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April 5, 1984

Docket Nos. 50-352
50-353

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Limerick Generating Station, Units 1 and 2
Pump and Valve Operability Review Team (PVORT)
Audit of January 17-20, 1984 - PECO Resolution
of Open Items

Dear Mr. Schwencer:

We are pleased to provide in the enclosures the information necessary to resolve the finding identified during the subject audit. The finding is summarized below. We trust that the enclosed information will assist you in the closeout of SER Open Issue #6 concerning operability qualification of mechanical equipment.

As a result of the subject audit conducted at Limerick Generating Station, the following finding was issued:

"During the PVORT audit, it was noted that the original design parameters for some components were exceeded by the current expected normal operating or accident parameters." From discussions at the audit exit interview, the design parameters were identified as temperature and pressure.

The following is "Action Required for Open Items" from the finding:

"1.) Review all safety related pumps and valves.

2.) Identify those equipment items for which the original design parameters were exceeded by the current accident or normal values.

3.) In each case for which the original design parameters were exceeded, the applicant should provide justification that pump and valve operability is not adversely affected."

In accordance with the above "Action Required for Open Items", we have completed our review; and the results are included on the enclosures attached.

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In addition, appropriate portions of the LGS FSAR, including Tables 3.9-8 and 3.9-19, are in the process of being revised to provide an up-to-date list of safety related, active mechanical equipment to be consistent with AE/NSSS active safety related equipment lists. These revisions to the LGS FSAR will be submitted as soon as they are available.

Should any additional information be required, please do not hesitate to contact us.

Very truly yours,

John S. Kemper

Enclosures

Copy to: See Attached Service List.

cc: Judge Lawrence Brenner (w/o enclosure)
Judge Peter A. Morris (w/o enclosure)
Judge Richard F. Cole (w/o enclosure)
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ENCLOSURE

Enclosure 1 - Review Summary of BOP Active Pumps

Enclosure 2 - Review Summary of BOP Valves

Enclosure 3 - Review Summary of NSSS Active Essential Pumps & Valves

ENCLOSURE 1

Review Summary of BOP Active Pumps

1. Emergency Service Water Pumps Tag No.'s 0(A-D) P548 have a maximum shut-off head of 137 PSI, and the ESW piping system and the pumps are designed for this pressure. This system is satisfactory.

2. RHR Service Water Pumps Tag No.'s 0(A-D) P506 have a maximum shut-off head of 169 PSI with the piping system design pressure of 155 PSI. The system will only experience the 169 PSI less than 1% of its operating time, which is acceptable in accordance with ASME Section III 1973 Ed. ND-3612.3, applicable to Limerick.

3. Control Room Chilled Water Pumps Tag No.'s 0(A&B) P162 have a maximum shut-off head of 110 PSI; however, the piping system is designed for 120 PSI, which the system will never experience during operation. The piping system was hydrotested with the pump isolated to protect the pump from any overpressure.

4. Diesel Oil Transfer Pumps, Tag No.'s 1-(A-D) P514 have a maximum shut-off head of 31 PSI whereas the associated piping system was designed to 50 PSI. When the piping system was hydrotested the pumps were isolated to prevent overpressure . The maximum that this system could experience during operation is 31 PSI.

5. Safeguard Piping Fill Pumps Tag No.'s 1(A&B) P256 have a maximum shut-off head of 69 PSI. The safeguard piping system is designed to 150 PSI but will only experience 69 PSI, the shut-off head of the pump. When the piping systems were hydrotested, the pumps were isolated to prevent overpressurization.

