U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-334/88-06

Docket No. 50-334

License No. DPR-66

Licensee: Duquesne Light Company
Robinson Plaza Building No. 2
Suite #210, PA Route 60
Pittsburgh, Pa. 15205

Facility Name: Beaver Valley Power Station, Unit 1

Inspection At: Shippingport, Pennsylvania

Inspection Dates: February 8-12, 1988

Inspector: R. W. Winters, Reactor Engineer, MPS, EB, DRS, Region I — 3/1/88 date

Approved by: J. Strosnider, Chief, Materials & Processes Section, Engineering Branch, DRS, RI — 3/24/88 date

Inspection Summary: Routine unannounced inspection on February 8-12, 1988 (Report No. 50-334/88-06)

Areas Inspected: Steam Generator Eddy Current Inspection, Water Chemistry Controls, Steam Generator Maintenance Radiological Controls.

Results: No violations or deviations were identified.

DETAILS

1.0 Persons Contacted

Duquesne Light Company

*J. Crockett, Senior Manager, Nuclear Operations
A. Dulick, Engineer, Chemistry Laboratory
D. Girdwood, Supervisor, Health Physics
*D. Hunkele, Director, Quality Assurance, Operations
V. Linnenbon, Supervisor, Chemistry Laboratory
*F. Lipchick, Senior Licensing Supervisor
A. Mosso, Nondestructive Examination Coordinator
M. Pergar, Quality Control Supervisor
*R. Perry, Supervisor Nondestructive Examination Services
*B. Sepelak, Licensing Engineer
*W. Sikorski, Director, Inservice Inspection
*K. Troxeler, Supervisor of Inservice Inspection
*J. Vassello, Director, Licensing
*J. Waslousky, Quality Assurance Supervisor
*D. Weakland, Supervisor, Materials, Codes and Standards

United States Nuclear Regulatory Commission

J. Beall, Senior Resident Inspector, Beaver Valley Power Station
*M. Dev, Reactor Engineer, Region I
*S. Pindale, Resident Inspector, Beaver Valley Power Station

* Denotes those attending the exit meeting.

The inspector also contacted other administrative and technical personnel during the inspection.

2.0 Licensee's Actions on Previous NRC Concerns

(Closed) Unresolved Item (86-17-02) Incorporation of plant modifications resulting from design changes and maintenance work requests into the ISI program.

The inspector selected a representative sample of design change packages and maintenance work requests to assure that the licensee had reviewed these packages for incorporation into the Inservice Inspection Program (ISI). The licensee has established a traveler system for design changes and maintenance work requests that potentially affect the Inservice Inspection Program. In all cases the inspector noted that the travelers had been reviewed by the ISI coordination group for possible inclusion or changes to the program.

This item is closed.

3.0 References/Requirements

Steam Generator surveillance activities were inspected to determine compliance with the following requirements:

1. Technical Specifications - Steam Generators - paragraph 4.4.5.1

2. Final Safety Analysis Report - Steam Generators - paragraph 4.2.2.4

3. PWR Secondary Water Chemistry Guidelines - Electric Power Research Institute Special Report, EPRI NP-2704-SR

4.0 Activities Reviewed

The inspector reviewed the eddy current test (ECT) data collected during the current outage, the water chemistry results for the preceding year, and the radiation records for the work done on the steam generators during this outage.

4.1 Steam Generator Eddy Current Inspection

Plant Information

The Beaver Valley Power Station Unit 1 is a pressurized water reactor Nuclear Steam Supply System furnished by Westinghouse Electric Corporation. It is designed for a rated output of 2,660 MWt. The reactor coolant system is arranged as three closed reactor coolant loops connected in parallel to the reactor pressure vessel with each containing a reactor coolant pump, isolation and bypass valves, piping and a steam generator. The steam generators are vertical shell, U-bend Westinghouse Model 51. The preservice inspection was conducted using a 400 kHz single frequency bobbin coil inspection method. In 1984 the licensee performed the Technical Specification (TS) required examination on 305 tubes in steam generator '1A'. This examination was full length of the tubes (entry on the hot leg side to exit on the cold leg side). The result of this inspection was that none of the tubes examined had defects above the TS plugging limit. The steam generator was in category C-1. Following this TS examination the remaining tubes were examined for the full length of the tubes. As a result of this additional examination, twenty-four tubes were plugged due to defects greater than 40% through wall. Forty-six additional tubes were found with indications in excess of nineteen percent through wall.

