct the pertinent reference design specification so that it indicates Rev. 3 instead of Rev. 4. (According to the G.E. representative there is not a fourth version of this technical report.)
2) To fill in the number and the size of the bonnet flange bolts.
3) To correct the title of the qualification report.
4) To indicate that STARDYNE version was used.
5) To fill in the maximum critical deflection and justify the allowable.

The applicant corrected the SQRT form as requested and therefore the above five cases do not represent open items.

Based on our review of the technical reports, the inspection and the clarifications given by the applicant and GE we conclude that the equipment is qualified for seismic loads prescribed for the Enrico Fermi 2 Plant.

Open Items

None.

B31 F031: Recirculation Discharge Valve

(Lunkenheimer, D-12461)

Two recirculation dishcarge valves are installed within the reactor water recirculation system. These serve to open the recirculation system. Each valve is a massive structure weighing 10,275 lbs. It is mounted on the 28 inch line located on the discharge side of the recirculation pump. Both of these valves are located inside the primary containment at elevation 578'-10". This equipment is a 800# stainlesss steel Bolted Bonnet Gate Valve which is mounted to the pipe with full penetration butt welds. The valve is motor operated by an extended structure which weighs about 1325.3 lbs.

Documentation qualifying this equipment was prepared by Lunkenheimer and was reviewed by GE. The report is entitled "Design Calculations for Discharge Valve No. B31-F031 on GE Purchase Order No. AA-535 for E. Fermi Project", Technical Report No. 354, Rev. 3, May 10, 1971 (VPF 2803-69-6). The report was later revised for the new floor response spectra developed from the plant specific ground input motion.

The valve is originally qualified by performing a static finite element analysis. Preliminary calculations indicated that the first fundamental frequency is above 33 Hz. Hence, a static analysis with 1.5 g in horizontal direction and 0.14 g in vertical is justified. However, according to GE the seismic analysis carried out for the piping system includes the valve operator in the finite element model. These results show that the valve operator experiences about 2.0 g in the horizontal and 0.6 g in the vertical directions.

This problem (of exceeding the design limits) was discussed with GE personnel. Additional documentation was then provided (based on the material allowable limits). These results indicate that the valve assembly could exhibit a horizontal g-load of 19.91 g and vertical of 4.0 g without any deleterious effects.

The valve was again reassessed with the new load criteria corresponding to the site specific spectra. It was found that attenuated new g-values from the piping analysis when subjected to the new spectra are not exceeded by the above limit values.

From the structural resistance point of view, the equipment is found to have adequate strength to withstand the seismic environment. However, the operability of the valve was never demonstrated in the report. According to GE, since the stress conditions do not exceed the elastic limit, the valve operator would not experience any permanent deformation during the seismic event. Hence, the operability of the valve operator will be maintained.

Based on our review, the inspection of the field installations and the applicant's responses, we conclude that this equipment is qualified for the seismic environment specified at the plant site.

Open Items

None.

C11-D001: Hydraulic Control Unit

(General Electric, Model #729E950G5)

The function of the hydraulic control unit is to trigger the control rod drive mechanism in order to insert or withdraw the poisoned control rods in the reactor core assembly. There are 185 units installed at two locations in the Reactor Building at an elevation of 583'-6". Each unit controls one control rod in the reactor core. Each HCU consists of two valves, two cylinders, four solenoid valves, tubings connecting these components, and many other small items. All the components are found to be tied together into a supporting frame which is mounted to the floor by four 1/2" bolts. Several such units are structurally held together by a common frame structure. These are housed in separate rooms isolated from other noncritical systems.

The report qualifying the HCU is entitled as "Hydraulic Control Unit Test Report", Documentation No. 384HA183, dated July 21, 1975. The report was prepared and reviewed by the General Electric Company. The testing was carried out by the Wyle Labs as per test Specification 21A8799. The Wyle Lab Report No. 3503 dated July 16, 1973 is included as appendices in the original GE Report.

In carrying out the test the complete unit was mounted to the test frame in a manner similar to the actual mounting condition. However, the tubing coming out of the unit to the discharge volume header line were held together

by a plate mounted at the top. This is somewhat different from the actual installed case. The test was conducted to a satisfactory completion of a SCRAM cyle. SCRAM is achieved by activating air pilot valves V117 and V118 when the device is in the prepared SCRAM conditions. For a successful SCRAM, the accumulator pressure of the device must decrease from 1510 psig to 750 psig within 2 seconds or less from the time of activation of the air pilot valves.

