

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-271/86-02

Docket No. 50-271

License No. DPR-28 Priority - Category C

Licensee: Vermont Yankee Nuclear Power Corporation
1671 Worcester Road
Framingham, Massachusetts 01701

Facility Name: Vermont Yankee

Inspection At: Vernon, Vermont

Inspection Conducted: January 21-31, 1986

Inspectors:

Harry W. Kergh
Harry W. Kergh, Lead Reactor Engineer, NDE

2-14-86
date

Richard H. Harris
Richard H. Harris, NDE Technician

2-14-86
date

Randy M. Campbell
Randy M. Campbell, NOE Technician

2-14-86
date

Approved by:

James Wiggins
James Wiggins, Chief, Materials & Processes,
EB, DRS

2-14-86
date

Inspection Summary:

Inspection Conducted January 21-31, 1986 (Report No. 50-271/86-02)

Areas Inspected: A special, announced inspection utilizing the NRC Mobile NDE Van to perform nondestructive examinations on replacement piping in the reactor recirculation system. A visual inspection of pipe restraints, embedment plate weldments and other safety related areas was also performed.

Three regional-based inspection personnel assisted by two contracted NDE personnel were utilized during this inspection. The inspection involved 422 onsite hours and 64 hours in Region I office.

Results: No violations were identified.

DETAILS

1.0 Persons Contacted

Vermont Yankee

- *J. P. Pelletier, Plant Manager
- *S. A. Vekasy, DSR Supervisor
- *B. Wittmer, Project Manager
- *J. Gianfrancesco, Construction Superintendent

Yankee Atomic

- *L. Mullins, NDE/ISI Supervisor

US Nuclear Regulatory Commission

- *W. Raymond, Senior Resident Inspector

*Denotes those present at Exit Meeting.

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

During the period of January 13 through 17, quality records received from Vermont Yankee Nuclear Generating Station were reviewed in the regional office for completeness and compliance to the licensee's FSAR commitment to applicable codes, standards and specifications. Subsequently, an onsite independent verification inspection was conducted from January 21 through January 31, using the NRC Mobile Nondestructive (NDE) Laboratory. This inspection was performed by NRC contracted personnel in conjunction with regional-based NRC personnel. The purpose of this examination was to verify the adequacy of the licensee's welding quality control program during replacement of the Reactor Recirculation System piping. This was accomplished by duplicating those examinations required by the regulations and evaluating the results. These test results were then compared to the licensee's quality assurance records for completeness, accuracy and correlation. In addition to the above examinations, a visual examination of other safety-related items including pipe restraints and embedded plates was performed along with a walkdown of HPCI system piping and supports.

The NRC Senior Resident Inspector made a selection of pipe weldments which provided a representative sample of the recirculation piping system replaced by the licensee. The selection made represented various pipe sizes and included, shop and field weldments fabricated to ASME Class 1 component requirements. Also selected were embedded plates mounted on reactor building walls for visual inspection for movement or any areas of

cracked concrete around the embedded plates. The items selected were previously accepted by the licensee based on vendor shop and onsite QA/QC records.

2.1 Quality Documents Review

Nineteen safety related piping system document packages were reviewed for compliance with licensee procedures, applicable codes and standards and regulatory requirements. The following types of documents were reviewed.

<u>Document</u>	<u>Attributes Reviewed</u>
Material Certification	Material chemical and (Base) physical properties compared to standards and code requirements.
NDE Records	Examinations meet codes and standards, licensee procedures and other commitments; personnel properly qualified; appropriate examinations performed.
Fabrication Records	Fabrication travelers and records were reviewed and compared against other corresponding records and sign-off sheets.
Drawings (Isometrics)	Drawings were reviewed for proper designation of weldments, location and classification.
Procedures	Procedures were reviewed for completeness, and licensee's commitment to Code requirements.
Welding Material	Material certifications for welding materials were reviewed for physical and chemical properties as required by licensee's commitment to Code and industry standards.

