



UNITED STATES  
**NUCLEAR REGULATORY COMMISSION**  
 REGION II  
 101 MARIETTA ST., N.W.  
 ATLANTA, GEORGIA 30323

Report Nos.: 50-413/88-32 and 50-414/88-32

Licensee: Duke Power Company  
 422 South Church Street  
 Charlotte, NC 28242

Docket Nos.: 50-413 and 50-414

License Nos.: NPF-35 and NPF-52

Facility Name: Catawba 1 and 2

Inspection Conducted: August 15-19, 1988

Inspector: B. R. Crowley  
 B. R. Crowley

9/8/88

Date Signed

Approved by: J. J. Blake  
 J. J. Blake, Section Chief  
 Materials and Processes Section  
 Engineering Branch  
 Division of Reactor Safety

9/12/88

Date Signed

SUMMARY

Scope: This routine, unannounced inspection was conducted in the areas of Steam Generator Tube Leak (Unit 1), IST of Pumps and Valves (Unit 1), ISI (Unit 1), Temporary Instruction 2500/26 (Bulletin 87-02) (Units 1 and 2), NRC Bulletins (Units 1 and 2), and Actions on Previous Inspection Findings (Units 1 and 2).

Results: Based on inspection of licensee activities during the current SG tube leak outage, the licensee has a strong program for monitoring SG tube leakage, tube inspection, and taking corrective action when leakage is identified. Plant management as well as corporate personnel were actively involved in analyzing the leak, inspection of the SGs and repair of the leaking tube. Resolution of technical issues from a safety standpoint was considered to be a strong point based on the licensee's analysis of the tube leak, decision to shutdown the plant, repair of the leak, and additional tube inspections. One weakness was identified relative to the use of an unapproved procedure change (See paragraph 4.c).

Based on limited inspection of IST and ISI activities, these programs were found to be adequate.

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Responsiveness to NRC initiatives was considered very good based on review of licensee actions and responses to three NRC Bulletins (87-02, 88-02, and 88-05).

Training and qualification effectiveness appeared to be good based on observations of ET examiners performing examinations and evaluations, and review of qualification records for ET examiners and ISI NDE examiners.

## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees

- W. Bailey, Design Engineer - Mechanical
- M. Carwile, Performance Engineer
- C. Cheezem, QA Engineer - IST
- R. Gilis, IST Coordinator
- \*R. Glover, Compliance Supervisor
- R. Kaye, Nuclear Production Specialist - Maintenance Engineering Services
- \*V. King, Compliance
- J. Lynch, Nuclear Production Specialist - Maintenance Engineering Services
- D. Mayes, Nuclear Production Engineer - Nuclear Maintenance
- T. Mauldin, Nuclear Production Specialist - Maintenance Engineering Services
- \*T. Owen, Station Manager
- G. Smith, Superintendent of Maintenance
- C. Therrien, Supervising Scientist
- M. Thompson, Supervisor, Vendor Audit and Survey Group
- \*R. Wardell, Superintendent of Technical Services
- D. Whitaker, Nuclear Production Engineer - Mechanical Maintenance
- J. Willis, Station QA Manager

Other licensee employees contacted during this inspection included craftsmen, engineers, QA personnel, mechanics, security force members, technicians, and administrative personnel.

#### Other Organizations

- M. Gallagher, Level III Examiner, B&W
- M. Storey, Supervisor NDE Field Services, B&W

#### NRC Resident Inspectors

- K. Van Doorn, Senior Resident Inspector
- \*M. Lesser, Resident Inspector

\*Attended exit interview

### 2. Steam Generator Tube Leak (73753)(62700)(Unit 1)

On August 5, 1988, the licensee decided to shut down Catawba Unit 1 to repair a SG tube leak in Generator "D". The licensee had been monitoring the leak since early 1988. The leak had been considered too small to locate. However, from mid July until August 5, the leak increased from approximately 30 gpd to approximately 100 gpd at which time the licensee

felt assured the leak could be located. On August 11th, the secondary side of SG "D" was pressurized to locate the leaking tube. On August 12th, ET inspection using a standard type Bobbin coil confirmed the leak to be in the U-bend (cold leg side) of row 1 tube 1-53 approximately 2" above the upper support plate. Also, six row 1 tubes, three on either side of tube 1-53, and 7 adjacent row 2 tubes were ET inspected using the Bobbin coil. It should be noted that using the Bobbin coil on rows 1 and 2 U-bends is on a best effort basis considering the tightness of the bends. No additional defective tubes were identified.

