UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 17, 1994

Mr. Douglas R. Gipson
Senior Vice President
Nuclear Generation
Detroit Edison Company
6400 North Dixie Highway
Newport, MI 48166

SUBJECT: REQUEST FOR WITHHOLDING INFORMATION FROM PUBLIC DISCLOSURE (FERMI-2)

Dear Mr. Gipson:

By your application dated October 19, 1994 (NRC-94-0097), and affidavits as dated below, you submitted 13 documents (attachments) related to the Fermi-2 turbine generator repairs, actions taken as a result of the December 25, 1993, turbine event, and restart from the fourth refueling outage and requested that they be withheld from public disclosure pursuant to 10 CFR 2.790. Each affidavit was accompanied by the documents, referred to as attachments, as set forth below:

Affidavit by Robert McKeon, Detroit Edison, dated August 4, 1994:

1. TES Report No. 94V70-13, "Metallurgical Analysis of Fermi 2 LP3 Eighth Stage Turbine Blading," June 20, 1994.

2. Memo to L.C. Fron from J.E. Schaefer, "Metallurgical Examination of Fermi-2 Low Pressure Seventh Stage Turbine Blading (TES Report 94V70-22)," July 21, 1994.

3. Memo to L.C. Fron from J.D. Black, "Metallurgical Analysis of Fermi-2 Low Pressure Seventh and Eighth Stage Turbine Blading (TES Report 94V70-30)," July 22, 1994.

Affidavit by Robert McKeon, Detroit Edison, dated August 9, 1994:

4. Memo to L.C. Fron from P.K. Hudson, "N.D.E. Testing of LP and HP Turbine Rotors," July 30, 1994.

Affidavit by Robert McKeon, Detroit Edison, dated August 9, 1994:

5. Detroit Edison Company, "Fermi 2 Main Turbine Generator December 25, 1993 Forced Outage Root Cause Analysis Report," July 1994.

Affidavit by Paul J. Jancek, GEC Alsthom International, Inc., dated August 8, 1994:

6. GEC Alsthom, "Fermi 2 Turbine Generator Incident, 25th December 1993 - Root Cause Investigation Conclusions Based on Information Available up to 30th June 1994," July 1994.

Affidavit by C. Chiu, FPI International, dated August 4, 1994:

7. FPI International, "Interim Status Report - Independent Root Cause Analysis Assessment of the Detroit Edison Fermi 2 Turbine-Generator Event on December 25, 1993," July 26, 1994.

Affidavit by Neville F. Rieger, Stress Technology Inc., dated September 21, 1994:

8. Stress Technology, Inc., "Failure Investigation on the Fermi 2 LP L-1 Stage Blades," Technical Report PB942, September 27, 1994.

Affidavit by Paul J. Jancek, GEC Alsthom International, Inc., dated Sept. 6, 1994:

9. GEC Alsthom, "Fermi 2 LP Rotor Inspections NDT Reports," Report Nos. T3365, T3366, and T3367, June 8, 1994.

Affidavit by Donald C. Adamonis, WesDyne International, dated October 5, 1994:

10. WesDyne International, "Nondestructive Examination LP1, LP2, and LP3 Turbine Rotor Disks, Enrico Fermi Unit 2," June 6, 1994.

11. WesDyne International, "Nondestructive Bore Examination and Condition Assessment of GEC Alsthom HP Rotor, Enrico Fermi Nuclear Station, Unit 2," June 27, 1994.

Affidavit by Paul J. Jancek, GEC Alsthom International, Inc., dated Sept. 6, 1994:

12. GEC Alsthom, various memos and drawings dealing with the pressure plates for Fermi 2 turbine generator (as identified in L. C. Fron memo to W. D. Romberg, dated July 21, 1994 (w/attachments 1-13).

Affidavit by George B. Stramback, General Electric Company, dated Sept. 8, 1994:

13. General Electric Co., "Enrico Fermi 2 Materials and Fuels Evaluation Final Report," NEDC-32320D, Vols. 1 and 2, September 1994.

You stated that the submitted information should be considered exempt from mandatory public disclosure for the following reasons:

Documents (Attachments) 1, 2, and 3:

a. It discloses a process and approach which constitutes a competitive economic advantage over other companies,

b. It contains detailed information about the Fermi 2 turbine, which if used by a competitor of the Original Equipment Manufacturer, would reduce his expenditures of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product, and
c. Considerable resources of Detroit Edison were used to prepare these reports between December 1993 and July 1994.

Document (Attachment) 4:

a. It contains detailed information about the Fermi 2 turbine NDE inspection methods and results, which if used by a competitor of the Original Equipment Manufacturer, would reduce his expenditures of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product, and

b. Considerable resources of Detroit Edison were used in the performance of the inspections which are the subject of this report.

Document (Attachment) 5:

a. It discloses a process and approach which constitutes a competitive economic advantage over other companies,

b. It contains detailed information about the Fermi 2 turbine, which if used by a competitor of the Original Equipment Manufacturer, would reduce his expenditures of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product, and

c. Considerable resources of Detroit Edison were used to prepare this report between December 1993 and July 1994.

Document (Attachment) 6:

a. It discloses essential details of the design philosophy of GEC Alsthom Turbine Generators Limited which is proprietary information the intellectual property rights in which are the property of GEC Alsthom NV,

b. It contains detailed information about the Fermi 2 turbine which, if used by a competitor of GEC Alsthom, might improve his competitive position in the design, manufacture, installation, quality assurance, or licensing of a similar product,

c. It contains information which relates to plant which is the property of other utilities which is subject to undertakings of confidentiality to those utilities and to strict restrictions on further disclosure, and

d. Considerable resources of GEC Alsthom were employed in the preparation of the report between December 1993 and July 1994.

Document (Attachment) 7:

a. The information consists of detailed modeling techniques or other similar methods concerning a process, method, or component, the application of which results in substantial competitive advantage to FPI International.

b. Public disclosure of the information is likely to cause substantial harm to the competitive position of FPI International because:

(1) Development of this information by FPI required a lot of research and development manhours.

(2) In order to acquire such information, a competitor would also require considerable time and inconvenience to determine the cracking growth rate, crack initiation time, allowable operation time modeling and analysis techniques.

(3) The information required significant effort and expense to obtain the licensing approvals necessary for application of this information. Avoidance of this expense would decrease a competitor's cost in applying the information and marketing the product to which the information is applicable, and

(4) Use of the information by competitors in the international marketplace would increase their ability to market competitive services by reducing the costs associated with their technology development.

Document (Attachment) 8:

a. Performance of this engineering service required access to information and data proprietary to Detroit Edison and GEC Alsthom International Inc., and the STI report contains, references, documents, or otherwise is comprised of proprietary information supplied to STI from GEC or Detroit Edison, and

b. Specific analytical procedures utilized by STI are also included in the report documents. These procedures and information, if disclosed, may afford a competitor access to information that could improve his market position through product refinement, specification, application, manufacture, design, warranty, or license of like product.

Document (Attachment) 9:

a. It discloses essential details of the design philosophy and inspection techniques of GEC Alsthom Turbine Generators Limited which is proprietary information the intellectual property rights in which are the property of GEC Alsthom NV,

b. It contains detailed information about the Fermi 2 turbine which, if used by a competitor of GEC Alsthom, might improve his competitive position in the design, manufacture, installation, quality assurance, or licensing of a similar product,

c. It contains information which relates to plant which is the property of other utilities which is subject to undertakings of confidentiality to those utilities and to strict restrictions on further disclosure, and

d. Considerable resources of GEC Alsthom were employed in carrying out the inspections and preparing the report.

Documents (Attachments) 10 and 11:

a. Performance of these inspection services required access to information and data proprietary to Detroit Edison and GEC Alsthom International Inc., and the WesDyne reports contain, reference, document, or otherwise are based on proprietary information supplied to WesDyne from GEC or Detroit Edison.