These documents were reviewed to verify compliance to NRC requirements and licensee's commitments to industry codes and standards. The document packages reviewed are listed in Attachment #3.

Results: No violations were identified.

2.2 Nondestructive Examinations

Examinations were performed using NRC procedures with addenda written specifically for compliance to the licensee's FSAR commitments. The intent was to duplicate, to the extent possible, the techniques and methods used during the original examination.

The following examinations were performed:

Radiographic Examination

Eighteen pipe weldments were radiographically examined per NRC procedure NDE-5, Revision 0, Addenda VY-1-5-1. These weldments were located in the RHR and Reactor Recirculation systems.

Results: No violations were identified.

Liquid Penetrant Examination

Fourteen pipe weldments and adjacent base metals were examined per NRC procedure NDE 9, Revision 0, and addenda VY-1-9-1. Samples examined were ASME Class 1 pipe.

Results: No violations were identified.

Visual Examination

Nineteen pipe weldments and adjacent base materials were examined for weld reinforcement, surface condition and overall workmanship per NRC procedure NDE-14, Revision 0.

Results: No violations were identified.

Thickness Measurements

Seven weldments and adjacent pipe material were examined per NRC procedure NDE-11, Revision 0, using a Nova D-100 thickness gauge. Minimum wall thickness was determined by using ASTM standard pipe size and nominal thickness chart.

Results: No violations were identified.

2.3 Other Confirmatory Examinations

2.3.1 Walkdown (HPCI) High Pressure Coolant Injection System

The inspectors performed a walkdown inspection of the High Pressure Coolant Injection system, utilizing site drawing PI-1062. The walkdown inspection involved a visual and physical inspection of piping and pipe supports identified on the aforementioned site drawing.

Aspects of the walkdown inspection included the following:

- pipe geometry, dimensions, angles and orientation;
- pipe support location;
- pipe-to-pipe and pipe-to-equipment welds; and
- support dimensions and welding.

See Attachment #4 for specific supports inspected.

Results: No violations were identified.

2.3.2 Whip Restraints

The inspectors performed a visual examination of (10) ten large bore pipe restraints on the Reactor Recirculation system. Inspection was performed on the whip restraint fillet weld mounting plates of Loops A and B. The licensee had previously completed an inspection and evaluation of all the recirculation system whip restraints (total of 32) in accordance with the original construction drawing G-191711, Revision 2. The licensee's examination indicated that the original installation of the component fillet welds was not in accordance with the design drawing for some restraints. The licensee has developed a corrective action program to restore the required restraints to operable conditions during the piping replacement program.

The NRC inspectors performed an overview weld inspection and compared the results with the licensee's findings and evaluation (Document #006820 MEM-PT-MIS, Appendix 2). See Attachment #4 for specific restraints inspected.

Results: No violations were identified.

2.3.3 Embedded Plates and Penetrations

The inspectors performed a visual examination of selected areas around embedded plates and penetrations to identify indications of plate movement or other unusual conditions. These inspections were undertaken as a result of the licensee's findings that a high pressure coolant injection system pipe support plate had not been properly installed during plant construction.

The inspectors performed a visual inspection on the following embed plates for additional instances of improperly installed support plates:

<u>Reference Area</u>	<u>Embed Plates Inspected</u>
Penetration x 39A	2 plates

Results: No violations were identified.

2.4 Review of QA/QC Procedures

The following procedures were reviewed for compliance with NRC regulations and applicable code requirements.

(NDE) Nondestructive Examination Procedures

Morrison and Knudson

<u>Document</u>	<u>Title</u>	<u>Rev.</u>
FQP-09-01	Visual Inspection	2
FQP-09-02	Liquid Penetrant	2
FQP-09-03	Magnetic Particle	1
FQP-09-04	Radiographic	2
FQP-09-06	Ultrasonic Thickness Examination	2
FQP-02-03	Qualification and Certification of Audit Personnel	0
FQP-02-02	Qualification and Certification of Inspection Personnel	0
FWP-04-01	Control of Welding	3

Hitachi Ltd.

