PHILADELPHIA ELECTRIC COMPANY

2301 MARKET STREET

P.O. BOX 8699

PHILADELPHIA, PA. 19101

(215) 841-4500

JOHN S. KEMPER
SENIOR VICE-PRESIDENT
ENGINEERING AND PRODUCTION

November 17, 1987

Docket No. 50-352

Mr. William T. Russell, Administrator
U.S. Nuclear Regulatory Commission
Region 1
631 Park Ave.
King of Prussia, PA 19406

Subject: Limerick Generating Station Unit 1
I.E. Bulletin 85-03, "Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings"

Reference: J. S. Kemper (PECo) letter to T. E. Murley (NRC), dated October 2, 1986

File: GOVT 1-1 (Bulletins)

Dear Mr. Russell:

This submittal provides Philadelphia Electric Company's (PECo) final response to I.E. Bulletin 85-03 for Limerick Generating Station Unit 1. The referenced letter provided PECo's initial response to the subject bulletin and contains the required design basis differential pressure information and scope of testing. The report enclosed herein completes the bulletin's reporting requirements with regard to Limerick Unit 1.

Should you have any questions regarding the information contained in this submittal, please contact us.

Sincerely,

John S Kemper

TSN/pd09288701

Enclosure

Copy to: E. M. Kelly, LGS Resident Site Inspector
USNRC, Document Control Desk
Washington, DC 20555

Per RJ Kiessel

IE11
1/1

LIMERICK GENERATING STATION

UNIT 1

RESPONSE TO I.E. BULLETIN 85-03

REVISION 0

NOVEMBER 16, 1987

REPORT FOR LIMERICK GENERATING STATION UNIT 1
IN RESPONSE TO I.E. BULLETIN 85-03

PURPOSE

This report responds to I.E. Bulletin 85-03 which required licensees to develop and implement a program to assure that motor-operated valve (MOV) switch settings in certain safety systems are selected, set and maintained correctly such that the MOVs will function during both normal and abnormal events within the plant design basis. This report is intended to satisfy the program completion reporting requirements of I.E. Bulletin 85-03 action item (f) for Limerick Unit 1.

RESPONSE TO BULLETIN REQUIREMENTS

The following discussion provides PECo's responses to items (a) through (f) of I.E. Bulletin 85-03. The requirements of the Bulletin are restated below along with PECo's response.

Item (a)

"Review and document the design basis for the operation of each valve. This documentation should include the maximum differential pressure expected during both opening and closing the valve for both normal and abnormal events to the extent that these valve operations and events are included in the existing, approved design basis, (i.e., the design basis documented in pertinent licensee submittals such as FSAR analyses and fully-approved operating and emergency procedures, etc.). When determining the maximum differential pressure, those single equipment failures and inadvertent equipment operations (such as inadvertent valves closures or openings) that are within the plant design basis should be assumed."

PECo Response

Reference (3) provided PECo's preliminary I.E. Bulletin 85-03 submittal which addressed bulletin action item a). The information supplied below provides a more complete discussion of PECo's compliance with this action item and describes how it relates to the overall Limerick program.

PECo was a participating member of the BWROG committee which established the scope of systems and valves subject to the I.E. Bulletin 85-03 requirements. This committee also developed and recommended the methodology by which the MOV design basis operational differential pressures were to be calculated. Reference (2) is the BWROG topical report which describes these results and provides recommendations regarding I.E. Bulletin 85-03 program implementation. PECo has adopted the BWROG Committee's recommended program and has expanded it to include other Motor Operated Valves.

For Limerick Units 1 and 2, the systems identified by the BWROG as being subject to I.E. Bulletin 85-03 are the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) Systems. The BWROG report further defined the Bulletin scope by stating that only those HPCI/RCIC MOVs designated as having an active safety function need comply. For the other safety-related MOVs which the BWROG classified as having no active safety function, similarly developed methodologies were used to calculate their maximum operational differential pressures. These calculations are considered conservative, since they include a conservatively modeled hydrodynamic pressure component.

The NRC in Reference (4) took exception with the BWROG position on I.E. Bulletin 85-03. The central issue concerned the exclusion of certain MOVs from the scope of the Bulletin on the basis that they would not be inadvertently out of position when called upon to operate. Inadvertent MOV operation according to the BWROG is beyond design basis and failures resulting from it are considered within system single failure criteria. Since PECo's I.E. Bulletin 85-03 program scope includes all HPCI and RCIC safety-related MOVs, the NRC's major objection with the BWROG is not applicable to Limerick.

