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VARGA,S.A. Operating Reactors Branch 1

SUBJECT: Forwards results of 1983 steam generator eddy current & fiber optics visual exams,per Tech Spec 4.2.b.5.a.Summary of return to power SER encl.Facility placed in C2 category, requiring next insp within 24 months.

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WISCONSIN PUBLIC SERVICE CORPORATION

P.O. Box 1200, Green Bay, Wisconsin 54305

May 2, 1983

Director of Nuclear Reactor Regulation
Attention: Mr. S. A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Varga:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Steam Generator Inspection Results

The results of the 1983 Steam Generator Eddy Current and fiber optics visual examinations are enclosed for your review. This report is being submitted in accordance with Technical Specification 4.2.b.5.a.

Enclosure 1, entitled "1983 KNPP/WPSC Steam Generator Eddy Current Inspection Report" is a summary of the inspection program based on a preliminary reduction of 6700 data sheets. All data sheets are being carefully rereviewed and any significant changes to information presented herein will be the subject of future correspondence. The final report on this inspection will be included in the Annual Operating Report. A synopsis of the results is as follows. Kewaunee experienced, for the first time in 9 years of operation, defective tubes which required mechanical plugging. Four such tubes were found in the 1A steam generator and 18 in the 1B steam generator. In addition to these defective tubes, 19 tubes in the 1A steam generator and 31 in the 1B steam generator were plugged as a preventative measure.

These results place Kewaunee in the C2 category, requiring the next inspection within 24 months.

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Enclosure 2 is a Safety Evaluation Report prepared by Westinghouse which details the visual inspection performed on both steam generators. A safety evaluation was necessitated by the discovery of foreign objects on the top of the tube sheet. Two of these objects, consisting of welding rod stubs, have been removed. Two additional objects, one of which has been identified as a small bolt and the other which remains unidentified, are firmly held in place at the location where they were discovered, in spite of considerable effort to retrieve them.

The Westinghouse Safety Evaluation Report addresses the potential concerns for leaving these parts in place. It concludes that operation of the steam generator with the parts in place does not constitute a safety concern. This conclusion is based on the immobility of the objects.

Very truly yours,

C. W. Giesler

C. W. Giesler
Vice President - Nuclear Power

js

Enc.

cc - Mr. Robert Nelson, US NRC

Enclosure 1

1983 KNPP/WPSC STEAM GENERATOR EDDY CURRENT INSPECTION REPORT

An eddy current inspection of the Kewaunee steam generator tubes was performed during April, 1983 in accordance with Technical Specifications and Section XI of the ASME Boiler & Pressure Vessel Code (Inservice Inspection). Multifrequency techniques were utilized to cancel background interferences.

The initial inspection program was designed to inspect the Row 1 - Row 2 U-bend areas, the peripheral tubes for possible foreign object wear, and a statistical sampling of the remaining tubes for general degradation and anti-vibration bar fretting. Seven tubes were added to the program for 1A generator since they had shown some non-progressing indications in previous inspections. Identification of the initial defect in 1A generator dictated a program expansion (1st expansion) as required by Technical Specifications. When more data became available from both generators, a management decision was made to inspect 100% of the tubes in both generators. The extent of inspection in each tube was determined by the relative position of the tube in the generator and probable degradation mode of that tube.

The inspection results disclosed four (4) tubes in 1A generator and 18 tubes in 1B generator that exceeded the Technical Specification plugging limit (degradation greater than 50% wall thickness). An additional 17 degraded tubes were located in 1A generator and 81 additional in 1B (degradation between 20% and 50% wall thickness). The degradation mechanism has not been determined at this time but general tube wall wastage (thinning) is not evident.

The twenty-two defective tubes were plugged with mechanical plugs. An additional nineteen (19) tubes were plugged in 1A generator. Fourteen of these

were Row 1 - Row 2 U-bend indications which could not be quantified. Two (2) tubes were plugged since they showed some (greater than 30%) degradation and were adjacent to a defect tube. The final three (3) tubes are adjacent to a bolt lodged in the sludge blanket on the secondary side of the tube sheet. One end of two of these last three tubes contains a "sentinel" plug consisting of a standard mechanical plug with a 0.040" drilled orifice which allows monitoring for tube shear. Preventative plugging was also performed on thirty-one (31) tubes in 1B generator. Ten (10) of these tubes showed undefined degradation in the tube sheet region. The remainder (21) had degradation in the 40% range and were in close proximity to defect tubes.

The results of the inspection place the plant in the C-2 category of Technical Specification 4.1.2 increasing the inspection frequency to once per 24 months vs. once per 40 month interval.