VY-IP-001	Liquid Penetrant	3
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Results: No violations were identified.

3.0 Radiographic Review

The inspector reviewed the site radiograph data packages for twenty-nine (29) vendor shop welds and six (6) field welds. Of the thirty-five (35) sets of radiographic data packages reviewed, thirteen (13) were compared to NRC radiographic data packages. This comparison of radiographs was performed to verify the adequacy and completeness of the licensee's records.

See Attachment #2 for specific radiographs reviewed.

Results: No violations were identified. The inspector found the contractor's radiographic program to be very good.

4.0 Infrared Demonstration

Background

During the recirculation piping replacement activities, an embedded plate used as an anchor point for high pressure coolant injection (HPCI) system piping was discovered pulled from the wall. The problem with this plate was traced to original plant construction, wherein the required plate anchors and shear lugs had apparently been removed. Visual inspection of this and similar embedded plates was made by the licensee. The attributes verified were size of plate, location and evidence of plate movement or evidence of cracking of the concrete around the embedded plates; shear lugs and anchors were not initially verifiable. To address the shear lugs and anchors, the utility has developed a NDE Infrared (IR) technique using heat flow analysis to determine if the lugs and anchors are attached.

The utility performed an infrared test demonstration that was witnessed by the inspector to show that the IR technique was able to verify the proper installation of the embedments. As a result of the demonstration, the inspector agreed that lugs and anchors near the edges of the embedments could be positively identified using the IR technique.

The utility has written a preliminary procedure 85-03 for IR testing and for a pull test of embedded plates. Since only a portion of the embedments can be positively verified by IR, a sample of the embedment plates that were IR-tested will also be subjected to a pull test. The test will apply a 10,000 lb. load; this load exceeds any load currently applied to embedded plates of the type in question.

The inspector concluded that after the licensee completes the qualification of the IR technique and completes the pull test, the test results obtained should adequately resolve the issue of improper installation of existing embedded plates.

5.0 Welding Problems Encountered

During the course of this inspection, the inspector examined certain problems which had been previously identified by the licensee. The inspector sought to assess the adequacy of the licensee's proposed corrective actions.

5.1 Safe Ends

During the course of the recirculation piping replacement, the licensee identified several welding problems. The inspector looked into the welding problems associated with safe end N2H-SE reported on OIR #046. This safe end was welded up to $\frac{1}{2}$ " weld thickness, then radiographed. Radiographs of areas 0-10 and 20-30 were rejected by the contractor for incomplete fusion. Both affected weld areas were repaired; repairs were radiographed and subsequently rejected for ID root problems as reported on OIR #065.

Site engineering disposition was to remove and reweld safe end N2H-SE. This disposition was based on Vermont Yankee Welding Specification EDCR 85-1(E), paragraph 6.5.5. This section dealt with repairs and the control of sensitization of stainless steel face material. Also, the inspector noted that Morrison Knudsen Welding Procedure FWP-9.1, Revision 3, paragraph 4.4.2.9, limited the maximum allowed weld repairs to three repairs within the same area. All repairs were required to be reported on the back of the weld data card for licensee engineering review.

Site welding engineering has reviewed these welding problems and has corrected or improved the following welding practices:

- (a) use of purging dams;
- (b) control of weld wire feed; and
- (c) specification of the angle of electrode for each pass in the welding procedure.

With the above changes, site welding engineering believes that the safe end problems will be eliminated. The inspector concurred with this position.

