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DEC 0 1 2005

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop OP1-17
Washington, DC 20555-0001

SUSQUEHANNA STEAM ELECTRIC STATION
PROPOSED LICENSE AMENDMENT
NUMBERS 272 FOR UNIT 1 OPERATING LICENSE NO. NPF-14
AND 241 FOR UNIT 2 OPERATING LICENSE NO. NPF-22
POWER RANGE NEUTRON MONITOR SYSTEM
DIGITAL UPGRADE
SUPPLEMENTAL INFORMATION
PLA-5983

Docket Nos. 50-387
and 50-388

Reference: 1) PLA-5880, B. T. McKinney (PPL) to Document Control Desk (USNRC), "Susquehanna Steam Electric Station Proposed License Amendment No. 272 for Unit 1 Operating License No. NPF-14 and 241 for Unit 2 Operating License No. NPF-22 Power Range Neutron Monitor System Digital Upgrade," dated June 27, 2005.

The purpose of this letter is to supplement the referenced proposed amendment request, which requested a license amendment to the Susquehanna Steam Electric Station (SSES) Unit 1 and 2 Technical Specifications to implement a digital upgrade to the Power Range Neutron Monitor System. The supplemental information provided herein documents the information requested during the November 2, 2005 teleconference held between NRC and PPL Susquehanna (PPL). The supplemental information is provided in the Attachments.

PPL has reviewed the No Significant Hazards Consideration and the Environmental Consideration submitted with Reference 1 relative to this supplemental information. We have determined that there are no changes required to either of these documents.

The enclosed RAI response (Attachment 2) contains proprietary information as defined by 10 CFR 2.390. GE, as the owner of the proprietary information, has executed the enclosed affidavit, which identifies that the enclosed proprietary information has been handled and classified as proprietary, is customarily held in confidence, and has been withheld from public disclosure. The proprietary information was provided to PPL Susquehanna, LLC in a GE transmittal that is referenced by the affidavit.

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The proprietary information has been faithfully reproduced in the enclosed RAI responses such that the affidavit remains applicable. GE hereby requests that the enclosed proprietary information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17. A non-proprietary version of the RAI response is also provided (Attachment 3).

PPL respectfully requests that NRC complete the reviews and approval of the Proposed Power Range Neutron Monitor Digital Upgrade License Amendment Change by the February 1, 2006 date requested in Reference 1.

If you have any questions or require additional information, please contact Mr. John Oddo at (610) 774-7596.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 12-1-05

B. T. McKinney

B. T. McKinney

Attachments:

- Attachment 1 - Supplemental Information
- Attachment 2 - PPL Susquehanna Steam Electric Station, Seismic/Dynamic Qualification of NUMAC Power Range Neutron Monitoring (PRNM) System Equipment Control Panel P608 (1/2C608), Dated November 2005 (Proprietary)
- Attachment 3 - PPL Susquehanna Steam Electric Station, Seismic/Dynamic Qualification of NUMAC Power Range Neutron Monitoring (PRNM) System Equipment Control Panel P608 (1/2C608), Dated November 2005 (Non-Proprietary)
- Attachment 4 - GE Affidavit for Attachment 2
- Attachment 5 - Changes to License Amendment Request
- Attachment 6 - Changes to Technical Specifications
- Attachment 7 - Changes to Technical Specifications Bases (For Information)

cc: NRC Region I
Mr. B. A. Bickett, NRC Sr. Resident Inspector
Mr. R. V. Guzman, NRC Project Manager
Mr. R. Janati, DEP/BRP

Attachment 1 to PLA-5983

Supplemental Information

Subject: PROPOSED LICENSE AMENDMENT REQUEST POWER RANGE NEUTRON MONITOR DIGITAL UPGRADE

NRC Question 1:

In PPL's application dated June 27, 2005, Section 7.2, "Plant Specific Actions Required by NEDC-32410P-A," the following additional information is requested to support the NRC staff review:

A. In response to Section 2.3.4, PPL identified the existing plant variation, with regards to the Average Power Range Monitor/Rod Block Monitor/Technical Specifications (ARTS), as 2.3.3.5.1.4, "ARTS not implemented and not planned," and the replacement PRNM alternative as "Non-ARTS variation of STP [simulated thermal power] trip setpoint algorithm..." In light of the Phase 2 implementation, incorporation of ARTS logic, explain why the ARTS variation and implementation was not the selected option.

PPL Response:

The response to 2.3.4 will be revised to read: ARTS Current 2.3.3.5.1.3, i.e., variation "ARTS implementation after replacement of PRNM installation (Non-BWR6 plants that are planning to obtain approval and implement the ARTS improvement at some time after the PRNM project)." See Attachment 5.

PPL's original selection of Existing Plant Variation 2.3.3.5.1.4 (NEDC-32410P-A) was based on PPL's interpretation of the variation options given that Susquehanna Unit 1 would not have ARTS implemented immediately following installation of PRNMS. However, PPL agrees that Existing Plant Variation 2.3.3.5.1.3 better represents the implementation of ARTS relative to PRNMS for both Susquehanna units.

B. In response to Section 4.4.2.3.4, PPL responded with, "Evaluations to confirm that the maximum seismic accelerations at the mounting locations of the equipment do not exceed qualification limits of the equipment will be completed...The seismic qualification results will be documented in a plant-specific "Qualification Summary."" Please provide to the NRC staff the Qualification Summary which should include verification that the results, including updates from the original configuration by GE, incorporate the SSES 1 and 2 spectrum.

PPL Response:

A Susquehanna-specific seismic qualification report is provided as Attachment 2.

Please note that the Qualification Summary referred to in the License Amendment Request is a post-Factory Acceptance Test document, typically issued just prior to site installation. The report is a summary of the overall qualification of the system, including, among other things, seismic qualification.

C. Supplement 1 of GE Licensing Topical Report NEDC-32410P-A, "NUMAC PRNM Retrofit Plus Option III Stability Trip Function," was not referenced for Section 8.4.4.3.4, which stated, "The utility action in the base report applies except that "OPRM Trip" is replaced by "OPRM Upscale." This action has yet to be implemented, please explain.

PPL Response:

Supplement 1 of NEDC-32410P-A is Reference 2 as listed in Section 8 of the License Amendment Request, and referred to as NUMAC PRNM LTR, Supplement 1 in Section 8.4.4.3.4. Page 2 of 81 of the License Amendment Request identifies NUMAC PRNM LTR as NEDC-32410P-A.

As noted on page 3 of 81 of the License Amendment Request, the terminology "OPRM Trip" is identified to be the same as "OPRM Upscale" used in the Supplement 1 of NEDC-32410P-A. Reference to "OPRM Trip" was to maintain consistency with current Tech Specs terminology. However, in order to maintain conformity with the LTR and industry standard terminology, PPL revises the License Amendment Request as follows:

- The third bullet at the top of page 3 of 81 is revised to read "The OPRM Upscale Function (referred to as "OPRM Trip" in this License Amendment Request) is added ..." See Attachment 5.

- The Tech Spec pages (including Bases) are revised to read "OPRM Upscale". See Attachments 6 and 7.

NRC Question 2:

In Section 2.1 of the submittal, several Technical Specification (TS) changes have been proposed relating to Reactor Protection System instrumentation functions, including changes in terminology in the current TSs. If the proposed TS changes represent any alteration or adjustment of the instrument safety function, then describe the differences between the function before and after the upgrade, the methodology used to justify the change, and if the methodology was approved by the NRC staff.

PPL Response:

There are no changes in RPS functions. Sections 3.1 and 3.2 provide more detail on the RPS Functions listed under Section 2.1. The changes listed under Section 2.1 Functions are in accordance with NEDC-32410P-A.

Attachment 3 to PLA-5983

PPL Susquehanna Steam Electric Station, Seismic/Dynamic Qualification of NUMAC Power Range Neutron Monitoring (PRNM) System Equipment Control Panel P608 (1/2C608), Dated November 2005 (Non-Proprietary)

GE Energy
Nuclear

GE-NE- 0000-0047-0104
Revision 1
Class I
DRF 0000-0035-7906
November 2005

Susquehanna Steam Electric Station

Seismic/Dynamic Qualification of NUMAC Power Range Neutron Monitoring (PRNM) System Equipment Control Panel P608 (1/2C608)

Prepared By: M. Kaul, Principal Engineer
Structural Analysis & Hardware Design
Seismic and Dynamic Analysis

Verified By: D. K. Henrie, Technical Lead
Structural Analysis & Hardware Design
Seismic and Dynamic Analysis

Approved By: S. Chakraborty, Project Manager
PPL Susquehanna - PRNM Project

INFORMATION NOTICE

This is a non-proprietary version of the document GE-NE-0000-0047-0104P, Revision 1,which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [[ ]].

IMPORTANT NOTICE REGARDING CONTENTS OF THIS REPORT

Please Read Carefully

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Table of Contents **Page**

1.0 INTRODUCTION AND PURPOSE

This report presents the technical basis for qualification of the PRNM Panel P608 of the Control Structure at Susquehanna Steam Electric Station, and the following equipment and hardware installed in it:

a) NUMAC Power Range Neutron Monitoring (PRNM) chassis,
b) 4-Channel Analog Isolator Module,
c) MDR 4165 Relay, and
d) the baffle plates in the enclosure structure and the exchange of the front top and bottom panel fillers of the structure with grilles for residual heat removal.

1.1 Background

GE supplied NUMAC Power Range Neutron Monitoring (PRNM) hardware and software are being installed in the Control Structure at Susquehanna Steam Electric Station. The NUMAC PRNM equipment will be mounted in equipment control PRNM Panel P608.

The NUMAC PRNM system includes power supplies for the existing Ion Chamber in-core detectors with isolated Local Power Range Monitor (LPRM) channels for each detector. Flow signal inputs are also provided. The Rod Block Monitor function is also included. All outputs and logic to drive annunciators, trips, and digital Reactor Protection System (RPS) are provided. Fiber-optic signals are sent between divisions for voting and separation. Operator displays provide real-time updates of the status of the system.

1.2 Purpose

All NUMAC PRNM equipment and the panel enclosures in which they are installed are safety related Seismic Category 1 components. The purpose of this report is to document the seismic/dynamic qualification of the NUMAC PRNM Panel P608 Assembly (henceforth P608 Assembly) to the Susquehanna site specific, seismic and non-seismic, licensing design basis input motions.

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The methodology for demonstrating dynamic qualification of the P608 Assembly is discussed in detail in Section 3.0 below.

2.0 CONCLUSIONS

The following conclusions are based on the seismic/dynamic analysis for the Susquehanna P608 Assembly. The rationale leading to these conclusions is briefly stated with each conclusion. More detailed discussions pertaining to the underlying methodology and the results on which these conclusions are based are provided in Sections 3.0 and 4.0 below.

2.1 Seismic Qualification (Operability) of the NUMAC Equipment

The NUMAC PRNM equipment (Chassis) is dynamically qualified to the Susquehanna site unique seismic/dynamic input motions given in Reference 5.1a. This follows directly from the fact that the test input motion spectra (TRS) to which the NUMAC equipment have been qualified by dynamic test envelop the corresponding bounding in-panel RRS throughout the frequency range of interest (applicable to the equipment). The lower limit of this frequency range is equal to the fundamental frequency of the safety related component being qualified. This is greater than 30 Hz for the components mounted in the panel (References 5.5 and 5.6).

The test input motion RRS plot is given in Appendix A in Figure A-8. In the frequency range of interest, i.e., 30 Hz and greater, the test input motion RRS corresponds to lower envelops of the actual NUMAC test input motion TRS. Consequently, if the test input motion RRS envelop the NUMAC in-panel RRS it follows that the test motion TRS must also envelop the NUMAC chassis in-panel RRS.

In all cases in the frequency range applicable to the equipment, namely frequencies greater than 30 Hz, the test RRS (minimum TRS) envelop the corresponding bounding in-panel RRS, with significant margin as discussed in Section 4.0 below.

