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September 13, 1996
NRC-96-0109

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

- References:
- 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43
 - 2) NRC Letter dated December 7, 1995, Fermi 2 Control Center Heating, Ventilation and Air Conditioning System (including Safety Evaluation on the same subject)
 - 3) NRC Letter dated February 21, 1996, Control Center Heating, Ventilation and Air Conditioning (CCHVAC) Concern Resolution
 - 4) Detroit Edison Letter NRC-96-0042 dated April 3, 1996, NRC March 1, 1996 Meeting to Discuss Fermi 2 CCHVAC Duct and Duct Support Structural Qualification Approach
 - 5) Fermi Design Criteria Document FERMI-DC-76230-1, Revision A dated June 27, 1996, CCHVAC Duct and Duct Support Qualification

Subject: Summary Status Report for Fermi 2 CCHVAC Duct and Duct Support Structural Qualification Activities

Detroit Edison has completed the evaluations related to the Control Center Heating, Ventilation, and Air Conditioning (CCHVAC) System duct and duct support structural qualification in response to the Reference 2 NRC letter. The purpose of this letter is to summarize the results of the evaluation, and to describe the remaining activities that will be completed prior to restart from the upcoming fifth refueling outage (RFO5). In summary, Detroit Edison is confident that all of the issues and concerns raised by the NRC staff in Reference 2 and subsequent meetings have been properly resolved, and that with the completion of the remaining modifications, the structural adequacy and qualification of the CCHVAC duct and related supports will have been demonstrated.

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Background

In Reference 2, the NRC provided Detroit Edison with a Safety Evaluation regarding the structural qualification of the Control Center Heating, Ventilation and Air Conditioning (CCHVAC) system for the Fermi 2 plant. The NRC Safety Evaluation noted some deficiencies in information previously provided by Detroit Edison, identified several remaining concerns, and requested that Detroit Edison perform further evaluations of the structural adequacy of the CCHVAC ductwork and supports, with proper consideration of the concerns and issues contained in the letter and associated Safety Evaluation. The Reference 2 letter requested that the CCHVAC structural adequacy evaluation and any necessary changes to demonstrate compliance with the committed requirements be completed prior to restart following the fifth refueling outage, scheduled to begin September 27, 1996.

The following discussion summarizes the actions taken by Detroit Edison in response to the Reference 2 NRC letter.

Actions Taken to Resolve CCHVAC Issues

Upon initial review of the Reference 2 NRC letter, Detroit Edison developed an integrated action plan for the resolution of all concerns identified by the NRC. Detroit Edison retained the services of Raytheon, who was not previously involved with the CCHVAC duct and duct support design or evaluation efforts, to assist in developing and executing the action plan.

The NRC concerns and Detroit Edison's integrated action plan for resolving them were discussed in a meeting at NRC Headquarters on February 7, 1996 as documented in the Reference 3 NRC letter, with the NRC staff generally concluding that the plan was responsive to the concerns. As stated in the Reference 3 letter, Detroit Edison and the NRC staff agreed to hold additional working level status meetings as necessary to assure that the analyses and other activities planned by Detroit Edison, when completed, would resolve all of the NRC concerns.

A follow-up meeting was held at the NRC on March 1, 1996. A draft Design Criteria Document, which contained individual and specific resolutions to the concerns, was developed prior to that meeting, and was used to structure the technical discussion on duct and duct support structural qualification at that meeting. A markup copy of the document was submitted with the Reference 4 Detroit Edison letter as a means of documenting changes and agreements discussed at the March 1, 1996 meeting. The Reference 4 letter also provided additional information regarding the approach for structural qualification of the CCHVAC ducts and hangers that was discussed but not addressed in the design criteria document. The Reference 5 document, provided as

Enclosure 2, was issued subsequent to the meeting to address all comments, clarifications, and responses to the additional comments, in full compliance with the NRC requirements.

The following discussion summarizes the key activities to implement the integrated action plan.