5.2 Thermal Sleeve

During the removal of safe end N2H-SE, it was necessary to remove the thermal sleeve-to-piping weld. The licensee performed a visual inspection of the previously inaccessible weld side and found that the consumable insert was not completely consumed for a length in excess of 8". This welding defect was reported on NCR 074. To address this problem site engineering changed the weld design from a

consumable insert to a weld with a backing strip. This weld is to be made by a remote control operator using a TV camera. The nozzle opening was noted to be approximately 10" ID and the weld to be made would be 30" inside of this 10" ID nozzle. The site examination requirements for this weld were specified as a solvent-removable liquid penetrant examination. Also used would be a small diameter boroscope to view the liquid penetrant results and to perform a visual inspection. Other licensee considerations were that ten of these welds are to be made and there would be a radiation problem related to the nozzle shine.

The inspector had several concerns regarding the examination of thermal sleeves. The inspector noted that the solvent removable penetrant method presents a problem with the remote removal of penetrant from as-welded surfaces. He further noted that other penetrant test methods may reduce personnel radiation exposures. Lastly, a concern was expressed regarding the qualification and use of a bore-scope for the visual acceptance of the penetrant examination results because of the limited field of view presented and the difficulty of interpreting the results.

The adequacy of the licensee's proposed examination techniques is considered unresolved pending further evaluation by the licensee and review by the NRC. (50-271/86-02-01).

5.3 Welding Material Control

The licensee's contractor found that carbon steel (70S-3) welding rods were issued to a welder for repairs on the weld prep of an N2F nozzle. This was not discovered until the welder returned two welding stubs to the welding wire room and the attendant noticed that the returned stubs were carbon steel and not stainless steel as required by the withdrawal slip. The discovery was reported on NCR #058. The inspector visited the welding rod rooms and verified that blank filler material withdrawal slip forms have been removed. The inspector and contractor discussed a plastic hinged cover to be placed on half of the welding wire control storage box, so that carbon steel is segregated from the stainless steel welding wire.

A review of NCR #058, under the section dealing with actions to prevent recurrence, revealed to the inspector that there was documentation for the training of welders and weld wire attendants, but none for the Quality Control personnel, regarding weld wire issuance procedures. The inspector also reviewed the changes made to procedure FQP-10-1, Revision 4, which provided guidance for the QC personnel regarding welding material controls. This procedure had not been approved or issued, however, it was the inspector's understanding that when it was implemented, all personnel concerned would be trained. The inspector had no further questions.

6.0 Quality Control Interfaces

In the process of inspecting the licensee's radiographic program, vendor (Hitachi) radiographic film for the recirculation piping replacement were reviewed by the NRC. Several deficiencies were identified with the radiographic film and reader sheets. Further inspection revealed that Yankee site quality personnel had previously identified the same problems with the radiographic film and reader sheets, and had addressed the deficiencies by requiring re-reviews and additional radiographic examinations onsite. These actions were documented on report MSG 5/86 W.O. #4867.

No violations were identified.

7.0 Attachments

Attachment No. 1 is a tabulation of the specific welds examined and the results.

Attachment No. 2 is a list of specific radiographs reviewed and the results.

Attachment No. 3 is a list of specific documentation packages reviewed.

Attachment No. 4 is a list of specific hanger supports and restraints examined and results.

8.0 Exit Interview

The inspector met with the licensee representatives (denoted in paragraph 1) at the conclusion of the inspection. The inspector summarized the scope and applicable findings of this inspection. No written information was given to the licensee by the inspector during the course of this inspection.

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INDEPENDENT MEASUREMENT PROGRAM
ATTACHMENT

SITE: VERMONT YANKEE

WELD NUMBER Line/ISO	CLASS	ALLOY ANAL.	FERRITE	THICK	M.T.	R.T.	U.T.	P.T.	HARDNESS	VISUAL	REMARKS
PLR-A-16	/	N/A	N/A	N/A	N/A	ACC.	N/A	ACC.	N/A	ACC.	
PLR-B-16	/	"	"	"	"	"	"	"	"	"	
WA-2	/	"	"	ACC	"	"	"	"	"	"	
WB-2	/	"	"	"	"	"	"	"	"	"	
RHR-W32-2	/	"	"	"	"	"	"	"	"	"	
RHR-W32-3	/	"	"	"	"	"	"	"	"	"	
RHR-W32-4	/	"	"	"	"	"	"	"	"	"	
RHR-W32-8	/	"	"	"	"	N/A	"	"	"	"	
RHR-W30-5	/	"	"	"	"	ACC	"	"	"	"	
RH-A-2	/	"	"	N/A	"	"	"	"	"	"	
RH-A-3	/	"	"	"	"	"	"	"	"	"	
AD-11	/	"	"	"	"	"	"	"	"	"	
RH-B-3	/	"	"	"	"	"	"	"	"	"	
BD-12	/	"	"	"	"	"	"	"	"	"	