2.2 Seismic Qualification (Operability) of the 4-Channel Analog Isolator

The 4-Channel Analog Isolator is dynamically qualified to the Susquehanna site unique seismic input motions given in Reference 5.1a. This follows directly from the fact that the test TRS to which the 4-Channel Analog Isolator has been qualified by dynamic test envelop the corresponding bounding in-panel RRS, which is greater than that of the Analog Isolator, throughout the frequency range applicable to the equipment. This range has its lower limit at the equipment fundamental frequency determined by tests, which, as stated in Section 2.1, is greater than 30 Hz for the present study (References 5.5 and 5.6).

The Analog Isolator test input motion RRS is given in Appendix A in Figure A-8. Note that, in the frequency range of interest, i.e., 30 Hz and greater, the test input motion RRS correspond to lower envelops of the actual NUMAC test input motion TRS. Consequently, if the test input motion RRS envelop the NUMAC Analog Isolator in-panel RRS it follows that the test motion TRS must also envelop the Analog Isolator in-panel RRS.

In all cases for frequencies greater than 30 Hz, the test RRS (minimum TRS) envelop the corresponding bounding in-panel RRS, with significant margin as discussed in Section 4.0.

2.3 Seismic Qualification (Operability) of MDR 4165 Relay

The MDR 4165 Relay is dynamically qualified to the Susquehanna site unique seismic input motions given in Reference 5.1a. This follows directly from the fact that the test TRS to which the MDR-4165 Relay has been qualified by dynamic test envelop the corresponding bounding in-panel RRS, which is greater than that of the Relay for frequencies greater than about 5 Hz. This frequency range includes the frequency range applicable to the equipment which has its lower limit at the equipment fundamental frequency higher than 5 Hz.

The MDR 4165 Relay test input motion TRS is given in Appendix A in Figure A-9 for both horizontal and vertical excitations. The test motion TRS were obtained from Reference 5.1b and are the lower bounds of the two TRS excitations used in the tests. The two test motion TRSs correspond to a damping of 2.5% which is slightly less than the 3% damping bounding in-panel RRS generated in this analysis. A comparison of the two show a significant margin in the test TRS over bounding in-panel RRS which more than offset the effect of lower damping in the test motion TRS.

In all cases for frequencies greater than 5 Hz, the test TRS (minimum TRS) envelop the corresponding bounding in-panel RRS, with significant margin as discussed in Section 4.0

2.4 Structural Integrity of the NUMAC PRNM Panel Assemblies

The maximum principal stresses in all the NUMAC panel assembly structural support elements are well below the material allowable stresses for the lowest grade carbon steel. Also, the hold-downs and fasteners for the added safety related equipment and components were qualified by the corresponding seismic/dynamic tests performed for those equipment and components. This follows from the fact that the test mounting configurations for all safety related equipment and components are essentially identical to the corresponding in service mounting configurations. Furthermore, the mounting configurations, including hold-downs and fasteners, for all non-safety equipment and components in the modified panel assembly, are the same as their corresponding mounting configurations in other panel assemblies which have been qualified by dynamic testing.

It is therefore concluded that the NUMAC PRNM Panel P608 Assemblies are seismically qualified to the Susquehanna site specific seismic/dynamic licensing design basis loads.

3.0 METHODOLOGY AND ANALYSIS

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3.1 Prior Analysis of the P608 Assembly Model

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3.2 Natural Frequencies and Flexibility of Panel With Respect to Seismic Input Motion

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3.3 Structural Damping for Use in Analysis

Since the P608 Assembly is of mixed bolted and welded construction, the damping used in the analysis is taken as average of numbers in Table 1 of NRC Regulatory Guide 1.61 (Reference 5.7). Thus, for the Upset condition a 3% damping is used, and for the Faulted condition a 5% damping is used. In other words, the seismic input spectra used correspond to 3% and 5% dampings for the Upset and Faulted case analyses respectively. These values are identical to those used in the P608 Assembly for Limerick 1.

3.4 Susquehanna Seismic/Dynamic Input Motion for Panel Analysis

The OBE, SSE, SRV and LOCA floor spectra that combine to produce the Upset and Faulted input motion spectra appropriate for the analysis of the P608 Assembly are provided in Reference 5.1 The horizontal motion (N-S and E-W) spectra were provided for three damping values, i.e., 0.5%, 1.0% and 2.0%. [[

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The Upset and Faulted spectra at 3% and 5% damping respectively were thus obtained at all extracted natural frequencies of the P608 Assembly and are tabulated in Table B-3 for the Upset Case and Table B-4 for the Faulted Case. The Tables also provide a comparison with the corresponding Limerick 1 spectra for which the P608 Assembly was analyzed and seismically qualified.

An examination of Table B-3 shows that all the three Upset case Limerick 1 spectra for which the PRNM Assembly was seismically qualified are higher than the corresponding Susquehanna spectra at all the natural frequencies of the P608 Assembly, the excess over Susquehanna spectra being at least 21% for the EW direction and Mode 1. The Upset case analysis for Susquehanna will thus produce more stress margins and an increased assurance of equipment operability than was demonstrated by the Limerick 1 Upset case analysis.

For the Faulted condition, Table B-4 shows that the Limerick 1 spectra envelops the Susquehanna spectra for the vertical direction for all P608 Assembly frequencies, the minimum exceedance being at least 128% in the 11^{th} mode. The vertical analysis case under Faulted condition thus produces a higher response from the Limerick 1 spectra than from the Susquehanna spectra; therefore the former is governing analysis.

In the EW and NS Faulted cases (Table B-4), Limerick 1 spectra envelopes the corresponding Susquehanna spectra in all but two of the P608 Assembly vibration modes. In EW excitation direction, Limerick 1 Faulted spectrum falls below Susquehanna Faulted spectrum by a maximum of 14% in the 8^{th} mode and in the NS excitation direction, by a maximum of 22% in the 6^{th} mode. Despite this, the seismic qualification of the PRNM Assembly previously established under Limerick 1 seismic/dynamic excitations remains valid under the Susquehanna specific conditions. This will be demonstrated in the following sections and is a consequence of the fact that the stress and operability margins available in P608 Assembly under Limerick 1 seismic excitations are large enough to absorb any reduction due to increases in seismic excitations indicated by Table B-4.

3.5 NUMAC PRNM Panel Assembly Seismic Qualification

As indicated in the Qualification Criteria stated in Subsection 1.2, seismic qualification of the NUMAC PRNM assembly must, in general, address: (i) Operability of the NUMAC hardware, as well as (ii) Structural Integrity of the panel assembly, including the in-panel structural support framework to which the NUMAC hardware is mounted.

Operability. The NUMAC chassis and Analog Isolator test input motion RRS from Limerick 1 is plotted in Figure A-8 of Appendix A. Figure A-9 shows the plots of test input motion TRS for

MDR-4165 Relay which is located at the same elevation as the Analog Isolator. Operability of the NUMAC PRNM Chassis, Analog Isolator Units and MDR-4165 Relay is demonstrated if the test input motion RRS, given in Figure A-8 and the test motion TRS, given in Figure A-9, for these components, envelops the corresponding NUMAC chassis in-panel RRS due to the Upset and Faulted design basis input motions in the frequency range of interest. This range includes the vibration frequencies of the Analog Isolator and NUMAC chassis and MDR-4165 Relay. The in-panel RRS are obtained by applying the seismic/dynamic input motion RRS described in Subsection 3.4 above to the base of the NUMAC PRNM panel seismic model described in Subsection 3.1. The analysis is performed using the Reference 5.4 GE Engineering Computer Program (ECP) ERSIN03V as described above.

Structural Integrity. The structural integrity of the PRNM panel assembly structure, including the NUMAC chassis in-panel structural support framework, is addressed by performing a conservative response spectrum analysis of the panel assembly dynamic finite element model which is subjected to the Faulted design basis input motions described in Subsection 3.3 above. A sufficient, but not necessary, condition for establishing structural integrity is to show that the calculated element principal stresses for every member in the panel assembly model are below the corresponding material allowable stresses.

4.0 RESULTS

The discussion in Sections 3.1 through 3.5 establishes a basis for deriving conclusions about the response of P608 Assembly at Susquehanna from the results obtained from the analysis of a similar assembly at the Limerick 1 plant. Because the P608 Assemblies at both the plants are almost identical and because the analysis structural dampings used for the Upset and Faulted conditions at both plants are also identical, the differences in the response of the assemblies at the two plants are a consequence of the differences in the Upset and Faulted floor response spectra at the two plants. The strengthening effect of Halon system on the Susquehanna P608 Assembly is conservatively ignored. These differences are discussed in Sections 3.1 and 3.4 above.

It is clear from Section 3.4 discussion that for the Upset condition, the Limerick 1 response of P608 Assembly will envelop the Susquehanna response of the identical assembly. This is a consequence of the fact that the Limerick 1 Upset floor response spectra envelop the Susquehanna Upset floor response spectra at all frequencies of the P608 Assembly. Since the P608 Assemblies are seismically qualified at Limerick for the Upset condition, the immediate conclusion from the preceding observation is that identical assemblies are also qualified at Susquehanna. In other words the P608 Assembly at Susquehanna will maintain the structural integrity and equipment operability under Susquehanna specific seismic and dynamic loads under an Upset condition.

In Section 3.4 it was also observed that the Faulted horizontal floor spectra at Susquehanna exceed those at Limerick 1 by a maximum of 22%, even though such exceedance is isolated to less than three vibration modes of the P608 Assembly – modes 7 and 8 in the side-to-side direction and modes 6 and 7 in the front-to-back direction. A reference to Modal Participation Factors Table B-2 shows small contributions from these modes to the response which is dominated by Mode 1 (13.17 Hz) in the side-to-side direction and Mode 5 (33.52 Hz) in the front-to-back direction. Conservatively, one could assume the impact of Faulted spectra values at Modes 6 through 8 corresponding to frequencies 44.32 Hz to 46.32 Hz. to extend to Mode 2 frequency of 25.08 Hz. However, a simplified but a more conservative approach to estimating the Susquehanna P608 Assembly seismic/dynamic response is to assume that this response will amplify for ALL modes by an additional 22% over the response obtained when subjected to Limerick 1 Faulted floor spectra. In other words the P608 Assembly structural integrity and equipment operability under Susquehanna specific Faulted spectra can be assured if the P608 Assembly structural integrity and equipment operability can be established under 1.22 times the Faulted Limerick 1 floor response spectra. This form the basis for demonstrating the seismic qualification of P608 Assembly at Susquehanna and is discussed in the following sections.

4.1 Structural Integrity

Conservative upper bound values for the beam and plate finite elements with the maximum principal stresses for the entire PRNM panel model under Limerick 1 Faulted conditions are given in Table B-3. Both the beam element and the plate element maximum principal stresses are less than 35% of the material allowable stresses. If the Limerick 1 Faulted spectra were increased by 22% for ALL vibration modes of the P608 assembly (under the simplified procedure discussed in the preceding Section), these stresses will correspondingly increase by 22%, and yet remain at a maximum of 42% of the allowable stress values. It then follows that the Susquehanna NUMAC PRNM panel assembly, including all in-panel NUMAC equipment structural supports, are structurally qualified to the Susquehanna seismic/dynamic design basis input motions.

4.2 NUMAC In-Panel RRS

Computer plots of the bounding Faulted horizontal RRS of the NUMAC chassis in-panel support locations are given in Figures A-10 through A-17. These plots correspond to Limerick 1 seismic excitation and were generated using the Reference 5.4 ERSIN03V computer program. The test RRS is also plotted in the Figures A-10 through A-17. All in-panel response spectra and Test RRS are plotted for 3% oscillator damping.

It should be recalled that the frequencies of interest for comparison of in-panel RRS with the test RRS, which forms the basis of seismic/dynamic qualification discussed in the following Sections 4.3 and 4.4, exceed 30 Hz. as explained in Section 2.1, except for the case of the Relay, in which case they exceed 5 Hz.

