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U. S. Nuclear Regulatory Commission
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Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
GENERIC LETTER 96-05: NRC REQUESTED,
PPL MOV PROGRAM CLARIFICATIONS
PLA-5175

Docket Nos. 50-387
and 50-388

References:

1. *Letter (PLA-4973) from R. G. Byram (PPL) to NRC Document Control Desk, titled "Generic Letter 96-05: Revised 180 Day Response," dated September 17. 1998.*

2. *Letter (PLA-5077) from R. G. Byram (PPL) to NRC Document Control Desk, titled "Response to Request for Additional Information Regarding Generic Letter 96-05 Program," dated July 15. 1999.*

The purpose of this letter is to provide clarification on PPL's Motor Operated Valve (MOV) periodic verification program developed in response to NRC Generic Letter 96-05. PPL has previously provided its commitment with regards to GL 96-05 in PLA-4973 and PLA-5077 as referenced above. During a visit to Corporate Headquarters on February 17, 2000, the NRC verbally requested additional clarification on two particular areas in order to resolve the Generic Letter. The two particular areas are: clarification of PPL's commitments related to the Joint Owners Group (JOG) Periodic Verification Program and disposition of follow-up items from PPL's GL 89-10 closure inspection.

General Periodic Verification Strategy

PPL is an active participant in the development of the Joint Owners Group (JOG) Periodic Verification Program and is committed to implement the program as described within NEDC-32719, Revision 2, "BWR Owners' Group on Periodic Verification" with

A073

Rising Stem Valve Periodic Verification Strategy

The PPL and JOG static test frequencies are compared in Table 1. In general, PPL is conservative in comparison to JOG. The only exception is the specified retest frequency for high-risk significant valves with a medium margin (≥5% and ≤10%). The JOG program specifies a four-year retest frequency for this category valve while the PPL program allows a retest frequency of six years for this same category of valves. PPL currently has no MOVs, with the scope of its GL 96-05 program, which fall into this category; although the scope of MOVs within each category varies annually. As stated in PPL's 180-day response (PLA-4973), PPL performs annual trending assessments that determine margins and degradation trends. This assessment is used to validate the continued use of these static test frequencies or to adjust them as appropriate. In addition, deficient conditions (e.g. vendor updates) that would cause the above listed static test frequencies to be exceeded would be captured under PPL's Condition Report Program.

The JOG Program classifies valves, which were evaluated using the EPRI Performance Prediction Program (PPM), as having inherently high margin and therefore requires no additional margin for the valves to be classified as "high margin." As noted in Table 1, PPL applies this same approach not only to its PPM valves but also to valves with a design basis differential pressure of zero psid, valves which make use of a conservatively high valve factor (typically 1.0 for gate valves and 2.0 for globe valves unless otherwise justified) and flow assisted globe valves.

Butterfly Valve Periodic Verification Strategy

The PPL and JOG static test frequencies are compared in Table 1. In addition, PPL has conservatively chosen to periodically dynamic test one out of each group (type) of butterfly valves (a total of five) on a six year frequency in order to understand their performance and degradation mechanisms of the valve internals, seating surfaces and the actuator. But, as stated in PPL's 180-day response, "...if the JOG program identifies any unique degradation attributes pertinent to the SSES butterfly valves, this information will be incorporated into the PP&L, Inc. program as appropriate." Therefore between the JOG program, and PPL planned in-situ tests, there will be adequate information to draw conclusions relative to butterfly valve degradation.

Justification For Extension of Static Test Frequency to Greater Than A 3 Cycle (6 Year) Interval

First it must be noted that the criteria to extend static test intervals beyond three cycles is quite conservative. The following restrictions apply:

- Butterfly valve test intervals cannot be extended beyond 3 cycles.
- High-risk significant valve test intervals cannot be extended beyond 3 cycles.
- Valves categorized as "requiring greater scrutiny" cannot be extended beyond 3 cycles. These include GL 89-10 Supplement 3 valves, valves with Deloro discs and rising-rotating valves. The intent of this consideration is to identify any MOV uniqueness for which a retest frequency greater than 6 years may not be justified based upon lack of data.
- If valve specific degradation is not available, then 25% margin is required for the valve, actuator and stem factor (for a total of 75% margin) to extend the static test frequency beyond 3 cycles. These assumptions are felt to be bounding and conservative.

As input to the annual trending assessment, PPL is constantly gathering test data from static tests at varying retest frequencies. Adverse trends in margins or degradations are evaluated and those, which may apply to a particular subset of the valve population or the valve population in general, would be addressed.

