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SUBJECT: Provides addl info to support NRC review of proposed amend 205 & 168 which clarify scope of repsonse time testing.

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SUSQUEHANNA STEAM ELECTRIC STATION
ADDITIONAL INFORMATION SUPPORTING
PROPOSED AMENDMENT NOS. 205 AND 168
CLARIFICATION OF THE SCOPE OF RESPONSE TIME TESTING **Docket Nos. 50-387**
PLA - 4627 **FILES R41-2/A17-2** **and 50-388**

Reference: (1) PP&L Letter PLA-4597, "Proposed Amendment No. 205 To License NPF-14 and Proposed Amendment No. 168 To License NPF-22: Clarification Of the Scope Of Response Time Testing," dated April 4, 1997.

(2) PP&L Letter PLA-4608, "Supplemental Information Supporting Proposed Amendment Nos. 205 and 168: Clarification of Response Time Testing," dated April 14, 1997.

(3) BWR Owner's Group Licensing Topical Report NEDO-32291, "System Analyses for Elimination of Selected Response Time Testing Requirements," dated January 1994.

(4) NRC Letter to BWR Owner's Group, dated December 28, 1994, transmitting evaluation of Licensing Topical Report NEDO-32291, "System Analyses for Elimination of Selected Response Time Testing Requirements."

(5) Generic Letter 93-08, "Relocation of Technical Specification Tables of Instrument Response Time Limits," dated December 29, 1993.

(6) NRC Letter to PP&L, dated July 11, 1995, issuing Amendments No. 148 to Facility Operating License NPF-14 and No. 118 to Facility Operating License NPF-22.

(7) PP&L Letter PLA-4594, "Request for Enforcement Discretion, Response Time Measurement," dated March 26, 1997.

The purpose of this letter is to provide additional information to support the NRC review of proposed changes to Susquehanna Steam Electric Station (SSES) Unit 1 and Unit 2 Technical Specifications clarifying the scope of response time testing. Submittal of this information on the docket was requested at a teleconference on May 15, 1997 with your Messrs. Poslusny and Loeser. The proposed changes to Unit 1 and Unit 2 Technical Specifications were submitted via

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Reference No. 1, and supplemental information was provided in response to an NRC request, via Reference No. 2.

Specifically, this letter provides information on the following topics discussed at the May 15, 1997 teleconference:

(1) Basis for Identified Functions Subject to Proposed Surveillance Requirements
(2) Confirmatory Review of Statistical Calculation Using NUREG-1475
(3) Clarification of Discussion of Rosemount Transmitters in Reference No. 2
(4) Basis for Use of More Than One Administrative Value for Barton 288A
(5) Explanation of Variability in Response Time Testing Performance Data
(6) Equivalency of the B2T Sensor

Topic No. 1 -- Basis for Identified Functions Subject to Proposed Surveillance Requirements

At the May 15, 1997 teleconference, the NRC reviewer asked for details regarding how the response time test limits in SSES FSAR Tables were modified to reflect implementation of the BWROG Licensing Topical Report (LTR) approved by the NRC for selected elimination of response time tests (see References Nos. 3 and 4). Particularly, the reviewer expressed interest in those functions for which response time limits were replaced with "N/A" annotations in the tables, as a result of implementing the LTR.

In response, PP&L reiterated that subsequent to the relocation of the response time tables from the Technical Specifications to the FSAR via a separate licensing action (see References Nos. 5 and 6), PP&L applied the provisions of 10 CFR 50.59 to eliminate selected instrument and relay response time testing from the FSAR tables, in accordance with guidelines contained within the LTR and the implementation requirements delineated in the associated NRC SER. This resulted in the following changes to the FSAR response time tables:

(1) For the Reactor Protection System (RPS), sensor response time testing was eliminated for functional unit no. 4, Reactor Vessel Water Level - Low, Level 3. This is indicated via a footnote in FSAR Table 7.3-28. Those functions for which "N/A" annotations appeared in the table were not modified by this change.

