



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION II  
101 MARIETTA STREET, N.W.  
ANTA, GEORGIA 30323

Report Nos.: 50-369/07 and 50-370/89-07

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

Docket Nos.: 50-369 and 50-370

License Nos.: NPF-9 and NPF-17

Facility Name: McGuire 1 and 2

Inspection Conducted: March 20-24, 1989

Inspector:

*J. L. Coley*  
J. L. Coley

*4-17-89*

Date Signed

Approved by:

*J. J. Blake*  
J. J. Blake, Chief  
Materials and Processes Branch  
Engineering Branch  
Division of Reactor Safety

*4/17/89*

Date Signed

#### SUMMARY

Scope: This special, unannounced inspection was conducted in the areas of inservice inspection (ISI) - review of procedures (Units 1 and 2), observation of work activities (Unit 1), and evaluation of eddy current testing (ECT) data (Unit 1). The inspection objectives were: To determine if the licensee's investigation of the cause of the steam generator tube (18-25) rupture in Unit 1 was proceeding effectively; and to ensure that details which could reveal the mechanism for the tube failure were identified, and properly evaluated by the licensee.

Results: The licensee appears to have established an effectively managed and technically competent recovery team to determine the cause of the steam generator tube rupture and ensure that necessary corrective actions are taken to prevent this type of failure from recurring. The licensee made a strong effort to be responsive to the inspector's requests for information during this inspection.

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## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees

- \*J. Day, Associate Engineer, Compliance
- \*C. Hendrix, Manager, Nuclear Support
- \*D. Mayes, Maintenance Engineer
- \*C. Robinson, Maintenance Engineer
- \*M. Sample, Maintenance Superintendent

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

#### Other Organizations

Babcock & Wilcox (B&W)  
T. Richards - Product Manager, ISI

#### NRC Resident Inspector

\*R. Croteau

\*Attended exit interview

### 2. Inservice Inspection & Repair of Steam Generator Tube Rupture

On March 7, 1989, a steam generator tube rupture event occurred on McGuire Unit 1. Currently a tube rupture outage is underway which will perform the necessary steam generator inspections and repairs. In order to ensure that an integrated and all-encompassing approach is taken for investigation of the tube failure and recovery actions the licensee has established a Steam Generator Tube Rupture Recovery Team.

The purpose of the Recovery Team is to coordinate all efforts toward determining the cause of the tube rupture, provide technical leadership and implement a recovery program.

The inspector reviewed the recovery team's objectives and on-going progress. In addition the inspector reviewed eddy current procedures for technical content and observed examination activities including a visual examination of the inconel tubes from the secondary side of the steam generator.

Examiner's certifications, qualifications and performance, were reviewed. Equipment calibration records, preservice eddy current data/evaluations, and the data analysis process for the current eddy current examinations which utilized a multi-frequency bobbin coil, examinations of tubes in the

same heat as the ruptured tube using a non-magnetic bias bobbin coil, examinations using a rotating pancake coil (RPC) and profileometry examinations were reviewed by the inspector.

The applicable code for the examination and repair activities on Unit 1 is the American Society of Mechanical Engineers Boiler and Pressure Vessel (ASME B&PV) Code, Section XI, 1980 Edition with Addenda through Winter 1980. Specific procedures, work activities, and data analyzed are delineated below:

a. Review of Procedures (Units 1 and 2) (73052)

The inspector reviewed the following eddy current examination procedures, eddy current data evaluation procedures and eddy current analysis guidelines to ensure the methods of examination, recording, evaluating, and dispositioning findings are established and reporting requirements are in compliance with applicable code requirements.

<u>Procedure No.</u>	<u>Title</u>
B&W Procedure No. ISI-460, Rev. 14	Technical Procedure for the Evaluation of Eddy Current Data of Nuclear Grade Steam Generator Tubing
B&W Procedure No. ISI-424, Rev. 14	Multi-frequency Eddy Current Examination of .750 "OD x .044" Wall RSG Tubing for ASME Examination and Wear at Tube Support Plates
B&W Procedure No. ISI-463, Rev. 6	Technical Procedure for the Evaluation of Eddy Current Data Generated from the Multi-element Probe
B&W Procedure No. ISI-464, Rev. 4	Technical Procedure for the Evaluation of Eddy Current Data of Nuclear Grade Steam Generator Tubing for Wear Fretting
B&W Procedure No. ISI-510, Rev. 6	Eddy Current-360/RDAU System Operating Procedure
Procedure for Unscheduled Outage	Eddy Current Analysis 3,89, Rev. 2, Dated 3-14-89 Guidelines for McGuire Nuclear Station Unit 1

The above procedures were also reviewed to ensure that they had been approved by authorized licensee personnel, qualifications of nondestructive examination personnel were specified and in accordance with the licensee's approved ISI program; and methods of examination, extent, and technique were adequately described and in conformance with the requirements of ASME, B&PV Code, Section V, and special requirements imposed by joint NRC or industry initiatives and licensee commitments.