The licensee had planned to inspect all SG "D" row 1 tube U-bends using a state of the art rotating pancake ET coil (Eddy 360). However, on August 12, before the inspection was started, RHR pump 1B was lost due to shaft leakage and high vibration (see Paragraph 3 below). Manway covers were re-installed and the RC loops filled. The RHR pump was replaced with a new spare pump. On August 17th, after installation of the new RHR pump, SG "D" manway covers were removed and the Eddy 360 ET coil used to inspect the U-bends of all Row 1 tubes and the seven row two tubes previously inspected with the Bobbin coil. No other defective tubes were identified. A 20% thru wall indication (acceptable by IS) was identified in the U-bend area of Tube 1-8. In addition to plugging defective Tube 1-53, Tube 1-8 was plugged for preventative measures.

The following summarizes the inspector's examination of licensee activities relative to the leaking tube and ET examinations:

a. SG Tube Inspection History

The inspector reviewed and discussed with the licensee the inspection history for the Unit 1 SG tubes. The following summarizes the tubes ET tested during the 1986 and 1987 outages:

		1986	1987
SG	A	534	528
SG	B	522	491
SG	C	527	571
SG	D	520	578

Both the 1986 and 1987 inspections included inspection of all Row 1 tubes from the hot leg side. The 1987 inspection included the U-bends to the upper support plate on the cold leg side. The 1986 inspection did not include the U-bends. It should be noted that these inspections were made with a Bobbin coil which is only a best effort basis for the Row 1 tight U-bends. No tubes were plugged as a result of these inspections.

The licensee re-reviewed the 1987 ET data for Tube 1-53. No detectable flaws existed in the 1987 data using the Bobbin coil inspection method.

b. Leak Monitoring

The inspector discussed with the licensee their methods for monitoring and tracking SG "D" leakage. In response to NRC bulletin 88-02, the licensee is in the process of developing and implementing a program for actions required for detecting and taking action for rapidly increasing SG tube leaks. Chemistry, Operations, and Health Physics departments are involved in monitoring leakage and taking actions for SG tube leakage. Procedures for all departments have been issued describing actions to be taken. In addition, a SD has been drafted to coordinate the activities of all departments in evaluating the SG tube leakage and to provide acceptance criteria and licensee actions for specific leakage levels. The licensee provided the following to the inspector for review:

- Plot of leakage rate versus time for the current SG "D" leak
- Chemistry Guideline 3.3.2, R1, Steam Generator Tube Leaks
- Draft SD 3.0.1.3 (TS), Enhanced Primary to Secondary Leak Rate Monitoring Program

The licensee decided to shutdown Unit 1 and repair the leak in SG "D" at approximately 100 gpd leak. This was based on the fact that the rate of increase in leak rate was increasing and at 100 gpd the location of the leak could be identified. It did not appear that the leak was caused by a rapidly propagating fatigue crack as described in NRC Bulletin 88-02.

c. ET Inspections

The inspector performed the following observations and reviews relative to the in-process ET performed on SG "C" tubes.

- The following B&W ET documents were reviewed:
  - ° ISI-510, R4, Eddy-360/RDAU System Operating Procedure
  - ° Summary of Accuracy and Sensitivity Qualification for B&W U-Bend Eddy-360 Inspection System
  - ° U-Bend Eddy-360 Analysis Guidelines

Prior to start of the inspection, the inspector noted that Revision 4 to Procedure ISI-510 was in the ET trailer and being used. Review of DPC's copy of the B&W procedures manual revealed that the manual contained Revision 3. Further review revealed that Revision 4 had not been approved by DPC.

Revision 4 had been issued to DPC by a B&W Change Authorization in February 1988. B&W Procedure ISI-3 requires customer review and approval of Change Authorizations prior to the authorization taking effect. When questioned by the inspector, the licensee reviewed and approved Revision 4 (about the time the actual ET work started) to the procedure and started investigating why the change authorization had not been approved. B&W was instructed by DPC to issue a nonconformance report to evaluate the situation. The significance of this problem was considered to be minimal based on: (1) The procedure changes from revision 3 to revision 4 were not significant, (2) this appeared to be an isolated case based on numerous previous inspections of B&W verifying the use of the latest approved procedures, and (3) the procedure was approved without change, about the time the actual inspection started.