4.3 NUMAC PRNM Chassis Seismic/Dynamic Qualification

The in-panel RRS and test RRS plots are presented in Figures A-10 through A-12. A comparison of Limerick 1 in-panel RRS and test RRS shows that in the range of frequencies exceeding 30 Hz, the test RRS possesses the smallest margin over in-panel RRS in the front-to-back (Y-Y) direction in and around 30-40 Hz range. The test RRS in this frequency range exceeds the in-panel RRS by about 75% of the latter. A 22% increase in the in-panel RRS beyond 30 Hz will reduce this margin but will still maintain the test RRS exceedance over in-panel RRS exceedance by about 43%.

In view of this simplified analysis for the Faulted condition and Section 4.0 discussion for the Upset condition, it follows that all test input motion RRS bound the corresponding upper bound components of the NUMAC in-panel RRS with significant margins throughout the frequency range of interest, which is frequencies greater than 30 Hz. It then follows that the NUMAC PRNM Chassis are dynamically qualified to the Susquehanna licensing design basis seismic/dynamic input motions. These inputs were applied at the base of the panel assembly.

4.4 NUMAC PRNM 4-Channel Analog Isolator Seismic/Dynamic Qualification

The in-panel RRS and test RRS plots are presented in Figures A-13 through A-15. A comparison of Limerick 1 in-panel RRS and test RRS shows that in the range of frequencies exceeding 30 Hz, the test RRS possesses the smallest margin over in-panel RRS in the front-to-back (Y-Y) direction in and around 30-40 Hz range. The test RRS in this frequency range exceeds the in-panel RRS by about 75% of the latter. A 22% increase in the in-panel RRS beyond 30 Hz will reduce this margin but still maintain the test RRS exceedance over in-panel RRS exceedance by about 43%.

In view of this simplified analysis for the Faulted condition and Section 4.0 discussion for the Upset condition, it follows that all test input motion RRS bound the corresponding upper bound components of the NUMAC PRNM Analog Isolator in-panel RRS with significant margins throughout the frequency range of interest which is frequencies greater than 30 Hz. It then follows that the NUMAC PRNM Analog Isolators are dynamically qualified to the Susquehanna licensing design basis seismic/dynamic input motions. These inputs were applied at the base of the panel assembly.

4.5 NUMAC PRNM MDR-4165 Relay Seismic/Dynamic Qualification

The horizontal in-panel RRS and test TRS plots are presented in Figure A-16. The in-panel RRS is the envelope of the side-to-side and front-to-back RRS and the test TRS is the lower bound of the two test TRS excitations (Reference 5.1b). A comparison of the Limerick 1 in-panel RRS envelope and the test RRS shows that in the range of frequencies exceeding about 5 Hz., the test TRS possesses a very large margin over the in-panel RRS envelope, large enough to absorb the effect of a 22% increase (resulting from Susquehanna floor response spectra) in the in-panel RRS beyond 5 Hz. Even though the test TRS corresponds to 2.5% damping and the in-panel RRS envelope corresponds to 3% damping the very high margin in the TRS will be affected only in the region of 2 – 4 Hz. This would still leave a significant margin in the frequency region of 5 Hz. and above.

The vertical bounding in-panel RRS is much smaller than the test TRS as shown in Figure A-17. The effect of different damping values for the in-panel RRS and the test TRS, and the 22% increase of Susquehanna floor spectra values over corresponding Limerick 1 values, will not eliminate the high margins in the test TRS. The arguments are similar to those used in the previous paragraph for horizontal spectra.

In view of this simplified analysis for the Faulted condition and Section 4.0 discussion for the Upset condition, it follows that all test input motion TRS bound the corresponding upper bound components of the NUMAC PRNM MDR-4165 Relay in-panel RRS with significant margins throughout the frequency range of interest which is frequencies greater than 5 Hz. It then follows that the NUMAC PRNM MDR-4165 Relay is dynamically qualified to the Susquehanna licensing design basis seismic/dynamic input motions. These inputs were applied at the base of the panel assembly.

5.0 REFERENCES

5.1 (a) "Required Response Spectra for Neutron Monitoring Specification," Specification J1113, Rev. 0, Attachment A, (b) "PPL Contract No. 303015-C: Input to Seismic Analysis EPUL-0211," Letter from John M. Kulick to Edward Schmidt, dated August 17, 2005.

5.2 ECP SAP4G07, "SAP4G07 User's Manual - Static and Dynamic Analysis of Mechanical and Piping Components by Finite Element Method," NEDO-10909, Rev. 7, 79NED165R, Class I, December 1979.

5.3 "SAP4G07V Postprocessor - POSAP User's Manual - Static and Dynamic Analysis of Mechanical and Piping Components by Finite Element Method."

5.4 ECP ERSINO3, "A Secondary Response Spectra Calculation Code Incorporating Multiple Support Spectra/Time History Analysis Technique," NEDE-22261, 82NED119, Class II, October 1982.

5.5 "Seismic Simulation Test Program on a PRNM Component System," Wyle Laboratories Test Report 45424-1, May 1996.

5.6 "Seismic Qualification Test Report of the NUMAC Wide Range Neutron Monitor Including Detector Preamp Operator Display Assembly and 4-Channel Analog Isolator Module," NEDE-32087, June 1992.

5.7 USNRC Regulatory Guide 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," October 1973

5.8 ECP Rinex 01, NEDE-30824, Class II, November 1984.

APPENDIX A

FIGURES

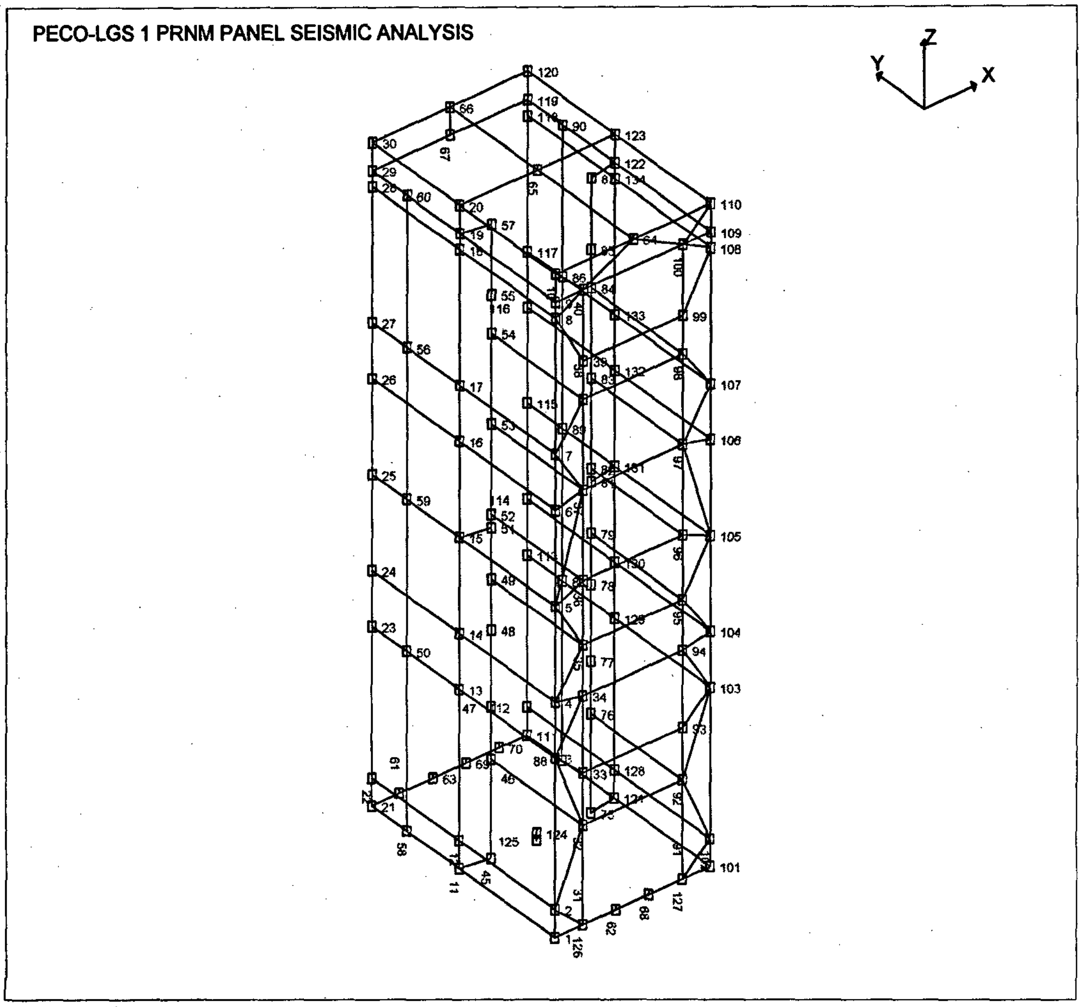

Figure A-1. PRNM Panel P608 Finite Element Model Beam and Plate Elements (With Node Numbers)

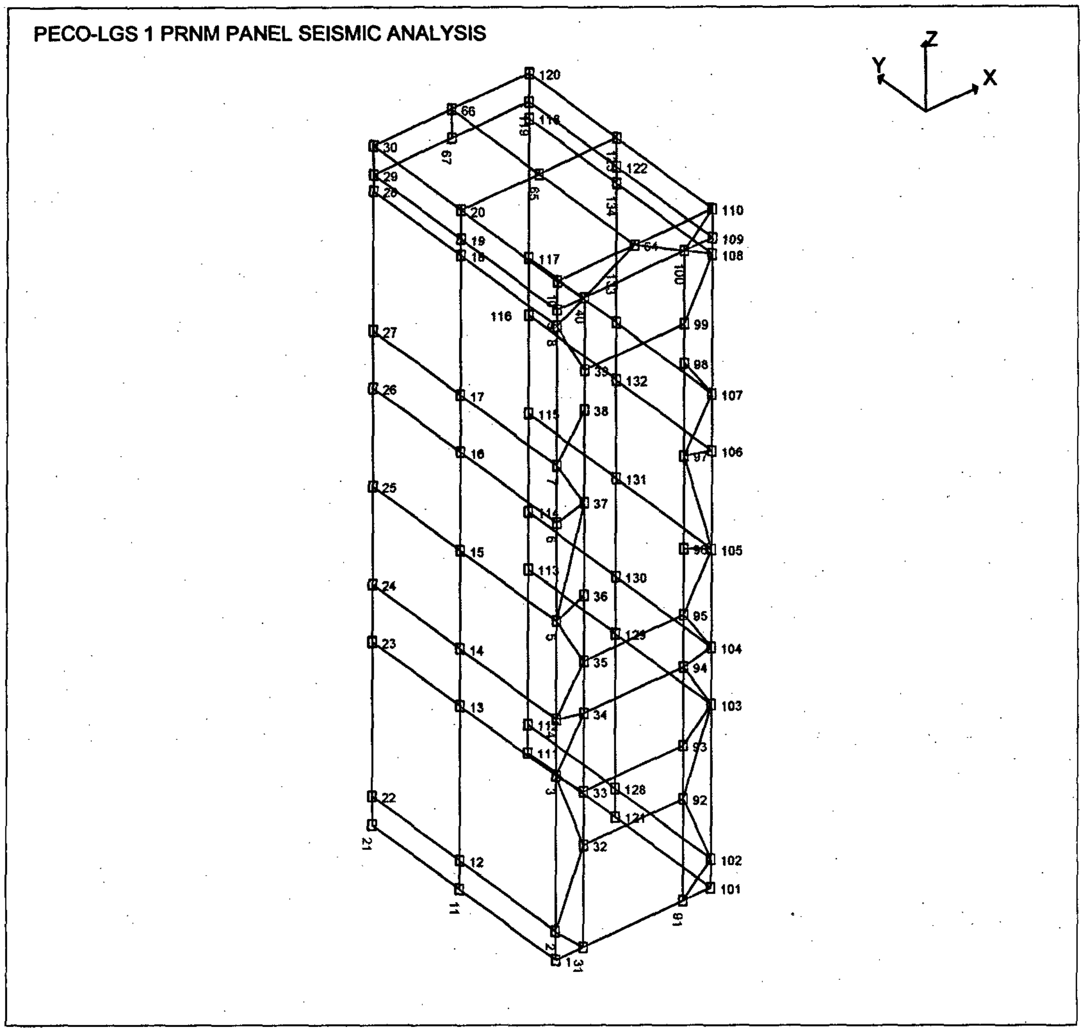

Figure A-2. PRNM Panel P608 Finite Element Model Plate Elements (With Node Numbers)