The test included a search for the natural frequency between 1-50 Hz and a simulated seismic excitation test of the equipment. This was followed by a test up to a g-level of 15 g. The test was completed without significant damage to the HCU. After the first test, some damage was observed. This however, was due to the test frame itself. The supporting frame structure was subsequently braced. Later tests were then successfully completed without damage.

The equipment was reassessed as per the new spectra specified for the Fermi site. Since the test g-level is much higher than the new g-values, the equipment is qualified for the new spectra.

It should be noted that the equipment qualified by GE includes only part but not all of the tubings connected to 2-inch header lines. This header line is under the design scope of Detroit Edison. At the time of the site visit, these lines were not properly supported for seismic environment. Later discussions with the applicant has confirmed that supports will be installed at a future date. In view of this, it is to be noted that the operability of HCU depends on the installation of pipe supports for the 2-inch header lines.

Based on our review, inspection of the field installations and the applicant's responses, we conclude that the equipment is qualified for the seismic environment specified at the Fermi site. The final qualification of the equipment, however, depends on the proper installation of supports for the 2-inch header lines.

Open Issues:

(1) Tne 2-inch header lines above the hydraulic control units should be supported properly for any possible pipe breaks at the time of seismic occurrences.

Differential Pressure Transmitter Equipment No. B31-N014A

Model No. 368; Vendor: Barton

This differential pressure transmitter is located in the Reactor Building at an elevation of 562'. It weighs 9 lbs. and measures approximately 8-1/2"x 6"x9". It is fastened with 4 bolts to a moderately thin base plate which is mounted on an instrument stand with another 4 bolts. The instrument stand is welded to the floor and has several other instruments of various sizes mounted on it. Physical dimensions of the transmitter mounting plate and actual positions of the bolts were not available during the SQRT visit. These are expected to be sent to us shortly from Detroit Edison.

The transmitter is located in the recirculation system and measures the recirculation flow. It is not required either for hot standby or for cold shutdown conditions. It is designed as per reference design specifications GE PPD 145C 3026. The Qualification Report No. GE 117C3387 entitled, "Differential Pressure Transmitter", contains a section (VPF 145C 3026-4a, dated November 9, 1971) by Wyle Laboratories on vibration test results for the transmitter. This report was reviewed and accepted by GE.

Test results show that the transmitter has a natural frequency of 30 Hz in the front/back direction. Vibration endurance tests using frequency sweep over 1-50 Hz range are presented to establish the operability of the transmitter up to an input g-level of at least 1.5 g in the two horizontal and

the vertical directions. The corresponding design basis accelerations in side/side, front/back and vertical directions are 1.5 g, 1.5 g and 0.14 g respectively. The qualification report does not specify mounting configuration (as compared with field mounting) for the transmitter during these tests. The report also does not make it clear why a single frequency, maximum input acceleration test was not conducted at the natural frequency of 30 Hz even though such a test was specifically required by GE design specifications. Further information was, therefore, requested during the SQRT visit regarding possible amplification of the input acceleration by the instrument stand and the base plate, and the operability of the transmitter at its natural frequency.

Based on our field inspection, review of the reports and responses provided by GE representatives, we conclude that further data and information is required in order to complete our seismic qualification review for this equipment.

Open Issues:

ok (1) Provide details of the field and test mounting configurations, and assess the effect of amplification of input acceleration by the instrument stand and the base plate.

? (2) Establish operability of the transmitter at its natural frequency (30 Hz).

E11A-K001A: G.E. HGA Relay

The HGA Relay is part of the residual heat removal system. It is energized to initiate the emergency core cooling system actions.

The relay is a small box-like equipment which measures 4"x 4-1/2" x 2-1/2" which is field mounted to the H11-P617 panel. The panel is located in the Reactor Building at the 613'6" level.

The relay qualification tests are contained in GE Document No. 225A6250, "Seismic Test Results, G.E. HGA Relay", dated, May 5, 1970 and in G.E. Document No. 234A9802, "Seismic Tests Results", Relay HGA, dated May 5, 1971. Both of these tests are summarized in G.E. Document No. 225A6964, "Seismic Qualification Summary, Relay G.E. HGA", dated August 24, 1973 and approved by C. A. Vondamn.