- ET examiner qualification records were reviewed for 5 Level I, 2 Level I-trainee, 4 Level II, 4 Level IIA, and 2 Level III examiners.
- In-process ET (Eddy-360) inspection was observed for the following SC "D" tubes:

2-52	1-54
2-51	1-55
2-50	1-41
1-50	1-40
1-53 (leaking tube)	1-6
1-51	1-7
1-52	1-8
	1-88 (Rerun)

- In-process data evaluation was observed for the following SG "D" tubes:

1-53 (leaking tube)	1-51
2-53	1-52
2-52	1-54
2-51	1-55
2-50	1-56
1-50	1-57

The leak in tube 1-53 was evaluated to be caused by a longitudinal crack (.3-.4 inches long) on the outside of the U-bend near the transition from straight section to bend. This type defect in Row 1 U-bends has been noted previously throughout the industry.

d. Tube Plugging

As noted above, the licensee plugged Tubes 1-8 and 1-53 in SG "D". The inspector discussed the plugging process with the licensee, observed in-process preparations for plugging and reviewed the following documents:

- B&W Procedure 1170155-A2, Operating Instruction for Ribbed Plug Installation Tool (Center Pull Type)
- B&W Proc 1169898-A1, Manual and Remote Marking of Tube Locations
- B&W Procedure 1155135-A2, Recirculating Steam Generator .750 and .875 Tube Plugging with Ribbed Mechanical Plugs
- B&W Procedure 1170119 - A), Open System Log For Steam Generator Activities
- Completed Data Sheets for Plugging Operations

Within the areas inspected, no violations or deviations were identified. Overall, the licensee's programs for monitoring SG tube leakage, tube inspections, and taking corrective actions appeared to be good. One weakness was identified relative to the use of an unapproved procedure change.

3. Inservice Testing Of Pumps and Valves (73756) (Unit 1)

The inspector examined the IST activities described below to determine whether regulatory and code requirements were being met. The applicable code for IST is the ASME B&PV Code, Section XI, 1983 Edition with addenda through S83.

As noted in Paragraph 2 above, RHR pump 1B failed due to shaft leakage and excessive vibration and was replaced. The inspector discussed pump replacement and subsequent testing of the new pump with the licensee. In-process WR 284460P covering pump replacement was reviewed. In addition, the inspector observed in-process activities relative to post maintenance testing the new pump and reviewed the following documents relative to testing the new pump and old pump:

- Completed PT/1/A/4400/01, ECCS Flow Balance, for new pump
- Completed PT/1/A/4200/10B, Residual Heat Removal Pump 1B Performance Test, for New Pump
- New head curve and baseline data established by the above two PTs

- Completed PT/1/A/4200/10B dated 6/9/87, 9/3/87, 11/3/87, 2/10/88, 5/10/88, and 8/1/88, for the old pump.
- Standing WR 002792SWR - 10/11/84, 10/9/85, 11/25/86, and 9/15/87. These standing WRs are for the annual PM (bearing oil change) for Pump 1B. These records and the completed PTs above were reviewed to determine if there were any indications of pump bearing problems prior to the failure. The IST history and the PM history did not indicate any bearing problems. It did appear that the vibration increased between the February 10, 1988, measurements and the May 10, 1988 measurement. However, the measurements and increase were well within code and procedure requirements and do not point to a vibration problem.

Within the areas inspected, no violations or deviations were identified. Based on the limited inspection, the IST program appeared to be adequate.

#### 4. ISI Data Review and Evaluation (73755)(Unit 1)

The inspector reviewed the ISI NDE records indicated below to determine whether the records were consistent with regulatory requirements and licensee procedures. The applicable code is the ASME B&PV Code, Section XI, 1980 Edition with Addenda through W81.

During the short outage to repair the SG tube leak, the licensee performed a limited amount of the ISI planned for the next refueling outage. The inspector reviewed ISI data for these inspections as detailed below:

- a. Completed inspection reports were reviewed for the following welds/components:

<u>Item</u>	<u>Weld/Component</u>	<u>Size</u>	<u>Method</u>
B05.070.003A	1SGB Inlet SE	31" x 2.5"	PT
B05.070.004A	1SGB Outlet SE	31" x 2.5"	PT
B05.130.002A	1NC 22-02	31" x 2.5"	PT
B05.130.003A	1NC 22-03	31" x 2.5"	PT
B09.011.001A	1NC 22-04	31" x 2.5"	PT
B09.031.002	1NC 22-WN7	14" x 2.3"	PT
B09.032.004	1NC 22-WN6	2.5" x .800"	PT
C02.021.005A	1SGB-SB-02	16" x 3.3"	MT
-	1RCP-1B-F	RCP Bolting	UT