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ENCLOSURE 2

Review Summary of BOP Valves

Valve Data Sheet No.	Valve Tag No.'s	Line No.	Valve Data Sheet P_D	T_D	P_{max}	T_{max}	System Design/ Maximum Cond. P_D	T_D	P_{max}	T_{max}	Remarks
P-102	49-1F010 -2F010	HBB-130	125	100	125	100	125	170	125	170	Analyzed to 750 PSI @ 500°F See Notes 1, 7&8
1	55-1F004 -2F004	HBB-110	125	100	125	100	125	170	125	170	See Notes 1 & 2, 7
2	51-1F006A,B -2F006A,B	HBB-118	140	320	140	320	190	360	190	360	
3	51-1F075 -2F075	GBB-11	500	320	500	320	420	360	500	360	Analyzed to 500 PSI @ 480°F See Notes 3,7
4	52-127,128 -227,228	HBB-134	150	200	150	200	125	212	125	212	See Notes 1 & 2,7
18	51-1F040 -1F049	GBB-104	500	320	500	320	420	360	500	360	Analyzed to 1500 PSI @ 500°F See Notes 2, 3, 7 & 8
	-2F040 -2F049	GBB-104	500	320	500	320	420	360	500	360	
18	51-105A,B -205A,B	GBB-109	500	320	500	320	420	360	500	360	
20	51-1F068A,B -2F068A,B	GBB-103	455	150	455	150	420	480	500	480	See Notes 2 & 3, 7
21	52-1F031A,B -2F031A,B	GBB-112	420	212	475	212	500	212	550	212	See Notes 3,7
27	51-1F073 -2F073	GBC-106	455	150	500	150	420	320	500	320	See Notes 2 & 3,7
27	51-1F014A,B -2F014A,B	GBC-102	455	150	500	150	420	480	500	480	
35	55-1F095 -2F095	HBB-144	30	212	30	212	185	366	185	366	See Notes 1,2 & 7
36	55-1F093 -2F093	HBB-144	65	360	65	360	185	366	185	366	
36	49-1F080 -2F080	HBB-145	65	360	65	360	160	268	160	268	
36	49-1F084 -2F084	HBB-145	30	212	30	212	160	268	160	268	
38	51-1F007A-D -2F007A-D	GBB-109	420	320	500	320	420	360	500	360	Analyzed to 1500 PSI @ 500°F See Notes 2, 3&8
39	61-111 -211	HBB-164	150	140	150	140	65	340	65	340	See Notes 1,2 & 7
39	61-131 -231	HBB-165	150	140	150	140	65	340	65	340	
40	57-160A,B -260A,B	HBD-161	100	150	100	150	150	150	150	150	Analyzed for 175 PSI @ 100°F See Notes 1, 2 & 7

Valve Data Sheet No.	Valve Tag No.'s	Line No.	Valve Data Sheet P_D	T_D	P_{max}	T_{max}	System Design/ Maximum Cond. P_D	T_D	P_{max}	T_{max}	Remarks
P-103											
1	55-1F042 -2F042	HBB-109	70	212	70	212	125	170	125	170	See Notes 1,2 & 7
1	51-1F004A-D -2F004A-D	HBB-117	70	212	70	212	190	360	190	360	
1	51-125A,B -225A,B	GBB-108	430	170	430	170	420	320	500	320	See Notes 2,3 & 7
2	52-1F015A,B -2F015A,B	GBB-114	445	212	445	212	500	212	550	212	
2	49-1F060 -2F060	HBB-101	25	268	25	268	160	268	160	268	See Notes 1,2 & 7
2	55-1F072 -2F072	HBB-108	25	268	25	268	185	366	185	366	
P-104											
1	49-1F022 -2F022	EBB-133	1300	170	1500	170	1325	170	1575	170	Valve Analyzed for max Pd=2160 See Notes 4, 7
2	55-1F007 -2F007	EBB-129	1396	170	1625	170	1423	170	1707	170	Valve analyzed for max Pd=2160 See Notes 4, 7
2	55-1F008 -2F008	EBB-134	1396	170	1625	170	1423	170	1707	170	Valve analyzed for max Pd=2160 See Notes 4, 7
2	55-1F006 -2F006	EBB-129	1396	170	1625	170	1423	170	1707	170	
3	55-1F071 -2F071	EBB-134	1396	170	1625	170	1423	170	1707	170	
8	49-1F012 -2F012	EBB-135	1300	170	1500	170	1325	170	1575	170	
19	55-1F011 -2F011	EBB-134	1396	170	1625	170	1423	170	1707	170	Valve analyzed for max Pd=2160 See Notes 4, 7
P-106											
2	61-130 -230	HCB-107	150	140	150	140	65	291	65	291	See Notes 1, 7
2	61-110 -210	HCB-106	150	140	150	140	65	291	65	291	