Document (Attachment) 12:

a. It discloses essential details of the design philosophy of GEC Alsthom Turbine Generators Limited which is proprietary information of the intellectual property rights in which are the property of GEC Alsthom NV,

b. It contains detailed information about the Fermi 2 turbine which, if used by a competitor of GEC Alsthom, might improve his competitive position in the design, manufacture, installation, quality assurance, or licensing of a similar product,

c. It contains information which relates to plant which is the property of other utilities which is subject to undertakings of confidentiality to those utilities and to strict restrictions on further disclosure, and

d. Considerable resources of GEC Alsthom were employed in the preparation of these various memos and drawings.

Document (Attachment) 13:

a. The information discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies, and

b. The information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

We have reviewed your application and the material in accordance with the requirements of 10 CFR 2.790 and, on the basis of your statements, have determined that the submitted information sought to be withheld contains trade secrets or proprietary commercial information.

Therefore, all information submitted in Documents (Attachments) 1 through 13 marked as proprietary, will be withheld from public disclosure pursuant to 10 CFR 2.790(b)(5) and Section 103(b) of the Atomic Energy Act of 1954, as amended. However, as stated in your application dated October 19, 1994, certain portions of Document (Attachment) 12 are not considered proprietary by your company or the NRC. The following portions of Document (Attachment) 12 have been identified as nonproprietary and will be placed in the Public Document Room:

1. Fron, L.C., memo to W.D. Romberg, "LP Turbines Operated with 7th and 8th Stage Pressure Plates," (TMTB-94-0011), July 21, 1994.

2. Attachments 5, 6, 7, and 13 to Document (Attachment) 12 of your October 19, 1994, submittal (NRC-94-0097). [Attachment 8 (of Document 12), "Turbine Missile Accident Safety Evaluation, SE-94-0073, Rev. 1, 10/6/94," also nonproprietary, was submitted as Attachment 15 to another Detroit Edison October 19, 1994, submittal (NRC-94-0098)]

Withholding from public inspection shall not affect the right, if any, of persons properly and directly concerned to inspect the documents. If the need arises, we may send copies of this information to our consultants working in this area. We will, of course, ensure that the consultants have signed the appropriate agreements for handling proprietary information.

If the basis for withholding this information from public inspection should change in the future such that the information could then be made available for public inspection, you should promptly notify the NRC. You also should understand that the NRC may have cause to review this determination in the future, for example, if the scope of a Freedom of Information Act request includes your information. In all review situations, if the NRC makes a determination adverse to the above, you will be notified in advance of any public disclosure.

Sincerely,

ORIGINAL SIGNED BY
John N. Hannon, Director
Project Directorate III-1
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-341

cc: See next page

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cc:

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Rochester, New York 14623

Mr. Donald C. Adamonis
WesDyne International
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1002 Corporate Drive
Export, Pennsylvania 15236

Mr. George B. Stramback, Project
Manager
Licensing Services
General Electric Company
175 Curtner Avenue
San Jose, CA 95125

ATTACHMENT 12

The attached are those portions
of the Oct 19, 1994, submittal
not considered proprietary.
and may be released to the PDR.

~~CONFIDENTIAL~~ No longer considered confidential by DECo
RC Kerbrni
8/22/94

0801.21

Date: July 21, 1994
TMTB-94-0011

To: W. D. Romberg
Assistant Vice President
and Manager, Technical

From: L. C. Fron
Director, Turbine & Special Projects

Subject: **LP Turbines Operated With 7th and 8th Stage Pressure Plates**

This memo is being written to assemble, organize and summarize documents applicable to the above subject. The EF2 Main Turbine Generator has experienced problems with the LP 7th and 8th stages of rotating blades. Due to this fact, reviews were performed to determine the safety and reliability of operating the Main Turbine Generator with the airfoils removed from the 7th and 8th stages of rotating blades and pressure plates installed in place of the 7th and 8th stage diaphragms. Results of these reviews show that the turbine can be operated safely and reliably in this modified configuration. The plan is to run for one cycle in this modified configuration and then to install new LP rotors and diaphragms.

The following actions were taken to investigate and determine the safety and reliability of operating in this modified configuration.

1. The pressure plates were designed by the original equipment manufacturer (O.E.M.), GEC. The basis for the GEC design is documented in a memo from A. Holmes to L. R. Gobbett, dated 7/26/94, which is included as Attachment 1. The pressure plates were designed to replicate the pressure drops exhibited by the stationary and rotating blades they are replacing. GEC provided a review of their experience in designing pressure plates and the operating experience with those installations. The applicability of this experience to the proposed design and installation at Fermi 2 was also documented. This document is included as Attachment 2.

2. Westinghouse provided a summary of their design experience for pressure plates, and the operating experience with those plates. They presented this experience and its applicability to their review of the GEC design to site personnel. This is included as Attachment 3. As can be seen from this attachment, Westinghouse has a significant amount of experience in designing and operating with pressure plates.

3. Westinghouse performed a detailed review of the GEC proposed pressure plate design using their own design methodology and verification process (Attachment 4). They have concluded that the GEC design is adequate and, indeed, conservative.

4. Technical and Engineering Services (DECo) provided detailed review of the operational experience with pressure plates designed by GEC at Fermi 2. No adverse operational or vibration effects were identified. This review is included as Attachment 5.

5. MPR Associates performed a survey (Attachment 6) of domestic Westinghouse and GE turbines that have operated with pressure plates installed. This survey specifically requested operational limitations and adverse operational effects experienced. The period covered begins in 1970, with more than twelve nuclear plants identified. Experience supports the installation of pressure plates at Fermi, with several plants identified that also installed pressure plates in the last two stages of the LP turbine(s).

6. Failure Prevention International (FPI) performed:

   a. an independent study utilizing their own experience,
   b. a review of the GEC and Westinghouse identified relevant experience summaries,
   c. a review of the Westinghouse conclusions of the GEC design review, and
   d. a review of the MPR industry experience survey.

   FPI concluded that their experience, the Westinghouse design review of GEC design (in light of Westinghouse's experience), and the identified operational experience supports the prudency and viability of installing pressure plates. Their report is included as Attachment 7.

7. A Safety Evaluation (SE) was performed in accordance with 10CFR50.59 and site procedures and it determined that there would be no unreviewed safety question and that operation in this modified configuration would reduce the probability of a turbine missile accident. For additional details, see Attachment 8 (SE 94-0073).

8. An Engineering Design Package (EDP) has been prepared in accordance with site procedures to document the design and installation of these pressure plates. EDP 26726 is included as Attachment 9.

9. GEC has revised the heat balance for EF2 (Drawing TS 24122) with these pressure plates installed and it is included as Attachment 10.

10. Westinghouse has reviewed the GEC revised heat balance as it affects operability of the pressure plates and found there are no significant differences from their initial evaluation. Attachment 11 documents this review.

~~CONFIDENTIAL~~ 8/22/94

11. The fabrication drawing for the pressure plates, Drawings TI-3687, are included as Attachment 12.

12. Heat Exchanger Systems, Inc. performed an analysis of the effects on the condenser from operating the turbine with these pressure plates installed and determined that the condenser will operate satisfactorily. This review is included as Attachment 13.

In summary, these reviews clearly show that the EF2 Main Turbine Generator can be safely and reliably operated with these pressure plates installed.

LCF/klb

Attachments

Attachment 5 -

Date: June 10, 1994

To: G. Trahey
Fermi 2 Power Plant

From: L. G. Fron
Technical and Engineering Services

Subject: Fermi 2 Main Turbine - Generator Vibration During Operation with Blades Removed and Pressure Plates Installed

This memorandum is written in response to our telephone conversation on June 10, 1994; the subject of which was Main Turbine - Generator (MTG) shaft lateral vibration during operation with pressure plates in place of Low Pressure (LP) Turbine blade rows.

During Fermi 2 refueling outage RF01, the fifth stage rotating blades from both flows of each LP Turbine rotor were removed. The MTG operated in this condition from late December 1989 to late November 1990.