The attached Tables 1 and 2 present a summary of information, including differential pressure requirements, applicable to the valves/operators in the HPCI/RCIC systems. These tables have been formulated to provide sufficient technical data to permit identification of motor-operated valve assemblies for which similarity (type) testing can be applied. In these tables please note the changes in the differential pressure values previously reported in Reference 3). The changes resulted from subsequent evaluation and refining of the supporting calculations during the checking process. All changes had a negligible effect on MOV operating requirements as will be demonstrated in later discussions.

Item (b)

"Using the results from item (a) above, establish the correct switch settings. This shall include a program to review and revise, as necessary, the methods for selecting and setting all switches, (i.e., torque, torque bypass, position limit, overload) for each valve operation (opening and closing).

"If the licensee determines that a valve is inoperable, the licensee shall also make an appropriate justification for continued operation in accordance with the applicable technical specification."

PECo Response

Reference (3) provided a brief summary of the Limerick program elements that support compliance with this action item. The information supplied below provides the specific details which demonstrate compliance.

The Limerick program was essentially in place prior to issuance of I.E. Bulletin 85-03. This program provided for torque switch setpoint testing based on the original specified differential pressure for each valve tested. These differential pressure values remained as the bases for setting the torque switches on those valves where the values exceeded the newly calculated design basis differential pressures. Therefore, this Limerick program feature provides additional conservatism with respect to valve capability to function under higher than the design basis differential pressure conditions.

With other valves for which the original specified differential pressures were less than the newly calculated values , the as-left settings were confirmed to be adequate to assure MOV closure against the higher design basis differential pressures. To ensure that replacement valves are capable of operating against the higher design basis differential pressures, the applicable Limerick valve specifications are being revised to reflect the more stringent design requirements. The necessary specification revisions are scheduled to be completed by the end of 1987.

Torque Switches

At Limerick Generating Station, motor-operator torque switches settings are based on the following criteria:

1) The minimum acceptable setting shall be such that the developed stem thrust, as-measured using the Motor Operated Valve Analysis and Test System (MOVATS), is sufficient to fully close the valve against the as-specified differential pressure.

2) The maximum acceptable setting is constrained by the lower of the following four limits:

   a) The valve maximum allowable thrust as specified by the valve manufacturer.

   b) The maximum allowable thrust for the specific motor operator type.

   c) The maximum torque capability of the motor @ degraded voltage.

   d) Spring pack specific maximum allowable settings.

The valve stem thrust requirements are as specified on Valve Motor Operator Compatibility Forms (VMOCF) which were supplied by the valve manufacturer for each MOV. For those valves with the newly calculated differential pressure (per columns 3 and 4 of Tables 1 and 2) having a value less than the valve design differential pressure, a revised stem thrust value is not necessary and has not been provided. Valves having a newly calculated differential pressure higher than the valve design differential pressure have been listed in Table 3 with the higher required stem thrust corresponding to that pressure. These revised stem thrust values were derived from standard procedures provided by the operator manufacturer and were confirmed to be acceptable by the valve supplier. The applicable VMOCF forms were revised to reflect the above. MOVATS data for all valves within the scope of this program is included in Tables 3 and 4 which demonstrate that the developed closing thrusts at torque switch trip (for the established torque switch settings) exceed the required minimum in all cases.

A review of the actual thrust requirements for the valves indicates that no valve assembly is loaded beyond its allowable maximum. This evaluation was made by comparing the actual measured closing thrusts against valve/operator maximum capabilities specified on the VMOCFs.

Another positive feature of the Limerick program is that the open and close torque switch settings are identical. Therefore, an operator output force at least equal to that required to fully close the valve against maximum differential pressure is available to fully open the valve when actuated. This program conservatism further assures recovery from inadvertent valve operation.

The torque switch setting adjustment and/or verification requirements discussed above have been implemented on all Limerick safety-related MOVs having SMB-000 through SMB-4 type operators. These include all valves within the scope of I.E. Bulletin 85-03 with the exception of HV-55-1F041 which is a limit-seated butterfly valve operating under relatively low differential pressure conditions. Over four hundred (400) MOVs at Limerick Unit 1 have had their torque switches set in this manner. This same scope of work is in progress at Limerick Unit 2. The torque switch setting and stem thrust testing utilizing MOVATS are implemented through PECo Field Engineering Procedures FE-14 or FE-16. FE-14 is used for establishing an acceptable torque switch setting range; whereas, FE-16 is used for verification of as-found conditions.