Valve Data Sheet No.	Valve Tag No.'s	Line No.	Valve Data Sheet P_D	T_D	P_{max}	T_{max}	System Design/ Maximum Cond. P_D	T_D	P_{max}	T_{max}	Remarks
P-114A											
9	61-102,112, -132, 202 -212, 232	HCB-123	150	140	150	140	55	291	55	291	See Notes 6A, 7
10	48-1F006A,B -2F006A,B	DCA-102	1680	150	1680	150	1500	598	1500	598	See Notes 6B, 7
12	49-1F002 -2F002	HBB-101	75	190	75	190	160	268	160	268	See Notes 6A, 7
15	57-116 -216	HBB-125	62	340	62	340	150	340	150	340	
26	51-156A,B -157A,B	GBC-104	155	95	182	95	420	480	500	480	See Notes 6A, 7
	-256A,B -257A,B	GBC-104	155	95	182	95	420	480	500	480	
26	51-158A,B -258A,B	GBC-103	155	120	182	120	420	480	500	480	
28	57-165,166 -167,169	HBD-161	125	150	125	150	150	150	150	150	

General Note: All valves not listed have been reviewed against postulated accident conditions of temperature and pressure and are acceptable.

NOTES: Referred to under "Remarks" column:

1) Valves are designed to standard pressure rating of 150# per ANSI B16.5 which allows a maximum pressure of 275 PSI @ 100°F and 150 PSI @ 500°F. (Intermediate pressures/corresponding temperatures are per Table 2 of B16.5.)

2) Material allowable stresses do not vary thru temperature range from 100°F to 650°F for ASME Class 2 and 3 components.

3) Valves are designed to standard pressure rating of 300# per ANSI B16.5 which allows a maximum pressure of 720 PSI @ 100°F and 625 PSI @ 500°F. (Intermediate pressures are per Table 3 of B16.5.)

4) Valves are designed to standard pressure rating of 900# per ANSI B16.5 which allows a maximum pressure of 2160 PSI @ 100°F. (Alternate pressures/temperatures are per Table 6 of B16.5.)

5) Valves are designed to standard pressure rating of 600# per ANSI B16.5 which allows a maximum pressure of 1440 PSI @ 100°F. (Alternate pressures/temperatures are per Table 5 of B16.5.)

6) Valves are designed to standard pressure rating of 1500# per ASME Section III -- 1974 Ed. Table NB-3531-6. (Flanged end valves for 2" and smaller per NB-3513.)

   a) For carbon steel valves maximum pressure is 3750 PSI @ 100°F with alternate values per above Table.

   b) For stainless steel (Type 316L) maximum pressure is 2570 PSI @ 100°F with alternate values per above Table.

7) All changes were checked against applicable stress analyses and determined to have no impact. In addition, where pressures have been revised, the "actual operating" differential pressure requirements for the valve/operator were confirmed to be within the qualified range for the valve/operator as supplied.

8) Valve body is actually a higher pressure rating than required; therefore enveloping pressure was used in the analysis.

REVIEW SUMMARY OF NSSS ACTIVE ESSENTIAL PUMPS AND VALVES

NRC PVORT AUDIT GENERIC FINDING:

Finding: During the PVORT audit it was noted that the original design parameters for some components were exceeded by the current expected normal operating or accident parameters.

Required Action:

1) Review all safety related pumps and valves.

2) Identify those equipment items for which the original design parameters were exceeded by the current accident or normal values.

3) In each case for which the original design parameters were exceeded, the applicant should provide justification that pump and valve operability is not adversely affected.

GE Response:

1) GE has completed a review of all active essential pumps and valves in the GE NSSS scope of supply.

2) Table 1 lists all of the active essential pumps and valves in the GE NSSS scope of supply, with the corresponding component design parameters (pressure and temperature, per GE purchase specifications) and the maximum service conditions (i.e., worst case normal or accident pressures and temperatures, per GE system design specifications and process diagrams, except the ATWS transient conditions are excluded).