The relay, when de-energized and with normally closed contacts, will not chatter for a time duration in excess of 10 ms for input motions of up to 1.5 g in the most critical axis when vibrated over the frequency range from 1 to 30 Hz. The critical axis is normal to the front face. The tests also show that the relay will operate normally up to 1.1 g's along this critical axis, if the chatter limit is 1 millisecond. The other two axes will tolerate 4 g's and 5 g's respectively. A resonance occurs at 32 Hz in the critical axis direction and appears to be the limiting factor for this equipment. For the application on the H11-P617 panel, the limitation of 1.5 g's is the maximum malfunction limit for which documentation is available. This limit is applicable only if the 10 ms chatter is the acceptable duration.

The required acceleration at the floor level of this equipment is 1.5 g in both the S/S and F/B and 1.4 g in the vertical direction. Therefore, the relay can operate successfully at the 1.5 g level only if there are no resonances on the control panel over the frequency range of excitation since this would amplify the input at the mounting point of the relay.

Following a review of the equipment during the site inspection visit, two open items remained for this equipment. These were listed in the memorandum, dated July 30, 1981 from S.E. Hassan to R.L. Smith on the subject, "Addressing Open Items From NRC Site Audit of Seismic Qualification". Open Item A requested a statement for the acceptable chatter limit for the HGR Relay. A response was given during the Exit Meeting and is listed in the memo as 20 m sec. But the malfunction limit of the equipment for this chatter limit is not documented.

The second Open Item asked for the resonant frequencies of the panel and the amplification factors at the location of the relay. The resonant frequencies of a similar panel were listed on the memo as occurring within the excitation frequency range. But the seismic test report of the similar panel was to be sent.

The seismic test report was received at BNL on September 1, 1981. It was entitled, "Test Report Cofrentes H13-P618", GE No. DRF No. H13-42. This panel is similar to Fermi H11-P617. Table 8-1 of this report shows sizeable resonances over much of the panel. Amplification factors are as high as 7.8 at the top of the panel. Further down, at about half the height, the amplification is 4.0 at 25 Hz.

The seismic qualification documentation regarding the G.E. HGA Relay is therefore still incomplete. It cannot be concluded from the documentation that the equipment can satisfactorily function under the required seismic environment.

To sum up what is revealed in the documentation:

a) The relay can withstand 1.1 g for a chatter limitation of 1 ms.

b) The relay can withstand 1.5 g for a chatter limit of 10 ms.

c) The acceptable chatter limit for this equipment is 20 ms, but malfunction limit at 20 ms is not documented.

d) The required acceleration at the floor level is 1.5 g.

e) A similar panel (Cofrentes) has resonances in the frequency range up to 33 Hz with the maximum amplification of 7.8 at the top and with an amplification of 4.0 toward the center.

f) The nature of the similarity between the two panels loaded with their own instruments or the rational of the dynamic relationships that might be expected between them is not documented.

As a consequence of this, several questions remain. These are listed as the following Open Items.

Open Items:

? 1a) Rationalize the dynamic similarity between the Cofrentes panel H13-P618 and the relay panel H11-P617 from the point of view of the differences in the instrumentation loading as well as from the structural viewpoint.

? 1b) What would be the expected maximum amplification factor at the relay location on the Fermi panel.

? 2. What is the malfunction limit in g's of the relay.

Differential Pressure Transmitter

Equipment No. G33-N041

Model: 555, Vendor: GE/Bailey

This instrument is located in the Reactor Building at an elevation of 576'9". It is box shape in appearance measuring approximately 9.7" x 5.5" x 5.5" and weighing 23 lbs. It is fastened to a 1/2" thick plate with four 5/8" bolts. The plate is mounted on a wall with stiff channel racks and four 1/4" bolts. The instrument is located in the reactor water clean up unit and measures the return flow to the reactor pressure vessel. It is not required to be functional either for hot standby or cold shutdown conditions.

This differential pressure transmitter is designed as per General Electric Reference Design Specifications GE PPD 14C3007. The Qualification Report No. 225A6259, dated, May 30, 1970 is part of another Report, No. GE 145C3007 entitled, "Differential Pressure Transmitter." These reports were prepared and reviewed by GE.

Results for single frequency, single axis sine beat tests are presented in the qualification report. These results show that the transmitter has no natural frequency in the frequency range 5-33 Hz. Under input g-level tests, the instrument maintains its operability for side/side, front/back and vertical accelerations of 1.5 g, 1.5 g and 0.5 g, respectively. The corresponding required accelerations in these three directions are 1.5 g, 1.5 g and 0.14 g. Further, a fragility test at 33 Hz demonstrated that the transmitter performed normally up to 12 g.

Based on our field inspection, review of the reports and responses provided by GE representatives, we conclude that this differential pressure transmitter is qualified for seismic loads specified for Fermi 2 site.

Open Issues

None.