In late November 1990, an outage was required to disassemble LP Turbine 3 to confirm fourth stage blade failures predicted by vibration analysis. During this forced outage the LP Turbine 3 fourth stage rotating blades were removed and pressure plates were installed in both flows of LP Turbine 3. The MTG was returned to service on January 1, 1991. The plant operated at 80% power from January 1991 to March 1991 (to refueling outage RF02) with fifth stage blades removed from all LP Turbine flows, fourth stage blades removed from both flows of LP Turbine 3, and pressure plates installed in both flows of LP Turbine 3 between the third and sixth stage blades. During this time of operation with pressure plates in LP Turbine 3, no abnormal shaft lateral vibration was observed. MTG shaft vibration amplitudes were less than 6.5 mils P-P at each bearing at approximately 800 Mw.

As we discussed, if uniform axisymmetric flow is maintained by the pressure plates, shaft lateral excitation should not result. I am not aware of a situation where two pressure plates were utilized in one flow of a turbine. My experience of pressure plates effect on shaft vibration is limited to that described above for the Fermi 2 LP Turbine 3.

Rotordynamic characteristics of a rotor will change as a result of removing blades (mass) from the rotor. Reduction in rotor mass results in increasing the critical speeds (shaft lateral vibration natural frequencies) of the rotor.

Removing the eighth and seventh stage blades from both flows of an LP Turbine rotor results in an approximate 7% reduction in rotor weight. Simple rotating beam model calculations predict a less than 5% increase in critical speed due to a 7% decrease in weight. The LP Turbine rotors operate very close to their second critical speeds which complicates field balancing. However, balancing characteristics have been established from experience and successful balancing has been performed. Therefore, it is anticipated that an increase in the critical speeds on the order of less than 5% will not result in amplified shaft lateral vibration that cannot be dealt with by field balancing.

Attachment 6

Not confidential BCM

MPR ASSOCIATES, INC.

320 King Street
Alexandria, VA 22314-3238
(703) 519-0200

(703) 519-0224 Fax Number

FAX TRANSMITTAL COVER SHEET

DATE: June 13, 1994

TO: Brian Stone FROM: L. Demick

COMPANY: Detroit Edison LOCATION:

FAX NUMBER: 313-586-1772

VERIFICATION NO.:

NO. OF PAGES: 8 INCLUDING COVER

MACHINE: OMNIFAX G93

MESSAGES

Attachment 6

Not confidential

MPR ASSOCIATES, INC.

320 King Street
Alexandria, VA 22314-3238
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(703) 519-0224 Fax Number

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MESSAGES

Table 1
Plants With Operating Experience with
Pressure Plates Installed in Place of LP Turbine Stages

GENERAL ELECTIC PLANTS

Plant	Affected Stage(s)	Power Loss (MW)	Discussion
Brunswick 2	4TA	15	Installed pressure plate in 1993. Have not inspected since installation. Intend to operate until outage in 1996. Have no operating restrictions and have not noted any change in vibration or feed system operation.
Nine Mile Point 2	N/A	22	Installed in the Fall of 1993. No adverse impact of installation other than loss of power noted. Will be replacing the rotors with monoblocks the next refueling outage.
Oyster Creek	5GB	10	Installed in 1993. Will inspect in September 1994 when long shank buckets will be installed. No vibration problems noted and there are no operating restrictions.
Monticello	5TA	N/A	Operated for a couple of years in the early 1980's with a pressure plate in 5TA stage. No problems encountered except loss of MW (Actual loss not remenbered but is indicated by GE to be "minimal"). No damage was found to downstream stages when rotor was replaced. Stage temperatures at the pressure plate were monitored to ensure the startup transients did not exceed design ramp rates for the plates and that the plates produced the desired pressure ratios. The pressure ratios were satisfactory. This is believed to be the first GE installation of pressure plates in a nuclear turbine.
Millstone 1	N/A	N/A	We were not able to contact Millstone, however they are reported to have operated with pressure plates.

Table 2

WESTINGHOUSE TURBINES

Plant	Affected Stage(s)	Power Loss (MW)	Discussion
Prairie Island	L-1/L-2	100	The pressure plates were installed in the 1970s. The 17% power loss was attributed to reduced reactor power (80%) stemming from flow restrictions across the pressure plates. Specifically, the design pressure drop was not achieved resulting in significant stress on the pressure plates. It was reported that the holes in the pressure plates were not large enough to achieve the desired pressure drop. The station tried to increase back pressure but this had no significant effect. The heater drain temperature increased slightly.
Surry	N/A	N/A	We were not able to contact personnel familiar with operation with removed stages. We were informed that operating experience from a decade ago would be unretrievable. However, they are reported to have operated with removed stage(s).
Salem 1	2nd	N/A	We were not able to contact personnel familiar with operation with removed stages. However, they are reported to have operated with removed stage(s).
Ginna 1	L-0/L-1/L-2	40	The unit is rated at 470 MW but generally runs at ~490MW (less in summer months). The plates were installed in 1974 in one of the LP turbines (both barrels) and ran with this configuration for about two years until reblading. The crossover line between condenser zones was blanked out during this operation period. No significant deviation was observed in the feedwater train. There were no limiting conditions for operation and, as such, reactor power was not reduced.
Maine Yankee 1	L-2 L-2/L-3	30 60	The unit operated at two separate times with pressure plates installed. The original Westinghouse steam path was replaced after the second period ('88) with an ABB design. The pressure plates were approximately 1 inch thick. The blades were cut off such that the roots remained. There is no recollection of torsional vibration analyses being performed or of any torsional problems during operation with stages removed.

Table 2 (continued)

WESTINGHOUSE TURBINES

Plant	Affected Stage(s)	Power Loss (MW)	Discussion
Indian Point 3	L-2	15	The pressure plates were used in the mid 1980s while procuring a new steam path. The actual unit derate was close to that predicted by Westinghouse. No significant deviation was observed in the feedwater train. There were no limiting conditions for operation and, as such, reactor power was not reduced. The blades were cut off such that the roots remained.

June 13, 1994
021-004

TELECON MEMORANDUM

Date: June 13, 1994

Subject: Turbine Pressure Plate - Operating Experience

Person Called: Carl Jacobs [Indian Point 3] (914) 681-6262

Person Calling: D. Lutchenkov

The unit has three LP turbines and was operated with pressure plate(s) installed in the L-2 stage (both barrels of one LP turbine only) in the early 1980s. The L-0 was also removed. The unit lost about 7½MW per stage removed (15MW total) which was the predicted value by Westinghouse. No significant deviation was observed in the feedwater train. There were no limiting conditions for operation and, as such, reactor power was not reduced. However, the blades were cut off just above the root which, due to SCC in some locations, broke apart sending damaging fragments into the condenser tube bundle.

No problems were reported with pressure plate operation. The plates were about an inch thick.

The original Westinghouse steam path has been replaced with an ABB design. The steam path replacement took 76 days. Significant effort (~$300K) was expended in covering the condenser tube bundles with platforms to preclude tube damage from above. Herculized, fire retardant wood was used.

Mr. Jacobs wrote the procurement specification (~60 pages) for the replacement steam path. The specification required numerous documentation regarding material composition reports, vibration test results and stress analyses. The specification also included the following:

- replacement of expansion bellows (the inner cylinder was replaced)
- expansion bellows couplings
- hydraulic bolting
- replacement of all asbestos gaskets with graphite filled

June 13, 1994
021-004

TELECON MEMORANDUM

Date: June 10, 1994

Subject: Turbine Pressure Plate - Operating Experience

Person Called: Hunter Gilpatrick [Maine Yankee] (207) 882-6321

Person Calling: D. Lutchenkov

The unit has two LP turbines and was operated with pressure plate(s) installed in the LP turbine twice with the Westinghouse steam path as follows:

- Early in the 1980s the L-3 stage was removed in both barrels (for balancing) with a total of 30 MW derate. The blades were cut off but the root was retained.

- In 1987 the L-2 and L-3 stages were removed in both barrels resulting in a derate of 60 MW. Operation was maintained in this configuration for a bout a year until the steam path was replaced in 1988 with an ABB design. The blades were cut off but the root was retained. The steam path replacement took 55 days.

