U.S. NUCLEAR REGULATORY COMMISSION
Region I

Report No. 50-352/84-27

Docket No. 50-352

License No. CPPR-106 Priority -- Category B

Licensee: Philadelphia Electric Company
2301 Market Street
Philadelphia, Pennsylvania 19101

Facility Name: Limerick Generating Station, Unit No. 1

Inspection At: Limerick, Pennsylvania

Inspection Conducted: June 11-22, 1984

Inspectors: Samuel D Reynolds for 8/15/84
S. K. Chaudhary, Senior Resident Inspector date

J. P. Durr per 8/26/84
J. P. Durr, Chief, Materials & Processes Section date

J. A. Prell for 8/20/84
R. J. Paolino, Lead Reactor Engineer date

J. A. Prell 8/20/84
J. A. Prell, Reactor Engineer date

J H Raval 8/20/84
J. H. Raval, Reactor Engineer date

Samuel D Reynolds 8/15/84
S. D. Reynolds, Jr., Lead Reactor Engineer date

Approved By: S. D. Ebneter 9/11/84
S. D. Ebneter, Chief, Engineering Programs Branch, DETP date

Inspection Summary: Inspection on June 11-22, 1984 (Report Number 50-352/84-27)
Areas Inspected: A special, announced facility "as-built" inspection by four regional based inspectors, a section chief team leader, and the senior resident inspector. The inspection consisted of two weeks preparation and inspection in the regional office and two weeks onsite. The inspection consisted of reviews of the applicable design bases and examination of systems to verify compliance with the design. The inspection involved 469 hours onsite and 100 hours in the regional office.

Results: Two violations were identified; failure to install pipe supports in accordance with design drawings and an inadequate electrical specification for environmental protection of equipment.

DETAILS

1. Persons Contacted

Philadelphia Electric Company

* K. Carrabine, Engineer
* J. M. Corcoran, Field Quality Assurance Head
* F. Coyle, Quality Assurance Engineer
  G. Lauderback, Quality Assurance Engineer
  J. Lisa, Quality Assurance Engineer
* D. A. Marascio, Quality Assurance Engineer
* P. K. Pavlides, Manager, Quality Assurance
* R. F. Smith, Quality Assurance Engineer

Bechtel Power Corporation

* G. C. Bell, Project Quality Assurance
* R. J. Bulchis, Resident Project Engineer
* F. J. Hunt, Quality Assurance Engineer
* G. C. Kelly, Lead Site Quality Assurance Engineer
* L. Memola, Plant Design Group Supervisor (SFHO)
  T. Molinaro, Project Superintendent
* K. L. Quinter, Assistant Project Field Engineer
* E. Patel, Deputy Project Field Engineer
* M. Schlager, Field Quality Engineer
* R. H. Slaughter, Lead Quality Control Engineer (Hangers)
* K. G. Stout, Project Quality Control Engineer
* D. C. Thompson, Assistant Project Field Engineer

* Denotes those persons present at the interview conducted on June 22, 1984.

2. Inspection Purpose and Scope

The purpose of the inspection was to verify that selected plant systems have been installed in accordance with the design bases, FSAR commitments, and design specifications and drawings. This was accomplished by selecting a team of NRC inspectors with various engineering backgrounds capable of performing in-depth design and as-built inspections. The team was composed of engineer-inspectors from the mechanical, civil and electrical/instrumentation disciplines.

The basis for selection of the systems identified for this inspection was the site specific probabilistic risk assessment (PRA) study performed by an NRC contractor. This study ranked systems according to the degree to which they contribute to core melt accidents if they fail. Other factors considered were whether the system had been selected by other inspection groups for examination and the complexity of the system. The high pressure coolant injection (HPCI) system and the emergency service water (ESW) system were selected for examination. The HPCI ranked tenth and the ESW ranked second in the aforementioned PRA study.

The HPCI consists of several subsystems which include the HPCI turbine steam supply and exhaust, the pump suction and discharge, and the associated instrumentation and electrical systems. The ESW was selected because of its multiple interfaces with several other safety related systems.

The inspection was based on a six week cycle. The first two weeks consisted of a preparatory phase in which the team examined the FSAR, system drawings and other inspection related documents. Specific details of the systems were noted for future verification at the site. The second two weeks were spent onsite examining the actual hardware and comparing design specifications with procurement documents, the FSAR, and installation specifications verifying that equipment met the requirements.

