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

May 16, 1980

Docket No. 50-333

Mr. George T. Berry
President and Chief Operating
Officer
Power Authority of the State
of New York
10 Columbus Circle
New York, New York 10019

Dear Mr. Berry:

On December 28, 1979 the NRC Office of Inspection and Enforcement (IE) issued Information Notice No. 79-37 that discussed the discovery of cracks in the keyway and bore sections of discs in Westinghouse low-pressure turbines. A copy of this Information Notice with an errata sheet is enclosed. Subsequently, all licensee/ users of low-pressure turbines manufactured by General Electric were invited to meet with the NRC staff and representatives of the vendor on January 9, 1980 to discuss the probability of disc cracking in these turbines. A summary of this meeting and the General Electric Company's presentation are also enclosed with this letter.

At the time of the January 9 meeting General Electric did not have any recent results of ultrasonic inspections of its low-pressure turbines. Since that date full UT inspections have been performed on six rotors at five nuclear power plants. Some indications in the keyway region have been reported in discs at three of these plants. General Electric personnel believe that these indications were caused by water erosion rather than by stress corrosion.

The staff desires to learn more about the underlying reasons for the indications found and the probable rate of growth of these indications and their effects on turbine disc integrity.

For this purpose we request that you provide the information sought in Enclosure 3 to this letter and address its safety significance. Under the provisions of 10 CFR 50.54(f) your response is requested within 30 days of the receipt of this letter. A copy of this letter is being telecopied to you, along with Enclosure 3.

It is my understanding that additional UT inspections are to be performed by General Electric in the near future. We encourage this action as being the only certain means of determining the integrity of turbine discs. We also recommend that if you have not already done so, that you develop a schedule for performing a full UT inspection of at least one of your low-pressure turbines during the next major outage of your plant.

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POOR QUALITY PAGES

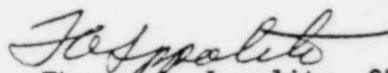
Mr. George T. Berry

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May 16, 1980

This request for generic information was approved by GAO under clearance number B-180225 (S79014); this clearance expires June 30, 1980.

Sincerely,


Thomas A. Ippolito, Chief
Operating Reactors Branch #2
Division of Licensing

Enclosures:

1. Information Bulletin
79-37
2. Meeting Summary
3. Information Requests

cc w/o enclosures:
See next page

Mr. George T. Berry

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May 16, 1980

cc:

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UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 OFFICE OF INSPECTION AND ENFORCEMENT
 WASHINGTON, D.C. 20555

ISINS NO.: 6870
 Accession No.:
 7910250525

December 28, 1979

IE Information Notice No. 79-37

CRACKING IN LOW PRESSURE TURBINE DISCS

Description of Circumstances:

An anonymous letter was received by the Director of the Office of Inspection and Enforcement, on November 17, 1979 which alleged possible violation of Part 10 CFR 50.55e and/or 10 CFR 21 Regulations concerning reportability of recently discovered stress corrosion cracking in Westinghouse 1800 rpm low pressure turbine discs. Westinghouse had made a presentation on the turbine disc cracking to electric utility executives on October 30, 1979.

Telephone discussions between the NRC staff and Westinghouse's Turbine Division on November 20, 1979 established that cracking, attributed to stress corrosion phenomena, had been found in the keyway areas of several LP turbine discs at operating plants and that inservice inspection techniques (i.e., in situ ultrasonic examination) for crack detection have been developed and are being implemented in the field. The Office of Inspection and Enforcement was also notified on November 20, 1979 that during the current overhaul of Commonwealth Edison's Zion Unit 1 LP turbine, ultrasonic examination revealed embedded cracks located on the inlet side on the disc bore area where no cracks had been previously observed. Ultrasonic measurements indicate this disc bore cracking is of greater depth than the keyway cracks found to date. According to Westinghouse, these bore cracks have been metallurgically examined and preliminary findings show them not to be typical of classical stress corrosion cracking observed in the keyways. The probable cracking mechanism and impact on disc integrity is being further evaluated by Westinghouse.

A meeting was held on December 17, 1979 between the NRC staff, Westinghouse and utility representatives to discuss the disc cracking problem, repair alternatives, turbine missile evaluation, inspection techniques and plant inspection priorities. In response to the staff's request, Westinghouse provided the staff an updated report on December 21, 1979 regarding the current field inspection program that included a list of nuclear power plants already inspected, recommended inspection schedules and pertinent information related to LP turbines where cracks have been observed. Inspections to date have identified turbine disc cracks at Perry Unit 2, Point Beach Unit 2, Palisades, Indian Point Unit 3 and Zion Unit 1. All units except Zion Unit 1 will not be returning to power until the plants return to power. Point Beach Unit 2 will not be returning to power with a small crack in the No. 2 turbine disc. Westinghouse indicated that the current field inspection program will continue during 28 additional months of turbine inspection results a

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No. of pages: 6

Westinghouse also notified the staff that extrapolation of information obtained from Indian Point Unit 3 inspection and analysis indicates that disc cracking could be significant at Indian Point Unit 2 and the turbines should be inspected sooner than the spring outage of 1980. The NRC staff is currently reviewing Consolidated Edison's plans for prompt evaluation of this potential problem at this unit.

Enclosure 1 lists the PWR plants having Westinghouse 1500/1800 rpm turbines. The AA category represents those turbines which appear to have the earliest need for inspection. With the exception of Yankee Rowe, Westinghouse has recommended to utilities that inspection of these machines be completed by the Spring 1980 outage period. The Rowe unit is uninspectable by the present ultrasonic techniques due to its design. Westinghouse has recommended the remaining machines of the Category A plants be inspected as their service periods approach five years or in the event significant corrosion problems become evident during this time. The NRC staff is currently reviewing the need for inspection of those PWR plants having other interfacing turbine designs shown in Enclosure 2. Changes to the forementioned inspection schedules proposed by Westinghouse may be necessary as new technical information becomes available.