Limit Switches

The setting of MOV limit switches is procedurally controlled and documented at Limerick via Maintenance Procedure PMQ-500-087. This procedure requires that:

(1) the open torque switch bypass switch (i.e. on the same rotor as the close limit) is to remain closed until positive evidence that the valve disk has unseated as demonstrated by visually observing torque switch operation and noting change in motor loading; and

(2) the open limit switch is set such that the stem or disk does not coast into the backseat after terminating electrical operation. For SMB-000 operators, the valves are set to stop 1/2 to 1 handwheel turn from the backseat. For all other rising stem operators except SMB-000, the acceptance criteria is end of coasting between 1/4" to 1/2" of stem travel off the backseat.

In order to comply with I.E. Bulletin 85-03, the applicable limit switch verification portions of PMQ-500-087 were repeated during Limerick's first refuel outage (August 1987).

Thermal Overloads

At Limerick Generating Station, safety-related motor-operator thermal overload (TOL) protection has the following features:

(1) Motor-operator overload trips are annunciated in the control room.

(2) The motor-operator overload trip is bypassed during auto-actuations which increases the probability that the valve will perform its safety function.

(3) Thermal overload protection can be bypassed in an emergency by the control room operator. This is accomplished by holding the control switch in the open or close position.

(4) The overload heaters are sized in accordance with the special service requirements of intermittent duty motors. The sizing criteria is such that the motor will rapidly trip off if a locked rotor condition exists; but provides sufficient margin over normal operational loadings.

The overload heaters on all I.E. Bulletin 85-03 MOVs were verified to be properly sized and oriented during Limerick's first refuel outage.

Item (c)

"Individual valve settings shall be changed, as appropriate, to those established in item b, above. Whether the valve setting is changed or not, the valve will be demonstrated to be operable by testing the valve at the maximum differential pressure determined in item (a) above with the exception that testing motor-operated valves under conditions simulating a break in the line containing the valve is not required. Otherwise, justification should be provided for any cases where testing with the maximum differential pressure cannot practicably be performed. This justification should include the alternative to maximum differential pressure testing which will be used to verify the correct settings.

PECo Response

As described in our response to item b), the MOVS at Limerick Unit 1 were set and tested during the construction startup phase in accordance with a program developed to assure their proper operation. Using the calculated valve actuator forces required to overcome the maximum differential pressures, the valves were stroke tested using MOVATS to verify the adequacy of the existing torque switch settings. This testing, which is an alternative to full differential pressure testing, is an integral part of the program discussed in our response to item b).

PECo has completed a pre-operational and surveillance test review and performed supplementary MOV differential pressure testing in order to demonstrate the adequacy of using MOVATS for setting actuator torque switches. Due to the nature of the postulated failures and the prohibitive system configurations required to achieve the maximum differential pressures, the supplementary testing was performed at the highest differential pressures practical. The data collected from this overall effort confirms the adequacy of the torque switch setting techniques and, to the extent practical, the vendor's methodology to predict the necessary stem force for a given differential pressure. The data was collected from a large representative sample of Limitorque operator types, valve vendors and valve types subject to the I.E. Bulletin. Tables 5 and 6 provide details of the specific supplementary tests performed.

In conclusion, PECo's Limerick I.E. Bulletin 85-03 program provides a very high confidence that the subject MOVs will perform their design basis safety function.

Item (d)

"Prepare or revise procedures to ensure that correct switch settings are determined and maintained throughout the life of the plant. Ensure that applicable industry recommendations are considered in the preparation of these procedures."

PECo Response

Procedures E11.10, FE-14 and FE-16 were used during Limerick Unit 1 startup testing for initial MOV torque switch setup and continue to be used as required. Limerick Maintenance Procedure PMQ-500-087 is used to ensure that the correct motor-operator switch settings are maintained in addition to providing an electrical checkout following maintenance. This procedure is performed following safety-related MOV maintenance to provide a complete functional checkout of the motor-operator. No revisions to the above procedures were determined to be necessary.