No problems were reported with pressure plate operation. The plates were about an inch thick.

Mr. Gilpatrick recommended calling Clayton Giggey (performance, x5604) to discuss detailed impact on operation while pressure plates were installed. Talked to Mr. Giggey on 6/13/94. He only has experience with the 1987 pressure plate operation. He indicated that Westinghouse predicted 58 MW derate with the L-2 and L-3 stages removed. They could not monitor the pressure drop across the plates but did monitor extraction pressures to verify satisfactory operation. No significant deviation was observed in the feedwater train. There were no limiting conditions for operation and, as such, reactor power was not reduced. Mr. Giggey will forward any operating data available which spanned this period of operation.

June 13, 1994
021-004

TELECON MEMORANDUM

Date: June 9, 1994

Subject: Turbine Pressure Plate - Operating Experience

Person Called: Joe Eastwood [Surrey] (804) 273-2730

Person Calling: D. Lutchenkov

Mr. Eastwood does not recall operation with pressure plates installed. In addition, any information concerning this operation would be unretrievable. He could not offer any additional help or leads.

June 13, 1994
021-004

TELECON MEMORANDUM

Date: June 13, 1994

Subject: Turbine Pressure Plate - Operating Experience

Person Called: Paul Detwiler [GINNA] (315) 524-4446 x8306
Dennis Grandjean [Rochester gas & Electric] (716) 724-8062

Person Calling: D. Lutchenkov

~~The unit is rated at 470 MW but generally runs at ~490MW (less in summer months).~~ The plates were installed in 1974 in one of the LP turbines (both barrels) and ran with this configuration for about two years until reblading. The stages were removed from LP2 due to failure of a blade in the L-2 stage. The crossover line between condenser zones was blanked out during this operation period. There were no limiting conditions for operation and, as such, reactor power was not reduced.

No problems were reported with pressure plate operation. The plates were about an inch thick.

Note: Originally called Jeff Wayland (Rochester Gas & Electric) who referred me to Barry Ketchmaryk (x215) who is a performance engineer at the station. Mr. Ketchmaryk referred me to Paul Detwiler who a maintenance engineer at the station. Mr. Detwiler referred me to his supervisor Mr. Dennis Grandjean at the main office for more detailed information.

June 13, 1994
021-004

TELECON MEMORANDUM

Date: June 9, 1994

Subject: Turbine Pressure Plate - Operating Experience

Person Called: Bernie Haug [SALEM] (609) 339-1790
Mark Moncourtois (609) 935-6000 (x2065)

Person Calling: D. Lutchenkov

Mr. Haug recalls that Salem 1 operated with pressure plates installed in the 2nd stage (from front) in the early 1980s. He does not have any specific details about operation with this configuration.

MPR
ASSOCIATES INC.
ENGINEERS

June 14, 1994
021004-03

Brian Stone
Fermi Unit 2
Detroit Edison Company
6400 North Dixie Highway
Newport, MI 48166

Subject: Pressure Plate Installations at Prairie Island and Ginna

Dear Mr. Stone:

As a follow up to our telephone conversation June 14, 1994, the following summarizes the results of our review to-date on the use of pressure plates at Prairie Island and Ginna. This summary is based on review of the "Grey Books" (Nureg 0020, "Operating Units Status Report for Licensed Generating Reactors" for the period January 1974 through November 1978. The grey books were not published prior to January 1974.

Prairie Island 1

- Prairie Island 1 went critical in December 1973. On 3/9/74 a turbine blade failure was reported. The plant was operated to ≈91% reactor power. The report does not indicate the status of the failed turbine stage. Possibly a pressure plate was installed. On 4/27/94 another turbine blade failure was reported. Three stages of LP blading were replaced with pressure plates (called baffles in the grey books). The unit was then restricted to 85% power.
- On September 5, 1974 the unit was shutdown to repair the turbine, i.e., replace the blading. The unit was returned to full power in October 1974. Maximum dependable power rating was 520 Mwe. The electrical rating was 530 MWe.
- ASME turbine cycle heat rate tests were performed in November 1974.
- No other problems with the turbine or derates due to turbine problems are reported through November 1978. In early 1977 the maximum dependable capacity (MDC) of the unit was decreased to 507 MWe. I don't believe that was related to turbine problems because the electrical rating was still 530 MWe.

Prairie Island 2

- The first records for Prairie Island 2 begin in May 1975. Turbine bearing problems required a shutdown of the unit that month.
- An L-1 blade failed in the No. 2 LP turbine in December 1975. The last three rows of blading in LP2 were replaced with baffles. The unit was restricted to 445 MWe at 100% power.
- New LP turbine rotors were installed in December 1976 and the 100% power rating was returned to 520 MWe.
- The MDC for this unit was also reduced to 507 MWe with an electrical rating of 530 MWe in early 1977. No turbine problems were reported through November 1978.

Ginna

- Ginna began commercial operation in March 1970. A turbine blade failure in the No. 2 LP turbine is reported in the February 1974 status report. The unit was in an outage for turbine repair. The nature of the repair was not described. The plant was returned to 70% power in April 1974 "to evaluate turbine blade failures in similar turbine units". In August and September 1974 power was increased to 91%. In October power was increased to 100%.
- On January 19, 1976 another blade failure occurred in the No. 2 LP turbine. Apparently pressure plates were installed, because the 100% power rating of the unit was reduced from 470 MWe (MDC) to 415 MWe. The electrical rating of the plant was 490 MWe.
- Another blade failure in the No. 2 LP turbine was reported on August 7, 1976. No details on the repair to return to service are provided.
- The plant remained at 415 MWe 100% power rating until May 1978 when a new rotor was installed in the No. 2 LP turbine. The 100% power rating was returned to 470 MWe. No turbine problems were noted through November 1978.

We have enclosed copies of those pages of the grey books for the pertinent events in each plant. If you have any questions please give me a call.

Sincerely,

L. E. Demick

PRAIRIE ISLAND 1

FACILITY DATA

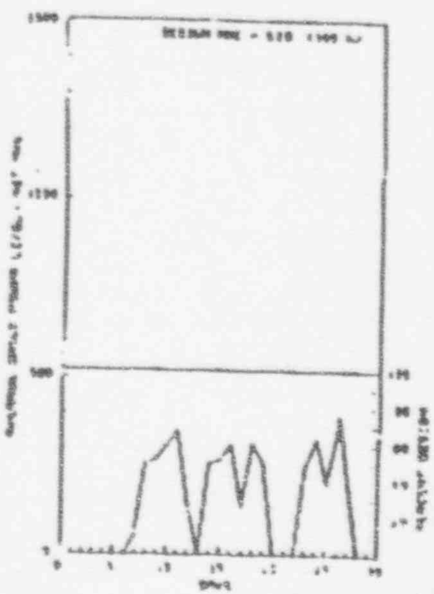
INSPECTION STATUS

ENFORCEMENT STATUS

REPORTS RECEIVED FROM LICENSEE

PRAIRIE ISLAND 1

DAILY REACTOR POWER



OPERATING STATUS

1. [illegible] [illegible] TO [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]
10. [illegible]
11. [illegible]
12. [illegible]
13. [illegible]
14. [illegible]
15. [illegible]
16. [illegible]

Performance factors			
[illegible]	[illegible]	PLANT CAPACITY FACTOR	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