Integrated Action Plan Description

Implementation of the action plan to demonstrate qualification of the Fermi 2 CCHVAC system to the requirements of ANSI/ASME-N509-1980 is an integrated effort involving both HVAC systems and civil/structural engineering disciplines. In general terms, the qualification involves both analysis and evaluation of testing requirements, with HVAC system calculations for normal and maximum CCHVAC internal duct pressures providing input to both the testing required by the N509 standard and to the duct and hanger structural analysis.

It was recognized prior to updating the CCHVAC system pressure analysis that a plant modification to reduce the recirculation fan speed would be of value to plant operations as well as to the limiting calculated internal duct pressures. This modification, to be implemented prior to startup from RFO5 by EDP-28160, has been credited in CCHVAC normal operating and maximum internal duct pressure calculations. Design calculations associated with this EDP indicated that the maximum pressures will be equal to or less than 14 inches of W.G. for recirculation line ductwork, and equal to or less than 6.5 inches of W.G. for the remaining CCHVAC ductwork. This represents a decrease from the original analysis, which conservatively calculated a recirculation duct maximum pressure of 22 inches of W.G. and equal to or less than 11 inches of W.G. for the remaining CCHVAC ductwork. The revised results are used as input to the ANSI/ASME-N509 qualification testing evaluation and structural engineering calculations for the CCHVAC ducts and duct supports as summarized in the following paragraphs.

An evaluation was performed to demonstrate that the CCHVAC meets the qualification testing requirements of ANSI/ASME-N509-1980. The evaluation identifies the portions of the CCHVAC system to which the qualification testing requirements apply, defines the design pressure and allowable leakage for each applicable duct segment based on pressure calculations in accordance with the standard, lists the existing pressure and leakage test results for each applicable duct segment, and documents the qualification conclusion. The evaluation, documented in a design calculation, concluded that given the revised system pressures as a result of EDP-28160, the existing testing demonstrates qualification of the CCHVAC system

to the requirements of ANSI/ASME-N509-1980, and no additional testing is required.

For the purpose of the civil/structural analysis modeling, the CCHVAC system ducts, duct supports, and anchorages were broken down into 22 non-rigid systems and 37 rigid systems. Three-dimensional finite element model, large displacement analyses were performed on select straight rectangular duct segments and transition segments, (i.e., Tees and Wyes), to define the state of stress under the effects of duct internal pressures. The following categories of calculations have been prepared to document the civil/structural analysis methodology, approach, and results:

- Generic Evaluations for String Analysis & Duct Supports
- Duct String Analysis & Support Evaluation (various systems)
- Duct Skin Stress Evaluation Under Internal Pressure
- Duct Evaluation (various systems)
- Duct & Support Evaluation of Rigid Systems

All analyses and evaluations were performed in accordance with the requirements of the Reference 5 Design Criteria Document. The conservative allowable stress limits for the duct and supports were based on the ANSI/ASME-N509-1980 and AISC limits.

Conditions where the calculated stress exceeded code qualification allowables were identified for some supports, anchorages, duct segments, and one Wye duct section. Plant modifications were identified for these cases, and the modified configurations were evaluated for adequacy. The extent and nature of the duct, support, and anchorage modifications are generally characterized as follows:

- New supports required due to duct overstress - 4 (in 3 systems)
- Supports requiring additional bracing or member - 16 (in 7 systems)
- Duct stiffener - 1
- Support connection to duct to provide positive axial connection - 1

Structural modifications required to meet the criteria of the CCHVAC structural qualification evaluations will be completed by EDP-28147 prior to startup from RFO5.

Individual NRC Staff Concerns Identified in the Reference 2 NRC Letter

All NRC staff concerns identified in the Reference 2nd letter have been specifically and individually considered and resolved, as summarized in tabular form in Enclosure 1. The table provides a cross reference to the applicable portion of the Design Criteria

Document that addresses the NRC concern. It should be noted that the Enclosure 1 table does not address concerns 1, 6, 7, 8, 10, and 11. This is because concerns 1, 6, 7, and 8 were closed by the Reference 2 letter, and because concerns 10 and 11 are included in the technical issues of concerns 3 and 13, which are addressed by the table in Enclosure 1.