As part of the procedures review, PECo developed a specific list of MOV maintenance ctivities (see Reference (5)) which may effect baseline MOVATS results. Under the PECo program, all future MOV maintenance will be reviewed against this list to determine what testing must be performed prior to returning any safety-related MOV to service.

Item (e)

"Within 180 days of the date of this bulletin, submit a written report to the NRC that: (1) reports the results of item (a) and (2) contains the program to accomplish items (b) through (d) above including a schedule for completion of these items."

PECo Response (Complete)

Reference (3) provided PECo's response to this action item.

Item (f)

"Provide a written report on completion of the above program. This report should provide (1) a verification of completion of the requested program, (2) a summary of the findings as to valve operability prior to any adjustments as a result of this bulletin, and (3) a summary of data in accordance with Table 2, Suggested Data Summary Format. The NRC staff intends to use this data to assist in the resolution of Generic Issue II.E.6.1. This report shall be submitted to the NRC within 60 days of completion of the program. Table 2 should be expanded, if appropriate, to include a summary of all data required to evaluate the response to this bulletin."

PECo Response

This document completes the reporting requirements of I.E. Bulletin 85-03 action item (f) for Limerick Unit 1. A supplementary report to address Limerick Unit 2 specific information will be provided within three (3) months following completion of the remaining Unit 2 work scope (Projected completion 3/88).

As explained in earlier discussions, motor-operator switch settings were/are being verified to be adequate during the startup/construction phase of Limerick 1/2. As a result, a summary of the as-found findings as prescribed by the bulletin are not considered appropriate for Limerick. Limerick fully complies with the primary purpose and intent of the bulletin by having instituted a comprehensive program to assure the adequacy of its MOV switch settings.

PECo MOV PROGRAMS BEYOND I.E. BULLETIN 85-03

During the Limerick Unit 1 construction & startup phase, all safety-related MOVs have undergone a program to inspect, refurbish and test the Limitorque motor-operators. This program was initiated in response to Significant Deficiency Report - 38 through a joint effort on the part of Bechtel Power Corporation, Limitorque Corp. and PECo. Over four hundred (400) MOVs at Limerick Unit 1 have undergone this program which is currently planned to be implemented on all Limerick Unit 2 MOVs. Personnel involved with the "hands-on" aspect of the program are trained to perform the specified activities and are certified by Limitorque. The Limitorque Rework program is described in procedure 8031-FM-4 (attached).

CONCLUSION

This report has provided a complete Limerick Unit 1 response for all action items of I.E. Bulletin 85-03. PECo has exceeded the bulletin's requirements by having implemented a comprehensive motor-operator rework program applicable to Limitorque safety-related MOVs. On the basis of Limerick's previously established program and since no physical MOV adjustments were determined to be necessary as a result of compliance with action items (a), (b) or (c), PECo has determined that the existing condition and capability of the subject valves were and continue to be adequate to assure performance of their design basis safety function.

REFERENCES

(1) I.E. Bulletin 85-03, "Motor-Operated Valve Common Mode Failure During Plant Transients Due to Improper Switch Settings, November 15, 1985
(2) BWROG Report on the Operational Design Basis of Selected Safety-Related Motor-Operated Valves, NEDC-21322, September 1986
(3) J. S. Kemper (PECo) letter to Dr. T. E. Murley (NRC), dated October 2, 1986
(4) E. L. Gordon (NRC) letter to T. A. Pickens (BWROG), dated January 30, 1987
(5) J. J. Milito letter to C. B. Wyler, dated October 7, 1987
(6) Procedure FE-14, Procedure to Adjust and Set Limitorque Stem Thrust, revision 5
(7) Procedure FE-16, Procedure to Evaluate "As-found" Limitorque Stem Thrust, Revision 5
(8) Procedure PMQ-500-087, Preventive Maintenance Procedure for Electrical Checkout and Adjustment of Q-Listed Limitorque Operators, Revision 1
(9) Procedure 8031-FM-4, Limitorque Rework Program and Supplemental Technical and Maintenance Instruction for all Limitorque Motor Operators at Limerick, Revision 7
(10) Procedure EE11.10, Procedure to Inspect and Test Motor Operated Valves, Revision 2

TSN/pd09298705

Attachments

Tables 1 through 6

TABLE 1

LIMERICK - HIGH PRESSURE COOLANT INJECTION SYSTEM (M-55 & 56)