3. High Pressure Coolant Injection System (HPCI)

The HPCI system is designed to ensure that the reactor core is adequately cooled in the event of a small break in the reactor coolant pressure boundary or a loss of coolant that does not result in rapid depressurization of the reactor vessel. This system, an engineered safety feature system, pumps water from either the condensate storage tank or the suppression pool to the reactor vessel via a core spray line and a feedwater line. The system includes a turbine-driven pump, a dc-motor-driven auxiliary oil pump, a gland seal condenser condensate pump, a gland seal condenser blower, automatic valves, control devices, sensors and logic circuitry.

3.1 Mechanical Inspection

The inspection of the high pressure coolant injection system (HPCI) consisted of a review of the design commitments in the FSAR and comparing them with the output design specifications and drawings to verify that they were consistent. Various design parameters were selected such as the pumps net positive suction head pressure, flow rates, and prime mover outputs, these values were compared with the nameplate data, procurement specifications and vendor supplied documents.

In addition, the accessible HPCI subsystems were physically examined to verify that they conformed to the installation drawings, flow diagrams, and field specification. The examinations involved verification of selected attributes on the installation drawings for the piping supports and associated welds. Where possible, the relative locations of the piping and supports were verified. These location measurements were made with an accuracy limited to tape measure approximations.

The subsystems, piping isometrics, pipe supports, and components that were examined are listed in Table 3.1.

The examination identified two discrepancies in pipe supports which do not comply with the design drawings. Hanger HBB-108-H6 has a 20" diameter, four bolt pipe clamp installed within a fabricated box frame made of W6x20 beams. A note on the drawing states, "cut clamp here to avoid interference if necessary. Maintain minimum 2-bolt diameter distance from (centerline) bolt load to cut." The referenced bolts are 1 1/2" in diameter, thus, requiring a 3" distance from the centerline to the cut edge. Field measurement disclosed this to be 2".

Hanger EBB-129-H8A, item #7, requires two stiffener plates, 3/8"x2 1/4"x7 1/4", to be installed between the flanges and web of item #8. Inspection determined that these stiffener plates were not installed.

A review of quality control records for the above discrepant hangers disclosed that final quality control inspections have been performed. The failure to install safety related pipe supports in accordance with design drawings is a violation of 10 CFR 50, Appendix B, Criterion V (352/84-27-01).

During the HPCI walkdown inspection, the major equipment listed in Table 3.2 was selected for detailed review of the nameplate data, procurement specifications and design bases information.

The HPCI pump data indicates that the original procurement specified an inlet temperature range of 40-140°F. This is also reflected by the pump nameplate. However, the FSAR, Section 6.3.2.2.1.2, states that the suppression pool water will be at 170°F for the given operating mode. The licensee produced an internal General Electric document which verifies that the HPCI pump is capable of operation at this elevated temperature.

The inspector had no further questions concerning this matter at this time.

TABLE 3.1

HPCI WALKDOWN INSPECTION

ISOMETRIC NUMBER	LINE SYSTEM	SUPPORT NUMBER	EQUIPMENT	FINDINGS
HBB-109-1 (M55)	HPCI Suction Suppress Pool	None	102F210 & 101F210 Suction Strainers	None
HBB-109-2 (M55)	HPCI Suction Suppress Pool	HBB-109-H1 HBB-109-H2 HBB-109-H3A HBB-109-H4 HBB-109-H5 HBB-109-H6	1F045 Check Val M01F041 Butterfly M01F042 Gate	H6 lug orientation varied on FSK and isometric. Item Resolved.
HBB-110-1 (M55)	HPCI Suction Cond. Str.	HBB-110-H1 HBB-110-H4	M01F004 Valve	None
HBB-108-1 (M55)	HPCI Turbine Exhaust	HBB-108-H3 HBB-108-H3A HBB-108-H4 HBB-108-H5 HBB-108-H6 HBB-108-H7 HBB-108-H9 HBB-108-H11 HBB-108-H13	HV1F072 Valve	H6 had 3 stiffener plates versus 1 shown; item resolved; clamp bolt edge distance criteria violated. H13 had W21x55 flange warped; item resolved
HBB-113 (M55)	HPCI Turbine Exhaust Vent	None	PSE-56-1D 003 & 004 Rupture Disks	None
EBB-129-1 (M55)	HPCI Pump Discharge	EBB-129-H1 EBB-129-H1A EBB-129-H7 EBB-129-H17 EBB-129-H47 EBB-129-H48	None	None