- b. Examiner qualification records, as follows, for personnel performing the above inspections were reviewed:

7 Level II PT Examiners  
 2 Level II MT Examiners  
 1 Level II UT Examiners



- c. Equipment certification records for the below listed equipment used for the inspections listed in a. above, were reviewed:

PT Penetrant	-	Batch 78E084
PT Cleaner	-	Batch 87L003
PT Developer	-	Batch 86B076
PT Cleaner	-	Batch 86J005
PT Developer	-	Batch 83G033
MT Particles	-	Batch 86C057
UT Couplant	-	Batch 8767
UT Instrument	-	S/N 516i

The records were reviewed near the end of the inspection. The certification records for UT transducer Serial No. JD-0981 could not be located. At the close of the inspection, it was not clear whether the certification did not exist, the serial number was identified incorrectly on the inspection report, or the certification record had been lost. The licensee was investigating to determine why the certification record could not be located. This matter is identified as Inspector Followup Item 413/88-32-01, Certification Record for UT Transducer JD-0981, in order that a further review can be conducted at a future inspection.

Within the areas inspected, no violations or deviations were identified. Based on the limited inspection, the IST program appeared to be adequate.

5. Temporary Instruction (IT) 2500/26, Inspection Requirements for NRC Compliance Bulletin 87-02, Fastener Testing to Determine Conformance With Applicable Material Specifications

Prior to issue of NRC Bulletin 87-02, some NRC procurement inspections have included the collection and testing of a small sample of fasteners. This limited program was initiated in response to a concern by Industrial Fastener Institute over the potential use of inferior fasteners in military and industrial applications, including Nuclear Power Plants. The results indicate that 11 out of 32 fasteners tested do not meet specification requirements for mechanical and/or chemical properties. In a separate effort, one utility tested 1539 fasteners following discovery that commercial grade fasteners had been used in safety-related applications. The test results indicated that 399 failed to meet specification requirements for mechanical and/or chemical properties. Based on evaluations performed by the utility, the fasteners which did not meet specification would have fulfilled their safety function.

Based on the testing described above, the NRC issued NRC Bulletin 87-02 on November 6, 1987. The Bulletin requested that licensees perform independent testing on a sample of fasteners and provide information to the NRC as follows:

- Describe characteristic examined during Receipt Inspection (RI) of fasteners and controls of storage and issue

- Select ten safety-related and ten non safety-related fasteners from current stock and perform mechanical and chemical testing in accordance with specification requirements - The NRC is to participate in selection of the fasteners for test.
- Forward test results and supporting information to the NRC
- For any fastener found out specification, provide an evaluation of the safety significance
- Based on the results of the testing and review of current procedures, describe any further actions being taken to assure fasteners meet specification requirements.

The licensee's letter of response is dated January 12, 1988. Supplemental responses are dated February 11, February 29, and April 11, 1988.

See NRC Report 50-413,414/87-42 for documentation of NRC's participation in selecting the sample of fasteners to be tested.

The purpose of this inspection was to:

- Review the licensee's procedures for control of fasteners and compare the procedures with descriptions in the licensee's response
- Review the licensee's further action being taken as required by Paragraph 6 of the Bulletin

The following summarizes the inspector's review:

a. Receipt Inspection

Relative to receipt inspection, the inspector reviewed the licensee's response and the following procedures:

- QCG-1, R28, Receipt, Inspection, and Control of QA Condition Materials, Parts and Components Except Nuclear Fuel
- QA-410, R13, Processing of QA Records for Purchased Items
- QA-505, R24, Processing of Procurement Documents for Operational Nuclear Stations
- QA-601, R15, Vendor Evaluation
- QA-605, R5, Vendor QA Releases

for QA materials, the above procedures control procurement and receipt inspection of fasteners as described in licensee's letter of response dated January 12, 1988.

Non safety-related fasteners are not receipt inspected.

b. Storage, Issues and Control

Relative to storage, issue and control, the inspector reviewed the licensee's response and the following procedures:

- DPC Catawba Nuclear Station Materials Manual
- SD 3.3.7 (M), R7, Work Request Preparation
- MMP 1.0, R24, Work Request Preparation

Plant equipment fasteners are controlled using the MMIS (a unique number is assigned to each type fastener) and the WR system. In addition, SK fasteners are further controlled using unique QA Tags.