1983 Steam Generator Summary

Number of tubes inspected	1A	1B
Initial Program	766	766
Added from previous inspections	7	0
First Program Expansion	211	*
*No First Expansion on 1B		
Second Program Expansion	1426	1656
Third Program Expansion	967	966
TOTAL	3377	3388

Eleven tubes in 1A steam generator were not inspected as they were either under the inspection fixture or contained temporary fasteners.

Number of Tubes Plugged		
Defect Tubes (>50%)	4	18
U-Bend Indications	14	0
Undefined Indications	0	10
Preventative Plugging	5*	21

*Two of these tubes contain "sentinel" plugs. Refer to text.

Enclosure 2

Kewaunee

Summary of the Return to Power Safety Evaluation Report
Prepared by Westinghouse

A recent inspection of the secondary side of the Model 51 steam generators at Kewaunee revealed a foreign object in the hot leg of steam generator A sitting on top of the tubesheet. Fiber optics were used to photograph the object, situated at the periphery of the tube bundle in a region bounded by tubes R44C33, R43C33 and R43C32. Photographs identify the object to be a hex head bolt, approximately 1.0 long and 0.25" in diameter. To the left of the bolt head is an unidentified mass, apparently attached to one of the flats of the bolt head. Figure 4 is a schematic of the foreign object and its location in the tube bundle.

As the photographs reveal, the bolt is heavily corroded which indicates that it has been present for a long time, probably longer than 2-3 years. No eddy current indications have been observed on the three adjacent tubes in the past at this elevation. Additionally, prior to this inspection, no tubes in the steam generator had been plugged. Plugging was performed at this inspection due to AVB indications and indications within the tubesheet only. Thus, there is no evidence of tube damage due to the bolt floating freely on the secondary side and impacting tubes in the past.

A retrieval team made several attempts to remove the bolt. The bolt was accessible from both the periphery and through the tube columns. The bolt was grasped and pulled on from the periphery and pushed on from the tube column. Neither exercise was successful in even budging the bolt. See

Appendix A for a detailed description of the retrieval efforts. Experienced retrieval personnel have reported that as much force was used in trying to remove the bolt as has been used in successfully retrieving foreign objects from other steam generators in the past. The following is an evaluation of plant operation with the bolt remaining in place.

Several actions were agreed upon by Westinghouse and Wisconsin Public Service Corporation personnel which would allow the plant to safely return to power with the bolt still in place. Firstly, based on the results of the retrieval attempts it was determined that the bolt is either wedged or corroded firmly in place. The probability that the bolt will become free sometime during operation was judged to be low. This position is reinforced by the fact that there is no evidence of tube damage due to impacting in the past and that retrieval efforts with a good grip on the bolt were unsuccessful. The bolt has been ridgidly in place for some time. In order to insure that the bolt is still in place, future outages will include a visual inspection of this region to verify the presence of the bolt. Secondly, to prevent a large leakage from occurring if the bolt should begin to vibrate against one of the bordering tubes, two tubes (R44C33, R43C32) have been plugged on the hot leg with leaktight mechanical plugs and on the cold leg with leak-limiting sentinel plugs. One tube (R43C33) was plugged with leaktight mechanical plugs at both ends. Should one of these three tubes wear through-wall due to vibration of the bolt, the sentinel plugs would limit primary-to-secondary leakage to a low, detectable level. Normal procedures could then be followed in order to shutdown the unit for inspection and repairs as necessary. Plugging these three tubes is considered a conservative measure since none have any record of

eddy current indications at the tubesheet elevation. This is an indication that the bolt has not been causing wear on nearby tubes due to vibration. Thirdly, after retrieval efforts were complete, an eddy current inspection of the peripheral tubes and tubes in the columns that were used to gain access to the bolt was performed. This verified that no mechanical damage was done to nearby tubes as a result of the retrieval process.

Based on the above three considerations, it was determined that the unit can safely return to power with the bolt firmly held in place as is. One final question remained to be answered, that of the origin of the bolt. The possibility exists that the bolt is either a foreign object (i.e., non-steam generator part) or a loose part (i.e., steam generator part). For a foreign object classification it can only be stated that it originated outside the steam generator. For the loose part classification a single source possibility has been identified. Seventeen 3/8" x 1" bolts are used to secure the mid-deck plate access hatch in the moisture separator region of the steam generator. These dimensions are close to those of the bolt found on the tubesheet as estimated by the photographs. A visual inspection has determined that the bolt did not originate from access hatch described above. No other part of the steam generator utilizes bolts of similar dimensions ~~(see Appendix B)~~. From this, it can be concluded that absence of the bolt has not compromised the integrity of any part of the steam generator.