PLANT SHUTDOWNS

NUMBER	DATE	TYPE	DURATION HOURS	REASON	METHOD	COMMENTS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SUMMARY

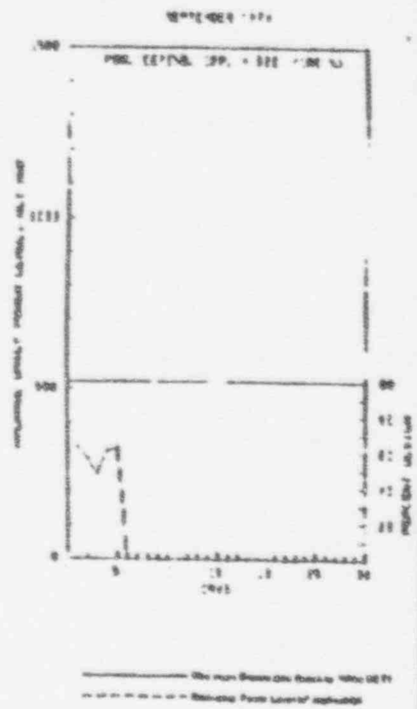
[illegible]

261

PRAIRIE ISLAND 1

REACTOR AVAILABILITY (%)	24.0	UNIT AVAILABILITY (%)	16.5	UNIT CAPACITY (%)	8.6	FORCED OUTAGE RATE (%)	0

AVERAGE DAILY POWER LEVEL (MWe)



OPERATING STATUS

[illegible]

UNIT SHUTDOWNS/REDUCTIONS

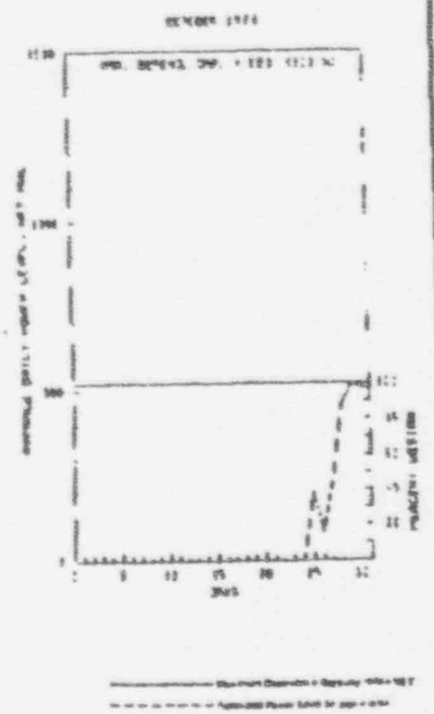
[illegible]

PRAIRIE ISLAND 1

REACTOR AVAILABILITY (%)	PLANT AVAILABILITY (%)	UNIT CAPACITY (%)	FORCED OUTAGE RATE (%)
26.6	18.5	14.4	6.9

AVERAGE DAILY POWER LEVEL (MWe)

OCTOBER 1974



OPERATING STATUS

1. REPORTING PERIOD [illegible]
2. CURRENTLY AUTHORIZED POWER LEVEL [illegible]
3. POWER LEVEL TO WHICH RESTRICTED [illegible]
4. REASONS FOR RESTRICTIONS [illegible]

	THIS MONTH	YR TO DATE	CUMULATIVE TO DATE
5. NUMBER OF HOURS THE REACTOR WAS CRITICAL	[illegible]	[illegible]	[illegible]
6. REACTOR RESERVE SHUTDOWN HOURS	[illegible]	[illegible]	[illegible]
7. HOURS GENERATOR ON LINE	[illegible]	[illegible]	[illegible]
8. UNIT RESERVE SHUTDOWN HOURS	[illegible]	[illegible]	[illegible]
9. GROSS THERMAL ENERGY GENERATED (MWH)	[illegible]	[illegible]	[illegible]
10. GROSS ELECTRICAL ENERGY GENERATED (MWH)	[illegible]	[illegible]	[illegible]
11. NET ELECTRICAL ENERGY GENERATED (MWH)	[illegible]	[illegible]	[illegible]
12. REACTOR AVAILABILITY FACTOR 1/	[illegible]	[illegible]	[illegible]
13. UNIT AVAILABILITY FACTOR 2/	[illegible]	[illegible]	[illegible]
14. UNIT CAPACITY FACTOR 3/	[illegible]	[illegible]	[illegible]
15. UNIT FORCED OUTAGE RATE 4/	[illegible]	[illegible]	[illegible]

16. SHUTDOWNS SCHEDULED OVER NEXT 6 MONTHS (TYPE, DATE AND DURATION OF EACH): [illegible]

17. IF SHUT DOWN AT END OF REPORT PERIOD, ESTIMATED DATE OF STARTUP: [illegible]

UNIT SHUTDOWNS/REDUCTIONS

NUMBER	DATE	TYPE F-FORCED S-SCHEDULED	DURATION (HOURS)	REASON*	METHOD OF SHUTTING DOWN REACTOR**	COMMENTS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

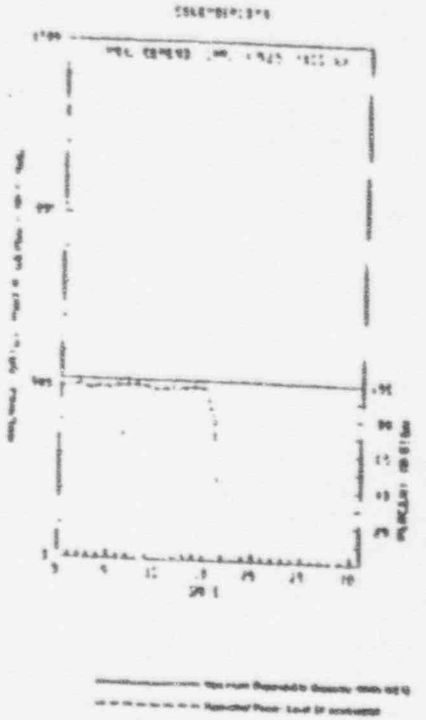
SUMMARY

[illegible]

2-77

PRAIRIE ISLAND 2

AVERAGE DAILY POWER LEVEL (MWe)



OPERATING STATUS

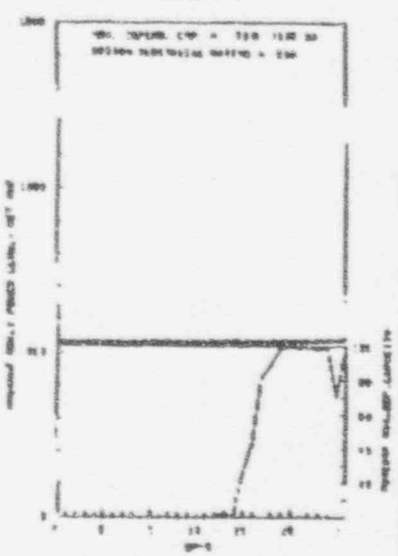
[illegible]

UNIT SHUTDOWNS/REDUCTIONS

[illegible]

PRAIRIE ISLAND 2

AVERAGE DAILY POWER LEVEL (MWe)



OPERATING STATUS

[illegible]

UNIT SHUTDOWNS/REDUCTIONS

Number	Date	Type	Duration (Hours)	Reason	Method of Shutting Down Reactor	Remarks
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SUMMARY

[illegible]

2.93

GINNA

FACILITY DATA

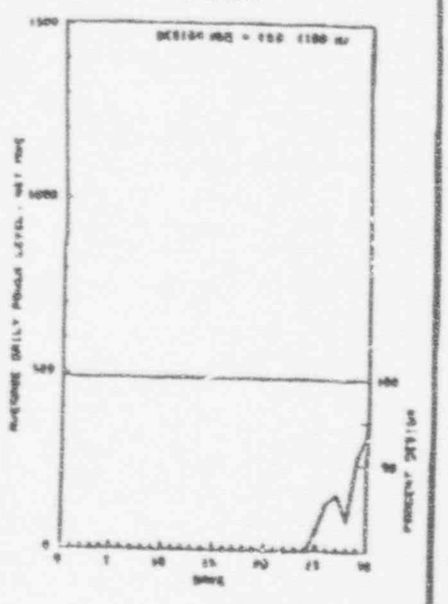
INSPECTION STATUS

ENFORCEMENT STATUS

REPORTS RECEIVED FROM LICENSEE

GINNA

DAILY REACTOR POWER



OPERATING STATUS

PLANT SHUTDOWNS

2-23

GINNA

FACILITY DATA

[illegible]

