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Office of Nuclear Reactor Regulation

SUBJECT: Forwards response to NRC 800516 ltr requesting info re turbine disc cracking.Response includes site-specific technical data,insp info,water chemistry results & generic info.No stress corrossion cracking observed at site.

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NSP

NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA 55401

June 18, 1980

Director of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Washington, DC 20555

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Information on Turbine Disc Cracking

In a letter dated May 16, 1980 from Mr Thomas A Ippolito, Chief, Operating Reactors Branch #2, Division of Licensing, USNRC, we were requested to provide information related to turbine discs as outlined in Enclosure 3 to the May 16, 1980 correspondence.

Responses to the site specific general questions and the generic questions, keyed to the outline numbers in NRC Enclosure 3, are contained in Attachment A to this letter.

L O Mayer

L O Mayer, PE
Manager of Nuclear Support Services

LOM/jh

cc J G Keppler
G Charnoff

A001 S3/3
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W HAZELTON "
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8006230437 P

UNITED STATES NUCLEAR REGULATORY COMMISSION

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

Docket No. 50-263

LETTER DATED JUNE 18, 1980
RESPONDING TO NRC REQUEST DATED MAY 16, 1980
FOR INFORMATION ON TURBINE DISCS

Northern States Power Company, a Minnesota corporation, by this letter dated June 18, 1980 hereby submits information in response to NRC request for information concerning turbine discs.

This request contains no restricted or other defense information.

NORTHERN STATES POWER COMPANY

By L. O. Mayer
L O Mayer
Manager of Nuclear Support Services

On this 18th day of June, 1980, before me a notary public in and for said County, personally appeared L O Mayer, Manager of Nuclear Support Services, and being first duly sworn acknowledged that he is authorized to execute this document on behalf of Northern States Power Company, that he knows the contents thereof and that to the best of his knowledge, information and belief, the statements made in it are true and that it is not interposed for delay.

Jeanne M Hacker

JEANNE M. HACKER
NOTARY PUBLIC - MINNESOTA
HENNEPIN COUNTY
My Commission Expires May 6, 1985

ATTACHMENT A

MONTICELLO NUCLEAR GENERATING PLANT

RESPONSE TO NRC REQUEST FOR INFORMATION RELATED TO TURBINE DISCS

SITE SPECIFIC GENERAL QUESTIONS

I. Each LP Turbine

A. Turbine type - TC4F-38

B. Operating hours at last inspection -

LP turbine last inspected in January of 1975. Cummulative hours to that date are 22,627.6

Hours of operation since January, 1975 are 38,604.4 as of May 31, 1980

C. Number of turbine trips and overspeeds-

Turbine trips	54
Overspeed trips	22 (surveillance tests only)
TOTAL TRIPS	76

D. Turbine disc material properties-

General Electric Company has informed NSP that answers to these questions involve data which are proprietary to General Electric Company. Information was provided directly to the NRC during a meeting between General Electric and NRC representatives on April 21, 1980. It is our understanding that the NRC has informed General Electric that the information presented at that meeting is an acceptable reply to this question.

II. Inservice Inspection of LP Turbine Rotors-

The low pressure turbines were last inspected in 1975. That inspection did not include UT examination of the turbine discs. No turbine disc abnormalities were disclosed during the 1975 inspections.

III. Water Chemistry Conditions-

(Data from 1971 -1980)

Parameter	Maximum	Minimum	Average
Conductivity (umho/cm)	1.6-1.8	0.12	0.2
pH	7.2	6.8	6.9
Chloride (ppb)	<40ppb	<40ppb	<40ppb
Silica (ppb)	1200	100	200-300

Generally, the conductivity and silica maximums have resulted from condenser tube leaks. One silica transient resulted from inadequate flush of a feedwater heater shell following sandblasting. The elevated values were experienced over the last nine years of power operation. The estimated above-normal conditions lasted about 2400 hours total.

IV. Future Inspections-

It is planned that the LP turbines will be inspected during the 1981 refueling outage, including UT inspection of the turbine discs.

V. Inspection Plans (if in service with defects)-

Not applicable

VI. Turbine Missile Analysis-

Turbine missile analyses were performed and are referenced in Section 12 of the Monticello FSAR, Subsection 2.3, external missile protection. This information can be found on page 12-2.22B.

GENERIC QUESTIONS:

I. Quality Control and Inspection Procedures-

After the rough machined wheel/disk forging has been tempered, material is removed from surface locations to measure mechanical properties. The forging is then subjected to a 100% volumetric ultrasonic inspection. If the test results meet stringent acceptance standards, the forging is released for final machining. During final machining, attention is continually paid to the finish, contour and dimensions of every surface. For instance, the keyway depth, width, location, radii, and surface finish for every wheel is checked for conformance to drawings. Quality control personnel assure that tolerances are maintained. Any deviation from accepted tolerances are reported to engineering for disposition.

Only coolants and lubricants approved by engineering are used in the manufacturing and assembly process. These coolants and lubricants have undergone extensive laboratory corrosion testing to ensure their acceptability prior to their approval for use in manufacturing. Periodic sampling is done on all such fluids to verify that their chemistry is within acceptable limits. If required, corrective actions are taken to maintain the chemistry within limits.

After finish machining, each wheel is thoroughly cleaned and given a magnetic particle inspection of all surfaces. If acceptable, the buckets are assembled and the wheel is static balanced. After assembly on the shaft, each wheel is inspected and measurements are made to assure its proper location. The assembled rotor is then spun to 20% overspeed following a high speed balance. Finally, after a magnetic particle inspection of the buckets, the rotor is cleaned to prepare for shipment.

II. Repair/Replacement Procedures for Faulty Discs

Stress corrosion cracks have not been observed to date in nuclear wheels manufactured by General Electric, and they do not anticipate that removal or replacement of wheels will be required because of this phenomenon. The water erosion which has been observed in the keyways of wheels on several non-reheat machines is being studied intensively. GE currently believes that the erosion process is self-limiting and should not require the replacement of any wheels.

III. Actions to Minimize "Water Cutting"

No immediate actions are required to minimize water erosion because of the apparent self-limiting nature of the phenomenon. However, if future inspections show an unexpected progression of the water erosion, appropriate operating restrictions and/or modifications will be recommended.

IV. Fabrication and Heat Treatment Sequence

The wheel/disc forgings are heat treated in the rough machined condition. The heat treatment consists of soaking at a temperature above the upper critical temperature with the time and temperature sufficient to ensure complete austenitization throughout the forging, followed by a quench in cold, vigorously circulated water for a sufficient time to ensure complete transformation throughout the section. The forgings are heated uniformly to a tempering temperature below the lower critical temperature and held for a sufficient time to soften to the desired tensile range. After tempering, the forgings are still-air cooled to room temperature.

After final machining, the wheels (discs) are uniformly heated in an electric furnace to a temperature below the embrittling range, but sufficiently high to increase the wheel diameter enough to assemble on the shaft with the required shrink fit.