From the information available to the NRC staff at this time it appears that cracking may be more generically widespread in turbine discs (e.g., keyways and bore areas) than previously observed. It is important to note that the UT inspections performed by Westinghouse thus far were essentially limited to the keyways (disc outlet) of selected discs whereas the Zion Unit 1 inspection results indicate that examination of the disc bore section must be taken into account. Also, Westinghouse is currently re-evaluating their previously estimated turbine missile energies based on recent missile test results from model symmetric and non-symmetric missile impact tests. Their preliminary findings, although subject to change, now indicate possible higher missile exit energies in some cases than previously expected.

This Information Notice is provided as an early notification of a possibly significant matter, the allegations and the generic safety implications of which are currently undergoing review by the NRC staff. It is expected that recipients will review the information applicable to their facilities. If NRC evaluations so indicate, further licensee actions may be requested or required. Embedded cracking in keyways and disc bore areas have been observed only in Westinghouse LP turbines thus far. However, the NRC staff believes that turbines of other manufacturers should be included in consideration of this problem.

No written response to this Information Notice is required. If you have any questions regarding this matter, please contact the Director of the appropriate NRC Regional Office.

Enclosures: As stated

Errata Sheet For
IE Information Notice No. 79-37

Page 1, paragraph 2, line 9: Change "inlet" to "outlet"

Page 1, paragraph 3, lines 9 and 10: Change "Point Beach Unit 2" to
"Point Beach Unit 1"

Page 1, paragraph 3, line 10: After Point Beach Unit 1 add an asterisk
("*") footnote and place a note at the bottom of the page as follows:
"*Wisconsin Electric Power Company orally notified the NRC project
manager on November 5 that turbine disc cracking had been observed at
Point Beach Unit 1."

Enclosure 1, line 4: Change "Russellville" to "ANO"

Enclosure 1, line 8: Change to read: "Yankee Atomic Electric, Yankee Rowe"

Enclosure 1, lines 9 and 15: Change "Wisc Mich Pwr" to "Wisc Elec Pwr"

Enclosure 1, line 16: Change to read "Maine Yankee Atomic Pwr, Maine Yankee"

Enclosure 1, page 3, line 13: Delete as redundant reference to North
Anna 2

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

FEBRUARY 21 1980

MEMORANDUM FOR: A. Schwencer, Chief
Operating Reactors Branch #1, DOR

FROM: W. J. Ross, Project Manager
Operating Reactors Branch #1, DOR

SUBJECT: MEETING WITH GENERAL ELECTRIC RELATED TO TURBINE DISC
CRACKS

At the staff's request, representatives of General Electric met with the staff and licensee/user of G.E. turbines on January 9, 1980 to discuss the design of and operational experience of low pressure turbines. A list of attendees at the non-proprietary and proprietary sessions is attached.

In the non-proprietary session General Electric's personnel discussed the following topics: (a) turbine wheel (disc) integrity; (b) minimizing wheel (discs) bursts. Copies of the slides used in this presentation are attached in Enclosure 3.

Turbine Wheel Integrity

There has been no indication of cracks in the bore regions of G.E. low pressure turbine wheels. This experience includes the operation of 35 turbines at nuclear generating plants (22 BWRs-of which only three have actually been inspected) and 4000 wheels at 235 fossil units (percent of wheels inspected was not established at the meeting). A G.E. turbine has the following design characteristics:

- (1) 14 wheels or discs per rotor with 38" or 43" active length buckets or blades.
- (2) Rectangular axial keyway and circumferential locking ring minimize rotation of wheels on the turbine shaft (i.e. minimize stress).
- (3) Feedwater systems on flow demineralizer, good even with poor

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P (<127% normal turbine speed)	=	2.6×10^{-7}
P (runaway)	=	1.5×10^{-7}
P (lifetime total)	=	4.1×10^{-7}
P (annual average)	=	1.4×10^{-8}

General Electric continues to recommend that its users perform UT inspections of wheel bores at 6-year intervals. A satisfactory UT test has been developed for this purpose. To date the three UT tests that have been performed were on nuclear turbines that had averaged about 3 years of operating experience.

Minimizing Wheel Bursts

A brief review of actions taken by G.E. to eliminate the formation of cracks in turbine wheels was presented and included the following:

- 1) Forging process designed to eliminate internal cracks.
- 2) New wheels are inspected by visual, UT and magnetic particle techniques.
- 3) New wheels are tested at 120% operating speed.
- 4) Tolerance of defects caused by stress and corrosion maximized through choice of material.
- 5) Provision for UT testing of wheels after installation and use.

General Electric's personnel provided the following responses to questions from the audience.

1. Retention of a 6-year interval for inspection of turbines was justified by operating experience and crack growth rate studies.
2. Three G.E. turbines at nuclear plants (1 BWR and 2 PWR) have been inspected by UT and no indications observed. These turbines had seen about 3 years of service.
3. All wheels of turbines at nuclear sites are inspectable in sites (without removal from the turbine). Approximately 5 days are required to inspect one 14-wheel rotor. Four additional days would be needed to complete the inspection of a second rotor at the same site.
4. The length of a crack is postulated by G.E. to be 4 to 5 times the depth determined by UT.
5. Overspeed devices on G.E. turbines are testable under load and retain their protective capability during the test.