GE Rack - H21-P025

The G.E. H21-P005 is a local rack on which is mounted 8 Rosemont D/P Transmitters which measure steam flow. It is located in the Reactor Building at the 583'-6" level.

The H21-P025 rack at Fermi 2 is structurally the same as other G.E. racks that were previously tested for the Peach Bottom Nuclear Plant. The Fermi 2 rack is an open frame structure which measures 72" x 72" x 24". The qualification of the Fermi 2 rack is based on tests that were made on a similar six foot rack at the Peach Bottom Nuclear Plant. The test results are contained in the G.E. Report, "Seismic Test Results, Local Racks Standard Plant", GE No. 225A6555, dated, July 14, 1970 and approved by R. E. Green. The report shows that resonant frequencies occurred at 20.1 Hz and 23.3 Hz. In addition, because of the construction of this type of rack, the maximum amplification is only about 3.

The Rosemount Model 1151 Differential Pressure Transmitters are also seismically qualified by test. The seismic qualification of the entire rack was approved by E.G. Margerone of the Nuclear Energy Division of G.E. in a Memo dated July 30, 1981. The Rosemount Test Report 9726C entitled "Seismic Vibration Test Report Rosemont Model 1107", dated, September 11, 1972 and the Rosemount Report 12737F entitled, "Vibration Test Report 1151 Pressure Transmitter Module", dated, December 11, 1973 showed that this equipment can withstand and operate successfully over the range of 4 Hz to 70 Hz with X = 5.5 g, Y = 31 g and Z = 15.5g. The electromagnetic shaker limited the ability to test below 4 Hz. However, other tests showed that the natural frequencies of this equipment are very high and so the effective lower frequency limit could be taken as zero.

The results of the tests show that the essential instrumentation will function at the seismic levels that are required by the response spectra. The Fermi 2 H21-P025 local rack and the Rosemont Differential Pressure Transmitters will operate as required under the seismic loading at the site.

✓ Open Items:

None.

158B7072 - Temperature Control Element

(Model No. C41-N006-Fenwal Inc.)

The temperature control element measures and displays the liquid temperature in the Standby Liquid Control (SLC) tank. This instrument is located in the Reactor Building at an elevation of 659.5'. The instrument has two components, a sensing element and a temperature control/display. The sensing element is located in an 8.5" x 1.0" O.D. cylindrical thermal well that is welded into the base of the wall of the SLC tank. The control/display unit is located on an instrument rack approxiamtely 10' away from the sensing element. The two components are connected via a conduit protected wire.

The temperature control element is not required to operate during or after a seismic event. However, the thermal well in the side of SLC tank is a Class B pressure integrity instrument. Thus it must maintain structural integrity during and after a seismic event, so that the SLC tank does not leak. The instrument was designed according to G.E. purchase part Drawing No. 158B7072.

The thermal well was qualified by analysis in the G.E. Report "Temperature Control Element", by July 25, 1981, Report No. DRF A00-1043-15. This design record file contains the results of a static analysis of the thermal well that was carried out to determine the margin of safety between the allowable stresses and the design hydrostatic pressure stresses. The report indicates that the allowable stress level is two orders of magnitude larger than the design hydrostatic stress. The report also contains a natural frequency analysis.

Using a cantilever beam model for structural idealization, the fundamental frequency of the thermal well is reported to be in excess of 500 Hz. It is to be noted, however, that no seismic stress analysis of the thermal well was performed in this report.

After discussing this problem with G.E. personnel, they indicated that the large margin of safety between allowable and hydrostatic stresses, and the large natural frequency, would allow for large g levels at the thermal well. It was felt that the allowable g levels would far exceed the required input g levels. The SQRT Review Team requested and received a statement to this effect from the G.E. personnel (see attached sheet).

On the basis of the design record file, and the statement supplied by G.E, it is concluded that this instrument is qualified for the seismic and hydrostatic loads specified for the Fermi 2 Plant.

Open Items

None.

Master Parts List No. C41-N006

Purchased Part Drawing No. 158B7072

Vendor Fenwal

Description Temperature Control Element

The above piece of equipment as given above is qualified to the original design basis seismic requirements for the Fermi 2 Atomic Power Plant as justified by the margin of safety between the allowable stress of 8,827 p.s.i., the hydrostatic stress of 30 p.s.i., and the negligible seismic stresses (due to the high natural frequency 558 Hz.) in the thermal well as outlined in the G.E. Qualification File DRF No. A00-1043-15.

R. L. Smith
Sr. Project Engineer
7/21/81