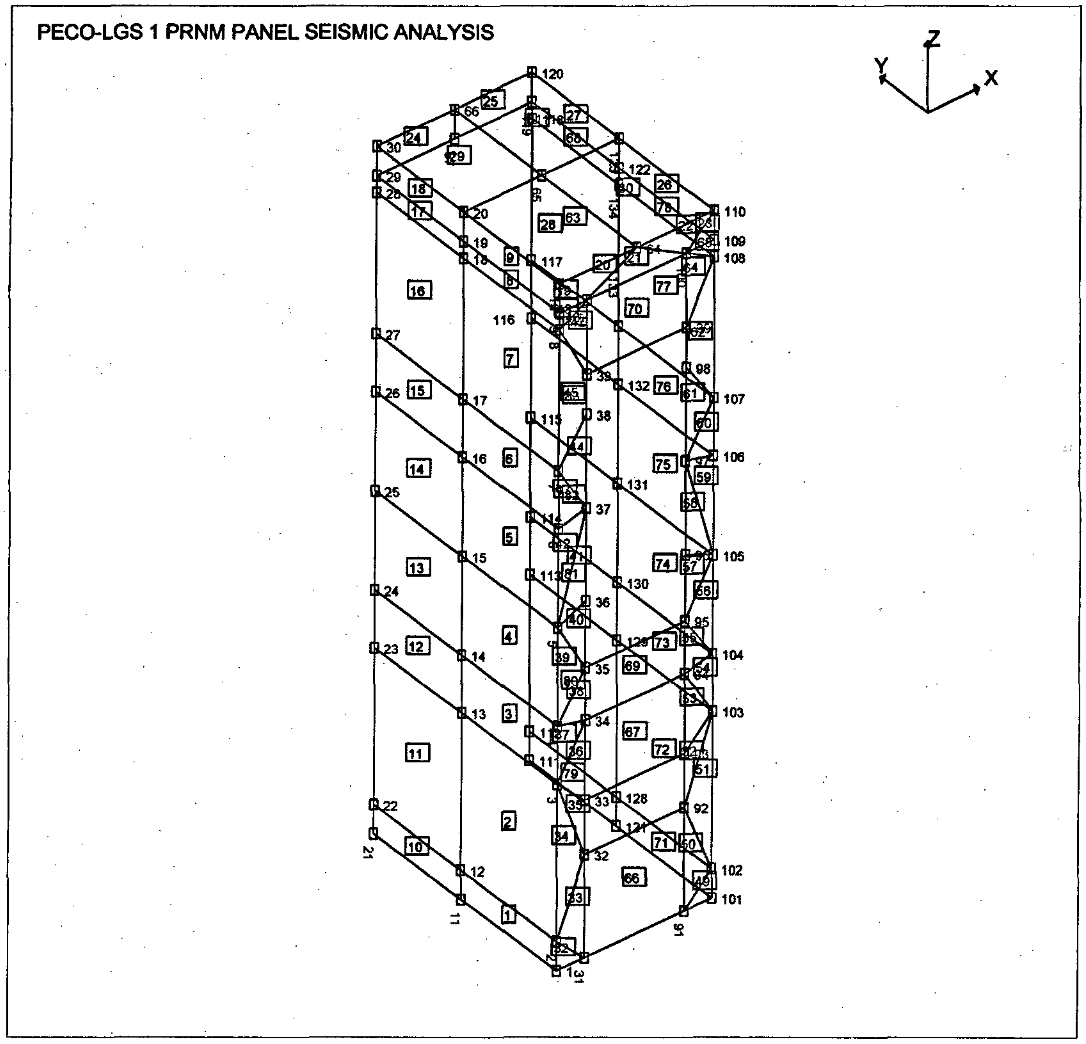

Figure A-3. PRNM Panel P608 Finite Element Model Plate Elements (With Node and Element Numbers)

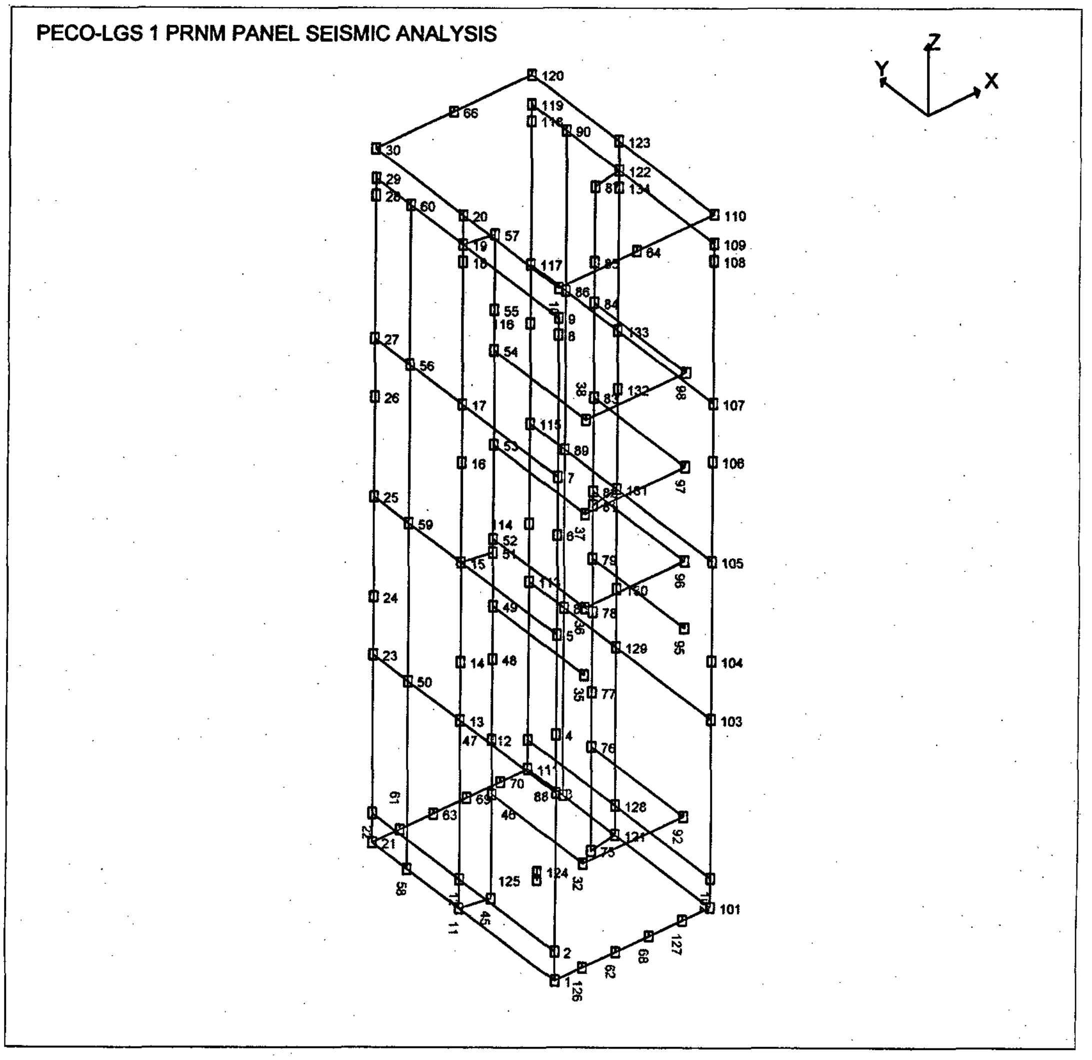

Figure A-4. PRNM Panel P608 Finite Element Model Beam Elements (With Node Numbers)

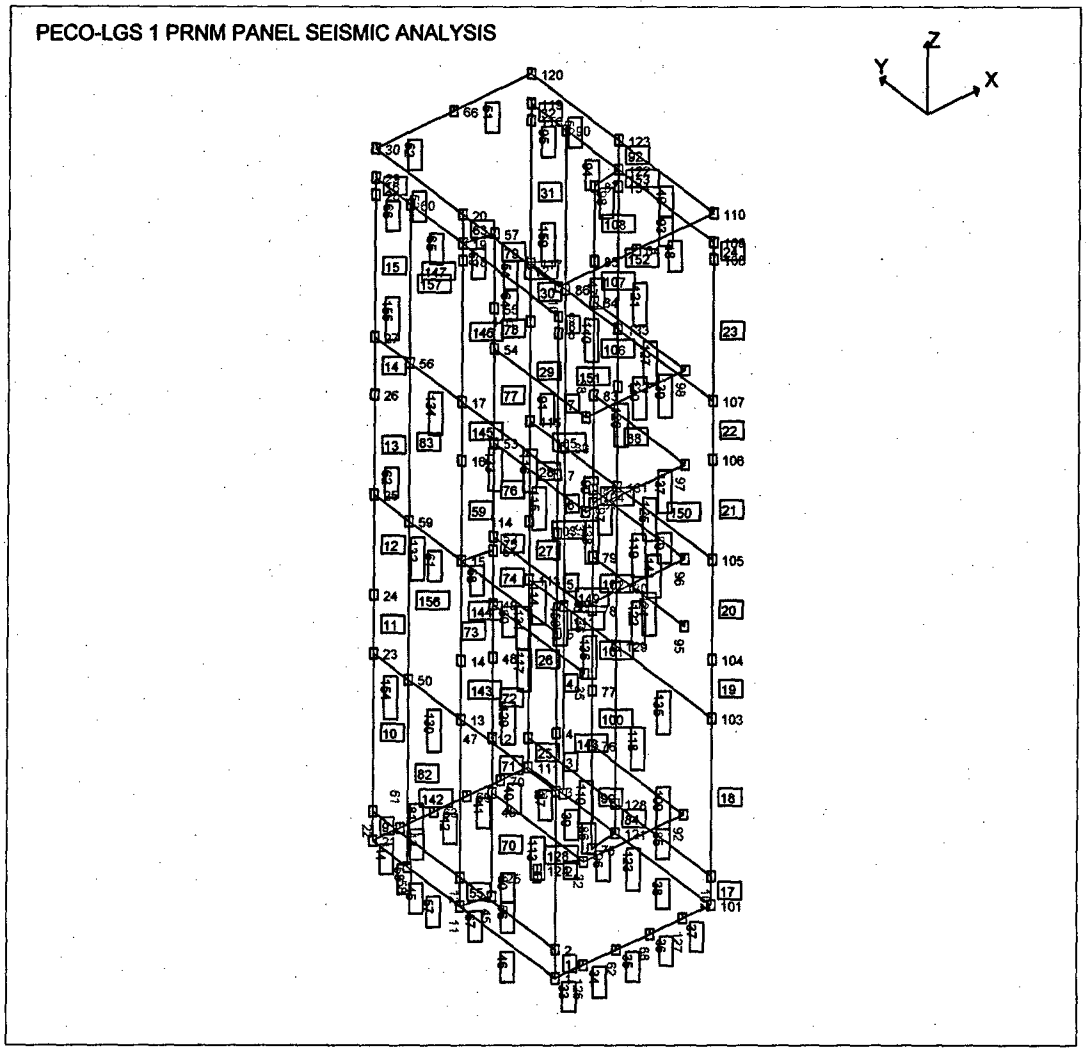

Figure A-5. PRNM Panel P608 Finite Element Model Beam Elements (With Node and Element Numbers)