Valve I.D. Number	BWROG Generic Valve Reference Number	Valve Design Differential Pressure (psid)(1)	Calculated Valve Differential Pressure on Opening (psid)(2)	Calculated Valve Differential Pressure on Closing (psid)(2)	Valve Size	Operator Size (SMB)	Manuf. P.O. Item	Spring Pack	High Press Loc.(4)	Power Supply	T.S. Setting
HV-55-1F105	(1)	1625	1357 (7) / 1154* (6)	1454 (7) / 1154* (6)	8" GT	2-80	Velan	0007	U	DC	4
HV-55-1F006	(1a)	1625	1357 / 1154*	1468 / 1154*	12" GT	SB 3-150	Velan	0010	U	DC	3 3/4
HV-55-1F012	(2)	1400	1494	1494	4" GB	0-25	Anchor-Darling	0017	U	DC	2 1/2
HV-55-1F004	(3)	125	**	23	16" GT	0-15	Anchor-Darling	0017	U	AC	1 1/4
HV-55-1F042	(4)	70	94	37 (6)	16" GT	0-15	Anchor-Darling	0017	U	AC	1 1/4
HV-55-1F041	(4a)	125	94	39 (6)	16" BF	HIBC 00-15	BIF	0048	U	AC	1
HV-55-1F008	5	1000	63**	63** / 1206*** (6)(7)	10" GB	3-150	Anchor-Darling	0010	(5)	AC	3 1/4
HV-55-1F011	6	1000	23**	23** / 1206*** (6)(7)	10" GT	1-40	Velan	0068	(5)	AC	2 1/4
HV-55-1F071	7	50	23**	23** (6) / 120*** (7)	4" GT	0-7 1/2	Velan	0004	(5)	DC	1 1/4
HV-55-1F007	8	1625	1035** / 1171** (6)(7)	**	14" GT	SB 3-150	Velan	0010	(5)	DC	4 1/4
HV-56-1F059	(9)	430	55	55	2" GB	000-2	Rockwell	0023	U	DC	1 1/2
HV-55-1F00[illegible]	(I)	1337	1130	1130	12" GT	SB 3-100	Velan	0010	U	DC	3 1/4
HV-55-1F002	II	1337	**	1130	10" TGB	4-150	Anchor-Darling	0003	(5)	AC	2
HV-55-1F003	III	1337	**	1130	10" TGB	4-150	Anchor-Darling	0003	(5)	AC	2
HV-55-1F100	V	1337	**	1130	GB 4-1/2"	000-5	Rockwell	0024	(5)	AC	1 1/2
HV-55-1F072	(VI)	50	**	31 (6)	12" GT	0-7-1/2	Anchor-Darling	0004	D	AC	1 1/2
HV-55-1F093	(VII)	185	**	59	4" GT	000-2	Anchor-Darling	0023	U	AC	1
HV-55-1F095	(VIII)	30	**	59	4" GT	000-2	Anchor-Darling	0023	U	AC	1

TABLE 2

LIMERICK - REACTOR CORE ISOLATION COOLING SYSTEM (M-49 & 50)