Schedule

Validation of degradation assumptions is a continual effort performed as diagnostic test information is received. The information from the JOG dynamic diagnostic test program will be incorporated into the PPL MOV program as appropriate. It is expected that the entire validation effort be completed and incorporated into the PPL MOV program by the later of December 31, 2003 or six months after closure of the JOG effort.

PPL Use of EPRI PPM on Lunkenheimer Gate Valves:

To further support its position regarding the acceptability of use of the EPRI Performance Prediction Methodology (PPM) on Lunkenheimer gate valves, PPL has performed an assessment of the current margin on the Recirculation System Discharge Gate Valves. Using the PPM results as the basis for the minimum required thrust, the valves presently have motor capability margins in the range of 17.9% to 61.2% and thrust at torque switch trip margins in the range of 7.5% to 14.3%. The most limiting valve is HV243F031A, which can accommodate a valve factor of 0.75 based upon thrust at torque switch trip and

a valve factor of 0.83 based upon motor capability. The motor capability value is of importance since the close torque switch is bypassed a nominal 97%. The details of this assessment are provided in Table 2.

In addition, PPL completed a survey of BWRs and selected PWRs to determine if any DP test data was available for Lunkenheimer gate valves of this size. Of the utilities that responded to the survey, none had performed any DP testing on valves of a size similar to the SSES Lunkenheimer valves.

Unpredictability of the RHR Shutdown Cooling Isolation Valves:

Since PPL provided its response to the NRC's Request for Additional Information, PPL has decided to remove the RHR F008 and F009 valves from the scope of valves evaluated using the EPRI PPM. This decision was based upon Revision 2 of the EPRI MOV Performance Prediction Program "Performance Prediction Methodology Implementation Guide" which states that the model is no longer considered qualified for stainless steel on stainless steel guide designs. Since the PPM code can no longer be applied on these valves, an alternate approach for valve functionality had to be developed. A decision was made to include these valves in the excess margin category by employing a valve factor of 1.0 in the determination of the minimum required thrust. In order to address any lingering concerns regarding disk tipping and sharp edge contact, a valve factor of 1.5 has been incorporated for determining the thrust requirements for motor capability evaluations until the disk chamfers are completed. This approach is considered justifiable based upon the following:

- The valve is not subject to true blowdown conditions as modeled via the PPM model since it is a Moderate Energy Line and thus is not postulated to experience a guillotine break but rather a crack.
- The DP thrust calculated using a valve factor of 1.0 provides adequate conservatism for thrust at torque switch trip assessments.
- The DP thrust calculated using a valve factor of 1.5 provides additional conservatism in motor capability assessments.
- Per applicable design drawings, the valves have a nominal 0.06" chamfer on both the disk and body seats. Based upon the results of the EPRI valve design effects this should be sufficient to insure that sharp edge contact does not occur during a blowdown closure.

Table 3 provides data regarding the maximum valves factors corresponding to the current set-up for each of the valves.

PPL Valve Factor Statistical Approach for Non-Testable Valves:

For certain non-testable MOVs within the SSES GL 89-10 Program, PPL has chosen to apply a statistical approach to verifying functionality. This approach combines the bias terms with random aspects of valve performance where the random aspects are combined via the "square root sum of the squares" (SRSS) methodology. This is a commonly accepted approach within the industry for combining independent random variables (Ref. ANSI/ISA S67.04). It is the same approach Liberty uses for determining the total VOTES system error and it is also the method both Liberty and EPRI (Ref. Pages 6-10 and 6-11 of EPRI PPM Implementation Guide-TR-103244) recommend for combining random aspects of diagnostic equipment error, torque switch repeatability and load sensitive behavior. PPL has taken this approach a step further and combined the valve factor randomness aspects with the torque switch repeatability, equipment diagnostic error and load sensitive behavior repeatability terms.

Calculation EC-VALV-1054 provides the basis for the use of the statistical approach and also provides an assessment of the conservative nature of the approach. The calculation actually applies the statistical approach to eighteen gate valves tested as part of the PPL dynamic test program. The results of this assessment show that the statistical approach provides bounding results for all but one valve out of the eighteen (see Table 4). The average margin of conservatism is over 30%. The only test not bounded was a dynamic test on HV252F031A which was not even included in the statistical analysis because the dynamic test results were considered suspect. This valve was excluded because it is a small valve with a very high evaluated valve factor. Small valves often exhibit large deviations in valve factor because of the small contribution of the DP load to the overall required thrust and the resulting extreme sensitivity in evaluated results to even minor variations in trace marking and/or zeroing. The "B" loop and Unit 1 counterparts to this valve were also dynamically tested and all had evaluated valve factors between 0.38 and 0.526. Even though this valve had an evaluated valve factor of about 0.7, the statistical method still provides a predicted thrust which is within 91 lbs. of the actual required thrust based upon the dynamic test results again re-enforcing the conservative nature of the approach.