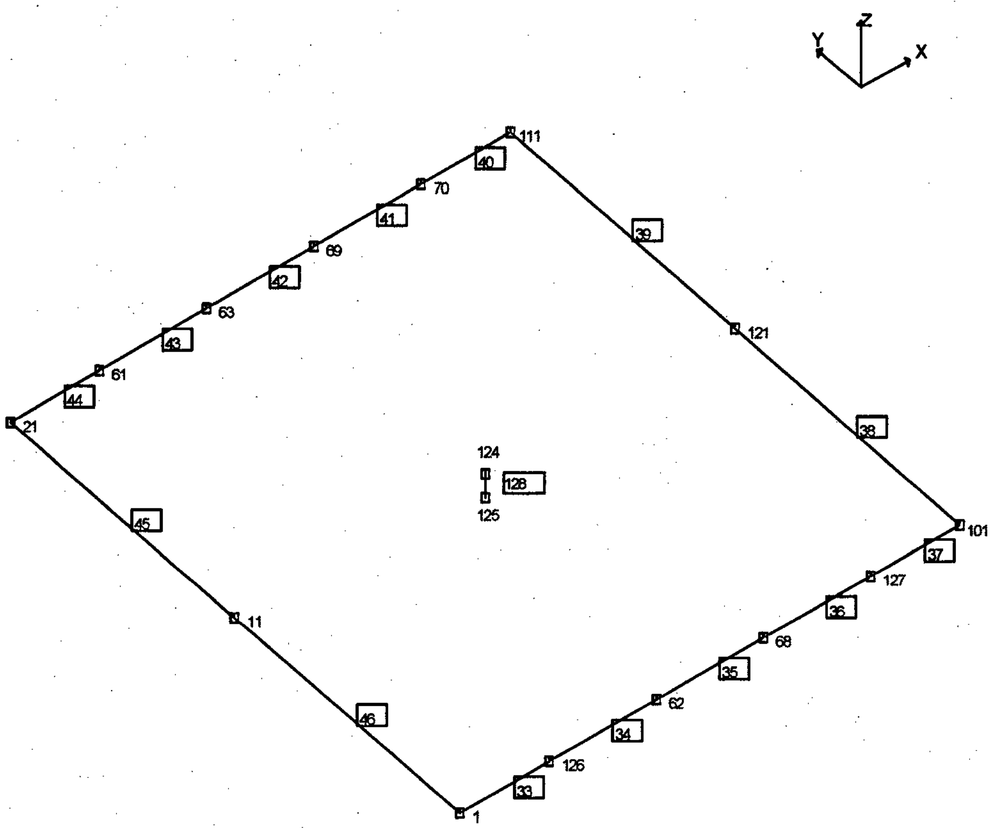

Figure A-6. PRNM Panel P608 Finite Element Model
Panel Base -- Beam Elements (With Node and Element Numbers)

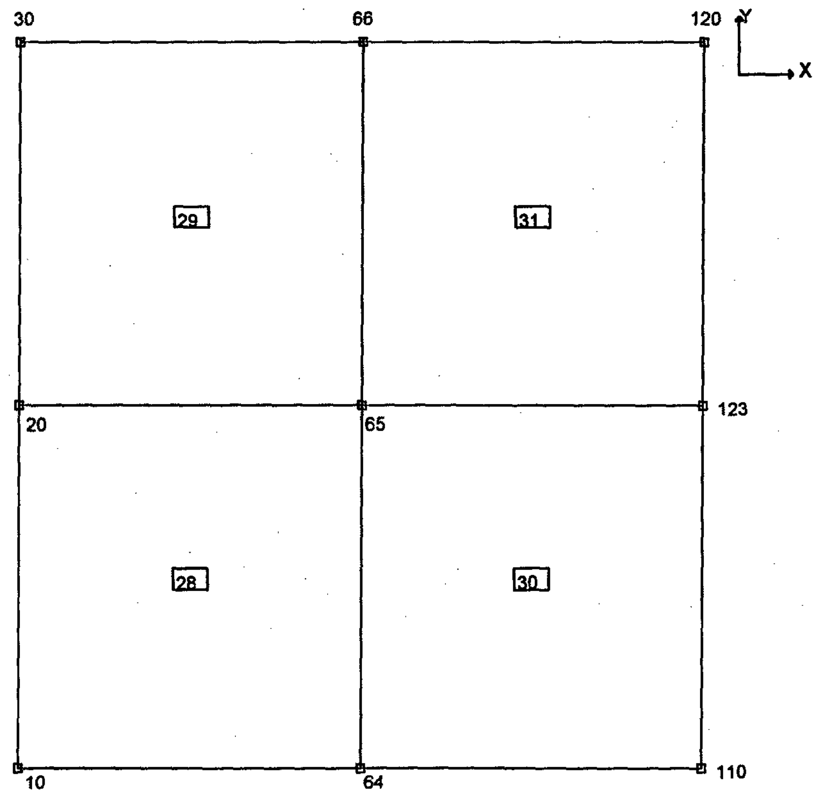

Figure A-7. PRNM Panel P608 Finite Element Model
Top Enclosure Plate Elements (With Node and Element Numbers)

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Figure A-8 [[ ]]

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Figure A-9 [[ ]]

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Figure A-10 [[ ]]

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Figure A-11 [[ ]]

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Figure A-12 [[ ]]

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Figure A-13 [[ ]]

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Figure A-14 [[ ]]

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Figure A-15 [[ ]]

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Figure A-16 [[ ]]

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Figure A-17 [[ ]]

APPENDIX B

TABLES

TABLE B-1 Eigenvalue Summary Table of PRNM PANEL P608 Model

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TABLE B-2. Modal Participation Factor Summary
PRNM P608 Panel Model

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Attachment 5 to PLA-5983

Changes to License Amendment Request

- The APRM "Inop" trip is retained but is changed somewhat to reflect the new NUMAC PRNM system equipment and to delete the minimum LPRM detector count from this trip. The minimum LPRM detector count will be retained in the APRM "Trouble" alarm function.

- A new APRM "pseudo function" entitled "2-out-of-4 Voter" is added to Technical Specifications to facilitate minimum operable channel definition and associated actions.

- The OPRM ~~Trip~~ Upscale Function (called an OPRM ~~Upscale~~ Trip in ~~the NUMAC PRNM LTRs~~ this License Amendment Request) is added to the Technical Specifications under APRM Functions. This function replaces the function currently covered by LCO 3.3.1.3 at SSES.

Minimum Number of Operable APRM/OPRM Channels

- The required minimum number of operable APRM channels will change from four (2 per RPS trip system) to three channels.

- The required minimum number of operable OPRM channels will be three channels.

- The new 2-out-of-4 Voter Function will have a requirement that all four Voter channels must be operable (2 per RPS trip system).

Note: The following two bullets are Technical Specification Bases information and are provided as additional detail and are described in the NUMAC PRNM LTR. This information was previously moved to the Technical Specification Bases as part of the Improved Standard Technical Specification program which, was reviewed and approved by the NRC.

- The minimum number of operable LPRMs per APRM channel required for APRM channel operability will increase from 14 to 20 per APRM channel and from 2 to 3 for each of the four LPRM axial levels per APRM channel. The number of inoperable LPRMs is managed administratively.

- A new maximum number of LPRMs per APRM channel that may become inoperable (and bypassed) between APRM gain calibrations will be added. The new limit is 9 LPRMs per APRM channel. This is an administrative limit.

- The OPRM setpoints and settings, such as minimum number of LPRMs per OPRM cell, are presently maintained in the TRM section 3.3.9, "OPRM Instrumentation Configuration." OPRM Plant Specific settings information outlined in the NUMAC PRNM LTR section 8.4.2.2 will continue to be maintained in the TRM.

NEDC-32410P-A Section No.	Utility Action Required per NEDC-32410P-A	Utility Response
2.1.1.2	<u>OPRM Instability Trip</u> The instability trip function defined by the BWROG as OPRM Option III detect and suppress function is being added for the plant along with applicable plant operator's panel display functions. (NOTE: The first cycle of operation will be used as an evaluation period. During that period, all OPRM functions will be installed, but the final automatic trip will not be connected. Evaluation of performance will be done off line using data automatically collected, This off line evaluation assures no confusion for the operator during the performance assessment period).	An OPRM Option III instability trip system compliant with the BWROG Licensing Topical Reports is currently installed, armed, and operating at SSES. This system was made operable after an extensive pre-operational observation and tuning period, intended to adjust parameters to the characteristics of the SSES operating core. Based on operating experience with the SSES system, the lack of extensive changes to the operating core characteristics, and PPL's review of operating experience of the GE NUMAC OPRM system at other BWRs. PPL plans to implement the OPRM Technical Specification changes and arm the OPRM trips with the initial installation without an additional evaluation period as described in the NUMAC PRNM LTR.
2.3.4	<u>Plant Unique or Plant-Specific Aspects</u> Confirm that the actual plant configuration is included in the variations covered in the Power Range Neutron Monitor (PRNM) Licensing Topical Report (LTR) [NEDC-32410P-A, Volumes 1 & 2 and Supplement 1], and the configuration alternative(s) being applied for the replacement PRNM are covered by the NUMAC PRNM LTR. Document in the *plant-specific licensing submittal* for the PRNM project the actual, current plant configuration of the replacement PRNM, and document confirmation that those are covered by the NUMAC PRNM LTR. For any changes to the plant operator's panel, document in the submittal the human factors review actions that were taken to confirm compatibility with existing plant commitments and procedures.	The actual, current plant configuration and the proposed replacement PRNM are included in the NUMAC PRNM LTR sections listed as follows: <u>Phase 1:</u> <u>Current</u> <u>Proposed</u> APRM 2.3.3.1.1.2 2.3.3.1.2.2 RBM 2.3.3.2.1.1 2.3.3.2.2.1 Flow Unit 2.3.3.3.1.2 2.3.3.3.2.2 Rod Control 2.3.3.4.1.2 2.3.3.4.2.2 ARTS 2.3.3.5.1.~~4~~3 2.3.3.5.2.2 Panel Interface 2.3.3.6.1.1 2.3.3.6.2.2 GE NUMAC PRNM LTR section 2.3.3 does not specifically identify the OPRM function as a current configuration variation. SSES differs from this section of the NUMAC PRNM LTR in that it presently has an ABB OPRM interface to APRM. This OPRM is being revised as proposed in the GE NUMAC PRNM LTR.

Attachment 6 to PLA-5983

Changes to Technical Specifications

Unit 1

Technical Specifications Mark-Ups

INSERT 8:

e. 2-Out-Of-4 Voter	1,2	2	G	SR 3.3.1.1.2 SR 3.3.1.1.12 SR 3.3.1.1.15 SR 3.3.1.1.17	NA
f. OPRM Upscale ~~Trip~~	≥ 25% RTP	3(c)	I	SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.12 SR 3.3.1.1.18 SR 3.3.1.1.19 SR 3.3.1.1.20	(d)

INSERT 9:

(c) Each APRM channel provides inputs to both trip systems.

(d) See COLR for OPRM period based detection algorithm (PBDA) setpoint limits.

INSERT 11:

6. Oscillation Power Range Monitor (OPRM) Upscale ~~T~~trip setpoints, for Specification 3.3.1.1.

Unit 2

Technical Specifications Mark-Ups

INSERT 8:

e. 2-Out-Of-4 Voter	1,2	2	G	SR 3.3.1.1.2 SR 3.3.1.1.12 SR 3.3.1.1.15 SR 3.3.1.1.17	NA
f. OPRM Upscale ~~Trip~~	≥ 25% RTP	3(c)	I	SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.12 SR 3.3.1.1.18 SR 3.3.1.1.19 SR 3.3.1.1.20	(d)

INSERT 9:

(c) Each APRM channel provides inputs to both trip systems.