ISOMETRIC NUMBER	LINE SYSTEM	SUPPORT NUMBER	EQUIPMENT	FINDINGS
EBB-129-2 (M55)	HPCI Pump Discharge	EBB-129-H45 EBB-129-H9 EBB-129-H8 EBB-129-H8A EBB-129-H10 EBB-129-H10A EBB-129-H11 EBB-129-H11A EBB-129-H58 EBB-129-H16 EBB-129-H12 EBB-129-H13 EBB-129-H902	HV1F007 Valve 1F005 Valve	Hanger H8A has two 3/8x2-1/4x7-1/4 stiffener plates are not installed H11 pipe to floor distance is 3'-0 versus 2'-1; item resolved. Bottom plate is 2 inches versus 1/2; item resolved
EBB-129-3 (M55)	HPCI Pump Discharge	EBB-129-H27 EBB-129-H41 EBB-129-H43	1F006 Valve	None
EBB-131 (M55)	HPCI Pump Discharge	EBB-131-H2 EBB-131-H7 EBB-131-H8 EBB-131-H9 EBB-131-H10		H7 item #10 and H2 item #8 show 8 nutes, installed 4-item resolved H7 item 4, beam 3'-9 1/4, actual 2'-10, item resolved
DLA-110-1 (M55)	HPCI to Cont.	DLA-110-H1 DLA-110-H3 DLA-110-H4 DLA-110-H5		H4 toe of weld ground > 1/32, W10x49 lower flange warped. Items resolved
DCA-319	HPCI to Vessel	DCA-319-H1 DCA-319-H2 DCA-319-H3 DCA-319-H4		None

TABLE 3.2

HPCI EQUIPMENT SELECTED FOR DESIGN DATA REVIEW

EQUIPMENT	IDENTIFICATION NUMBER	DATA
M01F042 HBB-109-2 Valve	E5422-3-1 270861	Limitorque, type SMB, 16 inch
HPCI Turbine Gear	Sl. 3065 MDL 4110	Ratio 1.975/1; oil 150SSU@00F 4150RPM in/2100 out; 1500HP
HPCI Pump Primary	701S0833 DVMX	10x12x15; 5600 GPM; 40F-140F; 2075 to 4150 RPM, 295 psi suction
HPCI Booster Pump	701S0832	5600 GPM; 40F - 140F, 6.5 psi suction 1037-2075 RPM
HPCI Turbine	T36690A RS-1105-558-50	Type CCS; Inlet 575F; 1250 psi exhaust 200 psig; 4150 RPM
HPCI Turbine Rupture Disks	PSE-56-1D 003 & 004	Material 316 ss; 378F; 170-188 psi
M01F004 HBB-110 Valve	E5428-9-1	275 psi; 100F
1F005 EBB-129-2 Valve	1426-02 205AE340	700F; 940 psi
HV1F007 Valve	483	900 psi, SA-105 material, 14"
M01F006 DBB-GT	482	900 psi (1625 psi @ 170F), 12"

3.2 Electrical and Instrumentation

The HPCI system is automatically initiated by either low reactor vessel water level or high primary containment pressure signals. Four level sensors monitor the water level in the reactor vessel. These sensors each feed a trip unit. The four trip units are connected in a one-out-of-two-twice logic scheme to provide an automatic HPCI initiation signal. Similarly, there are four drywell pressure monitor sensors each of which feeds a high level trip unit. Each trip unit is connected in a one-out-of-two-twice logic scheme to provide an automatic HPCI initiation signal.

3.2.1 High Pressure Coolant Injection - As-Built Configuration Electrical

The team reviewed schematic and wiring diagrams for portions of the high pressure coolant injection system (HPCI) to determine whether the requirements of the FSAR, system description, control loop and logic diagrams were adequately presented in the electrical diagrams used for the installation and termination of electrical components.

The inspection included the review and analysis of the HPCI automated start initiation network and the control circuitry for motor operated valves (MOV) in the turbine steam line, HPCI discharge line, condensate storage tank and suppression pool inlet lines. Documents examined for this determination are listed in Table 3.2.1.

The team determined that the HPCI system is functional electrically and in accordance with applicable procedures and drawings.

No violations were identified.

3.2.2 Instrumentation

The team examined work performance and completed work pertaining to the installation of control instrumentation and associated tubing and control cables to determine whether the installed configuration represents the as-built condition. Attributes inspected include range, size, type, and location of HPCI instruments. Instrument lines were checked for slope, routing, bend radius, anchor location and type. Cables were checked for size, type, routing and proper termination at the local panels and the actuating device.

Installation drawings used for this determination are listed in Table 3.2.2.

The team determined that the HPCI control instrumentation and associated tubing and cables (except for conduit sealing noted in paragraph 3.1.2) were installed in accordance with established procedures, to reflect the as-built configuration.

No violations were identified.

The team verified the licensee's impact review program for room Nos. 258 and 258A and its implementation of Specification No. 8031-M-400 which specifies the Safety Impact Program prior to and/or post room turnover. The team reviewed Facility Package No. 77-E8, dated March 28, 1984, which documents the results of the safety impact review for rooms 258 and 258A. The package includes descriptions of electrical conduit and instrument installations determined not in accordance with procedures/instructions and provides the rationale for acceptance and/or rework.

