

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-316/88-24

Docket No. 50-316

License No. DPR-74

Licensee: Indiana & Michigan Electric
1 Riverside Plaza
Columbus, Ohio

Facility Name: Donald C. Cook

Inspection At: Benton Harbor, MI

Inspection Conducted: September 6 through September 15, 1988

Inspectors:

J. Strosnider 10/19/88
for H. W. Kerch, Senior Reactor Engineer date

J. Strosnider 10/19/88
for R. H. Harris, NDE Technician date

J. Strosnider 10/19/88
for M. A. Oliveri, NDE Technician date

Approved by:

Jack Strosnider 10/19/88
J. R. Strosnider, Chief, Materials, and date
Processess Section, EPB, DRS, Region I

Inspection Summary and Conclusions: A routine announced inspection was conducted at the D. C. Cook Nuclear Power Station on September 6 through September 15, 1988 (Report No. 50-316/88-24).

Areas Inspected: A routine, announced NRC independent measurements inspection was conducted at the D. C. Cook Nuclear Power Station using the NRC mobile non-destructive examination (NDE) laboratory. The inspection focused on steam generator replacement activities. Selected safety related piping and weldments in the feedwater and reactor coolant systems and steam generator girth welds were inspected. These welds were fabricated to either Section III or Section XI of the ASME Code. Radiographic, ultrasonic, magnetic particle, liquid penetrant and visual examinations were performed by the NRC inspectors. Licensee procedures and QA/QC documentation also was reviewed.

Inspection Summary and Conclusion: Report No. 50-316/88-24:

Two large bore safety related steam generator nozzle weldments were examined using liquid penetrant on the inside surface. A violation was identified in that one nozzle that had been liquid penetrant examined and accepted by the licensee contained rejectable linear indications. The other nozzle examined had rejectable indications, but this nozzle was still in the repair cycle and the liquid penetrant examination had not been performed.

The steam generator shell circumferential closure weld, two steam generator nozzles and two feedwater pipe weldments were radiographed by the NRC inspectors. A violation was identified in that rejectable radiographic indications were found in the steam generator shell weld. Regarding the two steam generator nozzles, one contained an indication that required a surface verification check, however, before the surface check could be performed, the weld surface was reworked. This item is considered unresolved until the weld is reradiographed and reviewed by NRC. The other nozzle was radiographed and found to be acceptable. The two feedwater piping weldments radiographed were found to be acceptable.

Two feedwater piping weldments and three sections of steam generator girth weldments were magnetic particle examined and found to be acceptable.

Seven procedures were reviewed for compliance with governing codes and standards. It was determined that radiography procedure FQP-9.4 does not reinforce the quality requirements of SE-142. (See paragraph 4.0)

In addition, the overall quality of welding was found to be poor. Steam Generator nozzles have had severe cracking problems (Region III is tracking this) and the steam generator girth weldments have had extensive problems with unacceptable slag inclusions.

DETAILS

1.0 Persons Contacted (30703)

American Electric Power Service Corporation

*J. White, Site Project Manager
D. Patience, Metallurgist
B. Rarrick, QA Supervisor
K. Worthington, QA Senior Auditor
R. T. Huerter, Supervisory Auditor

Indiana Michigan Power Company

*L. Gibson, Assistant Plant Manager
*E. Morse, General Supervisor (QC/NDE)
J. M. Fitchuk, NDE Technologist
*J. Steinhauser, NDE Supervisor
*D. K. Welcher, Construction Engineer
*C. A. Freer, ISI Coordinator
R. Rickman, ISI Supervisor
W. G. Smith, Jr., Plant Manager
J. R. Sampson, Safety Superintendent

Morris Knudson-Ferguson

*A. I. Walcut, Quality Manager
B. Baker, NDE Level III
*M. Bingham, Project Manager
*M. Grayson, Quality Director

Westinghouse Corporation (SGRP)

*D. A. Del Signore, Welding Engineer
*C. J. Rapp, Site Manager

U.S. Nuclear Regulatory Commission

*J. Jacobson, RIII, Reactor Engineer
*G. A. Walton, RII, Resident Inspector (Watts Bar)
*P. K. Eapen, RI, Chief, Special Test Program
*B. Jorgensen, RIII, Resident Inspector (D.C. Cook)

*Denotes those attending the exit meeting.

