POWER AUTHORITY OF THE STATE OF NEW YORK

10 COLUMBUS CIRCLE NEW YORK, N. Y. 10019

(212) 397-6200

July 29, 1980
JPN-80-37

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. Thomas A. Ippolito, Chief
Operating Reactors Branch No. 3
Division of Operating Reactors

Subject: James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
LP Turbine

Reference: Letter, T.A. Ippolito (NRC) to G.T. Berry (PASNY) dated May 16, 1980

Dear Sir:

Attached are responses to the NRC requests for information in Enclosure 3 to the referenced letter related to LP turbine disc integrity.

Very truly yours,

J. P. Bayne
Senior Vice President
Nuclear Generation

A001
S
1/1

ADD:	Ltr	Enc
W. Ross	1	1
W. Hazelton	1	1
H. Walker	1	1

8008050 005

RESPONSE TO REQUEST FOR INFORMATION RELATED TO TURBINE DISCS

SITE SPECIFIC GENERAL QUESTIONS

QUESTION I:

Provide the following information for each LP turbine:

A. Turbine type

B. Number of hours of operation for each LP turbine at time of last turbine inspection or if not inspected, postulated to turbine inspection.

C. Number of turbine trips and overspeeds

D. For each disc:

1. Type of material, including material specifications
2. Tensile properties data
3. Toughness properties data including Fracture Appearance Transition Temperature and Charpy upper steel energy and temperature
4. Keyway temperatures
5. Critical crack size and basis for the calculation
6. Calculated bore and keyway stress at operating design overspeed
7. Calculated K_{1C} data
8. Minimum yield strength specific for each disc

RESPONSE TO I:

I.A. Turbine Generator Type; GE 170X504, tandem-compound with four-flow low pressure stages. The turbine consists of 3 sections, a double flow high pressure and 2 double flow low pressure sections.

1.B. The last low pressure turbine ultrasonic inspection of keyways was during fabrication of the unit. Ultrasonic examination to detect possible cracks at keyways is scheduled for the next refueling outage at the end of fuel cycle 4. Since initial operation, the turbine generator has been in service (generator online) for 30,309 hours. Based on a fuel cycle 4 target burnup of 7362 Mwd/t and a unit capacity factor of 80%, it is estimated that the turbine generato will operate an additional 10,517 hours before the next inspection.

1.C. Since initial start-up, overspeed test of the turbine has been conducted five times. No additional overspeed events have occurred. Since initial start-up, 13 turbine trips have occurred.

RESPONSE (cont):

I.D. Answers to these questions involve data which are proprietary to the General Electric Company. Information was provided directly to the NRC during a meeting between General Electric and NRC representatives on April 21, 1980. The NRC has informed GE that this information is an acceptable reply to this question.

QUESTION II:

Provide details of the results of any completed inservice inspection of LP turbine rotors, including areas examined, since issuance of an operating license. For each indication detected, provide details of the location of the indication, its orientation, size, and postulated cause.

RESPONSE TO II:

As noted in item I.B. above, the inservice inspection of the low pressure turbine rotors which have been conducted since initial start-up, have not included ultrasonic examination for the purpose of detecting keyway cracks. Consequently, the existence of any possible cracks is an unknown factor.

QUESTION III:

Provide the nominal water chemistry conditions for each LP. Describe any condenser inleakages or other significant changes in water chemistry to this point in its operating life.

RESPONSE TO III:

Two steam carryover tests were performed at JAF during the initial start-up chemistry testing program. The results of the tests are as follows:

Test Date	%Na-24 Carryover	% Iodine Carryover
5/19/75	0.004	0.51 (I 133)
11/8/75	0.0011	0.88 (I-133)

Iodine-131 was not used in the first test because it could not be detected in the steam sample. With regard to turbine discs this data is considered the most relevant since it is a measure of steam quality. Samples of steam are not routinely taken because of the difficulty in obtaining representative samples due to the amount of sample cooling with respect to required flow and flow time necessary. However, there is no reason to believe that the carryover values have changed because the results obtained from the start-up samples were representative of other BWR carryover tests.

GENERIC QUESTIONS

QUESTION I:

Describe what quality control and inspection procedures are used for the disc bore and keyway areas.

RESPONSE TO I:

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.

QUESTION II:

Provide details of the General Electric repair/replacement procedures for faulty disks.

RESPONSE TO II:

Stress corrosion cracks have not been observed to date in nuclear wheels manufactured by General Electric, and we 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

RESPONSE TO II (cont):

keyways of wheels on several non-reheat machines is being studied intensively. We currently believe that the erosion process is self-limiting and should not require the replacement of any wheels.

QUESTION III:

What immediate and long term actions are being taken by General Electric to minimize future "water cutting" problems with turbine disks? What actions are being recommended to utilities to minimize "water cutting" of disks?

RESPONSE TO III:

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

QUESTION IV:

Describe fabrication and heat treatment sequence for disks, including thermal exposure during shrinking operations.

RESPONSE TO IV:

The wheel/disk 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 (disks) 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.

RESPONSE (cont):

In a review of the routine reactor water samples for 1979 and 1980, it was found that silica concentrations averaged approximately 50 ppb and that three weekly samples showed highs of 400 to 600 ppb.

QUESTION IV:

If your plant has not been inspected, describe your proposed schedule and approach to ensure that turbine cracking does not exist in your turbine.

QUESTION V:

If your plant has been inspected and plans to return or has returned to power with cracks or other defects, provide your proposed schedule for the next turbine inspection and the basis for this inspection schedule, including postulated defect growth rate.

RESPONSE TO IV AND V:

No keyway cracks are known to exist and no inspection for the purpose of detecting such cracks is planned until during the refueling outage at the end of fuel cycle 4. Bases on the inspection of other turbine generators with a similar operating history and age, General Electric does not consider it likely that any cracks exist in the FitzPatrick unit at this time.

QUESTION VI:

Indicate whether an analysis and evaluation regarding turbine missiles have been performed for your plant and provided to the staff. If such an analysis and evaluation had been performed and reported, please provide appropriate references to the available documentation. In the event that such studies have not been made, consideration should be given to scheduling such an action.

RESPONSE TO VI:

A discussion of turbine missile analysis for JAF was provided in response to the NRC letter of November 29, 1971, Question 10.1. This response is provided in the FSAR.