Valve I.D. Number	BWROG Generic Valve Reference Number	Valve Design Differential Pressure (psid)(1)	Calculated Valve Differential Pressure on Opening (psid)(2)	Calculated Valve Differential Pressure on Closing (psid)(2)	Valve Size	Operator Size (SMB)	Manuf. P.O. Item	Spring Pack	High Press Loc.(4)	Power Supply	T.S. Setting
HV-49-1F013	(1)	1500	1174 (6)(7) / 1134*	1362 (6)(7) / 1134*	6" GT	0-40	Velan	0017	U	DC	2 1/4
HV-49-1F019	(2)	1300	1278	1278	2" GB	000-5	Anchor-Darling	0023	U	DC	2 2/3
HV-49-1F010	(3)	125	**	**	6" GT	0-7 1/2	Velan	0004	D	DC	1 3/4
HV-49-1F029	(4)	125	49 (6)	42 (6)	6" GT	0-7 1/2	Velan	0004	D	DC	1 1/4
HV-49-1F031	(4a)	125	49 (6)	37 (6)	6" GT	0-7 1/2	Velan	0004	D	DC	1 1/4
HV-49-1F022	5	1200	29**	29** / 1173*** (6)(7)	4" GB	0-10	Anchor-Darling	0017	(5)	AC	2
HV-49-1F002	(7)	75	**	31 (6)	2" SCR	000-2	Rockwell	0060	D	DC	1 3/4
HV-49-1F012	8	1500	1035** / 1171*** (6)(7)	**	6" GT	0-40	Velan	0017	(5)	DC	2 1/4
HV-50-1F046	(9)	1337	1287	41 (6)	GB 1 1/2"	000-5	Rockwell	0024	U	DC	1 1/2
HV-50-1F045	(1)	1337	1130	1130	6" GB	1-60	Anchor-Darling	0007	U	AC	3
HV-49-1F007	II	1337	**	1130	3" SCR	0-10	Anchor-Darling	0017	(5)	AC	1 3/4
HV-49-1F008	III	1337	**	1130	3" SCR	0-10	Anchor-Darling	0017	(5)	AC	1 3/4
HV-49-1F076	V	1337	**	1130	GB 1 1/2	000-5	Rockwell	0024	(5)	AC	1 1/2
HV-49-1F060	(VI)	50	**	31 (6)	8" GT	0-5	Anchor-Darling	0004	D	AC	1
HV-49-1F080	(VII)	160	**	59	3" GT	000-2	Anchor-Darling	0027	U	AC	1 3/4
HV-49-1F084	(VIII)	30	**	59	3" GT	000-2	Anchor-Darling	0027	U	AC	1 3/4

NOTES AND REFERENCES FOR TABLES 1 AND 2

NOTES:

* Pump not operating.

** Does not perform an active safety-related function per the BWROG Report.

*** Initiation of HPCI (Table 1) or RCIC (Table 2) system due to accident conditions.

(X) Circled valve number represents valves required to be tested per BWROG Report, paragraph 4.3.

(1) Design differential pressures are obtained from the Design Specification for the valve.

(2) Calculated valve differential pressures are per Bechtel Calc. Misc-47.

(3) Deleted

(4) U designates upstream
D designates downstream

(5) Valve is not required to be tested per BWROG Report, paragraph 4.4.

(6) Change from values previously reported in Reference 3).

(7) differential pressure values are presented with each corresponding to a different set of assumptions. The highest values are used for conservatism although they may be beyond the BWROG design basis.

TABLE 3

THRUST REQUIREMENTS FOR VALVES WITH MAXIMUM CALCULATED DIFFERENTIAL PRESSURE EXCEEDING ORIGINAL DESIGN DIFFERENTIAL PRESSURE

Valve I.D. Number	BWROG Generic Valve Ref. No.	Valve Design Differential Pressure (psid)	Maximum Calc. Valve Differential Pressure per BWROG Report(psid)	Design Thrust (lbf)(6)	Actual Thrust(4) (lbf)	Required thrust for Maximum Calc. Differential Pressure (lbf)(5)
HV-49-1F022(1)	5	1000	1172	13,454	18,540	16876
HV-49-1F084	VIII	30	59	1,032	1,620	1507(2)
HV-55-1F008(1)	5	1000	1206	64,920	139,500	81500
HV-55-1F011(1)	6	1000	1206	31,060	33,670	26041
HV-55-1F012	2	1400	1494	19,821	22,600	21100
HV-55-1F042	4	70	94	6,407	21,611	8170
HV-55-1F071(.)	7	50	1207	1,640	10,220	6657
HV-55-1F095	VIII	30	59	1,641	2,620	2271(3)

(1) Test valve: no active safety function per BWROG.

(2) Thrust specified is suitable for diff. pressure of 160 psid per duplicate valve HV-49-1F080 (i.e. 1507 lbf)

(3) Thrust specified is suitable for diff. pressure of 185 psid per duplicate valve HV-55-1F093 (i.e. 2271 lbf)

(4) Actual thrust as obtained from motor operated valve analysis and testing system (MOVATS) measurements.

(5) Calculated values were based on standard procedures provided by the operator manufacturer. The applicable MOCFs have been revised to reflect these values.

(6) Design thrust per Valve Motor Operator Compatability Forms.