INSPECTION STATUS

ENFORCEMENT STATUS

- A. [illegible]
- B. [illegible]

OTHER SIGNIFICANT ITEMS

A - SYSTEMS AND COMPONENT PROBLEMS

- [illegible]

B - FACILITY ITEMS (PLANS AND PROCEDURES)

- [illegible]

C - MANAGERIAL ITEMS

None

[illegible]

REPORTS RECEIVED FROM LICENSEE

[illegible]

[illegible]

GINNA

FACILITY DATA

INSPECTION STATUS

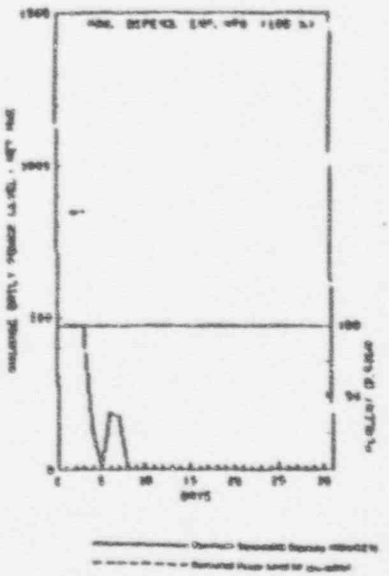
ENFORCEMENT STATUS

OTHER SIGNIFICANT ISSUES

REPORTS RECEIVED FROM LICENSEE

GINNA

AVERAGE DAILY POWER LEVEL (MWe) OPERATING STATUS



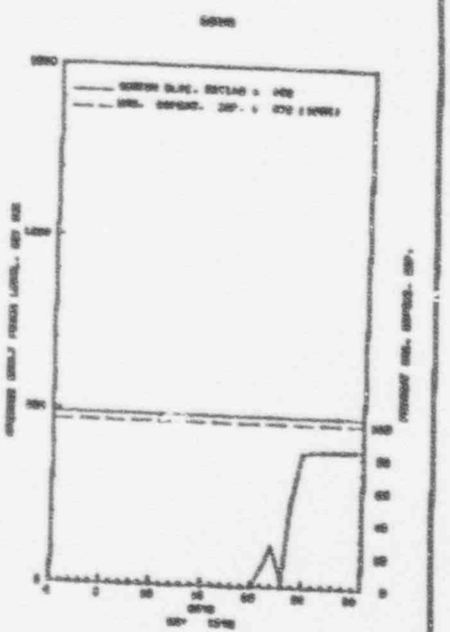
UNIT SHUTDOWNS/REDUCTIONS

2-41

TOTAL P.12

GINNA

AVERAGE DAILY POWER LEVEL (MWe)



OPERATING STATUS

UNIT SHUTDOWNS/REDUCTIONS

Not conf. per B. Wilkerson

Attachment 7

FPI International

The Leading Experts in Failure Prevention & Investigation

June 15, 1994

Mr. Len Fron
Turbine Supervisor
Detroit Edison Company
Fermi-2
6400 N. Dixie Highway
Newport, MI 48166

Subject: **FPI Review of Pressure Plate Use on Fermi-2**

Dear Mr. Fron,

Per your verbal request of June 11, 1994, FPI has conducted a review of various subjects regarding use of pressure plates in large steam turbines. This review is organized based on discussions with Mr. Brian Stone into the following areas.

1. Experience / perspective on operation with pressure plates / baffles.

2. Review of industry experience as provided by Westinghouse.

3. Review of Westinghouse evaluation for Fermi-2 pressure plates.

This review does not attempt to provide an in-depth evaluation of whether FPI would recommend pressure plates versus other turbine repair possibilities such as reblading. It is understood that this analysis has been conducted and the determination has been made to use pressure plates in all three LP rotors for all L-0 and L-1 rows provided the technical analysis of this installation does not jeopardize turbine operation. The primary purpose of this assessment therefore, is to provide an independent review of current industry experience using pressure plates and review the evaluations conducted by Westinghouse and others for Detroit Edison. This is to support the Detroit Edison Company in ensuring all consideration is given to arrive at the best overall decision regarding the return to service of the Fermi - 2 turbine.

112 W. Canada • San Clemente, California 92672
Phone / Fax: (714) 361-5479 • Messages: (714) 361-5474

1. Experience / perspective on operation with pressure plates / baffles.

The primary purpose for installing pressure plates is to prevent overloading upstream and downstream stages when it becomes necessary to operate a turbine with rotor blade stage(s) removed. The theory is that the pressure drop through the installed pressure plate is designed to replicate the expected pressure drop exhibited by the stage diaphragm and rotating blading it is replacing. Therefore, surrounding stages continue to have the same pressure forces exerted on them as if the rotating blades were installed. The typical industry use for pressure plates has been in reaction stages, usually L.P. exhaust stages for example L-4, L-3, L-2, L-1, and L-0 stages. The industry experience has been good with respect to pressure plate applications.

Problems which might occur due to improperly designed or installed pressure plates are: rotor vibration, excessive blade vibration upstream or downstream, excessive noise emissions, overheating of exhaust, casing distortion (not expected in diaphragm type construction), overheating of condenser expansion joint, excessive rotor thrust (not expected in double flow design), failure or distortion of pressure plates, unacceptable changes in rotor torsional frequency to name a few. Certain operating limitations could be experienced with pressure plates installed such as: reduced generator output, rotor vibration limits, reduced steam flow, additional exhaust temperature control requirements, for example: capacity of exhaust sprays, capacity of exhaust cooling water system, condenser heat removal capacity, cooling water system capacity. The above must be considered when installing pressure plates.

However, pertinent experience in the use of pressure plates occurred at the Southern California Edison Mohave Generating Station. Mohave Generating Station is a 790 megawatt coal fired supercritical unit using General Electric double flow L.P. steam turbines. These are 1800 RPM turbines with L-0 blades of 52", L-1 = 34", and L-2 = 22.5". Both units have experienced problems on different stages resulting from disc cracking and both required the use of pressure plates. Unit 1, L-2 stage cracks were in the rotor dovetail. Unit 2, L-1 stage had a disc bore crack at a keyway. These units are similar to the Fermi - 2 turbine in that they both employ diaphragms. No operational problems were experienced with either Mohave unit which were operated with pressure plates for over 1 year.

Therefore, based on the above discussion and knowledge that pressure plates have been used throughout the industry on numerous occasions without adverse consequences, it is our conclusion that pressure plates are a suitable alternative for the Fermi - 2 turbine. This similar question was posed to FPI personnel during a recent presentation to the Detroit Edison Board of Directors. When asked if FPI personnel thought pressure plates were a viable alternative it was stated that after hearing the entire presentation by Fermi personnel we would concur with the decision to install pressure plates for one operating cycle.

2. Review of industry experience as provided by Westinghouse.

FPI reviewed a series of documents that were prepared for Detroit Edison personnel by GEC Alstrom and MPR Associates. These documents provide the results of industry use by the three major turbine vendors: GEC, G.E., and Westinghouse, of pressure plates. FPI's conclusion based on the review of this industry data compilation is that it supports our conclusion expressed in item 1 above that the industry experience concerning use of pressure plates has been successful. Therefore, this reinforces FPI's overall conclusion that use of pressure plates for the Fermi 2 turbine is a suitable alternative solution.

3. Review of Westinghouse evaluation for Fermi-2 pressure plates.

FPI reviewed a draft memo Phillip R. Ratliff, Mgr. Turbine Service Programs of Westinghouse Electric Corporation to Len Fron, Sr. of Detroit Edison Company, Subject: Westinghouse Evaluation of GEC Design Pressure Plates for Fermi 2, dated June 14, 1994. This document presents Westinghouse Electric Corporations technical assessment of the GEC design for Fermi 2 turbine pressure plates. This points to the facts that Westinghouse has utilized pressure plates successfully in many applications in the past 20 years which is important from a practical industry experience standpoint. In addition they have developed tools which have provided them both analytical and empirical design basis for reviewing pressure plate designs. They express confidence in their capability of reviewing the GEC design using their tools and have done this through their design review process. The Westinghouse review process concludes that the thermodynamic design of the GEC pressure plates closely matches the Westinghouse predictions. The memo also goes on to describe other evaluations that were performed to validate the adequacy of the GEC design for the pressure plates. Thus, the FPI review of the Westinghouse analysis concludes that the Westinghouse review and validation process adequately considers those parameters necessary for pressure plate design and that the GEC design meets those requirements.