In 1986 as a result of the TS required examination steam generator '1A' was classed as category C-3. As a result, the remaining tubes were examined and all of the tubes in steam generators '1B' and '1C' were also examined from entry on the hot leg side to exit on the cold leg side. The result of these inspections is summarized as follows:

Defect Size	Steam Generator '1A'	'1B'	'1C'
Greater than 40%	11	14	6
Greater than 19% less than 40%	32	49	21

Those tubes with defects greater than 19% will be examined in future inspections as required by the TS.

Details of the Review

ECT had been completed for all three steam generators prior to the inspection. The inspector reviewed the data acquired and the interpretation system used during the inspection. Testing was remotely controlled from a trailer outside the containment. From this location technicians controlled the location and insertion of the eddy current probes. Measurements were taken as the probes were withdrawn to minimize the effects of the probe cable. Other technicians monitored the operation by closed circuit television from a low radiation area within the containment and performed necessary maintenance activities, such as changing probes on the ECT equipment as required. This technique minimized the radiation exposure during the ECT. The data was recorded for later analysis.

Data analysis was performed on site but at a location outside the protected area. Each data tape was duplicated and then read independently by two individuals certified as level II ECT analysts. The independence of these analysts was assured since the licensee had contracted for one analysis from the vendor performing the testing and a second vendor for the independent review of the data. Both reviewers results were then compared. If both reviewers agreed the results were accepted. However, if there was a difference, the data was then reviewed by a third certified analyst and the differences resolved, or a retest of the inspection was made using a rotating eddy current probe.

The inspector noted that the licensee had inspected the U-bends in the area of the antivibration bars to determine the location of these bars. This inspection also included a greater number of tubes with the smallest radius U-bends than had been previously inspected. In addition, this inspection was made with the rotating eddy current probe.

When the results of the analysis indicated a defective tube, but with a low voltage reading during the testing, the licensee retested the tube using the rotating eddy current probe to determine the true size and nature of the defect. This approach was taken due to the uncertainties in data interpretation under these circumstances. This technique assured that tubes that were defective were plugged. The

inspector reviewed the data collected for these tubes and concluded that this approach was acceptable. In no case was a tube found defective with low voltage and reinspected with the rotating probe found to be defective on retest. The rotating probe results were used to determine if a tube should be plugged.

Findings

ECT results required that 37 tubes in the "A" steam generator, 20 tubes in the "B" steam generator, and 15 tubes in the "C" steam generator be plugged. As a result of the North Anna tube rupture incident the licensee had determined that one tube in steam generator "A" was susceptible to this type of failure. This tube was plugged on one end with a solid plug and on the other end with a plug designed to leak at 300 gallons per day. Similarly in steam generator "C" five tubes were plugged with leak limiting plugs. The purpose of these plugs was to assure that if any of these susceptible tubes ruptured the primary to secondary leak rate would be controlled within limits and the plant could be shut down in an orderly manner.

The results of the inspection of steam generator "A" placed this generator in technical specification category C-3. As a result steam generators "B" and "C" were inspected. Use of the rotating eddy current probe accounted for the relatively large number of U-bend defects.

The total number of tubes plugged this inspection and the cause of the defects was as follows:

	Steam Generator		
	"A"	"B"	"C"
Suspected IGSCC		6	2
Antivibration Bar Wear	1		5
Cold Leg Thinning in Support Plate	8	3	4
U-Bend Defects	28	10	4
Foreign Object Damage		1 (1)	
Total This Inspection	37	20	15
Total Plugged in Generator	79	36	28

(1) Short Piece of Welding Electrode.

Evaluation of the eddy current by two independent analysts has become standard practice in the industry. However, the use of two vendors for this analysis is unusual. Since the licensee does not have an employee certified as a Level III analyst this approach minimized the chance of vendor errors during the data analysis.

Conclusions

Eddy current testing and the interpretation of the data adequately met the requirements of the technical specifications.

4.2 Water Chemistry

Scope

This inspection was performed to determine the licensee's compliance with the requirements of the Technical Specifications, Steam Generators Owners Group and EPRI recommendations for water chemistry. The methods of analysis or operation of the chemistry laboratory were outside the scope of this inspection.