(2) For the Isolation Actuation System (IAS), sensor and relay response time tests were eliminated for the trip functions listed below. These changes are reflected as additional "N/A" annotations in FSAR Table 7.3-29.

* Primary Containment Isolation: Reactor Vessel Water Level -- Low Level 3 [1.a(1)]; Reactor Vessel Water Level -- Low Low, Level 2 [1.a(2)]; Reactor

Vessel Water Level -- Low Low Low, Level 1 [1.a(3)]; Drywell Pressure - High [1.b]; and SGTS Exhaust Radiation - High [1.d].

* Secondary Containment Isolation: Reactor Vessel Water Level - Low Low, Level 2 [2.a]; Drywell Pressure - High [2.b]; Refuel Floor High Exhaust Duct Radiation - High [2.c]; Railroad Access Shaft Exhaust Duct Radiation - High [2.d]; and Refuel Floor Wall Exhaust Duct Radiation - High [2.e].

* Reactor Water Cleanup System Isolation: Reactor Vessel Water Level- Low Low, Level 2 [4.e].

* Reactor Core Isolation Cooling System Isolation: RCIC Steam Line Δ Pressure - High [5.a]; RCIC Steam Supply Pressure - Low [5.b]; and Drywell Pressure - High [5.j].

* High Pressure Coolant Injection System Isolation: HPCI Steam Flow - High [6.a]; HPCI Steam Supply Pressure - Low [6.b]; and Drywell Pressure - High [6.j].

* RHR System Shutdown Cooling/Head Spray Mode Isolation: Reactor Vessel Water Level - Low, Level 3 [7.a]; and Drywell Pressure - High [7.e].

Additionally, sensor response time testing was eliminated for the functions listed below. This is indicated via a footnote in FSAR Table 7.3-29. Those functions for which "N/A" annotations appeared in this section of the table were not modified by this change.

* Main Steam Line Isolation: Reactor Vessel Water Level - Low, Low, Low, Level 1 [3.a]; Main Steam Line Pressure - Low [3.c]; and Main Steam Line Flow - High [3.d].

(3) For the Emergency Core Cooling System (ECCS), response time testing of instruments and relays was eliminated for the functions listed below. This is indicated via a footnote in FSAR Table 7.3-30. Those functions for which "N/A" annotations appeared in FSAR Table 7.3-30 were not modified by this change.

* Core Spray System: Reactor Vessel Water Level - Low Low Low, Level 1 [1.a]; Drywell Pressure - High [1.b]; and Reactor Vessel Steam Dome Pressure - Low [1.c].

* Low Pressure Cooling Injection Mode of RHR System: Reactor Vessel Water Level - Low Low Low, Level 1 [2.a]; Drywell Pressure - High [2.b]; Reactor Vessel Steam Dome Pressure - Low, System Initiation [2.c(1)]; and Reactor

Vessel Steam Dome Pressure - Low, Recirculation Discharge Valve Closure [2.c(2)].

* High Pressure Coolant Injection System: Reactor Vessel Water Level - Low Low, Level 2 [3.a]; and Drywell Pressure - High [3.b].

The changes listed above for the RPS, IAS and ECCS systems were made to the cited FSAR tables (attached to Reference No. 7) to reflect implementation of the LTR under the provisions of 10 CFR 50.59. The Technical Specification amendment proposed in Reference No. 1 clarifies the scope of response time testing to reflect these changes, as well as the "N/A" annotations which were present in the tables prior to this change. (It should be noted that a clarification to the surveillance requirements was first necessitated by the relocation of the response time test tables from the Technical Specifications to the FSAR, which occurred prior to the implementation of the LTR and FSAR table revisions to eliminate selected response time tests. As described in Reference Nos. 1 and 7, the need for a clarification to the surveillance requirements was not recognized by the industry until recently.)