   Under the "REMARKS" column of Table 1, "O.K." means the maximum service conditions are equal to or less than the component design parameters, and no further evaluation effort was required.

3) For those components which the maximum service conditions exceed the design parameters, the enclosures to Table 1 provide justification for the exceedance.

ATWS TRANSIENT

The GE design basis for ATWS (Anticipated Transient Without Scram) requires that the pressure integrity of the primary pressure boundary components shall be assured for the initial (short-term) peak ATWS conditions under ASME code rules for these conditions using Service Level C limits. None of the components are required to perform any active safety related functions during the initial peak ATWS transient. The subsequent (long-term) peak ATWS conditions are

considered for the active safety related functions of applicable components; however, these ATWS conditions are within the component design conditions. Consequently, the peak ATWS transient conditions do not affect the operability of the active safety related pumps and valves listed in Table 1, and these peak ATWS conditions are not included in the maximum service conditions listed in Table 1. All components exposed to ATWS transient conditions have been evaluated as acceptable under these conditions in accordance with the GE design basis for ATWS.

TABLE 1

LIMERICK GE NSSS PUMPS & VALVES

COMPONENT PARAMETERS - DESIGN VS. MAX SERVICE CONDITIONS

MPL	DESCRIPTION	COMPONENT DESIGN(1) PRESS.	COMPONENT DESIGN(1) TEMP.	MAX SERVICE CONDITIONS(2) PRESS.	MAX SERVICE CONDITIONS(2) TEMP.	REMARKS
B21-F013	MS Safety Relief Valve	1250	575	1250	575	O.K.
B21-F022/28	Main Steam Isolation Valves	1250	575	1250	575	O.K.
C11-F009/182	CRD Solenoid Valves	500	180	105	200	Enc. A.1
C11-F010/180	SDV Vent Valves	1250	280	1250	500	Enc. A.2&B
C11-F011/181	SDV Drain Valves	1250	280	1250	500	Enc. A.2&B
C11-F160/162/163	ARI Valves	250	215	105	200	O.K.
C41-C001	SLC Pump/Motor	1400	150	1400	150	O.K.
C41-F004	SLC Explosive Valve	1400	150	1400	150	O.K.
C41-F029	SLC Relief Valve	1540	150	1400	150	O.K.
E11-C002	RHR Pump/Motor	500	360	290	360	O.K.
E11-F015	RHR MO Valve	1500	575	1500	575	O.K.
E11-F016	RHR MO Valve	500	360	500	360	O.K.
E11-F017	RHR MO Valve	1250	575	1250	575	O.K.
E11-F021	RHR MO Valve	500	360	500	360	O.K.
E11-F027	RHR MO Valve	500	360	500	360	O.K.
E11-F041	RHR AO Check Valve	1250	575	1250	575	O.K.
E11-F050	RHR AO Check Valve	1250	575	1250	575	O.K.
E21-C001	Core Spray Pump/Motor	500	212	290	212	O.K.
E21-F001	CS MO Valve	150	500	100	212	O.K.
E21-F005	CS MO Valve	1360	575	1360	575	O.K.
E21-F006	CS AO Check Valve	1250	575	1250	575	O.K.
E21-F037	CS MO Valve	1360	575	1360	575	O.K.
E41-C001	HPCI Pump	1500	140	1670	140	Enc. A.3
E41-C002	HPCI Turbine	1250	SAT.	1140	SAT.	O.K.
E41-F005	HPCI Swing Check Valve	1500	100	1670	170	Enc. A.4
E41-F012	HPCI MO Valve	2200	100	1670	170	Enc. A.5
E41-F021	HPCI Stop Check Valve	150	366	185	366	Enc. A.6
E51-C001	RCIC Pump	1500	140	1575	140	Enc. A.3
E51-C002	RCIC Turbine	1250	SAT.	1140	SAT.	O.K.
E51-F001	RCIC Stop Check Valve	275	100	160	267	Enc. A.6
E51-F014	RCIC Swing Check Valve	1500	100	1575	170	Enc. A.6
E51-F019	RCIC MO Valve	1500	100	1575	170	Enc. A.5

NOTES:
(1) Component Design Parameters per GE Purchase Specifications.
(2) Max Service Condition Parameters per GE System Design Specifications and Process Diagrams, except ATWS conditions are excluded.
(3) Pressure = psig, Temperature = °F
(4) Max service conditions are shown = component design conditions in many cases where actual expected max service conditions are less than component design conditions.