No violations were identified.

The team reviewed the HPCI exception work list, selecting several items for verification.

Items selected include:

-- Final adjustments and verification of light and alarm switches - Test Package No. XV55-1F024A.

-- Rewiring vendor supplied component in 10TB-HPCI terminal box - Test Package No. 1BQ076, SWO-52A-134.

-- Revised GE wiring drawings to agree with as-built in 10C620 Test Package 1BQ076, Startup Field Report No. 43.

The documentation packages are current, legible, easily retrieveable, and complete with signatures of authorized personnel.

No violations were identified.

Table 3.2.1

Electrical Documents Reviewed

-- Drawing No. 8031-E-33, Revision 19, Sheets 1 thru 3, Single Line Meter and Relay Diagram 125/250 VDC System

-- Drawing No. 8031-E-55, Sheets 1 and 2, Single Line Meter and Relay Diagram - MCC Load Tabulations D114-R-9 and D124-R-G

-- Drawing No. 8031-E-58, Sheet 3, Single Line Meter and Relay Diagram, MCC Load Tabulation D114-R-C, D124-R-C

-- Drawing No. 8031-M1-H12-1060-E2 thru 8, Elementary Diagram Power and Utility Distribution Interconnection

-- Drawing No. 8031-M1-E41-1040-F1, Elementary Diagram HPCI System

-- Drawing No. 8031-M1-E21-1040-E15.18, Elementary Diagram Core Spray System

-- Drawing No. 8031-M-55, Revision 24, P&ID HPCI

-- Drawing No. 8031-M1-E41-E5.21, Elementary Diagram HPCI

-- Drawing No. 8031-M1-E41-E6.22, Elementary Diagram (HPCI Isolation)

-- Drawing No. 8031-M1-E41-1040-E12.26, Elementary Diagram HPCI (Pump Discharge Valve/Condensate Pump)

-- Drawing No. 8031-M1-E41-1040-E-13.14, Elementary Diagram HPCI (Steam Supply Line Valves)

-- Drawing Nos. 8031-M1-H23-P014-D-1.4 and 8031-M1-H23-P014-E-1.2, Local HPCI Panel B

-- FDDR Nos. HH1-507, HH1-1306 and HH1-1313

Table 3.2.2

Instrumentation Documents Reviewed

-- P&ID Drawing No. 8031-M-55, Revision 24 for HPCI System

-- Instrument Panel Drawing No. 8031-M1-H23-P014-C-1.2, HPCI Local Panel B

-- Isometric - Condensate and Refueling Water Storage Piping Drawing No. HCD-119-1, Revision 1

-- Isometric - Reactor Building Piping Drawing Nos. HBB-110-1 Revision 19, HBB-109-2 Revision 15, EBB-129-3 Revision 25, EBB-129-2 Revision 31, HBB-113-1 Revision 5, DBA-106-2 Revision 13 and EBB-129-1 Revision 22

-- High Point Vent Drawing No. HCD-119-1F, Revision 1

-- Plan and Sections Drawing No. DBA-106-1, Revision 20

-- Instrumentation Connection Drawings Nos. SP-HBB-113-F, Revision 4 and SP-EBB-129-1F, Revision 5

-- Hanger Location Drawing Nos. FJ-55-1 Sheet 1 of 2, Revision 9, FJ-56-10 Sheet 1 and 2, Revision 5

-- Instrument Location Drawing No. FJ-55-1 Sheet 2 of 2, Revision 9

-- Transmitter Specification Drawing No. 8031-M1-B21-3050-H-1.17

-- Flow Controller Specification Drawing No. 8031-M1-E41-3050-H-1.6

-- Cable No. 1AB21303B-1&2 from Panel 10B21303 to Valve No. HV52-1F005 per Connection Drawing Nos. E-2713 Revision 2 and E-2706 Revision 1

-- Cable No. 1BI004F-1a&2a from Panel 10C792-E to Flow Transmitter No. FT55-1N008 per Connection Drawing E-2594 Revision 4 and JT-9352 Revision 1

-- Cable No. 1BD20302A-1a and 2a from Panel 10D20302 to Valve No. HV55-1F007 per Connection Drawing E-2659 Revision 1 and E-2717 Revision 2 and 3

-- Cable No. 1BI004A-1a and 2a from Panel 10C014 to Panel 10C792E per Connection Diagram E-2114 Revision 1 and E-2594 Revision 5

-- Cable No. 1DB22418D-1 and 2 from Valve No. HV55-1F002 to Panel No. 10JX105D per Connection Diagram E-2725 Revision 3 and E-2713 Revision 4