Topic No. 2 -- Confirmatory Review of Statistical Calculation Using NUREG-1475

For those channels whose sensor response time tests were eliminated via application of the LTR methodology, but for which relay response time testing is still required, an assumed value for sensor response time is required. As described in References Nos. 1 and 2, PP&L selected this "penalty" value based upon operational history (i.e., the longest measured response time recorded since 1987 for each of the sensors in question). (Note that the necessary "design" data from the manufacturer was not available.) This 'penalty' value was then added to PP&L's procedures for calculating total channel response time.

At the request of the NRC reviewer, PP&L performed a statistical analysis of the sensor response time test data recorded since 1987 to ensure that the selected "penalty" values were appropriate. PP&L calculated a 95% confidence (2 sigma) value, and concluded that the administrative limits assumed for the sensor response time were conservative relative to the statistically-determined response times. The PP&L calculation containing the statistical analysis was provided in Reference No. 2 for the NRC reviewer's information.

Following a review of the PP&L calculation, the NRC reviewer suggested that weighting factors be applied to the statistical analysis to account for the sample size, using a methodology such as that defined in NUREG-1475. In response, PP&L performed a second confirmatory statistical analysis using the one-sided tolerance limit factors for a normal distribution provided in Table T-11b of NUREG 1475. The results are provided in the following table.

Function	Manufacturer & Model No.	Response Time "Penalty" Assigned for Sensors in PP&L Procedures (ms)	Confirmatory Statistical Calculation		
			Value Derived from 2 sigma method (ms)	Number of data points	Value Derived via Application of One-Sided tolerance limit factors (ms)
RPS Reactor Vessel Low Level 3	Barton 288A (GE Purchase Part Dwg.: 159C4384P003)**	600	582	24	602
MSIV Isolation Reactor Vessel Low Level 1	Barton 760	600	378	36	395
MSIV Isolation Main Steam Line Low Pressure	Barksdale B1T-M12SS-GE	100	58	24	64
MSIV Isolation Main Steam Line High Flow	Barton 288A (GE Purchase Part Dwg.: 145C3009P001)**	200	140	39	145

PP&L determined that for the RPS Reactor Vessel - Low Level 3 function, the value derived from the confirmatory NUREG statistical analysis (602 ms) exceeded the originally calculated value (600 ms) by a fractional amount. However, this difference is not statistically significant, given the bounds of the accuracy of the calculation (number of significant figures of the data) and the data itself. Thus, PP&L has concluded that both confirmatory calculations performed at the request of the NRC reviewer support PP&L's selection of the "penalty" values for sensor response time.

Topic No. 3 -- Clarification of Discussion of Rosemount Transmitters in Reference No. 2

In Reference No. 2, PP&L provided a description of PP&L's response to each of the applicability conditions identified in the NRC SER (Reference No. 4). Statement (d) from the NRC's SER reads as follows:

> "That for any request involving the elimination of RTT for Rosemount pressure transmitters, the licensee is in full compliance with the guidelines of Supplement 1 to Bulletin 90-01, "Loss of Fill-Oil in Transmitters Manufactured by Rosemount."

** PP&L does not purchase these components directly from ITT Barton. Rather, the components are purchased from GE as qualified components for specific applications. Thus, the GE reference is provided to differentiate the two Barton 288A components.

In Reference No. 2, PP&L stated that no action was necessary because there are no Rosemount transmitters in any of the response time tested loops. PP&L offers the following clarification:

> "No action was necessary because there are no Rosemount transmitters in any of the loops where response time testing was eliminated by applying the GE LTR methodology."

Topic No. 4 -- Basis for Use of More Than One Administrative Value for Barton 288A

This issue specifically applies to the Barton 288A instruments used to satisfy the RPS Reactor Vessel Low Level 3 and MSIV Isolation Main Steam Line High Flow signals. As described above, PP&L selected a sensor response time "penalty" of 600 ms for the RPS function, and 200 ms for the MSIV Isolation function, based upon a review of historical response time test data (i.e., sensor response times measured since 1987).