Summary and Conclusion

Detroit Edison has completed the evaluations related to the Control Center Heating, Ventilation, and Air Conditioning (CCHVAC) System duct and duct support structural qualification in response to the Reference 2 NRC letter. Detroit Edison is confident that all of the issues and concerns raised by the NRC staff have been properly resolved, and that the structural adequacy and qualification of the CCHVAC duct and related supports have been demonstrated, subject to the completion of the remaining modifications during the outage.

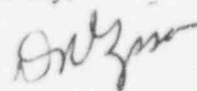
Commitments

The following commitments are being made in this letter:

- The CCHVAC recirculation fan speed modification required to meet the criteria of the CCHVAC structural qualification evaluations will be completed prior to startup from RFO5.
- Structural modifications required to meet the criteria of the CCHVAC structural qualification evaluations will be completed prior to startup from RFO5.

If you have any questions on this matter, please contact Mr. Robert Newkirk at (313) 586-4211.

Sincerely,



Enclosures

cc: A. B. Beach
M. J. Jordan
A. J. Kugler
A. Vogel

CCHVAC Concern Resolution Approach and Implementation Summary

12/7/95 NRC LETTER CONCERN NO.	RESOLUTION APPROACH	IMPLEMENTING SECTION NO. OF DESIGN CRITERIA FERMI-DC-76230-1
1, 6, 7, 8	Closed in 12/7/95 NRC letter	-
10, 11	Included in technical concerns 3 and 13, which are addressed below	-
3, 15, 18	In calculating duct properties, bare (0.0478") metal thickness is used.	3.3
3, 12, 13, 15, 18, 19	Acceptance criteria is based on the minimum published yield and ultimate strengths of materials used. For duct work components, these are: Sheet Metal: ASTM A-526/527 Fy=33ksi Stiffeners: ASTM A-575 Fy=32ksi Welds: Based on ASTM A-527 Fu=45ksi	3.2
2, 3	In calculating seismic responses and internal and support reaction loads, "Effective Sections" are determined and used. The approach used for the "Effective Section" calculations is based on guidance provided in the AISI manual and various industry references.	3.4.1, 3.4.2
3, 4, 14, 15, 18	Seismic response loads resulting from the simultaneous application of the three directional SSE seismic effects is considered in the evaluations of duct-duct supports.	3.5.1
18	Damping values do not exceed 7% and 4% in the analysis of duct-duct support systems with rectangular and circular ducts respectively, under the SSE effects.	3.5.3.1

12/7/95 NRC LETTER CONCERN NO.	RESOLUTION APPROACH	IMPLEMENTING SECTION NO. OF DESIGN CRITERIA FERMI-DC-76230-1
3, 13, 15	For calculation of stresses in rectangular duct due to internal pressure loading, a finite element model of a bounding duct segment(s) (stiff. to stiff.) is prepared and analyzed. The results, together with guidance provided in industry references, are used for the evaluation of other duct panels.	3.3
5	The duct work & supports of the Fermi 2 CCHVAC were fabricated and installed in accordance with the requirements of SMACNA standards. The need for proper stiffening of "Tee & Wye" pieces and other discontinuities is recognized by SMACNA. In addition, support requirements in the proximity of such fittings are also specified, to reduce the loading. Such "Fittings" were selected & analyzed in detail, on duct runs subject to high (14 inch WG) pressure, to show adequacy. Modifications are identified and issued as required.	3.3
9, 14	Appropriate vertical seismic response spectra from the UFSAR are used in the evaluation of seismic effects. The correctness of the vertical accelerations of these spectra at 50 Hz has been clarified at the 3/1/96 NRC/DECo meeting.	3.5.3.1, Appendix B
18, 19	Duct supports are evaluated for structural adequacy to safely resist the calculated reaction loads resulting from simultaneous application of dead weight, pressure and SSE response loads. Acceptance criteria of UFSAR Table 3.8-19 for structural steel is used.	3.5.4, 3.5.4.2