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



2.0 Independent Measurements - NRC Nondestructive Examination and Quality Records Review of Safety Related Systems

During the period of September 6 through September 15, 1988, an onsite independent inspection was conducted at D. C. Cook Nuclear Power Station Unit 2. The inspection was conducted by NRC regional based inspectors and contracted nondestructive evaluation (NDE) personnel. The purpose of this inspection was to verify the adequacy of the licensee's nondestructive examination program during the steam generator replacement project being conducted at the site. This was accomplished by reperforming examinations required by code and regulations and evaluating the results. Included in this inspection sample was piping from the feedwater (FW) and reactor coolant loop (RC) systems and Steam Generator girth welds.

3.0 Nondestructive Examination (NDE)

Liquid Penetrant Examination (57060)

Two large bore safety related pipe weldments and adjacent base material (1 inch on either side of the weld) were examined on the inside surface of the pipe using the visible dye penetrant technique per NRC procedure NDE-9, Rev. 0 in conjunction with the licensee's procedure FQP-9.2 Rev. 2. Included in this inspection were carbon to stainless steel weldments at the steam generator nozzle to the cold leg pipe joints. The following is a list of items examined:

<u>System/Component</u>	<u>Identification</u>
Cold leg/SG No. 21	FW-1-1
Cold leg/SG No. 24	FW-4-1

Weld FW-4-1 in steam generator No. 24 was found to have linear indications ranging in length from .5 to .625 inches in two areas, and weld FW-1-1 in steam generator No. 21 was found to have linear indications ranging in length from .5 to .625 inches in five areas. The indications found were evaluated and found to be unacceptable, however, site records indicated that FW-1-1 on steam generator No. 21 had not received final acceptance by the licensee. Steam Generator No. 24 had been accepted by the licensee. A subsequent dye penetrant reexamination by site NDE personnel revealed that the two indications found by the NRC inspectors were valid. A non-conformance report (NCR-109) was written regarding the unacceptable indications.

The inspector reviewed Nonconformance Report NCR No. 109 and agreed with the following corrective actions:

- The indications within the weld were removed by light grinding.

- The weld was reinspected and accepted by liquid penetrant.
- QC reperformed all other final liquid penetrant examinations performed by the inspector who had performed the liquid penetrant examination on Weld FW-4-1 and found them all to be acceptable.
- To preclude recurrence, QC has instituted a policy where one inspector will perform penetrant evaluations of the I.D. of loop welds and evaluate the results. This evaluation will then be confirmed by a second inspector.

This item is considered an apparent violation (50-316/88-24-02). The inspector notes that this violation was corrected prior to the completion of this inspection and agrees with the corrective action and therefore, no additional response with respect to this matter is required. Violation 50-316/88-24-02 is considered closed.

Magnetic Particle Examination (57070)

Two (2) safety related large bore pipe weldments and three steam generator girth weldments including adjacent base material (1/2 inch on either side of the weld) were examined using the dry magnetic particle technique per procedure, NDE-6, Rev. 0 in conjunction with the licensee's procedure FQP-9.3, Rev. 1. The following is a list of items examined:

<u>System/Component</u>	<u>Identification</u>	<u>Comments</u>
Feedwater Nozzle	SG-21 FW-1-5	Accepted
Feedwater Nozzle	SG-24 FW-4-5	Accepted
Steam Generator No. 21		
Areas Inspected:		
#1 Channel to tube plate, 0 to 90 Deg.		Accepted
#2 Tube plate to stub barrel, 90 to 180 Deg.		Accepted
#3 Stub barrel to shell (A), 180 to 270 Deg.		Accepted

No violations or deficiencies were identified during this inspection.

Radiographic Examination (57090)

Four (4) safety related large bore pipe weldments were radiographed using an Iridium 192 source. The technique and procedure used were in accordance with NRC procedure NDE-5, Rev. 0, the licensee's procedure FQP-9.4 Rev. 0 and licensee supplied radiographic data. The four weldments examined were selected from steam generators No. 21 and No. 24, reactor coolant loop piping and feedwater system piping. Also, radiographed during this inspection was a girth weld on steam generator No. 21; using a Cobalt 60 source. The following is a list of items radiographed:

<u>System/Component</u>	<u>Identification</u>	<u>Remarks</u>
Feedwater/SG No. 21	FW-1-5	accepted
Feedwater/SG No. 24	FW-4-5	accepted
Cold leg/SG No. 24	FW-4-1	accepted
Cold leg/SG No. 21	FW-1-1	unresolved
Girthweld/SG No. 21	FW-1-6	violation

The radiograph of the steam generator No. 21 cold leg pipe to nozzle weld, FW-1-1, had indications on NRC film area 50 to 56 and needed to have a surface check performed. However, this weld surface was reworked subsequent to radiography by NRC and before the surface check could be performed. This item is considered unresolved pending reradiography and review (50-316/88-24-03).