Table 5 provides an updated assessment of the current status of the MOVs, which employ the statistical approach in the close direction. This assessment shows:

- The statistical approach provides results equivalent to those using a fixed valve factor in the range of 0.48 to 0.57 depending upon the actual valve in question.

- All of the Unit 1 statistical MOVs have current setup capabilities to accommodate valve factors of at least 0.6.

PPL Load Sensitive Behavior Assumptions for Non-Testable Valves:

PPL Calculation EC-VALV-0538 provides the basis for the Load Sensitive Behavior assumptions made for non-testable gate valves at SSES. The calculation performs a statistical evaluation of SSES and applicable EPRI dynamic test data to determine the mean and random aspects associated with load sensitive behavior. This approach is consistent with that recommended in Addendum 2 to EPRI TR-103237-R2: "Thrust Uncertainty Method." Within this report EPRI states that the input values for the bias and random components of ROL "may be determined from a statistical evaluation of applicable plant test data." Of the 28 data points included in the statistical analysis, 21 are actual test results from SSES dynamic tests. Table 6 provides the data used in this evaluation while Figure 1 provides a histogram showing the distribution of the SSES data. Because of the nature of the statistical evaluation, it is expected that future individual tests will not have significant impact on the results of the evaluation, however PPL will update the statistical analysis concurrent with incorporating the JOG dynamic test program into the PPL MOV program.

If you have any questions, please contact Mr. Cornelius T. Coddington at 610-774-4019.

Sincerely,

G. T. Jones

Copy: Regional Administrator - Region I
Mr. S. L. Hansell, NRC Sr. Resident Inspector
Mr. R. G. Schaaf, NRC Sr. Project Manager

TABLE 1

COMPARISON OF VALVE STATIC TEST FREQUENCY (YEARS) BETWEEN THE PPL AND JOG PROGRAMS

RISK	RISING STEM VALVE MARGINS									
	LOW			MEDIUM			HIGH			VERY HIGH
	PPL		JOG	PPL		JOG	PPL		JOG	PPL
	Degradation data not available	Degradation data available		Degradation data not available	Degradation data available		Degradation data not available	Degradation data available		Degradation data not available
	Margin<5	margin<5	margin<5	5</=margin</=10	5</=margin</=10	5</=margin<10	10<margin<25	10<margin	10</=margin	margin>/=25
high risk	2	2	2	6	6	4	6	6	6	6
medium risk	2	2	4	6	6	8	6	10	10	10
low risk	2	2	6	6	10	10	6	10	10	10

NOTES

1. Due to design considerations, the following do not need valve margin to be listed as "HIGH MARGIN" for PPL.
   Excess Margin valves [e.g. VF = 1.0 for gates & 2.0 for globes].
   Valves with no differential pressure.
   EPRI valves (in accordance with JOG program).
   Flow assisted globe valves.
2. Actuator degradation is not included in the listed margins.

RISK	BUTTERFLY VALVE/ACTUATOR MARGINS					
	LOW		MEDIUM		HIGH	
	PPL	JOG	PPL	JOG	PPL	JOG
	Margin<5	Margin<5	5</=Margin<10	5</=Margin<10	10</=Margin	10</=Margin
high risk	N/A	2	N/A	4	N/A	6
medium risk	2	4	2	8	6	10
low risk	2	6	2	10	6	10

NOTES

1. The listed margins account for both valve and actuator degradation for PPL.

Table 2*				
Tag Number	Excess Motor Capability Margin	Excess Thrust at Torque Switch Trip Margin	Maximum Valve Factor Corresponding to Current Setup	
			Motor Capability	C14 Thrust
HV143F031A	30.85%	10.75%	0.93	0.77
HV143F031B	61.13%	12.74%	1.15	0.79
HV243F031A	17.82%	7.47%	0.83	0.75
HV243F031B	37.88%	14.23%	0.98	0.80

* Based upon current data as of 3/21/00.