Details of the Review

The inspector reviewed the water chemistry from February 1987 until the start of the refueling outage in December 1987. Also reviewed were the methods of treatment and sampling and the locations for the sampling.

Findings

Chemical analysis of the steam generator blowdown water was as shown in Table 1 for periods when the plant was above 30% power in mode 1. These analysis were made daily except for the silica which was measured three times weekly.

TABLE 1
Values in Parts per Billion (ppb)

Period	pH		Cation Cond.		Sodium		Chlorides		Sulfate		Silica	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Feb	9.55	9.06	.648	.286	1*	1*	5	1*	15	1*	19	9
Mar	9.47	9.02	.476	.275	1*	1*	14	1*	12	1*	25	9
Apr	9.45	9.02	.335	.230	1*	1*	17	1*	16	1*	11	9
May	Plant was shut down in May											
Jun	9.41	9.01	.806	.260	2	1*	4	1*	8	2	35	10*
Jul	9.51	9.08	.366	.259	1	1*	5	1*	10	1*	17	10*
Aug	9.36	9.04	.376	.167	1	1*	12	1*	11	1*	17	10*
Sep	9.45	9.06	.601	.213	4	1*	13	1*	6	1*	15	10*
Oct	9.43	9.06	.480	.235	1*	1*	9	1*	16	1*	22	10*
Nov	9.48	9.17	.605	.221	3	1*	11	1*	16	1*	30	10*
Dec	9.41	9.21	.441	.205	1	1*	6	1*	9	1*	10	10*

* indicates value was less than that shown
___ underline indicates out of specification in one 24 hour period

Requirements							
FSAR	9.0	9.5	0.8 max	20 max	20 max	20 max	300 max
EPRI	9.0 min		0.8 max	20 max	20 max		300 max

From the above the licensee was above the specified range of pH and cation conductivity in one 24 hour period. However, in both cases effective remedial action was performed.

The licensee used all volatile treatment for water conditioning and adds morpholine for pH control and to assist in conditioning the sludge for removal by the blowdown. During this outage and inspection the licensee reported the sludge pile height of approximately one inch. This sludge was not removed.

On line sampling is done on the steam generator blowdown lines, the condenser hotwells, feedwater pump suction or discharge, and on the reheater drain receiver tanks. Grab samples are normally not used due to the impurities introduced in obtaining the sample.

Conclusions

The licensee has adequate control of secondary water chemistry. During the period from February 1987 through December 1987 daily sampling showed the water out of specification for pH once and cation conductivity once. In both cases the deviations were minor and corrected in a timely manner. The low volume of sludge indicates that the generators are being maintained in an acceptable manner.

4.3 Radiation Exposures

Radiation exposures were reviewed as part of the steam generator inservice inspection and maintenance inspection. The methods of collecting and verifying the accuracy of these exposures was not included in the scope of this inspection.

Findings

The inspector reviewed the preliminary exposure data for the steam generator inspection work. Initial surveys in the lower section of the steam generators indicated exposure rates as shown in Table 2. Total exposures for the inspection and maintenance are shown in Table 3.

TABLE 2
Values in Rem/Hr

Location	"A" Side		"B" Side		"C" Side	
	Hot	Cold	Hot	Cold	Hot	Cold
Bottom of Tubesheet	40.8	39.9	44.4	67.5	56.4	49.5
18 inches below Tubesheet	31.8	28.9	30.6	40.5	31.2	40.2
Bottom of Plenum	24.0	26.5	25.0	19.9	21.8	22.1

TABLE 3
Values in Man-Rem

Steam Generator "A"	55.070
Steam Generator "B"	18.925
Steam Generator "C"	21.475

Conclusions

The significantly higher exposures received in steam generator "A" reflect the additional work performed in this generator, both in the number of tubes inspected and the tube plugging that was done.

5.0 Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items or violations. Unresolved items are discussed in paragraph 2.0.

6.0 Management Meetings

Licensee management was informed of the scope and purpose of the inspection at the entrance interview on February 8, 1988 The findings of the inspection were discussed with licensee representatives during the course of the inspection and presented to licensee management at the February 12, 1988 exit interview (see paragraph 1 for attendees).

At no time during the inspection was written material provided to the licensee by the inspector. The licensee did not indicate that proprietary information was involved within the scope of this inspection.