(d) See COLR for OPRM period based detection algorithm (PBDA) setpoint limits.

INSERT 11:

6. Oscillation Power Range Monitor (OPRM) Upscale ~~T~~trip setpoints, for Specification 3.3.1.1.

Attachment 7 to PLA-5983

Changes to Technical Specifications Bases For Information

Unit 1

Technical Specifications Bases Mark-Ups For Information

INSERT B2:

Average Power Range Monitor (APRM)

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. The APRM channels receive input signals from the local power range monitors (LPRMs) within the reactor core to provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than RTP. Each APRM channel also includes an Oscillation Power Range Monitor (OPRM) Upscale Function which monitors small groups of LPRM signals to detect thermal-hydraulic instabilities.

The APRM trip System is divided into four APRM channels and four 2-out-of-4 Voter channels. Each APRM channel provides inputs to each of the four voter channels. The four voter channels are divided into two groups of two each with each group of two providing inputs to one RPS trip system. The system is designed to allow one APRM channel, but no voter channels, to be bypassed. A trip from any one unbypassed APRM will result in a "half-trip" in all four of the voter channels, but no trip inputs to either RPS trip system.

APRM trip Functions 2.a, 2.b, 2.c, and 2.d are voted independently from OPRM ~~Trip~~ Function 2.f. Therefore, any Function 2.a, 2.b, 2.c, or 2.d trip from any two unbypassed APRM channels will result in a full trip in each of the four voter channels, which in turn results in two trip inputs into each RPS trip system logic channel (A1, A2, B1, and B2), thus resulting in a full scram signal. Similarly, a Function 2.f trip from any two unbypassed APRM channels will result in a full trip from each of the four voter channels.

Three of the four APRM channels and all four of the voter channels are required to be OPERABLE to ensure that no single failure will preclude a scram on a valid signal. In addition, to provide adequate coverage of the entire core consistent with the design bases for the APRM Functions 2.a, 2.b, and 2.c, at least [20] LPRM inputs with at least three LPRM inputs from each of the four axial levels at which the LPRMs are located must be OPERABLE for each APRM channel, with no more than [9], LPRM detectors declared inoperable since the most recent APRM gain calibration. Per Reference 23, the minimum input requirement for an APRM channel with 43 LPRM inputs is determined given that the total number of LPRM outputs used as inputs to an APRM channel that may be bypassed shall not exceed twenty-three (23). Hence, (20) LPRM inputs needed to be operable. For the OPRM ~~Trip~~ Upscale Function 2.f, each LPRM in an APRM channel is further associated in a pattern of OPRM "cells," as described in References 17 and 18. Each OPRM cell is capable of producing a channel trip signal.

INSERT B5:

2.e. 2-out-of-4 Voter

The 2-out-of-4 Voter Upscale Function provides the interface between the APRM Functions, including the OPRM ~~Trip~~ Function, and the final RPS trip system logic. As such, it is required to be OPERABLE in the MODES where the APRM Functions are required and is necessary to support the safety analysis applicable to each of those Functions. Therefore, the 2-out-of-4 Voter Function is required to be OPERABLE in MODES 1 and 2.

All four voter channels are required to be OPERABLE. Each voter channel includes self-diagnostic functions. If any voter channel detects a critical fault in its own processing, a trip is issued from that voter channel to the associated RPS trip system.

The Two-Out-Of-Four Logic Module includes both the 2-out-of-4 Voter hardware and the APRM Interface hardware. The 2-out-of-4 Voter Function 2.e votes APRM Functions 2.a, 2.b, 2.c, and 2.d independently of Function 2.f. This voting is accomplished by the 2-out-of-4 Voter hardware in the Two-Out-Of-Four Logic Module. The voter includes separate outputs to RPS for the two independently voted sets of Functions, each of which is redundant (four total outputs). The analysis in Reference 15 took credit for this redundancy in the justification of the 12-hour Completion Time for Condition A, so the voter Function 2.e must be declared inoperable if any of its functionality is inoperable. The voter Function 2.e does not need to be declared inoperable due to any failure affecting only the APRM Interface hardware portion of the Two-Out-Of-Four Logic Module.

There is no Allowable Value for this Function.

2.f. Oscillation Power Range Monitor (OPRM) Trip

The OPRM ~~Trip~~ Upscale Function provides compliance with GDC 10, "Reactor Design," and GDC 12, "Suppression of Reactor Power Oscillaitons" thereby providing protection from exceeding the fuel MCPR safety limit (SL) due to anticipated thermal-hydraulic power oscillations.

References 17, 18 and 19 describe three algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: the period based detection algorithm (confirmation count and cell amplitude), the amplitude based algorithm, and the growth rate algorithm. All three are implemented in the OPRM Upscale ~~Trip~~ Function, but the safety analysis takes credit only for the period based detection algorithm. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM ~~Trip~~ Upscale Function OPERABILITY for Technical Specification purposes is based only on the period based detection algorithm.

The OPRM ~~Trip~~ Upscale Function receives input signals from the local power range monitors (LPRMs) within the reactor core, which are combined into "cells" for evaluation by the OPRM algorithms. Each channel is capable of detecting thermal-hydraulic instabilities, by detecting the related neutron flux oscillations, and issuing a trip signal before the MCPR SL is exceeded. Three of the four channels are required to be OPERABLE.

(continued next sheet)

TECH SPEC BASES MARKUP

INSERT B5 (continued):

The OPRM Upscale trip ~~Trip~~ is automatically enabled (bypass removed) when THERMAL POWER is ≥ 30% RTP, as indicated by the APRM Simulated Thermal Power, and reactor core flow is ≤ the value defined in the COLR, as indicated by APRM measured recirculation drive flow. This is the operating region where actual thermal-hydraulic instability and related neutron flux oscillations are expected to occur. Reference 21 includes additional discussion of OPRM Trip enable region limits.

These setpoints, which are sometimes referred to as the "auto-bypass" setpoints, establish the boundaries of the OPRM Upscale ~~Trip~~ enabled region. The APRM Simulated Thermal Power auto-enable setpoint has 1% deadband while the drive flow setpoint has a 2% deadband. The deadband for these setpoints is established so that it increases the enabled region once the region is entered.

Upscale

The OPRM ~~Trip~~ Function is required to be OPERABLE when the plant is at ≥ 25% RTP. The 25% RTP level is selected to provide margin in the unlikely event that a reactor power increase transient occurring without operator action while the plant is operating below 30% RTP causes a power increase to or beyond the 30% APRM Simulated Thermal Power OPRM ~~Trip~~ auto-enable setpoint. This OPERABILITY requirement assures that the OPRM ~~Trip~~ auto-enable function will be OPERABLE when required.

An APRM channel is also required to have a minimum number of OPRM cells OPERABLE for the Upscale Function 2.f to be OPERABLE. The OPRM cell operability requirements are documented in the Technical Requirements Manual, TRO 3.3.9, and are established as necessary to support the trip setpoint calculations performed in accordance with methodologies in Reference 19.

Upscale

An OPRM Upscale trip ~~Trip~~ is issued from an APRM channel when the period based detection algorithm in that channel detects oscillatory changes in the neutron flux, indicated by the combined signals of the LPRM detectors in a cell, with period confirmations and relative cell amplitude exceeding specified setpoints. One or more cells in a channel exceeding the trip conditions will result in a channel OPRM ~~Trip~~ from that channel. An OPRM trip is also issued from the channel if either the growth rate or amplitude based algorithms detect oscillatory changes in the neutron flux for one or more cells in that channel. (Note: To facilitate placing the OPRM ~~Trip~~ Function 2.f in one APRM channel in a "tripped" state, if necessary to satisfy a Required Action, the APRM equipment is conservatively designed to force an OPRM trip output from the APRM channel if an APRM Inop condition occurs, such as when the APRM chassis keylock switch is placed in the Inop position.)

There are three "sets" of OPRM related setpoints or adjustment parameters: a) OPRM trip auto-enable region setpoints for STP and drive flow; b) period based detection algorithm (PBDA) confirmation count and amplitude setpoints; and c) period based detection algorithm tuning parameters.

The first set, the OPRM trip auto-enable setpoints, as discussed in the SR 3.3.1.1.19 Bases, are treated as nominal setpoints with no additional margins added. The settings are defined in the Technical Requirements Manual, TRO 3.3.9, and confirmed by SR 3.3.1.1.19. The second set, the OPRM PBDA trip setpoints, are established in accordance with methodologies defined in Reference 19, and are documented in the COLR. There are no allowable values for these setpoints. The third set, the OPRM PBDA "tuning" parameters, are established or adjusted in accordance with and controlled by requirements in the Technical Requirements Manual, TRO 3.3.9.

TECH SPEC BASES MARKUP

INSERT B8:

I.1 and I.2

Required Actions I.1 and I.2 are intended to ensure that appropriate actions are taken if more than two inoperable or bypassed OPRM channels result in not maintaining OPRM trip capability.

In the 4-OPRM channel configuration, any 'two' of the OPRM channels out of the total of four and one 2-out-of-4 voter channels in each RPS trip system are required to function for the OPRM safety trip function to be accomplished. Therefore, three OPRM channels assures at least two OPRM channels can provide trip inputs to the 2-out-of-4 voter channels even in the event of a single OPRM channel failure, and the minimum of two 2-out-of-4 voter channels per RPS trip system assures at least one voter channel will be operable per RPS trip system even in the event of a single voter channel failure.

References 15 and 16 justified use of alternate methods to detect and suppress oscillations under limited conditions. The alternate methods are consistent with the guidelines identified in Reference 20. The alternate-methods procedures require increased operator awareness and monitoring for neutron flux oscillations when operating in the region where oscillations are possible. If operator observes indications of oscillation, as described in Reference 20, the operator will take the actions described by procedures, which include manual scram of the reactor. The power/flow map regions where oscillations are possible are developed based on the methodology in Reference 22. The applicable regions are contained in the COLR.

The alternate methods would adequately address detection and mitigation in the event of thermal hydraulic instability oscillations. Based on industry operating experience with actual instability oscillations, the operator would be able to recognize instabilities during this time and take action to suppress them through a manual scram. In addition, the OPRM system may still be available to provide alarms to the operator if the onset of oscillations were to occur.

The 12-hour allowed Completion Time for Required Action I.1 is based on engineering judgment to allow orderly transition to the alternate methods while limiting the period of time during which no automatic or alternate detect and suppress trip capability is formally in place. Based on the small probability of an instability event occurring at all, the 12 hours is judged to be reasonable.

The 120-day allowed Completion Time, the time that was evaluated in References 15 and 16, is considered adequate because with operation minimized in regions where oscillations may occur and implementation of the alternate methods, the likelihood of an instability event that could not be adequately handled by the alternate methods during this 120-day period was negligibly small.

The primary purpose of Required Actions I.1 and I.2 is to allow an orderly completion, without undue impact on plant operation, of design and verification activities required to correct unanticipated equipment design or functional problems that cause OPRM ~~Trip~~ Function Upscale INOPERABILITY in all APRM channels that cannot reasonably be corrected by normal maintenance or repair actions. These Required Actions are not intended and were not evaluated as a routine alternative to returning failed or inoperable equipment to OPERABLE status.

INSERT B9:

A second note is provided for SR 3.3.1.1.18 that requires that the recirculation flow (drive flow) transmitters, which supply the flow signal to the APRMs, be included in the SR for Functions 2.b and 2.f. The APRM Simulated Thermal Power-High Function (Function 2.b) and the OPRM ~~Trip~~ Function (Function 2.f) both Upscale require a valid drive flow signal. The APRM Simulated Thermal Power-High Function uses drive flow to vary the trip setpoint. The OPRM ~~Trip~~ Function uses drive flow to automatically enable or bypass the OPRM Trip output to the RPS. A CHANNEL CALIBRATION of the APRM drive flow signal requires both calibrating the drive flow transmitters and the processing hardware in the APRM equipment. SR 3.3.1.1.20 establishes a valid drive flow / core flow relationship. Changes throughout the cycle in the drive flow / core flow relationship due to the changing thermal hydraulic operating conditions of the core are accounted for in the margins included in the bases or analyses used to establish the setpoints for the APRM Simulated Thermal Power-High Function and the OPRM ~~Trip~~ Function.