Table 3

Tag Number	Maximum Valve Factor Corresponding to Current Setup	
	C14 Thrust	Motor Capability
HV151F008	1.75	3.91
HV151F009	2.46	2.60
HV251F008	2.01	3.34
HV251F009	1.93	2.10

Table 4					
Valve	Test Line Pressure	Test DP	Minimum Required Thrust		Conservatism of Statistical Approach
			DP Test Results	Statistical Approach	
HV-151F007A	345	345	8397	9664	15.1%
HV-151F007B	350	350	7587	9765	28.7%
HV-151F022	332	295	6373	7792	22.3%
HV-151F028A	333	333	35074	51898	48.0%
HV-151F028B	333	333	39296	51898	32.1%
HV-152F005A	375	371	18760	25325	35.0%
HV-152F031A	370	370	2638	3331	26.3%
HV-152F031B	371	371	3249	3337	2.7%
HV-155F012	1360	1360	11031	14792	34.1%
HV-251F007A	350	350	6487	9765	50.5%
HV-251F007B	350	350	5850	9765	66.9%
HV-251F022	340	303	7430	7914	6.5%
HV-251F028A	326	326	38559	50572	31.2%
HV-251F028B	329	329	45810	51003	11.3%
HV-252F005A	384	369	15743	25271	60.5%
HV-252F031A	385	385	3528	3436	-2.6%
HV-252F031B	385	385	2529	3436	35.9%
HV-255F012	1494	1494	13231	16043	21.3%
			Average Conservatism =		30.9%

Table 5 #				
Valve	Equivalent Fixed Valve Factor	Current Motor Capability Margin	Current C14 Margin	Valve Factor Corresponding to Current Setup
HV-11313	0.54	42.36%	45.39%	1.00
HV-11314	0.51	13.21%	78.66%	0.69
HV-11345	0.51	90.74%	43.83%	1.20
HV-11346	0.56	342.61%	242.35%	2.52
HV-141F016*	0.56	33.15%	43.22%	0.84
HV-141F016**	0.56	35.17%	35.34%	0.85
HV-149F010	0.48	81.56%	46.74%	1.80
HV-149F013	0.55	107.57%	54.87%	1.13
HV-149F031	0.48	133.42%	42.89%	1.57
HV-149F059	0.52	465.55%	196.55%	3.55
HV-151F004A	0.57	97.92%	12.08%	0.66
HV-151F004B	0.57	140.01%	39.06%	0.86
HV-151F004C	0.57	91.18%	9.60%	0.64
HV-151F004D	0.57	71.92%	9.85%	0.65
HV-151F021A	N/A	832.95%	350.38%	N/A
HV-151F021B	N/A	1052.54%	410.84%	N/A
HV-152F001A	0.57	316.90%	167.34%	1.84
HV-152F001B	0.53	147.22%	40.02%	1.07
HV-155F004	0.56	64.79%	12.81%	0.67
HV-155F006	0.57	174.06%	84.22%	1.21
HV-155F042	0.55	35.20%	11.51%	0.67
HV-155F066	0.55	71.94%	60.48%	1.19
HV-15766	0.53	137.85%	161.84%	2.30
HV-15768	0.53	92.79%	67.65%	1.34
HV-21313	0.54	32.76%	76.70%	0.89
HV-21314	0.54	23.57%	65.65%	0.78
HV-21345	0.52	466.17%	183.71%	2.97
HV-21346	0.53	75.49%	55.45%	1.26
HV-241F016	0.56	34.83%	37.01%	0.86
HV-249F010	0.48	80.49%	50.28%	1.83
HV-249F013	0.54	83.83%	34.79%	0.94
HV-249F031	0.48	42.58%	4.74%	0.60
HV-249F059	0.50	292.56%	95.49%	2.51