The inspector's review of the above procedures revealed a strong program for eddy current examination and data evaluation of inconel tubes in Westinghouse Steam Generators at the McGuire facility.

b. Observation of Work and Work Activities (Unit 1) (73753)

The inspector observed work activities and reviewed certification records of equipment and nondestructive examination personnel which were being utilized during this unscheduled outage. However, the emphasis of this inspection was not on eddy current data collection, since the licensee had committed to 100% eddy current examination of the tubes in all four generators, but rather to the evaluation of the collected data. B&W's work activities were observed only on a surveillance basis in the following two areas:

- Eddy current data collection
- Visual examination of Steam Generator B, Tube 18-25, using a boroscope, from the secondary side of B Steam Generator.

Examiner qualification documentation for Duke Power (DP), B&W, and Zetac examiners listed below were reviewed in the following areas; employees name; person certified; activity qualified to perform; effective period of certification; signature of employers designated representative; basis used for certification; and annual visual acuity, color vision examination; and periodic recertification.

<u>Company</u>	<u>Examiner</u>	<u>Level of Eddy Current Certification</u>
DP	TBA	L-11
DP	GGB	L-11A
DP	CRB	L-11
DP	MWB	L-11A
DP	WB	L-11
DP	CBC	L-11A
DP	MKD	L-11A
DP	TH	L-11A
DP	MBT	L-11A

<u>Company</u> (cont'd)	<u>Examiner</u>	<u>Level of Eddy Current Certification</u>
B&W	PRC	L-11
B&W	PRC	L-11
B&W	MWD	L-1 (Trainee)
B&W	GCG	L-1
B&W	CRH	L-11A & L-11
B&W	EPL	L-11A
B&W	ACM	L-11
B&W	RLM	L-(Trainee)
B&W	SDM	L-1(Trainee)
B&W	JDM	L-11
B&W	JCO	L-1
B&W	TAR	L-111
B&W	GKS	L-11
B&W	HLS	L-11A
B&W	MMS	L-11A & L-11
B&W	JBW	L-11A
Zetec	PAA	L-11A & L-11
Zetec	MAB	L-11A & L-11
Zetec	DRD	L-11
Zetec	DJH	L-11A & L-11
Zetec	CSH	L-11A & L-11
Zetec	KJW	L-111 & L11A
Zetec	KDS	L-11 & L-11A
Zetec	GLW	L-11 & L-11A

Equipment calibration certification, for the following ECT equipment was also examined by the inspector.

<u>Instrument</u>	<u>Serial No.</u>
MIZ 18RDAU	SN-180
MIZ 18RDAU	SN-006
MIZ 18RDAU	SN-071
MIZ 18RDAU	SN-074
MIZ 18RDAU	SN-131
MIZ 18RDAU	SN-186

Within the areas examined, violations or deviations were not identified.

c. Eddy Current Data Review and Evaluation (Unit 1) (73755)

The inspector observed the examiners evaluations of the following inconel tubes to determined whether the testing results were consistent with the applicable acceptance criteria:

<u>Company</u>	<u>S. G.#</u>	<u>Row</u>	<u>Column</u>	<u>Both Type</u>
Duke	D	14	28	Bobbin Coil
Duke	D	14	27	Bobbin Coil
Duke	D	14	26	Bobbin Coil
Duke	D	14	25	Bobbin Coil
Duke	D	14	24	Bobbin Coil
Dukc	D	14	23	Bobbin Coil
Duke	D	14	22	Bobbin Coil
Duke	D	14	21	Bobbin Coil
Duke	D	14	20	Bobbin Coil
Duke	D	14	19	Bobbin Coil
Duke	D	14	18	Bobbin Coil
Duke	D	14	17	Bobbin Coil
Duke	D	14	16	Bobbin Coil
Duke	D	14	15	Bobbin Coil
Duke	D	14	14	Bobbin Coil
Duke	D	14	13	Bobbin Coil
Duke	D	14	12	Bobbin Coil
Duke	D	14	11	Bobbin Coil
Duke	D	14	10	Bobbin Coil
Duke	D	14	9	Bobbin Coil
Duke	D	14	8	Bobbin Coil
Duke	D	14	7	Bobbin Coil
Duke	D	14	6	Bobbin Coil
Duke	D	14	5	Bobbin Coil
Duke	D	14	4	Bobbin Coil
Duke	D	14	3	Bobbin Coil
Duke	D	13	3	Bobbin Coil
Duke	D	13	4	Bobbin Coil
Duke	D	13	5	Bobbin Coil
Duke	D	13	6	Bobbin Coil
Duke	D	13	7	Bobbin Coil
Duke	D	13	8	Bobbin Coil
Duke	D	13	9	Bobbin Coil
Duke	D	13	10	Bobbin Coil
Duke	D	13	11	Bobbin Coil
Duke	D	13	12	Bobbin Coil
Duke	D	13	13	Bobbin Coil
Duke	D	13	14	Bobbin Coil
Duke	D	13	15	Bobbin Coil
Duke	D	13	16	Bobbin Coil
Duke	D	12	24	Bobbin Coil
Duke	D	12	23	Bobbin Coil
Duke	D	12	22	Bobbin Coi
Duke	D	12	19	Bobbin Coil
Duke	D	12	18	Bobbin Coil
Duke	D	12	17	Bobbin Coil

<u>Company</u> (cont'd)	<u>S. G.#</u>	<u>Row</u>	<u>Column</u>	<u>Both</u> <u>Type</u>
B&W	B	19	27	360° Rotating Pancake Coil
B&W	B	19	26	360° Rotating Pancake Coil
B&W	B	19	25	360° Rotating Pancake Coil
B&W	B	19	24	360° Rotating Pancake Coil
B&W	B	19	23	360° Rotating Pancake Coil
B&W	B	20	23	360° Rotating Pancake Coil
B&W	B	20	24	360° Rotating Pancake Coil
B&W	B	20	25	360° Rotating Pancake Coil
B&W	B	20	26	360° Rotating Pancake Coil
B&W	B	20	27	360° Rotating Pancake Coil
B&W	B	17	25	360° Rotating Pancake Coil
B&W	B	17	26	360° Rotating Pancake Coil
B&W	B	17	27	360° Rotating Pancake Coil
B&W	B	16	27	360° Rotating Pancake Coil
B&W	B	16	26	360° Rotating Pancake Coil
B&W	B	16	25	360° Rotating Pancake Coil
B&W	B	16	24	360° Rotating Pancake Coil
B&W	B	16	23	360° Rotating Pancake Coil
B&W	B	13	34	360° Rotating Pancake Coil
B&W	B	21	38	360° Rotating Pancake Coil
B&W	B	7	24	360° Rotating Pancake Coil
B&W	B	47	46	360° Rotating Pancake Coil

<u>Company</u> (cont'd)	<u>S. G.#</u>	<u>Row</u>	<u>Column</u>	<u>Both</u> <u>Type</u>
B&W	B	43	52	360° Rotating Pancake Coil
Duke	B	*18	25	Bobbin Coil
B&W	B	*18	25	360° Rotating Pancake Coil
B&W	B	*18	25	Profileometry

\*NOTE: Evaluation of Ruptured Tube

Other tubes using various techniques were also examined by the inspector on a surveillance basis. At the conclusion of the inspection the status of ECT was as delineated below:

#### GENERATOR

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
No. F/L INSPECTIONS PLANNED	4470	4770	4505	4446
No. TUBES DATA ACQUIRED	0	4770	677	4446
No. TUBES ANALYZED-PRIMARY	0	4770	587	4446
No. TUBES ANALYZED-SECONDARY	0	4700	587	4446
No. TUBES AWAITING RERUNS	0	75	47	238
TUBES W/EDDY-360 PLANNED		65		208
TUBES W/EDDY-360 ACQUIRED		40		208
TUBES W/EDDY-360 PRIMARY		40		208
TUBES W/EDDY-360 SECONDARY		40		208

Within the areas examined, violations or deviations were not identified.

### 3. Exit Interview

The inspection scope and results were summarized on March 24, 1989, with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results. Although reviewed during this inspection, proprietary information is not contained in this report. Dissenting comments were not received from the licensee.