The difference in these values is explained by design differences in the switch for the two different applications. Specifically, the size of the bellows differs according to the pressure rating of the switch. For the subject RPS function, the level switch has a 0-60" w.c. range, and a diameter of 1.625 in. The switch applied in the MSIV function has a range of 0-150 psid, a higher pressure differential, and thus has a smaller diameter (0.75 in.). Representatives of the manufacturer of the switch, ITT Barton, have confirmed that the larger diameter bellows would result in longer response time. This characteristic is evident in the operational data and the derived penalties.

Topic No. 5 -- Explanation of Variability in Response Time Testing Performance Data

Following a review of the historical sensor response time test data provided in the calculation attached to Reference No. 2, the NRC reviewer requested an explanation of the variability in the data over the years of sensor response time testing. At the May 15, 1997 teleconference with the NRC, PP&L described: (1) the factors which contribute to data variability in response time testing data; and (2) the acceptability of data variability given the objectives of response time testing.

(1) Contributing Factors to Data Variability

As discussed at a teleconference with the NRC on May 15, 1997, the response time test data is not a standard distribution due to the repeatability of the switch, the accuracy of the measurement and test equipment,, and the limitations of human data measurement. The role of each of these factors is better understood in the context of the testing methodology. A typical response time test includes the following steps:

(a) A setpoint check is performed to ensure the setpoint is within the as-found tolerance.

(b) A ramp test is performed to determine the t=0 point of the test. The ramp is either an "up-ramp," starting from a value less than the setpoint and increasing in pressure, or a "down-ramp," starting from a value greater than the setpoint and decreasing in pressure.

(c) A faster ramp, based on the Time Response Test Set ("TRTS box") specifications is then performed. The output of the switch and the output of the ramp signal are connected to a high speed recorder..

(d) The chart paper from the original ramp test that determined t=0 is then lined up with the faster ramp test chart paper to determine the t=0 point on the faster ramp test chart paper.

(e) The difference in change of state of the tested switch can be seen on the switch recorder chart paper by the change in state (AC voltage versus flat or step change in DC response). This time is lined up with the faster ramp output chart paper.

(f) The time difference as measured on the ramp recorder chart paper between the t=0 point and the point on the switch recorder paper where the signal changes state is the recorded response time.

One fundamental contributor to variability in the response time test data is the repeatability of the component. For example, the Barton literature identifies repeatability of the 288A switch to be ±0.2% full scale. Actuation of the switch prior to the established t=0 point would yield a zero or negative response time. That is, if the t=0 point was determined to be 111 psid, and during the response time test the switch actuated at 110 psid, a zero or negative value could have been obtained. Similarly, a switch that actuated later (e.g., 112 psid) than the originally assumed value due to the instrument's repeatability, would yield a longer than expected response time.

Also, as indicated above, a high speed recorder is used to measure response time. The recorder is an electronic device that has a calibrated time-base response accuracy of ±0.5%. The "TRTS" provides an interface between an nitrogen pressure source and water to the instrument to be tested. It produces ramp input pressure to instrument to be tested, and contains a pressure transducer whose output is directed to the high-speed recorder as the pressure input ramp reference signal. The TRTS pressure transducer is not maintained as a "calibrated" piece of test equipment; rather, for each response time test, the TRTS is set up utilizing a "calibrated" pressure monitoring device (i.e., Heise gauge- accuracy of ±0.1%).

Finally, as described above, the technician 'lines up' the chart paper for two ramp tests, and applies judgment as to which point to consider the t=0 point and the response time end point. Any electronic noise present in the switch actuation signal (typically not a clean

square wave step response) may cause one technician's judgement to be different than another technician's relative to the t=0 point and response time end point.

(2) Objectives of Response Time Testing

Fundamentally, it is PP&L's position that this data variability is acceptable, since response time tests are designed to ensure that the limits in the safety analyses are not exceeded, and *not* to demonstrate that a specific value is met. This is consistent with the bases for response time testing, as described in Standard Technical Specifications (NUREG 1433, for BWR/4). For example, the bases for surveillance requirement 3.3.1.1.17 for RPS instrumentation states that the surveillance requirement ensures that the individual channel response times are less than or equal to the maximum values assumed in the accident analyses. The intent is to ensure that the desired system response occurs at least as quickly as the assumptions in the safety analysis.