ENCLOSURE A

JUSTIFICATION FOR EXCEEDANCE OF DESIGN PARAMETERS

1. C11-F009/182 - CRD Solenoid Valves

Design pressure is not exceeded. The design temperature of 180°F is exceeded by the maximum service temperature of 200°F. A qualification test was successfully performed on the valve using an environment of 200°F plus margin. Hence the design adequacy of this valve has been demonstrated at the higher maximum service temperature.

2. C11-F010/180 & C11-F011/181 - SDV Vent & Drain Valves

Design pressure is not exceeded. The design temperature of 280°F is exceeded by the maximum service temperature of 500°F. The valves supplied are 2,500 # valves, with a body material of SA352LCB. According to ANSI B16.34-1977, the allowable working pressure for a 2,500 lb. of material SA352LCB at 500°F is 4,850 psig (See Enclosure B). Further, the 500°F condition occurs after the scram (280°F design temperature) when the valve would have already operated.

3. E41-C001 & E51-C001 - HPCI & RCIC Pumps

Design temperature is not exceeded. The design pressure of 1500 psig is exceeded by the maximum service pressure of 1,670 psig for the HPCI pump and 1,575 psig for the RCIC pump. The basis for the pressure transient is a worst case accumulation of conditions (105% turbine drive overspeed, maximum suction head, maximum discharge pressure at pump shutoff, etc.) which occurs less than 1% of the operating time. Paragraph 102.2.4 of the ANSI B31.1.0-1967 code allows 20% overpressure for events which occur less than 1% of the operating time. The 1,670 psig and 1,575 psig peak pressures are within 120% of design pressure (1.2 x 1500 = 1800 psig) as allowed by the code.

Further, operability on the HPCI and RCIC pumps can be addressed with respect to the following criteria:

1) During any loading or pressurization event the deflections of the pump case and shaft must not be such that contact at close clearance locations, such as wear rings, occurs due to the deflections.

2) No permanent plastic deformation of the pump case and other parts shall take place which cause misalignment of the bearing and seal centerlines and other factors affecting shaft and case alignment.

3) Overpressurization shall not cause failure of the shaft mechanical seal parts such as elastomeric seal rings, carbon seal parts, or failure of metallic structural parts.

The HPCI and RCIC pumps are assessed as follows with respect to these criteria:

1) Review of the pump designs show that their cases are basically symmetrical with shaft centerlines. Therefore, deformation of the pump cases and shafts due to overpressure would not be expected to affect bearing or seal clearance.

2) If it were possible to have some local plastic yielding due to an overpressure condition, the case symmetry would prevent yielding to cause loss of bearing or seal clearances. Further the pumps have been subjected to vendor hydrostatic tests at 150% of design pressures and subsequently operated satisfactorily. Hence, no detrimental plastic deformation occurred at these more severe overpressure conditions.

3) The seal manufacturer for both the HPCI and RCIC pumps states that the mechanical seals see only suction pressure + 25 psi (i.e., ~100 psig maximum) and the seal is designed for 1000 psig operating pressure. Consequently, the pump seals are not affected by these maximum pump discharge overpressure transients.

4. E41-F005 - HPCI Swing Check Valve

The design temperature of 100°F is exceeded by the maximum service temperature of 170°F. The design pressure of 1500 psig is exceeded by the maximum service pressure of 1670 psig.

Based on the valve actual wall thickness and the 1968 Nuclear Pump and Valve Code, this valve cannot meet the code allowable pressure at these maximum service conditions. However, the following rationale is used to justify the exceedance of the design conditions. This is a Class 2, 600 # valve, with a body material of A216, Gr. WCB.

a. The allowable stress is 17,500 psi for temperatures up to 650°F. Thus, the 170°F service temperature is justified.

b. The valve was designed according to the 1968 NP&V Code which did not specifiy a design method for any condition that is a variation from normal conditions. Therefore, the criteria for Power Piping ANSI B31.1.0 - 1967 are adopted. Paragraph 102.2.4 of this code allows up to 20% increase above the allowable stress during 1% of the operating time. Since the maximum pressure of 1670 psig at 170°F is expected to occur less than 1% of the operating time, this allowance is applicable to valve E41-F005.