INSERT B10:

SR 3.3.1.1.12

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. For the APRM Functions, this test supplements the automatic self-test functions that operate continuously in the APRM and voter channels. The scope of the APRM CHANNEL FUNCTIONAL TEST is that which is necessary to test the hardware. Software controlled functions are tested as part of the initial verification and validation and are only incidentally tested as part of the surveillance testing. Automatic self-test functions check the EPROMs in which the software-controlled logic is defined. Changes in the EPROMs will be detected by the self-test function and alarmed via the APRM trouble alarm. SR 3.3.1.1.1 for the APRM functions includes a step to confirm that the automatic self-test function is still operating.

The APRM CHANNEL FUNCTIONAL TEST covers the APRM channels (including recirculation flow processing -- applicable to Function 2.b and the auto-enable portion of Function 2.f only), the 2-out-of-4 Voter channels, and the interface connections into the RPS trip systems from the voter channels.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 184-day Frequency of SR 3.3.1.1.12 is based on the reliability analyses of References 15 & 16. (NOTE: The actual voting logic of the 2-out-of-4 Voter Function is tested as part of SR 3.3.1.1.15. The auto-enable setpoints for the OPRM Upscale trip are confirmed by SR 3.3.1.1.19.)

A Note is provided for Function 2.a that requires this SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 APRM Function cannot be performed in MODE 1 without utilizing jumpers or lifted leads. This Note allows entry into MODE 2 from MODE 1 if the associated Frequency is not met per SR 3.0.2.

A second Note is provided for Functions 2.b and 2.f that clarifies that the CHANNEL FUNCTIONAL TEST for Functions 2.b and 2.f includes testing of the recirculation flow processing electronics, excluding the flow transmitters.

INSERT B12:

RPS RESPONSE TIME for the APRM 2-out-of-4 Voter Function (2.e) includes the APRM Flux Trip output relays and the OPRM trip output relays of the voter and the associated RPS relays and contactors. (Note: The digital portion of the APRM, OPRM and 2-out-of-4 Voter channels are excluded from RPS RESPONSE TIME testing because self-testing and calibration checks the time base of the digital electronics. Confirmation of the time base is adequate to assure required response times are met. Neutron detectors are excluded from RPS RESPONSE TIME testing because the principles of detector operation virtually ensure an instantaneous response time. See Reference 12 and 13)

TECH SPEC BASES MARKUP

INSERT B14:

SR 3.3.1.1.19

This surveillance involves confirming the OPRM Upscale ~~T~~trip auto-enable setpoints. The auto-enable setpoint values are considered to be nominal values as discussed in Reference 21. This surveillance ensures that the OPRM Upscale ~~T~~trip is enabled (not bypassed) for the correct values of APRM Simulated Thermal Power and recirculation drive flow. Other surveillances ensure that the APRM Simulated Thermal Power and recirculation drive flow properly correlate with THERMAL POWER (SR 3.3.1.1.2) and core flow (SR 3.3.1.1.20), respectively.

If any auto-enable setpoint is nonconservative (i.e., the OPRM Upscale ~~T~~trip is bypassed when APRM Simulated Thermal Power ≥ 30% and recirculation drive flow ≤ value equivalent to the core flow value defined in the COLR, then the affected channel is considered inoperable for the OPRM ~~Trip~~ Upscale Function. Alternatively, the OPRM Upscale ~~T~~trip auto-enable setpoint(s) may be adjusted to place the channel in a conservative condition (not bypassed). If the OPRM ~~T~~trip is placed in the not-bypassed condition, this SR is met and the channel is considered OPERABLE.

For purposes of this surveillance, consistent with Reference 21, the conversion from core flow values defined in the COLR to drive flow values used for this SR can be conservatively determined by a linear scaling assuming that 100% drive flow corresponds to 100 Mlb/hr core flow, with no adjustment made for expected deviations between core flow and drive flow below 100%.

The Frequency of 24 months is based on engineering judgment and reliability of the components.

SR 3.3.1.1.20

The APRM Simulated Thermal Power-High Function (Function 2.b) uses drive flow to vary the trip setpoint. The OPRM ~~Trip~~ Upscale Function (Function 2.f) uses drive flow to automatically enable or bypass the OPRM ~~T~~trip output to RPS. Both of these Functions use drive flow as a representation of reactor core flow. SR 3.3.1.1.18 ensures that the drive flow transmitters and processing electronics are calibrated. This SR adjusts the recirculation drive flow scaling factors in each APRM channel to provide the appropriate drive flow/core flow alignment.

The Frequency of 24 months considers that any change in the core flow to drive flow functional relationship during power operation would be gradual and the maintenance of the Recirculation System and core components that may impact the relationship is expected to be performed during refueling outages. This frequency also considers the period after reaching plant equilibrium conditions necessary to perform the test, engineering judgment of the time required to collect and analyze the necessary flow data, and engineering judgment of the time required to enter and check the applicable scaling factors in each of the APRM channels. This timeframe is acceptable based on the relatively small alignment errors expected, and the margins already included in the APRM Simulated Thermal Power - High and OPRM ~~Trip~~ Upscale Function trip-enable setpoints.

Unit 2

Technical Specifications Bases Mark-Ups For Information

INSERT B2:

Average Power Range Monitor (APRM)

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. The APRM channels receive input signals from the local power range monitors (LPRMs) within the reactor core to provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than RTP. Each APRM channel also includes an Oscillation Power Range Monitor (OPRM) Upscale Function which monitors small groups of LPRM signals to detect thermal-hydraulic instabilities.

The APRM trip System is divided into four APRM channels and four 2-out-of-4 Voter channels. Each APRM channel provides inputs to each of the four voter channels. The four voter channels are divided into two groups of two each with each group of two providing inputs to one RPS trip system. The system is designed to allow one APRM channel, but no voter channels, to be bypassed. A trip from any one unbypassed APRM will result in a "half-trip" in all four of the voter channels, but no trip inputs to either RPS trip system.

APRM trip Functions 2.a, 2.b, 2.c, and 2.d are voted independently from OPRM ~~Trip~~ Function 2.f. Therefore, any Function 2.a, 2.b, 2.c, or 2.d trip from any two unbypassed APRM channels will result in a full trip in each of the four voter channels, which in turn results in two trip inputs into each RPS trip system logic channel (A1, A2, B1, and B2), thus resulting in a full scram signal. Similarly, a Function 2.f trip from any two unbypassed APRM channels will result in a full trip from each of the four voter channels.

Three of the four APRM channels and all four of the voter channels are required to be OPERABLE to ensure that no single failure will preclude a scram on a valid signal. In addition, to provide adequate coverage of the entire core consistent with the design bases for the APRM Functions 2.a, 2.b, and 2.c, at least [20] LPRM inputs with at least three LPRM inputs from each of the four axial levels at which the LPRMs are located must be OPERABLE for each APRM channel, with no more than [9], LPRM detectors declared inoperable since the most recent APRM gain calibration. Per Reference 23, the minimum input requirement for an APRM channel with 43 LPRM inputs is determined given that the total number of LPRM outputs used as inputs to an APRM channel that may be bypassed shall not exceed twenty-three (23). Hence, (20) LPRM inputs needed to be operable. For the OPRM Upscale ~~Trip~~ Function 2.f, each LPRM in an APRM channel is further associated in a pattern of OPRM "cells," as described in References 17 and 18. Each OPRM cell is capable of producing a channel trip signal.

TECH SPEC BASES MARKUP

INSERT B5:

2.e. 2-out-of-4 Voter

The 2-out-of-4 Voter Upscale Function provides the interface between the APRM Functions, including the OPRM ~~Trip~~ Function, and the final RPS trip system logic. As such, it is required to be OPERABLE in the MODES where the APRM Functions are required and is necessary to support the safety analysis applicable to each of those Functions. Therefore, the 2-out-of-4 Voter Function is required to be OPERABLE in MODES 1 and 2.

All four voter channels are required to be OPERABLE. Each voter channel includes self-diagnostic functions. If any voter channel detects a critical fault in its own processing, a trip is issued from that voter channel to the associated RPS trip system.

The Two-Out-Of-Four Logic Module includes both the 2-out-of-4 Voter hardware and the APRM Interface hardware. The 2-out-of-4 Voter Function 2.e votes APRM Functions 2.a, 2.b, 2.c, and 2.d independently of Function 2.f. This voting is accomplished by the 2-out-of-4 Voter hardware in the Two-Out-Of-Four Logic Module. The voter includes separate outputs to RPS for the two independently voted sets of Functions, each of which is redundant (four total outputs). The analysis in Reference 15 took credit for this redundancy in the justification of the 12-hour Completion Time for Condition A, so the voter Function 2.e must be declared inoperable if any of its functionality is inoperable. The voter Function 2.e does not need to be declared inoperable due to any failure affecting only the APRM Interface hardware portion of the Two-Out-Of-Four Logic Module.

There is no Allowable Value for this Function.

2.f. Oscillation Power Range Monitor (OPRM) Trip

The OPRM ~~Trip~~ Upscale Function provides compliance with GDC 10, "Reactor Design," and GDC 12, "Suppression of Reactor Power Oscillaitons" thereby providing protection from exceeding the fuel MCPR safety limit (SL) due to anticipated thermal-hydraulic power oscillations.

References 17, 18 and 19 describe three algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: the period based detection algorithm (confirmation count and cell amplitude), the amplitude based algorithm, and the growth rate algorithm. All three are implemented in the OPRM ~~Trip~~ Upscale Function, but the safety analysis takes credit only for the period based detection algorithm. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM ~~Trip~~ Upscale Function OPERABILITY for Technical Specification purposes is based only on the period based detection algorithm.

The OPRM ~~Trip~~ Upscale Function receives input signals from the local power range monitors (LPRMs) within the reactor core, which are combined into "cells" for evaluation by the OPRM algorithms. Each channel is capable of detecting thermal-hydraulic instabilities, by detecting the related neutron flux oscillations, and issuing a trip signal before the MCPR SL is exceeded. Three of the four channels are required to be OPERABLE.

(continued next sheet)

INSERT B5 (continued):

The OPRM ~~Trip~~ Upscale trip is automatically enabled (bypass removed) when THERMAL POWER is ≥ 30% RTP, as indicated by the APRM Simulated Thermal Power, and reactor core flow is ≤ the value defined in the COLR, as indicated by APRM measured recirculation drive flow. This is the operating region where actual thermal-hydraulic instability and related neutron flux oscillations are expected to occur. Reference 21 includes additional discussion of OPRM Trip enable region limits.

These setpoints, which are sometimes referred to as the "auto-bypass" setpoints, establish the boundaries of the OPRM ~~Trip~~ Upscale enabled region. The APRM Simulated Thermal Power auto-enable setpoint has 1% deadband while the drive flow setpoint has a 2% deadband. The deadband for these setpoints is established so that it increases the enabled region once the region is entered.

Upscale

The OPRM ~~Trip~~ Function is required to be OPERABLE when the plant is at ≥ 25% RTP. The 25% RTP level is selected to provide margin in the unlikely event that a reactor power increase transient occurring without operator action while the plant is operating below 30% RTP causes a power increase to or beyond the 30% APRM Simulated Thermal Power OPRM ~~Trip~~ auto-enable setpoint. This OPERABILITY requirement assures that the OPRM ~~Trip~~ auto-enable function will be OPERABLE when required.

An APRM channel is also required to have a minimum number of OPRM cells OPERABLE for the Upscale Function 2.f to be OPERABLE. The OPRM cell operability requirements are documented in the Technical Requirements Manual, TRO 3.3.9, and are established as necessary to support the trip setpoint calculations performed in accordance with methodologies in Reference 19.