-- Cable No. 1BD20211C-1 and 2 from Panel No. 10D20211 to Valve No. HV55-1FC42 per Connection Diagram E2717 Revision 3 and E-2658 Revision 0 and 2

-- Cable No. 1AB51516A-1 and 2 from Panel No. 10B51516 to Valve No. HV55-124 per Connection Diagram E-2086 Revision 2 and E-2711 Revision 5

-- Pressure Transmitter Nos. PT-56-1N052, PT-56-1N053 and Pressure Indicator Nos. PI-56-1R005 and PI-1R001

-- Flow Element Nos. FE-1N007, FE-1N032

-- Motor Operated Nos. MO-124, MO-125, MO-1F004, MO-1F042, MO-1F006 and MO-1F002

4. Emergency Service Water System

The emergency service water (ESW) system is a safety-related system designed to supply cooling water to selected equipment during a loss of offsite power condition or loss-of-coolant accident. The system is common to Limerick Units 1 and 2, and consists of two independent loops with two 50% capacity pumps per loop. The EWS system has the capability of supplying cooling water to the following safety-related equipment:

a. RHR motor oil and seal coolers

b. RHR pump compartment unit coolers

c. Core spray pump compartments unit coolers

d. Control room chillers

e. Standby diesel-generator heat exchangers

f. RCIC pump compartment unit coolers

g. HPCI pump compartment unit coolers

h. Spent fuel pools (makeup water)

4.1 Mechanical Inspection

A walkdown verification inspection was conducted on the emergency service water system (ESW). The ESW piping is a Seismic Class I, Q-Listed, Class 3 system. The inspection consisted of a review of the FSAR design commitments and verification that these commitments were consistent with the design specifications, procurement documents and installed equipment. The inspection commenced at the spray pond and followed the cooling system line through the pump house and pipe tunnel area and to the cooling heat exchangers for the diesel generator, RHR pump compartment coolers, RHR pump motor coolers, RHR pump seal coolers and control room chillers. Vendor supplied documents in the procurement packages and equipment nameplate data were reviewed for conformance to specification requirements.

The piping system was checked in detail for proper location and installation of all components including hangers and supports. The location of these items was compared with the isometric drawings and individual hanger drawings. In the case of hangers and supports, each individual item on the bill of materials was compared with that specific item in the as installed condition. In many cases, it was noted that the "as built" detail drawings did not explicitly conform to the hardware items installed. In every case it was determined

that the variance noted was acceptable in accordance with the dimensional variations permitted by Bechtel Engineering Specifications 8031-P-319 and QC Instruction 8031/P-2.10B. The items examined are listed in Table 4.1.

During the walkdown inspection of Emergency Service Water system piping and supports, the inspector identified an expansion anchor bolt that appeared to be improperly installed. The anchor bolt was one of the six bolts attaching the hanger support plate for HBB-138-H24 to the wall, and was the middle bolt on the right side of the plate. On the inspector's request, the licensee loosened the nut to facilitate examination of the anchor for proper installation. The inspector determined that the nut was in fact shouldered out on the bolt shank, and was installed in violation of project installation criteria for such anchor bolts. The concrete expansion bolt criteria were established and implemented on the project in response to IEB 79-02 by Bechtel Specification SFPD-7902-5, Revision 3. The specification/procedure, Paragraph 3.1.E, required that the bolts must be installed such that at least two threads remained below the surface of the plate. The inspector informed the licensee that this improper installation of concrete anchor bolts was a violation of the specification/procedure, and was contrary to 10 CFR 50, Appendix B, Criterion V (352/84-27-01).

During the pipe support inspection of ESW system in the diesel generator enclosure, the inspector identified that the pipe support HBC-194-H901 was installed such that it did not conform to the applicable design drawing for the support. The sectional view B-B on Drawing HBC-194-H901, Revision 3, Sheet 2, showed the pipe to be installed concentrically with the embeded support anchor. However, the inspector determined that the pipe was installed 1½" off center to the right of the plate, and this condition was neither permitted by any location tolerances or drawing nor was documented in inspection reports to be a variation from the requirements. The inspector informed the licensee that the improper installation of the pipe was a violation 10 CFR 50, Appendix B, Criterion V (352/84-27-01).

Inspection of Hanger HBC-138-1-H903, Revision 3, indicated that the weld between Part 1 to the pipe, which is a wall penetration pipe to flat plate ring weld, did not appear to have a face dimension sufficient to be that of a 3/4" full penetration, single 45° bevel joint. In addition to this problem, the weld symbol used for flat plate to embedment plate weld does not clearly specify the size of both the fillet and groove weld; however, visual inspection indicates the weld size produced may be adequate.