Based on the valve wall thickness and the provision of Paragraph 104.1.2(a) of B31.1.0, the valve stress at the maximum service pressure is shown to be within the allowable stress value (17500 psi). Therefore, the exceedance of the design pressure is also justified.

It can be concluded that valve E41-F005 is justified to maintain its structural integrity under the peak transient conditions.

The internal pressure does not affect the operability of the check valves. Therefore, operability of the valves is assured even though the peak pressure exceeds the design condition.

5. E41-F012 & E51-F019 - HPCI & RCIC Motor Operated Valves

a. Pressure Integrity

Table 5.1 lists the design conditions, the maximum service conditions and the maximum allowable pressure at the service temperature, of the valves. The allowable pressures were based on the valves wall thickness, material, and the NP&V Code, 1968, pressure and temperature rating tables.

From 1968 NP&V Code, the maximum allowable stress of the valve material (A216, Gr. WCB) is 17500 psi, unchanged for all temperatures up to 650°F. Therefore, the exceedance in temperature of the valves does not affect the pressure integrity of the valves.

As shown in Table 5.1, the maximum allowable pressure corresponding to the service temperature of the above valves is higher than the maximum service pressure. Thus, the pressure integrity of the valves is assured.

b. Operability of Actuator Under Peak Pressure

The Limitorque actuator motor capability is 25 ft-lb for valve E41-F012, and 5 ft-lb. for E51-F019. These motor sizes were selected based on a design ΔP of 1400 psi and 1300 psi, respectively. The Limitorque motor-sizing procedure was used to calculate the maximum required torque to operate against the maximum service pressures of 1670 psig for valve E41-F012 and 1575 psig for valve E51-F019. This calculation showed that the motor capability exceeds the required torque by a 2 to 1 margin, approximately. Therefore, the maximum service pressure does not affect the actuator operability. Table 5.2 summarizes the above results.

TABLE 5.1

PRESSURE-TEMPERATURE RATINGS

Valve	Temperature		Pressure		Allowable Press.
	Design	Service	Design	Service	At Service Temp.
E41-F012	100°F	170°F	2200 psig	1670 psig	2110 psig
E51-F019	100°F	170°F	1500 psig	1575 psig	1849 psig

TABLE 5.2

ACTUATOR MOTOR SIZING

Valve	Design ΔP	Maximum ΔP	Torque Due to Maximum ΔP	Actuator Motor Torque Capability
E41-F012	1400 psi	1670 psig	13.4 ft-lb	25 ft-lb
E51-F019	1300 psi	1575 psi	2.04 ft-lb	5 ft-lb

6. E41-F021, E51-F001 & E51-F014 - HPCI & RCIC Check Valves

Table 6.1 lists the design conditions, the maximum service conditions and the maximum allowable pressure at the service temperature, of the valves. The allowable pressures were based on the valve wall thicknesses, material, and the NP&V Code, 1968 pressure and temperature rating tables.

From the 1968 NP&V Code, the maximum allowable stress of the valve material (A216, Gr. WCB) is 17500 psi, unchanged for all temperatures up to 650°F. Therefore, the exceedance in temperature of the valves does not affect the pressure integrity of the valves.

As shown in Table 6.1, the maximum allowable pressure corresponding to the service temperature of the valves is higher than the maximum service pressure. Thus, the pressure integrity of the valves is assured.

The internal pressure does not affect the operability of the check valves. Therefore, operability of the valves is assured even though the maximum service pressures exceed the design conditions.

TABLE 6.1

Valve	Temperature (°F)		Pressure (psig)		Allowable Press.
	Design	Service	Design	Service	At Service Temp.
E41-F021	366	366	150	185	190 psig
E51-F001	100	267	275	160	220 psig
E51-F014	100	170	1500	1575	2539 psig