The radiograph of the girth weld is discussed in paragraph 4.0 of this report.

Ultrasonic Examination (57080)

An area of approximately sixty-five (65) inches on the steam generator No. 24 tube sheet to channel head girth weld was ultrasonically inspected. The ultrasonic examination was performed using a Sonic Mark 1 ultrasonic flaw detector per NRC procedure NDE-1, Rev. 0, associated site drawings, ultrasonic test data and quality control records. Instrument calibration (linear verification) was performed per NRC procedure NDE-2, Rev. 0. A distance amplitude correction curve (DAC) was constructed using the licensee's calibration standard No. PL-30-CS-22-DCC. To ensure repeatability of the ultrasonic examination, the instrument setting and search unit (transducer) were matched as near as possible to those indicated by the licensee's ultrasonic data reports. The extent of the examination was as follows:

<u>Component</u>	<u>Area Inspected (from 0 deg.)</u>	<u>Remarks</u>
Steam generator No. 24	15 to 50 deg.	Axial scan
Channel to Tube Sheet	200 to 260 deg.	Axial scan

No recordable indications were observed, and no violations were identified.

Visual Examination (57050)

Included in this examination were visual examinations performed on five (5) large bore pipe weldments and one steam generator girth weld. The weld and base material ($\frac{1}{2}$ inch on either side of weld) were examined per NRC procedure NDE-14, Rev. 0, site procedure FQP-0.1 Rev. 0 and associated site drawings and quality documentation. The examination was performed specifically to identify any visible cracks or linear indications, deep gouges, arc strikes with craters or corrosion, which may infringe upon the pipe wall thickness. Mirrors, lights and weld gauges were used to aid in the inspection and evaluation of these weldments.

The components and areas examined were as follows:

<u>System/Component</u>	<u>Identification</u>	<u>Remarks</u>
Feedwater/SG No. 21	FW-1-5	accepted
Feedwater/SG No. 24	FW-4-5	accepted
Cold leg/SG No. 21	FW-1-1	accepted
Cold/leg/SG No. 24	FW-4-1	accepted
Girth weld SG No. 21	FW-1-6	accepted

No discontinuities were observed during the visual surface examination; however, as discussed in previous sections, indications were found during the volumetric examination (radiography) and dye penetrant examinations.

4.0 Radiographic Techniques and Procedure Review

The inspector reviewed the radiographic technique employed by the licensee's contractor for radiography of the steam generator field girth welds. The radiographic set up consisted of centering the source tube on the I.D. of the steam generator shell course (87½" SFD) and positioning 300 curies of Cobalt 60 23° (37") off of the centerline of the closure girth weld (See Attachment 1). This technique does not comply with ASME Section V Article 22, Radiographic Standards; SE-142 Standard Method for Controlling Quality of Radiographic Testing; paragraph 3.0, Direction of Radiation. One of the five Geometric Principles of radiography states that the direction of the central beam of radiation shall be perpendicular to the recording surface (film). ASME Section V, Article 2 paragraph T-273 has the same requirement. Site radiographic procedure FQP-9.4 attachment 3 displays three suggested techniques that meet SE-142 paragraph 3.0. These techniques could have been used to radiograph these girth welds but were not employed. ASME Section V, Article I, paragraph T-110(e) requires when special techniques are used they must be equivalent to or superior to the techniques described in the Code Section. The techniques shall be capable of detecting discontinuities by demonstration and shall be equivalent to the capabilities of the techniques described in the Code. A review of the welding history of these girth welds indicated above normal frequency of weld defects. On September 12, 1988, the NRC radiographed two film areas out of 42 on steam generator number 21 girth weld FW1-1. The NRC radiographic technique used was to place the film on the ID while the source was centered on the weld on the OD at 30" SFD. A 37 curie cobalt 60 source was used. This technique is in site procedure FQP9.4 attachment 3(c). NRC film area 23-24 disclosed a rejectable slag indication that ran the entire length of the film (17"). A review of the licensee's radiograph for this same area disclosed that this indication was not present. It was the inspector's understanding that this girth weld, FW-1-1, was to undergo post weld heat treatment (PWHT) after the NRC was finished with the radiography of the weld. The inspector also understood that the licensee planned to use the same configuration to perform radiography after PWHT that they had used originally with the exception of using