- c. The inspector reviewed the revision history of Procedure QCG-1 to determine the significance and/or reasons for recent procedure changes. For fasteners, the significant change appears to be the upgrading of receiving inspection instruction sheets to better define marking requirements.
- d. The inspector reviewed the licensee's description of further action being taken as required by Bulletin 87-02. The licensee's corrective actions for discrepancies found are identified in licensee response dated April 11, 1988. In addition to review of the licensee's response, the inspector reviewed PIRs C88-0192 and C88-0050 (including LER 413/88-11) covering resolution of discrepancies. The inspector also discussed with licensee personnel planned improvements in the control of fasteners. As noted in the licensee's April 11, 1988 response, the licensee had established a Bolting Task Force prior to issue of the Bulletin. The task force has issued a report recommending program improvements in the following areas:
- Develop standard procedure for use at all nuclear stations (NPD and CMD)
  - Inspect and convert stock to most proper MMIS classification
  - Identify and publish list of qualified personnel for bolting material questions
  - Develop and provide appropriate training for personnel

- Establish and implement evaluation criteria for non-safety bulging suppliers
- Develop and implement generic procurement specifications

DPC management is reviewing the recommendations of the task force.

6. NRC Bulletins (92701) (Units 1 and 2)

- a. (Open) 88-BU-02, Rapidly Propagating Fatigue Cracks in Steam Generator Tubes. The licensee's letters of response dated March 24 and April 24, 1988 were reviewed. See Paragraph 2.b. above for details of the inspector's review of licensee activities relative to this Bulletin. As noted in licensee's letter of response dated April 25, 1988, the licensee plans to provide additional response after the next refueling outage.
- b. (Open) 88-BU-05, Nonconforming Materials Supplied By Piping Suppliers, Inc. at Folsom, New Jersey and West Jersey Manufacturing Company at Williamstown New Jersey. Based on Supplement 2 to the Bulletin, further testing has been suspended at Catawba. To date 413 flanges have been identified as having been ordered from WJM and PSI. Twenty-three were installed in QA systems. Twenty-two of the 23 have been hardness tested. One tested low (136 Brinell) and two tested high (187 and 211 Brinell). These are being evaluated by the licensee. Preparation of submittal to the NRC is proceeding and is on schedule.

7. Action On Previous Inspection Findings (92701 and 92702) (Units 1 and 2)

- a. (Closed) IFI 413, 414/88-02-01, Differences In Procedures for Frequency of MT Yoke Calibration. Procedure NDE-25 required checking magnetizing force of MT yokes every six months versus 12 months required by Procedure NDE-C. Revision 12 to NDE-25 revised the frequency to 12 months.
- b. (Closed) Violation 414/88-09-01, Failure to Establish Adequate Measures to Control ET Testing of Steam Generator Tubes. Duke Power Company's letter of response dated April 14, 1988, has been reviewed and determined to be acceptable. Based on examination of corrective actions as stated in the letter of response and discussions with responsible licensee personnel, the inspector concluded that DPC had determined the full extent of the subject violation, performed the necessary survey and follow-up actions to correct the present conditions and developed the necessary corrective actions to preclude recurrence of similar circumstances. The corrective actions identified in the letter of response have been implemented. The licensee has initiated the requirement to have an independent second

review of all ET data. The re-review of all 1987 data for Units 1 and 2 has been completed with no additional defective tubes identified and no significant differences in results identified.

#### 8. Exit Interview

The inspection scope and results were summarized on August 19, 1988, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results. The IFI listed below was discussed with the licensee on August 24, 1988. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

(Open) IFI 413/88-32-01, Certification Record for UT Transducer JD-0981 - Paragraph 4.c.

#### 9. Acronyms and Initialisms

ASME	-	American Society for Mechanical Engineers
B&PV	-	Boiler and Pressure Vessel Code
B&W	-	Babcock and Wilcox
DPC	-	Duke Power Company
ET	-	Eddy Current Test
gpd	-	Gallons Per Day
IFI	-	Inspector Followup Item
ISI	-	Inservice Inspection
IST	-	Inservice Testing
MMIS	-	Materials Management Information System
MMP	-	Maintenance Management Procedure
MT	-	Magnetic Particle Testing
NDE	-	Nondestructive Examination
PT	-	Liquid Penetrant Testing
QA	-	Quality Assurance
R	-	Revision
RC	-	Reactor Coolant
RCP	-	Reactor Coolant Pump
RHR	-	Residual Heat Removal
SG	-	Steam Generator
SD	-	Station Directive
SR	-	Safety Related
TS	-	Technical Specification
UT	-	Ultrasonic Testing
WR	-	Work Request

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