This position is supported by EPRI Report No. NP-267, which recommends a response time test methodology, and provides the basis for the industry approach. PP&L's methodology is consistent with that described in the EPRI report, and in general with the approach taken throughout the industry. Regarding the need for precision in measuring response time testing, the EPRI report reiterates the fundamental purpose of system response time testing. Specifically, it states:

> "The EPRI report...attempted to develop test equipment test procedures that would provide a verification of adequate sensor response time rather than a precise measurement of actual sensor response time. This approach is justified since the predicted sensor response time is generally a small fraction of overall system response time; consequently, a given inaccuracy in the measurement of a sensor's response time is not particularly significant in terms of system performance."

Further, the LTR (Reference No. 5) approved by the NRC (Reference No. 6), states:

> "the purpose of [response time tests] is to ensure that changes in response time beyond acceptable limits assumed in the safety analysis are detected. It is not necessary to demonstrate that the response time design value is met."

Topic No. 6 -- Equivalency of the B2T Sensor

As PP&L related at the May 15, 1997 teleconference, subsequent to the submittal provided via Reference No. 2, PP&L determined that the Barksdale B2T sensor should be included in the scope of response time testing eliminated in accordance with the LTR. As described in previous

submittals (References Nos. 1 and 7), the B2T was evaluated as part of PP&L's implementation of the LTR, and has been addressed in the LTR as an acceptable candidate for such replacement. The B2T was included in PP&L's evaluation under 10 CFR 50.59 to preserve a replacement option for the B1T. During discussions at the May 15, 1997 teleconference, PP&L reiterated the basis for inclusion of the B2T in its implementation of the LTR to eliminate response time testing. The B2T is discussed in Section K.6.2.1 of the LTR as an acceptable candidate for response time testing elimination. Specifically, Section K.6.2.1 of the LTR states the following:

> "The Barksdale B1T and B2T series are Bourdon tube instruments and do not have components that can cause response time related failures. Therefore, response time testing is not required."

The B1T switch was included in Table 1 of the LTR and approving SER. This table includes all instruments for which response time testing can be eliminated. The B2T switch was apparently inadvertently omitted from this table.

At the May 15, 1997 teleconference, the NRC reviewer requested that PP&L provide additional information to describe the physical differences between the B1T and B2T sensors, and to account for any impacts (e.g., mass of moving member, friction losses) on response time. The fundamental difference between the B1T and B2T sensors is that the B2T switch contains two microswitches and the B1T switch contains one microswitch. In the applications of interest, only one microswitch of the B2T sensor is employed. An analysis of these differences is provided below.

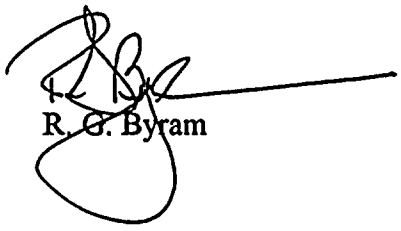
* The B1T sensor consists of a bourdon tube driving one microswitch. Based on the approved LTR, there are no components that can cause response time related failures. The B2T applications of interest consist of the exact configuration of a B1T, except the second microswitch is not used. In this case, the pressure source is applied through the bourdon tube to the single microswitch. There is no movement of the second microswitch, nor is there movement of any other internal part. It is therefore PP&L's conclusion that the B2T sensor, using one microswitch, would have the same response time characteristic as the B1T sensor.

* PP&L has reviewed its response time data for these channels and found no significant difference in the response time data from before 1992 and after 1992 (when the B2T was installed).

Therefore, PP&L has confirmed the acceptability of eliminating response time testing for the B2T in the subject applications, based upon: (1) the evaluation in the LTR approved by the NRC, (2) the similarity of configuration, and (3) the similarity of response time data.

If you have any additional questions, please contact Ms. K.R. Leone at (610) 774-4023.

Very truly yours,



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