12/7/95 NRC LETTER CONCERN NO.	RESOLUTION APPROACH	IMPLEMENTING SECTION NO. OF DESIGN CRITERIA FERMI-DC-76230-1
3, 16, 17, 18	Calculated duct maximum stresses resulting from the load combination of dead weight, maximum pressure and three directional SSE response loads remain within 0.9 Fy of the material per ANSI/ASME-N509-1980.	3.5.4.1
	Hardware modifications are being designed and implemented when the duct or duct support/anchorage allowables are exceeded.	3.2, 3.3
12, 13	With the reduced calculated pressures (6.5 inch WG & 14 inch WG) and limitation of stresses to elastic limit, the longitudinal joint structural adequacy and leak tightness are further ensured. The tests performed at -20.5 inch W.G. have demonstrated the adequacy of the joints at higher pressure. In fact, the in-leakages occurred at areas other than joints. Periodic tests of select duct segments will provide further assurance of adequacy. Based on this, the existing installation longitudinal joints are considered acceptable, and effectively in accordance with ANSI/ASME-N509-1980.	-
12, 19	Appropriate minimum published yield and ultimate strength are used for the structural adequacy evaluation of the duct stiffener material. Although not specifically listed in the ANSI/ASME-N509-1980, this material is similar to those listed. Recognizing the fact that it is not practical for a standard to list multitudes of materials, it is considered that, with the use of appropriate strength values, this material is acceptable to ANSI/ASME-N509-1980.	3.2, 3.6.2

Enclosure 2

Fermi Design Criteria Document FERMI-DC-76230-1
Revision A dated June 27, 1996
CCHVAC Duct and Duct Support Qualification

CCHVAC Concern Resolution Approach and Implementation Summary

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2, 3	In calculating seismic responses and internal and support reaction loads, "Effective Sections" are determined and used. The approach used for the "Effective Section" calculations is based on guidance provided in the AISI manual and various industry references.	3.4.1, 3.4.2
3, 4, 14, 15, 18	Seismic response loads resulting from the simultaneous application of the three directional SSE seismic effects is considered in the evaluations of duct-duct supports.	3.5.1
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9, 14	Appropriate vertical seismic response spectra from the UFSAR are used in the evaluation of seismic effects. The correctness of the vertical accelerations of these spectra at 50 Hz has been clarified at the 3/1/96 NRC/DECo meeting.	3.5.3.1, Appendix B
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Enclosure 2 to
NRC-96-0109
Page 1

Enclosure 2

Fermi Design Criteria Document FERMI-DC-76230-1
Revision A dated June 27, 1996
CCHVAC Duct and Duct Support Qualification

DETROIT EDISON COMPANY

ENRICO FERMI POWER PLANT UNIT 2

DE963-0742 5-94

VENDOR DOCUMENT APPROVAL

DTC: TDDATA

DSN: FERMI DC 76230-1 PAGE: REV: A

PIS NO: T4100

P.O. 223622 EDISON FILE NO: PI-15437

DATE: 960627 / VENDOR NAME: RAYT

SUPERSEDING EDISON DRAWING NO:

PLANT ENGINEERING

TITLE	APPROVED	AS NOTED	NOT APPROVED
<u>SEISMICITY</u>	<u>4/20/96</u>	<u>6/27/96</u>	
FINAL <u>Abdullah</u>			
SUPERSEDED BY: <u>6/27/96</u>			

Ref EO-DE-RC-96-03

DESIGN CRITERIA NO. FERMI-DC-76230-1

CCHVAC DUCT AND DUCT SUPPORT QUALIFICATION

REV. A

~~* SUPPORT DATABASE TO APPENDIX "A" WILL BE INCORPORATED LATER~~

- REV. A INCORPORATED THE DATABASE IN APPENDIX "A"
- REPLACED P. 35 OF 36; ADDED PAGES A1 - A9; REVISED P. 26 OF 36.

	REVISION RO	R1	R2	R3	R4
	DATE 3/15/96				
PREPARED	<u>W. Chao / C.T.</u>				
REVIEWED	<u>F. Hittinger / C.T.</u>				
APPROVED	<u>E. Odan</u>				

Raytheon Engineers & Constructors