type "AA" film rather than type "T" film. The licensee changed their radiographic technique after review of the NRC film for area 23-24. The improved radiographic technique as described in site radiographic procedure FQP9.4 attachment 3 is in use now. This technique meets SE 142 paragraph 3.0 requirements. (See attachment 1). Use of radiographic techniques not satisfying applicable ASME Code requirement is an apparent violation (50-316/88-24-01).

5.0 Review of site NDE Procedures and Manuals

The following procedures were reviewed for compliance with the licensee's FSAR comments and applicable codes, standards and specifications.

<u>Procedure title</u>	<u>Number/Revision</u>
Visual Weld Examination	FQP-9.1 Rev. 0
Radiographic Examination	FQP-9.4 Rev. 0
Magnetic Particle Examination	FQP-9.3 Rev. 1
Liquid Penetrant Examination	FQP-9.2 Rev. 2
ASME Section XI Repairs/Replacement Program	MHI-5075 Rev. 2
Job Orders	PMI-2290 Rev. 7

No deficiencies were identified in these procedures.

6.0 Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items or violations; an unresolved item is discussed in paragraph 3.

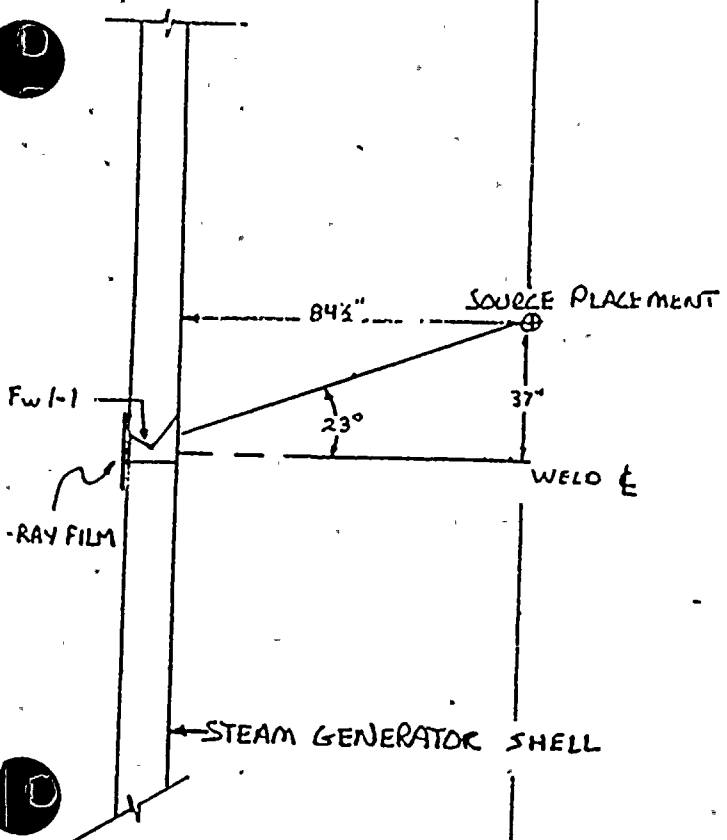
7.0 Management Meetings (30703)

Licensee management was informed of the scope and purpose of the inspection at the entrance meeting on September 6, 1988. The findings of the inspection were discussed with the licensee representatives during the course of the inspection and presented to licensee management at the exit meeting on September 15, 1988 (see paragraph 1.0 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.