In summary, the conclusion of this evaluation is that Kewaunee can safely return to power and operate since the bolt present on the secondary side of steam generator A is firmly held in place and is judged to have a low probabi-

lity of coming loose. Steps taken to monitor the condition of the bolt include subsequent visual inspections and the installation of sentinel plugs in nearby tubes. These factors all contribute to the continued safe operation of Kewaunee at no undue risk to the public health and safety.

APPENDIX A

A service trip was made to the Kewaunee (WPS) Nuclear Power plant for the purpose of sludge lancing and photographic-fiberoptic inspection of the secondary side of two series 51 steam generators. The sludge lancing was performed according to the customer's requirements.

A preliminary review of flow slot photographs reveals no indications of hourglassing or other distortion of the seven support plates. During the fiberoptic search of the annular region between the peripheral tubes of the tube bundle and the steam generator shell several foreign objects were found.

The objects were located on the hot leg side of S/G A(Secondary Side) within the nozzle side quadrant. These objects consisted of two short welding stubs which were 2" & 2-1/2" long by 1/8" in diameter. Also, there were two objects clustered together in the triangle formed between the tubes, which are located at Row 43, Columns 32 & 33, and Row 44, Column 33. One of these objects was a bolt with a hex-head, and the other appeared to be a bolt with a round head with a slot which would accommodate a screw driver. The hex-head is clearly a bolt, but the round head may or may not be a bolt, it is too worn off and encased in what appears to be a coating to ascertain its precise geometric configuration. The round head object, if it is a bolt, would have its threaded part going between two columns of tubes, which makes it inaccessible for positive fiberoptic identification. The location of these two objects is shown on Attachment One of this report.

The two short welding stubs were readily retrievable since they were both loose in the annular region and were both magnetic. They were subsequently

retrieved. The two bolts were "wedged" in place and partially encased in a hard substance which made them very rigid and not retrievable when this effort was made.

Retrieval attempts were made from three different directions. They were approached from both nozzle and manway side six-inch inspection holes via the respective tube to shell annular regions, and also, from the nozzle side six-inch inspection holes via the tube lane, going perpendicularly up between the columns with a pushing tool.

The procedure used in the annular region was to grab the hex-head bolt on the threaded portion with various pneumatic gripping tools and/or snares fabricated of steel cable (approximately 1/16" in diameter).

The delivery system for both of these method was a rope which was strung thru this region and a flexible cable and/or conduit to push the tools into position. The conduit, when used in conjunction with the steel cable, also served as a choking device to hold the cable in position when it was wrapped around the outer end portion of the threaded hex-head bolt. Only the outside end of the bolt was accessible for snaring since beyond the first one or two threads there was a hard substance in the space between the bolt threads and the Row 44, Column 33 tube. Also, the proximity of this tube to the end of the bolt made the snaring of this bolt very difficult.

However, both the snaring of the hexhead bolt and the grabbing of it with pneumatic grippers were achieved. A 1/16" diameter steel cable used in conjunction with a conduit for choking purposes was affixed to the hex-head bolt

end with such tenacity that it took two people pulling from the nozzle side handhole to break the wire loose. The bolt, however, remained fixed in its position. The pneumatic grippers were affixed to the bolt on numerous occasions with no success in moving it. The gripper fingers would slide off before the bolt would break loose.

Several flat metal sections attached to banding material were used to strike the wedged bolts from within the tube bundle. These metallic places were approximately 1/4" thick and varied in size from 2" x 3" to approximately 1" x 2". This flat stock was welded to banding material which was inserted through a specially fabricated tool holder up the tube lane and perpendicular up between the columns of tubes. This tool struck the lodged bolts from behind with such force that nicks resulted in the pushing tools' striking surfaces. Despite these substantial blows to the backside of these objects, they did not appear to move.

The last effort used was to loop the bolt from the annular region and pull on it to satisfy ourselves that striking it from behind had not dislodged it. This was done prior to the final eddy current test of the tubes in the proximity of the lodged bolts, and the tubes in the respective columns which the pushing tool passed down. It is our judgement the bolt was still securely lodged in place after the retrieval effort.

An estimated size of the hex-head bolt is 3/8" diameter (on the threaded portion) with an overall length of approximately 1-1/4". The round head bolt adjacent to the hex-head one appears to have a round-head of 3/4" in diameter by approximately 1/4" thick. If the round-head bolt is indeed a bolt with

the threaded section still attached, its' diameter would be less than .406 inches, since this is the distance between the tubes. Judging from where the pushing tool hit a solid object while going up the column, it can be assumed that the length of the threaded part would be no more than 1-1/2". It also can be stated that there is a possibility that the pushing tool is striking some hard sludge in this area and the threaded portion, if it does exist, could be shorter.