In conclusion, FPI conducted an independent review based on the decision by Detroit Edison to install pressure plates for L-0 and L-1 turbine blades. This review determined that although there are certain special considerations as described above which should be considered prior to installing pressure plates it was demonstrated that Detroit Edison took the necessary prudent steps to examine those considerations to allow installation of pressure plates for the Fermi-2 turbine. In fact, multiple independent analysis were conducted to provide assurance that this is a prudent and intelligent decision based on facts available at this time.

Please feel free to contact me regarding any questions you might have regarding the above subject.

Sincerely,

Jeffrey S. Summy
Director,

Ralph J. Ortolano
Concurrence:
Mr. Ralph Ortolano

cc: Dr. Chung Chiu

PLEASE SEE ATTACHMENT 15 TO DETROIT EDISON LETTER
TO NRC, NRC-94-0098, DATED 10/19/94

Attachment 13

Not class per Wickman

Heat Exchanger Systems, Inc.

Consulting Engineers and Non-Destructive Examination
374 Congress Street, Suite 602, Boston, MA 02210
TEL. (617) 338-6650 FAX (617) 426-7142

July 21, 1994

Via Telecopier:

Mr. Mohan Deora
Detroit Edison Company
6400 N. Dixie Highway
Newport, MI 48166

Subject: Condenser Vibration/Performance Analysis - Fermi Unit 2

Dear Mohan:

Heat Exchanger Systems, Inc. (HES) has performed the subject analyses for the Fermi Unit 2 condenser.

The analyses were performed in order to evaluate the effects of changes to the steam flow rate and enthalpy to the main condenser. The changes in steam conditions are caused by proposed modifications to the L.P. turbine.

The revised values used in the analyses are as follows:

Steam Flow (lb/hr)	Steam Enthalpy (Btu/Lb)
8,129,928	1054.1

The analyses/results were as follows:

Vibration Analysis

Utilizing the HES tube support spacing analysis program and the new value for steam flow, the maximum allowable tube support spacing was determined for the condenser tubed with 22 BWG titanium. The maximum allowable unsupported tube length is 31.19 inches at a condenser pressure of 1.48 inches HgA.

Since the Fermi 2 condenser has anti-vibration staking installed in between the existing support plates for all tubes, the maximum unsupported tube length is less than 20 inches.

Based upon the HES analysis, the increased steam flow to the condenser will not require any additional anti-vibration staking.

The analysis output from the tube support spacing program is attached.

Thermal Performance Analysis

HES determined theoretical condenser pressure based upon the new steam flow rate and enthalpy over a range of circulating water inlet temperature from 60.0°F to 87.5°F.

The analysis was performed utilizing the HES proprietary performance prediction computer program. The analysis assumed 5 circulating water pumps in service and a cleanliness factor of 90%.

The predicted pressures are presented in the table below, along with predicted condenser pressures at the same CW inlet temperatures at the 105 percent power duty (7.79×10^9 BTU/HR).

CONDENSER PRESSURE (INCHES HgA)

CWIT (°F)	105% POWER	NEW DUTY
60.0	1.46	1.61
62.5	1.56	1.71
65.0	1.66	1.82
67.5	1.78	1.94
70.0	1.90	2.07
72.5	2.03	2.22
75.0	2.18	2.37
77.5	2.33	2.53
80.0	2.49	2.71
82.5	2.67	2.90
85.0	2.86	3.10
87.5	3.06	3.32

The thermal performance analysis indicates that condenser pressure will increase 0.15-0.26 inches HgA, depending upon the circulating water inlet temperature.

The condenser pressure performance prediction computer output sheets are attached, alone with the predicted condenser pressures in graphical form.

Should you have any questions or require additional information, please advise.

Sincerely,

Charles D. Hardy

Charles D. Hardy
Senior Mechanical Engineer

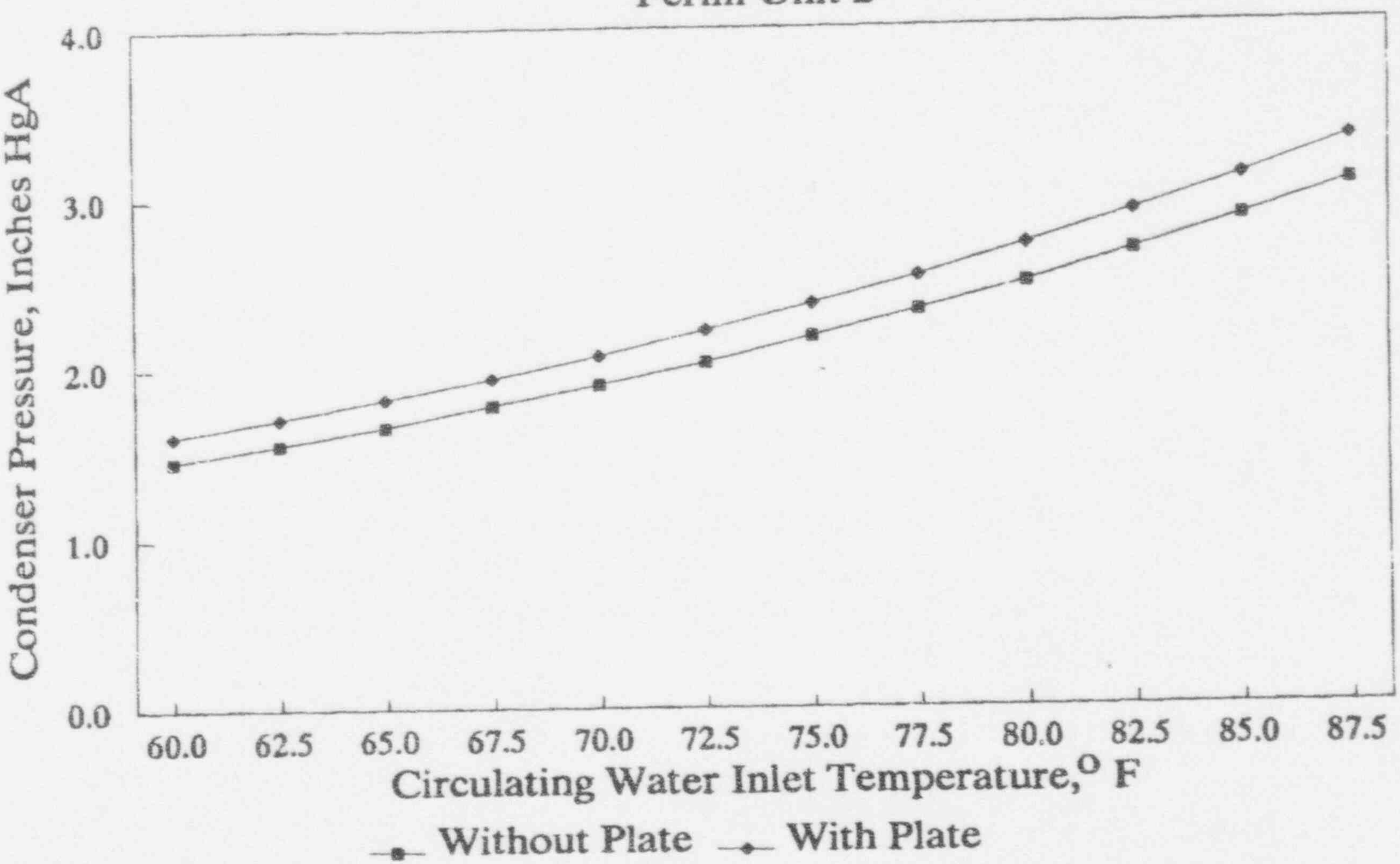
CDH/rcl

Attachment

cc: HES File #711

Condenser Pressure (Inches, HgA)