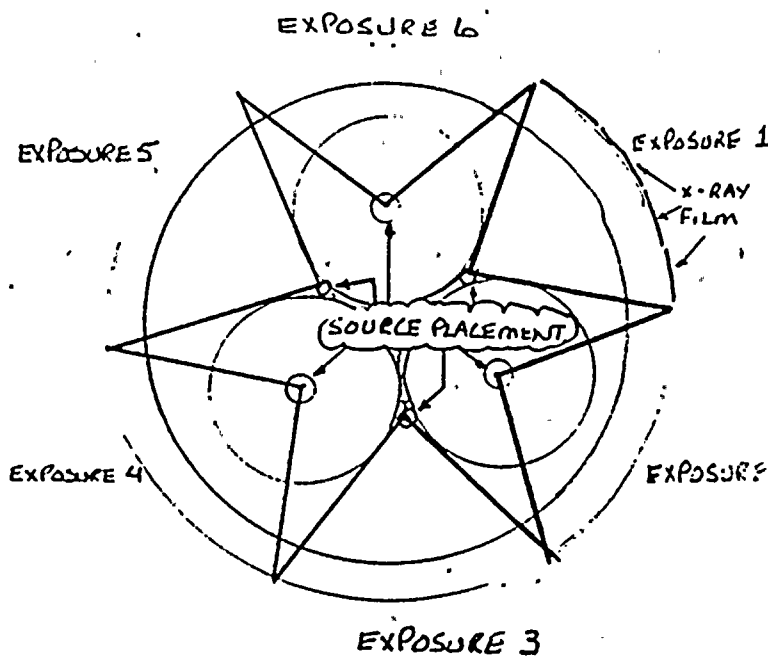
(A)

#21 STEAM GENERATOR



ELEVATION VIEW

(B)

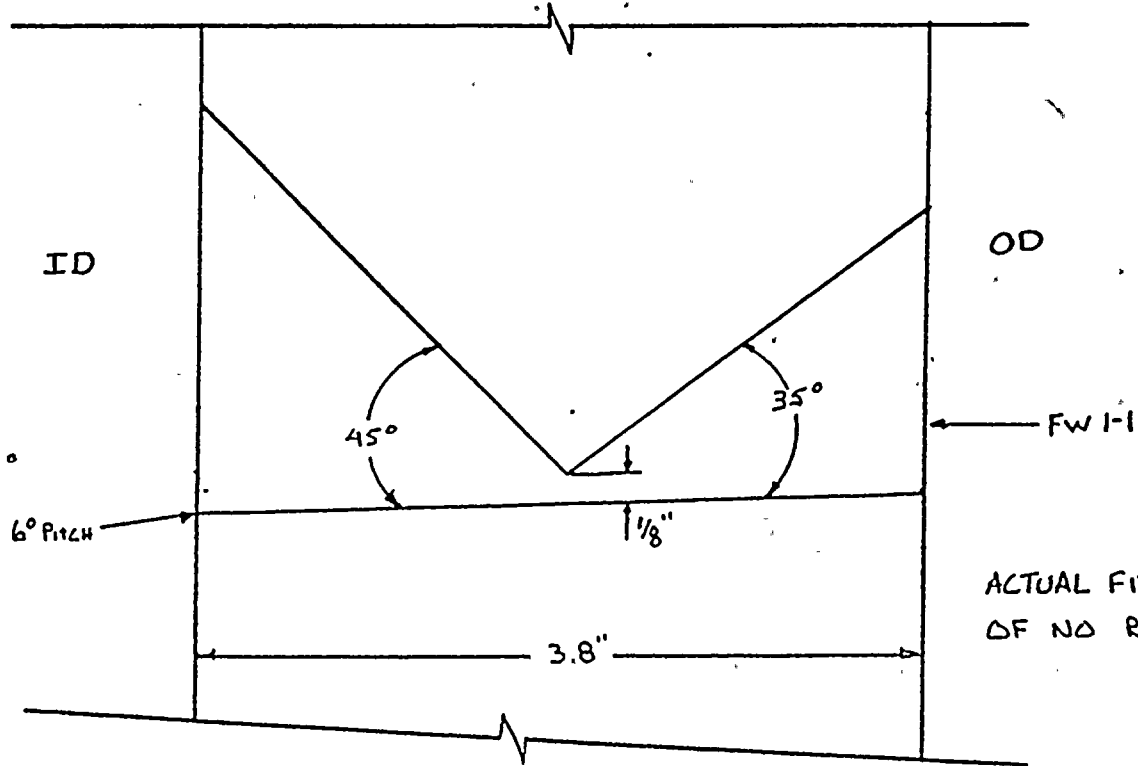


SOURCE WAS PLACED AT THE WELD E (SEE FIG A) AND PERPENDICULAR TO FILM

PLAN VIEW

- FIG A IS THE OLD RADIOGRAPHIC TECHNIQUE
- FIG B IS THE NEW RADIOGRAPHIC TECHNIQUE
- FIG C IS JOINT DESIGN

(C)



ACTUAL FITUP CONSISTS OF NO ROOT GAP

(L)