ATTACHMENT #1

C - CRACK
 SL - SLAG
 P - POROSITY
 T - TUNGSTON

LE - LACK FUSION
 IP - INADEQUATE PENETRATION
 LI - LINEAR INDICATION
 UI - UNFUSED INSERT

A - ARTIFACTS
 S - SURFACE
 CC - CONCAVITY
 CV - CONVEXITY

SYSTEM/LINE	WELD-ID	ACC	REJ	C	SL	P	T	LF	IP	LI	UI	A	S	CC	CV	COMMENTS	
HITACHI SHOP WELDS			★ DENOTES FILM COMPARED TO NRE FILM														
RHR	W30-5*	✓															
PLR	WA-2*	✓															RE-XRAYED SURFACE ID
PLR	WB-6	✓															
PLR	WB-28	✓															
PLR	WB-2*	✓															
PLR	WA-28	✓															
PLR	WA-33	✓															
PLR	WA-29	✓															
PLR	WB-33	✓															
PLR	WA-16*	✓															
PLR	WB-17	✓															
RHR	W32-4*	✓															
RHR	W32-8	✓															
RHR	W30-6	✓															
RHR	W32-2*	✓															
RHR	W32-3*	✓															
PLR	WA-6	✓															
PLR	WA-17	✓															
PLR	WA-30	✓															
PLR	WB-37	✓															
PLR	WA-38	✓															
PLR	WA-37	✓															
PLR	WB-13	✓															
RHR	W30-2	✓															ID SURFACE
RHR	W31-2	✓															

REVIEW OF DOCUMENTATION PACKAGES

LINE NO.	WELD NO	REVIEW	COMMENTS
PLR	WB-37	ACC	12" pipe to reducer CL.1
PLR	WA-2	"	28" pipe to EL. CL.1
PLR	WB-2	"	28" pipe to EL. CL.1
PLR	WA-6	"	28" pipe to EL. CL.1
PLR	WB-6	"	28" pipe to EL. CL.1
PLR	WB-16	"	12" pipe to reducer CL.1
PLR	WA-13	"	27" reducer to tee CL.1
PLR	WB-17	"	12" pipe to reducer CL.1
PLR	WB-13	"	27" reducer to pipe CL.1
PLR	WA-17	"	12" pipe to reducer CL.1
PLR	WB-33	"	4" pipe to flange CL.1
PLR	WA-33	"	4" pipe to flange CL.1
BHR	W30-2	"	24" pipe to EL. CL.1
BHR	W30-5	"	24" pipe to EL. CL.1
BHR	W30-3	"	24" pipe to EL. CL.1

WHIP RESTRAINT & HANGER INSPECTION

WHIP RESTRAINTS			HANGERS		
IDENTIFICATION	DRAWING	COMMENTS	IDENTIFICATION	DRAWING	COMMENTS
LOOP A R6	DOCUMENT 006820 MEM-PT- MS / Appendix II	ACCEPTABLE	HPCI - HD 26A	PI-1062	ACCEPTABLE
LOOP A R7			- H26		
LOOP B R2			- H26B		
LOOP B R3			- H24		
LOOP B R4			- HD 24		
LOOP B R5			- MS-H22		
LOOP B R6			- MS-HD22A		
LOOP B R12			- H28		
LOOP B R13			- HD27		
LOOP B R14					