An OPRM ~~Trip~~ Upscale trip is issued from an APRM channel when the period based detection algorithm in that channel detects oscillatory changes in the neutron flux, indicated by the combined signals of the LPRM detectors in a cell, with period confirmations and relative cell amplitude exceeding specified setpoints. One or more cells in a channel exceeding the trip conditions will result in a channel OPRM ~~Trip~~ from that channel. An OPRM trip is also issued from the channel if either the growth rate or amplitude based algorithms detect oscillatory changes in the neutron flux for one or more cells in that channel. (Note: To facilitate placing the OPRM trip Function 2.f in one APRM channel in a "tripped" state, if necessary to satisfy a Required Action, the APRM equipment is conservatively designed to force an OPRM trip output from the APRM channel if an APRM Inop condition occurs, such as when the APRM chassis keylock switch is placed in the Inop position.)

Upscale

There are three "sets" of OPRM related setpoints or adjustment parameters: a) OPRM trip auto-enable region setpoints for STP and drive flow; b) period based detection algorithm (PBDA) confirmation count and amplitude setpoints; and c) period based detection algorithm tuning parameters.

The first set, the OPRM trip auto-enable setpoints, as discussed in the SR 3.3.1.1.19 Bases, are treated as nominal setpoints with no additional margins added. The settings are defined in the Technical Requirements Manual, TRO 3.3.9, and confirmed by SR 3.3.1.1.19. The second set, the OPRM PBDA trip setpoints, are established in accordance with methodologies defined in Reference 19, and are documented in the COLR. There are no allowable values for these setpoints. The third set, the OPRM PBDA "tuning" parameters, are established or adjusted in accordance with and controlled by requirements in the Technical Requirements Manual, TRO 3.3.9.

TECH SPEC BASES MARKUP

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I.1 and I.2

Required Actions I.1 and I.2 are intended to ensure that appropriate actions are taken if more than two inoperable or bypassed OPRM channels result in not maintaining OPRM trip capability.

In the 4-OPRM channel configuration, any 'two' of the OPRM channels out of the total of four and one 2-out-of-4 voter channels in each RPS trip system are required to function for the OPRM safety trip function to be accomplished. Therefore, three OPRM channels assures at least two OPRM channels can provide trip inputs to the 2-out-of-4 voter channels even in the event of a single OPRM channel failure, and the minimum of two 2-out-of-4 voter channels per RPS trip system assures at least one voter channel will be operable per RPS trip system even in the event of a single voter channel failure.

References 15 and 16 justified use of alternate methods to detect and suppress oscillations under limited conditions. The alternate methods are consistent with the guidelines identified in Reference 20. The alternate-methods procedures require increased operator awareness and monitoring for neutron flux oscillations when operating in the region where oscillations are possible. If operator observes indications of oscillation, as described in Reference 20, the operator will take the actions described by procedures, which include manual scram of the reactor. The power/flow map regions where oscillations are possible are developed based on the methodology in Reference 22. The applicable regions are contained in the COLR.

The alternate methods would adequately address detection and mitigation in the event of thermal hydraulic instability oscillations. Based on industry operating experience with actual instability oscillations, the operator would be able to recognize instabilities during this time and take action to suppress them through a manual scram. In addition, the OPRM system may still be available to provide alarms to the operator if the onset of oscillations were to occur.

The 12-hour allowed Completion Time for Required Action I.1 is based on engineering judgment to allow orderly transition to the alternate methods while limiting the period of time during which no automatic or alternate detect and suppress trip capability is formally in place. Based on the small probability of an instability event occurring at all, the 12 hours is judged to be reasonable.

The 120-day allowed Completion Time, the time that was evaluated in References 15 and 16, is considered adequate because with operation minimized in regions where oscillations may occur and implementation of the alternate methods, the likelihood of an instability event that could not be adequately handled by the alternate methods during this 120-day period was negligibly small.

The primary purpose of Required Actions I.1 and I.2 is to allow an orderly completion, without undue impact on plant operation, of design and verification activities required to correct unanticipated equipment design or functional problems that cause OPRM ~~Trip~~ Function Upscale INOPERABILITY in all APRM channels that cannot reasonably be corrected by normal maintenance or repair actions. These Required Actions are not intended and were not evaluated as a routine alternative to returning failed or inoperable equipment to OPERABLE status.

TECH SPEC BASES MARKUP

INSERT B9:

A second note is provided for SR 3.3.1.1.18 that requires that the recirculation flow (drive flow) transmitters, which supply the flow signal to the APRMs, be included in the SR for Functions 2.b and 2.f. The APRM Simulated Thermal Power-High Function (Function 2.b) and the OPRM ~~Trip~~ Function (Function 2.f) both require a valid drive flow signal. Upscale The APRM Simulated Thermal Power-High Function uses drive flow to vary the trip setpoint. The OPRM ~~Trip~~ Function uses drive flow to automatically enable or bypass the OPRM trip output to the RPS. A CHANNEL CALIBRATION of the APRM drive flow signal requires both calibrating the drive flow transmitters and the processing hardware in the APRM equipment. SR 3.3.1.1.20 establishes a valid drive flow / core flow relationship. Changes throughout the cycle in the drive flow / core flow relationship due to the changing thermal hydraulic operating conditions of the core are accounted for in the margins included in the bases or analyses used to establish the setpoints for the APRM Simulated Thermal Power-High Function and the OPRM ~~Trip~~ Function.

INSERT B10:

SR 3.3.1.1.12

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. For the APRM Functions, this test supplements the automatic self-test functions that operate continuously in the APRM and voter channels. The scope of the APRM CHANNEL FUNCTIONAL TEST is that which is necessary to test the hardware. Software controlled functions are tested as part of the initial verification and validation and are only incidentally tested as part of the surveillance testing. Automatic self-test functions check the EPROMs in which the software-controlled logic is defined. Changes in the EPROMs will be detected by the self-test function and alarmed via the APRM trouble alarm. SR 3.3.1.1.1 for the APRM functions includes a step to confirm that the automatic self-test function is still operating.

The APRM CHANNEL FUNCTIONAL TEST covers the APRM channels (including recirculation flow processing -- applicable to Function 2.b and the auto-enable portion of Function 2.f only), the 2-out-of-4 Voter channels, and the interface connections into the RPS trip systems from the voter channels.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 184-day Frequency of SR 3.3.1.1.12 is based on the reliability analyses of References 15 & 16. (NOTE: The actual voting logic of the 2-out-of-4 Voter Function is tested as part of SR 3.3.1.1.15. The auto-enable setpoints for the OPRM Upscale Trip are confirmed by SR 3.3.1.1.19.)

A Note is provided for Function 2.a that requires this SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 APRM Function cannot be performed in MODE 1 without utilizing jumpers or lifted leads. This Note allows entry into MODE 2 from MODE 1 if the associated Frequency is not met per SR 3.0.2.

A second Note is provided for Functions 2.b and 2.f that clarifies that the CHANNEL FUNCTIONAL TEST for Functions 2.b and 2.f includes testing of the recirculation flow processing electronics, excluding the flow transmitters.

INSERT B12:

RPS RESPONSE TIME for the APRM 2-out-of-4 Voter Function (2.e) includes the APRM Flux Trip output relays and the OPRM trip output relays of the voter and the associated RPS relays and contactors. (Note: The digital portion of the APRM, OPRM and 2-out-of-4 Voter channels are excluded from RPS RESPONSE TIME testing because self-testing and calibration checks the time base of the digital electronics. Confirmation of the time base is adequate to assure required response times are met. Neutron detectors are excluded from RPS RESPONSE TIME testing because the principles of detector operation virtually ensure an instantaneous response time. See Reference 12 and 13)

INSERT B14:

SR 3.3.1.1.19

This surveillance involves confirming the OPRM Upscale ~~T~~trip auto-enable setpoints. The auto-enable setpoint values are considered to be nominal values as discussed in Reference 21. This surveillance ensures that the OPRM Upscale ~~T~~trip is enabled (not bypassed) for the correct values of APRM Simulated Thermal Power and recirculation drive flow. Other surveillances ensure that the APRM Simulated Thermal Power and recirculation drive flow properly correlate with THERMAL POWER (SR 3.3.1.1.2) and core flow (SR 3.3.1.1.20), respectively.

If any auto-enable setpoint is nonconservative (i.e., the OPRM Upscale ~~T~~trip is bypassed when APRM Simulated Thermal Power ≥ 30% and recirculation drive flow ≤ value equivalent to the core flow value defined in the COLR, then the affected channel is considered inoperable for the OPRM Upscale ~~Trip~~ Function. Alternatively, the OPRM Upscale ~~T~~trip auto-enable setpoint(s) may be adjusted to place the channel in a conservative condition (not bypassed). If the OPRM Upscale ~~T~~trip is placed in the not-bypassed condition, this SR is met and the channel is considered OPERABLE.

For purposes of this surveillance, consistent with Reference 21, the conversion from core flow values defined in the COLR to drive flow values used for this SR can be conservatively determined by a linear scaling assuming that 100% drive flow corresponds to 100 Mlb/hr core flow, with no adjustment made for expected deviations between core flow and drive flow below 100%.

The Frequency of 24 months is based on engineering judgment and reliability of the components.

SR 3.3.1.1.20

The APRM Simulated Thermal Power-High Function (Function 2.b) uses drive flow to vary the trip setpoint. The OPRM Upscale ~~Trip~~ Function (Function 2.f) uses drive flow to automatically enable or bypass the OPRM ~~T~~trip output to RPS. Both of these Functions use drive flow as a representation of reactor core flow. SR 3.3.1.1.18 ensures that the drive flow transmitters and processing electronics are calibrated. This SR adjusts the recirculation drive flow scaling factors in each APRM channel to provide the appropriate drive flow/core flow alignment.

The Frequency of 24 months considers that any change in the core flow to drive flow functional relationship during power operation would be gradual and the maintenance of the Recirculation System and core components that may impact the relationship is expected to be performed during refueling outages. This frequency also considers the period after reaching plant equilibrium conditions necessary to perform the test, engineering judgment of the time required to collect and analyze the necessary flow data, and engineering judgment of the time required to enter and check the applicable scaling factors in each of the APRM channels. This timeframe is acceptable based on the relatively small alignment errors expected, and the margins already included in the APRM Simulated Thermal Power - High and OPRM Upscale ~~Trip~~ Function trip-enable setpoints.

Attachment 4 to PLA-5983

GE Affidavit for Attachment 2

General Electric Company
AFFIDAVIT

I, Bradley J. Erbes, state as follows:

(1) I am *Manager*, Systems Engineering, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 2 to GE letter KR-GP-017, Sujit Chakraborty (GE) to Mr. John Kulick (PPL), *Response to NRC RAI 1B Regarding Seismic Qualification for Power Range Neutron Monitoring (PRNM) System for PPL Susquehanna Steam Electric Station 1 & 2*, dated November 17, 2005. The proprietary information in Enclosure 2, *GE Response to Support NRC RAI 1B,* is identified by a double underline inside double square brackets. In each case, the superscript notation{3} refers to Paragraph (3) of the enclosed affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, <u>Critical Mass Energy Project v. Nuclear Regulatory Commission,</u> 975F2d871 (DC Cir. 1992), and <u>Public Citizen Health Research Group v. FDA,</u> 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, resulting in potential products to General Electric;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

(5) To address 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed results of analytical models, methods and processes, including computer codes, which GE has developed, obtained NRC approval of, and applied to perform evaluations of transient and accident events in the GE Boiling Water Reactor ("BWR"). The development and approval of these structural mechanics and materials models, and computer codes was achieved at a significant cost to GE, on the order of several hundred thousand dollars.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this the 17th day of November 2005.

Bradley J. Erbes

Bradley J. Erbes
General Electric Company