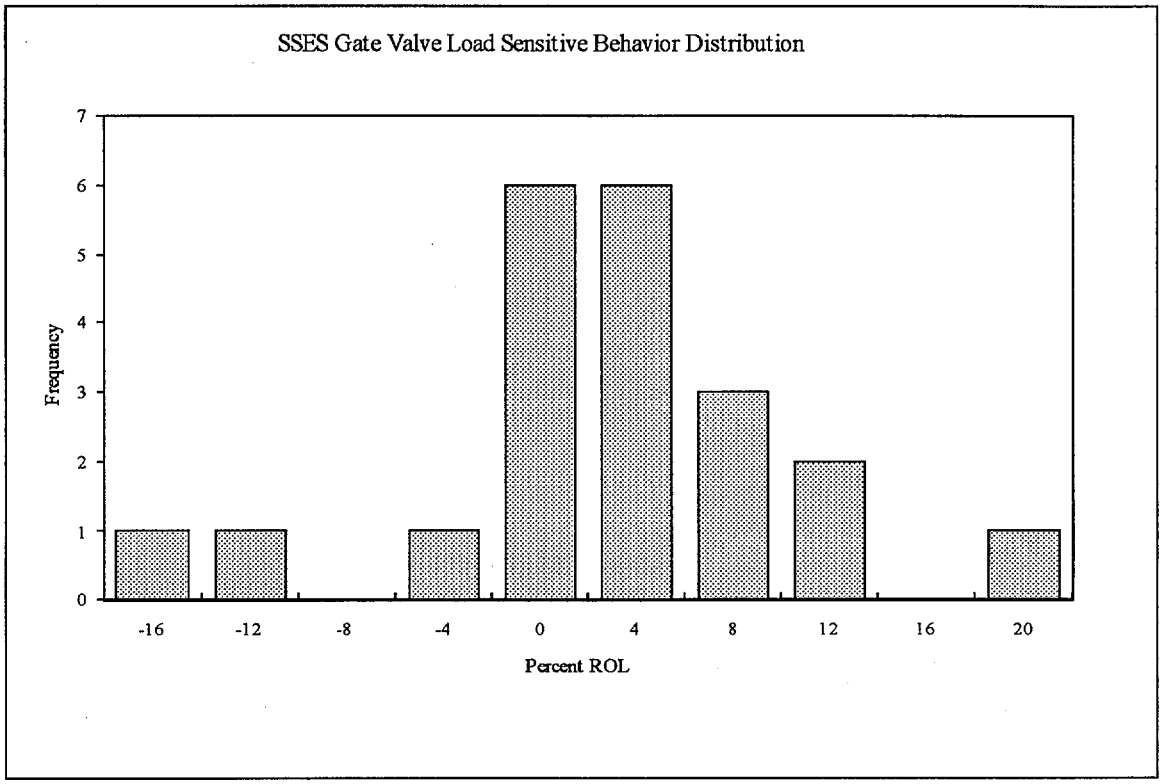
Table 5

Valve	Equivalent Fixed Valve Factor	Current Motor Capability Margin	Current C14 Margin	Valve Factor Corresponding to Current Setup
HV-251F004A	0.57	379.62%	177.91%	1.93
HV-251F004B	0.58	71.81%	18.45%	0.71
HV-251F004C	0.58	90.21%	36.42%	0.84
HV-251F004D	0.57	60.27%	17.24%	0.70
HV-251F021A	N/A	1025.61%	314.17%	N/A
HV-251F021B	N/A	1539.72%	504.28%	N/A
HV-252F001A	0.54	137.45%	77.98%	1.43
HV-252F001B	0.53	151.68%	49.87%	1.17
HV-255F004	0.56	60.56%	25.81%	0.79
HV-255F006	0.56	222.08%	55.84%	1.03
HV-255F042	0.55	52.15%	25.50%	0.82
HV-255F066	0.53	97.92%	35.01%	0.99
HV-25766	0.50	23.31%	45.29%	0.92
HV-25768	0.51	44.83%	17.10%	0.79

With the exception of HV11314, all data is current as of 3/21/00.
Data for HV11314 is from testing performed on 4/12/00.
* Postulated Case B LOCA
** Small Break LOCA Scenario

Table 6			
Valve Tag Number	Thrust At Torque Switch Trip		Percent LSB
	Static	Dynamic	
HV151F022	11963	13700	-14.52
HV255F012	15178	17196	-13.30
HV251F022	14502	15100	-4.12
HV212F073A	6571	6688	-1.78
HV151F028B	53249	53655	-0.76
HV112F073B	5153	5178	-0.49
HV252F031A	5701	5710	-0.16
HV212F073B	5119	5096	0.45
HV252F031B	5771	5680	1.58
HV152F031A	4807	4687	2.50
HV251F007B	12018	11686	2.76
HV151F007A	9465	9160	3.22
HV251F007A	12296	11724	4.65
HV112F073A	5457	5191	4.87
HV251F028A	49874	47283	5.20
HV155F012	16353	15347	6.15
HV151F007B	11072	10192	7.95
HV252F005A	24876	22685	8.81
HV152F031B	4781	4267	10.75
HV151F028A	54421	48096	11.62
HV251F028B	54803	44624	18.57

FIGURE 1


SSES Gate Valve Load Sensitive Behavior Distribution
Frequency
0
1
2
3
4
5
6
7
-16
-12
-8
-4
0
4
8
12
16
20
Percent ROL