TABLE 4

ACTUAL REPORTED THRUSTS FOR VALVES WITH MAXIMUM CALCULATED DIFFERENTIAL PRESSURE LESS THAN ORIGINAL DESIGN DIFFERENTIAL PRESSURE

Valve I.D. Number	BWROG Generic Valve Ref. No.	Valve Design Differential Pressure (psid) (1)	Maximum Calc. Valve Differential Pressure per BWROG Report(psid) (2)	Design Thrust (lbf)(3)	Actual Thrust(4) (lbf)	Reference Document for Design Thrust
HV-49-1F013	1	1500	1362	16,293	19,620	P-104B-81-2
HV-49-1F019	2	1300	1278	4,432	5,840	P-104C-122-2
HV-49-1F010	3	125	22	2,047	2,780	P-102C-107-2
HV-49-1F029	4	125	49	2,047	8,450	P-102C-107-2
HV-49-1F031	4a	125	49	2,047	6,520	P-102C-107-2
HV-49-1F002	7	75	31	259	1,080	P-114A-110-8
HV-49-1F012	8	1500	1171	16,293	17,740	P-104B-81-2
HV-50-1F046	9	1337	1287	4,613	6,676	P-114A-247-1
HV-50-1F045	I	1337	1130	39,047	49,370	P-104C-54-1
HV-49-1F007	II	1337	1130	9,456	17,580	P-104C-56-1
HV-49-1F008	III	1337	1130	9,456	12,280	P-104C-56-1
HV-49-1F076	V	1337	1130	4,613	4,840	P-114A-110-8
HV-49-1F060	VI	50	31	2,498	3,740	P-103-98-3BR
HV-49-1F080	VII	160	59	1,507	1,300(6)	P-102A-213-5BR

TABLE 4

ACTUAL REPORTED THRUSTS FOR VALVES WITH MAXIMUM CALCULATED DIFFERENTIAL PRESSURE LESS THAN ORIGINAL DESIGN DIFFERENTIAL PRESSURE

Valve I.D. Number	BWROG Generic Valve Ref. No.	Valve Design Differential Pressure (psid) (1)	Maximum Calc. Valve Differential Pressure per BWROG Report(psid) (2)	Design Thrust (lbf)(3)	Actual Thrust(4) (lbf)	Reference Document for Design Thrust
HV-55-1F105	1	1625	1454	40,130	54,980	P-104B-168-1
HV-55-1F006	1a	1625	1463	50,050	91,800	P-104B-93-2
HV-55-1F004	3	125	23	6,407	12,520	P-102B-172-1
HV-55-1F041	4a	125	94	11,461(5)	(5)	P-119A-166-1
HV-55-1F007	8	1625	1171	55,866	114,360	P-104B-94-2
HV-56-1F059	9	430	55	1,484	2,510	P-114A-246-1
HV-55-1F001	I	1337	1130	41,888	93,600	P-104B-95-2
HV-55-1F002	II	1337	1130	107,932	116,000	P-104C-52-1
HV-55-1F003	III	1337	1130	107,932	137,500	P-104C-52-1
HV-55-1F100	V	1337	1130	4,613	5,220	P-114A-110-8
HV-55-1F072	VI	50	31	3,557	3,820	P-103-99-4BR
HV-55-1F093	VII	185	59	2,271	3,130	P-102A-212-4BR

NOTES: 1) Design differential pressure was obtained from the valve Design Specification.
2) Calculated valve difderential pressures listed are maximum from Tables 1 and 2 for the opening or closing directions.
3) Design thrust per the Valve Motor Operator Compatability Form based on valve design differential pressure.
4) Actual thrust as obtained from motor operated valve analysis and testing system measurements (MOVATS).
5) Value is torque (in-lbs), actual torque was confirmed by testing of similar units.
6) Actual thrust of 1300 lbs is acceptable since design thrust for dp of 50 psi is 1032 lbs per identical valve HV-49-1F084, when interpolated to 59 psi thrust required is 1071 lbs. Alternatively, thrust can be adjusted in unit to obtain 1507 lbs.