These two weld joint questions on the subject hanger are considered to be an unresolved item pending verification of the weld joint configuration and analysis indicating the acceptability of the weld produced (352/84-27-02).

The inspector reviewed the document packages listed in Table 4.2 for appropriate code and standard compliance, material properties and design data conformance to requirements.

Bechtel Specification M-12 specifies the heat treatment condition for the ESW pump shaft as ASTM:A276, Type 410 H.T., this is an incorrect temper (heat treat) designation as the ASTM specification indicates the acceptance conditions as "A" for furnace annealed, "H" for hard (cooled at a sufficient rate to be martensitic) or "T" which is a thermally tempered martensitic structure which has an optimum balance of properties. As the M-12 specification is incorrect, the mechanical properties can not be properly interpreted in the test report. This item is considered unresolved pending engineering clarification of the specified service conditions and verification that the pump shaft as supplied meets these requirements (352/84-27-03).

Table 4.1

ESW Walkdown Inspection

Isometric Number	Line and System	Support Number	Equipment	Comments
HBC-81-2	ESW (Pump House)	H20	M11-0002A	Gate Valve
		H19	M11-0001A	Check Valve
		H22	P1-002A	BJ6400 GPM Pump
HBC-83-1 -2	ESW (Reactor Bldg.)	H1	10"x6" Red.	(Concentric)
		H4	12"x10" Red.	(Eccentric)
		H5	20"x12" Red.	(Eccentric)
		H6	8 Branch Conn.	
		H7		Iso HBC-294-1 Blind
		H9	6" HBC-299	flange and piece
		H10		of pipe missing.
		H11	0064A	check valve
		H12	FE0011A	flow element
		H13	HV00A	butterfly valve
		H14		flow element
		H15		
		H16		
		H17		
		H18		
		H20		
		H21		
		H22		
		H23		
		H24		
		H26		
		H27		
HBC-138-1 -2	ESW (Turbine Bldg. and Reactor Bldg.)	H1		
		H2		
		H3		
		H4		
		H5	0032A	Check valve improper
		H7		tag affixed indicating-
		H15		not packable - not
		H16	TV-C-0[illegible]	applicable
		H18	0031A	
		H19		Motor operated valve
		H20		
		H21		
		H22		
		H23		
		H24		Excessive thread showing
		H25		on embed stud

Isometric Number	Line and System	Support Number	Equipment	Comments
HBC-138 (Cont.)		H28		
		H901		
		H902	1007	Check valve
		H903		
HBC-137-1 -3	ESW (Reactor Bldg.)	H37		
		H38		
		H39		
		H46		
		H48	KV104E	
		H49	4"x3" Red.	Concentric
		H11		
		H11A		
		H10		
		H8		
		H9		
		H6		
		H5		
		H901		
HBC-147-2 -1	ESW (Turbine Bldg. and Reactor Bldg.)	H33		
		H30		
		H903		

Table 4.2

ESW Equipment Selected for Design Data Review

20" HBC-GT 150# flex wedge gate valve manufactured by Anchor Darling (HBC-81 1-P-002A) serial #E5428-23-1

20" HBC-CK 150# swing check valve manufactured by Anchor Darling (HBC-1-P-001A) serial 2171-28-1-14 (also reviewed documents for 2171-28-1-15 and -16)

American Air Filter Company RHR Pump Room Components Cooler 1AV210 Serial GF20565

4" HBC-GT-AO-11-104A RHR Pump Down Component Cooler Flow Controller Valve (HBC-148)

Ingersoll Rand RHR Pump OAP-548 Serial Number 077178

Colt (Fairbanks Morse) Supplied American Standard Manufactured diesel engine intercooler serial number 4-750-17-096-011

4.2 Electrical

The team reviewed schematic and wiring diagrams for portions of the Emergency Service Water System (ESW) to determine whether the requirements of the FSAR, system description, control loop and logic diagrams were adequately presented in the electrical diagrams used for the installation and termination of electrical components. Documentation examined for this determination is listed in Table 4.3.

During the field walkdown of instrument cables, the team noted the highly humid conditions existing in the ESW pipe tunnels. An inspection of the cable terminations to instruments located in the ESW pipe tunnel was performed and resulted in identifying a nonconforming condition. Cable entering temperature element TE-011-007A, and flow transmitters FT-11-013A and FT-11-011A and B were not sealed against the intrusion of moisture from the external environment. Specification E-1406, Sheet 4.6 specifies sealing of conduits located in specific humid areas in the plant, but does not include the safety related equipment in the pipe tunnel. Specification 8031-M-171 defines humid areas, including the pipe tunnel, which are not addressed in Specification E-1406 resulting in the nonconforming condition. In addition, the equipment manufacturer's Installation Drawing No. H39219-0602, Note 11, states in part that: "the terminal side of the electronics housing must be sealed from the external environment."