Fermi Unit 2



TUBE SUPPORT SPACING

CALC:
DATE: 07-20-1994

PLANT: FERMI UNIT 2
CLIENT: DETROIT EDISON

CALCULATED BY:
CHECKED BY:

GIVEN

TUBE MATERIAL	TITANIUM	
TUBE O.D.	1.00	IN
WALL THICKNESS	.028	IN
MODULUS OF ELASTICITY	14.9	E6 PSI
TUBE MATERIAL DENSITY	.163	LB/CU IN
TUBE PITCH	1.25	IN
TURBINE EXHAUST AREA	1074.7	SQ FT
TURBINE FLOW RATE	4.06	E6 LB/HR
COOLING FLUID	LAKE ERIE	
COOLING FLUID DENSITY	62.34	LB/CU FT
CONDENSER BACK PRES.	1.50	IN HGA
TUBE SUPPORT SPACING	39.0	IN

RESULTS

MAX SPAN @ GIVEN BACK PRESSURE - 31.44 IN

MINIMUM PRESSURE FOR GIVEN SPACING - 2.75 IN HGA

THE MINIMUM TUBE STAKE SPACING IS - 31.19 IN
AND IT OCCURS AT A PRESSURE OF - 1.48 IN HGA

HEAT EXCHANGER SYSTEMS INC.
BOSTON,MASS.

CONDENSER PERFORMANCE ANALYSIS
DETROIT EDISON
FERMI UNIT 2
105% POWER-5 CWP'S

CONDENSER DATA

TUBE DIAMETER(INS)	= 1.000	
FIRST MATERIAL	=22BWG, TITANIUM	59592 AVAILABLE TUBES
SECOND MATERIAL	=22BWG, TITANIUM	0 AVAILABLE TUBES
TOTAL DESIGN SURFACE AREA	= 776800.(SQ.FT)	
EFFECTIVE SURFACE AREA	= 776800.(SQ.FT)	

CONDENSER PERFORMANCE

RUN NUMBER	1	2	3	4
CLEAN CONDENSER				
SATURATION PRESSURE(INHG)	1.38	1.47	1.57	1.68
HEAT TRAN.COEFF.(BTU/HR FT2 F)	547	561	573	584
TERMINAL TEMP. DIFF.(F)	10.64	10.23	9.87	9.56
INLET WATER TEMP.(F)	60.00	62.50	65.00	67.50
TEMPERATURE RISE (F)	18.38	18.39	18.40	18.41
CIRCULATING WATER FLOW(GPM)	847500	847500	847500	847500
TUBE VELOCITY(FPS)	6.52	6.52	6.52	6.52
CONDENSER DUTY (MMBTU/HR)	7790.00	7790.00	7790.00	7790.00
CLEANLINESS DATA				
SATURATION PRESSURE(INHG)	1.46	1.56	1.66	1.78
HEAT TRAN.COEFF.(BTU/HR FT2 F)	492	504	516	526
TERMINAL TEMP. DIFF.(F)	12.52	12.06	11.66	11.31
CLEANLINESS FACTOR	.90	.90	.90	.90
CONDENSER PERFORMANCE				
DATE DATA TAKEN	0- 0- 0	0- 0- 0	0- 0- 0	0- 0- 0
TIME DATA TAKEN	0: 0	0: 0	0: 0	0: 0
SATURATION PRESSURE(INHG)	.00	.00	.00	.00
HEAT TRAN.COEFF.(BTU/HR FT2 F)	-145	-140	-135	-131
TERMINAL TEMP. DIFF.(F)	*****	*****	*****	*****
TEMPERATURE RISE (F)	18.38	18.39	18.40	18.41
PERFORMANCE FACTOR(%)	-26.6	-25.1	-23.7	-22.5
SUBCOOLING (F)	.00	.00	.00	.00
VOL OXYGEN CONTENT PPB	0	0	0	0

CONDENSER PERFORMANCE

RUN NUMBER	5	6	7	8
CLEAN CONDENSER				
SATURATION PRESSURE(INHG)	1.80	1.93	2.07	2.22
HEAT TRAN.COEFF.(BTU/HR FT2 F)	594	603	611	618
TERMINAL TEMP. DIFF.(F)	9.30	9.06	8.87	8.70
INLET WATER TEMP.(F)	70.00	72.50	75.00	77.50
TEMPERATURE RISE (F)	18.42	18.43	18.44	18.45
CIRCULATING WATER FLOW(GPM)	847500	847500	847500	847500
TUBE VELOCITY(FPS)	6.52	6.52	6.52	6.52
CONDENSER DUTY (MMBTU/HR)	7790.00	7790.00	7790.00	7790.00
CLEANLINESS DATA				
SATURATION PRESSURE(INHG)	1.90	2.03	2.18	2.33
HEAT TRAN.COEFF.(BTU/HR FT2 F)	535	543	550	556
TERMINAL TEMP. DIFF.(F)	11.01	10.75	10.52	10.33
CLEANLINESS FACTOR	.90	.90	.90	.90
CONDENSER PERFORMANCE				
DATE DATA TAKEN	0- 0- 0	0- 0- 0	0- 0- 0	0- 0- 0
TIME DATA TAKEN	0: 0	0: 0	0: 0	0: 0
SATURATION PRESSURE(INHG)	.00	.00	.00	.00
HEAT TRAN.COEFF.(BTU/HR FT2 F)	-127	-123	-119	-116
TERMINAL TEMP. DIFF.(F)	*****	*****	*****	*****
TEMPERATURE RISE (F)	18.42	18.43	18.44	18.45
PERFORMANCE FACTOR(%)	-21.4	-20.4	-19.5	-18.8
SUBCOOLING (F)	.00	.00	.00	.00
VOL OXYGEN CONTENT PPB	0	0	0	0

TEMP.CORRECTION BASED ON HEI

CONDENSER PERFORMANCE

RUN NUMBER	9	10	11	12
CLEAN CONDENSER				
SATURATION PRESSURE(INHG)	2.38	2.55	2.73	2.93
HEAT TRAN.COEFF.(BTU/HR FT2 F)	624	630	634	638
TERMINAL TEMP. DIFF.(F)	8.55	8.43	8.32	8.23
INLET WATER TEMP.(F)	80.00	82.50	85.00	87.50
TEMPERATURE RISE (F)	18.46	18.47	18.48	18.49
CIRCULATING WATER FLOW(GPM)	847500	847500	847500	847500
TUBE VELOCITY(FPS)	6.52	6.52	6.52	6.52
CONDENSER DUTY (MMBTU/HR)	7790.00	7790.00	7790.00	7790.00
CLEANLINESS DATA				
SATURATION PRESSURE(INHG)	2.49	2.67	2.86	3.06
HEAT TRAN.COEFF.(BTU/HR FT2 F)	562	567	571	574
TERMINAL TEMP. DIFF.(F)	10.17	10.03	9.91	9.80
CLEANLINESS FACTOR	.90	.90	.90	.90
CONDENSER PERFORMANCE				
DATE DATA TAKEN	0- 0- 0	0- 0- 0	0- 0- 0	0- 0- 0
TIME DATA TAKEN	0: 0	0: 0	0: 0	0: 0
SATURATION PRESSURE(INHG)	.00	.00	.00	.00
HEAT TRAN.COEFF.(BTU/HR FT2 F)	-112	-109	-106	-103
TERMINAL TEMP. DIFF.(F)	*****	*****	*****	*****
TEMPERATURE RISE (F)	18.46	18.47	18.48	18.49
PERFORMANCE FACTOR(%)	-18.1	-17.4	-16.8	-16.3
SUBCOOLING (F)	.00	.00	.00	.00
VOL OXYGEN CONTENT PPB	0	0	0	0

TEMP.CORRECTION BASED ON HEI