TABLE 5

CONFIRMATORY DIFFERENTIAL PRESSURE TESTING OF HPCI SYSTEM MOTOR-OPERATED VALVES

VALVE #	DESCRIPTION	PRE-OP TEST INFORMATION	SUPPLEMENTAL AND SURVEILLANCE D-P TEST TYPE & CONDITIONS	TEST RESULTS
HV-55-1F105 HV-55-1F006	Injection Valve	Open D-P Test @ 1320 psid	None	Satisfactory
HV-55-1F012	Minimum Flow Bypass Valve	Open D-P Test @ 1320 psid	Open valve and return it close against pump discharge head at rated conditions.*	Satisfactory
HV-55-1F041	Pump Suction - Suppression Pool Isolation Valve	N/A	Open valve against differential pressure generated by pressurizing line via vent valve to 100 psig.	Satisfactory
HV-55-1F008	Test Loop Throttle Valve	N/A	Close valve and return it to throttle position against pump discharge head at rated conditions.*	Satisfactory
HV-55-1F011	Test Loop Isolation Valve	N/A	Close valve and return it to open against pump discharge head at rated conditions.*	Satisfactory
HV-55-1F007	Pump Discharge Valve	Open D-P Test @ 1320 psid	None	Satisfactory
HV-56-1F059	Turbine Accessory Cooling Valve	N/A	Close valve and return it to open against pump discharge head @ rated conditions.*	Satisfactory
HV-55-1F001	Steam Admission Valve to Turbine	Open D-P Test @ 1160 psid (Cold)	Valve is opened and closed against live steam flow at rated conditions* during quarterly system surveillance tests.	Satisfactory

VALVE #	DESCRIPTION	PRE-OP TEST INFORMATION	SUPPLEMENTAL AND SURVEILLANCE D-P TEST TYPE & CONDITIONS	TEST RESULTS
HV-55-1F002	Inboard Steam Isolation Valve	Open D-P Test @ 1160 psid	None	Satisfactory
HV-55-1F003	Outboard Steam Isolation Valve	Open D-P Test @ 1160 psid	Close valve against live steam flow while running in test mode at rated conditions.*	Satisfactory
HV-55-1F093 HV-55-1F095	Vacuum Breaker Isolation Valves	Open D-P Test @ 200 psid	Close valve against containment ILRT pressure prior to containment depressurization.	Satisfactory

NOTES: *Rated Conditions - The system temperature and pressure conditions representative of 100% reactor power and steam flow. System pump discharge pressure sufficient to provide rated flow to the reactor.

JN/aud/10228705

TABLE 6

CONFIRMATORY DIFFERENTIAL PRESSURE TESTING OF RCIC SYSTEM MOTOR-OPERATED VALVES

VALVE #	DESCRIPTION	PRE-OP TEST INFORMATION	SUPPLEMENTAL AND SURVEILLANCE D-P TEST TYPE & CONDITIONS	TEST RESULTS
HV-49-1F013	Injection Valve	Open D-P Test @ 1275 psid	None	Satisfactory
HV-49-1F019	Minimum Flow Bypass Valve	Open D-P Test @ 1240 psid	Open valve and return it close against pump discharge pressure at rated conditions.*	Satisfactory
HV-49-1F031	Pump Suction - Suppression Pool Isolation Valve	N/A	Open valve against D-P developed by pressurizing suction line via vent valve to 100 psig.	Satisfactory
HV-49-1F022	Test Loop Throttle Valve	N/A	Close valve and return it to throttle position against pump discharge pressure at rated conditions.*	Satisfactory
HV-50-1F046	Turbine Accessory Cooling Valve	N/A	Close valve and return it to open against pump discharge pressure at rated conditions.*	Satisfactory
HV-50-1F045	Steam Admission Valve to Turbine	Open D-P Test @ 1170 psid (Cold)	Valve is routinely opened and closed against live steam flow at rated conditions during quarterly surveillance test.	Satisfactory
HV-49-1F007	Inboard Steam Isolation Valve	Open D-P Test @ 1160 psid (Cold)	None	Satisfactory
HV-49-1F008	Outboard Steam Isolation Valve	Open D-P Test @ 1160 psid (Cold)	While in test mode valve closed against live steam flow at rated conditions.*	Satisfactory

VALVE #	DESCRIPTION	PRE-OP TEST INFORMATION	SUPPLEMENTAL AND SURVEILLANCE D-P TEST TYPE & CONDITIONS	TEST RESULTS
HV-49-1F076	Steam Line Warmup Valve	N/A	Initiate RCIC line warmup by opening valve against rated pressure* then close valve.	Satisfactory
HV-49-1F080 HV-49-1F084	Vacuum Breaker Isolation Valves	Open D-P Test @ 200 psid	Open then close valve against containment ILRT pressure prior to containment depressurization.	Satisfactory

NOTES: *Rated Conditions - The system temperature and pressure conditions representative of 100% reactor power and steam flow. System pump discharge pressure sufficient to provide rated flow to the reactor.

TSN/pd10238704