The licensee was informed that this was a violation of 10 CFR 50, Appendix B, Criterion III which states in part that: "Measures shall be established for the -- review for suitability of application of -- materials, parts, equipment that are essential to the safety-related functions of the -- components" (352/84-27-04).

The team determined the ESW system to be functional electrically and in accordance with the as-built electrical diagrams except as noted above.

4.3 Instrumentation

The team inspected work performance and completed work pertaining to the installation of ESW pressure, flow and temperature instrumentation, including the racks and panels containing these instrument components, to ascertain whether the requirements of applicable specifications, procedures and instructions were being met in the areas of receipt inspection, material qualification, tube routing, physical separation and final as-built configuration. The team field walkdown of the ESW instrumentation consisted of verifying isometric installation drawings listed in Table 4.6 and examination of items listed in Table 4.4.

The team examined work performance and completed work pertaining to the installation of instrument control cable for specific ESW control parameter, to ascertain whether the requirements of applicable specifications, procedures and instructions were being met in the areas of raceway installation, cable pulling, routing, separation and termination to electrical equipment. Items selected for this determination are listed in Table 4.5.

The team determined that the ESW instruments and associated tubing runs were installed in accordance with established procedures and reflect the as-built configuration.

No violations were identified.

Table 4.3

Electrical Documents Reviewed

-- 8031-M-11, Revision 22, P&ID for Emergency Service Water System

-- 8031-M-11FD, Revision 2, Functional Description of Emergency Service Water System

-- 8031-M-P102C-73, Limitorque Wiring Diagram

-- 8031-E-56, Sheet 1&2, Single Line Meter and Relay Diagram

-- 8031-E-59, Sheet 1&2, Single Line Meter and Relay Diagram

-- 8031-E-322, Sheet 1&2, D-G Emergency Service Water Inlet/Outlet MOV's Schematic Diagram

-- 8031-E-321, Sheet 1 thru 6, Emergency Service Water Pump Schematic Diagram

-- 8031-E-591, D-G Control and Auxiliary Unit Schematic Diagram

-- 8031-E-7-18, Single Line Meter and Relay Diagram - 4KV Safeguard Power System

-- 8031-E-2551, Revision 9, Emergency Service Water Connection Lists - Division 1 Panel OAC667

Table 4.4

Instrumentation Documents Reviewed

-- Control Valve Specification No. 8031-M-250A, Revision 3

-- Control Valve Data Sheets No. 8031-M-608, Revision 8

-- Control Valve Purchase Order No. 8031-M-250A-AC

-- Statement of Conformance for 8031-M-250A-AC

-- Pressure Switch Specification No. 8031-M-224, Revision 19

-- Pressure Switch Data Sheet No. 8031-M-636, Revision 1

-- Seismic/Hydrodynamic Test Plan and Analysis

-- Pressure Gauge Specification No. 8031-M-213, Revision 5

-- Pressure Gauge Data Sheet No. 8031-M-635, Revision 4

-- Statement of Conformance (Pressure Gauge)

-- Certified Calibration Results (Pressure Gauge)

-- Test Procedure No. RT11-00001

-- Control Room Annunciators Specification No. 8031-E-20, Revision 3

-- Panel No. OAC687

-- Schematic Diagram No. 8031-E-602 Main Control Room Annunciator Panel OAC687

-- Electronic Transmitter Specification No. 8031-M-206, Revision 17

-- Pressure Transmitter Data Sheets No. 8031-M-668, Revision 12

-- Differential Pressure Transmitter Data Sheets No. 8031-M-669, Revision 17

-- Transmitter Statement of Conformance

-- Flow Element Specification No. 8031-M-212, Revision 3

-- Flow Element Data Sheets No. 8031-M-646, Revision 3

-- Orifice Plant Data Sheets No. 8031-M-647, Revision 2

-- Performance Test Results and Calibration Certificates

-- Temperature Elements Specifications No. 8031-M-226B, Revision 2

-- Temperature Element Data Sheets No. 8031-M-893, Revision 2

-- Thermowell Data Sheets No. 8031-M-835, Revision 5

-- Material Certification per ASME SA-105, SA-695, SA-696, SA-182 (GR-316, GR-3162, GR-304, GR-304L), SA-479 (GR-316)

Table 4.5

Instrument Cable Installations

-- Cable No. OAITH00A-1 and -2 from Panel OAC667 to Temperature Element TE11-007A.

-- Cable No. OAIF002A from Panel OAC667 to Flow Transmitter FT11-013A.

-- Cable No. OAIF076A from Panel OAC562 to Flow Transmitter FT11-053A.

-- Cable No. 1AA11507K-1 and -2 from Man Hole MN-109 to ESW "A" Pump OAP548.

-- Cable No. 1AB211042 from Panel 10B21104 to Valve HV11-104A.

-- Cable No. 1AA11508G from Panel 10A11508 to Pressure Switch PSL11-002A.

-- Purchase Order No. 8031-F-68476, Rockbestos Micatemp #RSS-5-304 Wire.

-- Project Quality Control Instruction 8031/E5.0, (Cable Termination and 8031/E4.0 (Installation of Electrical Cables).

-- 8031-E-1406, Conduit and Cable Tray, Notes, Symbols and Details.

-- 8031-E-1412, Revision 23, Wire and Cable Notes.

-- 8031-JT-9352, Instrument Termination Drawing.

-- 8031-E-1506, Circuit Schedule.

-- 8031-E-1507, Circuit Schedule.

-- Megger Test Records - Control No. E-407.

-- 8031-JR-E-10, Permanent Plant Cable Installation and Termination.

Table 4.6

Isometric Installation Drawings

-- Emergency Service Water Vents/Drains - Drawing Nos. SP-HBC-147-3F, Revision 4, SP-HBC-83-1F, Revision 4, SP-HBC-138-3F, Revision 5 and SP-HBC-81-1F, Revision 6

-- Turbine Building Drawing Nos. HBC-147-3, Revision 14 and HBC-138-3, Revision 15

-- Reactor Building Drawing Nos. HBC-138-1, Revision 13, HBC-83-1, Revision 15, HBC-81-1, Revision 10, HBC-148-4, Revision 8, HBC-139-3, Revision 16

-- Spray Pond Pump House Drawing Nos. SP-HBC-81-2F, Revision 5, FJ-11-29, Revision 2, HBC-81-2, Revision 5, FJ-11-25, Revision 2, SP-HBC-81-2F, Revision 5, HBC-81-2, Revision 5

5. QA/QC Involvement

The inspection team reviewed and verified QA/QC involvement in design, procurement and installation activities related to the HPCI and ESW systems. The team reviewed QC instructions (QCIs), QC inspection records (QICRs), manufacturers data reports, and startup work orders (SWOs) as indicated in Table 5.0

In addition, team members held discussions with craft and QA/QC personnel to ascertain QA/QC involvement and expertise related to these systems. QA/QC personnel were found knowledgeable and effective in discharging their responsibilities. No violations were identified.

Table 5.0

Quality Control Records

-- SWO 52A-158, HPCI152A, 5/8/84

-- PO 11052, Nuclear Service Valves, 3/4", Serial Numbers A2636 thru A2660, 1/27/78

-- QCI 8031/E-4.0, Installation of Electrical Cable, Revision 9

-- QCI 8031/E-5.0, Cable Terminations, Revision 7

-- QCIR-OAUTH001A-1, QCIR for Cable Terminations, 8/5/83

-- QCIR-OAITH001A-2, QCIR for Cable Terminations, 10/28/83

-- QCIR-OAIF002A-1, QCIR for Cable Terminations, 3/3/83

-- QCIR-OAIF002A-2, QCIR for Cable Terminations, 4/19/83

-- QCIR-OCIF076A-2, QCIR for Cable Terminations, 4/18/83

-- QCIR-1AA11508K-2, QCIR for Cable Terminations, 3/7/83

-- QCIR-1AB21104D-2, QCIR for Cable Terminations, 6/13/83

-- QCIR-1AA11508G-2, QCIR for Cable Terminations, 8/6/82

-- QCIR-OCITH134C-2, QCIR for Cable Terminations, 1/20/83

-- QCIR-1AA11508-1, QCIR for Cable Terminations, 3/6/84

6. Conclusion

The document reviews and system examinations, although revealing deviations from design drawings, indicate that systems are essentially installed as designed. The inadequacy in the electrical specification for sealing of instruments in areas beyond its scope must involve a management evaluation to determine the significance of the finding and the appropriate corrective actions. The consensus of the team is that the quality of workmanship in the systems examined is very good.

7. Unresolved Items

Unresolved items are matters about which more information is required for the inspector to determine if the condition is a violation, a deviation, or acceptable. An unresolved item is discussed in Paragraph 4.1 of this report.

8. Exit Interview

The inspectors verbally relayed tentative findings to the licensee throughout the inspection as they were identified. Formal meetings were held on June 15 and 22, 1984, to convey the official findings of the inspection to the licensee's representatives denoted in Paragraph 1. No written inspection findings were transmitted to the licensee during this inspection.